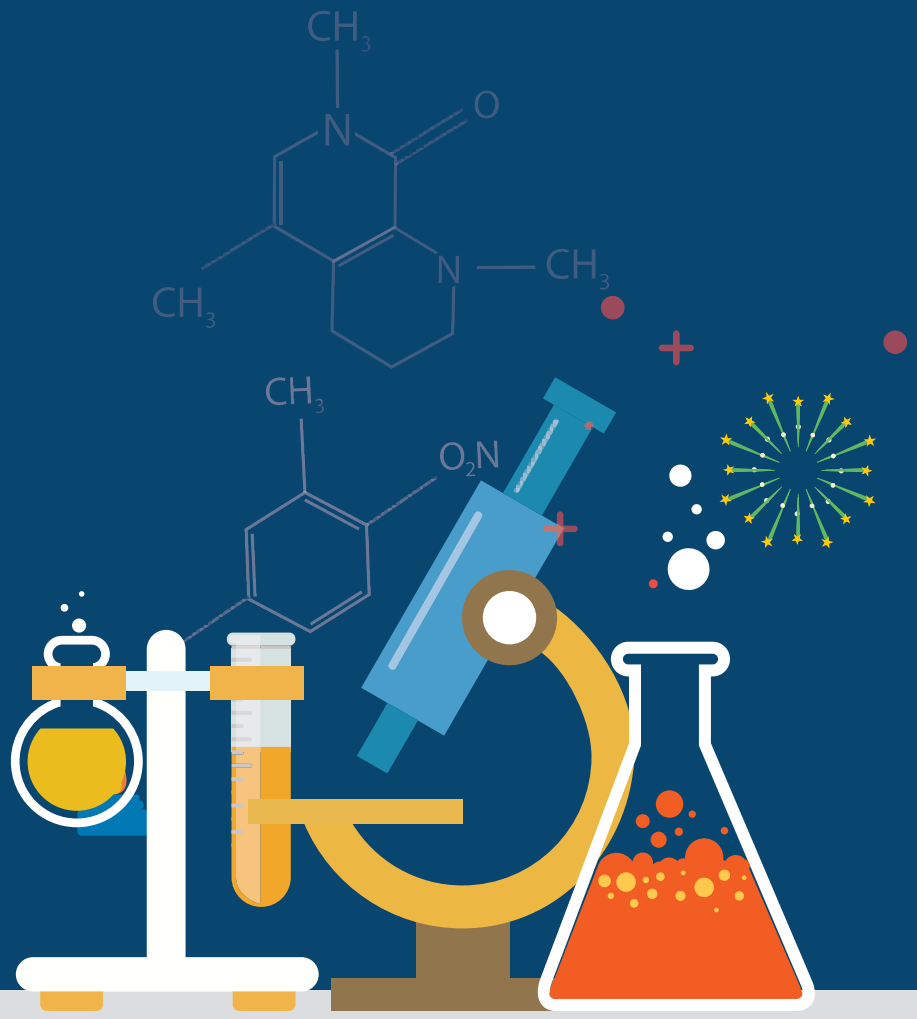
CHEMISTRY

IIT-JEE Advanced Revision Package



This study package is prepared by:

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PART I: PHYSICAL CHEMISTRY

XI:

SECTION I: SINGLE OPTION CORRECT

1. The ionic product of water is 1×10^{-14} $(mol/l)^{2.}$ The number of H^+ ions that present in one millionth part of 1 ml of pure water is -
(A) 66.9 million (B) 52.2 million (C) 48.3 million (D) 60.3 million

2. Gas equation PV = nRT is obeyed by :
(A) only isothermal process (B) only adiabatic process
(C) both (A) and (B) (D) none of these

3. $[H^+]$ and $[OH^-]$ ion in a 8 litre solution containing 9.25 gm// of $Ca(OH)_2$ at 25ºC, is
(A) $[OH^-] = 0.25 \times 10^{-7}$, $[H^+] = 4 \times 10^{-7}$ (B) $[OH^-] = 0.25$, $[H^+] = 4 \times 10^{-14}$
(C) $[OH^-] = 1.25 \times 10^{-7}$, $[H^+] = 4 \times 10^{-7}$ (D) $[OH^-] = 2.5$, $[H^+] = 4 \times 10^{-14}$

4. The degree of hydrolysis of a salt of weak acid and weak base in its 0.1 M solution is found to be 50%. If the molarity of the solution is 0.2 M, the percentage hydrolysis of the salt should be
(A) 100% (B) 50% (C) 25% (D) none of these

5. Molar solubility of As_2S_3 in 0.3 M Al_2S_3 solution in terms of solubility product K_{sp} or As_2S_3 is–

(A) $\sqrt{\frac{K_{sp}}{2.916}}$ (B) $3\sqrt{\frac{K_{sp}}{2.916}}$ (C) $\sqrt{\frac{K_{sp}}{1.2}}$ (D) $3\sqrt{\frac{K_{sp}}{1.2}}$

6. In a gaseous mixture at 20°C the partial pressure of the components are, :
H_2 : 150 Torr , CO_2 : 200 Torr , CH_4 : 300 Torr , C_2H_4 : 100 Torr,
Volume percent of H_2 is :
(A) 26.67 (B) 73.33 (C) 80.00 (D) 20

7. The volume of water needed to dissolve 1 g of $BaSO_4$($K_{sp} = 1.1 \times 10^{-10}$) at 25ºC is –
(A) 820 litre (B) 410 litre (C) 205 litre (D) none of these

8. The wavelength of a spectral line for an electronic transition is inversely related to :
(A) Number of electrons undergoing transition
(B) the nuclear charge of the atom
(C) the velocity of an electron undergoing transition
(D) the difference in the energy levels involved in the transition

9. Number of moles of electrons taken up when 1 mole of NO_3^- ions is reduced to 1 mole of NH_2OH is :
(A) 2 (B) 4 (C) 5 (D) 6

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10. Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl :

(A) furnishes H^+ ions in addition to those from oxalic acid.
(B) reduces permanganate to Mn^{2+}.
(C) oxidises oxalic acid to carbon dioxide and water.
(D) gets oxidised by oxalic acid to chlorine.

11. Which of the following statements is not true ?

(A) The ratio of the mean speed to the rms speed is independent of the temperature.
(B) The square of the mean speed of the molecules is equal to the mean squared speed at a certain temperature.
(C) Mean kinetic energy of the gas molecules at any given temperature is independent of the mean speed.
(D) The difference between rms speed and mean speed at any temperature for different gases diminishes as larger and yet larger molar masses are considered.

12. If velocity of an electron in I orbit of H atom is V, what will be the velocity of 3rd orbit of Li^{+2}

(A) V (B) V/3 (C) 3 V (D) 9 V

13. When one gram mole of $KMnO_4$ reacts with HCl, the volume of chlorine liberated at NTP will be

(A) 11.2 litres (B) 22.4 litres (C) 44.8 litres (D) 56.0 litres

14. A solution contains both Na_2CO_3 and $NaHCO_3$ was treated with excess of $CaCl_2$ solution and filtered. The precipitate weighed m_1 grams. On adding NaOH in drops to the filtrate avoiding excess, a further m_2 grams was precipitated. If after adding excess $CaCl_2$, the solution (had not been filtered) but was simply boiled and then filtered, what would be the total weight of the precipitate

(A) $(m_1 + m_2)$ grams (B) $(m_1 + m_2/2)$ grams
(C) $(m_1 + m_2)/2$ grams (D) $(m_2 + m_1/2)$ grams

15. 0.7 g of a sample of $Na_2CO_3 . x\ H_2O$ were dissolved in water and the volume was made to 100 ml 20 ml of this solution required 19.8 ml of N/10 HCl for complete neutralization. The value of x is :

(A) 7 (B) 3 (C) 2 (D) 5

16. Consider the following statements : The coefficient B in the virial equation of state

$$PV_m = RT\left(1+\frac{B}{V_m}+\frac{C}{V_m^2}+.....\right)$$

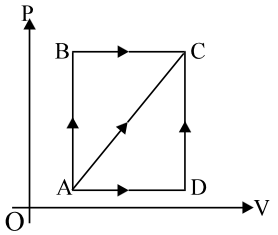
A : is independent of temperature
B : is equal to zero at Boyle temperature
C : has the dimension of molar volume

Which of the above statements are correct?

(A) A and B (B) A and C (C) B and C (D) A, B and C

17. . A thermodynamic process is shown in the following figure. The pressure and volumes corresponding to some point in the figure are :

$P_A = 3 \times 10^4$ Pa , $P_B = 8 \times 10^4$ Pa , $V_A = 2 \times 10^{-3}$ m^3 , $V_D = 5 \times 10^{-3}$ m^3



In the process AB, 600 J of heat is added to the system and in BC, 200 J of heat is added to the system. The change in internal energy of the system in the process AC would be :

(A) 560 J (B) 800 J (C) 600 J (D) 640 J

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18. Which of the following statements is correct in the contact of $3d_{z^2}$ orbital?

(A) This orbital consists of two positive lobes along the ± z axis and a negative doughnut in the xy plane.

(B) This orbital consists of two negative lobes along the ± z axis and a positive doughnut in the xy plane.

(C) This orbital consists of one negative lobe along the ± z axis and a negative doughnut in the xy plane.

(D) This orbital consists of one positive lobe along the ± z axis and a negative doughnut in the xy plane.

19. 20 gm of N_2 at 300 K is compressed reversibly and adiabatically from 20 dm^3 to 10 dm^3. Change in internal energy for the process is :

(A) 284.8 J (B) 142.46 J (C) 1424.69 J (D) 3462.89 J

20. Which of the following is path function as well as an extensive property

(A) temperature (B) internal energy

(C) molar heat capacity (D) heat capacity

21. The shapes of PCl_4^+, PCl_4^- and $AsCl_5$ are respectively:

(A) square planar, tetrahedral and see-saw

(B) tetrahedral, see-saw and trigonal bipyramidal

(C) tetrahedral, square planar and pentagonal bipyramidal

(D) trigonal bipyramidal, tetrahedral and square pyramidal

22. Number of electrons having *l*+ m value equal to zero in $_{24}Cr$ may be:

(A) 14 (B) 10 (C) 13 (D) 12

23. If the enthalpy change for the reaction

$$CH_4(g) + Cl_2(g) \longrightarrow CH_3Cl(g) + HCl(g)$$

ΔH = –25 kcal. bond energy of C – H is 20 kcal mol^{-1} greater than the bond energy of C – Cl and bond energies of H – H and H–Cl are same in magnitude, then for the reaction :

$$\frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g) \longrightarrow HCl(g) \ ; \qquad \Delta H = ?$$

(A) –22.5 kcal/mol (B) –20.5 kcal/mol (C) –32.5 kcal/mol (D) –12.5 kcal/mol

24. The main factor responsible for weak acidic nature of B - F bond in BF_3 is ;

(A) Large electronegativity of F (B) Three centred two electron bond in BF_3

(C) Pπ - dπ back bonding (D) Pπ - Pπ back bonding

25. Among the following species, identify the isostructural pairs : NF_3, NO_3^-, BF_3, H_3O^+, HN_3

(A) [NF_3, NO_3^-] and [BF_3, H_3O^+] (B) [NF_3, HN_3] and [NO_3^-, BF_3]

(C) [NF_3, H_3O^+] and [NO_3^-, BF_3] (D) [NF_3, H_3O^+] and [HN_3, BF_3]

26. Bond length of HCl is 1.275 Å (q = 4.8×10^{-10} e.s.u.) if μ = 1.02 D then HCl is :

(A) 100 % ionic (B) 83% covalent (C) 50% covalent (D) 40% ionic

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SECTION II: MORE THAN ONE OPTION CORRECT

27. The dissociation of ammonium carbonate may be represented by the reaction

$NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2$

ΔH° for the forward reaction is negative. the equilibrium will shift from right to left if there is

(A) a decrease in pressure
(B) an increase in temperature
(C) an increase in the concentration of ammonia
(D) an increase in the concentration of carbondioxide

28. Which of the following samples of reducing agents is /are chemically equivalent to 25 ml of 0.2 N $KMnO_4$ to be reduced to Mn^{2+} and water.

(A) 25 ml of 0.2 M $FeSO_4$ to be oxidized to Fe^{3+}
(B) 50 ml of 0.1 M H_3AsO_3 to be oxidized to H_3AsO_4
(C) 25 ml of 0.1 M H_2O_2 to be oxidized to H^+ and O_2
(D) 25 ml of 0.1 M $SnCl_2$ to be oxidized to Sn^{4+}

29. The equilibrium of which of the following reaction will not be disturbed by the addition of an inert gas at constant volume

(A) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ (B) $N_2O_4(g) \rightleftharpoons 2NO_2(g)$
(C) $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ (D) $C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$

30. 1.2kg of iron pyrites (FeS_2) are roasted to convert sulphur in (FeS_2) to SO_2 with 80% efficiency. It is then oxidised to SO_3 which is then absorbed in water to give H_2SO_4. If the maximum and minimum possible efficiencies are 60% and 30% respectively for any of these two steps, which of the following amounts of H_2SO_4 could possibly be obtained ? (Fe = 56, S = 32)

(A) 0.8 mol (B) 1.5mol (C) 3.6mol (D) 5.7mol

31. Four gas balloons A, B, C, D of equal volumes containing H_2, H_2O, CO, CO_2 respectively were pricked with needle and immersed in a tank containing CO_2. Which of them will shrink after some time.

(A) A (B) B (C) C (D) Both A and D

32. Heisenberg uncertainty principle is not valid for

(A) moving electrons (B) motor car
(C) stationary particles (D) all

33. When HCl(g) is passed through a saturated solution of common salt, pure NaCl is precipitated because

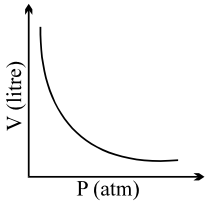
(A) HCl is highly soluble in water
(B) the ionic product $[Na^+]$ $[Cl^-]$ exceeds its solubility product (K_{sp})
(C) the K_{sp} of NaCl is lowered by the presence of Cl^- ions
(D) HCl causes precipitation

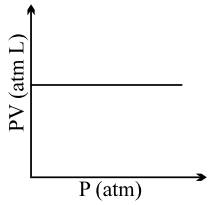
34. Which is true about an electron

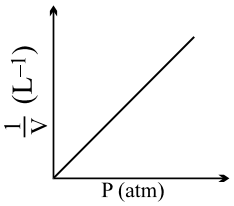
(A) Rest mass of electron is 9.1×10^{-28} gm
(B) Mass of electron increases with the increase in velocity
(C) Molar mass of electron in 5.48×10^{-4} gm/mole
(D) e/m of electrron is 1.7×10^8 coulomb/gm

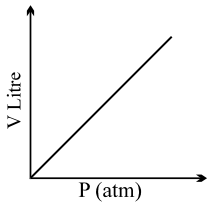
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35. Boyle's law is represented by -

(A) 

(B) 

(C) 

(D) 

36. The incorrect order of decreasing oxidation number of S in compounds is :

(A) $H_2S_2O_7 > Na_2S_4O_6 > Na_2S_2O_3 > S_8$ (B) $H_2SO_5 > H_2SO_3 > SCl_2 > H_2S$

(C) $SO_3 > SO_2 > H_2S > S_8$ (D) $H_2SO_4 > SO_2 > H_2S > H_2S_2O_8$

37. According to Charles's law :

(A) $V \propto \frac{1}{T}$ (B) $\left(\frac{dV}{dT}\right)_P = K$ (C) $\left(\frac{dT}{dV}\right)_P = K$ (D) $\left(\frac{1}{T} - \frac{V}{T^2}\right) = 0$

38. Which of the following are correct statements?

(A) vander Waal's constant a is a measure of attractive force

(B) vander Waal's constant b is also called covolume or excluded volume

(C) b is expressed in L mol^{-1}

(D) a is expressed in atm L^2 mol^{-2}

39. Which of the following will suppress the ionization of phthalic acid in an aqueous solution

(A) KCl (B) H_2SO_4 (C) HNO_3 (D) NaOH

40. Following are the atoms having the number of neutrons and protons as given below :

Atoms	Protons	Neutron
A	8	8
B	8	9
C	8	10
D	7	8
E	7	9

Select incorrect conclusion(s) :

(A) A, B and C, D are isotopes (B) A and D are isotones

(C) A and E are isobars (D) A and B are isodiaphers

41. Three gases of densities A(0.82), B(0.25), C(0.51) are enclosed in a vessel of 4L capacity. Pick up the correct statement :

(A) Gas A will tend to lie at the bottom

(B) The number of atoms of various gases A, B, C are same

(C) The gases will diffuse to form homogeneous mixture.

(D) The average kinetic energy of each gas is same.

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42. In which of the following reaction is $K_p < K_c$

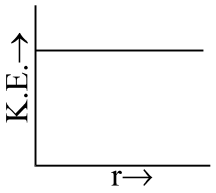
(A) $CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$ (B) $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$

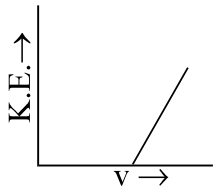
(C) $2BrCl(g) \rightleftharpoons Cl_2(g) + Br_2(g)$ (D) $I_2(g) \rightleftharpoons 2I(g)$

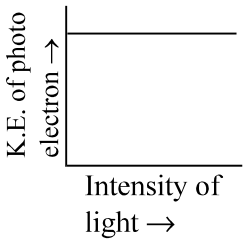
43. Which of the following gases deviate fairly largely form ideal behaviour:

(A) CO_2 (B) SO_2 (C) C_2H_6 (D) None

44. Which is correct graph (K.E. is kinetic energy of photo electron)

(A) 

(B) 

(C) 

(D) None of these

45. Which of the following are redox reactions ?

(A) $NaIO_3 + NaHSO_3 \longrightarrow NaHSO_4 + Na_2SO_4 + I_2 + H_2O$

(B) $FeCl_3 + K_4[Fe(CN)_6] \longrightarrow KCl + Fe_4[(Fe(CN)_6]_3$

(C) $AgCl + Na_2S_2O_3 \longrightarrow Na_3[Ag(S_2O_3)_2] + NaCl$

(D) $NaBiO_3 + MnSO_4 + HNO_3 \longrightarrow HMnO_4 + Bi(NO_3)_3 + NaNO_3 + Na_2SO_4 + H_2O$

46. The oxidation number of Cr = +6 in

(A) $FeCr_2O_4$ (B) $KCrO_3Cl$ (C) CrO_5 (D) $[Cr(OH)_4]^-$

47. Which of the following have planar structure ?

(A) I_3^- (B) H_2O_2 (C) $Ni(CO)_4$ (D) $[Ni(CN)_4]^{2-}$

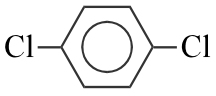
48. Which have odd-order bond ?

(A) O_2^+ (B) O_2^- (C) NO (D) H_2^+

49. Which of the following mathematical relations are correct for an ideal gas?

(A) $\left(\frac{\partial H}{\partial V}\right)_T = 0$ (B) $\left(\frac{\partial H}{\partial p}\right)_T = 0$ (C) $Cp - C_V > R$ (D) $\left(\frac{\partial C_V}{\partial V}\right)_T = 0$

50. Which has (have) zero value of dipole moment

(A) $[Ni(CN)_4]^{2-}$ (B) $CHCl_3$ (C) CO_2 (D) 

51. The standard molar enthalpy of CO_2 is equal to

(A) the standard molar enthalpy of combustion of gaseous carbon

(B) the standard molar enthalpy of combustion of carbon (graphite)

(C) the sum of the standard molar enthalpies of formation of CO and O_2

(D) - 394 kJ mol^{-1}

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52. Three centre-two electron bonds exist in –
(A) B_2H_6 (B) $Al_2(CH_3)_6$ (C) $BeH_2(s)$ (D) $BeCl_2$ (s)

53. Which of the following statements are correct ?
(A) the entropy of an isolated system increases in an irreversible process
(B) the entropy of an isolated system remains unchanged in a reversible process
(C) Entropy can never decrease
(D) ΔS(system) as well as (surroundings) are negative quantities

54. The factors that influence the heat of reaction are :
(A) the physical state of reactants and products
(B) the temperature
(C) the pressure or volume
(D) the method by which the final products are obtained

55. The condition for spontaneity in a chemical reaction is
(A) $(\Delta G)_{T,p} \leq 0$ (B) $(\Delta U)_{S,V} \leq 0$ (C) $(\Delta H)_{S,p} \leq 0$ (D) $(\Delta S)_{U,V} \geq 0$

SECTION III: COMPREHENSIONS

COMPREHENSION # 1
Paragraph for Questions Nos. 56 to 58

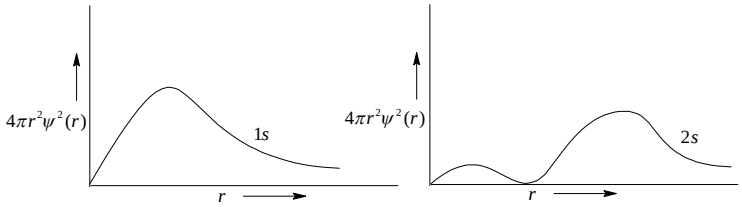
In the quantum mechanics there is operator $(\hat{A})$ for every physically observable property like momentum (linear or angular), position, K.E., total energy etc., and whenever the function (ψ) is operated upon by the operator of any property , we get back ψ multiplied by a constant (a) which is the value of the property under consideration. The function ψ obeying the condition is called eigenfunction of the operator $\hat{A}$ and the constant "a" is called eigen-value. Mathematically

$$\hat{A}\psi = a \cdot \psi$$

This equation is called eigen-value equation.
The Schrodinger wave equation is the energy eigen value equation. The operator for total energy is called Hamiltonion operator (H) defined as

$$H = -\frac{h^2}{8\pi^2 m}\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}\right)+V$$

Where V = PE, m = mass of microparticle.
Solving Schrodinger wave equation for H-atom after putting proper value of V, we get wave functions (ψ) and corresponding energy values. Each wave function denotes an orbital. ψ^2 measures the probability of finding the electron and $\psi^2 dx$ gives the probability if finding the electron in the region x and x + dx. $4\pi r^2\psi^2(r)dr$ gives the probability of finding the electron in spherical shell of thickness dr at a distance r from the nucleus. A plot of radial distribution function $[4\pi r^2\psi^2(r)]$ vs. distance from the nucleus (r) gives the radial probability distribution curve of electron. For 1s and 2s orbitals each containing only one electron, these curves are as given below



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The wave functions of 1s and 2s orbitals of hydrogenic atom or ion are given below:

$$\psi_{1s} = 2\left(\frac{Z}{a_0}\right)^{1/2} e^{-Zr/a_0}$$

$$\psi_{2s} = \left(\frac{Z}{2a_0}\right)^{1/2}\left(2-\frac{Zr}{a_0}\right)e^{-Zr/2a_0}$$

In 2s-orbital there occurs a point at the radius at which curve touches X-axis. Here the probability of finding the electron is zero. This is called radial node.

On the basis of the above write-up, answer the following questions:

56. Which of the functions given below is not the eigen function of the operator $\frac{d^2}{dx^2}$?

(A) e^{-3x} (B) sin4x (C) $4x^2$ (D) cos2x

57. An electron moves along x-axis and restricted to move only between x = 0 and x = L. Hence

(A) $\int_0^L \psi^2 dx = 1$ (B) $\int_0^L \psi^2 dx = 0$ (C) $\int_0^L \psi^2 dx > 1$ (D) $\int_0^L \psi^2 dx < 1$

58. An electron is moving along X-axis in absence of any external field. The energy eigen-value of electron with $\psi = e^{-5x}$, is

(a) $\frac{25}{8}\frac{h^2}{\pi^2 m}$ (b) $\frac{3}{8}\frac{h^2}{\pi^2 m}$ (c) $\frac{h^2}{8\pi^2 m}$ (d) $\frac{h^2}{4\pi^2 m}$

COMPREHENSION # 2
Paragraph for Questions Nos. 59 to 60

From the Bohr's model and De-broglie's theory it can be proved that number of waves in an orbit is equal to its principal quantum nos.(n). The orbital motion of the electron around the nucleus is described by angular momentum of the electron which is characterised by azimuthal quantum number, l. l have all possible whole number values from 0 to n – 1 and magnitude of angular momentum is given by $(\ell/\ell+1)^{1/2}\,\hbar$. The various sub shells are distributed as s, p, d, f, … according to the value of l = 0, 1, 2, 3, … respectively.

Angular momentum about the z-axis is quantised and given by z-component of angular momentum = $m_\ell.\hbar$ where $m_\ell = \ell(\ell+1)^{1/2}\cos\theta$ and is known as magnetic quantum number. Possible values of m range from –l through 0 to +l, thus making a total of 2l + 1 values. The possible values of m indicates the number of degenerate orbitals in a given energy sub level within a principal energy level.

59. When the value of l = 1, then the values of θ are

(A) 60°, 120°, 180° (B) 0, 90°, 180° (C) 45°, 90°, 135° (D) 30°, 60°, 90°

60. The difference between orbital angular momentum of a 2s and a 3d electron is

(A) $\sqrt{2}\hbar$ (B) 0 (C) $\sqrt{4}\hbar$ (D) $\sqrt{6}\hbar$

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COMPREHENSION # 3
Paragraph for Questions Nos. 61 to 63

The radial probability at a distance r from the nucleus is given by the function $4\pi r^2\psi^2 dr$. *In this function, as the probability factor* ψ^2 *decreases, the volume factor* $4\pi^2 dr$ *increases with increse in value of r. The probability increases gradually as the distance increases, goes to a maximum and then begins to decrease. For 1s orbital of hydrogen atom, the maximum value is found by differentiating adial probability distribution with respect to r and setting the derivative equal to zero as*

$$\frac{dP(r)}{dr} = \frac{4}{a_0^3}\left[-\frac{2r^2}{a_0} + 2r\right]e^{-2e/a_0} = 0 .$$

The radial motion of an electron in an atom is controlled by the centrifugal force $\ell(\ell+1)/r^3$ *as well as by coulombing force of attraction* $(-Ze^2/r^2)$ *or*

$$\frac{\ell(\ell+1)}{r^3} - \frac{Ze}{r^2} = 0$$

61. The probability of radial distribution function of an electron is zero becomes possible when distance r is equal to

(A) 0.529Å (B) zero (C) 2×0.529Å (D) $\frac{0.529}{2}$ Å

62. In two different cases under similar conditions, an electron tends to stay farther from the nucleus in case I with respect to case II. It shows that

(A) Orbital angular momentum in, case I > case II
(B) Orbital angular momentum in, case I < case II
(C) Orbital angular momentum in, case I = case II
(D) None of the above

63. The electron distribution in 1s orbital is found to be symmetrical. Considering θ and ϕ be the angles involved in polar coordinate, it may be concluded that:

(A) ψ_{1s}^2 is dependent on θ (B) is dependent on ϕ
(C) is dependent on both θ and ϕ (D) is independent of θ and ϕ

COMPREHENSION # 4
Paragraph for Questions Nos. 64 to 67

In CBSE XII, a question was asked which reads as follows:

Dry air contains 80% N_2 and 20% O_2 by volume. Calculate density of dry air at 27°C and 1 atm pressure.

If relative humidity of moist air is 50% and V.P. of water at 27°C is 40 mm. Calculate the density (g/L) of moist air also. Assume ideal behavior of each gas. Relative humidity is defined as the ratio of the partial pressure of moisture in air to its V.P.

Three students "X", "Y" and "Z" solved 1st part of the problem in the following three different ways:

Solution of "X": One litre dry air contains 0.8 L N_2 and 0.2 L O_2 at the partial pressure of 0.8 atm and 0.2 atm respectively while each at 27°C i.e. 300K. He then calculated number of mole (n) of each gas using the ideal gas equation PV = nRT. He then multiplied number of mole with respective MW to get the mass of each gas in gram. Adding the masses of the two gases he was able to find the mass of 1 litre air in gram and the same he reported as the density of dry air.

Solution of "Y": One litre dry air contains 0.8 L N_2 and 0.2 L O_2 each at a pressure of 1.0 atm and temperature of 27°C i.e. 300K. Thereafter he followed the same method as adpted by "X" and reported the density of dry air.

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Solution of "Z":One litre dry air may be supposed to contain 1.0 L each of N_2 and O_2 at 27°C but at a partial pressure of 0.8 atm and 0.2 atm, respectively. Then he followed the method as adopted by his aforesaid guys, and reported the density of dry air.

64. The correct solution(s) is (are) that of:
(A) both X and Y (B) both Y and Z (C) All the three (D) Only X

65. If solution "X" is wrong what conceptual mistake he has committed:
(A) Boyle's law is violated (B) Charle's law is violated
(C) Graham's law is violated (D) There is no violation of any gas law

66. If solution "Y" is wrong what conceptual mistake he has committed:
(A) Dalton's law of partial pressure is violated
(B) Avogadro's hypothesis has been violated
(C) Boyle's law is violated
(D) There is no violation of any gas law

67. Solution of "Z" is wrong because
(A) Boyle's law is violated (B) Charle's law is violated
(C) Avogadro's hypothesis is violated (D) The solution is correct

COMPREHENSION # 5
Paragraph for Questions Nos. 68 to 70

Compressibility factor (Z): Real gases deviate from ideal behaviour due to the following two faulty assumptions of kinetic theory of gases.

i) Actual volume occupied by the gas molecule is negligible as compared to the total volume of the gases.

ii) Forces of attraction and repulsion among the gas molecules are negligible.
To explain, the extent of deviation of the real gas from ideal behaviour in terms of compressibility or, compression factor (Z), which is function of pressure and temperature for real gases.

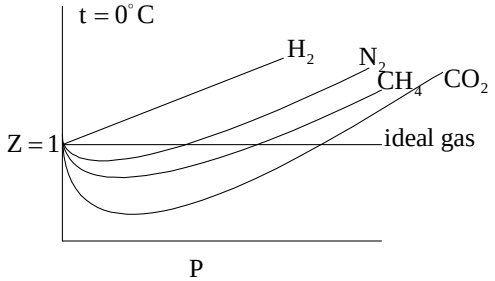
$$Z = \frac{P_0 V_0}{nRT}$$

For ideal gases Z = 1

For real gases either $Z > 1$ or $Z < 1$

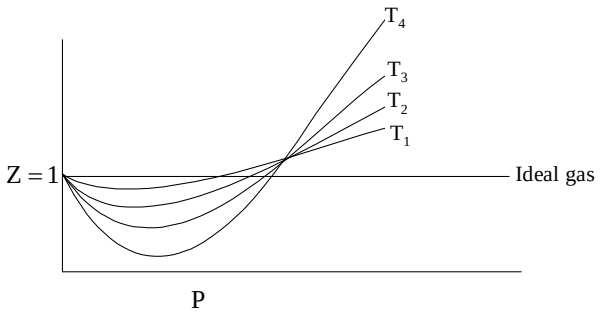
When $Z > 1$, then it is less compressible because force of repulsion dominates over force of attraction when $Z < 1$, force of attraction dominates over the force repulsion and it is more compressible.

Graph in between Z & P is shown as under



On increasing temperature, Z increases and approaches to unity. Graph between Z and P at different temperature for the same gases are as under:

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68. Which of the following statements are correct?

(A) The compressibility factor for ideal gases dependent on temperature and pressure.

(B) $\left(\frac{dZ}{dP}\right)_T$ for real gas is independent of pressure.

(C) for all real gases have same value

(D) for different real gases have different values.

69. Which of the following is the correct order of temperature shown in the above graph Z vs P for the same gases.

(A) $T_4 > T_3 > T_2 > T_1$ (B) $T_1 > T_2 > T_3 > T_4$

(C) $T_1 > T_2 > T_{-4} > T_3$ (D) $T_3 > T_{-4} > T_2 > T_1$

70. Which of the following statements is correct for gas A having molar mass 16 g and density 0.75 g/litre at 2 atmospheric pressure and 27°C temperature?

(A) Force of attraction are dominating than force of repulsion among the gas molecules.

(B) Force of repulsion are dominating than force of attraction among the gas molecules.

(C) Gas molecules are behaving ideally

(D) None

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COMPREHENSION # 6
Paragraph for Questions Nos. 71 to 73

The van der waal's equaiton of state for 1 mole real gas is ... (i)

The virial equation for 1 mole real gas is as under:

Where A, B and C are constants which are known as 2nd, third and fourth virial coefficients respectively.

Since we known that V=f(P, T, n]

Since ideal gas equation for 1 mole ideal gas is

$PV = RT$ ...(ii)

The temperature at wihch real gas obey ideal gas equation is known as Boyle's temperature i.e. T_B.

71. If equation (ii) be one of the form of equation (i), then value of "A" will be

(A) $b - \frac{a}{RT}$ (B) $a - \frac{b}{RT}$ (C) $RT - \frac{a}{b}$ (D) $\frac{RT \times b}{a}$

72. Which of the following is the correct statement about the Boyle's temperature (T_B)?

(A) Temperature at which second virial coefficient becomes zero

(B) Temperature at which first virial coefficient becomes zero

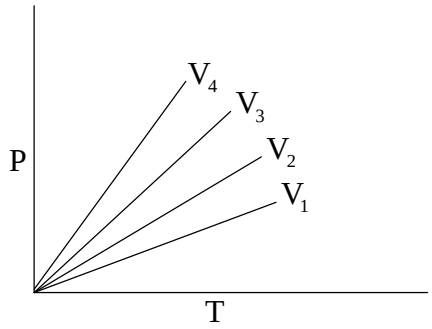
(C) The value of T_B is equal to $\frac{a}{Rb}$

(D) Both (a) and (c) are correct

73. The ideal gas equation for 1 mole of ideal gas is given as under

$$PV = nRT$$

The graph is drawn in between P and T for different isochoric process, or different constant volume, which gives different straight lines shown as under:



then which of the following is the correct order of volume?

(A) $V_4 > V_3 > V_2 > V_1$ (B) $V_1 > V_2 > V_3 > V_4$

(C) $V_1 > V_2 > V_4 > V_4$ (D) $V_2 > V_1 > V_3 > V_4$

COMPREHENSION # 7
Paragraph for Questions Nos. 74 to 76

Diffusion is the one of the most striking property of the gas, due to which one gas intermixes with other against gravity at low pressure gradient at constant temperature. And according to Graham, rate of diffusion of a diffusing gas is inversely proportional to the square root of the density or molecular mass of the diffusing gas i.e.,

$$r \propto \frac{1}{\sqrt{d}} \propto \frac{1}{\sqrt{m}} \quad \text{...(i)}$$

The rate of diffusion inside an open tube is directly proportional to the length



$$r = \frac{v}{t} = \left(\frac{A}{t}\right) \times \text{length}$$

$r \times length$

But, effusion is a special kind of diffusion, possible at high pressure gradient only. It is a kind of forced diffusion. Infact, incase of effusion rate of intermixing will be influenced by pressure gradient. So, in effusion pressure must be considered i.e.,

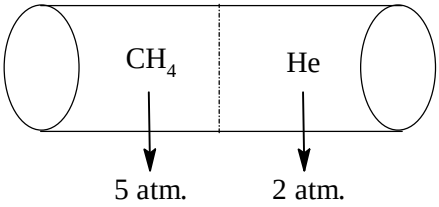
$$r \propto \frac{P}{\sqrt{m}} \propto \frac{P}{\sqrt{d}}$$

74. At the start of an experiment one end of a U-tube of 6 mm glass tubing is immersed in conc. NH_3 solution and the other end is immersed in conc. HCl solution. At the point in the tube where vapours of NH_3 and HCl meet, a white cloud of NH_4Cl (s) forms. At what fraction of the distance along the tube from the NH_3 solution does the white cloud first form?

(A) 0.068 (B) 6.82 (C) 0.422 (D) 4.22

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75. A long cylindrical glass tube, equipped with a process disc at the centre contain CH_4 gas at 5 atm. on one side and He gas at 2 atm on the other side of the disc as shown in the diagram.



Disc is permeable to both gases and rate of diffusion is directly proportional to the gas pressure and inversely proportional to square root of molar masses as;

$$-\frac{dP}{dt} = \frac{kP}{\sqrt{M}}$$

If K for the CH_4 is 2.5×10^{-2} sec^{-1}, determine time after which pressure of CH_4 chamber will drop to 4 atm?

(A) 8.778 sec. (B) 87.88 sec. (C) 48.2 sec. (D) 40 sec.

76. If a space capsule is filled with Ne gas at 1 atm and 290K. The gas effuses through a pin-hole into outer space at such a rate that the pressure drops by 0.30 torr/s. If the capsule were filled with NH_3 at the same temperature and pressure what would be the rate of pressure drop?

(A) 0.33 torr/s (B) 0.20 torr/s (C) 0.13 torr/s (D) 3.3 torr/s

COMPREHENSION # 8
Paragraph for Questions Nos. 77 to 79

"Percentage of available chlorine in the sample of blaching power"

Bleaching powder is a mixture of calcium hypochlorite ($CaOCl_2$) and the basic chloride $CaCl_2.Ca(OH)_2.H_2O$ free slaked lime is also present in addition.

Available chlorine in bleaching powder is the amount of chlorine liberated by the action of dilute acids on bleaching powder according to the equation.

$OCl^- + Cl^- + 2H^+ \longrightarrow$

The available chlorine is expressed as the percentage by weight of the bleaching powder. It is measured by iodometric titration. The bleaching powder solution or suspension is treated with an excess of KI and then acidified with acetic acid where I_2 is liberated

$$OCl^- + 2I^- + 2H^+ \longrightarrow Cl^- + I_2 + H_2O$$

The liberated I_2 is determined with standard $Na_2S_2O_3$ solution using starch as indicator near the end point

$$I_2 + 2S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$$

77. 0.05 moles of $CaOCl_2$ reacts with excess of KI and liberated $I_2$is titrated with V ml of 0.1M hypo solution then value of V is

(A) 500 ml (B) 1000 ml (C) 2000 ml (D) 250 ml

78. A 20 ml (specific gravity 1.02) of chlorine water is treated with excess of KI and the liberated Iodine required 25 ml of 0.2 N $Na_2S_2O_3$. The percentage of free chlorine in chlorine water is

(A) 0.87 (B) 87 (C) 0.78 (D) 0.82

79. The volume of 0.2 M $Na_2S_2O_3$ equivalent to I_2 liberated by the oxidation of excess KI by 10 millimole of bleaching powder (pure) is

(A) 50 ml (B) 20 ml (C) 25 ml (D) 100 ml

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COMPREHENSION # 9
Paragraph for Questions Nos. 80 to 83

Like acid base titration, in redox titration also, the equivalence point is reached when the reducing agent is completely oxidized by the oxidizing agent. But contrary to the acid-base titrations, oxidizing agents can themselves be used as internal indicator in redox titration e.g. $Cr_2O_7^{2-}$ (orange yellow), Cr^{3+} (green), MnO_4^- (purple), Mn^{2+} (light pink), where strength of the solution may be expressed as molarity i.e. number of moles of solute per litre of solution.

80. In a titration experiment, a student finds that 23.48 ml of a NaOH solution are needed to neutralize 0.5468g of KHP (molecular formula $KHC_8H_4O_4$). What is the concentration in molarity of NaOH solution?
(A) 0.114 M (B) 0.228M (C) 0.057M (D) 0.028 M

81. A 16.42 ml volume of 0.1327M $KMnO_4$ solution is needed to oxidize 25.00 ml of a $FeSO_4$ solution in an acidic medium. What is the number of moles of $FeSO_4$ being oxidized for the reaction

$$5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$$

(A) 2.18×10^{-2} ml (B) 1.09×10^{-2} ml (C) 0.545×10^{-2} ml (D) 0.272×10^{-2} ml

82. A purple coloured solution is added from a burette to $FeSO_4$ solution kept in the flask. After sometime, the purple colour changes to light pink. The ion formed from that solution is

(A) MnO_4^- (B) Fe^{2+} (C) Fe^{3+} (D) Mn^{2+}

83. Concentrated aqueous sulphuric acid is 98% H_2SO_4 by mass and has a density of 1.84 g/ml. What volume of the concentrated acid is required to make 5 litre of 0.50M H_2S_4 solution.
(A) 271.7 ml (B) 13.5 ml (C) 135.85 ml (D) 27.1 ml

COMPREHENSION # 10
Paragraph for Questions Nos. 84 to 86

Double Titration

1. **Methyl orange as an indicator**

The volume of 0.1 NHCl used in the titration will correspond the neutralization as directed.

$NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$ *(colour change)*
$Na_2CO_3 + 2HCl \longrightarrow NaCl + CO_2 + H_2O$ *(colour change)*
$NaOH + HCl \longrightarrow NaCl + H_2O$ *(colour change)*

The volume of 0.1M NaOH in the titration will neutralize as directed
HA (mono basic acid) + NaOH $\longrightarrow$ *NaA (colour change)*
H_2A *(di basic acid) + NaOH* $\longrightarrow$ *NaHA (colour change)*
H_3A *(tribasic acid) + NaOH* $\longrightarrow$ NaH_2A *(colour change)*

2. ***Phenolphthelien as an indicator***

The volume of 0.1 NHCl used in the titration will correspond the neutralization as directed.
$NaHCO_3 + HCl \longrightarrow$ *(no colour change)*
$Na_2CO_3 + HCl \longrightarrow NaHCO_3$ *(colour change)*
$NaOH + HCl \longrightarrow NaCl$ *(colour change)*

The volume of 0.1M NaOH in the titration will neutralize as directed
HA (mono basic acid) + NaOH $\longrightarrow$ *NaA (colour change)*
H_2A *(di basic acid) + 2NaOH* $\longrightarrow$ Na_2A *(colour change)*
H_3A *(tribasic acid) + 2NaOH* $\longrightarrow$ Na_2HA *(colour change)*

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84. 0.01 mole of H_3PO_4 and 0.01 mole H_3PO_2 reacts with V ml standard NaOH in presence of phenolpthelien indicator volume of NaOH used is

(A) 500 ml (B) 400 ml (C) 300 ml (D) 200 ml

85. 20 ml of x M HCl neutralizes completely 10 ml of 0.1 M solution and a further 5 ml of 0.2 M solution to methyl orange end point. The value of x is:

(A) 0.167 M (B) 0.133M (C) 0.15 M (D) 0.2 M

86. Certain moles of is dissolved in excess of NaOH. The resulting solution is divided into two equal parts. One part needs 30 ml of 2.5 N HCl and other part needs 40 ml of 2.5 N HCl using phenolphthalein and methyl orange indicator respectively. The mass of dissolved is:

(A) 2.5×10^{-2} (B) 5×10^{-2} (C) 10×10^{-2} (D) 1.5×10^{-2}

COMPREHENSION # 11
Paragraph for Questions Nos. 87 to 89

Bond length is the average distance between the nuclei of the two atoms held by a bond. This represents the internuclear distance corresponding to minimum potential energy for the system. Main factors which affect the bond length are given below:—

i) Multiple bonds are shorter than corresponding single bonds

ii) Sometimes single bond distances are some what larger than double of their respective covalent radii (e.g. F_2). It is due to strong repulsive interaction between the lone-pair electrons on adjacent atoms.

iii) Some times single bond distances are some what shorter than double of their respective covalent radii because bonds acquire some partial double bond character. This normally happens when one atom having vacant orbital and another atom containing lone pair. It is also possible it become shorter due to high ionic character in the covalent bond.

87. Which is not true about the N – N bond length among the following species

I. H_2N — NH_2 II. N_2

III. $H\overset{+}{N}$— NH_2 IV. N_2O

(A) N — N bond length is shortest in II

(B) N — N bond length in I is shorter than that of in III

(C) N — N bond length in III is shorter than that of in I

(D) N — N bond length IV is intermediate between I and III

88. The correct order about of C—O bond length is

I. CO, II. CO_2 III. CO_3^{2-}

(A) II < I < III (B) III < II < I (C) I < II < III (D) I < III < II

89. The bond angle is Cl_2O is more than that in F_2O because of so many reasons like

(a) $p_\pi - d_\pi$ overlap in Cl_2O which is not possible in F_2O

(b) There is no lp – lp repulsion in Cl_2O which is present in F_2O

(c) F is more electronegative than oxygen while Cl is less electronegative than oxygen

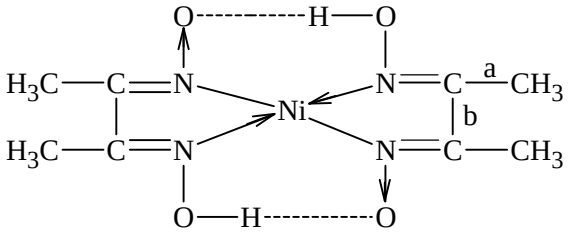
The correct reason is (are)

(A) both a and b (B) only a (C) only b (D) all the three

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COMPREHENSION # 12
Paragraph for Questions Nos. 90 to 92

"Dimethyl glyoxime is an important reagent, which is used in the detection of Ni^{2+} ion in fourth group of qualitative analysis and also in its gravimetric estimation. The compound formed by Ni^{2+} ions with dimethyl glyoxime is diamagnetic with the structure as given below.



'a' and 'b' are c—c bond length".

90. Wchih of the following is correct regarding the bond length 'a' and 'b'.

(A) a = b (B) a > b (C) b > a (D) none of the above

91. The necessary conditions for the formation of intramolecular hydrogen bonding is

(A) The ring formed as a result of hydrogen bond should be planar
(B) A five or six membered ring should be formed
(C) Interacting atoms should be placed in such a way that there is minimum strain during the ring formation
(D) All of these

92. The atomic orbitals which the central atom is using in hybridisation are:

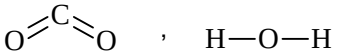
(A) $4s, 4p_x, 4p_y and 4p_z$ (b) $3dz^2, 4s, p_x \text{ and } 4p_y$

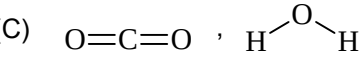
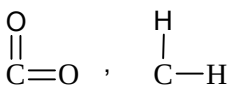
(C) $3d_{x^2-y^2}, 4s, 4p_x \text{ and } 4p_y$ (d) $3d_{x^2-y^2}, 4s, 4p_y \text{ and } 4p_z$

COMPREHENSION # 13
Paragraph for Questions Nos. 93 to 95

The formal charge is the difference between the number of valence electrons in an isolated (i.e. free) atom and the number of electrons assigned to that atom in a Lewis structure. While as a result of polarization, the molecule possesses a dipole moment which is the product of charge on the dipole and distance between them. For a molecule, the net dipole moment is the vector addition of all the dipole moment. Just as all the covalent bonds have some partial ionic character the ionic bonds also have partial covalent character. The polarizing power of the cation, the polarisability of the anion and the extent of distortion of anion are the factors, which determine the percent covalent character of the ionic bond.

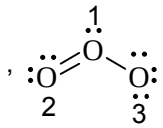
93. Experiment shows that H_2O has a dipole moment whereas CO_2 has not. Point out the structures which best illustrate these factor.

(A) O = C = O, H – O – H (B) 

(C)  (D) 

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94. It has been seen that in O_3, the central O atom is bonded to two other oxygen atoms as



Arrange oxygen atoms marked as 1, 2 and 3 in order of their decreasing formal charge:

(A) $1 < 2 < 3$ (B) $1 > 3 > 2$ (C) $1 > 2 > 3$ (D) $2 > 1 > 3$

95. Among LiCl, $BeCl_2$, BCl_3 and CCl_4, covalent bond character follows the order:

(A) $LiCl > BeCl_2 > BCl_3 > CCl_4$ (B) $LiCl < BeCl_2 < BCl_3 < CCl_4$

(C) $LiCl > BeCl_2 > CCl_4 > BCl_3$ (D) $LiCl < BeCl_2 < BCl_3 > CCl_4$

COMPREHENSION # 14
Paragraph for Questions Nos. 96 to 98

The delpletion of ozone in the stratosphere has been a matter of great concern among scientists in recent years. It believed that ozone can react with nitric oxide (NO) that is discharged from the high altitude jet plane. The reaction is:

$$O_3 + NO \rightarrow O_2 + NO_2$$

96. If 0.740 g of O_3 reacts with 0.670 g of NO, how many gram of NO_2 will be produced ?

(A) 0.71 g (B) 0.74 g (C) 0.68 g (D) 0.81 g

97. Which compound is the limiting reactant?

(A) NO (B) O_3

(C) Both are in equimolar ratio (D) Both are in stoichiometric ratio

98. Number of moles of the excess reactant remaining at the end of the reaction is

(A) 0.007 mol O_3 (B) 0.014 mol O_3 (C) 0.007 mol NO (D) 0.014 mol NO

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COMPREHENSION # 15
Paragraph for Questions Nos. 99 to 101

8.7 gm of a sample of is used in a chemical reaction with HCl to release . Released is used to displace from excess of KI solution. The iodine hence released is estimated using hypo and consumes 100 ml of hypo solution.. 12.5 ml of same hypo solution is required for complete reaction with 25 ml of 0.5 N solution.

99. % purity of is

(A) 4.35 (B) 43.5 (C) 50 (D) 6.25

100. Wt. of which may be completely neutralized by the amount of HCl made to react quantitatively with pure in the sample is

(A) 106 g (B) 10.6 g (C) 5.3 g (D) 53 g

101. Number of milli moles of iodine in the solution used with hypo are

(A) 6.25 (B) 12.5 (C) 10 (D) 20

COMPREHENSION # 16
Paragraph for Questions Nos. 102 to 104

Whenever any solute is dissolved in a given solvent, a solution is formed . Solution may be homogeneous or heterogeneous. Homogenous solution is termed as true solution and in this concentration of solution is defined as mole or mass of solute present in the given weight or volume of solution. Units which depends on mass are temperature independent while which depends on volume are temperature dependent. Answer following question after reading passage–

102. Which of the following unit is temperature dependent
(A) molality (B) ppm (C) mole fraction (D) molarity

103. If aqueous solution of KOH contains 28% by weight of KOH hence mole fraction of KOH is
(A) (B) (C) (D)

104. Mass of glucose ($C_6H_{12}O_6$) present in 50 ml of its 2 molar solution is
(A) 18000 gm (B) 180 gm (C) 18 gm (D) 1800 gm

COMPREHENSION # 17
Paragraph for Questions Nos. 105 to 108

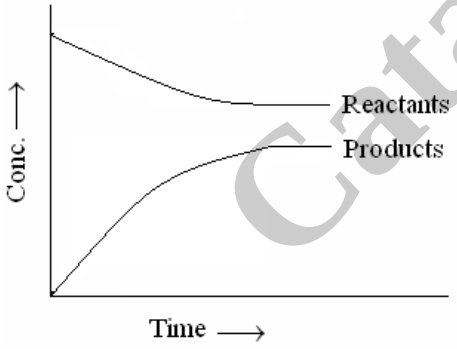
In a reversible chemical reaction, the rate of forward reaction decreases and that of backward reaction increases with the passage of time; at equilibrium the rate of forward and backward reactions become same.

Let us consider the formation of SO_3 in the following reversible reaction:

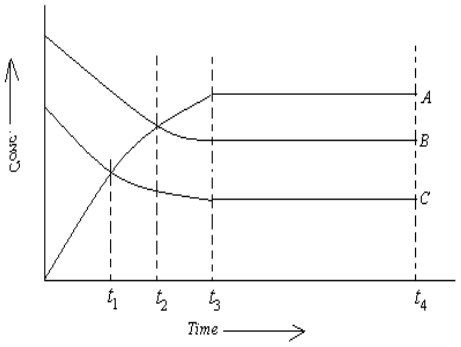
$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

Following graphs are plotted for this reaction:

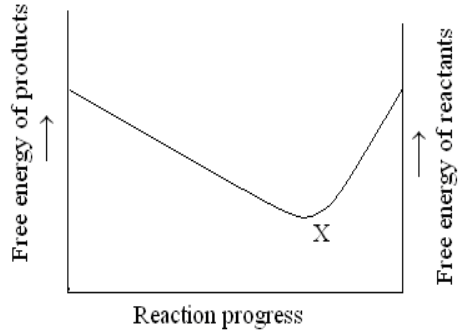
Graph – 1



Graph - 2



Graph - 3



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105. In the graph(1), the equilibrium state is reached at:
(A) t_1 (B) t_2 (C) t_3 (D) t_4

106. If pressure decreases when the reaction is in the state of equilibrium, then the reaction may shifted towards–

(A) SO_3

(B) SO_2 & O_2

(C) No change as all the molecules are gases

(D) Not specified

107. The graph(2) tells us that:
(A) equilibrium is never achievable
(B) equilibrium is achieved after the concentrations of reactants and products become equal
(C) equilibrium is achieved before the concentrations of reactants and products become equal
(D) none of these

108. From the graph(3), it can be interpreted that:
(A) equilibrium is achieved at X (B) reaction is nearer to the completion
(C) $\Delta G=0$ at X (D) all of the above

COMPREHENSION # 18
Paragraph for Questions Nos. 109 to 111

When 306 g of NH_4HS is introduced in a 4.1 litre evacuated flask and heated to 227ºC then solid NH_4HS decomposes into gaseous ammonia and hydrogen sulphide. At equilibrium, it is found that 170 gm of H_2S are present in the container.

109. Mass of solid remaining in the container is -
(A) 51 g (B) 136 g (C) 68 g (D) 100 g

110. If after establishment of equilibrium, H_2S is added in the container in such a way that partial pressure of H_2S now equals to original total pressure, then partial pressure of NH_3 at new equilibrium is -
(A) 50 atm (B) 25 atm (C) 100 atm (D) 75 atm

111. If at 227ºC, ammonia also starts decomposing into nitrogen and hydrogen and establishes equilibrium ($2NH_3 \rightleftharpoons N_2 + 3H_2$) then K_p for the reaction $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$ and total pressure developed in the container will -
(A) decreaes, increases (B) increases, decreases
(C) no change, no change (D) no change, increases

COMPREHENSION # 19
Paragraph for Questions Nos. 112 to 114

Law of mass action can also be applied to the study of equilibria in which the substances are not in the same phase. Considering the decomposition of solid $NaHCO_3$ to produce solid Na_2CO_3, gaseous CO_2 and H_2O.

$$2NaHCO_3(s) \rightleftharpoons Na_2(CO_3(s) + CO_2(g) + H_2O\ (g)$$

Applying the law of mass action.

$$K_C' = \frac{[Na_2CO_3][CO_2][H_2O]}{[NaHCO_3]^2}$$

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It involves two pure solids, Na_2CO_3 and $NaHCO_3$. It is customary not to include the concentrations of pure solids in equilibrium expressions.

$$\frac{K_C'[NaHCO_3]^2}{[Na_2CO_3]} = [CO_2]\,[H_2O] \qquad \text{or} \qquad K_C = [CO_2]\,[H_2O]$$

In terms of partial pressures we have $K_p = p_{CO_2} \times p_{H_2O}$. Similarly, in reactions in which a reactant or product occurs as a pure liquid phase, the concentration of that substance in the pure liquid is also constant. As a result, the concentrations of pure solid and pure liquid phases do not appears in the equilibrium constant expression.

112. Ammonium hydrogen sulphide dissociates according to the equation

$$NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$$

If the observed pressure at equilibrium is 2280 torr atm at 380 K, what is the equilibrium constant K_p of the reaction?

(A) 1.5 (B) 2.25 (C) 3 (D) 4.5

113. A vessel at 1000 K contains carbon dioxide with a pressure of 0.5 atm. Some of the carbon dioxide is converted to carbon monoxide on addition of graphite. Calculate the value of K_p if total pressure at equilibrium is 0.8 atm.

(A) 1.8 atm (B) 0.8 atm (C) 3.6 atm (D) 4 atm

114. A sample of $CaCO_3(s)$ is introduced into a sealed container of volume 0.64 litre and heated to 1000 K until equilibrium is reached. The equilibrium constant for the reaction,

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g),$$

is 4×10^{-2} atm at this temperature. Calculate the mass of CaO (in mg) present at equilibrium.

(A) 3.584 (B) 1.792 (C) 17.92 (D) 35.84

COMPREHENSION # 20
Paragraph for Questions Nos. 115 to 117

Buffer Solutions : In general, a buffer solution is one which is resistant to change of pH upon the addition of a small amount of acid or alkali. Such solutions usually consist of a micture of a weak acid and salt of its conjugate base, e.g. HAc and NaAc (called acidic buffers), or of a weak base and salt of its conjugate acid, e.g. NH_4OH and NH_4Cl (called basic buffers). A salt of a weak acid and a weak base, e.g.NH_4Ac, also has a buffer action.

The pH of an acidic buffer and basic buffer is expressed by Henderson-Hasselbalch equations

$$pH = pK_a + \log \frac{[\text{conjugate base}]}{[\text{weak acid}]} \qquad pOH = pK_b + \log \frac{[\text{conjugate acid}]}{[\text{weak base}]}$$

But limitations of the above equations is that it works only for buffer solutions that fit the following criteria

* The ratio, [conjugate base] / [weak acid] has a value between 0.1 and 10.
* Both [conjugate base] and [weak acid] exceed K_a by a factor of 100 or more.

The resistance to the charge in pH, on the addition of an acid or alkali is called 'Buffer action'. This buffer action ismeasured by 'Buffer capacity' (β). It is expressed as $\beta = \frac{db}{dpH}$

where dbis no. of moles of base added to one litre buffer solution and dpH is charge in pH. The buffer capacity (β) is maximum when the acid and the salt are pesent in equal concentrations.

115. The acetate-acetic acid buffer is suitable in the pH range (assume K_b of CH_3COO^- = 10^{-9})

(A) 8 – 10 (B) 4 – 6 (C) 5 – 7 (D) 5.5 – 7.5

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116. A solution of pH = 6 will be maintained by acidic buffer. Below are the few options given to a chemist. Which option will the chemist choose ?

(A) HA (0.1 M), NaA (1M) K_b of A^- = 10^{-9} (B) HB (0.01 M), NaB (1 M) K_b of B^- = 10^{-10}

(C) HC (1 M), NaX (0.01 M) K_b of X^- = 10^{-6} (D) Any one of the above

117. pH of a mixture of 1 M benzoic acid (pKa = 4.20) and 1 M C_6H_5COONa is 4.5 what is the volume of benzoic acidrequired to repare a 300 ml buffer [log 2 = 0.3] ?

(A) 200 ml (B) 150 ml (C) 100 ml (D) 50 ml

COMPREHENSION # 21
Paragraph for Questions Nos. 118 to 117

In a mixture of strong acid and a strong base , concentration of H^+ions or OH^- ions can be calculated as

$[H^+]$ or $[OH^-]$ = meq of S.A -meq of S.B / total volume in ml of the mixture or volume given

At equivalence point of titration of a strong acid with strong base pH=7 at 25^0C. Salt formed does not under go salt hydrolysis.

In case of weak acid with strong base, before the equivalence point, pHis calculated using the concept of acid buffer. At the equivalence point pH is calculated taking into consideration salt hydrolysis. pH= ½(pKw+pka+logC)

Beyond the equivalence point, there is excess of base, which mainly determines the pH. In case of weak base with strong acid, before the equivalence point buffer concept is used, at the equivalence point salt hydrolysis is taken into consideration.

pH= ½(pKw-pkb-logC)

In case of titration of weak acid and weak base at equivalence point pH is calculated on the basis of salt hydrolysis pH= ½(pKw+pka-pkb)

118. 100ml of 0.1 M mono acid weak base, Kb=2×10^{-5} is titrated with 0.1M HCl. pH of the reaction mixture at the titre value of 50ml and 100 ml are respectively.

(A) 9.3, 9.3 (B) 9.3 , 6.6 (C) 9.3 , 5.3 (D) 4.7, 6.6

119. When 50ml of 0.2M HA ,Ka =1.0×10^{-5} is mixed with 50ml of 0.2M KOH at 25^0 C pH of the resulting mixture would be

(A) 9.0 (B) 9.15 (C) 8.50 (D) 8.2

120. 100ml of 0.1M HCl is titrated with 0.1M NaOH . The pH of the reaction mixture after the addition of 50ml, 100ml, 150ml are respectively

(A) 1.3, 7.0, 9.23 (B) 1.48, 7.0, 12.3 (C) 1.7, 7.0 12.3 (D) 7.0, 1.3, 12.3

COMPREHENSION # 22
Paragraph for Questions Nos. 121 to 123

K_{sp} of $CdS = 8\times10^{-27}, K_{sp}$ of $ZnS = 1\times10^{-21}, K_a$ of $H_2S = 1\times10^{-21}$

121. Which metal sulphide is precipitated first when H_2S is added

(A) ZnS (B) CdS

(C) Both at same time (D) Both do not form ppt.

122. What $\left[H^+\right]$ must be maintained in a saturated $H_2S(0.1M)$ to precipitate CdS but not ZnS, if $\left[Cd^{+2}\right]=\left[Zn^{+2}\right]=0.1M$ initially

(A) $>0.1M$ (B) $>0.01M$ (C) $>0.2M$ (D) $>0.02M$

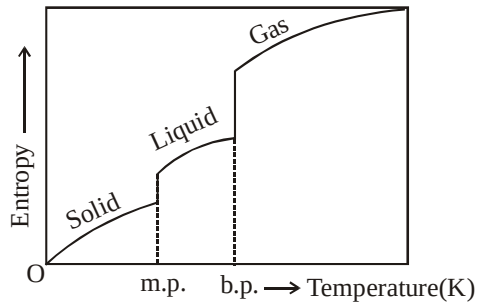
123. When ZnS starts precipitating. What is the concentration of Cd^{+2} is left

(A) 8×10^{-7} (B) 0.1 (C) 4×10^{-10} (D) 2×10^{-9}

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COMPREHENSION # 23
Paragraph for Questions Nos. 124 to 126

Entropy is associated with the orientation and distribution of molecules in space. Disordered crystals have higher entropy than ordered crystals and diffused gases have higher entropy than compressed gases.



Entropy is also associated with molecular motion. As the temperature of a substance increases, random molecular motion increases hence entropy increases. Figure gives variation of entropy with temperature. At absolute zero (–273ºC) every substance is in solid state whose particle are rigidly fixed in a crystalline structure. If there is no residual orientational disorder, like that in CO, entropy of the substance at 0 K will be zero. Third law of thermodynamics states that. **"At the absolute zero of temperature the entropy of every substance may become zero and does become zero in case of perfectly crystalline structure."**

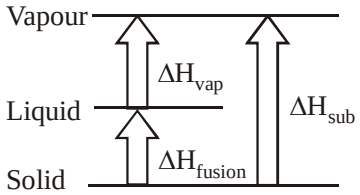
$$\lim_{T \to 0} s = 0$$

In case of CO and NO molecules in solid state, there is randomness even at 0 K due to their dipole moment hence entropy in such cases is not zero even at 0 K.

As the temperature is raised, the molecules begin to vibrate. The number of ways in which the vibrational energy can be distributed increases with increase in temperature and the entropy of the solid increases steadily as the temperature increases. At the melting point (m.p.) of a solid, there is a discontinuous jump in entropy because there are many more ways of arranging the molecules in the liquid than in the solid. An even greater jump in entropy is observed at the boiling point (b.p.) because molecules in the gas are free to occupy a more larger volume and randomness increases.

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124. From the figure representing enthalpy change of various transition as indicated, a substance has maximum enthalpy when present in:



(A) solid state (B) liquid state
(C) gaseous state (D) equal in all states

125. For the following reaction, $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$
If at 0 K, ΔS of this reaction is x cal mol^{-1} then entropy of CO_2 (g) at 0 K is :
(A) – x cal (B) –2x cal (C) + x cal (D) 0 cal

126. Which has the highest entropy per mol of the substance?
(A) H_2 at 25ºC at 1 atm (B) H_2 at STP
(C) H_2 at 100 K at 1 atm (D) H_2 at 0 K at 1 atm

COMPREHENSION # 24
Paragraph for Questions Nos. 127 to 129

Enthalpy of reaction : It is used for the heat change accompaining any reaction. depending upon the nature of the reaction the enthalpy of the reaction is named accordingly

For example : In the reaction

$CH_4(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(l)$ $\Delta H = -890.4$ kJ/mole

This reaction shown that 890.4 kJ of heat is produced when methane is completely burnt it is known as heat of combustion .

for example: In the reaction

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H = -393.5$ kJ/mole

when $CO_2(g)$ is formed from its elements i.e. from C(s) and $O_2(g)$ 393.5 kJ of heat is produced and the process in heat of formation.

127. The enthalpy of formation of methane from the following data

(i) $C(s) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H = -393.7$ kJ/mole

(ii) $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l)$ $\Delta H = -285.8$ kJ/mole

(iii) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$ $\Delta H = -890.4$ kJ/mol

(A) –74.9 kJ/mole (B) 54.6 kJ/mole (C) 99.7 kJ/mole (D) –89.6 kJ/mole

128. Calculate the enthalpy of formation of sucrose ($C_{12}H_{22}O_{11}$) from the following data:

(i) $C_{12}H_{22}O_{11} + 12O_2(g) \longrightarrow 12CO_2(g) + 11H_2O(l)$, $\Delta H = -5200.7$ kJ mol^{-1}

(ii) $C(s) + O_2(g) \longrightarrow CO_2(g)$, $\Delta H = -394.5$ kJ mol^{-1}

(iii) $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l)$, $\Delta H = -285.8$ kJ mol^{-1}

(A) –10.3 kJ/mole (B) + 863.4 kJ/mole

(C) –2677.1 kJ/mole (D) –4321.3 kJ/mole

129. Calculate the enthalpy of combustion of benzene from the following data:

(i) $6C(s) + 3H_2(g) \longrightarrow C_6H_6(l)$, $\Delta H = 49.0$ kJ mol^{-1}

(ii) $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l)$, $\Delta H = -285.8$ kJ mol^{-1}

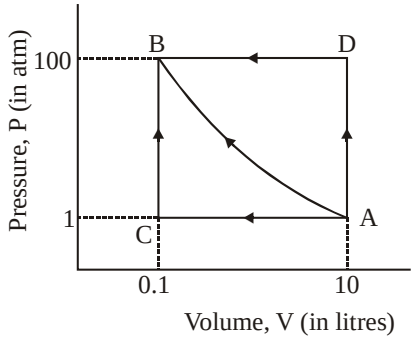
(iii) $C(s) + O_2(g) \longrightarrow CO_2(g)$, $\Delta H = -389.3$ kJ mol^{-1}

(A) + 463.6 kJ/mole (B) +32.4 kJ/mole

(C) –1432.3 kJ/mole (D) –3242.2 kJ/mole

COMPREHENSION # 25
Paragraph for Questions Nos. 130 to 132

Assume perfect gas behaviour in the following isotherm AB. Take $C_v = \frac{3}{2}R$, temperature of the isotherm = 313 K



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130. Number of moles of gas in this system at the start is:
(A) 0.39 mol (B) 0.17 mol (C) 0.78 mol (D) 0.34 mol

131. Work done on the gas along the isotherm AB is:
(A) –4.78 kJ (B) –8 kJ (C) +4.78 kJ (D) + 71 kJ

132. ΔE (Change in internal energy) for path ACB or ADB is:
(A) 19.7 kJ (B) 0.00 kJ (C) 51.2 kJ (D) 3.0 kJ

SECTION IV: MATCH THE FOLLOWING

133. If volume strength of H_2O_2 solution is 'X-V' then its

	Column I	**Column II**
(a)	Strength in g/L	(i) $\frac{X}{11.2}$
(b)	Volume strength X	(ii) $\frac{X}{5.6}$
(c)	Molarity	(iii) $\frac{17X}{5.6}$
(d)	Normality	(iv) 5.6 × N

(A) (a) - (iii) , (b) - (i) , (c) - (iv) , (d) - (ii)
(B) (a) - (iv) , (b) - (i) , (c) - (ii) , (d) - (i)
(C) (a) - (iii) , (b) - (iv) , (c) - (i) , (d) - (ii)
(D) (a) - (iii) , (b) - (ii) , (c) - (iv) , (d) - (i)

134.

	Column I **Reactant**	**Column II** **n-factor**
(a)	H_3PO_3	(i) 11/3
(b)	H_3PO_4	(ii) 2
(c)	$3MnO_4^- \longrightarrow 2Mn^{2+} + Mn^{+6}$	(iii) 3
(d)	$FeC_2O_4 \longrightarrow Fe^{3+} + 2CO_2$	
(e)	$2H_2O_2 \longrightarrow O_2 + 2H_2O$	

(A) (a) - (ii) , (b) - (iii) , (c) - (i) , (d) - (iii), (e)-(ii)
(B) (a) - (i) , (b) - (ii) , (c) - (iii) , (d) - (ii), (e)-(i)
(C) (a) - (ii) , (b) - (i) , (c) - (ii) , (d) - (iii), (e)-(ii)
(D) (a) - (iii) , (b) - (ii) , (c) - (i) , (d) - (ii), (e)-(iii)

135.

	Column I	**Column II**
(a)	$HClO_4$	(i) Oxidising agent
(b)	H_2S	(ii) Reducing agent
(c)	$Na_2S_2O_7$	(iii) Oxidising as well as reducing agent
(d)	SO_2	
(e)	HNO_2	

(A) (a) - (ii) , (b) - (iii) , (c) - (i) , (d) - (iii), (e)-(ii)
(B) (a) - (i) , (b) - (ii) , (c) - (iii) , (d) - (ii), (e)-(i)
(C) (a) - (ii) , (b) - (i) , (c) - (ii) , (d) - (iii), (e)-(ii)
(D) (a) - (i) , (b) - (ii) , (c) - (ii) , (d) - (iii), (e)-(iii)

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136. When mixture of 0.1 equivalent of each of the reactants mentioned under column I are reacted with 1 M HCl solution. in presence of indicator phenolphthalein, the volume required in ml of HCl solution for complete neutralization will be:

	Column I	**Column II**
(a)	Na_2CO_3 + $NaHCO_3$	(i) 100 ml
(b)	NaOH + $NaHCO_3$	(ii) 150 ml
(c)	Na_2CO_3 + Na_2CO_3	(iii) 50 ml
(d)	Na_2CO_3 + $NaHCO_3$ + NaOH	

(A) (a) - (i) , (b) - (iii) , (c) - (i) , (d) - (ii) (B) (a) - (i) , (b) - (ii) , (c) - (iii) , (d) - (ii)
(C) (a) - (ii) , (b) - (i) , (c) - (ii) , (d) - (iii) (D) (a) - (iii) , (b) - (i) , (c) - (ii) , (d) - (ii)

137.

	Column I	**Column II**
(a)	M_R on mixing two acidic solutions	(i) $\frac{x \times d \times 10}{M_{solute}}$
(b)	M_R on mixing two basic solutions	(ii) n × M × V ml
(c)	M_R on mixing acidic and basic solutions	(iii) $\frac{M_1V_1 - M_2V_2}{V_1 + V_2}$
(d)	milliequivalent	(iv) $\frac{M_1V_1}{V_2}$
(e)	Molarity	(v) $\frac{M_1V_1 + M_2V_2}{V_1 + V_2}$

(A) (a) - (i) , (b) - (iii) , (c) - (i) , (d) - (ii), (e)-(iv)
(B) (a) - (v) , (b) - (v) , (c) - (iii) , (d) - (ii), (e)-(i, iv)
(C) (a) - (ii) , (b) - (i) , (c) - (ii) , (d) - (iii), (e)-(ii)
(D) (a) - (i) , (b) - (ii) , (c) - (ii) , (d) - (iii), (e)-(iii)

138. Match the following

	List I	**List II**
(a)	$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_3$	(P) $K_P = K_C$
(b)	$H_{2(g)} + S_{(s)} \rightleftharpoons H_2S_{(g)}$	(Q) $K_P > K_C$
(c)	$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$	(R) $K_P < K_C$
(d)	$2NaHCO_{3(s)} \rightleftharpoons Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$	

(A) a-Q, b-P, c-P, d-R (B) a-P, b-P, c-Q, d-R
(C) a-Q, b-R, c-P, d-R (D) a-R, b-P, c-P, d-Q

139. Match the following

	List I	**List II**
(a)	$K_{eq} < 1$	(P) Affected by temperature
(b)	Degree of dissociation	(Q) Affected by pressure
(c)	Equilibrium constant	(R) $K_f < K_b$
(d)	Melting of ice	(S) $K_f > K_b$

(A) a-R, b-P, c-S, d-Q (B) a-R, b-P,Q, c-P, d-P,Q
(C) a-R, b-S c-P, d-Q (D) a-Q, b-R, c-S, d-P

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140. Match the following

	List I (Reaction)		**List II (units)**
(a)	$N_2 + O_2 \rightleftharpoons 2NO$	(P)	K_c = m/l
(b)	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	(Q)	no unit
(c)	$PCl_5 \rightleftharpoons PCl_3 + Cl_2$	(R)	$k_p = atm^{-2}$
(d)	$A_{(l)} \rightleftharpoons B_{(g)}$	(S)	K_p = atm
(A)	a-Q, b-R,c-P,S, d-P,S	(B)	a-Q, b-R,c-P, d-S
(C)	a-S, b-Q,c-P,R, d-P,S	(D)	a-R, b-Q,c-P,S, d-S

141. Match the following (Give correct match according to law of equivalence)

	Oxidising agent		**Reducing agent**
(A)	25 ml , 0.2 N $KMnO_4 \rightarrow Mn^{2+}$	(P)	50 ml 0.1 M $H_3AsO_3 \rightarrow H_3AsO_4$
(B)	25 ml , 0.1 M $K_2Cr_2O_7 \rightarrow Cr^{+3}$	(Q)	25 ml 0.2 M $FeSO_4 \rightarrow Fe^{+3}$
(C)	50 ml , 0.1 M Br_2/ $H_2O \rightarrow Br^-$	(R)	25 ml 0.15 M $H_2O_2 \rightarrow H^+$ and O_2
(D)	25 ml , 0.1 M $HNO_3 \rightarrow NO$	(S)	25 ml 0.3 M $SnCl_2 \rightarrow Sn^{+4}$

142. **Match the following :**

	Column I		**Column II**
(A)	NH_3	(P)	Non polar molecule
(B)	PF_2Cl_3	(Q)	Polar molecule
(C)	XeF_2	(R)	Bonding taking place in ground state
(D)	H_2S	(S)	Bonding taking place in excited state.

143. Match the following :

	Column I		**Column II**
(i)	A process carried out infinitesimally slowly	(a)	$\Delta E = 0, \Delta H = 0$
(ii)	A process in equilibrium	(b)	sublimation
(iii)	$A(s) \longrightarrow A(g)$	(c)	$\Delta G = 0$
(iv)	Cyclic process	(d)	reversible
(A)	i-c, ii-d, iii-a, iv-b	(B)	i-c, ii-d, iii-b, iv-a
(C)	i-d, ii-c, iii-a, iv-b	(D)	i-d, ii-c, iii-b, iv-a

144. Match the following

	Column I		**Column II**
(i)	Extensive properties P, V & T	(a)	density (at constant pressure)
(ii)	closed system	(b)	bursting of tyre
(iii)	path function	(c)	additive in nature
(iv)	adiabatic	(d)	E ≠ constant
(v)	intensive properties	(e)	heat
(A)	i-c, ii-d, iii-e, iv-b, v-a	(B)	i-d, ii-c, iii-b, iv-e, v-a
(C)	i-c, ii-e, iii-d, iv-b, v-a	(D)	i-e, ii-d, iii-c, iv-a, v-b

145. Match the following

	Column I		**Column II**
(i)	Exothermic	(a)	ΔH positive
(ii)	Endothermic	(b)	$\Sigma\Delta H_{f(P)} - \Sigma\Delta H_{f(R)}$
(iii)	Heat of reaction	(c)	ΔH negative
(iv)	Change in free energy	(d)	$\Sigma BE_R - \Sigma BE_P$
(v)	Spontaneous process	(e)	ΔG negative
		(f)	$\Delta H - T\Delta S$
(A)	i-c, ii-a, iii-bd, iv-f, v-e	(B)	i-d, ii-c, iii-b, iv-e, v-a
(C)	i-c, ii-e, iii-d, iv-b, v-a	(D)	i-e, ii-d, iii-c, iv-a, v-b

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146. Match the following

Column I		**Column II**			
		ΔG	ΔH	ΔS	T
(i)	non spontaneous, exothermic	(a) –ve	+ve	+ve	high
(ii)	spontaneous, endothermic	(b) +ve	+ve	+ve	low
(iii)	non spontaneous, increase in entropy	(c) +ve	–ve	–ve	high

(A) i-c , ii-a , iii-b (B) i-a , ii-b , iii-c
(C) i-b , ii-a , iii-c (D) i-c , ii-b , iii-a

147. Match the following :

Column I	**Column II**
(a) 10 vol H_2O_2	(P) 0.05 N
(b) 2.25 g/L $H_2C_2O_4$ as reducing agent	(Q) 3%(w/v)
(c) 2.5%(w/w) NaOH (density=1.2g/ml)	(R) 10 ppm
(d) 5 mg CaF_2 in 500 gm paste	(S) 0.625 m

148.

Column - I (Pair of species)	**Column - I (Identical Property in pairs of species)**
(A) PCl_3F_2 and PCl_2F_3	(P) Hybridisation of central atom
(B) BF_3 and BCl_3	(Q) Shape of molecule/ion
(C) CO_2 and CN_2^{-2}	(R) μ (dipole moment)
(D) C_6H_6 and $B_3N_3H_6$	(S) Total number of electrons

149. Match the following (1 to 1 matching):

Column I	**Column II**
(a) Rydberg Formula	(P) Weak electrolyte
(b) Ostwald isolation method	(Q) Spectrum of H atom
(c) Ostwald–Walker method	(R) Determination of kinetic order
(d) Ostwald dilution law	(S) Determination of vapor pressure

(A) (a – Q, b – R, c – S, d – P) (B) (a – P, b – R, c – S, d – Q)
(C) (a – Q, b – R, c – P, d – S) (D) (a – Q, b – S, c – R, d – P)

150.

Column-I (Compounds)	**Column-II (Properties)**
(A) XeF_4, $[ClF_4O]^-$, $[XeO_6]^{4-}$, IF_5	(p) same hybridisation of central atom
(B) XeO_3, $[ClF_2O]^+$, ClO_3^-, SO_3^{2-}	(q) same shape of the molecule/ion
(C) XeO_4 , $[XeO_6]^{4-}$, PCl_3F_2 , I_3^-	(r) all have zero dipole moment
(D) XeO_2F_2 , ClF_3O , XeF^+ , ICl^-	(s) all have atleast one lone pair of electrons on the central atom

151. Match the column

Column I Measurement of pressure	**Column II** Device used
(i) Pressure of gas is less than atm pressure	(A) Sphygmomanometer
(ii) Pressure of gas is more than atm pressure	(B) Barometer
(iii) Absolute pressure of gas	(C) open arm manometer
(iv) Atmospheric pressure	(D) closed arm manometer

(a) (i) - CD; (ii) - CD; (iii)-D ; (iv) - B (b) (i) - AD; (ii) - BC; (iii)-A ; (iv) - B
(c) (i) - AC; (ii) - CD; (iii)-A ; (iv) -D (d) (i) - AD; (ii) - BC; (iii)-B ; (iv) - A

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152. Match the following

List I Components present in solution		List II Method of determination of pH	
(a)	$CH_3COOH + HCl$	(P)	Basic buffer
(b)	$NH_4OH + NH_4Cl$	(Q)	Stronge base
(c)	NH_4Cl	(R)	Strong acid
(d)	$NH_4OH + NaOH$	(S)	Salt hydrolysis
(A)	a-Q, b-R, c-S, d-P	(B)	a-R, b-S, c-P, d-Q
(C)	a-Q, b-S, c-P, d-R	(D)	a-R, b-P, c-S, d-Q

153. Match the following

List I Salt		List II pH	
(a)	HCOONa	(P)	7
(b)	NH_4Cl	(Q)	< 7
(c)	$MgSO_4$	(R)	> 7
(d)	CH_3COONH_4		
(A)	a–Q, b-P, c-R, d-P	(B)	a–P, b-Q, c-Q, d-R
(C)	a–R, b-Q, c-P, d-P	(D)	a–R, b-R, c-Q, d-P

154. A weak acid HA having $K_a = 10^{-4}$ is given 100 ml of 0.1 M acid is taken in container. Now 0.1 M NaOH is added in the container List I contains volume of NaOH added and List II contains pH. Match them.

List I		List II	
(a)	10 ml NaOH solution	(P)	$\frac{1}{2}[pK_w + pK_a + \log c]$
(b)	25 ml NaOH solution	(Q)	$pK_a + \log 3$
(c)	75 ml NaOH solution	(R)	$pK_a - \log 3$
(d)	100 ml NaOH solution	(S)	$pK_a - 2\log 3$.
(A)	a-S, b-R, c-Q, d–P	(B)	a-P, b-Q, c-R, d–S
(C)	a-Q, b-R, c-S, d–P	(D)	a-S, b-P, c-Q, d–R

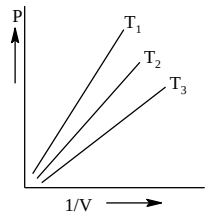
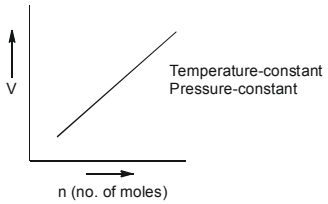
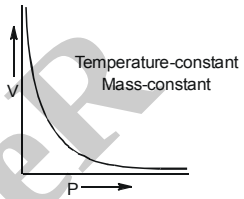
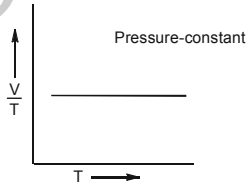
155. **Match the column**

Column I		Column II	
(i)	Boyle's law	(A)	Mass = constant
(ii)	Charle's law	(B)	Pressure = constant
(iii)	Gaylussac's law	(C)	Temperature = constant
(iv)	Avogadro's law	(D)	Volum = constant

(a) (i) - A, C ; (ii) - A, D ; (iii) - A,B ; (iv) - B, C
(b) (i)- B, D ; (ii) - A, C ; (iii) - A, C ; (iv) - A, B, C, D
(c) (i)- A, D ; (ii) - D, C ; (iii) - A, C ; (iv) - A, C
(d) (i)- B, C ; (ii) - C, D ; (iii) - D, C ; (iv) - A, D

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156. Match the column

Column I	Column II
(i) $T_1 > T_2 > T_3$	(A) 
(ii) Charle's Law	(B) 
(iii) Boyle's law	(C) 
(iv) Avogadro's law	(D) 

(a) (i) - CD; (ii) - CD; (iii)-D ; (iv) - B
(b) (i) - AD; (ii) - BC; (iii)-A ; (iv) - B
(c) (i) - AC; (ii) - CD; (iii)-A ; (iv) -D
(d) (i) - A; (ii) - D; (iii) - A,C; (iv) - B

157. Match the following :

Column I	Column II
(a) For a gas repulsive tendency dominates	(P) Effects in 'a' and 'b' compensates each other.
(b) At T_B = – 3 °C for a gas in high pressure region	(Q) There is no difference between liquid and gas.
(c) at T_C	(R) Z > 1
(d) for He gas at 0°C in all pressure region	(S) T_C = 80 K

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SECTION V: INTEGER TYPE

158. 3 moles of hydrogen are compressed isothermally and reversibly from 60 dm^3 to 20 dm^3 and 13.695 kJ of work is done on it. Assuming ideal behaviour, calculate the temperature of gas.
[R = 8.3 J/mol–K , *l*n 3 = 1.1]

159. A compound which contains one atom of X and two atoms of Y for each three atoms of Z is made by mixing 5.00 g of X , 1.15×10^{23} atoms of Y and 0.03 mole Z atoms . Given that only 4.40 g of compound results . Calculate the atomic weight of Y if the atomic weights of X and Z are 60 and 80 amu respectively .

160. If the oxidation number of Fe in $[Fe(CN)_6]^{-3}$, $[Fe(CN)_6]^{-4}$, $[Fe(SNC)]^{+2}$ and $[Fe(H_2O)_6]^{+3}$ respectively would be ABCD, the the value of that 4 digit integer will be:

161 The Enthalpy change involved in the oxidation of glucose is -2880 kJ mol^{-1} . 25 % of this energy is available for muscular work . If 100 kJ of muscular work is needed to walk one km. What is the maximum distance (in m) a person will be able to walk after eating 120 g of glucose.

162. Work done is expansion of an ideal gas from 4 litre to 6 litre against a constant external pressure of 2.5 atm was used to heat up 1 mole of water at 293 K. If specific heat of water is 4.184 J g^{-1} K^{-1}, what is the final temperature of water (in K) to the nearest integer?

163 For 10 minutes each, at 27ºC, from two identical holes nitrogen and an unknown gas are leaked into a common vessel of 3 litre capacity . The resulting pressure is 4.18 bar and the mixture contains 0.4 mole of nitrogen. What is the molar mass (in gm/mol) of the unknown gas ? Give your answer to the nearest integer

164. A drug marijuana owes its activity to tetrahydro cannabinol , which contains 70 % as many as carbon atoms as hydrogen atoms and 15 times as many hydrogen atoms as oxygen atoms . The number of mole in a gram of tetrahydro cannabinol is 0.00318 . If it's molecular formula is $\mathbf{C_x H_y O_z}$, Then find (x+y*z)

165 Calculate the pH at which $Mg(OH)_2$ begins to precipitate from a solution containing 0.10 M Mg^{+2} ions. K_{sp} of $Mg(OH)_2 = 1 \times 10^{-11}$.

166. A mixture of $(NH_4)_2SO_4$ and NH_4Cl in the ratio 43.7 % and 56.3 % respectively was dissolved in water to prepare 1 litre solution . 25 mL of this solution was boiled with 50 mL of N/10 NaOH until all the NH_3 was evolved . The excess of NaOH was neutralized by 24.3 mL of N/10 HCl . Calculate the weight of each component in mixture .

167. 13.6 eV is needed for ionisation of a hydrogen atom. An electron in a hydrogen atom in its ground state absrobs 1.50 times as much energy as the minimum energy required for it to escape from the atom. What is the wavelength of the emitted electron in Angstrom? (Answer to the nearest integer)
($m_e = 9.109 \times 10^{-31}$ kg, $e = 1.602 \times 10^{-19}$ coulomb, $h = 6.63 \times 10^{-34}$ J.s)

168. A series limit of the Balmer series of hydrogen is given by 3.65×10^{-5} cm . An element is found to give k_α line of wavelength 10^{-8} cm . Find out the atomic number of the element .

169. The maximum possible number of hydrogen bonds in which a water (H_2O) molecule can participate?

170 For the reaction $Ag(CN_2)^- \rightleftharpoons Ag^+ + 2CN^-$, the K_C at 25°C is 4×10^{-19}. If the $[Ag^+]$ concentration is $(ab \times 10^{-cd})$ in solution which was originally 0.1 M in KCN and 0.03 M in $AgNO_3$. Give the value of 4 digit integer 'abcd' eg. 1234.

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171. When light of frequency v is thrown on a metal surface with threshold frequency v_0 , Photoelectrons are emitted with maximum kinetic energy = 1.3×10^{-18} J . If the ratio , $v : v_0 = 3 : 1$, calculate the threshold frequency v_0 .

172. The ionization constant of benzoic acid is 6.46×10^{-5} and K_{sp} for silver benzoate is 2.5×10^{-13}. How many times is silver benzoate more soluble in a buffer of pH 3.19 compared to its solubility in pure water. Answer to the nearest integer.

173. A balloon of diameter 20 m weighs 100 kg. Calculate payload if it is filled with He at 1 atm and 27^0C. Density of air = 1.2 kg/m^3 . Answer tp the nearest integer

174. 0.1 g sample of chromite was fused with excess of Na_2O_2 and brought into solution according to reaction , $2\ Fe(CrO_2)_2 + 7\ Na_2O_2 \longrightarrow 2\ NaFeO_2 + 4\ Na_2CrO_4 + 2\ Na_2O$
The solution was acidified with dilute HCl and 1.2 g mohr salt (molecular weight 392) added . The excess of Fe^{2+} required 24 mL of 0.05 N $K_2Cr_2O_7$ for titration . What is percent of Cr in sample ?

175. How many unpaired electrons are present in N_2^+?

176. Calculate the root mean square velocity of ozone kept in a closed vessel at 20ºC and 82 cm mercury pressure.

177. The angle between the bonding orbitals of a molecule AX_3 with zero dipole moment is?

178 At 27^0C, hydrogen is leaked through a tiny hole into a vessel for 20 minutes. Another unknown gas at the same temperature and pressure as that of H_2 is leaked through the same hole for 20 minutes . After the effusion of the gases the mixture exerts a pressure of 6 atm. The hydrogen content of the mixture is 0.7 mole . If the volume of the container is 3 litre , what is molecular weight of unknown gas.

179. The dissociation pressure of solid ammonium hydro-sulphide at 27 ºC is 60 cm . What will be the total pressure when it dissociates at the same temperature in presence of NH_3 at a pressure of 45 cm ? Assume NH_4HS dissociates completely into NH_3 and H_2S .

180. In the following reaction , $KAl + LFe_3O_4 \rightarrow MAl_2O_3 + NFe$
The values of the 4 digit integer KLMN is?

181. The rate of disappearance of A at two temperature for the equilibrium $A \rightleftharpoons B$ is given by,

$$-\frac{dA}{dt} = 2 \times 10^{-2}\ [A] - 4 \times 10^{-3}\ [B] \text{ at } 300\ K$$

$$-\frac{dB}{dt} = 4 \times 10^{-2}\ [A] - 16 \times 10^{-4}\ [B] \text{ at } 400\ K$$

Calculate : (i) equilibrium constants at 300 K and 400 K and
(ii) heat of reaction

182. How will the concentration of Ag^+ in a saturated solution of AgCl diminish if such an amount of HCl is added to it that the concentration of Cl^- in the solution becomes equal to 0.03 mol litre^{-1} ?
[$K_{sp_{AgCl}} = 1.8 \times 10^{-10}$]

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XII

SECTION I: SINGLE OPTION CORRECT

183. Lowering of vapour pressure due to a solute in 2 molal solution at 100ºC is -
(A) 13.44 Torr (B) 14.12 Torr (C) 312 Torr (D) 26.4 Torr

184. An aqueous solution containing liquid A (M. wt. = 128) 64% by weight has a V. P. of 145 mm. If the vapour pressure of water is 155 mm then vapour pressure of A at the same temperature will be -
(A) 205 mm (B) 105 mm (C) 185 mm (D) 52.5 mm

185. Liquids A and B form an ideal solution and the B has stronger intermolecular forces. If X_A and X'_A are the mole fractions of A in the solution and vapour in equilibrium, then -
(A) $\frac{X'_A}{X_A} = 1$ (B) $\frac{X'_A}{X_A} > 1$ (C) $\frac{X'_A}{X_A} < 1$ (D) $X'_A + X_A = 1$

186. A solution of a non-volatile solute in water has a boiling point of 375. 3 K. The vapour pressure of water above this solution at 338 K is -
[Given p_0 (water) = 0.2467 atm at 338 K and K_b for water =0.52 K kg mol^{-1}]
(A) 0.18 atm (B) 0.23 atm (C) 0.34 atm (D) 0.42 atm

187. Which of the following is wrong :
(A) Enthalpy (numerical value) of physisorption is greater than that of chemisorption
(B) Physisorption is not very specific but chomisorption is highly specific
(C) Chemisorption takes place at relatively high temperatures
(D) In physisorption generally multi–molecular layers are formed on the adsorbent

188. Which of the following gases, will be adsorbed maximum on a solid surface :
(A) CO_2 (B) O_2 (C) N_2 (D) H_2

189. Which of the following has minimum gold number?
(A) Potato starch (B) Gum arabic (C) Gelatin (D) Albumin

190. Which of the following is a mismatch :
(A) Lyophilic colloids – reversible sols
(B) Associated collides – micelles
(C) Tyndall effect – scattering of light by colloidal particle
(D) Electrophoresis – movement of dispersion medium under the influence of electric field

191. Which of the following ions will be most effective in coaogulating the As_2S_3 sol :
(A) Fe^{3+} (B) Ba^{2+} (C) Cl^- (D) PO_4^{3-}

192. When freshly precipated $Fe(OH)_3$ is shaken with aqeous solution of $FeCl_3$, a colloidal solution is formed. This process is known as :
(A) Emulsification (B) Coagulation (C) Petpization (D) Electro–osmosis

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193. (i) At 298 K the volume of NH_3 adsorbed by 1g of charcoal is higher than that of H_2 under similar conditions.
(ii) The movement of collodial particles towards the oppositely charged electrodes on passing electric current is known as Brownian movement.
(A) T, T (B) T, F (C) F, T (D) F, F

194. Two solution of $CH_2ClCOOH$ and CH_3COOH are prepared separately molarity of both in 0.1 M and osmotic pressure are P_1 & P_2. The correct relationship between the osmotic pressure is

(A) $P_2 > P_1$ (B) $P_1 > P_2$ (C) $P_1 = P_2$ (D) $\frac{P_1}{P_1 + P_2} = \frac{P_2}{P_1 + P_2}$

195. The f.p of a 0.08 molal solution of $NaHSO_4$ is –0.372ºC. The dissociation constant for the reaction , $HSO_4^- \longrightarrow H^+ + SO_4^{2-}$; is - [K_f for water = 1.86ºC]
(A) 2×10^{-4} (B) 4×10^{-4} (C) 2×10^{-2} (D) 4×10^{-2}

196. 1 g of monobasic acid in 100 g of water lowers the freezing point by 0.168º. If 0.2 g of same acid requires 15.1 mL of N/10 alkali for complete neutralization, degree of dissociation of acid will be - [K_f for H_2O is 1.86 K mol^{-1} kg]
(A) 16.8% (B) 22.4% (C) 19.6% (D) 26.2%

197. Which of the following expressions is true in case of sodium chloride unit cell :

(A) $r_c + r_a = a$ (B) $r_c + r_a = \frac{a}{2}$ (C) $r_c + r_a = 2a$ (D) $r_c + r_a = \sqrt{2}\, a$

198. Two electro chemical cells are assembled in which the following reactions occur,
$V^{2+} + VO^{2+} + 2H^+ \longrightarrow 2V^{3+} + H_2O$; $E^\circ_{cell} = 0.616$ V
$V^{3+} + Ag^+ + H_2O \longrightarrow VO^{2+} + 2H^+ + Ag(s)$; $E^\circ_{cell} = 0.439$ V
then E° for the half reaction , $V^{3+} + e^- \longrightarrow V^{2+}$, is : [Given : $E^\circ_{Ag^+|Ag} = 0.799$ V]
(A) –0.256 V (B) +0.256 V (C) –1.05 V (D) +1.05 V

199. For the cell reaction , $Cu^{2+}(aq) + Zn(s) \longrightarrow Zn^{+2}(aq) + Cu(s)$
(C_1) (C_2)
of an electrochemical cell , the change in free energy ΔG at a given temperature is a function of :
(A) $\ell n(C_1)$ (B) $\ell n(C_2/C_1)$ (C) $\ell n(C_1 + C_2)$ (D) $\ell n(C_2)$

200. Consider the reaction of extraction of gold from its ore

$$Au + 2CN^-(aq.) + \frac{1}{4}O_2(g) + \frac{1}{2}H_2O \longrightarrow Au(CN)_2^- + OH^-$$

Use the following data to calculate ΔG° for the reaction

$K_f\{Au(CN)_2^-\} = X$

$O_2 + 2H_2O + 4e^- \longrightarrow 4OH^-$; $E^\circ = +0.41$ volt
$Au^{3+} + 3e^- \longrightarrow Au$; $E^\circ = +1.5$ volt
$Au^{3+} + 2e^- \longrightarrow Au^+$; $E^\circ = +1.4$ volt
(A) $-RT\ ln\ X + 1.29\ F$ (B) $-RT\ ln\ X - 2.11\ F$
(C) $-RT\ ln\ \frac{1}{X} + 2.11\ F$ (D) $-RT\ ln\ X - 1.29\ F$

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201. The activity of a radionuclide (X^{100}) is 6.023 curie. If the disintegration constant is 3.7×10^4 sec^{-1}, the mass of radionuclide is:
(A) 10^{-14} g (B) 10^{-6} g (C) 10^{-15} g (D) 10^{-3} g

202. The ionization constant of a weak electrolyte is 64×10^{-6} while the equivalent conductance of its 0.01 M solution is 20 s cm^2 eq^{-1}. The equivalent conductance of the electrolyte at infinite dilution (in S cm^2 eq^{-1}) will be :
(A) 250 (B) 196 (C) 392 (D) 384

203. The conductivity of 0.35 M solution of univalent weak electrolyte XY is 0.0175 Ω^{-1} cm^{-1}. The value of Λ_m^∞ of XY is 500 Ω^{-1} cm^2 mol^{-1}. the value of Ostwald dilution constant of AB is :
(A) 3.89×10^{-3} (B) 2.5×10^{-4} (C) 2.8×10^{-3} (D) 2.8×10^{-4}

204. Solid CO_2 is an example of the crystal type :
(A) ionic (B) covalent (C) metallic (D) molecular

205. Name the crystal class for which all the four types of unit cells are possible.
(A) hexagonal (B) tetragonal (C) monoclinic (D) orthorhombic

206. Co-ordination ratio changes to lower number e.g. 8 : 8 to 6 :6 on :
(A) applying pressure (B) increasing temperature
(C) a and b (D) change in catalyst

207. Radium has atomic weight 226 and half life of 1600 year. The number of disintegration produced per sec. from 1 g are:
(A) 4.8×10^{10} (B) 3.7×10^{10} (C) 9.2×10^6 (D) 3.7×10^8

208. NaCl shows schottky defects, AgCl frenkel defects. Their electrical conductivity is due to :
(A) motion of ions and not motion of electrons
(B) motion of electrons and not motion of ions
(C) lower co-ordination number of KCl
(D) higher co-ordination number of AgCl

209. In a crystalline solid, anion B are arranged in CCP lattice and cations A occupy 50% of the octahedral voids and 50% of the tetrahedral voids. What is the formula of the solid?
(A) AB (B) A_3B_2 (C) A_2B_2 (D) A_2B_3

210. An aqueous solution containing one mole per litre each of $Cu(NO_3)_2$, $AgNO_3$, $Hg_2(NO_3)_2$, $Mg(NO_3)_2$ is being electrolysed by using inert electrodes. The value of standard potentials are

$$E^\circ_{Ag^+|Ag} = 0.80V, E^\circ_{Hg_2^{2+}|Hg} = 0.79V, E^\circ_{Cu^{2+}|Cu} = 0.34V \text{ and } E^\circ_{Mg^{2+}|Mg} = -2.3V$$

With increasing voltage, the sequence of deposition of metals on the cathode will be
(A) Ag, Hg, Cu, Mg (B) Mg, Cu, Hg, Ag (C) Ag, Hg, Cu (D) Cu, Hg, Ag

211. If 'a' is the edge length of the unit cell of an atomic crystal having face centered cubic lattice, then what is the distance of closest approach between the two atoms in the crystal ?

(A) $\sqrt{2}\,a$ (B) $\frac{a}{2}$ (C) $\frac{\sqrt{2}}{a}$ (D) $\frac{1}{2}(\sqrt{2}a)$

212. The number of β-particle emitted during the change ${}_aX^c \longrightarrow {}_dY^b$ is:

(A) $\frac{a-b}{4}$ (B) $d + \left[\frac{a-b}{2}\right] + c$ (C) $d + \left[\frac{c-b}{2}\right] - a$ (D) $d + \left[\frac{a-b}{2}\right] - c$

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213. Which is correct relation in between $\frac{dC}{dt}$, $\frac{dn}{dt}$ and $\frac{dP}{dt}$ where C, n, P, represents concentration, mole and pressure terms for gaseous phase reactant A(g) $\longrightarrow$ product.

(A) $-\frac{dC}{dt} = -\frac{1}{V}\frac{dn}{dt} = -\frac{1}{RT}\frac{dP}{dt}$ (B) $\frac{dC}{dt} = \frac{dn}{dt} = -\frac{dP}{dt}$

(C) $\frac{dC}{dt} = \frac{RT}{V}\frac{dn}{dt} = -\frac{dP}{dt}$ (D) All

214. For the reaction, $H_2(g) + Br_2(g) = 2HBr(g)$, the reaction rate = $K[H_2][Br_2]^{1/2}$. Which statement is true about this reaction :

(A) The reaction is of second order (B) Molecularity of the reaction is 3/2

(C) The unit of K is sec^{-1} (D) Molecularity of the reacion is 2

215. A radioactive isotope having a half life of 3 day was received after 12 day. It was found that there were 3 g of the isotope in the container. The initial weight of the isotope when packed was:

(A) 12 g (B) 24 g (C) 36 g (D) 48 g

216. The rate constant for a reaction is 10.8×10^{-5} mol $litre^{-1}$ sec^{-1}. The rection obeys :

(A) First order (B) Zero order (C) Second order (D) Half order

217. Salts of A (atomic weight = 7), B (atomic weight =27) and C (atomic weight = 48) were electrolysed under identical conditions using the same quantity of electricity. It was found that when 2.1 g of A was deposited, the weights of B and C deposited were 2.7 and 7.2 g. The valencies of A, B and C respectively are

(A) 3, 1 and 2 (B) 1, 3 and 2 (C) 3, 1 and 3 (D) 2, 3 and 2

218. The $^{238}_{92}U$ disintegrates to give 4 α-and 6-β particles. The atomic number of the end product is

(A) 92 (B) 96 (C) 84 (D) 90

219. What is the order of reaction ,

$A_2 + B_2 \longrightarrow 2\,AB$; having following mechanism

$A_2 \rightleftharpoons A + A$ ..... (fast)

$A + B_2 \longrightarrow AB + B$ ..... (slow)

$A + B \longrightarrow AB$ ..... (fast)

(A) 2 (B) 1 (C) 3/2 (D) 1/2

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SECTION II: MORE THAN ONE OPTION CORRECT

220. 1 mol benzene ($P^{o}_{benzene}$ = 42 mm) and 2 mol toluene ($P^{o}_{toluene}$ = 30 mm) will have
(A) total pressure 38 mm
(B) mol fraction of vapours of benzene above liquid mixture is 7/19
(C) positive deviation from Raoult's law
(D) negative deviation from Raoult's law

221. Which of the following statements are correct ?
(A) The rate of the reaction involving the conversion of ortho-hydrogen to parahydrogen is

$$-\frac{d[H_2]}{dt} = k[H_2]^{3/2}$$

(B) The rate of the reaction involving the thermal decomposition of acetaldehyde is $k[CH_3CHO]^{3/2}$
(C) In the formation of phosgene gas from CO and Cl_2, the rate of the reaction is $k[CO][Cl_2]^{1/2}$
(D) In the decomposition of H_2O_2, the rate of the reaction is $k[H_2O_2]$.

222. Emulsion can be destroyed by
(A) the addition of an emulsifier which tends to form an emulsion of the same type
(B) electrophoresis with a high potential
(C) freezing
(D) all of these

223. Which of the following statements are correct
(A) ΔE_{cell} is temperature independent
(B) A reaction is spontaneous from left to right if $Q < K_{eq}$ in which case $\Delta E_{cell} > 0$
(C) A reaction occurs from right to left if $K_{eq} < Q$, in which case $\Delta E_{cell} < 0$
(D) none of these

224. During discharging of lead storage battery, which of the following is/are true ?
(A) H_2SO_4 is produced
(B) H_2O is consumed
(C) $PbSO_4$ is formed at both electrodes
(D) Density of electrolytic solution decreases

225. Isoelectric point is the pH at which colloidal particles
(A) coagulate
(B) becomes electrically neutral
(C) can move toward either electrode
(D) none of these

226. To 10 mL of 1 M $BaCl_2$ solution 5 mL of 0.5 M K_2SO_4 is added, $BaSO_4$ is precipitated out. What will happen?
(A) F. pt. is increased
(B) B. pt. is increased
(C) F. pt. is lowered
(D) B. pt. is lowered

227. Which of the following is/are correct
(A) α-rays are more penetrating than β-rays
(B) α-rays have greater ionizing power than β-rays
(C) β-particles are not present in the nucleus, yet they are emitted from the nucleus
(D) γ-rays are not emitted simultaneously with α and β-rays

228. Which of the following arrangement will produce oxygen at anode during electrolysis ?
(A) Dilute H_2SO_4 solution with Cu electrodes.
(B) Dilute H_2SO_4 solution with inert electrodes.
(C) Fused NaOH with inert electrodes.
(D) Dilute NaCl solution with inert electrodes.

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229. The azeotropic solution of two miscible liquids
(A) can be separated by simple distillation
(B) may show positive or negative deviation from raoult's law
(C) are super saturated solutions
(D) behave like a single component and boil at a constant temperature

230. Which of the following are macromolecular colloids
(A) starch (B) soap (C) detergent (D) cellulose

231. Which of the following statements is correct for electrophoresis ?
(A) colloids are uncharged particles and do not migrate towards the electrodes when electric field is applied
(B) in electrophoresis, solution migrates either to the anode or to the cathode depending on the positively or negatively charged solution
(C) electrophoresis is a useful method for finding the charge of a solution
(D) none of these

232. The basic theory of Arrhenius's equation is that
(A) the number of effective collisions is proportional to the number of molecules above a certain threshold energy
(B) as the temperature increases, the number of molecules with energies exceeding the threshold energy increases
(C) the rate constant is a function of temperature
(D) activation energy and pre-exponentional factors are always temperature independent

233. Pick out the **correct** statements among the following from inspection of standard reduction potentials (Assume standard state conditions).

Cl_2 (aq.) + 2e	l	2Cl⁻(aq.)	$E^o_{Cl_2/Cl^-}$ = + 1.36 volt
Br_2 (aq.) + 2e	l	2Br⁻(aq.)	$E^o_{Br_2/Br^-}$ = + 1.09 volt
I_2(s) + 2e	l	2I⁻ (aq.)	$E^o_{I_2/I^-}$ = + 0.54 volt
$S_2O_8^{2-}$ (aq.) + 2e	l	$2SO_4^{2-}$ (aq.)	$E^o_{S_2O_8^{2-}/SO_4^{2-}}$ = + 2.00 volt

(A) Cl_2 can oxidise SO_4^{2-} from solution
(B) Cl_2 can oxidise Br^- and I^- from aqueous solution
(C) $S_2O_8^{2-}$ can oxidise Cl^-, Br^- and I^- from aqueous solution
(D) $S_2O_8^{2-}$ is added slowly, Br^- can be reduce in presence of Cl^-

234. Effect of adding a non volatile solute to a solvent is
(A) to lower the vapour pressure (B) to increase its freezing point
(C) to increase its boiling point (D) to decrease its osmotic pressure

235. Methods used for the preparation of colloidal solutions are
(A) peptisation (B) hydrolysis
(C) ultrasonic dispersion (D) coagulation

236. The correct starting material and product of different disintegration series are
(A) ^{232}Th, ^{208}Pb (B) ^{235}U, ^{206}Pb (C) ^{238}U, ^{207}Pb (D) ^{237}Np, ^{209}Bi

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237. Surfactant molecules or ions can cluster together as micelles, which
(A) are colloid-sized cluster of molecules
(B) due to their hydrophobic tails tend to congregate
(C) due to their hydrophobic head provide protection
(D) none of these

238. Which of the following are correctly matched?
(A) Butter-gel (B) Milk-emulsion (C) Fog-aerosol (D) Dust-solid sol

239. Which of the following are incorrect statements?
(A) Hardy schulz rule is related to coagulation
(B) Brownian moment and Tyndall effect are the characteristic of colloids.
(C) In gel, the liquid is dispersed in liquid
(D) Lower the gold number, more is the protective power of lyophillic sols.

240. Which of the following are multimolecular colloids?
(A) Sulphur (B) Egg albumin in water
(C) Gold sol (D) Soap solution

241. The origin of charge on colloidal solution is
(A) Frictional rubbing
(B) Electron capture during Bredig's arc method
(C) Selective adsorption of ion on their surface
(D) It is due to addition of protective colloids

242. Which of the following are based on Tyndall effect.
(A) Ultra microscope (B) Deltas (C) Blue colour of sky (D) Coagulation

243. If 270.0 g of water is electrolysed during an experiment performed by miss Abhilasha with 75% current efficiency then
(A) 168 L of O_2 (g) will be evolved at anode at 1 atm & 273 K
(B) Total 504 L gases will be produced at 1 atm & 273 K.
(C) 336 L of H_2 (g) will be evolved at anode at 1 atm & 273 K
(D) 45 F electricity will be consumed

244. Which of the following reactions is of the first order ?
(A) The decomposition of ammonium nitrate in an aqueous solution
(B) The inversion of cane-sugar in the presence of an acid
(C) The acidic hydrolysis of ethyl acetate
(D) All radioactive decays.

245. If two solution are isotonic then : [C is concentration of solution and i is vant Hoff factor]
(A) $C_1 = C_2$ (if both are non-electrolyte)
(B) $i \times C_1 = C_2$ (If one is electrolyte and another is non-electrolyte)
(C) $i_1 \times C_1 = i_2 \times C_2$ (if both are electrolytes)
(D) none of these

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246. Which of the following is correctly matched (where Z is number of atoms per unit cell, a is edge lenght of cube and r is radius of atom)

(A)	SCC	Z = 1	a = $\sqrt{2}$ r
(B)	BCC	Z = 2	a = $\frac{4}{\sqrt{3}}$ r
(C)	FCC	Z = 4	a = $2\sqrt{2}$ r
(D)	HCP	Z = 4	a = 2 r

247. Which of the following statements are correct ?
(A) the work done by the system on the surrounding is negative
(B) the work done on the system by the surroundings is positive
(C) the heat absorbed by the system from the surroundings is positive
(D) the heat absorbed by the surroundings from the system is negative

248. Oxygen and hydrogen gas are produced at anode and cathode during the electrolysis of dilute aqueous solution of
(A) Na_2SO_4 (B) $AgNO_3$ (C) H_2SO_4 (D) NaOH

249. The calculation of the pre-exponential factor is based on the
(A) idea that, for a reaction to take place, the reactant species must come together
(B) Calculation of the molecularity of the reaction
(C) idea that the reactant species must come together, leading to the formation of the transition state which then transforms into the products
(D) calculation of the order of the reaction

250. In which of the following ways does an activated complex differ from an ordinary molecule ?
(A) It is quite unstable and has no independent existence.
(B) ΔH°_f is probably positive
(C) The system has a greater vibrational character.
(D) The system has no vibrational character.

251. $Zn + 2H^+ \longrightarrow Zn^{2+} + H_2$
Half-life period is independent of concentration of zinc at constant pH. For the constant concentration of Zn, rate becomes 100 times when pH is decreased from 3 to 2. Hence

(A) $\frac{dx}{dt} = k[Zn]^0[H^+]2$

(B) $\left(\frac{dx}{dt}\right) = k\,[Zn]\,[H^+]^2$

(C) rate is not affected if concentration of zinc is made four times and that of H^+ ions is halved.
(D) rate becomes four times if concentration of H^+ ion is doubled at constant Zn concentration,.

252. Which of the following statements are correct ?
(A) The electrolysis of aqueous NaCl produces hydrogen gas at the cathode and chlorine gas at the anode.
(B) The electrolysis of a dilute solution of sodium fluoride produces oxygen gas at the anode and O_2 gas at the cathode.
(C) The electrolysis of concentrated sulphuric acid produces SO_2 gas at the anode and O_2 gas at the cathode.
(D) After the electrolysis of aqueous sodium sulphate, the solution becomes acidic.

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253. Which of the following statements are correct ?
(A) The electrolysis of concentrated H_2SO_4 at 0–5ºC using a Pt electrode produces $H_2S_2O_8$.
(B) The electrolysis of a brine solution produces $NaClO_3$ and NaClO.
(C) The electrolysis of a $CuSO_4$ solution using Pt electrodes causes the liberation of O_2 at the anode and the deposition of copper at the cathode
(D) All electrolytic reactions are redox reactions.

254. In an electrochemical process , a slat bridge is used :
(A) to maintain electroneutrality in each solution
(B) to complete the circuit so that current can flow
(C) as an oxidizing agent
(D) as a colour indicator

255. The decomposition of hydrogen peroxide is an example of
(A) Exothermic reaction (B) Endothermic reaction
(C) Negative catalysis (D) Auto-oxidation

256. A concentration cell is a galvanic cell in which :
(A) the electrode material and the solutions in both half-cells are composed of the same substances
(B) only the concentrations of the two solutions differ
(C) $\Delta E^0_{cell} = 0$
(D) the Nernst equation reduces to $\Delta E_{cell} = -\left(\frac{0.0592}{n}\right)$ log Q at 25ºC

257. $Pb(s)|\underset{\text{saturated solution}}{PbSO_4}|\underset{\text{saturated solution}}{PbI_2}|Pb(s)$

Which of the following expressions represent the emf of the above cell at 25 ºC ?

(A) $E = \frac{0.0592}{2} \log \frac{(a_{pb^{2+}})_2}{(a_{pb^{2+}})_1}$ (B) $E = \frac{0.0592}{2} \log \frac{(a_{pb^{2+}})_1}{(a_{pb^{2+}})_2}$

(C) $E = \frac{0.0592}{2} \log \frac{[K_{sp}(PbI_2)]^{1/3}}{[K_{sp}(PbSO_4)]^{1/2}}$ (D) $E = \frac{0.0592}{2} \log \frac{K_{sp}(PbI_2)}{K_{sp}(PbSO_4)}$

258. When a non-volatile solute is added to a pure solvent, the
(A) vapour pressure of the solution becomes lower than that of the pure solvent
(B) rate of evaporation of the pure solvent is reduced
(C) solute does not affect the rate of condensation
(D) rate of evaporation of the solution is equal to the rate of condensation of the solution at a lower vapour pressure than that in the case of the pure solvent.

259. Which of the following combinations are correct for a binary solution, in which the solute as well as the solvent are liquid?
(A) C_6H_6 and $C_6H_5CH_3$; $\Delta H_{soln} > 0$; $\Delta V_{sol} = 0$
(B) CH_3COCH_3 and $CHCl_3$; $\Delta H_{soln} < 0$; $\Delta V_{sol} < 0$
(C) H_2O and HCl; $\Delta H_{soln} > 0$; $\Delta V_{sol} < 0$
(D) H_2O and C_2H_5OH; $\Delta H_{soln} > 0$; $\Delta V_{sol} > 0$

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260. Which of the following statements are correct for a binary solution which shows negative deviation from Raoult's law?

(A) The negative deviation from linearity diminishes and tends to zero as the concentration of the solution component approaches unity.
(B) When solutions from, their volumes are smaller than the sum of the volumes of their components
(C) Heat is released during the formation of the solution.
(D) Heat is absorbed during the formation of the solution.

261. Which of the following structures have layered lattices ?

(A) cadmium iodide (B) ice
(C) graphite (D) diamond

262. A binary liquid (AB) shows positive deviation from Raoult's law wen

(A) $p_A > p_A^0 X_A^{liq} > p_B^0 X_B^{liq}$ (B) intermolecular forces: A–A, B–B > A–B
(C) $\Delta V_{mix} > 0$ (D) $\Delta H_{mix} > 0$

263. Lead metal has a density of 11.34 g/cm^3 and crystallizes in a face–centered lattice. Choose the correct alternatives

(A) the volume of one unit celt is 1.214×10^{-22} cm^3
(B) the volume of one unit cell is 1.214×10^{-19} cm^3
(C) the atomic radius of lead is 165 pm
(D) the atomic radius of lead is 155.1 pm

264. Consider following solutions:

I : 1 M aq. glucose II : 1 M aq. sodium chloride
III : 1 M benzoic acid in benzene IV : 1 M ammonium phosphate
Select correct statement (s)

(A) all are isotonic solutions (B) III is hypotonic of I, II, IV
(C) I, II, IV are hypertonic of III (D) IV is hypertonic of I, II, III

265. Which of the following is (are) lyophobic colloids?

(A) Gold sol (B) As_2S_3 sol (C) Starch sol (D) $Fe(OH)_3$ sol

266. The ionic radii of Cs and Cl are 0.165 nm and 0.181nm respectively. Their atomic weights are 133 and 35.5. Then,

(A) the lattice parameter is 0.4 nm
(B) the lattice parameter can not be determined from this data
(C) the density of CsCl is 4.37×10^3 kg/m^3
(D) the CsCl structure has a fcc structure with a basis

267. Which of the following statements are correct about half-life period

(A) it is proportional to initial concentration for zeroth order
(B) average life = 1.44 half-life for first order reaction
(C) time of 75% reaction is thrice of half-life period in second order
(D) 99.9% reaction takes place in 100 minutes for the case when rate constant is 0.0693 min^{-1}

268. Which type of crystals contain one Bravais lattice?

(A) hexagonal (B) triclinic (C) rhombohedral (D) monoclinic

269. TiO_2(rutile) shows 6 : 3 coordination.Which of the following solids have a rutile-like structure ?

(A) MnO_2 (B) ZnS (C) KCl (D) SnO_2

270. The hcp and ccp structure for a given element would be expected to have

(A) the same coordination number (B) the same density
(C) the same packing fraction (D) all the above

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271. Two reaction A $\rightarrow$ products and B $\rightarrow$ products have rate constant k_A and k_B at temperature T and activation energies E_A and E_B respectively. If $k_A > k_B$ and $E_A < E_B$ and assuming that A for both the reactions is same, then

(A) at higher temperatures k_A will be greater than k_B
(B) at lower temperatures k_A and k_B will be close to each other in magnitude
(C) as temperature rises, k_A and k_B will be close to each other in magnitude
(D) at lower temperatures $k_B > k_A$

272. Which of the following statements are correct for the rock-salt structure ?

(A) the tetrahedral sites are smaller than the octahedral sites
(B) the octahedral sites are occupied by cations and the tetrahedral sites are empty
(C) the radius ratio is 0.732
(D) the radius ratio is 0.999

273. Which of the following statements are correct ?

(A) the coordination number of each type of ion in a CsCl crystal is eight
(B) a metal that crystallizes in a bcc structure has a coordination number of twelve
(C) a unit cell of an ionic crystal shares some of its ions with other unit cells
(D) the length of the unit cell is NaCl is 552 pm (given that r_{Na^+} = 95 pm and r_{Cl^-} = 181 pm)

274. Which of the followings are examples of pseudo-unimolecular reaction :

(A) $CH_3CO_2C_2H_5 + H_2O \xrightarrow{H^\oplus} CH_3CO_2H + C_2H_5OH$

(B) $C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^\oplus} C_6H_{12}O_6 + C_6H_{12}O_6$
(glucose) (Fructose)

(C) $CH_3COCl + H_2O \longrightarrow CH_3CO_2H + HCl$

(D) $CH_3CO_2C_2H_5 + H_2O \xrightarrow{OH^\Theta} CH_3CO_2H + C_2H_5OH$

275. Which of the following compounds represent a normal 2 : 3 spinel structure ?

(A) $Mg^{II}Al_2^{III}O_4$ (B) $Co^{II}(Co^{III})_2O_4$ (C) $Zn(TiZn)O_4$ (D) $Ni(CO)_4$

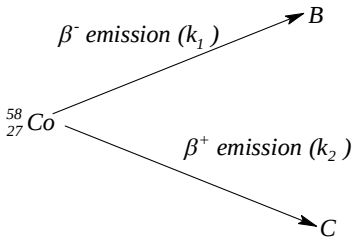
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SECTION III: COMPRHENSIONS

COMPREHENSION # 26

Paragraph for Questions Nos. 276 to 279

In a parallel reaction reactant cobalt which is a transition metal decays by parallel pathways to form 2 products B and C.



The ratio of concentration of [B] : [C] are 2 : 98 and the half life Co is 22 years.

276. The decay constant for (B) should be

(A) $63 \times 10^{-5}\ y^{-1}$ (B) $126 \times 10^{-5}\ y^{-1}$ (C) $863 \times 10^{-3}\ y^{-1}$ (D) None of these

277. The decay constant for C is

(A) $0.03\ y^{-1}$ (B) $1.5\ y^{-1}$ (C) $0.09\ y^{-1}$ (D) None of these

278. The product B will be

(A) Copper (B) Manganese (C) Nickel (D) Zinc

279. The product C will be

(A) Copper (B) Manganese (C) Nickel (D) Iron

COMPREHENSION # 27

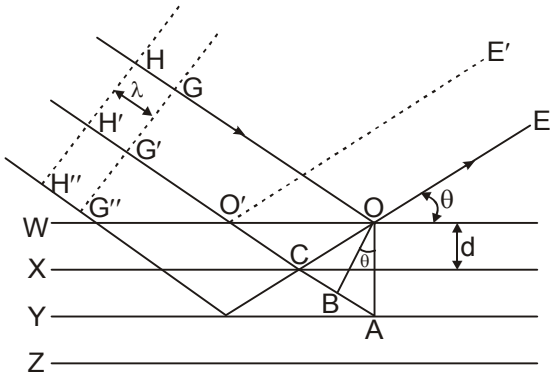
Paragraph for Questions Nos. 280 to 282

THE BRAGG METHOD OF CRYSTAL ANALYSIS

A simple method of crystal analysis is that suggested by W.H. and W.L. Bragg, and this is discussed below.

The Braggs first called attention to the fact, since a crystal is composed of a series of equally spaced atomic planes, it may be employed as a reflection grating. A beam of X rays striking the atoms which constitute these planes will be diffracted then in such a manner as to cause either interference with or reinforcement of the beam diffracted from the first, or outer plane, and the whole beam will behave as if it had been *reflected* from the surface of the crystal.

To understand better the theory of this method consider, as shown in figure,



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Reflection of X rays by parallel planes

A wave front GG′G″ of X rays approaching at an angle θ a series of parallel, equidistant planes, W, X, Y, Z, etc., which constitute the atomic planes of the crystal. Part of the beam HGO will be reflected at O along OE at the angle of reflection θ, which is the same as the angle of incidence. Similarly , the beam H′G′O′ will be reflected party at O′ along O′E′, and then again at C on the second plane along COE. In order to emerge along OE the second beam has to travel a longer distance than the first, namely, the distance H′ G′ O′ CO as against the distance HGO. If the difference in distance of the two paths is exactly equal to an integral multiple of the wave length of the radiation, the two beam will be in phase at O, will reinforce each other, and the intensity of the reflected rays will be at a maximum. When the two beams are out of phase, however interference will result, and the intensity of the reflected beam will be less than the maximum. The condition for maximum reflection intensity is then that the distance

$$G'CO - GO = n\lambda$$

where λ is the wave length of the X rays employed, while n is an integer taking on the values 1, 2, 3, ... and known as the *order of reflection*. If a perpendicular is drawn now from O to the extension of the line G′O′C, while another is dropped from O to A perpendicular to W, X, and Y, it follows that

$$G'CO = G'A - CA + CO$$
$$= G'A$$

Since CO = CA from the construction of the figure. But

$$GO = G'B$$

Therefore, $$G'CO - GO = G'A - G'B$$
$$= BA$$

and hence $$BA = n\lambda$$

It can readily be shown that the angle BOA is also θ. Then, since OB was constructed perpendicular to G′A,

$$\sin\theta = \frac{BA}{OA}$$

and $$BA = OA \sin\theta$$
$$= 2d \sin\theta$$

Where d is the distance between any two atomic planes in the crystal.

Therefore, $$n\lambda = 2d \sin\theta$$

This simple equation connect directly wave length and order of reflection of X rays with the interplanar distance d and the angle of maximum reflection θ. Without any further information the ration λ/d is deducible by measuring n and θ. On the other hand, if λ is known, d may be calculated; or vice versa, if d is known, the crystal may be employed to determine the wave length of the X rays.

280. The longest X-ray wavelength that may be used to determine a lattice spacing of 1Å by the Bragg reflection method is

(A) 1Å (B) 2Å (C) 3Å (D) 4Å

281. Using X-rays of wavelength 20 pm, it was found that the first order reflection from the face planes and planes parallel to face planes containing Cl^- ions, of a crystal of KCl (NaCl type structure) at 25°C is at θ = 1.8°. The density of the crystal determined is therefore nearly . K – 39, Cl – 35.5

(Take $\frac{1}{\pi}$ = 0.3183)

(A) 3.84 g/cc (B) 1.92 g/cc (C) 2.91 g/cc (D) 4.83 g/cc

282. What is the size of the K^+ ion if the size of the Cl^- ion is 1.8Å ? Take data from the above question.

(A) 0.9 Å (B) 1.0 Å (C) 1.18Å (D) 1.38 Å

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COMPREHENSION # 28
Paragraph for Questions Nos. 283 to 287

IMPERFECTION IN IONIC SOLIDS:

In an ideal crystal there must be regular repeating arrangement of the constituting particles and its entropy must be zero at absolute zero temperature. However, it is impossible to obtain an ideal crystal and it suffers from certain defects called imperfections, In pure crystal, these defects arise either due to disorder or dislocation of the constituting particles from their normal positions or to the movement of the particles even at absolute zero temperature. Such defects increase with rise in temperature. In addition to this, certain defects arise due to the presence of some impurities. Such defects not only modify the existing properties of the crystalline solids but also impart certain new characteristics to them.

In pure crystal, e.g. silicon or germanium at 0 K, the electrons are present in fully occupied lowest energy states and are not expected to conduct any electricity. However at temperature above 0K, some electrons leave their bonds and become free to move in the crystal lattice, giving rise to electrical conductivity. The electron deficient bonds, called holes (+ively charged) and thermally mobile electrons move in opposite directions under the electric field.

Stoichiometric point defects include (1) Schottky defects, which arise due to missing of both cations and anions from their lattice sites without disturbing the stoichiometry and (2) Frenkel defects, which arise due to misplacement of certain ions in the crystal lattice. The former defect gives rise to decrease in density of the crystal and the latter leads to no change of density.

Another type of defects are non-stoichiometric defects where the cations and anions are not present in the stoichiometric ratio. In metal excess defect, metal ions or positive ions are in excess as compared to anions of non-metals stoichiometrically. On the other hand in metal deficient defect, the cations are in lesser proportion than stoichiometric value. Since the crystal is neutral electrically, the balance of charge is maintained by free electrons or extra positive charges. The metal excess defects give rise to conduction of electricity due to the presence of free electrons. Also crystals having metal excess defects are paramagnetic and coloured due to the presence of electrons in the anions vacancies.

Impurity defects arise when some foreign atoms are present at the lattice sites in place of the host atoms or at the vacant interstitial sites.

When 15 group elements like P or As are doped into Si or Ge, the added impurity atoms occupy the lattice sites forming four covalent bonds with 4 Si/Ge atoms leaving an extra electron free to move. Such a crystal is said to be n-type semi conductor because the conduction of electricity is due to the movement of extra unbonded electrons.

If doping of a covalent crystals of 14 group elements are caused by addition of small amounts of elements of group 13, e.g. Al or Ga with three valence electrons, one covalent bond formed will be electron deficient and acts as a positive hole. The presence of such holes in the crystal leads to electrical conductivity and the crystal is said to be p-type semiconductor.

283. When LiCl is heated into the vapour of lithium, the crystal acquires pink colour. This is due to

(A) Schottkty defects (B) Frenkel defects

(C) Metal excess defect leading to F-centres (D) Electronic defect

284. Strongly heated ZnO crystal can conduct electricity. This is due to

(A) Movement of extra Zn^{2+} ions present in the interstitial sites

(B) Movement of electrons in the anion vacancies

(C) Movement of both Zn^{2+} ions and electrons

(D) None of these

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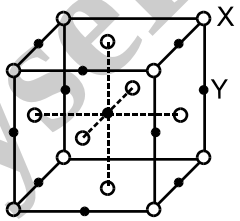
285. AgCl is crystallized from molten AgCl containing a little $CdCl_2$. The solid obtained will have
(A) cationic vacancies equal to number of Cd^{2+} ions incorporated
(B) cationic vacancies equal to double the number of Cd^{2+} ions
(C) anionic vacancies
(D) neither cationic nor anionic vacancies

286. Lattice defect per 10^{15} NaCl is 1. What is the number of lattice defects in mole of NaCl?
(A) 6.02×10^{23} (B) 6.02×10^{8} (C) 10^{14} (D) None of these

287. Which of the following statements is correct about the conduction of electricity in pure crystal of silicon at room temperature?
(A) The conduction is due to electrons present in fully occupied lowest energy states
(B) The conduction is due to only some electrons capable of leaving the bonds at room temperature
(C) The conduction is only due to the holes formed following release of electrons
(D) The conduction is due to the movement of both the electrons released and holes formed.

COMPREHENSION # 29
Paragraph for Questions Nos. 288 to 291

Consider the figure given for solid XY. Answer the following questions



288. The site Y represents
(A) tetrahedral void (B) Octahedral void (C) triangular void (D) cubical void.

289. The number of XY units per unit cell is
(A) 4 (B) 3 (C) 3 (D) 8

290. Co-ordination number of Y is
(A) 3 (B) 4 (C) 6 (D) 8

291. Which of the following type of solid adopt above crystal structure?
(A) CaCl (B) CaF_2 (C) ZnS (D) NaCl.

COMPREHENSION # 30
Paragraph for Questions Nos. 292 to 295

The arrhenius equation
$K = Ae^{-Ea/RT}$
The represents the variation of the specific rate constant with temperature.
exponential term represents the fraction of molecules having the energy to cross the energy barrier i.e. to reach the transition state and A signifies the number of collisions / unit time with effectiveness in order to form the product. 3.6×10^{-16}% of reactant molecules exists in the activated state of a reaction.

292. The energy of activation is
(A) 100 kJ (B) 200 kJ (C) 150 kJ (D) 250 kJ

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293. If a graph is plotted between K against 1/T the intercept obtained is

(A) logK (B) logA (C) $-\frac{Ea}{2.303R}$ (D) $\log\frac{1}{T}$

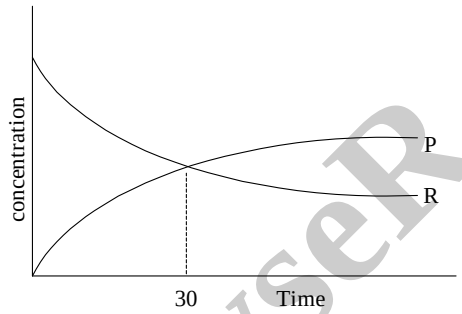
294. The dimension of A will be

(A) dimensionless (B) time (C) Joules/mol (D) $time^{-1}$

295. If a graph is plotted between K against 1/T the slope obtained is

(A) logK (B) logA (C) $+\frac{Ea}{2.303R}$ (D) $-\frac{Ea}{2.303R}$

COMPREHENSION # 31
Paragraph for Questions Nos. 296 to 299



The above graph shows the variation of the reactants product w.r.t time for a given reaction at 27°C for a first order reaction.

296. The half life of the reaction is

(A) 15 minutes (B) 60 mintues (C) 30 minutes (D) infinite

297. The specific rate constant of the reaction is

(A) 0.0462 min^{-1} (B) zero (C) 0.0231 min^{-1} (D) infinite

298. 3/4th life period of the reaction is

(A) 20 (B) 80 (C) 60 (D) none of these

299. The plot log $[A]_t$ vs time will have a intercept equal to

(A) –K (B) +K (C) A (D) logA

COMPREHENSION # 32
Paragraph for Questions Nos. 300 to 301

(Read the following passage and answer the questions. They have only one correct option)

In HCP or CCP, constituent particles occupy 74% of the available space. The remaining space (26%) in between the spheres, remains unoccupied and is called interstitial voids or holes. Considering the close packing arrangement, each sphere in the second layer rests on the hollow space of the first layer, touching each other. The void created is called tetrahedral void. If R is the radius of the sphere in the close packed arrangement, then

r (radius of tetrahedral void) = 0.225 R

In a close packing arrangement, the interstitial void formed by the combination of two triangular voids of the first and second layer is called octahedral void. Thus, double triangular void is surrounded by six spheres. The centre of these sphere on joining, forms octahedron. If R is the radius of the sphere in a close packed arrangement, then

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r (radius of octahedral void = 0.414 R.

300. If the anions (A) form hexagonal close packing and cations (B) occupy only 2/3rd octahedral voids in it, then the general formula of the compound is

(A) AB (B) A_3B_2 (C) A_2B (D) AB_2

301. If the spinel structure, oxide ions are cubic close whereas 1/8th of tetrahedral voids are occupied by A^{2+} cations and 1/2 of octahedral voids are occupied by B^{3+} cations. The general formula of the compound having spinel structure is:

(A) $A_2B_2O_4$ (B) AB_2O_4 (C) $A_2B_4O_2$ (D) $A_4B_2O_2$

COMPREHENSION # 33
Paragraph for Questions Nos. 302 to 307

(Read the following passage and answer the questions. They have only one correct option)

The Colloidal particles are electrically charged as is indictated by their migration toward cathode or anode under the applied electric field. In a particular colloidal system, all particles carry either positive charge or negative charge.

The electric charge on colloidal particles originate in several ways. According to preferential adsorption theory, the freshly obtained precipitate particles adsorb ions from the dispersion medium, which are common to their lattice and acquire the charge of adsorbed ions. For example, freshly obtained $Fe(OH)_3$ precipitated is dispersed, by a little $FeCl_3$, into colloidal solution owing to the adsorptions of Fe^{3+} ions in preference. Thus sol particles will be positively charged.

In some cases the colloidal particles are aggregates of cations or anions having ampiphilic character. When the ions possess hydrophobic part (hydrocarbon end) as well as hydrophilic part (polar end group), they undergo association in aqueous solution to form particles having colloidal size. The formation of such particles, called micelles plays a very important role in the solubilization of water insoluble substances, (hydrocarbon, oils, fats, grease etc.). In micelles, the polar end groups are directed towards water and the hydrocarbon ends into the centre.

The charge on sol particles of proteins depends on the pH. At low pH, the basic group of protein molecule is ionized (protonated) and at higher pH (alkaline medium), the acidic group in ionized. At Isoelectric pH, characteristic to the protein, both basic and acidic groups are equally ionized.

The stability of colloidal solution is attributed largely to the electric charge of the dispersed particles. This charge causes them to be coagulated or precipitated. On addition of small amount of electrolytes, the ions carrying opposite charge are adsorbed by sol particles resulting in the neutralization of their charge.When the sol particles either with no charge or reduced charge, come closer due to Browman movement, they coalesce to form bigger particles resulting in their separation from the dispersion medium. This is what is called coagulation or precipitation of the colloidal solution. The coagulating power of the effective ion, which depend on its charge, is expressed in terms of its coagulating value, defined as its minimum concentration (m mol/L) needed to precipitate a given sol.

302. A gelatin sol at pH less then the isoelectric value is subjected to an electric field. The sol particles migrate toward

(A) Anode (B) Cathode
(C) Both anode and cathode (D) Neither anode nor cathode

303. Which of the following ions would have the minimum coagulating value for sol obtained on peptizing $Sn(OH)_4$ by little NaOH solution.

(A) Cl^- (B) SO_4^{2-} (C) K^+ (D) Ba^{2+}

304. How would you obtain a sol of AgI, the particles of which migrate toward cathode under the electric field ?

(A) By adding little excess of KI to $AgNO_3$ solution
(B) By adding little excess of $AgNO_3$ to KI solution
(C) By mixing equal volumes of 0.010 M $AgNO_3$ and 0.010 M KI
(D) None of these

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305. When 9.0 ml of arsenius sulphide sol and 1.0 ml of 1.0×10^{-4} M $BaCl_2$ are mixed, turbidity due to precipitation just appears after 2 hours. The effective ion and its coagulating value are respectively

(A) Cl^-, 10 m mol/L (B) Cl^-, 20 m mol/L
(C) Ba^{2+}, 10 m mol/L (D) Ba^{2+} , 20 m mol/L

306. 100 ml each of two sols of AgI, one obtained by adding $AgNO_3$ to slight excess of KI and another obtained by adding KI to slight excess of $AgNO_3$, are mixed together. Then

(A) The two sols will stabilize each other
(B) The sol particles will acquire more electric charge
(C) The sols will coagulate each other mutually
(D) A true solution will be obtained

307. Under the influence of an electric field, the particles in a sol migrate towards cathode. The coagulation of the same sol is studied using NaCl, Na_2SO_4 and Na_3PO_4 solutions. Their coagulating values will be in the order

(A) $NaCl > Na_2SO_4 > Na_3PO_4$ (B) $Na_2SO_4 > Na_3PO_4 > NaCl$
(C) $Na_3PO_4 > Na_2SO_4 > NaCl$ (D) $Na_2SO_4 > NaCl > Na_3PO_4$

COMPREHENSION # 34
Paragraph for Questions Nos. 308 to 311

Ozone is prepared in laboratory by passing silent electric discharge through pure and dry oxygen in an apparatus known as ozoniser. This conversion from oxygen to ozone is a reversible and endothermic reaction. When oxygen is subjected to an ordinary electric discharge, most of the O_3 produced will get decomposed. When any insulating material such as glass, is inserted in the space between the two electrodes and high current density is applied, silent electric discharge passes on between the two electrodes. By this process no spark is produced and much less heat is generated, and as a result the decomposition of the produced ozone is much retarded.

The decomposition of ozone is believed to occur by the following mechanis:

$O_3 \underset{K_b}{\overset{K_f}{\rightleftharpoons}} O_2 + O$ *(fast step)*

$O_3 + O \xrightarrow{K_1} 2O_2$ *(slow)*

308. Order of the reaction is

(A) 1 (B) 2 (C) 3 (D) 0

309. Molecularity of reaction is defined by

(A) slow step (B) reversible step
(C) from overall reaction (D) fast step

310. When the concentration of O_2 is increased, for the same concentration of ozone, its rate

(A) increases (B) decreases
(C) remains the same (D) cannot be answered

311. When the concentration of O_3 is increased, for the same concentration of oxygen, its rate

(A) increases (B) decreases
(C) remains the same (D) cannot be answered

COMPREHENSION # 35
Paragraph for Questions Nos. 312 to 313

Silicon carbide (SiC) and diamond are covalent solids which crystallize in cubic strucures. In SiC, carbon atoms occupy points of the face centred cubic lattice (FCC positions) and silicon atoms occupy half of the tetrahedral voids available. In diamonds, same position of the tetrahedral voids are occupied by other carbon atoms.

Also the density of SiC and diamond are 3.2 and 3.6 g/cc respectively. Answer the following four questions based on the above information: (M : Si = 28)

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312. The radius of silicon atom is

(A) 0.76 Å (B) 1.12 Å (C) 3.54 Å (D) 4.75 Å

313. Which of the following will not change the density of SiC solid?

(A) Substitution of some Si atoms by some carbon atoms
(B) Schottky defects
(C) Interchange of some Si atom by some C atom
(D) Decreasing the temperature of solid.

COMPREHENSION # 36
Paragraph for Questions Nos. 314 to 316

Nuclear fission is the process of spliting of a heavy nucleus by bombarding with thermal neutrons in to two approximately equal parts, with simultaneous liberation of a huge amount of energy. If the sample of the fissionable material has a sufficiently large mass called critical mass, the neutrons produced cause additional fission reaction and a chain fission reaction ensues.

314. The missing product in the reaction : $^{235}_{92}u + {}^{1}_{0}n \longrightarrow {}^{146}_{57}La + ? + 3\left({}^{1}_{0}n\right)$ is

(A) $^{86}_{35}Br$ (B) $^{87}_{35}Br$ (C) $^{89}_{35}Br$ (D) $^{89}_{32}Ge$

315. The pair of elements that are produced in the following nuclear fission is

$$^{235}_{92}u + {}^{1}_{0}n \longrightarrow {}^{236}_{92}u \longrightarrow products + x\left({}^{1}_{0}n\right)$$

where x is either 2 or 3.

1) $^{144}_{56}Ba$ 2) $^{90}_{36}Kr$ 3) $^{144}_{54}Xe$ 4) $^{144}_{55}Cs$

(A) 3, 4 (B) 2, 3 (C) 1, 2 (D) 1, 4

316. Which one is correct for a nuclear fission reaction.

(A) the n/p ratio is low for the product elements
(B) in general β - emission is observed after the product elements are formed
(C) in general α - emission is observed after the product elements are formed
(D) the product elements are not radioactive in nature.

COMPREHENSION # 37
Paragraph for Questions Nos. 317 to 318

Copper reduces NO_3^- into NO and NO_2 depending upon conc. of HNO_3 in solution. Assuming $[Cu^{2+}] = 0.1$ M, and $P_{NO} = P_{NO_2} = 10^{-3}$ atm and using given data answer the following questions:

$E^o_{Cu^{2+}/Cu}$ = + 0.34 volt

$E^o_{NO_3^-/NO}$ = + 0.96 volt

$E^o_{NO_3^-/NO_2}$ = + 0.79 volt

at 298 K $\frac{RT}{F}(2.303) = 0.06$ volt

317. E_{Cell} for reduction of $NO_3^- \longrightarrow$ NO by Cu(s), when $[HNO_3] = 1$M is [At T = 298]

(A) ~ 0.61 (B) ~ 0.71 (C) ~ 0.51 (D) ~ 0.81

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318. At what HNO_3 concentration thermodynamic tendency for reduction of NO_3^- into NO and NO_2 by copper is same?

(A) $10^{1.23}$ M (B) $10^{0.56}$ M (C) $10^{0.66}$ M (D) $10^{0.12}$ M

COMPREHENSION # 38
Paragraph for Questions Nos. 319 to 321

The potential associated with each electrode is known as electrode potential. If the concentration of each species taking part in the electrode reaction is unit (if any gas appears in the electrode reaction, it is confined to 1 atmospheric pressure) and further the reaction is carried out at 298 K, then the potential of each electrode is said to be the standard electrode potential. By convention, the standard electrode potential of hydrogen electrode is 0.0 volt. The electrode potential value for each electrode process is a measure of relative tendency of the active species in the process to remain in the oxidised/reduced form. A negative E° means that the redox couple is a stronger reducing agent than the H^+/H_2 couple. A positive E° means that the redox couple is a weaker reducing agent than the H^+/H_2 couple. The metal with greater positive value of standard reducion potential forms the oxide of greater thermal stability.

319. Calculate the minimum mass of NaOH required to be added in R.H.S. to consume all the H^+ present in R.H.S. of the cell of emf + 0.701 volt at 25°C before its use.

$$\underset{0.1M}{Zn}\,|\,\underset{}{Zn^{2+}}\,\|\,\underset{1litre.}{HCl}\,|\,\underset{1atm}{Pt(H_2g)} \qquad E^0_{Zn/Zn^{2+}} = 0.760\ V$$

(A) 1.264 g (B) 4 g (C) 3.2 g (D) 2.258

320. The emf of the cell, $\underset{0.05M}{Ag\,|\,AgI\ in\ KI}\,|\,\underset{Sol.}{NH_4NO_3}\,|\,\underset{0.05M}{AgNO_3}\,|\,Ag$ is 0.788 volt at 25 °C . The degree of dissociation of KI and silver nitrate in the above solution is 0.90 each . Calculate the solubility product of AgI

(A) 9.472×10^{-17} (B) 4×10^{-17} (C) 11×10^{-17} (D) 2.105×10^{-17}

321. The standard reduction potential at 25°C of the reaction $2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$ is – 0.8277 volt. Calculate the equilibrium constant for the reaction in which water is forming from its ions at 25°C.

(A) 10^{-14} (B) 10^{-7} (C) 10^{14} (D) 10^{7}

COMPREHENSION # 39
Paragraph for Questions Nos. 322 to 324

Kohlrausch Law of independent migration of ions relates the ionic conductivities and molar conductivities of the electrolyte. Mobility of ion is not just the speed but, speed under a potential gradient. Moreover mobility of an ion is directly proportional to current carried by it. The fraction of total current carried by an ion is the transport number.

Given ionic mobilities of NH_4^+, H^+, ClO_4^-, Na^+ are 6.6 x 10^{-4}, 3.62 x 10^{-3}, 5.7 x 10^{-4}, 5.2 x 10^{-4}, $cm^2\ Volt^{-1}\ Sec^{-1}$ respectively at infinite dilution.

322. The equivalent conductance of $NaClO_4$ in $S\ cm^2\ eq^{-1}$ is

(A) 105.18 (B) 118.7 (C) 404.3 (D) 356.8

323. Which of the following incorrect with respect to kohlrausch law

(A) $\Lambda^0 Al_2(SO_4)_3 = 3\lambda^0_{(Al^{+3})} + 2\lambda^0_{(SO_4^{-2})}$ (B) $\Lambda^0 MgCl_2 = \lambda^0_{(Mg^{+2})} + 2\lambda^0_{(Cl^-)}$

(C) $\Lambda^0 NH_4NO_3 = \lambda^0_{(NH_4^+)} + \lambda^0_{(NO_3^-)}$ (D) $\Lambda^0 FeCl_3 = \lambda^0_{(Fe^{+3})} + 3\lambda^0_{(Cl^-)}$

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324. The ionic mobility of Na^+ if a potential of 15 Volt is applied across the electrodes 5cm apart.
(A) 5.2×10^{-4} (B) 15.6×10^{4} (C) 10.4×10^{-4} (D) 20.8×10^{-4}

COMPREHENSION # 40
Paragraph for Questions Nos. 325 to 327

An aqueous solution of NaCl on electrolysis gives $H_2(g)$, $Cl_2(g)$ and NaOH according to reaction

$$2Cl^-(aq) + 2H_2O \longrightarrow 2OH^-(aq) + H_2(g) + Cl_2(g)$$

A direct current of 25 ampere with a current efficiency of 62% is passed through 20 litre of NaCl solution (20% by weight)

Answer the following questions based on above passage.

325. Reaction taking place at cathode and at anode respectively are:

(A) $2e^- + 2H_2O \longrightarrow 2OH^- + H_2$; $2Cl^- \longrightarrow Cl_2 + 2e^-$

(B) $Na^+ + e^- \longrightarrow Na$; $2OH^- \longrightarrow H_2O + \frac{1}{2} O_2 + 2e^-$

(C) $2e^- + H_2 \longrightarrow 2H^-$; $H_2 \longrightarrow 2H^+ + 2e^-$

(D) $4e^- + O_2 \longrightarrow 2O^{-2}$; $H_2 + 2OH^- \longrightarrow 2H_2O + 2e^-$

326. Time required to produce 1 kg of Cl_2 is –
(A) 30.2 hr (B) 15.1 hr (C) 24.35 hr (D) 48.71 hr

327. Molarity of solution with respect to OH^- ions is –
(A) 2.8 (B) 0.35 (C) 1.4 (D) 0.7

COMPREHENSION # 41
Paragraph for Questions Nos. 328 to 330

Concentration cell is one in which anode and cathode of a voltaic cell is made of same electrode

Ex. $\underset{c_1}{A} \mid A^{n+} \parallel A^{n+} \mid \underset{c_2}{A}$

c_1 should not be equal to c_2 to have some emf in the cell. Now consider the cell

(Pt) $\underset{P_1}{Cl_2}$ | NaCl || AgCl | $\underset{P_2}{Cl_2}$ (Pt)
c (sat)

K_{sp} of AgCl is 10^{-12}

328. If $P_1 = P_2$, required condition so that the above cell has positive emf
(A) $c > 10^{-6}$ M (B) $c < 10^{-6}$ M
(C) $P_1 = P_2 = 1$ atm
(D) Emf of the cell cannot be found as it is not a concentration cell

329. If $c = 10^{-6}$ which of the following conditions will give positive emf
(A) $P_1 > P_2$ (B) $P_1 < P_2$ (C) $P_1 = P_2$ (D) None

330. Which one of the statements is correct about the cell (Pt) $\underset{1 \text{ atm}}{H_2}$ | HCl || NaOH | $\underset{1 \text{ atm}}{H_2}$ (Pt)
c c
(A) It is not a concentration cell
(B) It has a positive emf
(C) It has a negative emf
(D) cannot say anything about emf without knowing the value of c

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COMPREHENSION # 42
Paragraph for Questions Nos. 331 to 333

Colligative properties i.e., the [properties of solution which depends upon the number of particles present in solution are osmotic pressure. Depression in freezing point, elevation in boiling point and lowering in vapour pressure. Experimental values of colligative properties for electrolytes are always higher than those obtained theoretically because electrolytes dissociates to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute are lower than those obtained theoretically. The ratio of experimental colligative properties to theoretical colligative properties is called as Vant Hoff factor (*i*).

331. Vant Hoff factor (i) for tetramerisation of a substance A in water, assuming 80% degree of association is:

(A) 0.6 (B) 0.4 (C) 1.6 (D) 1.4

332. Value of α for the reaction , $A \longrightarrow \frac{1}{5} A_5$ is given by the relation

(A) $\alpha = \frac{5}{4}(i-1)$ (B) $\alpha = \frac{5}{4}(1-i)$ (C) $\alpha = \frac{4}{5}(1-i)$ (D) $\alpha = \frac{4}{5}(i-1)$

333. The maximum depression in freezing point is noticed in:

(A) 1 *M* NaCl (B) 1*M* Na_2SO_4 (C) 1 *M* Na_3PO_4 (D) 1 *M* $Na_4Fe(CN)_6$

COMPREHENSION # 43
Paragraph for Questions Nos. 334 to 336

At any fixed temperature, the vapour phase is always richer in more volatile component as compared to the solution phase. In other words, mole fraction of more volatile component is always greater in vapour phase than in solution phase. We can also say that vapour phase is relatively richer in the component whose addition to liquid mixture results in an increase in total vapour pressure.

334. If 2 moles of A and 3 moles of B are mixed to form an ideal solution, vapour pressures of A and B are 120 and 180 mm of Hg respectively. The total vapour pressure of solution will be :

(A) 48 mm Hg (B) 108 mm Hg (C) 156 mm Hg (D) 15.6 mm Hg

335. From the statement in question number **202**, the composition of A and B in the vapour phase when the first traces of vapours are formed is :

(A) A = 0.407 ; B = 0.592 (B) A = 0.8 ; B = 0.1
(C) A = 0.109 ; B = 0.791 (D) A = 0.307 ; B = 0.693

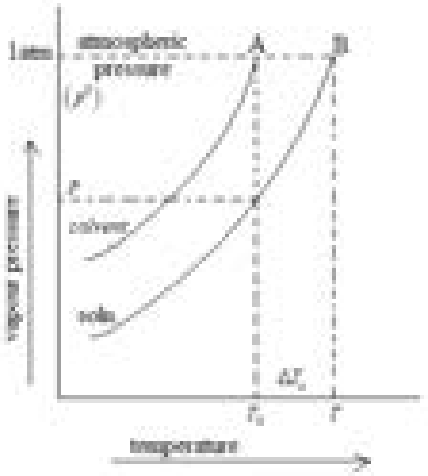
336. From the statement in question number **202** , at what pressure will the last traces of liquid disappear

(A) 100 mm Hg (B) 130 mm Hg (C) 140 mm Hg (D) 150 mm Hg

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COMPREHENSION # 44
Paragraph for Questions Nos. 337 to 339

Figure explains elevation in boiling point when a non-volatile solute is added to a solvent



337. Elevation in boiling point of an aqueous urea solution is 0.52^0 (K_b of water is 0.52 $K\ Kg\ mol^{-1}$). Hence mole fraction of urea in this solution is

(A) 0.982 (B) 0.0567 (C) 0.943 (D) 0.018

338. A complex of iron and cyanide ions is 100% ionized at one molal solution. If the elevation in boiling point is $2.08^0 C$ (K_b for water $0.52 K\ Kg\ mol^{-1}$) then the complex is

(A) $K_3[Fe(CN)_6]$ (B) $Fe(CN)_2$ (C) $K_4[Fe(CN)_6]$ (D) $[Fe(CN)_4]^-$

339. Ratio of $\frac{\Delta T_b}{K_b}$ of 6% AB_2 and 9% A_2B (both are non electrolytes) is one mole/Kg in both the cases. Hence atomic masses of A and B are respectively.

(A) 60, 90 (B) 40, 40 (C) 40, 10 (D) 10, 40

COMPREHENSION # 45
Paragraph for Questions Nos. 340 to 342

When a volatile substance A $\left(P_A^0 = 400\text{mm}\right)$ is added to another volatile substance B $\left(P_B^0 = 500\text{mm}\right)$, the vapour pressure of the resulting solution is 470 mm of Hg. To this solution a third volatile solvent C $\left(P_C^0 = 600\text{m}\right)$ is added and vapour pressure of final solution is 496 mm of Hg.

340. Mole fraction of A in the final solution

(A) 0.20 (B) 0.22 (C) 0.24 (D) 0.26

341. Mole fraction of A in the vapour phase

(A) 0.2 (B) 0.22 (C) 0.24 (D) 0.26

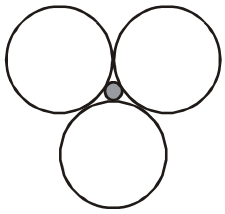
342. Mole fraction of C in the vapour phase

(A) 0.2 (B) 0.22 (C) 0.24 (D) 0.26

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COMPREHENSION # 46
Paragraph for Questions Nos. 343 to 345

When atoms are arranged in ABC ABC type of packing or ABAB type of packing, some space is left in between the atom which is known as voids. Depending upon the situation, voids can be classified as triangular, tetrahedral, octahedral or cubic
For example;



void shown in the figure is triangular void because it is formed by touching 3 atoms.

343. If radius of sphere is 200 pm then ideal radius of triangular void is:
(A) 31 pm (B) 45 pm (C) 62 pm (D) 90 pm

344. If for a particular compound AB, radius of A^+ is 80 pm and radius of B^- is 200 pm then location of A^+ ion in the crystal and % occupancy respectively is:
(A) Octahedral void 100% (B) Tetrahedral, 100%
(C) Tetrahedral , 50% (D) Octahedral, 50%

345. Formula of a compound formed by A, B and C in which A is arranged in ccp , B is present in 25% of the tetrahedral voids and C is present in all the remaining voids (tetrahedral as well as octahedral) is :
(A) AB_2C_2 (B) A_2BC_5 (C) ABC_5 (D) A_2B_5C

COMPREHENSION # 47
Paragraph for Questions Nos. 346 to 350

Many lyophilic sols and a few lyophobic sols when coagulated under some special conditions, change into semi rigid mass, enclosing whole amount of liquid within itself, it is called Gel process is called gelation. Gelatin Agar-Agar, gum-Arabic can be converted into gels by cooling them under moderate concentration conditions. Hydrophobic sols like silicic acid, $Al(OH)_3$ are prepared by double decomposition and exchange of solvent method.

346. Which of the following is not a gel?
(A) Cheese (B) Jellies (C) Curd (D) Milk

347. When liquid is dispersed in solid, it is called
(A) Sol (B) Emulsion (C) Gel (D) Aerosols

348. Which of the following is used to adsorb water
(A) Silica gel (B) Calcium acetate (C) Hair gel (D) Cheese

349. The process of imbibing water when elastic gels are placed in water is called
(A) Imbibation (B) Sybneresis (C) Coagulation (D) Thioxotropy

350. Some types of gels like gelatin and silica liquify on shaking thereby changing into sols. The sols on standing change back into gels. This process is known as:
(A) Syneresis (B) Thixotropy
(C) Double decomposition (D) Peptization

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COMPREHENSION # 48
Paragraph for Questions Nos. 351 to 353

Dilute solutions show colligative properties. These properties depend on the number of particles of the solute but not on their nature. If solute undergoes dissociation (or) association. The colligative property differ considerably from the calculated value.

351. Which of the following solutions has highest boiling point
(A) 1% (w/v) glucose (B) 1% (w/v) fructose (C) 1% (w/v) sucrose (D) 1% (w/v) urea

352. For a solute undergoing association, the Van't Hoff's factor is
(A) i > 1 (B) i < 1 (C) i = 0 (D) i = 1

353. Solutions having same vapour pressure are called
(A) isotonic solutions (B) isopiestic solutions
(C) isochoric solutions (D) isoelectric solutions.

COMPREHENSION # 49
Paragraph for Questions Nos. 354 to 358

Whenever a mixture of gases is allowed to come in contact with a particular adsorbent under the same conditions, the more strong adsorbate is adsorbed to greater extent irrespective of its amount present, e.g. H_2O is adsorbed to more extent on silica gel than N_2 and O_2. This shows that some adsorbates are preferentially adsorbed. It is also observed that preferentially adsorbable adsorbents can displace a weakly adsorbed substance from the surface of an adsorbent.

354. Which of the following gases is adsorbed to maximum extent:
(A) He (B) Ne (C) Ar (D) Xe

355. Which of the gas can displace remaining all the gases
(A) O_2 (B) N_2 (C) CO (D) H_2

356. When temperature is increased
(A) extent of adsorption increases
(B) extent of adsorption decreases
(C) no effect on adsorption
(D) extent of adsorption first decreases, then increases

357. Chromatogarphic separations are based on
(A) differential solubility (B) differential adsorption
(C) differential absorption (D) None of these

358. Activated charcoal is prepared by
(A) heated charcoal with steam so that it becomes more porous
(B) adding $Ca_3(PO_4)_2$ to charcoal
(C) adding impurity to charcoal
(D) reacted with conc. HNO_3

COMPREHENSION # 50
Paragraph for Questions Nos. 359 to 362

The clouds consist of charged particles of water dispersed in air. Some of them are + vely charged, others are negatively charged. When + vely charged clouds come closer they have cause lightening and thundering whereas when + ve and –ve charged colloids come closer they cause heavy rain by aggregation of minute particles. It is possible to cause artificial rain by throwing electrified sand or silver iodide from an aeroplane and thus coagulation the mist hanging in air.

359. When excess of $AgNO_3$ is treated with KI solution, AgI forms
(A) +ve charged sol (B) –vely charged sol (C) neutral sol (D) true solution

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360. Clouds are colloidol solution of
(A) liquid in gas (B) gas in liquid (C) liquid in liquid (D) solid in liquid

361. AgI helps in artificial rain because
(A) It helps in coagulation (B) It helps in dispersion process
(C) Both (D) None

362. Electrical chimneys are made on the principle of
(A) Electroosmosis (B) Electrophoresis (C) Coagulation (D) All of these

COMPREHENSION # 51
Paragraph for Questions Nos. 363 to 366

In macromolecular type of colloids, the dispersed particles are themselves large molecules (usually polymers). Since these molecules have dimensions comparable to those of colloidal particles, their dispersions are called macromolecular colloids. Most lyophilic sols belong to this category. There are certain colloids which behave as normal strong electrolytes at low concentrations, but exhibit colloidal properties at higher concentrations due to the formation of aggregated particles. These are known as micelles or associated colloids. Surface active agents like soaps and synthetic detergents belong to this class.

· Critical micelle concentration (CMC) is the lowest concentration at which micelle formation appears. CMC increases with the total surfactant concentration. At concentration higher than CMC, they form extended parallel sheets known as **lamellar micelles** which resemble biological membranes. With two molecules thick, the individual molecule is perpendicular to the sheets such that hydrophilic groups are on the outside in aqueous solution and on the inside is a non-polar medium.

· In concentrated solutions, micelles take the form of long cylinders packed in hexagonal arrays and are called lytotropic mesomorphs.

· In an aqueous solution (polar medium), the polar group points towards the periphery and the hydrophobic hydrocarbon chains point towards the centre forming the core of the micelle.

· Micelles from the ionic surfactants can be formed only above a certain temperature called the **Kraft temperature**.

· They are capable of forming ions

· Molecules of soaps and detergents consist of lyophilic as well as lyophilic parts which associate together to form micelles.

· Micelles may contain as many as 100 molecules or more.

363. Select incorrect statement(s):
(A) Surface active agent like soaps and synthetic detergents are micelles
(B) Soaps are emulsifying agents
(C) $C_{17}H_{35}$ (hydrocarbon part) and $-COO^-$ (carboxylate) part of stearate ion ($C_{17}H_{35}COO^-$) both are hydrophobic
(D) Soap is manufactured by the base catalysed hydrolysis(saponification) of animal fat.

364. Which part of the soap ($RCOO^-$) dissolves grease and forms micelle?
(A) R part (called tail of the anion) (B) $-COO^-$ part (called head of the anion)
(C) both (A) and (B) (D) none of these

365. In multimolecular colloidal sols, atoms or molecules are held together by:
(A) H-bonding (B) van der Waals forces
(C) ionic bonding (D) polar covalent bonding

366. Cleansing action of soap occurs because:
(A) oil and grease can be absorbed into the hydrophobic centres of soap micelles and washed away
(B) oil and grease can be absorbed into hydrophilic centres of soap micelles acid washed away
(C) oil and grease can be absorbed into both hydrophilic and hydrophobic centres but not washed away
(D) cleansing action is not related to micelles

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COMPREHENSION # 52
Paragraph for Questions Nos. 367 to 369

The protective power of the lyophilic colloids is expressed in terms of gold number a term introduced by Zsigmondy.Gold number is the number of milligram of the protective colloid which prevent the coagulation of 10 ml of red gold sol. when 1 ml of a 10 percent solution of sodium chloride is added to it. Thus, smaller the gold number of lyophilic colloid, the greater is the protective power.

367. On addition of one mL of solution of 10% NaCl to 10 mL of red gold sol in presence of 0.025 g of starch, the coagulation is just prevented. The gold number of starch is

(A) 0.025 (B) 0.25 (C) 2.5 (D) 25

368. Which of the following statement(s) is/are correct

(A) Higher the gold number, more protective power of colloid
(B) Lower the gold number, more the protective power
(C) Higher the coagulation value, more the coagulation power
(D) Lower the coagulation value, higher the coagulation power

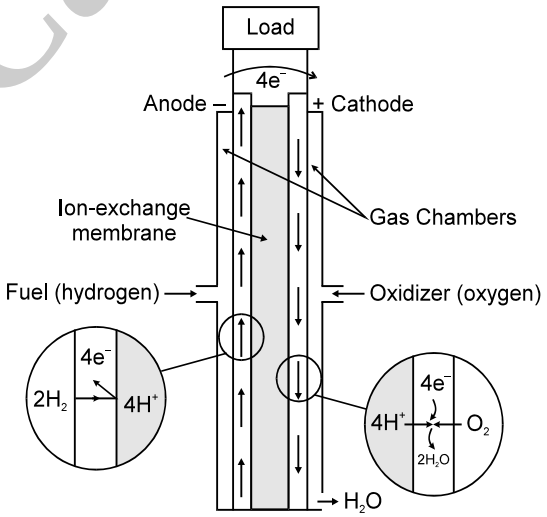
369. Gold number gives an indication of

(A) protective nature of colloids (B) purity of gold in suspension
(C) the charge on a colloidal solution of gold (D) g-mole of gold per litre

COMPREHENSION # 53
Paragraph for Questions Nos. 370 to 374

A fuel cell is a cell that is continuously supplied with an oxidant and a reductant so that it can deliver a current indefinitely. Fuel cells offer the possibility of achieving high thermodynamic efficiency in the conversion of Gibbs energy into mechanical work. Internal combustion engines at best convert only the fraction $(T_2 - T_1)/T_2$ of the heat of combustion into mechanical work. While the thermodynamic efficiency of the fuel cell is given by, $\eta = \frac{\Delta G}{\Delta H}$, where ΔG is the Gibbs energy change for the cell reaction and ΔH is the enthalpy change of the cell reaction. This efficiency can be upto 80% - 90% also in contrast to normal heat engine efficincies which are generally about 40%.

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Hydrogen-oxygen fuel cell with an ion exchange membrane.

Fuel cells may be classified according to the temperature range in which they operate : low temperature (25 to 100°C), medium temperature (100 to 500°C), high temperature (500 to 1000°C), and very high

temperature (above 1000°C).The advantage of using high temperature is that catalysts for the various steps in the process are not so necessary. Polarization of a fuel cell reduces the current. Polarization is the result of slow reactions or processes such as diffusion in the cell

The figure, indicates the construction of a hydrogen-oxygen fuel cell with a solid electrolyte, which is an ion exchange membrane. The membranes is impermeable to the reactant gases, but is permeable to hydrogen ions , which carry the current between the electrodes. To facilitate the operation of the cell at 40 to 60°C, the electrodes are covered with finely divided platinum that function as a catalyst. Water is drained out of the cell during operation. Fuel cells of this general type have been used successfully in the space program and are quite efficient. Their disadvantages for large-scale commercial application are that hydrogen presents storage problems, and platinum is an expensive catalyst. Cheaper catalysts have been found for higher temperature operation of hydrogen-oxygen fuel cells.

Fuel cells that use hydrocarbons and air have been developed, but their power per unit weight is too low to make them practical in ordinary automobiles. Better catalysts are needed.

A hydrogen-oxygen fuel cell may have an acidic or alkaline electrolyte. The half-cell reactions are

$$\frac{1}{2}O_2(g) + 2H^+ + 2e^- = H_2O(\ell) \quad E° = 1.2288\ V$$

$$2H^+ + 2e^- = H_2(g) \quad E° = 0$$

$$H_2(g) + \frac{1}{2}O_2(g) = H_2O(\ell) \quad E° = 1.2288\ V$$

or

$$\frac{1}{2}O_2(g) + H_2O(\ell) + 2e^- = 2OH^- \quad E° = 0.4009\ V$$

$$2H_2O(\ell) + 2e^- = H_2(g) + 2OH^- \quad E° = -0.8279\ V$$

$$H_2(g) + \frac{1}{2}O_2(g) = H_2O(\ell) \quad E° = 1.2288\ V$$

To maximize the power per unit mass of an electrochemical cell, the electronic and electrolytic resistances of the cell must be minimized. Since fused salts have lower electrolytic resistances than aqueous solutions, high-temperature electrochemical cells are of special interest for practical applications.

High temperature also allow the use of liquid metal electrode, which make possible higher current densities than solid electrodes.

370. If 560 mL of H_2 gas at STP is fed into and is consumed by the fuel cell in 10 minutes, then what is the current output of the fuel cell?

(A) 4 A (B) 8 A (C) 16 A (D) 12 A

371. For a Hydrogen - Oxygen fuel cell if $\Delta H_f^0(H_2O,\ell) = -285$ kJ/mole, then what will be its thermodynamic efficiencyunder standard conditions(use data given in the passage if required)

(A) 0.91 (B) 0.41 (C) 0.63 (D) 0.83

372. Why are fuel cells not being used in daily life despite their very high efficiency.

(A) The fuels needed for their operation are rarely found in nature
(B) Their operation always needs very high temperature
(C) The catalyst used in fuel cells at normal temperature are very expensive
(D) The design of fuel cells is so complicated that it is not feasible to construct these for daily life applications.

373. In a $H_2 - O_2$ fuel cell, 6.72 L of hydrogen at NTP reacts in 15 minutes, the average current produced in amperes is

(A) 64.3 amp (B) 643.3 amp (C) 6.43 amp (D) 0.643 amp

374. The reduction and oxidation potentials(approximately) of water respectively are

(A) 1.23 V, – 0.83 V (B) –1.23 V, 0.83 V (C) 0.40 V, – 0.83 V (D) – 0.83 V, 1.23 V

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SECTION IV: MATCH THE FOLLOWING

375. Match the following columns

	Column I Structure		Column II Location of atoms		Column III Coordination number
(a)	SCC	(i)	corners as well as face centre	(x)	8
(b)	BCC	(ii)	Only at corners	(y)	12
(c)	FCC	(iii)	Corners as well as body centre	(z)	6

(A) (a)-(i)-(z), (b)-(ii)-(x), (c)-(iii)-(y)
(B) (a)-(ii)-(x), (b)-(i)-(y), (c)-(iii)-(z)
(C) (a)-(iii)-(z), (b)-(i)-(x), (c)-(ii)-(y)
(D) (a)-(ii)-(z), (b)-(iii)-(x), (c)-(i)-(y)

376.

	Name of colloidal solution		Example
(a)	Emulsion	(i)	Pumic stone
(b)	Aerosol	(ii)	Rocks salts
(c)	Sol	(iii)	Cheese
(d)	Solid sol	(iv)	Protein
(e)	Foam	(v)	Milk
(f)	Gel	(vi)	Mist
(g)	Solid foam	(vii)	Whipped cream

377. Match the following columns

	Column I Location of ions		Column II No. of occupied voids		Column III Void
(a)	Cs^+ in CsCl structure	(i)	All	(p)	Octahedral
(b)	Na^+ in NaCl structure	(ii)	Alternate	(q)	Tetrahedral
(c)	Zn^{++} in ZnS structure	(iii)	One fourth	(r)	Triangular
(d)	F^- in CaF_2 structure	(iv)	One third	(s)	Cuboidal
(e)	Na^+ in Na_2O structure				

(A) (a)-(i)-(s), (b)-(i)-(q), (c)-(ii)-(q), (d)-(i)-(q), (e)-(i)-(q)
(B) (a)-(ii)-(s), (b)-(i)-(r), (c)-(ii)-(q), (d)-(iii)-(q), (e)-(i)-(q)
(C) (a)-(i)-(s), (b)-(iii)-(r), (c)-(ii)-(r), (d)-(i)-(q), (e)-(i)-(s)
(D) (a)-(ii)-(r), (b)-(i)-(s), (c)-(iii)-(q), (d)-(i)-(q), (e)-(ii)-(q)

378. Match the following column

	Column I Structure		Column II Packing efficiency
(a)	atoms are present at corners as well as on edge centre	(i)	$\pi/6$
(b)	atoms are present at corners as well as on face centre	(ii)	$\sqrt{3}\ \pi/8$
(c)	atoms are present at corners as well as on body centre	(iii)	$\pi/12$
(d)	atoms are present only at corners	(iv)	$\sqrt{2}\ \pi/6$

(A) (a)-(iii), (b)-(i), (c)-(iv), (d)-(iii)
(B) (a)-(ii), (b)-(v), (c)-(iv), (d)-(iii)
(C) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
(D) (a)-(v), (b)-(iv), (c)-(i), (d)-(iii)

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379.

Column (I)	Column (II)
(A) Gold sol	(P) Bredig's Arc method
(B) Purification of colloidal solution	(Q) Negatively charged
(C) As_2S_3 sol	(R) Ultra centrifugation
(D) Zeta potential	(S) Electro kinetic potential
(E) Casein	(T) Double decomposition reaction

380.

Property	Reason
(a) Brownian movement	(i) Due to the scattering of light
(b) Tyndal effect	(ii) Due to the presence of charge
(c) Electrophoresis	(iii) Due to the neutralization of charge
(d) Coagulation	(iv) Due to unequal bombardment by solvent molecules

381.

Name of colloidal solution	Example
(a) Emulsion	(i) Pumic stone
(b) Aerosol	(ii) Rocks salts
(c) Sol	(iii) Cheese
(d) Solid sol	(iv) Protein
(e) Foam	(v) Milk
(f) Gel	(vi) Mist
(g) Solid foam	(vii) Whipped cream

382.

Property	Application
(a) Tyndal effect	(i) Smoke precipitator
(b) Electrophoresis	(ii) Ultra microscope
(c) Coagulation	(iii) Medicine
(d) Adsorption	(iv) Sewage water disposal

383. Match the following column

Column I Structure	Column II Examples
(a) Spinel structure	(i) K_2O
(b) Antifluorite structure	(ii) $ZnFe_2O_4$
(c) Wurtzite structure	(iii) $BaCl_2$
(d) Fluorite structure	(iv) ZnS
(e) Corundum	(v) Fe_2O_3

(A) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii), (e)-(v)
(B) (a)-(ii), (b)-(v), (c)-(iv), (d)-(iii), (e)-(ii)
(C) (a)-(iii), (b)-(iv), (c)-(v), (d)-(i), (e)-(ii)
(D) (a)-(v), (b)-(iv), (c)-(i), (d)-(iii), (e)-(ii)

384. Match the following column

Column I Structure	Column II Crystal defect
(a) Density of crystal decreases	(i) Schottky defect
(b) dielectric constant increases	(ii) Frenkel defect
(c) equal no. of cations & anions are missing from the lattice	(iii) F-centres
(d) Anion vacancies having unpaired electrons	
(e) Cation is missing from its site and occupies void	

(A) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii), (e)-(v)
(B) (a)-(i), (b)-(ii), (c)-(i), (d)-(iii), (e)-(ii)
(C) (a)-(iii), (b)-(iv), (c)-(v), (d)-(i), (e)-(ii)
(D) (a)-(v), (b)-(iv), (c)-(i), (d)-(iii), (e)-(ii)

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385. Match the following :

Column I				**Column II**
(a)	if the activation energy is 65 kJ then how much time faster a reaction proceed at 25°C than at 0°C			(i) 5
(b)	Rate constant of a first - order reaction is 0.0693 min^{-1}. If we start with 20 mol L^{-1}, it is reduced to 2.5 mol L^{-1} in how many minutes			(ii) 11
(c)	Half - lives of first - order and zeroth order reactions are same. Ratio of rates at the start of reaction is how many times of 0.693			(iii) 30
(d)	the half-life periods are given ,			(iv) $\frac{1}{2}$
$[A]_0$	(M)	0.0677	0.136	0.272
$t_{1/2}$	(sec)	240	480	960
	order of the reaction is			
(e)	Rate of formation of SO_3 in the following reaction $2SO_2 + O_2 \rightarrow 2SO_3$ is 100 g min^{-1}. Rate of disappearance of O_2 in g min^{-1}			(v) 2
				(vi) 1
				(vii) zero
				(viii) 40
				(ix) 50

386. Match the following

Column A		**Column B**	
(i)	Zero order reaction	(a)	$\frac{k_{t+10}}{k_t}$
(ii)	First order reation	(b)	$\frac{dx}{dt}$
(iii)	Second order reaction	(c)	$-\frac{dx}{dt} = k[A]^2[B]$
(iv)	Instantaneous rate	(d)	$H_2 + Cl_2 \xrightarrow{h\nu} 2HCl$
(v)	Temperature coefficient	(e)	$CH_3COOCH_3 + NaOH \rightarrow CH_3COONa + CH_3OH$
(vi)	Rate equation for third order reaction	(f)	$2H_2O_2 \rightarrow H_2O + O_2$
(vii)	Acidic hydrolysis of ester	(g)	Pseudo-unimolecular reaction
(A)	i-e, ii-f, iii-g, iv-c, v-a, vi-d, vii-b	(B)	i-d, ii-f, iii-e, iv-b, v-a, vi-c, vii-g
(C)	i-e, ii-g, iii-f, iv-d, v-a, vi-c, vii-b	(D)	i-b, ii-c, iii-a, iv-d, v-f, vi-g, vii-e

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387. Match the following

Column I order		**Column II Rate reaction**	
(i)	Zero	(a)	$k_2 = \frac{x}{at(a-x)}$
(ii)	One	(b)	$k_0 = \frac{x}{t}$
(iii)	Two	(c)	$k_3 = \frac{x(2a-x)}{t.2a^2(a-x)^2}$
(iv)	Three	(d)	$k_1 = \frac{2.303}{t}\log\frac{a}{a-x}$

(A) i-b, ii-d, iii-a, iv-c (B) i-d, ii-b, iii-c, iv-a
(C) i-c, ii-a, iii-b, iv-d (D) i-a, ii-b, iii-c, iv-d

388. The following data are for the reaction A + B → products:

concn. A (M)	**concn. B (M)**	**Initial Rate (mol L^{-1} s^{-1})**
0.1	0.1	4.0×10^{-4}
0.2	0.2	1.6×10^{-3}
0.5	0.1	2.0×10^{-3}
0.5	0.5	1.0×10^{-2}

Column I		**Column II**	
(a)	the order with respect to A	(i)	2.8×10^{-3} M·s^{-1}
(b)	the order with respect to B	(ii)	One
(c)	the rate constant	(iii)	1.8×10^{-3} M·s^{-1}
(d)	the reaction rate for A and B are 0.2M and 0.35M, respectively.	(iv)	k[A][B]
(e)	the reaction rate for A and B are 0.3M and 0.15M, respectively.	(v)	$4 \times 10^{-2}M^{-1}s^{-1}$
(f)	rate of reaction	(vi)	$k[A]^2[B]$

389. Given the following steps in the mechanism for a chemical reaction :

A + B —fast⟶ C
B + C —slow⟶ D + E
D + F —fast⟶ A + E

Column I		**Column II**	
(a)	The stoichiometric equation for the reaction	(i)	Second
(b)	Catalysts in this reaction	(ii)	rate = k [B][C]
(c)	Intermediates in this reaction	(iii)	rate = k'[A][B]
(d)	The rate-determining step	(iv)	B + C → D + E
(e)	The rate law for the rate-determining step	(v)	2 B+F → 2E
(f)	Order of the reaction	(vi)	A
		(vii)	C
		(viii)	D

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390.

Column I **Examples of solution**	**Column II** **Types of solution**
(a) Acetone + Aniline	(i) Positive deviation from ideal behaviour
(b) Water + Methanol	(ii) Negative deviation from ideal behaviour
(c) Benzene + Toluene	(iii) Ideal solution
(d) n-Hexane + N-heptane	
(e) Water + HCl	

391.

Column I **Condition for various solutions**	**Column II** **Type of solutions**
(a) $P_A + P_B < P^o_A x_A + P^o_B x_B$	(i) Positive deviation from ideal behaviour
(b) A–B attractive forces should be weaker than B–B attractive forces.	(ii) Negative deviation from ideal behaviour
(c) $\Delta V_{mix} > 0$ & Endothermic dissolution	(iii) Ideal solution
(d) $\Delta H_{mix} < 0$ & volume decreased during dissolution	
(e) Raoult's law is obeyed at every range of temperatre	

392.

Column I **Example of electrolyte**	**Column II** **Value of Van't Hoff factor.**
(a) $K_3[Fe(CN)_3]$	(i) 2
(b) Benzoic acid in benzene	(ii) 1
(c) NaCl	(iii) $1 + \alpha$
(d) CH_3COOH	(iv) $1 - \left(1 - \frac{1}{n}\right) \alpha$
(e) Urea	(v) $1 + 3\alpha$

393.

Column I **Colligative properties.**	**Column II** **Their formula**
(a) π	(i) $P_0 x_B$
(b) $P_0 - P_s$	(ii) $\frac{nRT}{V}$
(c) ΔT_f	(iii) $K_b.m$
(d) ΔT_b	(iv) $\frac{1000 K_f W_A}{m_A W_B}$

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394.

	Column I **Properties**		**Column II** **Formula**
(a)	Molal depression constant (K_f)	(i)	$\frac{1000\times K_f\times W}{W\times\Delta T_f}$
(b)	degree of dissociation	(ii)	$\frac{i-1}{\frac{1}{n}-1}$
(c)	degree of association	(iii)	$\frac{M_{solute}\,(normal)}{M_{solute}\,(observed)}$
(d)	Van't Hoff factor	(iv)	$\frac{i-1}{n-1}$
(e)	M_{solute} (observed)	(v)	$\frac{R\,T_f^{\,2}}{1000\times L_f}$

395. Match the following :

	Column I		**Column II**
(i)	Cell constant	(a)	Ω cm
(ii)	λ_m	(b)	cm^{-1}
(iii)	λ_{eq}	(c)	S cm^{-1}
(iv)	k	(d)	S cm^2 mol^{-1}
(v)	ρ	(e)	S m^2 eq^{-1}
(A)	i-b, ii-d, iii-e, iv-c, v-a	(B)	i-a, ii-d, iii-c, iv-e, v-b
(C)	i-d, ii-b, iii-a, iv-c, v-e	(D)	i-b, ii-d, iii-a, iv-e, v-c

396. Match the following:

	Column I Electrolyte	Anode	Cathode		**Column II** Product at cathode at anode	
(i)	Aq $CuCl_2$	Pt	Pt	(a)	Cu(s)	Cu^{++}
(ii)	Aq $CuCl_2$	Cu	Cu	(b)	Cu(s)	$Cl_2(g)$
(iii)	Aq $CuCl_2$	Cu	Ag	(c)	Cu(s)	Cu^{++}
(iv)	Aq $CuCl_2$	Ag	Cu	(d)	Cu(s)	Ag^{++}

(A) i-b, ii-d, iii-a, iv-a (B) i-a, ii-b, iii-a, iv-d
(C) i-a, ii-b, iii-a, iv-d (D) i-b, ii-a, iii-a, iv-d

397. Match the following :

	Column I **Electrode**		**Column II** **Type**
(i)	Pt, H_2(1 atm) | H^+ (1M)	(a)	Secondary refrence electrode
(ii)	Zn(s) | Zn^{2+} || Cu^{2+} | Cu(s)	(b)	Primary reference electrode
(iii)	Calomel electrode	(c)	NHE
(iv)	Ag | AgCl | Cl^- (1M)	(d)	Denial cell
(A)	i-bc, ii-d, iii-a, iv-a	(B)	i-bc, ii-a, iii-d, iv-a
(C)	i-ac, ii-d, iii-b, iv-a	(D)	i-bc, ii-d, iii-a, iv-b

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398. Match the following :

	Column I		Column II
(i)	Salt bridge	(a)	$+\Delta G$
(ii)	nFE	(b)	Diffusion in ions
(iii)	Corrosion	(c)	$-\Delta G$
(iv)	Cu(s) | Cu^{++} || Zn^{++} | Zn(s)	(d)	Fe_2O_3 x .H_2O
(A)	i-d, ii-c, iii-b, iv-a	(B)	i-c, ii-b, iii-a, iv-d
(C)	i-b, ii-c, iii-d, iv-a	(D)	i-a, ii-c, iii-d, iv-b

399. Match the following :

	Column I		Column II
(i)	Loss of electron	(a)	Cathode to anode
(ii)	Gain of electron	(b)	Anode to cathode
(iii)	Flow of current	(c)	Cathode
(iv)	Flow of electron	(d)	Anode
(A)	i-c, ii-c, iii-a, iv-d	(B)	i-a, ii-c, iii-d, iv-c
(C)	i-d, ii-c, iii-a, iv-c	(D)	i-c, ii-a, iii-d, iv-c

SECTION V: INTEGER TYPE

400. What will be the initial rate of a reaction if its rate constant is 10^{-3} min^{-1} and the concentration of reactant is 0.2 mol dm^{-3} ? How much of reactant will be converted into products in 200 minute ?

401. Same quantity of electricity is being used to liberate iodine (at anode) and a metal x (at cathode). The mass of x deposited is 0.617g and the iodine is completely reduced by 46.3 cc of 0.124M sodium thiosulphate. Find the equivalent mass of x to the nearest integer.

402. One litre water in a bucket is placed in a closed dry air room having dimensions $4 \times 2 \times 1.5$ m^3 at 300 K . If the vapour pressure of water at 300 K is 27.0 mm and density of water at 300 K is 0.990 g cm^{-3}, calculate the amount of water left in liquid state .

403. The composition of a sample of wurtzite is $Fe_{0.93}O_{1.00}$. What percentage of iron is present in the form of Fe(III) ?

404. We have taken a saturated solution of AgBr.K_{sp} of AgBr is 12×10^{-14}. If 10^{-7} mole of $AgNO_3$ are added to 1 litre of this solution find conductivity (specific conductance) of this solution in terms of 10^{-7} S m^{-1} mol^{-1}.

Given : $\lambda^0_{(Ag^+)} = 6 \times 10^{-3}$ S m^2 mol^{-1} ; $\lambda^0_{(Br^-)} = 8 \times 10^{-3}$ S m^2 mol^{-1} ; $\lambda^0_{(NO_3^-)} = 7 \times 10^{-3}$ S m^2 mol^{-1}

405. From the following data, estimate the activation energy (in kcal/mol) for the reaction,

$H_2 + I_2 \longrightarrow 2HI$

T, K	1/T, K^{-1}	log k
769	1.3×10^{-3}	2.9
667	1.5×10^{-3}	1.1

406. A radioactive isotope of P^{32} ($t_{1/2}$ = 14.3 day) used in biotracer studies of phosphorus metabolism accumulates in waste material having activity 1 millicurie . If it is unsafe to dispose off this waste material until the activity falls to 0.01 microcurie , how long must we store the waste in lead container before it is safe to dispose it ?

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407. To reduce nitrobenzene to aniline , 20 g of $C_6H_5NO_2$, 30 mL of an alcohol , 250 mL of water , 11 g of HCl and 1 g of $SnCl_2$. 2 H_2O were placed in the cathode space . After passing a current of 26.5 ampere hour through the lead cathodic electrolytic cell , 12.76 g of aniline was produced . Determine the current efficiency .

408. Copper sulphate solution (250 mL) was electrolysed using a platinum anode and a copper cathode. A constant current of 2 mA was passed for 16 mintue. It was found that after electrolysis, the absorbance (concentration) of the solution was reduced to 50% of its original value. If the calculated concentration of copper sulphate in the solution to begin with comes out to be abc × 10^{-d} M. (Give the value of 4 digit integer no. 'abcd')

409. During the discharge of a lead storage battery the density of sulphuric acid fell from 1.294 to 1.139 g.ml^{-1}. H_2SO_4 of density 1.294 g mL^{-1} is 39% and that of density 1.139 g mL^{-1} is 20% by weight. The battery holds 3.5L of acid and the volume practically remains constant during the discharge. Calculate the number of ampere hours for which the battery must have been used. The discharging reactions are:

$Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$ (anode)

$PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$ (cathode)

410. Calculate the numbers of α and β particles emitted in the conversion of $_{92}U^{238}$ to $_{82}Pb^{206}$.
(Suppose the no. of α and β particles is x and y respectively then give your answer as two digit integer 'xy')

411. A binary compound AB (formula weight 6.023 Y amu , where Y is some arbitrary number) AB exists in rock salt structure (1 : 1) . The shortest cation-anion distance is $Y^{1/3}$ nm .
Calculate :
(i) The density
(ii) If observed density is 20 kg/m^3 then find which point defect is present ?

412. A small amount of solution containing Na^{24} radio nucleide with activity A = 2 × 10^3 dps was administered into blood of a patient in a hospital. After 5 hour, a sample of the blood drawn out from the patient showed an activity of 16 dpm per c.c. $t_{1/2}$ for Na^{24} = 15 hr. Find –
(a) volume of the blood in patient
(b) Activity of blood sample drawn after a further time of 5 hr.

413. The vapour pressures of ethanol and methanol are 44.5 and 88.7 mm of Hg respectively. An ideal solution is formed at the same temperature by mixing 60 g of ethanol and 40 g of methanol. Calculate the total vapour pressure of solution and mole fraction of methanol in vapour phase.

414. The coagulation of 100 ml of a colloidal sol of gold is completely prevented by addition of 0.25 g of starch to it before adding 1 ml of 10 % NaCl solution. Find out the gold number of starch.

415. The vapour pressure of liquids A and B at 100 ºC are 300 and 100 mm of Hg respectively . A mixture of two liquids forming ideal solution at 100 ºC exerts a vapour pressure in gaseous phase in which A and B are one mole each in vapour phase . Calculate the vapour pressure of mixture and the mole fraction of liquid mixture in which two liquids are mixed .

416. If an element crystallizes in a cubic structure of edge length 5 Å . If the density and the atomic mass of the element are 2 gm/cc and 75 respectively , then calculate the radius ?

417. The acid catalysed hydrolysis of an organic compound A at 30 ºC has half life of 100 minute when carried out in a buffer solution of pH = 5 and 10 minute when carried out at pH = 4 . Both the times the half life are independent of the initial concentration of A . If the rate of reaction is given by , rate = K $[A]^m [H^+]^n$, what are the values of m and n ?

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418. 200 g of a non-electrolyte compound (molar mass = 20) are dissolved in 2.0 litre of X M Na_2SO_4 aqueous solution . The osmotic pressure of this solution is found to be 480 atm at 27 ºC. Calculate the value of X. Assume complete dissociation of NaCl and ideal behaviour of this solution .
[R = 0.08 litre atm $mol^{-1} K^{-1}$]

419. How many kinds of space lattices are possible in a crystal ?

420. A metal of atomic weight 80 has density 50 gm/cm^3. If edge length of unit cell is 200 pm then calculate no. of atoms per unit cell ($N_0 = 6 \times 10^{23}$)

421. A wooden lamp excavated recently was found to emit 5 β -particles per minute per gram of carbon. The freshly cut wood is found to emit 14 β -particles per minute per gram of carbon. how old is wooden lamp. Half life period of ^{14}C is 5770 yrs.

422. For the coagulation of 100 ml of arsenious sulphide sol, 5 ml of 1 M NaCl is required. What is the Flocculation value of NaCl?

423. A nuclear reactor produces radioactive phosphorus (P^{32}) with half life of 13.8 days. Initially the activity was 2.0×10^9 nuclei per second. After how much time from the begining of production the activity will reduce to 1×10^9 dps. answer to the nearest integer.

424. The volume of nitrogen gas U_m (measured at STP) required to cover a sample of silica gel with a mono-molecular layer is 129 $cm^3 g^{-1}$ of gel. Calculate the surface area per gram of the gel if each nitrogen molecule occupies 16.2×10^{-20} m^2.

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XI

SECTION I: SINGLE OPTION CORRECT

425. The order of increasing thermal stabilities of ,
(I) K_2CO_3 , (II) $MgCO_3$, (III) $CaCO_3$, (IV) $BaCO_3$ is:
(A) II < III < IV < I (B) IV < II < III < I
(C) IV < II < I < III (D) II < IV < III < I

426. Iron is harder than sodium because
(A) iron atoms are smaller (B) iron atoms are more closely packed
(C) metallic bonds are stronger in sodium (D) metallic bonds are stronger in iron

427. Which of the following is the right order of lattice energy ?
(A) $Na_2O = Al_2O_3$ (B) $Al_2O_3 < Na_2O$ (C) $Na_2O > MgO$ (D) $Na_2O < MgO$

428. The maximum covalency is equal to –
(A) the number of unpaired p-electrons
(B) the number of paired d-electrons
(C) the number of unpaired s and p-electrons in the outermost shell
(D) the actual number of s and p-electrons in the outermost shell

429. The volatility of HF is low because of
(A) its low polarizability
(B) the weak dispersion interaction between the molecules
(C) its small molecular mass
(D) its strong hydrogen bonding

430. Acetylene does not form hydrogen bond because :
(A) absence of lone pair of electron in higher electronegative carbon atom
(B) absence of more electronegative atom
(C) size of more electronegative atom is large
(D) None of these

431. Anhydrous $AlCl_3$ is covalent but $AlCl_3 . 6 H_2O$ is ionic because :
(A) $AlCl_3$ has a plane triangular structure
(B) the ionization energy of Al is very low
(C) the hydration energy of $AlCl_3$ is very high
(D) the hydration energy of $AlCl_3$ compensates for the high ionization energy of aluminium

432. Which of the following employ(s) the technique of fractional crystallisation?
(A) Parke's process (B) Pattinson's process
(C) Van–arkel's process (D) zone refining

433. When a small amount of solid calcium phosphide, Ca_3P_2 , is added to water, what are the most likely products ?
(A) aqueous Ca^{+2} and OH^- ions and PH_3 gas
(B) aqueous Ca^{+2} and OH^- ions and aqueous H_3PO_3
(C) solid CaH_2 and aqueous H_3PO_3
(D) solid CaO and PH_3 gas

434. In Ostwald's Process, _____ is oxidised to NO using _____.
(A) N_2O, O_2 (B) N_2, O_2 (C) NH_3, N_2O (D) NH_3, O_2

435. A metal oxide when heated with water gas at 50^0C under atmospheric pressure, gets converted completely to a gas which is highly toxic and inflammable. The metal could be
(A) Pb (B) Ni (C) Hg (D) Ba

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436. Which variety of coal is used for reduction of tinstone in metallurgy of tin?
(A) Peat (B) Lignite (C) Bone char (D) Anthracite

437. In which of the following is highest temperature attainable
(A) kiln (B) induction furnace
(C) blast furnace (D) reverberatory furnace

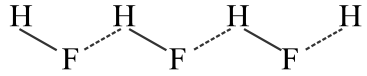
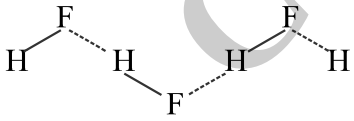
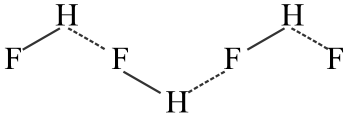
438. For the confirmatory tests of acid radicals, sodium carbonate extract is prepared because –
(A) all anions react with Na
(B) Na is more reactive
(C) Na_2CO_3 is water soluble
(D) sodium salts of almost all anions are water soluble

439. In a suspected case of poisoning, a forensic expert is analysing a food sample. When the sample is heated with zinc and dil. acid after appropriate treament, a foul-smelling gas is evolved which gives a silver mirror when passed through a heated glass tube. The poisonous element from the sample gives (in its ionic form in the solution) a yellow precipitate when H_2S is passed in its ammonical solution. The poisonous element could be
(A) Hg (B) Sb (C) As (D) Pb

440. The name of the blue product of the reaction between ferrous ion and ferricyanide ion is –
(A) thenard blue (B) turnbull's blue (C) Prussian blue (D) ultramarine blue

441. The correct lewis acid order for boron halides is -
(A) $BF_3 > BCl_3 > BBr_3 > BI_3$ (B) $BCl_3 > BF_3 > BBr_3 > BI_3$
(C) $BI_3 > BBr_3 > BCl_3 > BF_3$ (D) $BBr_3 > BCl_3 > BI_3 > BF_3$

442. Permutit is
(A) hydrated sodium aluminium silicate (B) sodium hexametaphosphate
(C) sodium silicate (D) sodium metaaluminate

443. The H bonding slip HF can be best represented as –
(A) H – F .. H – F .. H – F (B) 
(C)  (D) 

444. Soda extract of the salt is prepared by –
(A) fusing mixture of backing soda and slat and then extracting with water
(B) dissolving $NaHCO_3$ and salt in dil HCl
(C) boiling Na_2CO_3 and salt in dil HCl
(D) boiling Na_2CO_3 and salt in distilled water

445. Ferric ions form a Prussian blue coloured precipitate with $K_4Fe(CN)_6$ due to the formation of –
(A) $K_3[Fe(CN)_6]$ (B) $Fe_4[Fe(CN)_6]_3$ (C) $Fe(OH)_3$ (D) $KFe[Fe(CN)_6]$

446. What is incorrect about $Al_2(SO_4)_3$?
(A) it is a white salt
(B) its aqueous solution gives precipitate of compound Al with $AgNO_3$ solution.
(C) on adding NaOH solution to its aqueous solution, a precipitate is formed which dissolved in excess of NaOH
(D) it will give precipitate with lead acetate solution

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447. The main factor responsible for weak acidic nature of B - F bond in BF_3 is ;
(A) Large electronegativity of F
(B) Three centred two electron bond in BF_3
(C) Pπ - dπ back bonding
(D) Pπ - Pπ back bonding

448. Na_2CO_3 can be manufactured by Solvay process but K_2CO_3 can not be prepared because –
(A) K_2CO_3 is more soluble (B) K_2CO_3 is less soluble
(C) $KHCO_3$ is more soluble than $NaHCO_3$ (D) $KHCO_3$ is less soluble than $NaHCO_3$

449. Which one of the following does not have intermolecular H-bonding
(A) H_2O (B) o-nitrophenol (C) HF (D) CH_3COOH

450. An acid among the following is -
(A) $B(OH)_3$ (B) $Al(OH)_3$ (C) NaOH (D) None

451. Inert pair effect is prominent characteristic of :
(A) s - block (B) d - block (C) p - block (D) f - block

452. For $Be(NO_3)_2$ anhydrous which is correct .
(A) starting material is $Be(NO_3)_2.2H_2O$ with N_2O_4
(B) $Be(NO_3)_2$ (anh.) on heating upto 125° C gives basic beryllium nitrate $[Be_4O(NO_3)_6]$
(C) Be + HNO_3 (dil.) $\rightarrow$ $Be(NO_3)_2$ (anh.) + H_2O
(D) all of these are correct

453. CaNH on hydrolysis will give gas (A) which on oxidation by $CaOCl_2$ will convert into (B) . What are (A) and (B) ?
(A) A = NH_3 , B = N_2 (B) A = N_2 , B = NH_3
(C) A = NH_3 , B = NH_3 (D) A = N_2 , B = N_3H

454. The correct order of viscosity of alcohol, ethylene glycol and glycerol is
(A) alcohol > glycol > glycerol (B) glycerol > glycol > alcohol
(C) glycol > glycerol > alcohol (D) alcohol > glycerol > glycol

455. Highly pure dilute solution of sodium in liquid ammonia :
(A) shows blue colour
(B) exhibits electrical conductivity & act as reducing agent
(C) produces sodium amide
(D) All of these

456. Which of the following sets of characteristics leads to the increase in solubility of ionic substances
(A) High dipole moment, strong attraction by an ion and large solvation energy
(B) Low dipole moment, weak attraction by an ion and high solvation energy
(C) High dipole moment, strong attraction by an ion and low solvation energy
(D) High dipole moment, weak attraction by an ion and large solvation energy

457. What is the chemical composition of matte?
(A) Cu_2O + FeS (B) Cu_2O + Cu_2S (C) FeS + SiO_2 (D) Cu_2S + FeS

458. The second I.P. of Na, third I.P. of Mg and fourth I.P. of Al are very high because
(A) the ion Na^+, Mg^{2+} and Al^{3+} have high ionic potential
(B) these ions are isoelectronic
(C) these ions have outer ns^2np^6 configuration
(D) these ions are of normal elements

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459. Which of the following exhibit/s H-bonding?
(A) CH_4 (B) H_2Se (C) N_2H_4 (D) H_2S

460. Correct order of electronegative difference between bonded atom is :
(A) $AlCl_3 < MgCl_2 < NaCl$ (B) $NaCl < AlCl_3 < MgCl_2$
(C) $NaCl < MgCl_2 < AlCl_3$ (C) $MgCl_2 < NaCl < AlCl_3$

SECTION II: MORE THAN ONE OPTION CORRECT

461. Three centre-two electron bonds exist in –
(A) B_2H_6 (B) $Al_2(CH_3)_6$ (C) $BeH_2(s)$ (D) $BeCl_2$ (s)

462. Adding electron to neutral gaseous atom usually leads to
(A) Liberation of energy (B) Formation of ion
(C) Proton/electron ratio decreases (D) Stabilizing the species

463. Sodium nitrate decomposes above ~ 800ºC to give
(A) N_2 (B) O_2 (C) NO_2 (D) Na_2O

464. Select correct statement(s):
(A) Borax is used as a buffer
(B) 1 M borax solution reacts with equal volumes of 2 M HCl solution
(C) Titration of borax can be made using methyl orange as the indicator
(D) Coloured bead obtained in borax-bead test contains metaborate

465. Select correct statement about B_2H_6
(A) Bridging groups are electron-deficient with 12 valence electrons
(B) It has 2c - 2e B–H bonds
(C) It has 3c - 2e B–H–B bonds
(D) All of above are correct statements

466. Which one of the following process(es) will produce temporary hard water?
(A) Addition of Na_2SO_4 to water. (B) Saturation of water with $CaCO_3$
(C) Saturation of water with $MgCO_3$ (D) Saturation of water with $CaSO_4$

467. The reagent(s) that can't be used to determine hardness of water titrimetrically is/are :
(A) oxalic acid (B) disodium salt of EDTA
(C) sodium citrate (D) sodium thiosulphate

468. In context with the industrial preparation of hydrogen from water gas (CO + H_2), which of the following is/are the incorrect statement(s)?
(A) CO is oxidised to CO_2 with steam in the presence of a catalyst followed by absorption of CO_2 in alkali.
(B) CO and H_2 are fractionally separated using differences in their densities.
(C) CO is removed by absorption in aqueous Cu_2Cl_2 solution.
(D) H_2 is removed through occlusion with Pd.

469. Hydrogen peroxide is
(A) A stronger acid than water (B) A weaker acid than water
(C) An oxidising agent (D) A reducing agent

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470. Hydrogen can be obtained from water by

(A) Reaction with metal oxides (B) Reaction with non-metal oxides

(C) Reaction with metals (D) Reaction with metal hydrides

471. Which of the following is/are hard water(*s*)

(A) Water containing some potash alum (B) Water containing a few drops of *HCl*

(C) Water containing common salt (D) Water containing calcium nitrate

472. Pick the incorrect statement(s):

(A) Sodium borohydride reacts very slowly with cold water

(B) Sodium borohydride reacts very violently with cold water to produce H_2

(C) Solubility of sodium borohydride in water at 25°*C* is 10.05 *g*/*mL*

(D) Melting point of sodium borohydride is 500°*C*

473. Hydrogen can be obtained from water, by the action of water on

(A) Calcium carbide (B) Calcium hydride (C) Calcium oxide (D) Calcium

474. What is true about ice

(A) Its density is more than water (B) It is a good conductor of heat

(C) It is a thermal insulator (D) Its density is less than water

475. Which of the following order is wrong:

(A) $NH_3 < PH_3 < AsH_3$ – Acidic (B) $Li < Be < B < C$ – IE_1

(C) $Al_2O_3 < MgO < Na_2O < K_2O$ – Basic (D) $Li^+ < Na^+ < K^+ < Cs^+$ – Ionic radius

476. True statement(s) for periodic classification of elements is

(A) The properties of the elements are periodic function of their atomic numbers

(B) No. of nonmetallic elements is less than the no. of metallic elements

(C) First ionization energy of elements does not change continuously with increasing of atomic no. in a period .

(D) d-subshell is filled by directional electron with increasing atomic no. of transition elements.

477. Which of the following is / are correct for group 14 elements?

(A) The stability of dihalides are in the order $CX_2 < SiX_2 < GeX_2 < SnX_2 < PbX_2$

(B) The ability to form $p\pi$–$p\pi$ multiple bonds among themselves increases down the group

(C) The tendency for catenation decreases down the group

(D) They all form oxides with the formula MO_2.

478. The incorrect statement(s) among the following is/are:

(A) The first ionisatioin potential of Al is less than the first ionisation potential of Mg

(B) The second ionisation potential of Mg is greater than the second ionisation potential of Na

(C) The first ionisation potential of Na is less than the first ionisation potential of Mg

(D) The third ionisation potential of Mg is greater than the third ionisation potential of Al

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479. The correct statement(s) related to allotropes of carbon is/are

(A) graphite is the most stable allotropes of carbon and having a two dimensional sheet like structure of hexagonal rings of carbon (sp^2)

(B) diamond is the hardest allotrope of carbon and having a three dimensional network structure of C(sp^3)

(C) fullerene (C_{60}) is recently discovered non-crystalline allotrope of carbon having a football-like structure.

(D) Vander Waal's force of attraction acts between the layers of graphite 6.14 Å away from each other

480. The hydrolytic constants are expressed as K_{hydr}. At 25ºC, pK_{hydr} of the following calions are as given:

Cations

	Mg^{2+}	Ca^{2+}	Al^{3+}	Fe^{2+}
pK_{hydr}	*11.4*	*12.6*	*5.1*	*9.5*

(A) Smaller the value of ionisation constant of base, greater is the extent of hydrolysis

(B) Greater the polarisation power of the cation stronger the hydrolysis

(C) pK_{hydr} for Fe^{3+} is expected to be lesser than 9.5

(D) pK_{hydr} for Ba^{2+} is expected to be greater than 12.6

481. When an inorganic compound (X) having 3c-2e as well as 2c-2e bonds reacts with ammonia gas at a certain temperature, gives a compound (Y) iso-structural with benzene. Compound (X) with ammonia at a high temperature, produces a hard substance (Z). Then

(A) (X) is B_2H_6 (B) (Z) is known as inorganic graphite

(C) (Z) having structure similar to graphite (D) (Z) having structure similar to (X)

482. Which of the following statements is/are correct regarding B_2H_6?

(A) banana bonds are longer but stronger than normal B–H bonds

(B) B_2H_6 is also known as 3c–2e compound

(C) the hybrid state of B in B_2H_6 is sp^3 while that of sp^2 in BH_3

(D) it cannot be prepared by reacting BF_3 with $LiBH_3$ in the presence of dry ether

483. Select correct statements -

(A) $Ca_3(PO_4)_2$ is part of bones and $3Ca_3(PO_4)_2.CaF_2$ is part of enamel in teeth

(B) Ca^{2+} ions are important in blood clotting

(C) BeH_2 and MgH_2 are covalent and polymeric while CaH_2 , SrH_2 and BaH_2 are ionic

(D) BeH_2 contain three-centre two-electron bonds

484. Which of the following cannot be used as primary standard base -

(A) NaOH (B) $Ca(OH)_2$ (C) $Na_2B_4O_7$, $10H_2O$ (D) $Na_2C_2O_4$

485. Which of the following is correct among the following?

(A) Increasing polarising power : $Na^+ < Ca^{+2} < Mg^{+2} < Al^{+3}$

(B) Increasing covalent character : LiF < LiCl < LiBr < LiI

(C) Ionic character: $MCl < MCl_2 < MCl_3$

(D) Increasing polarisibility : $F^- < Cl^- < Br^- < I^-$

486. Which of the following carbides are methanides?

(A) CaC_2 (B) Mg_2C_3 (C) Al_4C_3 (D) Be_2C

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487. Which of the following statements about alkaline earth metals are correct ?
(A) Hydration energy of Sr^{2+} is greater than that of Be^{2+}
(B) $CaCO_3$ decomposes at a higher temperature than $BaCO_3$
(C) $Ba(OH)_2$ is stronger base than $Mg(OH)_2$
(D) $SrSO_4$ is less soluble in water than $CaSO_4$

488. Which of the following pairs of elements will give superoxides and peroxides respectively when heated in excess of air
(A) K, Ba (B) Na,Rb (C) K,Rb (D) Na, Ba

489. Which one of the following statement (s) is (are) correct?
(A) The electronic configuration of Cr is [Ar] $3d^5$ $4s^1$.(Atomic No. of Cr = 24)
(B) The magnetic quantum number may have a negative value
(C) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type. (Atomic No. of Ag = 47)
(D) The oxidation state of nitrogen in HN_3 is –3.

490. In Alkali metal family cesium is
(A) Used in photoelectric cells (B) Lightest of all
(C) Less electropositive than francium (D) Soft and has low melting and boiling points.

491. Alkali metals are characterised by
(A) Good conductor of heat and electricity (B) high oxidation potentials
(C) High melting points (D) Solubility in liquid ammonia.

492. Which of the following superoxides are orange coloured
(A) RbO_2 (B) CsO_2 (C) KO_2 (D) None of these

493. All the following substances react with water, in which of the cases same gaseous product is obtained?
(A) Na (B) Na_2O_2 (C) KO_2 (D) NaH

494. Solutions of equal strength of XOH and QOH are prepared. The Ionisation Potential of X and Q are 5.1 and 13.0eV respectively, whereas their Electronegativity are 0.9 and 3.2 respectively. Using the information, spot the correct conclusion(s)

(A) Reaction of XOH and NH_4Cl will produce NH_3

(B) Solution of QOH will give effervescence with $NaHCO_3$

(C) Phenolphthalein will give pink colour with XOH solutions

(D) The pH of QOH solution will be more than 7

495. Which of the following statement/s is/are correct?
(A) The structure of carborundum is as same that of diamond
(B) Carbogen is a mixture of O_2 and CO_2 (5–10%) which is used for artificial respiration in pneumonia patients
(C) $SnCl_2$ is a strong oxidizing agent.
(D) PbO a yellow coloured powder is known as litharge.

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SECTION III: COMPRHENSIONS

COMPREHENSION # 54
Paragraph for Questions Nos. 496 to 498

100 ml of hard water sample containing Ca^{2+} as only hardness imparting cation was divided into two equal parts.

To the first part, 1 ml of NH_4Cl-NH_4OH buffer was added and pH adjusted to 11, addition of 4–5 drops of Erichrome black T indicator. The colour of the resulting solution was pink. The solution so obtained was titrated with 10^{-3} (M) disodium salt of EDTA (Na_2 EDTA), 40 ml of Na_2 EDTA solution was required to change the colour of solution from pink to blue. For the following reaction

Na_2 EDTA + $Ca^{2+} \longrightarrow$ Ca EDTA + $2Na^+$

To the second part 10^3 ml of excess $Ca(OH)_2$ solution was added, thoroughly stirred,

6×10^{-4} gm of white ppt of $CaCO_3$ was obtained.

The density of hard water sample was 1gm/ml

496. What was the temporary hardness of given hard water sample? Hardness is expressed in ppm of $CaCO_3$.

(A) 3 ppm (B) 6 ppm (C) 18 ppm (D) 20 ppm

497. What was the permanent hardness of the given hard water sample with respect to ppm of $CaCO_3$?

(A) 80 ppm (B) 74 ppm (C) 64 ppm (D) 84 ppm

498. If the 100 ml of the given water sample is passed through in cation exchange resin only then what should be the pH of effluent water from the resin?

Given log 2 = 0.3 and log 3 = 0.48

(A) 4.8 (B) 2.52 (C) 2.8 (D) 5.8

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COMPREHENSION # 55
Paragraph for Questions Nos. 499 to 501

Depletion of resources of fossil fuels will at some future time make hydrogen, either for use directly by combustion and electrochemically in fuel cells or indirectly via hydrogenation of coal, the major alternative to nuclear energy; hence arises the current interest in the so-called hydrogen economy.

A thermochemical cycle for hydrogen production involves at least one element that can exist in two different oxidation states .

$2H_2O \rightarrow 2H_2 + O_2$

499. Production of H_2 from H_2O requires a net input of energy that would come from -

(A) nuclear source (B) solar source (C) both of these (D) none of these

500. In the above thermochemical cycle, $FeCl_2$ is one of the catalyst involved and thus regenerated at the end of the reaction, after formed into -

(A) $FeCl_3$, FeO, Fe_2O_3 (B) $FeCl_3$, Fe_2O_3, Fe_3O_4

(C) $FeCl_3$, FeO (D) $FeCl_3$, Fe_3O_4

501. H_2 is produced in the following thermochemical reaction -

(A) $FeCl_2 + H_2O \rightarrow$ (B) $Fe_3O_4 + Cl_2 + HCl \rightarrow$

(C) $FeO + H_2O \rightarrow$ (D) $FeCl_3 + H_2O \rightarrow$

COMPREHENSION # 56
Paragraph for Questions Nos. 502 to 506

Consider the following flowsheet and answer the questions given after it

$C_3H_{8(g)} + A \longrightarrow$ Syngas $\xrightarrow[Fe_2O_3/Cr_2O_3]{x}$

$Y + Z \xrightarrow[\text{High pressure}]{\text{Cold water}} Z(g)$ + Aq. solution of Y.

Z has low chemical reactivity at room temperature but under vigorous suitable conditions it reacts with other elements to form very useful compounds. Z is also being looked upon as prospecitve source of energy for future.

502. The above flowsheet refers to which process -

(A) Lane's process (B) Haber's process (C) Bosch process (D) Mond's process

503. Which two substances are same?

(A) X and Z (B) A and X (C) A and Y (D) A and Z

504. Which of following represents dihydrogen?

(A) Y (B) Z (C) X (D) None of these

505. Components of syngas are -

(A) CO_2, CO (B) CO, H_2O (C) CO, H_2 (D) CO_2, H_2

506. Which compound of Z is called oxidane ?

(A) X (B) Y (C) H_2O_2 (D) N_2H_4

COMPREHENSION # 57
Paragraph for Questions Nos. 507 to 509

The mineral colemanite is fused with sodium carbonate, compound (Z) is obtained along with white ppt. When (Z) reacts with conc. H_2SO_4 gives a compound (A) which on hydrolysis gives monobasic acid (B) which on strong heating gives (C). (C) on reduction with Mg produced (D) and non metal (X). (X) is a II period element and its valency shell have 3 electrons . Treatment of halogen on a mixture of (C) and carbon at high temperature gives a halide (E) which is fuming liquid (b. pt. 13ºC) along with a oxide (F), which is neutral in nature.

Based on the above paragraph answer the following questions .

507. Compound (B) is weak acid in .....(1)..... & strong acid in .....(2)..... What are (1) and (2)?

	(1)	(2)		(1)	(2)
(A)	H_2O	glycol	(C)	glycol	H_2O
	(1)	(2)		(1)	(2)
(C)	glycol	NH_4OH	(D)	glycol	NaOH

508. By heating the non metal (X) in the atmosphere of nitrogen yields a compound (Y). The structure of (Y) is similar to :

(A) diamond (B) graphite (C) silicate (D) carborundum

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509. The anhydrous form of (A) is :

(A) H_3BO_3 (B) B_2O_3 (C) $H_2B_4O_7$ (D) B

COMPREHENSION # 58
Paragraph for Questions Nos. 510 to 512

The electronic configuration of the elements show a periodic variation of increasing atomic number. Consequently there are also periodic variations in physical and chemical behaviour of the elements. Before examining the variation in properties, the concept of effective nuclear charge should also be understood as it influences the atomic size and ionization energy. The effective nuclear charge effect is the charge felt by the valence electron $Z_{eff} = z - \sigma$, where z is actual nuclear change and σ is screening constant. Now variation in different type of atomic radii i.e. metallic radius covalent radius and Vander Wall radius can be studied keeping Z_{eff} in consideration. Z_{eff} also plays an important role in variation of ionization energy across the period and group. A large Z_{eff} means a more tightly held outer electron and hence greater first ionization energy.

510. The increasing order of effective nuclear charge in Na, Al, Mg and Si atoms

(A) Na < Mg < Si < Al (B) Na < Mg < Al < Si

(C) Mg < Na < Al < Si (D) Na = Mg = Al = Si

511. Which of the following option is correct? **[State T for true and F for false]**

(i) On moving from left to right in a period screening constant value is increase

(ii) In a s, p, d, f-orbitals the order of screening effect is s > p > d > f in a given shell

(iii) In any period left to right effective nuclear charge increases so electronegativity is also increases

(iv) The effective nuclear charge of Na is 2.85

(A) TTTF (B) FFFT (C) FFTT (D) TTFF

512. Calculate the screening constant for the last electron of Si

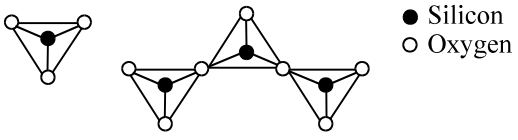
(A) 4.15 (B) 9.85 (C) 8.85 (D) 4.85

COMPREHENSION # 59
Paragraph for Questions Nos. 513 to 515

Read the following short write-up and answer the questions at the end of it

The name **'silica'** covers an entire group of minerals, which have the general formula SiO_2, the most common of which is **quartz**. Quartz is a framework silicate with SiO_4 tetrahedra arranged in spirals. The spirals can turn in a clockwise or anticlockwise direction – a feature that results in there being two mirror images, optically active, varieties of quartz.

513. The following pictures represent various silicate anions. Their formulae are respectively:

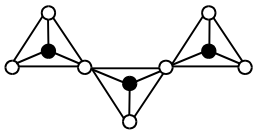


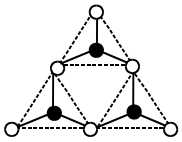
(A) SiO_3^{2-} $Si_3O_7^{2-}$ (B) SiO_4^{4-} $Si_3O_{10}^{8-}$

(C) SiO_4^{2-} $Si_3O_9^{2-}$ (D) SiO_3^{4-} $Si_3O_7^{8-}$

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514. $Si_3O_9^{6-}$ (having three tetrahedral) is represented as:

(A) 

(B) 

(C) both

(D) none

515. The silicate anion in the mineral kinoite is a chain of three SiO_4 tetrahedra that share corners with adjacent tetrahedra. The mineral also contains Ca^{2+} ions, Cu^{2+} ions, and water molecules in a 1:1:1 ratio mineral is represented as:

(A) $CaCuSi_3O_{10}\cdot H_2O$

(B) $CaCuSi_3O_{10}\cdot 2H_2O$

(C) $Ca_2Cu_2Si_3O_{10}\cdot 2H_2O$

(D) none of these

COMPREHENSION # 60
Paragraph for Questions Nos. 516 to 517

Silicons are synthetic polymers containing repreated R_2SiO units. Since, the empirical formula is that of a ketone (R_2CO), the name silicone has been given to these materials. Silicones can be made into oils, rubbery elastomers and resins. They find a variety of applications because of their chemical inertness, water repelling nature, heat-resistance and good electrical insulating property.

Commercial silicon polymers are usually methyl derivatives and to a lesser extent phenyl derivatives and are synthesised by the hydrolysis of

R_2SiCl_2[R=methyl (Me) or phenyl (ϕ)]

$$Me_2SiCl_2 \xrightarrow{H_2O} \begin{matrix} Me & Me & Me \\ | & | & | \\ O-Si-O-Si-O-Si-O- \\ | & | & | \\ Me & Me & Me \end{matrix}$$

516. If we mix Me_3SiCl with Me_2SiCl_2, we get silicones of the type:

(A) $$\begin{matrix} Me & Me & Me & Me \\ | & | & | & | \\ Me-Si-O-Si-O-Si-O-Si-Me \\ | & | & | & | \\ Me & Me & Me & Me \end{matrix}$$

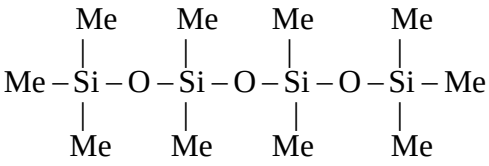
(B) $$\begin{matrix} & Me & Me & \\ & | & | & \\ -O-Si-O-Si-O- \\ & | & | & \\ & O & O & \\ & | & | & \\ -O-Si-O-Si-O- \\ & | & | & \\ & Me & Me & \end{matrix}$$

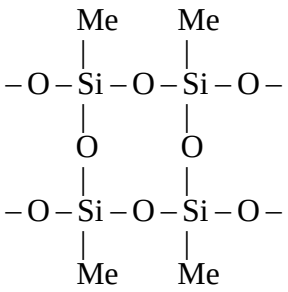
(C) both of the above

(D) none of the above

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517. If we start with $MeSiCl_3$ as the starting material, silicones formed is:

(A) 

(B) 

(C) both of the above (D) none of the above

COMPREHENSION # 61
Paragraph for Questions Nos. 518 to 520

Lattice enthalpy: The lattice enthalpy of an ionic solid is defined as the energy required to completely separate one mole of a solid ionic compound into gaseous constituent ions. For e.g., the lattice enthalpy of NaCl is 788 kJ mol^{-1}. This means that 788 kJ of energy is required to separate to an infinite distance 1 mole of solid NaCl into 1 mole of $Na^+(g)$ and one mole of $Cl^-(g)$. This process involves both the attractive forces between ions of opposite charges and the repulsive forces between ions of like charge. The solid crystal being three-dimensional; it is not possible to calculate lattice enthalpy directly from the interaction of forces of attraction and repulsion only. Factors associated with the crystal geometry have to be included.
The first theoretical interpretation of lattice enthalpy was given by Born and Lande. They gave a simple equation for the calculation of lattice enthalpy.

$$U_0 = \frac{AN_A |z^+||z^-|e^2}{4\pi\varepsilon_0 r_0}(1 - 1/n)$$

Where U_0 is the lattice enthalpy ; A, the Madelung constant (this take care of interaction with all the other ions besides the nearest neighbours) N_A, the Avogadro constant ; z^+, charge on the positive ion ; z^-, the charge on the negative ion ; e, charge on the electron ; π, constant (3.14159); ε_0 ; vacuum permittivity ; r_0 inter-ionic distance , n is the born exponent in the repulsion terms.
On moving up to down lattice energy decreases in groups. Same for hydration energy also. If lattice energy is less than hydration energy, means that salt will be soluble in water.

518. Which one has highest melting point among the following?
(A) NaCl (B) KCl (C) CsCl (D) RbCl

519. Which of the following order is correct for lattice energy (U) .
(A) $Fe_2O_3 > FeO$ (B) $Fe_2O_3 < FeO$ (C) $Fe_2O_3 = FeO$ (D) none of these

520. $BaSO_4$ is inosluble in water because :
(A) lattice energy is greater than hydration energy
(B) lattice energy is less than hydration energy
(C) lattice energy is almost same its hydration energy
(D) None of these

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COMPREHENSION # 62
Paragraph for Questions Nos. 521 to 523

Calcium sulphate is available in nature in two forms, anhydride, $CaSO_4$ and gypsum, $CaSO_4.2H_2O$. Gypsum when heated at 120ºC, from the monoclinic form it changes to orthorhombic form and then it loses three fourth of it's water of crystallisation and plaster of paris is produced

521. What will be the product if gypsum is heated at 200ºC?

(A) $CaSO_4.H_2O$ (B) $2CaSO_4.H_2O$

(C) $CaSO_4$ (D) CaO, SO_2 and O_2

522. Suspension of gypsum is used for production of nitrogeneous fertilizer as follows –

(A) $CaSO_4 + NH_3 \longrightarrow (NH_4)_2SO_4 + Ca(OH)_2$

(B) $NH_3 + CaSO_4 + CO_2 \longrightarrow (NH_4)_2SO_4 + CaCO_3$

(C) $CO_2 + CaSO_4 \longrightarrow Ca(OH)_2 + CaCO_3$

(D) $NH_3 + CaSO_4 + CO_2 \longrightarrow CaCO_3 + (NH_4)_2CO_3 + H_2SO_4$

523. Which of the following represent the setting reaction of plaster of paris ?

(A) $2CaSO_4.H_2O \xrightarrow{\Delta} CaSO_4$

(B) $2CaSO_4.H_2O \xrightarrow{H_2O} CaSO_4.2H_2O$ (orthorhombic)

(C) $2CaSO_4.H_2O \xrightarrow{H_2O} CaSO_4.2H_2O$ (monoclinic)

(D) $2CaSO_4.H_2O \xrightarrow{H_2O} CaSO_4.H_2O$ (monoclinic)

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COMPREHENSION # 63
Paragraph for Questions Nos. 524 to 529

Boron forms a number of hydrides having the general formulae B_nH_{n+4} and B_nH_{n+6}. These hydrides are called boranes. The simplest hydride of boron is diborance, B_2H_6. Boranes contain special types of bonds known as multicentre bonds. Boranes have high heat of combustion.

524. The type of hybridization of boron in diborane is

(A) sp (B) sp^2 (C) sp^3 (D) dsp^2

525. Three centre two electron bond(3c – 2e) is present in :-

(A) BF_3 (B) B_2H_6 (C) H_3BO_3 (D) None of these

526. Which of the following is electron deficient compound :

(A) C_2H_6 (B) SiH_4 (C) PH_3 (D) B_2H_6

527. Which hydride does not exist :

(A) BH_3 (B) H_2F_2 (C) SbH_3 (D) N_2H_4

528. From B_2H_6, all the following can be prepared except :

(A) H_3BO_3 (B) $B_2(CH_3)_4H_2$ (C) $B_2(CH_3)_6$ (D) $NaBH_4$

529. In B_2H_6 :

(A) There is direct boron-boron bond

(B) The boron atoms are linked through hydrogen bridges

(C) All the B-H bond distances are equal

(D) All the atoms are in one plane

COMPREHENSION # 64

Paragraph for Questions Nos. 530 to 532

Element A has two electrons in its valence shell & its principal quantum number for last electron is 2 & element B has 4 electrons in its valence shell & its principal quantum no. for last electron is 2 & element X has 3 electrons in its valence shell & principal quantum no. for last electron is 3.

530. The nature of the oxide of element X is:

(A) amphoteric (B) acidic (C) neutral (D) basic

531. Which of the following option is correct

(A) The element B and X element show diagonal relationship with each other

(B) The ionization potential value of A & X element is nearly same

(C) The electronegativity of A & X element is nearly same

(D) The ionic potential value (ϕ) of A & X element is nearly same

532. Compound XB and AB on hydrolysis gives

(A) CO_2 (B) CH_4 (C) B_2H_6 (D) SO_2

COMPREHENSION # 65

Paragraph for Questions Nos. 533 to 535

The atoms have an outer electronic configuration of s^2p^1. Monovalency is explained by the s electrons in the outer shell remaining paired, and not participating in bonding. This is called the 'inert pair effect'. If the energy required to unpair them exceeds the energy evolved when they form bonds, then the s electrons will remain paired. The inert pair effect is not the explanation of why monovalency occurs in group 13. It merely describes what happened, i.e. two electrons do not participate in bonding. The reason that they do not take part in bonding is energy. The inert pair effect is not restricted to group 13, but also occurs among the heavier elements in other groups in the p-block

Thus in the s-block, groups 1 and 2 show only the group valency. Groups in the p-block show variable valency, differing in steps of two. Variable valency also occurs with elements in the d-block.

533. Which of the following elements are capable of showing inert pair effect?

(A) Carbon (B) Aluminium (C) Lead (D) All of these

534. The correct order of shielding effect is s, p, d, f orbital

(A) s > p > d > f (B) s < p > d > f (C) s < p < d < f (D) s > p < d > f

535. Due the inert pair effect

(A) Heavier p-block element show lower oxidation state as stable oxidation state

(B) Heavier p-block element show higher oxidation state as stable oxidation state

(C) Strong shielding effect by inner-penultimate electrons

(D) The oxidation state is equal to the valence shell electron

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SECTION III: MATCH TYPE

536. Match the following columns

	Column I		**Column II**
(a)	NaCl	(P)	Soluble in water
(b)	AgCl	(Q)	Lattice energy > Hydration energy
(c)	$CdCl_2$	(R)	Lattice energy < Hydration energy
(d)	$FeSO_4$	(S)	Cation has Pseudo inert (18 e^- in valence shell) gas configuration

537. Match list I with list II & then select the correct answer from the codes given below

	List - I		**List - II**
(A)	Increasing atomic size	(a)	Cl < O < F
(B)	Decreasing atomic radius	(b)	B > Be > Li
(C)	Increasing electronegativity	(c)	Si < Al < Mg
(D)	Decreasing effective nuclear charge	(d)	N > O > F

538.

	Column- I		**Column-II**
(A)	Permanent hardness	(P)	Na^+ (aq)
(B)	Temporary hardness	(Q)	Ca^{2+} (aq)
(C)	React on heating	(R)	Mg^{2+} (aq)
(D)	Not responsible for hardness	(S)	HCO_3^- (aq)

539.

	Column- I		**Column-II**
(A)	Primary standard base	(P)	$Na_2C_2O_4$
(B)	Equiv. wt =	(Q)	$Na_2B_4O_7$
(C)	Primary standard reducing agent	(R)	Na_2CO_3
(D)	Capable of reducing hardness of water due to the presence of Ca^{2+}	(S)	As_2O_3

540.

	Column-I		**Column-II**
(A)	oxone	(P)	Na_2SO_4
(B)	Aq. Solution is Neutral toward litmus	(Q)	Na_2O_2
(C)	solvay process	(R)	$NaHCO_3$
(D)	Evolve $CO_2\uparrow$ on heating	(S)	Na_2CO_3

541.

	Column I(Heating effect of oxalate salts)		**Column II(Products of heating effect)**
(A)	$(COONa)_2$	(P)	CO
(B)	$Ba(COO)_2$	(Q)	CO_2
(C)	$Mg(COO)_2$	(R)	Carbonate salts
(D)	$(COOAg)_2$	(S)	Pure metal

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542.

	Column-I		Column-II
(A)	$[Be(OH)_4]^{2-}$	(P)	Amphoteric
(B)	BeF_2	(Q)	Tetrahedral
(C)	$Be(OH)_2$	(R)	Polymeric
(D)	MgO	(S)	NaCl type structure

543.

	Column-I		Column-II
(A)	$KHCO_3$	(P)	Exists in the solid state
(B)	$NaHCO_3$	(Q)	Soluble in water
(C)	$LiHCO_3$	(R)	Hydrogen bonding
(D)	NH_4HCO_3	(S)	Dimeric anion

544.

	Column-I		Column-II
(A)	NaO_2	(P)	Paramagnetic
(B)	KO_2	(Q)	Yellow, pyrites structure
(C)	RbO_2	(R)	Orange
(D)	CsO_2	(S)	Brown

545. Match the following columns

	Column I		Column II
(a)	Chlorine	(P)	transition element
(b)	Helium	(Q)	highest electron affinity
(c)	Iron	(R)	high ionisation energy
(d)	Lithium	(S)	strongest reducing agent

546. Match the column

	Column I		Column II
(a)	Ionization energy	(P)	Amount of energy released when an extra electron is added in any neutral gaseous atom.
(b)	Electron affinity	(Q)	The charge or partial charge which comes by transfer or parital shifting of electron in any atom during its compound formation.
(c)	Electronegativity	(R)	Minimum amount of energy required to remove an outermost electron.
(d)	Oxidation number	(S)	Relative tendency to attract shared pair of electron towards itself.

547. Match List I with List II and select the correct answer using the codes given below the lists -

	List I		List II
(1)	Heavy water	(A)	Bicarbonates of Mg and Ca in water
(2)	Temporary hard	(B)	lather with soap water
(3)	Soft water	(C)	D_2O
(4)	Permament hard	(D)	Sulphates and water chloride of Mg and Ca

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548.

	Column (A)	Column (B)
(a)	$Ca(OH)_2 + Cl_2 \xrightarrow[35°C]{below}$ (slaked lime)	(i) Calcium chloride
(b)	$Ca(OH)_2 + Cl_2 \xrightarrow{cold}$ (milk of lime)	(ii) Calcium chloride and cal. chlorate
(c)	$2Ca(OH)_2 + 2Cl_2 \xrightarrow{heat}$	(iii) Bleaching powder
(d)	$2Ca(OH)_2 + 2Cl_2 \xrightarrow{red\ heat}$ (Slaked lime)	(iv) Calcium chloride and calcium hypochlorite (v) Calcium chloride & calcium chlorite

(A) (a – iii) (b – iv) (c – ii) (d – i)
(B) (a – ii) (b – i) (c – iv) (d – iii)
(C) (a – iv) (b – i) (c – iii) (d – i)
(D) (a – ii) (b – iii) (c – iv) (d – i)

549. Match the following:

	Column I	Column II
(a)	Anhydrous $AlCl_3$	(i) Antiseptic
(b)	Alum	(ii) Alloy
(c)	Ultramarine	(iii) Friedel-Craft's reaction
(d)	Borax	(iv) Complex blue coloured silicate
(e)	Magnelium	(v) Tincal

(A) (a–i); (b–iv); (c–iii); (d–v); (e–ii)
(B) (a–iii); (b–i); (c–iv); (d–v); (e–ii)
(C) (a–v); (b–ii); (c–iii); (d–iv); (e–i)
(D) (a–ii); (b–i); (c–v); (d–iv); (e–iii)

550. Match the various sequences with the appropriate orders:

	Sequences	Orders
(I)	Na^+ Mg^{+2} Al^{+3}	(a) increasing size of ion in gaseous state
(II)	I^- S^{2-} N^{3-}	(b) decreasing size of ion in gaseous state
(III)	O O^- O^{-2}	(c) increasing size of ions aqueous state.
(IV)	N F O (IE_2)	(d) decreasing size of ions aqueous state.
		(e) increasing order of IE_2
		(f) decreasing order of electron affinity

551. Match the following:

	Column I	Column II
(A)	$Bi^{3+} \rightarrow (BiO)^+$	(P) Heat
(B)	$[AlO_2]^- \rightarrow Al(OH)_3$	(Q) Hydrolysis
(C)	$SiO_4^{4-} \rightarrow Si_2O_7^{6-}$	(R) Acidification
(D)	$(B_4O_7^{2-}) \rightarrow [B(OH)_3]$	(S) Dilution by water

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SECTION V: INTEGER TYPE

552. How much energy in joules must be needed to convert all the atoms of sodium to sodium ions present in 2.3 mg of sodium vapours ? Ionisation energy of sodium is 495 kJ $mole^{-1}$

553. The nuclei of tritium (H^3) atom would contain neutrons -

554. How many maximum Hydrogen bonds can be made by 1 molecule of water?

555. How many bridging chlorine are present in Al_2Cl_6?

556. Calculate the E.N. of Cl from the bond energy of ClF (61 KCal/mol). Given that bond energies of F_2 and Cl_2 are 38 and 58 KCal/mol respectively.

557. What mass of CaO will be required to remove the hardness of 10^3 litres of water containing 1.62 gm of calcium bicarbonate per litre -

558. Which property will NOT increase for IA group as we go down the group.

(a)	Atomic size	(e)	Melting point	(i)	Valance e^-
(b)	Ionic radii	(f)	Boiling point	(j)	Metallic ch
(c)	I E	(g)	E N	(k)	Chemical reactivity
(d)	Density	(h)	At. mass		

559. If there were 10 periods in the periodic table then how many elements would this period can maximum comprise of.

560. Calculate the effective nuclear charge (Z*) for valence shell electrons of bromine atom

561. The electron affinity of chlorine is 3.7 eV. How much energy in kcal is released when 2 g of chlorine is completely converted to Cl^- ion in a gaseous state ?
(1 eV = 23.06 kcal mol^{-1})

562. Find the degree of hardness of a sample of water containing 30 ppm of $MgSO_4$.

563. Certain sample of water was found to contain 68 ppm of $CaSO_4$ and 19 ppm of $MgCl_2$. What will be the total hardness of water ?

564. Calculate the electron affinity of the hydrogen atom using the following enthalpy data

$H_2(g) \longrightarrow 2H(g)$; $\Delta H = +436$ kJ mol^{-1}
$H_2(g) + 2K(s) \longrightarrow 2KH(s)$; $\Delta H = -118$ kJ mol^{-1}
$K(s) \longrightarrow K(g)$; $\Delta H = +83$ kJ mol^{-1}
$K(g) \longrightarrow K^+(g) + e^-$; $\Delta H = +413$ kJ mol^{-1}
$H^-(g) + K^+(g) \longrightarrow KH(s)$; $\Delta H = -742$ kJ mol^{-1}

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565. Indicate whether the following process is exothermic or endothermic :
$M(g) + 2X(g)\ M^{2+}(g) + 2X^{-}(g)$
$(I.E.)_1$ of M(g) = 737.7 kJ mol^{-1}
$(I.E.)_2$ of M(g) = 1451 kJ mol^{-1}
(E. A.) of X(g) = –328 kJ mol^{-1}

566. The ionization energy of lithium is 520 kJ mol^{-1}. The amount of energy required to convert 70 mg of lithium atoms in gaseous state into Li^+ ions is :

567. The n/p ratio for $_1H^1$ is -

568. 5.0 mL solution of H_2O_2 liberates 0.508 g of iodine from an acidified KI solution. Calculate the strength of H_2O_2 in terms of volume strength at STP.

569. A diatomic molecule has a dipole moment of 1.2 d. If the bond distance is 1.0 Å, what fraction of an electronic charge, e, exists on each atom ?

570. The dipole moment of LiH is 1.964×10^{-29} cm and the interatomic distance between Li and H in this molecule is 1.596Å. What is the percent ionic character in LiH.

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PART III: INORGANIC CHEMISTRY

XII

SECTION I: SINGLE OPTION CORRECT

571. The extraction of Nickel involves:
(A) The formation of $Ni(CO)_4$
(B) The decomposition of $Ni(CO)_4$
(C) The formation and thermal decomposition of $Ni(CO)_4$
(D) The formation and catalytic decompostiion of $Ni(CO)_4$

572. Consider the following statements:
According the Werner's theory.
1. Ligands are connected to the metal ions by covalent bonds
2. Secondary valencies have directional properties
3. Secondary valencies are non-ionisable.
of these statements:
(A) 1, 2 and 3 are correct (B) 2 and 3 are correct
(C) 1 and 3 are correct (D) 1 and 2 are correct

573. Which compound have all the types of bonds are present and count how many H – bond is present
(A) White vitriol & 2 H – bond (B) Green vitriol & 6 H – bond
(C) Blue vitriol & 4 H – bond (D) Mohr salt & 5 H – bond

574. Van Arkel method of purification of metals involves converting the metal to a :
(A) Volatile stable compound (B) Volatile unstable compound
(C) non volatile stable compound (D) none of the above

575. What is the colour of $(NH_4)_2SnCl_6$?
(A) white (B) pink (C) red (D) yellow

576 What is the coordination number of Cr in $K_3[Cr(ox)_3]$?
(A) 6 (B) 5 (C) 4 (D) 3

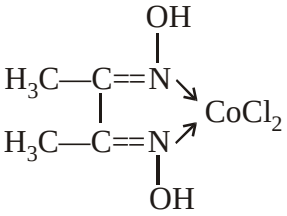
577. In the following precipitate reactions which one is not possible :
(A) $CdCl_2 + NaOH \xrightarrow{\Delta} Cd(OH)_2 + NaCl$
(B) $AgNO_3 + Na_3AsO_4 \xrightarrow{cold} Ag_3AsO_4 + NaNO_3$
(C) $Pb(NO_3)_2 + KI \xrightarrow{\Delta} PbI_2 + KNO_3$
(D) $AgNO_2 + Na_3AsSO_4 \xrightarrow{cold} Ag_3AsO_4 + NaNO_2$

578. When NH_4OH is added to solution of $NiCl_2$ the green colour precipitate is formed but when excess of NH_4OH is added in that precipitate., the complex is formed. What is the formula of that precipitate & complex :
(A) $Ni(OH)_2$, $[Ni(NH_3)_6]Cl_2$ (B) $Ni(OH)_3$, $[Ni(NH_3)_6]Cl_2$
(C) $NI(OH)_2$, $[Ni(NH_3)_4]Cl_2$ (D) $NI(OH)_3$, $[Ni(NH_3)_4]Cl_2$

579. A mixture of two salts is not soluble in water but dissolves completely in dil HCl to form a colourless solution. The mixture could be :
(A) $AgNO_3 + KBr$ (B) $BaCO_3 + ZnS$ (C) $FeCl_3 + CaCO_3$ (D) $Mn(NO_3)_2 + MgSO_4$

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580. The correct IUPAC name of the complex :



is:

(A) Dichlorodimethylglyoximatocobalt (II) (B) Bis(dimethylglyoxime)dichlorocobalt (II)
(C) Dimethylglyoximecobalt(II) chloride (D) Dichlorodimethylglyoxime-N, N-cobalt (II)

581. Zinc white is a better white pigment than lead white because it :
(A) Has more covering power than lead white
(B) Is not blackened by the action of atmosphere
(C) Is soluble in water
(D) Becomes yellow when heated

582. The effective atomic number of cobalt in the complex $[Co(NH_3)_4]^{3+}$ is –
(A) 36 (B) 33 (C) 32 (D) 30

583. KF combines with HF to form KHF_2. The compound contains the species
(A) K^+, F^- and H^+ (B) K^+, F^- and HF (C) K^+ and $[HF_2]^-$ (D) $[KHF]^+$ and F^-

584. Iron , once dipped in concentration H_2SO_4, does not displace copper from sulphate solution because
(A) It is less reactive than copper (B) A layer of sulphate is deposited on it
(C) A layer of oxide is deposited on it (D) None

585. In $[Cr(C_2O_4)_3]^{3-}$, the isomerism shown is
(A) ligand (B) optical (C) geometrical (D) ionisation

586. Which statement about corrosive sublimate is incorrect :
(A) It is prepared by heating mercury & chlorine
(B) It reduces stannic chloride
(C) It oxidises stannous chloride
(D) It sublimes at readily

587 Consider the following isomerisms:
1. Ionization 2. Hydrate 3. Co-ordination 4. Geometrical
(5) Optical
Which of the above isomerisms are exhibited $[Cr(NH_3)_2(OH)_2Cl_2]^{-1}$?
(A) 1 and 5 (B) 2 and 3 (C) 3 and 4 (D) 4 and 5

589. In the metallurgy of iron when lime stone is added to the blast furnace, the calcium ion ends up in
(A) Slag (B) Gangue (C) Metallic calcium (D) Calcium carbonate

590. The oxidation of Fe in $Na_2[Fe(CN)_5NO]$ & $Na_4[Fe(CN)_5NOS]$ are:
(A) +2 & +3 (B) +2 & +2 (C) +3 & +3 (D) +3 & +2

591. From gold amalgam, gold may be recovered by:
(A) Addition of Zn metal (B) Electrolytic refining
(C) Distillation (D) Dissolving Hg in HNO_3

592. The purification method used for mineral $Al_2O_3.2H_2O$ is –
(A) Froth floatation (B) Leaching (C) Liquation (D) Magnetic separation

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593. Which of the following is linear?
(A) XeF_2 (B) XeF_4 (C) SO_2 (D) ClF_3

594. Consider the following observation –

(A) $M^{n+} + HCl \longrightarrow$ white precipitate $\xrightarrow{\Delta}$ water solution

the metal ion M^{n+} will be –
(A) Hg^{2+} (B) Ag^{+} (C) Pb^{2+} (D) Sn^{2+}

595. Reaction of $K_2Cr_2O_7$ with NaCl and conc. H_2SO_4 gives –
(A) $CrCl_3$ (B) $CrOCl_2$ (C) CrO_2Cl_2 (D) Cr_2O_3

596. Preparation of looking mirrors involves the use of :
(A) red lead (B) ammonical silver nitrate
(C) ammonical $AgNO_3$ + red lead (D) ammonical $AgNO_3$ + red lead + HCHO

597. Which of the following oxides is amphoteric in nature ?
(A) N_2O_3 (B) P_2O_3 (C) Sb_2O_3 (D) Bi_2O_3

598. Which of the following salt liberate reddish brown gas on treatment with dilute H_2SO_4 ?
(A) $ZnBr_2$ (B) KBr (C) KNO_2 (D) KNO_3

599. In which of the following Xe atom is sp^3d^2 hybridised
(A) $[XeO_6]^{4-}$ (B) $[XeF_3]^{+}$ (C) XeO_4 (D) XeF_{26}

600. In a research lab a scientist is doing an experiment. He takes two test tubes one containing $Ba(NO_3)_2$ solution and other contains salts of chloride , fluoride and iodide . Now he mixed test tube Ist with test tube IInd. then what happens
(A) chloride is precipitate $BaCl_2$ form
(B) fluoride is precipitated in BaF_2 form
(C) iodide is precipitated in BaI_2 form
(D) all are precipitate in $BaCl_2$, BaF_2 and BaI_2 form

601. In comparison of ferrous salt, ferric salt is :
(A) More stable (B) Less stable (C) Equally stable (D) None of these

602. Salt (A) on decomposition gives basic gas, acidic gas , neutral gas along with H_2O . (A) is :
(A) $(NH_4)_2SO_4$ (B) $(NH_4)_2C_2O_4$ (C) $(NH_4)_2CO_3$ (D) $(NH_4)_2Cr_2O_7$

603. The chromyl chloride test is meant for which of the following ion ?
(A) Cl^- ions (B) SO_4^{--} ion (C) I^- ions (D) Cl^- and CrO_4^{2-} ions

604. Salt (A) gives black colour precipitate with H_2S in acidic medium . The precipitate dissolves in HNO_3 and gives solution (B) . (B) on reaction with $K_4[Fe(CN)_6]$ gives brown colour (C) . What is (B) ?
(A) CuS (B) $Cu(NO_3)_2$ (C) $Cu_2[Fe(CN)_6]$ (D) $CuSO_4$

605. A yellow turbidity, sometimes appears on passing H_2S gas even in the absence of the second group radicals. This happens because –
(A) sulphur is present in the mixture as in impurity
(B) the fourth group radicals are precipitated as sulphides
(C) the H_2S is oxidised by some acidic radicals present in solution
(D) the third group radicals are precipitated

606. Which is the hybridisation for Indian yellow .
(A) d^2sp^3 (B) dsp^3 (C) sp^3d^2 (D) sp^3d^3

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607. Which of the following oxyacids of sulphur contain no sulphur – sulphur (S – S) bonds ?
(A) $H_2S_2O_4$ (B) $H_2S_2O_5$ (C) $H_2S_2O_7$ (D) $H_2S_2O_3$

608. Precipitate of AgCl dissolves in liquid ammonia due to the formation of –
(A) $[Ag(NH_4)_2]OH$ (B) $[Ag(NH_3)_2]Cl$ (C) $[Ag(NH_3)_2]OH$ (D) $[Ag(NH_3)_2]Cl$

SECTION II: MORE THAN ONE OPTION CORRECT

609. Which of the following is/are not yellow in colour?
(A) CdS (B) HgS (C) PbS (D) Bi_2S_3

610. Colour of which of the following is attributed to charge transfer spectrum?
(A) $KMnO_4$ (B) KO_2 (C) $K_2Cr_2O_7$ (D) AgI

611. $p\pi - d\pi$ bonding occurs between oxygen and
(A) phosphorus in P_4O_{10} (B) chlorine in $HClO_4$
(C) nitrogen in N_2O_5 (D) carbon in CO_2

612. Which of the following statement(s) is are correct when a mixture of NaCl and $K_2Cr_2O_7$ is gently warmed with concentrated H_2SO_4?
(A) A deep red vapour is evolved
(B) The vapour when passed into NaOH solution gives a yellow solution of Na_2CrO_4
(C) Chlorine gas is evolved
(D) Chromyl chloride is formed

613. Extraction of silver from argentiferrous lead (Pb +Ag) involves
(A) distillation method (B) cupellation
(C) froth flotation method (D) treatment with NaCl

614. Which of the following metals sulphides are soluble in hot and 50% HNO_3 ?
(A) HgS (B) Bi_2S_3 (C) CuS (D) all these

615. BiF_5 doesn't exist due to
(A) the inert pair effect (B) the stable +3 oxidation state
(C) high ionisation energy (D) higher polarisation power of cation

616. Which of the following option is/are correct for the given complex :
$K_2[Cr(NO)(NH_3)(CN)_4]$, μ = 1.73 BM
(A) The hybridization is d^2sp^3
(B) The hybridization is sp^3d^2
(C) The oxidation state of NO in this complex is +1
(D) The name of this complex is Potassiumamminetetracyanonitrosoniumchromate (I)

617. Potassium manganate (K_2MnO_4) is formed when
(A) chloride is passed into aqueous $KMnO_4$ solution
(B) manganese dioxide is fused with potassium hydroxide in air
(C) formaldehyde reacts with potassium permanganate in presence of a strong alkali
(D) potassium permanganate reacts with conc. sulphuric acid

618. The aqueous solutions of the following salts will be coloured in the case of
(A) $Zn(NO_3)_2$ (B) $LiNO_3$ (C) $Co(NO_3)_2$ (D) $CrCl_3$

619. Which of the following alloys contains(s) Cu and Zn?
(A) Bronze (B) Brass (C) Gun metal (D) Type metal

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620. Which of the following statement (s) is/are true ?
(A) Ag^+ ions do not give white precipitate with concentrated HCl
(B) Cu^{2+} ions produce a white precipitate when KCN solution is added in a small quantity
(C) Hg^{2+} ions give deep blue precipitate with cobalt acetate and ammonium thiocyanate
(D) Black precipitate of BiI_3 turns orange when heated with water

621. Na_2SO_4 and Na_2S can be distinguished from each other by using :
(A) conc.H_2SO_4 (B) acidified $KMnO_4$ solution
(C) sodium nitroprusside solution (D) cadmium acetate solution

622. KI solution is the reagent for :
(A) Hg^{2+} (B) Pb^{2+} (C) Ag^+ (D) Cu^{2+}

623. The correct statement(s) is /are.
(A) titan yellow solution gives red colouration with a neutral solution containing Mg^{+2} ions
(B) solution of nitrite is decomposed by sulphamic acid.
(C) Fe^{2+} ions give brown colour precipitate with $[Fe(CN)_6]^{3-}$ ions solution.
(D) Green precipitate of $Cr(OH)_3$ is soluble in Na_2O_2.

624. Which of the following statement(s) is /are false ?
(A) Fe^{3+} gives red precipitate with dimethyl glyoxime in alkaline solution.
(B) Cu^{2+} ion with excess KI gives a dirty white ppt. which turns white on adding hypo solution.
(C) A filter paper soaked in mercurous nitrate turns black in contact with ammonia gas.
(D) Ag^{2+} gives white precipitate with $BaBr_2$

625. Solution of (X) + dil HCl $\rightarrow$ yellow ppt + gas having smell of burnt sulphur
solution of (X) + KCN solution $\rightarrow$ (Y) + (Z)
(Y) + excess of dil HCl + $FeCl_3$ solution $\rightarrow$ blood red colouration
(Z) + $Pb(NO_3)_2$ solution $\rightarrow$ white ppt $\xrightarrow{\text{boiling}}$ white ppt (M)
Solution of (Y) + $Pb(NO_3)_2$ solution $\xrightarrow{\text{boiling}}$ black ppt :
(A) (X) is $Na_2S_2O_3$ (B) Y is SCN^- (C) Z is SO_3^{2-} (D) M is $PbSO_3$

626. In nitroprusside ion the iron and NO exist as Fe^{+2} and NO^+ rather than Fe^{+3} and NO. These forms can be differentiated by .
(A) estimating the concentration of iron
(B) measuring the concentration of. CN
(C) measuring the solid state magnetic moment
(D) thermally decomposing the compound.

627. Addition of high proportions of manganese makes steel useful in making rails of railroads, because manganese
(A) gives hardness to steel
(B) helps the formation of oxides of iron
(C) can remove oxygen and sulphur
(D) can show highest oxidation state of + 7

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628. When a compound X reacts with ozone in aqueous medium, a compound Y is produced. Ozone also reacts with Y and produces compound Z. Z acts as an oxidising agent, then X, Y and Z will be

(A) X = HI, Y = I_2 and Z = HIO_3 (B) X = KI, Y = I_2 and Z = HIO_3

(C) X = KI, Y = I_2 and Z = HIO_4 (D) X = HI, Y = I_2 and Z = HIO_4

629. The species that undergo(es) disproportionation in an alkaline medium is/are

(A) Cl_2 (B) MnO_4^{2-} (C) NO_2 (D) ClO_4^-

630. Which of the following pairs of nitrates gives the same gaseous products on thermal decomposition?

(A) KNO_3 and $Pb(NO_3)_2$ (B) KNO_3 and $NaNO_3$

(C) $Pb(NO_3)_2$ and $Cu(NO_3)_2$ (D) $NaNO_3$ and $Ca(NO_3)_2$

631. Which of the following statements is/are correct regarding inter-halogen compounds of ABx types?

(A) x may be 1,3,5 and 7

(B) A is a more electronegative halogen than B

(C) FBr_3 cannot exit

(D) The structures of ClF_3 and IF_7 show deviation from normal structures and could be explained on the basis of VSEPR theory

632. $Al_2(SO_4)_3 + NH_4OH \longrightarrow X$, then

(A) X is a white coloured compound (B) X is insoluble in excess of NH_4OH

(C) X is soluble in NaOH (D) X cannot be used as an antacid

633. Which of the following sulphides dissolves only in aquaregia?

(A) CoS (B) NiS (C) CuS (D) HgS

634. Which of the following will give the same colour in oxidising flame as well as in the reducing flame in borax bead test (when cold) :

(A) Chromium (B) Copper (C) Cobalt (D) Nickel

635. Which of the following reduction reactions are actually employed in commerical extraction of metals?

(A) $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$

(B) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

(C) $2Na[Au(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2Au$

(D) $Cu_2S + Pb \rightarrow Cu + PbS\downarrow$

636. The metal which gives amphoteric oxide is :

(A) Zn (B) Cu (C) Sn (D) Ga

637. Metallurgical process of zinc involves roasting of zinc sulphide followed by reduction. Metallic zinc distills over as it is volatile and impurities like Cu, Pd and Fe gets condensed. The crude metal obtained is called spelter, which may be purified by

(A) electrolysis process (B) fractional distillation

(C) polling (D) heating with iodine

638. Which of the statement is correct ?

(A) In PCl_5 hybridisation is sp^3d and it has trigonal bipyramidal structure.

(B) The angle between the P and Cl is 90º which is same for all the P and Cl present in PCl_5

(C) The bond length of P—Cl in axial position is higher than in equatorial position.

(D) PCl_5 is ionic in solid phase

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639. The pairs of compounds which cannot exists together in aqueous solution are
(A) NaH_2PO_4 and Na_2HPO_4 (B) Na_2CO_3 and $NaHCO_3$
(C) NaOH and NaH_2PO_4 (D) $NaHCO_3$ and NaOH

640. Epsom salt is used
(A) As a purgative
(B) As a mordant is dyeing
(C) As a stimulant to increase the secretion of bile
(D) For removal of S from petroleum

641. Mark the wrong statement/s. Pure alumina is
(A) A good conductor of electricity (B) A bad conductor of electricity
(C) Volatile in nature (D) An electrovalent compound

642. In which of the following alloys Mg is present
(A) Electron (B) Magnalium (C) Duraluminium (D) Aluminium bronze

643. Which of the following pair of compounds is/are not an oxide?
(A) Felspar, sylvine (B) Magnesia, magnesite
(C) Lime, corundum (D) Sylvine, magnesite

645. Which of the following does not disproportionate?
(A) Cu^+ (B) Au^{3+} (C) Cu^{2+} (D) Au^+

646. During the extraction of Ag and Au using a KCN solution, cyanide ions react with metal ions as:
(A) A reducing agent (B) a complexing agent
(C) an oxidizing agent (D) a lewis acid

647. Which of the following complexes have tetrahedral geometry?
(A) $Ni(CO)_4$ (B) $Na_2[Zn(CN)_4]$ (C) $K_2[PtCl_4]$ (D) $[RhCl(PPh_3)_3]$

648. Hoop's process of purification of aluminium involves formation of layers during electrolysis. This is because :
(A) the three layers have same densities but different materials
(B) the three layers have different densities
(C) the upper layer is of pure aluminium which acts as a cathode
(D) the bottom layer is of impure aluminium which acts as an anode and middle layer consists of NaF, BaF_2 & AlF_3.

649. Which of the following option is/are correct?
(A) On fast cooling of pig iron we will get white cast iron & carbon impurity is present in form of cementite Fe_3C
(B) On slowly cooling of pig iron we will get grey cast iron 'C' impurity is present in form of graphite
(C) The M. Pt. of grey cast iron is more than pure iron due to presence of impurity
(D) Cast iron does not rust easily and neither be tempered. Due to high carbon content it is hard & brittle cannot be welded

650. Which options are true for pattinson's process
(A) This process is based on the fact that silver lead system has an eutectic mixture with 2.6% silver
(B) This eutectic mixture has M. Pt 303ºC where as pure Pb has M. Pt. 327ºC
(C) Further purification is done by cupellation process
(D) Argentiferous lead contain 2% Ag.

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651. Bessemer convertor which is used for the extraction of copper -
(A) hot air acts as oxidising agent & Cu_2S acts as self reducing agent
(B) slag is $CaSiO_3$
(C) SiO_2 lining is used in Bessemer convertor
(D) the copper obtained in this process is blister copper.

652. Which of the following option is/are correct ?
(A) vapour phase of XeF_6 is covalent and hybridisation is sp^3d^3
(B) Solid phase of XeF_6 is ionic and hybridisation is sp^3d^2
(C) XeF_2 is linear in shape
(D) XeO_2F_2 follows bent rule and structure is see-saw.

653. For Dow's process which is/are correct?
(A) For extraction of Mg by sea water
(B) $Ca(OH)_2$ is used to ppt Mg
(C) Mg is precipitated in form of $Mg(OH)_2$
(D) ppt. of $Mg(OH)_2$ is treated with HCl & then electrolysis for extraction of 'Mg'

654. Nitrogen (I) oxide is produced by :
(A) thermal decomposition of ammonium nitrate
(B) disproportionation of N_2O_4
(C) thermal decomposition of ammonium nitrite
(D) interaction of hydroxylamine and nitrous acid

655. Mercury is a liquid at 0°C because of
(A) very high ionisation energy (B) weak metallic bonds
(C) high heat of hydration (D) high heat of sublimation

656. Which of the following statements concern with transition metals?
(A) compounds containing ions of transition elements are usually coloured
(B) the most common oxidation state is +3
(C) they show variable oxidation states, which differ by two units only
(D) they easily form complexes

657. Correct statement(s) is/are
(A) an acidified solution of $K_2Cr_2O_7$ liberates iodine from KI
(B) $K_2Cr_2O_7$ is used as a standard solution for estimation of Fe^{2+} ions
(C) in acidic medium, M = N/6 for $K_2Cr_2O_7$
(D) $(NH_4)_2Cr_2O_7$ on heating decomposes to yield Cr_2O_3 through an endothermic reaction

658. Interstitial compounds are formed by
(A) Co (B) Ni (C) Fe (D) Ca

659. The catalytic activity of transition elements is related to their
(A) variable oxidation states (B) surface area
(C) complex formation ability (D) magnetic moment

660. In the equation: $M + 8CN^- + 2H_2O + O_2 \longrightarrow 4[M(CN)_2]^- + 4OH^-$, metal M is
(A) Ag (B) Au (C) Cu (D) Hg

661. To an acidified dichromate solution, a pinch of Na_2O_2 is added and shaken. What is observed:
(A) blue colour (B) Orange colour changing to green
(C) Copious evolution of oxygen (D) Bluish - green precipitate

662. Amphoteric oxide(s) of Mn is/are
(A) MnO_2 (B) Mn_3O_4 (C) Mn_2O_7 (D) MnO

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SECTION III: COMPRHENSIONS

COMPREHENSION # 66
Paragraph for Questions Nos. 663 to 664

When hydrogen peroxide is added to an acidified solution of a dichromate gives a deep blue coloured compound 'A' in presence of organic solvent, which decomposes rapidly in aqueous solution into 'B' and dioxygen. Compound 'A' can be extracted by dimethyl ether forming the adduct 'C'.

663. The oxidation state of the metal ion in compound 'A' are
(A) 3+ (B) 10 + (C) 6+ (D) 4+

664. The magnetic moment of compound 'B' is:
(A) 2.8 B.M (B) 4.9 B.M (C) 0 (D) 3.8 B.M

COMPREHENSION # 67
Paragraph for Questions Nos. 665 to 667

(T) imparts violet colour $\xrightarrow{\text{compd (U) } + \text{conc.} H_2SO_4}$ (V)Red gas $\xrightarrow{NaOH + AgNO_3}$ (W)Red ppt. $\xrightarrow{NH_3 \text{ soln.}}$ (X)

(W) Red ppt. $\xrightarrow{\text{dil. HCl}}$ (Y) white ppt.

(U) $\xrightarrow[\text{sublimes on heating}]{NaOH}$ (Z) gas (gives white fumes with HCl)

665. The compound 'W' is
(A) CrO_3 (B) Ag_2CrO_4 (C) HgI_2 (D) $AgNO_2$

666. The compound 'T' & 'U' are
(A) $KMnO_4$, HCl (B) $K_2Cr_2O_7$, HCl
(C) $K_2Cr_2O_7$, NH_4Cl (D) K_2CrO_4, KCl

667. The compound 'V' is
(A) CrO_3 (B) Cl_2 (C) Br_2 (D) CrO_2Cl_2

COMPREHENSION # 68
Paragraph for Questions Nos. 668 to 670

There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization easily explains the ease of sigma donation capability of NH_3 and PH_3. Phosphine is a flammable gas and is prepared from white phosphorous.

668. Among the following, the correct statement is
(A) Phosphates have no biological significance in humans
(B) Between nitrates and phosphates, phosphates are less abundant in earth's crust
(C) Between nitrates and phosphates, nitrates are less abundant in earth's crust
(D) Oxidation of nitrates is possible in soil

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669. Among the following, the correct statement is :

(A) Between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional

(B) Between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional

(C) Between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional

(D) Between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional

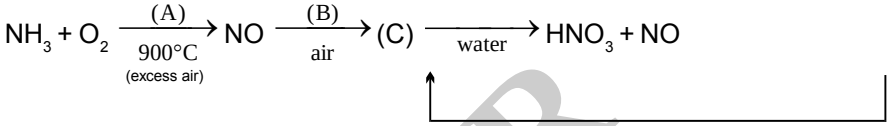
670. White phosphorus on reaction with NaOH gives PH_3 as one of the products. This is a

(A) dimerization reaction (B) disproportionation reaction

(C) condensation reaction (D) precipitation reaction

COMPREHENSION # 69
Paragraph for Questions Nos. 671 to 672

The following flow diagram represents the industrial preparation of nitric acid from ammonia:



Answer the questions given below:

671. Which line of entry describes the undefined reagents, products and reaction conditions?

	A	B	C
(A)	catalyst	R.T. (25°C)	NO_2
(B)	catalyst	R.T. (25°C)	N_2O
(C)	catalyst	high pressure	NO_2
(D)	high pressure	catalyst	N_2O_3

672. Formation of HNO_3 when (C) is dissolved in H_2O takes place through various reactions. Select the reaction not observed in this step.

(A) $NO_2 + H_2O \longrightarrow HNO_3 + HNO_2$ (B) $HNO_2 \longrightarrow H_2O + NO + NO_2$

(C) $NO_2 + H_2O \longrightarrow HNO_3 + NO$ (D) none of these

COMPREHENSION # 70
Paragraph for Questions Nos. 673 to 675

A is a colourless crystalline salt which is soluble in water to form a super saturated solution. Salt (A) reacts with salt (B) (which is sensitive to light & gets photo reduction to give its metal) it gives a white ppt (C) and with excess of salt (A), (C) gives a soluble complex (D). (C) in exposure in air and (D) on heating both produces same black coloured ppt (E). (A) is used in medicine and also in extraction of gold and decoloured I_2 in KI solution.

673. When salt (A) reacts with HCl solution it decompose to give

(A) brown coloured gas (B) rotten eggs smelled gas

(C) white turbidity (D) violet coloured gas

674. When salt (A) is heated to 223ºC the product obtained are

(A) Na_2SO_4, Na_2S_5 (B) PbO, SO_2 (C) CuO, SO_2 (D) $FeCl_2$, Cl_2

675. Identify (E)

(A) Hg_2O (B) Ag_2S (C) PbO_2 (D) CuS

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COMPREHENSION # 71
Paragraph for Questions Nos. 676 to 678

(I) $FeCr_2O_4 + NaOH + air \longrightarrow (A) + Fe_2O_3$

(II) $(A) + (B) \longrightarrow Na_2Cr_2O_7$

(III) $Na_2Cr_2O_7 + X \xrightarrow{\Delta} Cr_2O_3$

(IV) $Cr_2O_3 + Y \xrightarrow{\Delta} Cr$

676. Compounds (A) and (B) are:

(A) Na_2CrO_4, H_2SO_4 (B) $Na_2Cr_2O_7, HCl$

(C) Na_2CrO_5, H_2SO_4 (D) $Na_4[Fe(OH)_6], H_2SO_4$

677. (X) and (Y) are:

(A) C and Al (B) Al and C (C) C in both (D) Al in both

678. Na_2CrO_4 and Fe_2O_3 are separated by

(A) dissolving in conc. H_2SO_4 (B) dissolving in NH_3

(C) dissolving in H_2O (D) dissolving in dil. HCl

COMPREHENSION # 72
Paragraph for Questions Nos. 679 to 681

(i) A certain inorganic compounds (X) shows the following reactions on passing H_2S through acidified solution of (X) a brown ppt is obtained.

(ii) The ppt. obtained in (i) is dissolved in excess of yellow $(NH_4)_2S_2$.

(iii) On adding an aqueous solution of NaOH of solution of (X) first white ppt. is obtained, which dissolves in excess of NaOH.

(iv) the compound X reduces $FeCl_3$ solution.

679. The soluble complex which is obtained with excess of NaOH on oxidation produces -

(A) Na_2SnO_3 (B) Na_2MnO_4 (C) Na_2ZnO_2 (D) Na_2AlO_2

680. When salt X reacts with $AuCl_3$ we get –

(A) purple of cassius (B) liquid gold

(C) gold rush (D) candy fluid

681. The salt (X) gives grey mass and another compound (Z) with corrosive sublimate. (Z) on reaction with NH_4Cl gives (Y). Which is the correct statement about (Y).

(i) it is known as pink salt

(ii) it is used as mordant

(iii) it is used as moderator in nuclear reactors

(iv) it is known as scheele's salt

(A) i, ii (B) i, iii (C) ii, iv (D) iii, iv

COMPREHENSION # 73
Paragraph for Questions Nos. 682 to 684

(i) A white solid (A) on heating with NaOH gives an alkaline gas (B) and solid (C). Both (A) and (C) gives ring test while (C) gives golden yellow flame. (A) on strong heating it decomposed to give a gas (D) & H_2O. (D) is a neutral oxide which does not burn but helps more than air in burning. (D) on heating at 920°C which gives two gases (E) and (F). The gas (E) when mixed with hydrogen at high temperature and pressure give gas (B). Gas (F) is essential for living system. (D) combines with 'C', 'S', 'P' to form their acidic oxides. (D) on heating with sodamide gives sodium azide & water.

682. What is compound (A) -

(A) N_3H (B) NH_4NO_2 (C) $(NH_4)_2Cr_2O_7$ (D) NH_4NO_3

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683. The compound D is -

(A) N_2O (B) N_2 (C) CO (D) None of these

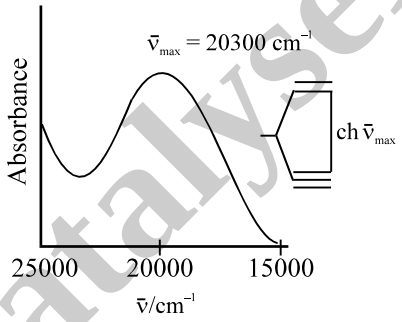
684. Hybridisation of central atom in cation and anion present in compound (A) respectively -

(A) sp^3, sp^2 (B) sp^3, sp^3 (C) sp^2, sp^3 (D) sp^3, sp

COMPREHENSION # 74
Paragraph for Questions Nos. 685 to 686

Read the following passage based on applications of crystal field theory to explain magnetic and spectral properties of complexes carefully and answer the questions .

With the help of CFT number of unpaired electrons in a compound can be calculated and we can calculate its paramagnetic moment (due to spin only(by the formula , u = $\sqrt{n(n+2)}$ Bohr magneton (BM) , where 'n' is the number of unpaired electron in the complex . For spectral analysis the separation between t_{2g} and e_g orbitals called ligand field splitting . Parameter Δ_0 (for octahedral complexes) should be known to us , which can be easily calculated by observing the absorption spectrum of one electron complex . Figure shows the optical absorption spectrum of the hexaaquatitanium (III) ion $[Ti(H_2O)_6]^{3+}$. The CFT assigns the first absorption maximum at 20,300 cm^{-1} to the transition $e_g \leftarrow t_{2g}$. For multielectronic $(d^2$ to $d^{10})$ system , the calculation of Δ_0 by absorption spectrum is not that easy as the absorption spectrum will also be affected by electron-electron repulsions .



(h = 6.6×10^{-34} Joule-sec , C = 3×10^8 m/sec, $N_0 = 6.023 \times 10^{23}$, 1 KCal= 4.2 KJ)

685. The magnetic moment of following arranged in increasing order will be :

[atomic number of Co = 27]

(i) Co^{3+} (octahedral complex with a strong field ligand)

(ii) Co^{3+} (octahedral complex with a weak field ligand)

(iii) Co^{2+} (tetrahedral complex)

(iv) Co^{2+} (square planar complex)

(A) i > ii > iii > iv (B) iii > ii > iv > i (C) ii > iii > iv > i (D) ii > iv > iii > i

686. The energy of transition for complex given in the passage , $[Ti(H_2O)_6]^{3+}$ will be :

(A) 243 KCal/mole (B) 58 KCal/mole (C) 97 KCal/mole (D) 143 KCal/mole

COMPREHENSION # 75
Paragraph for Questions Nos. 687 to 689

Because of the presence of vacant d-orbitals ,transition metals can accept ligands. Dependidng on the strengths of the ligands the complexes have different hybridization of the central atoms and consequently exhibit different magnetic properties. Thus strong ligands like CN^-, CO, NH_3, NO_2^- etc. cause maximum pairing of electrons and hence are diamagnetic ir have low spins. Weak ligands like F^-, Cl^-, Br^-, l^- etc. produce weak ligand field resulting in a large number of unpaired electrons in the complex. They are

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referred to as high spin complexes.

687. They hybridization in the complexes $\left[Ni(CN)_4\right]^{2-}$ and $\left[Cu(NH_3)_4\right]^{2+}$ are respectively

(A) sp^3, sp^3 (B) sp^3, dsp^2 (C) dsp^2, sp^3 (D) dsp^2, dsp^2

688. The species that is paramagnetic is

(A) $\left[Fe(CN)_6\right]^{4-}$ (B) $\left[Cr(CN)_6\right]^{-3}$ (C) $\left[Ni(CO)_4\right]$ (D) $\left[Co(CN)_6\right]^{-3}$

689. Three moles of $AgNO_3$ solution is added to 1 mole of CrCl3.6H2O and mixed thoroughly. It was found that 1 mole $AgNO_3$ remained in solution. The formula of the complex can be represented as

(A) $\left[Cr(H_2O)_6\right]Cl_3$ (B) $\left[CrCl(H_2O)_5\right]Cl_2.H_2O$

(C) $\left[CrCl_3(H_2O)_3\right]3H_2O$ (D) $\left[CrCl_2(H_2O)_6\right]Cl.2H_2O$

COMPREHENSION # 76
Paragraph for Questions Nos. 690 to 691

Questions given below are based on electronic configurations of the elements. The three elements X, Y and Z with the electronic configurations shown below all form hydrides:

Element	Electronic configuration
X	$1s^2, 2s^2, 2p^2$
Y	$1s^2, 2s^2, 2p^6, 3s^1$
Z	$1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^2, 4p^5$

690. Which line of properties (A, B, C, or D) correctly lists properties of the hydrides of these elements?

	Hydride of X	Hydride of Y	Hydride of Z
(A)	Colourless gas insoluble in H_2O	Silver/grey solid, reacts with H_2O to form an alkaline solution	Colourless gas form a strong acid in H_2O
(B)	Colourless liquid, no reaction with H_2O	Silver/grey solid, forms H_2O	Ionic solid with formula ZH
(C)	Colourless gas found naturally	Does not conduct electricity in the molten state	Colourless gas, reacts with Cl_2
(D)	Non-polar compound reacts with Cl_2 in light	Silver/grey ionic solid with formula YH_2	Forms when water is added to phosphorus and element Z

691. Which of the following exists as gas?

(A) X_2 (B) Y_2 (C) Z_2 (D) all of the above

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COMPREHENSION # 77
Paragraph for Questions Nos. 692 to 694

Pyrolusite on heating with KOH in the presence of air gives a dark green compound (A). The solution of (A) on treatment with H_2SO_4 gives a purple coloured compound (B), which gives following is reactions:

(i) KI on reaction with alkaline solution of (B) changes into a compound (C)

(ii) The colour of compound (B) disappears on treatment with the acidic solution of $FeSO_4$.

(iii) With conc. H_2SO_4 compound (B) gives (D) which can decompose to yield (E) and oxygen.

692. The compound (C) is

(A) I_2 (B) I_2O_5 (C) KIO_3 (D) KIO_4

693. The comopund (E) is:

(A) MnO (B) MnO_2 (C) Mn_2O_3 (D) Mn_3O_4

694. Oxidation state of manganese of the compound (A) is

(A) +2 (B) +4 (C) + 7 (D) +6

COMPREHENSION # 78
Paragraph for Questions Nos. 695 to 697

A salt (A) on reaction with NaOH gives a gas (B) , which gives black coloured water insoluble compound with Hg_2Cl_2. After completely expelling the gas (B) from the solution, zinc dust is added and boiled. Appearance of gas (B) again observed. The salt (A) on heating gives a gaseous product (C) which supports combustion.

695. The gas (C) reacts with $NaNH_2$ to obtain

(A) Na_2CO_3 (B) $NH_2–NH_2$ (C) NaN_3 (D) Na_2CN_2

696. The gas (B) reacts with excess of Cl_2. The product obtained is

(A) N_2 (B) NCl_3 (C) $COCl_2$ (D) NOCl

697. The gas (B) reacts with corrosive sublimate to obtain

(A) $HgNH_2Cl$ (B) $HgNH_2Cl–Hg$ (C) Hg_2Cl_2 (D) K_2HgI_4

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COMPREHENSION # 79
Paragraph for Questions Nos. 698 to 700

A green coloured compound (A) gave the following reactions :

(i) (A) dissolves in water to give a green solution. The solution on reaction with $AgNO_3$ gives a white ppt.(B) which dissolves in NH_4OH solution and reappears on addition of dil HNO_3.It on heating with $K_2Cr_2O_7$ and conc. H_2SO_4 produced a red gas which dissolves in $NaOH$ to give a yellow solution (C). Addition of lead acetate solution to (C) gives a yellow ppt. which is used as a paint

(ii) The hydroxide of cation of (A) in borax bead test gives brown colour in oxidising flame and grey colour in reducing flame.

(iii) Aqueous solution of (A) gives a block ppt. on passing H_2S gas. The block ppt. dissolves in aquaregia and gives back (A).

(iv) (A) on boiling with $NaHCO_3$ and Br_2 water gives a block ppt. (D).

(v) (A) on treatment with KCN gives a light green ppt. (E) with dissolves in excess of KCN to give (F).(F) on heating with alkaline bromine water gives the same black ppt. as (D).

698. Thye hybridization & magnetic behaviour of comnpound F' is

(A) dsp^2, dia (B) $sp^3, para$ (C) $dsp^3, para$ (D) sp^3, dia

699.. The cpd A, D & E respectively are

(A) $COCl_2, C_2O_3, CO(CN)_2$ (B) $NiCl_2, CO_2O_3CO(CN)_2$

(C) $NiCl_2, Ni_2O_3, Ni(CN)_2$ (D) $Ni(NO_3)_2\,NiCl_2\,Ni(CN)_2$

700. The cpd B & C respectively are & the Maximum OX state shown by the fromation metal in cpd 'C' is

(A) $AgCl, pbCrO_4 \& +6$ (B) $AgBr, NaCro \& +4$

(C) $MnCl_2, NariO_4 \& +7$ (D) $NiCl_2, K_2(Ni(CN)_4) + 2$

COMPREHENSION # 80
Paragraph for Questions Nos. 701 to 703

Some observations related to an unknown inorganic substance **A** are presented below.

1 A is a yellowish – white deliquescent solid and it sublimes on heating. It has a molecular weight of 267.

2 A reacts violently with water, forming solution B.

3 When a solution of NH_4Cl and NH_4OH is added to solution B, a white gelatinous precipitate is obtained

4 A sample of B also gives a curdy white precipitate C on addition of dilute nitric acid and silver nitrate solution. This white precipitate C readily dissolves when dilute NH_4OH is added, though a gelatinous white precipitate D is formed in its place with excess NH_4OH.

5 Precipitate D is filtered off and is dissolved in excess NaOH to give a clear solution E.

6 When CO_2 is passed through solution E, compound D is reprecipitated.

7 Substance A unchanged in dry ether, when this solution is reacted with excess LiH, it transforms to G.

701. Compound **A** is likely to be

(A) Dimer of $FeCl_3$ (B) Dimer of $AlCl_3$ (C) Dimer of $SnCl_2$ (D) Dimer of $CrCl_3$

702. The curdy white ppt (C) is

(A) $Al(OH)_3$ (B) $Sn(OH)_2$ (C) $Cr(OH)_3$ (D) AgCl

703. The compound (G) reacts with boran trichloride to form

(A) acidic oxide of boron (B) compound containing 3c-2e bond

(C) boran nitride (D) lithium borohydride

COMPREHENSION # 81
Paragraph for Questions Nos. 704 to 707

A white crystalling solid (a) on dehydration gave a poisonous pseudohalogen gas (B). Compound (A) when boiled with alkali gave a clourless gas (C). Which froms white fume with HCl. The fume condenses to a white solid (D) on cooling. (B) dissolves in caustic potash solution to gave two compounds (pseudo halides) (E) and (F). Compound (F) gives white precipitate (G) with $AgNO_3$ solution but the precipitate dissolves in excess of (E) When (F) is heated together with (D) a well known fertilizer (H) is obtained. identify (A) to (H) and write the reaction involved.

704. The hybridzaition shown by cpd 'B' (pseudo halides)

(A) Sp^3d (B) Sp^3d^2 (C) Sp^2 (D) Sp

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705. The ppt dissolves in excess of (E) due to formations of complex. The nature complex is

(A) Parra, colourless (B) Dia, colourless
(C) Dia, coloured (D) Parra, coloured

706. The hybridization shown by the cation & anions of compound ' A' are

(A) Sp^2, Sp^3 (B) Sp^2, Sp^2 (C) Sp^3, Sp^3 (D) Sp^3, Sp^2

707. How many σ and π bonds present in between 2 C atoms of cyanogen gas and their hybridization?

(A) 1 σ , 0 π ; sp , sp (B) 1 σ , 2 π ; sp , sp
(C) 1 σ , 0 π ; sp^3 , sp^3 (D) 1 σ , 1 π ; sp , sp

COMPREHENSION # 82
Paragraph for Questions Nos. 708 to 707

A white solid (A) on heating with NaOH gives an alkaline gas (B) & a solid (C) . Both (A) and (C) gives ring test while (C) gives golden yellow flame.(A) on strong heating is decomposed to give a gas (D) & H_2O . (D) is a neutral oxide it does not burn but helps more than air in burning.(D) on heating at 920 °C which gives two gases (E) and (F) . The gas (E) when mixed with hydrogen at high temperature and pressure give gas (B) . Gas (F) is essential for living system.(D) combines with 'C' , 'S' , 'P' to form their acidic oxides . (D) on heating with sodamide gives sodium azide & water.

708. Gas (B) is used in clock in Washington due to:

(A) flipping (B) gaseous form (C) liquid (D) rotation

709. The hybridization of central metal atom in cation and anion of compound (A) are respectively :

(A) sp^3 & sp^3 (B) sp^3 & sp^2 (C) sp^2 & sp^2 (D) sp & sp^2

710. Bond order of compound (D) is :

(A) 2.73 & 1.6 (B) 1.73 & 1.25 (C) 3 & 2 (D) 3.5 & 2.5

COMPREHENSION # 83
Paragraph for Questions Nos. 711 to 713

A , B, and C are three complexes of chromium (III) with the empirical formula $H_{12}O_6Cl_3Cr$. All the three complexes have water and chloride ions as ligands . Complex A does not react with concentrated H_2SO_4, whereas complexes B and C loss 6.75% and 13.5% of their original weight respectively, on treatment with concentrated H_2SO_4.

711. Complex A is :

(A) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ (B) $[Cr(H_2O)_6]Cl_3$
(C) $[Cr(H_2O)_4Cl_2]Cl.2H_2O$ (D) none of these

712. Which of the following statement is correct? **[State T for true and F for false]**

(i) The effective atomic number of the complex B is 33
(ii) H_2SO_4 is act in above question is used as a dehydrating agent
(iii) The number of ions provided by complex B is 3

(A) TTT (B) FTF (C) TTF (D) FFF

713. In the above complexes, which of the following complex is maximum hydrated ?

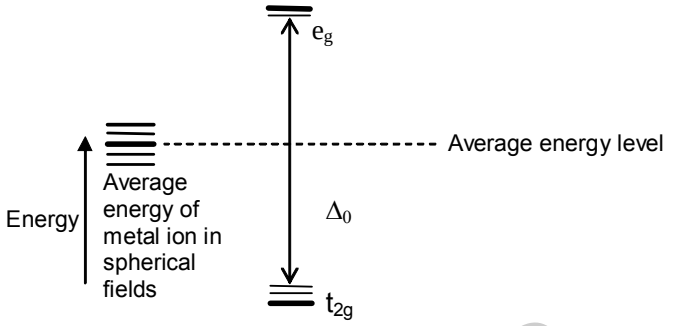
(A) Complex C (B) Complex B
(C) Complex A (D) All are equally hydrated

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COMPREHENSION # 84
Paragraph for Questions Nos. 714 to 716

In octahedral complexes the filling of t_{2g} orbitals decreases the energy of a complex , that is makes it more stable by $-0.4\Delta_0$ per electron . Filling the e_g orbitals increases the energy by $+0.6\Delta_0$ per electron . The total crystal field stabilisation energy is given by

CFSE (octahedral) = $-0.4\Delta_0(t_{2g}) + 0.6\Delta_0(e_g)$



The CFSE increases the thermodynamic stability of the complexes i.e it affects the actual lattice energy over the theoretically calculated energy that does not take CFSE it into account. In studying tetrahedral complexes a regular tetrahedron is related to a cube . One atom is at the centre and four of eight corners are occupied by the ligands . The directions of x , y , z point to the centres of the faces of the cube . The directions of the approach of the ligands does not coincide exactly with the atomic orbitals .

In these complexes the e_g orbitals are more stable compared to the t_{2g} orbitals.

714. In an octahedral complex X the central metal ion has 24 electrons . If its pairing energy is $+0.8\Delta_0$ (where Δ_0 is the difference in energy between the t_{2g} and the e_g orbitals). Will it obey Hund's rule and what is its spin magnetic moment

(A) Yes , 2.83 (B) No , 2.83 (C) Yes , 4.89 (D) No , 4.89

715. During the formation of a tetrahedral complex the angle between the e_g orbital and the central metal is X° and that of t_{2g} orbital and the central metal is Y° then X^0-Y^0 is.

(A) 24.3° (B) 19.3° (C) 35.36° (D) 21.24°

716. Considering Mn^{2+} if the measured lattice energy is X kJ / mol and the calculated lattice energy is Y kJ/mol then their relation between X and Y in a strong and a weak ligand field respectively is

(A) $X > Y$, $X = Y$ (B) $X > Y$, $X < Y$ (C) $X < Y$, $X > Y$ (D) $X < Y$, $X = Y$

COMPREHENSION # 85
Paragraph for Questions Nos. 717 to 718

Four elements P, Q, R & S have ground state electronic configuration as:

P $\rightarrow$ $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^3$ Q $\rightarrow$ $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^1$

R $\rightarrow$ $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^{10}$ $4s^2$ $4p^3$ S $\rightarrow$ $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^{10}$ $4s^2$ $4p^1$

717. Comment which of the following option represent the correct order of true (T) & false (F) statement.

I size of P < size of Q
II size of R < size of S
III size of P < size of R (appreciable difference)
IV size of Q < size of S (appreciable difference)

(A) TTTT (B) TTTF (C) FFTT (D) TTFF

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718. Order of IE_1 values among the following is
(A) P > R > S > Q (B) P < R < S < Q (C) R > S > P > Q (D) P > S > R > Q

COMPREHENSION # 86
Paragraph for Questions Nos. 719 to 721

Compounds containing M-C bonds are called organometallic compounds of which carbonyls constitute an important part. Synergic effect in bonding in the metal carbonyls makes them stable species, metal carbonyls abide by the effective atomic number (EAN) rule.

719. Which of the following is not an organ metallic compound ?

(A) $Al\left(C_2H_5O\right)_3$ (B) $Fr\left(C_5H_5\right)_2$

(C) $\left[PtCl_3\left(C_2H_2\right)\right]^-$ (D) $Cr\left(Co\right)_6$

720. The value of x in $\left[Mn\left(Co\right)_5\right]^{x-}$ is

(A) 3 (B) 2 (C) 1 (D) 0

721. Which of the following is true for the synergic bonding in metal carbonyls ?
(A) The C-O bond length increases (B) The bond order of CO increases
(C) The C-O bond length does not change (D) None of these

COMPREHENSION # 87
Paragraph for Questions Nos. 722 to 724

The following "cycle of copper" experiment is performed in some general chemistry laboratories. The series of reactions starts with copper and ends with metallic copper. The steps are as follows : (1) A piece of copper wire of known mass is allowed to react with concentrated nitric acid [The products are copper (II) nitrate, nitrogen dioxide, and water]. (2) The copper (II) nitrate is treated with a sodium hydroxide solution to form copper (II) hydroxide precipitate. (3) On heating copper (II) hydroxide decomposes to yield copper (II) oxide. (4) The copper (II) oxide is reacted with concentrated sulphuric acid to yield copper (II) sulphate. (5) Copper (II) sulphate is treated with an excess of zinc metal to form metallic copper. (6) the remaining zinc metal is removed by treatment with hydrochloric acid and metallic copper is filtered, dried, and weighted.

722. Assuming that a student started with 65.6 g of copper, calculate the theoretical yield of copper sulphate.
(A) 165 g (B) 82.4 g (C) 90 g (D) 100.2 g

723. Copper obtained at the end of the cycle is..... amount originally taken.
(A) less than (B) greater than
(C) nearly equal (D) only copper salts are obtained.

724. $CuSO_4$ solution thus formed is subjected to electrolysis. To deposit all the copper formed at the end, a current of 50 A will have to be used for approximately :
(A) 10 hours (B) 1 hour (C) 5 hours (D) 0.5 hours

COMPREHENSION # 88
Paragraph for Questions Nos. 725 to 726

At high temperature carbon reacts with water to produce a mixture of carbon monoxide, CO and hydrogen, H_2.

$$C + H_2O \xrightarrow{\text{red heat}} CO + H_2$$

CO is separated from H_2 and then used to separate nickel from cobalt by forming a volatile compound, nickel tetracarbonyl, $Ni(CO)_4$.

$$Ni + 4\,CO \rightarrow Ni(CO)_4$$

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725. How many moles of $Ni(CO)_4$ could be obtained from the CO produced by the reaction of 75.0 g of carbon ? Assume 100% reaction and 100% recovery in both steps.
(A) 6.25 (B) 1.563 (C) 3.125 (D) 25.0

726. Formation of volatile $NI(CO)_4$ and its subsequent heating gives pure Ni. process is called :
(A) Hall (B) Dow (C) Serpeck (D) Mond

COMPREHENSION # 89
Paragraph for Questions Nos. 727 to 729

Valence bond theory explains the magnetic bahaviour of coordination species Depending upon the magnetic behaviour one can understand whether the inner d- orbitals or outer d- orbitals are being used in a particular hybrid station However, the colours of coordination species can he explained by the crystal filed theory.

727. Which of the following compounds is diamagnetic as well as coloured

(A) $\left[Fe(CN)_6\right]^{4-}$ (B) $\left[Ni(CN)_4\right]^{2-}$ (C) $\left[Co(NH_3)_6\right]^{3+}$ (D) All of these

728. Though NH_3 is a strong filed ligand, in which of the following compounds, the d-electrons are not paired

(A) $\left[Cr(NH_3)_6\right]^{3+}$ (B) $\left[Ni(NH_3)_6\right]^{2+}$ (C) $\left[CrCl_3(NH_3)_3\right]$ (D) All of these

729. The correct order of paramagnetic moment is given by

(A) $\left[Cu(NH_3)_4\right]^{2+} < \left[FeF_6\right]^{3-} < \left[Cr(NH_3)_6\right]^{3+}$

(B) $\left[FeF_6\right]^{3-} < \left[Cu(NH_3)_4\right]^{2+} < \left[Cr(NH_3)_6\right]^{3+}$

(C) $\left[Cu(NH_3)_4\right]^{2+} < \left[Cr(NH_3)_6\right]^{3+} < \left[FeF_6\right]^{3-}$

(D) $\left[Cr(NH_3)_6\right]^{3+} < \left[Cu(NH_3)_4\right]^{2+} < \left[FeF_6\right]^{3-}$

COMPREHENSION # 90
Paragraph for Questions Nos. 730 to 734

Magnesium is a valuable, light weight metal used as a structural material as well as in alloys, in batteries, and in chemical synthesis. Although magnesium is plentiful in Earth's crust, it is cheaper to "mine" the metal from seawater. Magnesium forms the second most abundant cation in the sea (after sodium); there are about 1.3 g of magnesium in a kilogram of sea-water. The process from obtaining magnesium from sea - water employs all three types of reactions precipitation, acid-base, and redox reactions.

730. Precipitation reaction involves formation of :
(A) insoluble $MgCO_3$ by adding Na_2CO_3 (B) insoluble $Mg(OH)_2$ by adding $Ca(OH)_2$
(C) insoluble $MgSO_4$ by adding Na_2SO_4 (D) insoluble $MgCl_2$ by adding NaCl

731. Acid-base reaction involves reaction between:
(A) $MgCO_3$ and HCl (B) $Mg(OH)_2$ and H_2SO_4
(C) $Mg(OH)_2$ and HCl (D) $MgCO_3$ and H_2SO_4

732. Redox reaction involves reaction between :
(A) in the electrolytic cell when fused $MgCl_2$ is subjected to electrolysis.
(B) when fused $MgCl_2$ is heated.
(C) when fused $MgCO_3$ is strongly heated
(D) in none of the above.

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733. Instead of calcium hydroxide, why don't we simply add sodium hydroxide to seawater to precipitate magnesium hydroxide ?
(A) Solubility of $Ca(OH)_2$ is smaller than that of NaOH so that $Mg(OH)_2$ is precipitated.
(B) NaOH may dissolve $Mg(OH)_2$ formed.
(C) NaOH may also precipitate other species, being a strong electrolyte
(D) NaOH, being a weak electrolyte will not coagulate $Mg(OH)_2$

734. Which is the best source of the given process in the metallurgical process?
(A) Magnesite (B) Kieserite (C) Epsomite (D) Dolomite

COMPREHENSION # 91
Paragraph for Questions Nos. 735 to 738

An inorganic salt (A) is decomposed at about 523 K to give products (B) and (C). Compound (C) is a liquid at room temperature and is neutral to litmus paper while oxide (B) on burning with white phosphorous, given a dehydrating agent (D).

735. Compound (A) is
(A) NH_4NO_3 (B) N_2O (C) H_2O (D) P_2O_5

736. Compound (B) is
(A) NH_4NO_3 (B) N_2O (C) H_2O (D) P_2O_5

737. Compound (C) is
(A) NH_4NO_3 (B) N_2O (C) H_2O (D) P_2O_5

738. Compound (D) is
(A) NH_4NO_3 (B) N_2O (C) H_2O (D) P_2O_5

COMPREHENSION # 92
Paragraph for Questions Nos. 739 to 741

There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization eaily explains the ease of sigma donation capability of NH_3 and PH_3. Phosphine is a flammable gas and is prepared from white phosphorus.

739. Among the following, the correct statement is –
(A) Phosphates have no biological significance in humans
(B) Between nitrates and phosphates, phosphates are less abundant in earth's crust
(C) Between nitrates and phosphates, nitrates are less abundant in earth's crust
(D) Oxidation of nitrates is possible in soil

740. Among the following, the correct statement is –
(A) Between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional.
(B) Between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional.
(C) Between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional.
(D) Between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional.

741. White phosphorus on reaction with NaOH gives PH_3 as one of the products. This is a –
(A) dimerization raection (B) disproportionation reaction
(C) condensation reaction (D) precipitation reaction

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COMPREHENSION # 92
Paragraph for Questions Nos. 742 to 744

A white crystalling solid (A) on dehydration gave a poisonous pseudohalogen gas (B). Compound (A) when boiled with alkali gave a clourless gas (C). Which froms white fume with HCl. The fume condenses to a white solid (D) on cooling. (B) dissolves in caustic potash solution to gave two compounds (pseudo halides) (E) and (F). Compound (F) gives white precipitate (G) with $AgNO_3$ solution but the precipitate dissolves in excess of (E) When (F) is heated together with (D) a well known fertilizer (H) is obtained. identify (A) to (H) and write the reaction involved.

742. The hybridzaition shown by cpd 'B' (pseudo halides)
(A) sp^3d (B) sp^3d^2 (C) sp^2 (D) sp

743. The ppt dissolves in excess of (E) due to formations of complex. The nature complex is
(A) Parra, colourless (B) Dia, colourless (C) Dia, coloured (D) Parra, coloured

744. The hybridization shown by the cation & anions of compound ' A' are
(A) sp^2, sp^3 (B) sp^2, sp^2 (C) sp^3, sp^3 (D) sp^3, sp^2

COMPREHENSION # 93
Paragraph for Questions Nos. 745 to 749

A sulphate of a metal (A) on heating evolves two gases (B) and (C) and an oxide (D). Gas (B) turns $K_2Cr_2O_7$ paper green while gas (C) forms a trimer in which there is no S – S bond. Compound (D) with HCl, forms a Lewis base (E) which exists as a dimer.

745. Compound (A) is
(A) $FeSO_4$ (B) SO_2 (C) SO_3 (D) Fe_2O_3

746. Compound (B) is
(A) $FeSO_4$ (B) SO_2 (C) SO_3 (D) Fe_2O_3

747. Compound (C) is
(A) $FeSO_4$ (B) SO_2 (C) SO_3 (D) Fe_2O_3

748. Compound (D) is
(A) $FeSO_4$ (B) SO_2 (C) SO_3 (D) Fe_2O_3

749. Compound (E) is
(A) $FeCl_3$ (B) SO_2 (C) SO_3 (D) Fe_2O_3

COMPREHENSION # 94
Paragraph for Questions Nos. 750 to 753

$$\underset{\text{(organic compound)}}{A} + O_2 \longrightarrow X + Y + Z$$

Compound (A) in pure form does not give ppt. with $AgNO_3$ solution. A mixture containing 70% of (A) and 30% of ether is used as an anaesthetic. Compound (X) and (Y) are oxides while (Z) is a pungent smelling gas. (X) is a neutral oxide which turns cobalt chloride paper pink. Compound (Y) turns lime water milky and produces an acidic solution with water.

750. Compound (A) is –
(A) $CHCl_3$ (B) H_2O (C) CO_2 (D) Cl_2

751. Compound (X) is –
(A) $CHCl_3$ (B) Cl_2 (C) CO_2 (D) H_2O

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752. Compound (Y) is –
(A) $CHCl_3$ (B) H_2O (C) CO_2 (D) Cl_2

753. Compound (Z) is –
(A) $CHCl_3$ (B) H_2O (C) CO_2 (D) Cl_2

COMPREHENSION # 95
Paragraph for Questions Nos. 754 to 756

A crystalline solid (A) reacts with hydrogen gas to form a monoatomic gas (B) and a highly associated liquid (C). (A) is soluble in water and undergoes hydrolysis slowly to form (B), (C) and a diatomic gas (D). When pure and dry (D) is subjected to a silent electric discharge an another pale blue gas (E) is produced which like (A) also acts as a strong oxidising agent. (E) dissolves in potassium hydroxide forming an orange coloured solid which is paramagnetic in nature. (A) reacts with IF_5, SbF_5, PF_5 etc to form the addition compounds. (C) forms an addition compound (F) with KF which when electrolysed in molten state forms a most reactive gas (G). (B) and (G) (taken in 2 : 1 ratio) when heated in nickel tube at 400ºC and 6 atm. pressure forms (A). The IE_1 of (B) is fairly close to (D).

754. Gas (G) is produced by reacting K_2MnF_6 with :
(A) SbF_5 (B) MnF_3 (C) $KSbF_6$ (D) MnF_5

755. Which of the following statement is correct for (A)?
(A) The central atom of (A) is sp^3d hybridised with three lone pairs of electrons
(B) (A) reacts with S_8 molecules in presence of (C) to form a compound in which the S atom is sp^3d^2 hybridised.
(C) (A) reacts with SbF_5 as a lewis base.
(D) All of these

756. Which is correct choice for (D) and (E)
(A) (E) reacts with dry iodine to form I_2O_5
(B) A filter paper soaked in alcoholic benzidine becomes brown when brought in contact with (E)
(C) (D) is prepared by Brin's process
(D) (B) and (C) both

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COMPREHENSION # 96
Paragraph for Questions Nos. 757 to 760

Look at the location of elements A,B,C and D in the following periodic table and answer the questions given below :

757. Which of the elements indicated by A,B, C and D is expected to be found in native state
(A) A (B) B (C) C (D) D

758. Which is found as its sulphide?
(A) A (B) B (C) C (D) D

759. Which is found as its carbonate?
(A) A (B) B (C) C (D) D

760. Imagine a planet with an atmosphere that contains O_2 and SO_2 but no. CO_2 . What is the chemical composition of the mineral you would expect to find for the alkaline earth metals (M) on such a planet ?
(A) MO_2, M_2O_2 (B) MSO_3, MSO_4
(C) $M(HSO_3)_2\, M(HSO_4)_2$ (D) All of the above

COMPREHENSION # 97
Paragraph for Questions Nos. 761 to 765

The chief ore of zinc is the sulphide, ZnS. The ore is concentrated by flotation process and then heated in air, which converts the ZnS to ZnO.

$$2ZnS + 3O_2 \xrightarrow{90.6\%} 2ZnO + 2SO_2 \quad .....(1)$$

The ZnO is then treated with dilute H_2SO_4

$$ZnO + H_2SO_4 \xrightarrow{100\%} 2ZnSO_4 + H_2O \quad .....(2)$$

to produce $ZnSO_4$(aq.) which produces Zn metal on electrolysis.

$$2\,ZnSO_4 + 2H_2O \xrightarrow{98.2\%} 2Zn + 2H_2SO_4 + O_2 \quad .....(3)$$

761. What mass of Zn will be obtained from an ore containing 225 kg of ZnS ? Efficiencies of the process have been indicated above the arrow mark. (Zn = 65, S = 32, O=16, H=1)
(A) 134 kg (B) 112 kg (C) 102 kg (D) 130 kg

762. What amount of current is required (with 100% efficiency) in step (3) if it takes one month ?
(A) 10.2 A (B) 15.4 A (C) 17.0 A (D) 154.0 A

763. ZnO is step (i) can also be dissolved in NaOH forming :
(A) $Zn(OH)_2$ (B) Na_2ZnO_2 (C) Na_2O_3 (D) $NaZn(OH)_4$

764. How many kilomoles of NaOH are required to dissolve all the ZnO of step (1) assuming 100% yield ?
(A) 2.32 (B) 1.16 (C) 4.64 (D) 9.28

765. What valume of 98% H_2SO_4 (by weight, density 1.8 g/mL) is required in step (2) ?
(A) 130 L (B) 140 L (C) 120 L (D) 150 L

COMPREHENSION # 98
Paragraph for Questions Nos. 766 to 768

The Carbon–metal bond in carbonyls may be represented as M $\leftarrow$ C $\equiv$ O. A stronger second bond is formed by back bonding. This arises form sideways overlap of $\overset{*}{\Pi}$ 2Py orbital of carbon with full dxy orbital of the metal.

766. Because of back bonding 'CO' is called as:
(A) Π – acceptor ligand (B) Π – donar ligand
(C) σ – acceptor base (D) σ – donor ligand

767. In metal carbonyls the C–O bond length
(A) Decreases from double bond length to triple length.
(B) Increases from triple bond length to double bond length.
(C) Remain as triple bond length.
(D) Cannot be predicted.

768. Which pair of carbonyl is correctly matched with shape.
(A) Nickel carbonyl – Square planar (B) Iron carbonyl – Pentagonal bipyramidal
(C) Vanadium carbonyl – Tetrahedral (D) Chromium carbonyl – Octahedral

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COMPREHENSION # 99
Paragraph for Questions Nos. 769 to 771

Coordination compounds can also exhibit ionization and limeage isomerism types along with other isomerism types. In ionization isomerism type, the exchange of ions between coordination sphere and ionic sphere is observed. On the other hand, is linkage isomerism, the change in the donar atom of a ligand is observed.

769. Which one of the following is correct with respect to SCN^- ion ?

(A) metal - S bonds are stable in solvent with low dielectrtic constant
(B) metal - N bonds are stable in solvent with high dielectric constant
(C) metal - S bonds are stable in solvent with high dielectric constant
(D) in any solvent metal - S and metal - N bonds are stable

770. Which one of the following is not an example for ionization isomerism:

(A) $\left[(NH_3)_5 Co\ ^{18}OH\right] + NO_2 \rightarrow \left[(NH_3)_5 Co(NO_2)\right] +^{18} OH$

(B) $\left[(NH_3)_4 Co(H_2O)Cl\ \right] + 2Br \rightarrow \left[(NH_3)_4 Co(Br_2)\ \right] + Cl\ .H_2O$

(C) $\left[(NH_3)_5 Co(SO_4)\right] + NO_3 \rightarrow \left[(NH_3)_5 Co(NO_3)\right] + SO_4$

(D) $\left[(NH_3)_4 Co(NO_2)Cl\right] + Cl \rightarrow \left[(NH_3)_4 CoCl_2\right] + NO_2$

771. How many ways are possible to represent a coordination complex with a molecular formula $\left[M^{m\pm}a_4b_2\right]^{n\pm}$ (when m may or may not be equal to n) in - terms of geometrical isomerism

(A) 12 Cis forms and 3 trans forms (B) 6 Cis forms and 6 trans forms
(C) 4 Cis forms and 4 trans forms (D) 8 Cis and 4 trans formss

COMPREHENSION # 100
Paragraph for Questions Nos. 772 to 774

A metal complex having composition $Cr(NH_3)_4Br_2I$ was isolated in two forms (x) and (y). Form (x) reacts with $AgNO_3$ to give a pale yellow precipitate which is partially soluble in excess of NH_4OH. Whereas (y) gives a greenish yellow precipitate which is insoluble in NH_4OH.

772. (A) The formula of (x) and (y) are $[Cr(NH_3)_4IBr]Br$ and $[Cr(NH_3)_3Br_2I]NH_3$

(B) The formula of (x) and (y) are $[Cr(NH_3)_4IBr]Br$ and $[Cr(NH_3)_4Br_2]I$ respectively

(C) The formula of (x) and (y) are both $[Cr(NH_3)_4Br]BrI$

(D) The formula of (x) and (y) are $[Cr(NH_3)_2IBr_2](NH_3)_2$

773. Both the (x) form and (y) form show

(A) linkage isomerism (B) Co-ordination isomerism
(C) ionization isomerism (D) none of these

774. The oxidation state and co-ordination number of the central atom in the complex is

(A) +6, 6 (B) +6, 5 (C) +3, 5 (D) +3, 6

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SECTION III: MATCH TYPE

775. Match the following columns

	Column I		**Column II**
(a)	$V(CO)_6$	(P)	Paramagnetic with 1 unpaired electron
(b)	$[NiCl_2(PPh_3)_2]$	(Q)	Paramagnetic with 2 unpaired electrons
(c)	$[Ni(NH_3)_4]^{2+}$	(R)	sp^3 hybridization
(d)	$Ni(CO)_4$	(S)	Diamagnetic

776.

	Column-I		**Column-II**
(A)	$Zn(OH)_2$ precipitate dissolves in	(P)	Potassium cyanide
(B)	$Cr(OH)_3$ precipitate dissolves in	(Q)	Ammonia
(C)	AgCl precipitate dissolves in	(R)	Sodium hydroxide
(D)	CuS precipitate dissolves in	(S)	Sodium peroxidse

777.

	Column-I		**Column-II**
(A)	Highest density	(P)	Os
(B)	Colourless salts	(Q)	Cr
(C)	Maximum magnetic moment	(R)	Zn
(D)	Variable oxidation state	(S)	Mn

778.

	Column-I		**Column-II**
(A)	Bi^{3+} gives black ppt with	(P)	H_2S (saturated solution in water)
(B)	Cu^{2+} gives black ppt with	(Q)	Potassium thiocyanate solution
(C)	Zn^{2+} gives white ppt with	(R)	Potassium iodide solution
(D)	Ag^{+} gives white ppt with	(S)	Potassium ferrocyanide solution

779.

	Column-I		**Column-II**
(A)	Coloured ion	(P)	Cu^{+}
(B)	μ = 1.73 B.M.	(Q)	Cu^{2+}
(C)	d^{10} configuration	(R)	Fe^{2+}
(D)	More than 3 unpaired electrons	(S)	Mn^{2+}

780. Match the following

	Reactants		**Products**
(a)	anhydrous form of blue vitirol + $P_4 + H_2O \xrightarrow{\text{Cold}}$	(P)	H_3PO_4
(b)	anhydrous form of blue vitirol + $P_4 + H_2O \xrightarrow{\text{Hot}}$	(Q)	Cu_3P (black)
(c)	anhydrous form of blue vitirol + $PH_3 + H_2O \longrightarrow$	(R)	Cu
(d)	anhydrous form of blue vitirol + $H_3PO_2 + H_2O \longrightarrow$	(S)	Cu_2H_2 (Red)

781. Match the following :

	Column A		**Column B**
(i)	$NaI + Cl_2$ (water) + CCl_4 - shake	(a)	yellow ppt
(ii)	$CH_3COO^- + FeCl_3 + H_2O$ - boil	(b)	green mass
(iii)	$CoCl_2 + KNO_2 + CH_3COOH$ - warm	(c)	black ppt
(iv)	$MnCl_2 + KOH + KClO_3$ - fusion	(d)	purple colour
(v)	$MnCl_2 + NaOH + Br_2$ (water)	(e)	red brown ppt
(vi)	$FeCl_3 + KSCN$	(f)	blood red colour

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782.

	Name		% of C
[1]	Wrought iron/Meleable	(a)	0.25 to 2.0
[2]	Steel	(b)	2.6 to 4.3
[3]	Pig Iron	(c)	0.1 to 0.25
[4]	Cast Iron	(d)	2.3 to 4.6

783.

	Column-I		**Column-II**
(A)	Zn	(P)	d-block metal
(B)	Cu	(Q)	Coinage metal
(C)	Ag	(R)	Native metal
(D)	Fe	(S)	Transitional metal

784. Match the following columns

	List I		**List II**
(a)	NH_3	(P)	sp^3 hybridisation
(b)	XeF_6	(Q)	1 lone pair are present
(c)	B_2H_6	(R)	multi centre bond are present
(d)	NH_4^+	(S)	pyramidal shape

785. Match the geometry (given in column A) with the complex (given in column B).

	Column (A)		**Column (B)**
i)	Tetrahedral	(a)	$[Cu(NH_3)_4]^{2+}$
ii)	Octahedral	(b)	$[Ag(NH_3)_2]^+$
iii)	Square planar	(c)	$Fe(CO)_5$
iv)	Trigonal bipyramidal	(d)	$[Cr(H_2O)_6]^{3+}$
v)	Linear	(e)	$[NiCl_4]^{2-}$

(A) (i)-(e), (ii)-(d), (iii)-(a), (iv)-(c) ,(v)-(b)
(B) (i)-(d), (ii)-(e), (iii)-(a), (iv)-(c) ,(v)-(b)
(C) (i)-(d), (ii)-(e), (iii)-(b), (iv)-(a) ,(v)-(c)
(D) (i)-(c), (ii)-(e), (iii)-(b), (iv)-(a) ,(v)-(d)

786. Match column - I with column - II

	Column - I (Property)		**Column - II (Element/compound)**
(A)	Explosive	(P)	Cu
(B)	Self-reduction	(Q)	Fe_3O_4
(C)	Magnetic material	(R)	$Cu(CH_3COO)_2.Cu(OH)_2$
(D)	Verdigris	(S)	$Pb(NO_3)_2$

787. Match column - I and column - II and select the correct answer using the codes given below the lists:

	Column - I		**Column - II**
(A)	Cyanide process	(P)	Ultrapure Ge
(B)	Floatation process	(Q)	Dressing of HgS
(C)	Electrolytic reduction	(R)	Extraction of Al
(D)	Zone refining	(S)	Extraction of Au

788.

	Column I		**Column II**
1.	White crystalline precipitate	(a)	$K_3[Co(NO_2)_6]$
2.	Reddish brown precipitate	(b)	$Cr(OH)_3$
3.	Yellow precipitate	(c)	$Fe(OH)_3$
4.	Green precipitate	(d)	$PbCl_2$

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789.

	Column I		Column II
1.	$2NiS + 2HNO_3 + 6HCl$ – Evaporate to dryness	(a)	Black ppt & imparts greenish blue flame
2.	$CoCl_2 + 4NH_4CNS$ + amyl alcohol – Shake & allow to stand	(b)	Blue colour in organic layer
3.	$CuCl_2$ + NaOH – Heat strongly	(c)	White ppt insoluble in conc HNO_3 & HCl
4.	$Sr(CH_3COO)_2 + (NH_4)_2C_2O_4$ – Mix	(d)	Yellow residue turns green in water
5.	$H_2SO_4 + BaCl_2$ – Mix	(e)	Yellow ppt soluble in NaOH
6.	$Na_2CrO_4 + (CH_3OO)_2Pb$ – Mix	(f)	Scarlet red ppt
7.	$HgCl_2 + KI$ – Mix	(g)	White ppt & imparts crimson red flame

790.

	Column (A)		Column (B)
(a)	Fe^{3+}, Zn^{2+} & Cu^{2+} can be differentiated by	(i)	KI solution
(b)	PbS, CuS and CdS dissolve in	(ii)	Alkaline Na_2SnO_2 solution
(c)	Pb^{2+} gives yellow precipitate with	(iii)	50% HNO_3
(d)	Bi^{3+} gives a black precipitate with	(iv)	K_2CrO_4 solution
(e)	$[Ag(NH_3)_2]Cl$ gives back precipitate with	(v)	Aqueous NH_3.

791.

	Column – I		Column – II
(a)	$FeO + SiO_2 \longrightarrow FeSiO_3$	(i)	Calcination
(b)	$MgCl_2.6H_2O \xrightarrow[\Delta]{Dry\,HCl} MgCl_2$	(ii)	Leaching
(c)	$Cu_2S + 2Cu_2O \xrightarrow{\Delta} 6Cu + SO_2$	(iii)	Smelting
(d)	$Fe_2O_3 + 3C \longrightarrow 2Fe + 3CO$	(iv)	Roasting
(e)	$2Na[Ag(CN)_2] + Zn \longrightarrow Na_2[Zn(CN)_4] + 2Ag$	(v)	Bessemerisation

792. Match the various sequences with the appropriate orders:

	Sequences		Orders
(I)	Na^+ Mg^{+2} Al^{+3}	(a)	increasing size of ion in gaseous state
(II)	I^- S^{2-} N^{3-}	(b)	decreasing size of ion in gaseous state
(III)	O O^- O^{-2}	(c)	increasing size of ions aqueous state.
(IV)	N F O (IE_2)	(d)	decreasing size of ions aqueous state.
		(e)	increasing order of IE_2
		(f)	decreasing order of electron affinity

793.

	Column-I		Column-II
(A)	Containing carbonate radicals	(P)	Anglesite
(B)	Soluble in dilute H_2SO_4	(Q)	Cerussite
(C)	Insoluble in dilute H_2SO_4	(R)	Azurite
(D)	Substance containing lead	(S)	Calamine

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794. Match **Column-I** with **Column-II** and select the correct answer using the codes given below .

	Column-I (Metals)		**Column-II (Method used for refining)**
(A)	Iron & copper	(P)	Poling
(B)	Zirconium & Titanium	(Q)	Bessemerisation
(C)	Lead & Tin	(R)	Van-Arkel
(D)	Copper & Tin	(S)	Liquation

795. Match the following:

1.	Double salt	(a)	$[Co(NH_3)_3Cl_3]$
2.	Zeise's salt	(b)	Hexadentate
3.	Neutral molecule	(c)	bidentate
4.	EDTA	(d)	Paramagnetic
5.	$Ni(CO)_4$	(e)	$FeSO_4.(NH_4)SO_4.6H_2O$
6.	$[Cr(NH_3)_6]^{3+}$	(f)	$K_4Fe(CN)_6$
7.	Low spin complex	(g)	Diamagnetic
8.	Glycine	(h)	An organometallic compound

(A) (1–e); (2–h); (3–a); (4–b); (5–g); (6–d); (7–f); (8–c).
(B) (1–h); (2–e); (3–a); (4–b); (5–g); (6–d); (7–f); (8–c).
(C) (1–h); (2–e); (3–a); (4–b); (5–d); (6–g); (7–c); (8–f).
(D) (1–h); (2–a); (3–e); (4–b); (5–d); (6–g); (7–f); (8–c)

796. Match list I with List II and select the correct answer using the codes given below the lists.

	List I (Complex)		**List II(Geometry)**
A.	$[Ni(CN)_4]^{2-}$	1.	Tetrahedral
B.	$[ZnCl_4]^{2-}$	2.	Tetragonal
C.	$[Co(en)_3]^{3+}$	3.	Square planar
D.	$[Cu(NO_2)_6]^{4-}$	4.	Square pyramidal
		5.	Octahedral

Code	A	B	C	D
(A)	1	2	3	4
(B)	3	1	5	2
(C)	2	3	4	5
(D)	3	1	5	4

797. Match the following columns

	List I		**List II**
(a)	Arsenic	(P)	highest electron affinity (among list I)
(b)	Chlorine	(Q)	strongest reducing agent (among list I)
(c)	Fluorine	(R)	p-block element (among list I)
(d)	Lithium	(S)	highest ionisation energy (among list I)

798. **Match the following**

(a)	chalcopyrites (or) copper pyrites	(P)	$CuCO_3.Cu(OH)_2$
(b)	Chalcocite (or) copper glance	(Q)	Cu_3FeS_3
(c)	Bornite	(R)	Cu_2S
(d)	Cuprite (red)	(S)	Cu_2O
(e)	Malacite (green)	(T)	$CuFeS_2$
(f)	Azurite (blue)	(U)	$2CuCO_3.Cu(OH)_2$

799. Match column (I) (process) with column (II) (electrolyte)

	Column (I) (process)		**Column (II) (electrolyte)**
(A)	Downs cell	(P)	fused $MgCl_2$
(B)	Dow sea water process	(Q)	fused (Al_2O_3 + Na_3AlF_6 + CaF_2)
(C)	Hall-Heroult	(R)	fused (40% NaCl + 60% $CaCl_2$)
		(S)	($A\ell N$ + C + N_2)

CatalyseR

800. Match column - I with column - II and select the correct answer using the codes given below the lists:

	Column - I		**Column - II**
(A)	Van Arkel method	(P)	Manufacture of caustic soda
(B)	Solvay process	(Q)	Purification of titanium
(C)	Cupellation	(R)	Manufacture of Na_2CO_3
(D)	Poling	(S)	Purification of copper
		(T)	Refining of silver

801.

	Column-I		**Column-II**
(A)	Reduction of oxides with Al	(P)	Ti
(B)	Reduction of chlorides with Mg at higher temperature	(Q)	Cu
(C)	Auto reduction of Sulphides during reduction	(R)	Cr
(D)	Strong heating of metal oxides	(S)	Ag

802.

	Column – I		**Column – II**
(a)	$K_2MgCl_4.6H_2O$	(i)	Thomas slag
(b)	Al_2O_3	(ii)	Azurite
(c)	$Ca_3(PO_4)_2$	(iii)	Calamine
(d)	$3Ag_2S.Sb_2S_3$	(iv)	Langbeinite
(e)	$2CuCO_3.Cu(OH)_2$	(v)	Carnallite
(f)	$PbSO_4$	(vi)	Pyrargyrite
(g)	$K_2Mg_2(SO_4)_3$	(vii)	Corundum
(h)	$ZnCO_3$	(viii)	Anglesite

803.

	Column – I		**Column – II**
(A)	$4\,Au + 8\,NaCN + 2\,H_2O + O_2\,(air) \longrightarrow 4\,Na\,[Au\,(CN)_2] + 4\,NaOH$	(P)	Leaching
(B)	$CuFeS_2 + 2\,H_2SO_4 \longrightarrow CuSO_4 + FeSO_4 + 2\,H_2S$	(Q)	Smelting
(C)	$Fe_3O_4 + 4\,CO \xrightarrow{823\,K} 3\,Fe + CO$	(R)	Hydrometallurgy
(D)	$MgCl_2.6\,H_2O \xrightarrow[Dry\,HCl(g)]{\Delta} MgCl_2 + 6\,H_2O$	(S)	Calcination
		(T)	Dow's process

804. Match the column –

	Column I		**Column II**
(A)	N_2O_4	(p)	Produces mixed acids on reaction with water as final product
(B)	Cl_2O_6	(q)	Exists as ion pair in the solid state
(C)	SO_2Cl_2	(r)	Paramagnetic in monmeric form
		(s)	Stronger dehydrating agent compared to conc. H_2SO_4

CatalyseR

805. Match the column –

	Column I		Column II
(A)	Cl_2O	(p)	Exists in equilibrium with monomer
(B)	ClO_2	(q)	Paramagnetic
(C)	Cl_2O_6	(r)	Strongest acidic oxide
(D)	Cl_2O_7	(s)	Maximum steric on crowding

806. Match the column correctly –

	Column I		Column II
(A)	Best reductant	(p)	Fluorine
(B)	Arracks glass	(q)	F^-
(C)	Highest. hydrated halide ion	(r)	HF
(D)	Tri-iodide ion	(s)	HI
(E)	Does not show +1 oxidation state	(t)	Linear species

807. Match List–I with List–II and select the correct answer using codes given below in the list –

	List – I		List – II
(a)	Cyanide process	(P)	Ultrapure Ge
(b)	Floation process	(Q)	Pine oil
(c)	Electrolytic reduction	(R)	Extraction of Al
(d)	Zone refining	(S)	Extraction of Au

SECTION V: INTEGER TYPE

808. The oxidation state of Fe in brown ring complex $[Fe(H_2O)_5NO]SO_4$ is

809. The most common oxidation state of Lanthanoids is

810. Total number of inner transition elements in the periodic table is

811. How many statements are incoorect from the following:

(i) In the testing of v group radical NH_4OH is added to convert NH_4HCO_3 to $(NH_4)_2CO_3$ so that Ba^{2+}, Sr^{2+} and Ca^{2+} precipitate completely.

(ii) In the fusion test for Mn^{2+} ions, purple mass obtained turns green on adding NaOH solution (fusion with $KClO_3$ + KOH).

(iii) The addition of zinc dust during the testing of S^{2-} by dil H_2SO_4 enhances the evolution of H_2S gas.

(iv) Nonluminous flame is called oxidising flame and luminous flame is called reducing flame.

(v) $Cr_2(SO_4)_3 + 3B_2O_3 \xrightarrow{\Delta} 2Cr(BO_2)_3$ (blue bead) + $3SO_3$

812. Consider the following complex : $[Co(NH_3)_5CO_3]ClO_4$

The coordinations number, oxidation number, number of d-electrons and number of unpaired d-electrons on the metal are respectively –

813. Benitoite is represented as $BaTi[Si_3O_n]$, the value of n iS?

814. A metal complex of co-ordination number six having three different types of ligands *a*, *b* and *c* of composition $Ma_2b_2c_2$ can exist in several geometrical isomeric forms; the total number of such isomers is

815. Effective atomic number of Fe in the complex $K_4[Fe(CN)_6]$ is

816. % of silver in 'german silver' is

CatalyseR

817. From the following information

$A^- (g) \longrightarrow A^{+2} (g) + 3e^-$ $\quad \Delta H_1 = 1400$ kJ

$A (g) \longrightarrow A^{+2} (aq) + 2e^-$ $\quad \Delta H_2 = 700$ kJ

ΔH_{EG} $[A^+(g)] = -350$ kJ /mol

$(IE_1 + IE_2)$ for $A(g) = 950$ kJ/mol

Find IE_2 (kJ/mol) of A

818. f-Sub shell of which principle quantum no. is filled up progressively in actinoids?

819. How many of the following statements are correct

(i) All the lone pairs are not necessarily used in coordinate bonding.
(ii) Tetrahedral complex of coordination no. of '4' show geometrical isomerism
(iii) A polydentate ligands have flexidentate character.
(iv) Geometrical isomerism is not noticed in complex coordination no. 2 and 3 .
(v) EDTA has six lone pairs but it will be less than 6 lone pair s can be used in some coordinate complexes.
(vi) Perfect complexes are those in which complex ion is fairly stable.
(vii) It can be considered as undissociated and doesn't give the individual tests for cations and anions.
(viii) For the complex $K_4[Fe(CN)_6]$ it will give $4K^+$ and $[Fe(CN)_6]^{4-}$ but will not give individual test for Fe^{2+} & $6CN^-$.
(ix) Square planar complexes of coordination no. of '4' shows geometrical isomerism
(x) Octahedral complexes of coordination no. of '6' showing geometrical isomerism
(xi) It is either not dissociated or feebly dissociated in solution state.
(xii) Ambidentate ligands are those in which only one donor atom is attached to metal atom

820. What is the oxidation state of lead in litharge?

821. When Fe(s) is dissolved in aqueous hydrochloric acid in a closed vessel, the work done is?

822. Theoritically the No. of geometrical isomers expected for octahedral complex [Mabcdef] is :

823. The magnetic moment of a transition metal ion is found to be 3.87 BM. The number of unpaired electrons present in the ion is

824. Inorganic graphite is B_XN_Y, the value of X+Y is?

825. An ornament of gold has 75% of gold, then it is of how many carat?

826. In an alkaline medium, the equivalent mass of $KMnO_4$ is $\left(\frac{M}{x}\right)$. Then x is?

827. The number of unpaired electron in the complex ion $[CoF_6]^{3-}$ is

828. The possible number of optical isomers in $[Co(en)_2Cl_2]^+$ are

829. The number of milli-moles of acidified $KMnO_4$ required to convert one mole of sulphite ion into sulphate ion is

830. Colemanite has the formula : $Ca_2B_6O_{11}\cdot xH_2O$. What is x?

831. The atomic number of an element is 22. The highest oxidation state exhibited by it in its compounds is]

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832. Out of the following the number of process(es) which uses a catalyst is/are?
(I) Contact process
(II) Thermite process
(III) Ostwald's process
(IV) Haber's process

833. The mononuclear complex salt having the molecular composition $[Co(en)_2 (SCN) (NO_2)]Br$ can exist in a number of isomeric forms. The total number of possible isomer of all type is

834. Number of equivalent Cr —O bonds in the dichromate dianion are?

CatalyseR

PART III: ORGANIC CHEMISTRY

XI

SECTION I: SINGLE OPTION CORRECT

835. During the preparation of ethane by Kolbe's electrolytic method using inert electrodes, the pH of the electrolyte:

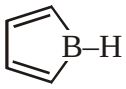
(A) increases progressively as the reaction proceeds
(B) decreases progressively as the reaction proceeds
(C) remains constant throughout the reaction
(D) may decrease , if the concentration of the electrolyte is not very high

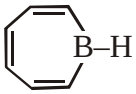
836. Arrange the following compounds in increasing order of their reactivity towards E_2 elimination with $(CH_3)_3COK$ in t-butanol:

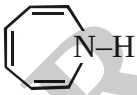
(I) $PhCHClCH_3$ (II) $PhCH_2CH_2Cl$
(III) $CH_3COCH_2CH_2Cl$ (IV) $CH_3COCHClCH_3$

(A) I < II < III < IV (B) III < II < IV < I (C) III < IV < II < I (D) I < IV < II < III

837. Which of the following compound would exhibit aromatic properties:

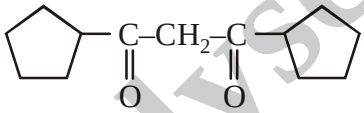
(A) 

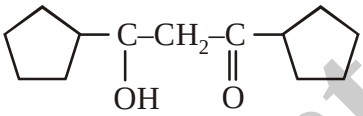
(B) 

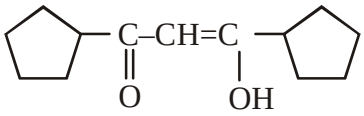
(C) 

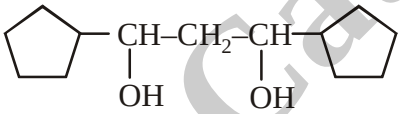
(D) 

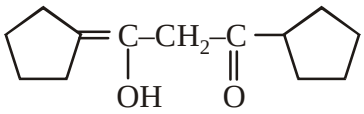
838. Which of the following is the enol tautomer of the compound shown?



(A) 

(B) 

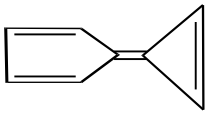
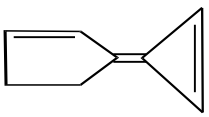
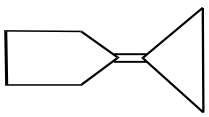
(C) 

(D) 

839. Highest heat of combustion is observed in:

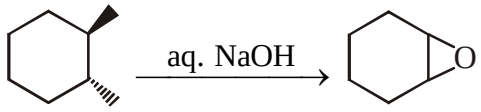
(A) n-hexane (B) 2-methylpentane
(C) 3-methylpentane (D) 2,2,3-trimethylbutane

840. Which of the following has highest dipole moment ?

(A) H – F (B) 
(C) 
(D) 

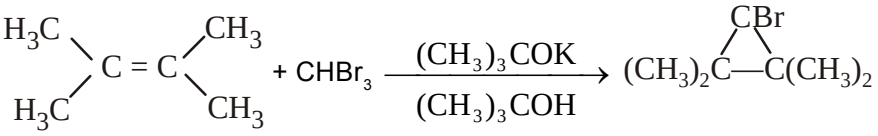
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841. Which of the following reactions involves a carbene reaction intermediate?

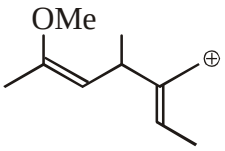
(A) 

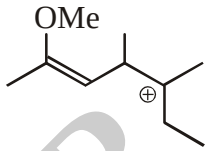
(B) $(CH_3)_3CBr \xrightarrow{EtOH} (CH_3)_3COC_2H_5$

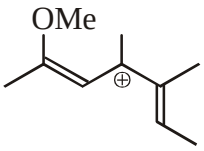
(C) $CH_4 + 4Cl_2 \xrightarrow{h\nu} CCl_4 + 4HCl$

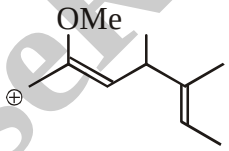
(D) 

842. Which of the following is the most stabilized carbocation?

(A) 

(B) 

(C) 

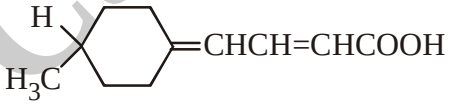
(D) 

843. Sodium formate on Kolbe's electrolysis, the products liberated at anode and cathode respectively are A and B.

(A) A = CO_2 B = H_2 (B) A = H_2 B = CO_2

(C) A = H_2 B = H_2 (D) A = CO_2 B = CO_2

844. How many stereoisomers are possible for the following molecule?



(A) 1 (B) 2 (C) 3 (D) 5

845. Kolbe's synthesis of 2, 2-dimethyl propanoic acid gives the following major product(s) at anode.

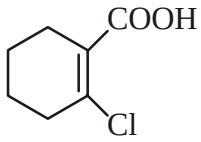
(A) isoctane (B) isobutene & isobutane

(C) 2, 2, 3, 3-tetramethyl butane (D) hydrogen gas

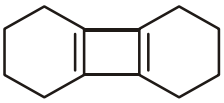
846. The relative reactivity of $1^o : 2^o : 3^o$ hydrogens to chlorination is 1 : 3.8 : 5. The percentage of 2 - chlorobutane, formed during the reaction of chlorine and butane.

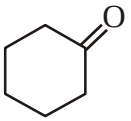
(A) 72 % (B) 28 % (C) 44 % (D) 33. 3 %

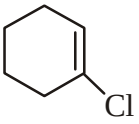
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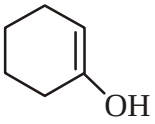
847. 

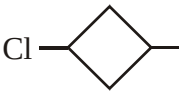
$\xrightarrow[CaO]{NaOH}$ The product is

(A) 

(B) 

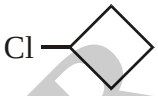
(C) 

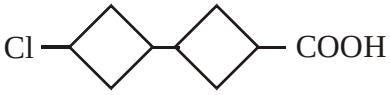
(D) 

848. 

$\xrightarrow[CaO]{NaOH}$ The major product is

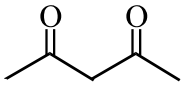
(A) 

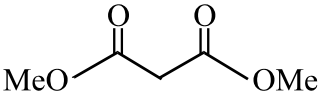
(B) 

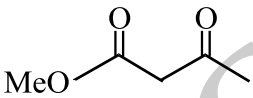
(C) 

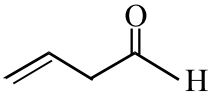
(D) 

849. Among the following compounds, the one that undergo deprotonation most radily in the presence of a base to form a carbanion is :

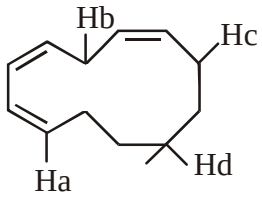
(A) 

(B) 

(C) 

(D) 

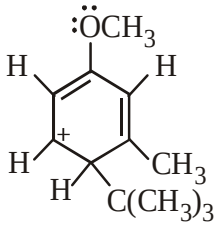
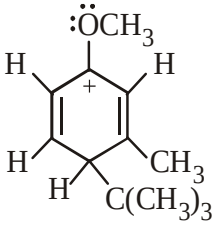
850. Increasing bond dissociation energy of the indicated C–H bond:

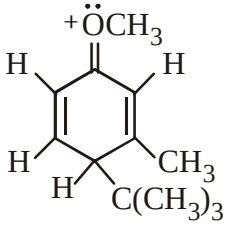
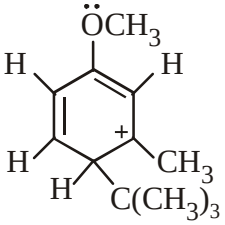


(A) c < b < a < d
(B) b < a < d < c
(C) b < c < d < a
(D) d < c < b < a

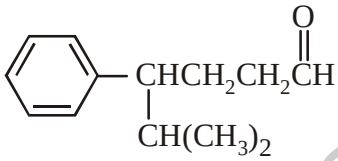
CatalyseR

581. Which is the most stable resonance form?

(A)  ⟷ (B)  ⟷

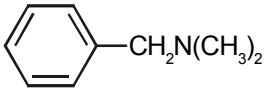
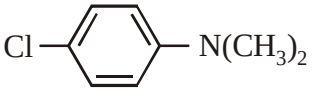
(C)  ⟷ (D) 

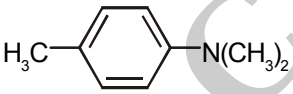
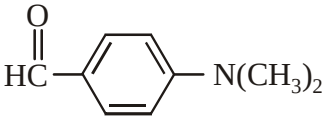
852. What is the IUPAC name for the compound shown?



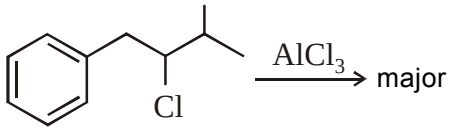
(A) 4-Benzyl-4-isopropylbutanal (B) 4-Isopropyl-4-phenylbutanal
(C) 2-methyl-3-phenylhexanal (D) 5-Methyl-4-phenylhexanal

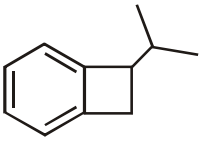
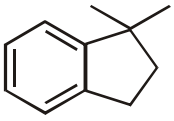
853. Which one of the amines is the least basic?

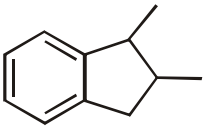
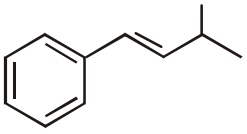
(A)  (B) 

(C)  (D) 

854. Give the major product of the following reaction:



(A)  (B) 

(C)  (D) 

CatalyseR

855. Which of the following are feasible reactions?

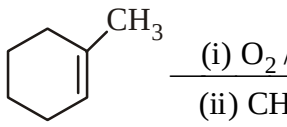
(i) $HC\equiv CH + CH_3Li \rightarrow HC\equiv CLi + CH_4$

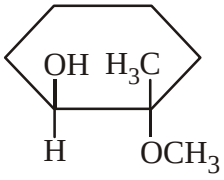
(ii) $HC\equiv CH + NaOH \rightarrow HC\equiv CNa + H_2O$

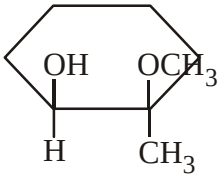
(iii) $HC\equiv CNa + NH_3 \rightarrow HC\equiv CH + NaNH_2$

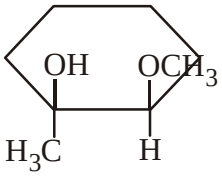
(iv) $H_2C{=}CH_2 + HC\equiv CNa \rightarrow H_2C{=}{=}CHNa + HC\equiv CH$

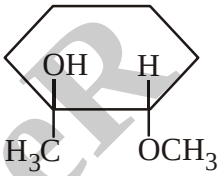
(A) i, ii and iii (B) ii, iii and iv (C) i, iii and iv (D) only i

856.  A. A is

(A) 

(B) 

(C) 

(D) 

857. Which of the following method will obtain major yield of coupling product?

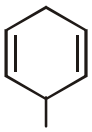
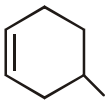
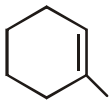
(A) $CH_3 - CH_2MgCl + CH_3 - \underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2 - Cl \longrightarrow CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CH_2 - CH_3$

(B) $CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - MgCl + CH_3 - CH_2 - Cl \longrightarrow CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CH_2 - CH_3$

(C) $(CH_3 - CH_2)_2CuLi + CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - Cl \longrightarrow CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CH_2 - CH_3$

(D) $(CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2)_2CuLi + CH_3 - CH_2 - Cl \longrightarrow CH_3 - \overset{\overset{CH_3}{|}}{CH} - CH_2 - CH_2 - CH_3$

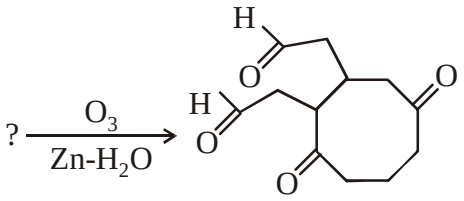
858. Arrange the following reaction in decreasing order of reactivity with NBS/heat:

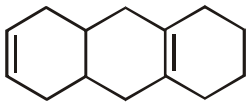
(1)  (2)  (3)  (4) 

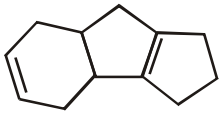
(A) 1 > 2 > 3 > 4 (B) 2 > 1 > 3 > 4 (C) 1 > 2 > 4 > 3 (D) 4 > 3 > 2 > 1

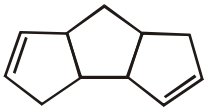
CatalyseR

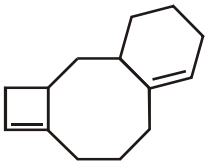
859. Which starting material should be used to produce the compound shown below?



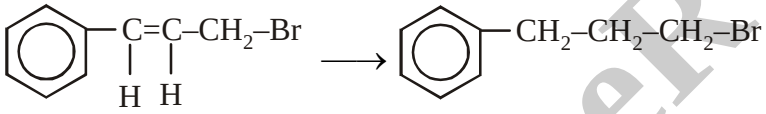
(A) 

(B) 

(C) 

(D) 

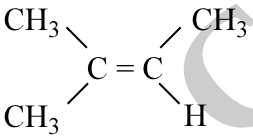
860. Which of the following reagents can be used for the following conversions

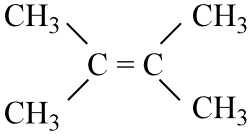


(A) $NH_2–NH_2/H_2O_2$ (B) $H_2/Pd–C$
(C) $LiAlH_4$ (D) Zn-Cu/EtOD

861. Reactivity of $F^{\ominus}$ is highest in–
(A) DMF (B) H_2O (C) EtOH (D) benzene

862. Which one of the following alkene will react fastest with H_2 under catalytic hydrogenation?
(A) Trans-cyclohexene (B) Cis-cyclohexene

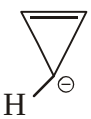
(C) 

(D) 

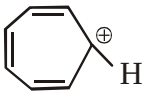
863. $Br–CH_2–C\equiv CH \xrightarrow{Mg / Et_2O}$ The product is
(A) $HC\equiv C–CH_2–Mg^+Br^-$ (B) $CH_3–C\equiv C–Mg^+Br^-$
(C) $HC\equiv C–CH_2–O–Et$ (D) Both (a) and (b)

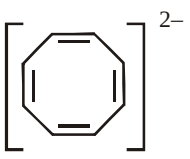
SECTION II: MORE THAN ONE OPTION CORRECT

864. Which of the following are aromatic:

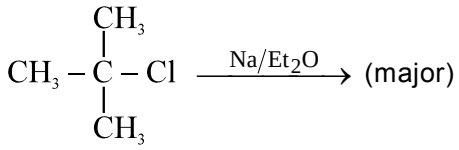
(A) 

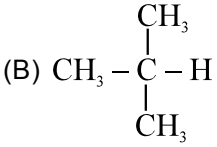
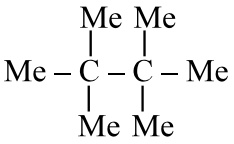
(B) 

(C) 

(D) 

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865. 

(A) 
(B) 
(C) 
(D) none of these

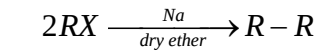
SECTION III: COMPRHENSIONS

ALKANES

COMPREHENSION # 101

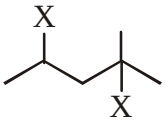
Paragraph for Questions Nos. 866 to 868

Alkanes can be prepared by Wurtz reaction, in which, alkyl halides are coupled each other with the help of metallic sodium is dry ether solvent, to give alkanes.



Due to elimination and rearrangement reactions, different byproducts are formed. Unsymmetrical alkanes can be prepared by this method, but practically it is very difficult to separate the individual alkane from the mixture of alkanes.

866. Which one of the following is correct for the following dihalide:



(A) intramolecular coupling alone take place
(B) extramolecular coupling alone take place
(C) intramolecular coupling dominates extramolecular coupling
(D) extramolecular coupling dominates intramolecular coupling

867. Identify the incorrect statement. In the stoichiometric Wurtz reaction on ethyl chloride.
(A) disproportionation of alkyl carbanion and alkyl halide take place.
(B) some sodium metal remains in the reaction mixture
(C) the byproducts dominate the chief product
(D) inter molecular hydrogenation take place

868. The intermediate in Wurtz reaction is:
(A) Carbanion
(B) Carbocation
(C) anion radical
(D) organo metallic compound

CatalyseR

COMPREHENSION # 102
Paragraph for Questions Nos. 869 to 871

Wurtz reacton involves the condensation of two molecules of alkyl halides in the presence of sodium and dry ether $R-X+2Na+X-R \xrightarrow{DryEehter} R-R+2NaX$

In this reaction small amount of alkene is also formed as by-product.

$$CH_3CH_2Br+CH_3CH_2Br \xrightarrow{Na/Dry\ ehter} CH_3-CH_2-CH_2-CH_3+CH_2=CH_2+\underbrace{CH_3-CH_3}_{\text{By-products}}$$

Tertiary alkyl halides do not give Wurtz reaction. Frankland reaction is similar but has similar but has certain advantages over Wurtz reaction. It is useful in the synthesis of symmetrical alkanes. Frankland reaction is shown by primary, secondary as well as tertiary alkyl halide.

Answer the following questions

869. Which of the following alkanes is not obtained from Wurtz reaction?

(A) Methane (B) Ethane (C) Propane (D) Butane

870. A mixture of ethyl iodide and methyl iodide is subjected to the Wurtz reaction. The products formed are:

(A) ethane (B) butane (C) propane (D) 2-methylpropane

871. The intermediate compound(s) formed in frankland reaction is/are:

(A) $RZnI_2$ (B) R_2Zn (C) RZnI (D) R_2ZnI

COMPREHENSION # 103
Paragraph for Questions Nos. 872 to 874

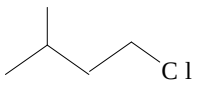
Chlorination on alkanes at below 300^0C

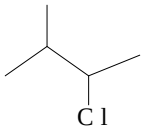
Reactivity order $3^0-H>2^0-H>1^0-H$

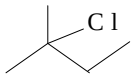
$4.5 : 3.25 : 1$

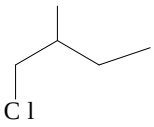
mono chlorination on 2-methyl butane

872. In the above reaction major product is

A) 

B) 

C) 

D) 

873. Number of isomers obtained in the above reaction

(A) 4 (B) 3 (C) 6 (D) 5

874. If chlorination takes place at '1' and '3' positions an 2-methyl butane simultaneously then how many optically active isomers are possible.

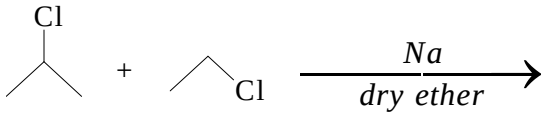
(A) 2 (B) 4 (C) 6 (D) 8

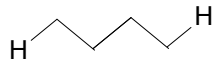
CatalyseR

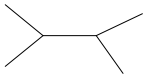
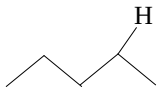
COMPREHENSION # 104
Paragraph for Questions Nos. 875 to 877

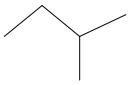
$$R - X \xrightarrow[dry\ ether]{Na} R - R + Na_X$$

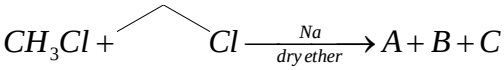
Mechanism is uncertain but explained by both ionic and free radical mechanism.

875. 

A) 

B) 
C) 

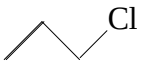
D) 

876. 

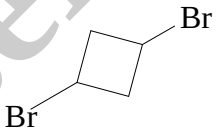
A, B, C are saturated hydrocarbons . Then *A, B, C* are

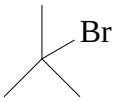
(A) Chain isomers (B) Positional isomers
(C) Homologous (D) Diastereomers

877. Which of the following reactant is not suitable for wurtz reaction

A) 

B) 

C) 

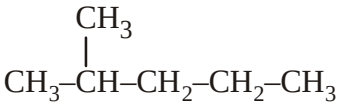
D) 

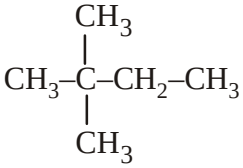
COMPREHENSION # 105
Paragraph for Questions Nos. 878 to 880

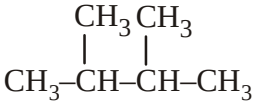
An alkane (A) molecular formula C_6H_{14} reacts with chlorine in the presence of ultra violet light to yield three isomeric monochloro derivatives (B) , (C) and (D) . Of these only (C) and (D) undergo dehydrohalogenation with sodium ethoxide in ethanol to produce an alkene . Moreover (C) and (D) yields the same alkene (E) (C_6H_{12}) . Hydrogenation of (E) produces (A) . Treating (E) with HCl produces a compound (F) that is an isomer of (B) , (C) and (D) . Treating (F) with Zn and acetic acid gives a compound (G) , which is isomeric with (A). Propose structures for (A) to (G) .

878. The structure of A is

(A) $CH_3–CH_2–CH_2–CH_2–CH_2–CH_3$

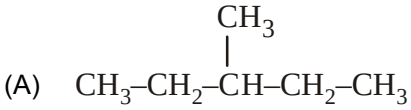
(B) 

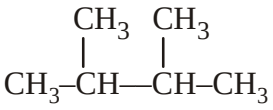
(C) 

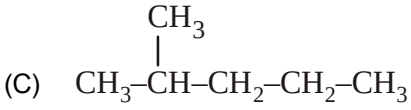
(D) 

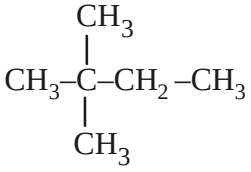
CatalyseR

879. The structure of G is

(A) 

(B) 

(C) 

(D) 

880. The compound (F) on treatment with alcoholic KOH, the major product obtained is

(A) 1-hexene (B) 2,3-dimethyl-2-butene

(C) 2,3-dimethyl-1-butene (D) 3-hexene

COMPREHENSION # 106

Paragraph for Questions Nos. 881 to 883

Alkanes are the saturated hydrocarbons. They are represented by a general formula C_nH_{2n+2} (n = 1, 2.....). They can be synthesized by different methods. One of the important method of formation is Corey-House synthesis. In this process when alkyl halide is treated with lithium, it forms alkyl lithium. Alkyl lithium on treatment with cuprous halide the formation of lithium dialkyl cuprate takes place. When it is treated with another alkyl halide or same alkyl halide, an alkane formation takes place. The reactions are as follows **:**

$$R{-}X + Li \longrightarrow RLi + LiX$$

$$2RLi + CuX \longrightarrow R_2CuLi + LiX$$

$$R_2CuLi + R'X \longrightarrow \underset{\text{Alkane}}{R{-}R'} + RCu + LiX$$

And in case of Wurtz reaction when alkyl halide (RX) is treated with sodium in presence of dry ether it gives the formation of alkane.

$$2RX + Na \xrightarrow[\text{Ether}]{\text{Dry}} R{-}R + 2NaX.$$

881. In Corey house reaction the yield of R–R' by raction of R'–X with R_2CuLi is in the following order

(A) Primary > Secondary > Tertiary (B) Tertiary > Secondary > Primary

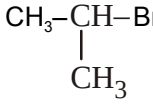
(C) Secondary > Primary > Tertiary (D) Secondary > Tertiary > Primary

882. In case of Wurtz reaction which alkyl halide gives maximum yield of alkane?

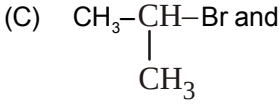
(A) Isopropyl bromide (B) Methyl bromide

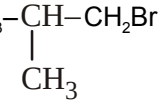
(C) Tert-butyl bromide (D) Ethyl bromide

883. To form the isopentane which of the following alkyl halides should be used in Corey house synthesis (RX) and (R'X) respectively as shown above **:**

(A) Both 

(B) CH_3Br and $CH_3CH_2CH_2CH_2Br$

(C) 

(D) 

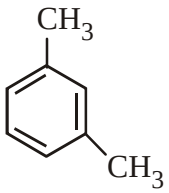
Catalyser

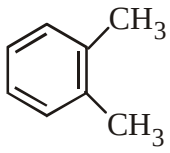
COMPREHENSION # 107

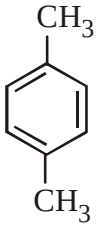
Paragraph for Questions Nos. 884 to 886

Two unknown compounds (A & B) have same molecular formula C_4H_9Br which give n-butane on reaction with Zn-Cu/EtOH

884. The compound A on wurtz reaction gives a linear hydrocarbon (X) which on further reaction with Cr_2O_3/Al_2O_3 gives an hydrocarbon that has octane number more than 100. The compound is:

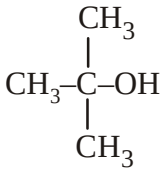
(A) 

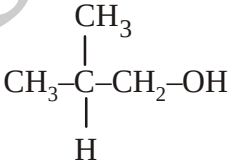
(B) 

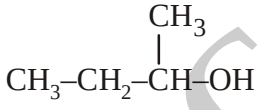
(C) 

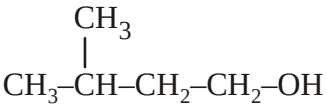
(D) 

885. The compound A $\xrightarrow{LiAlH_4}$ C $\xrightarrow{AlCl_3}$ D $\xrightarrow[H^+]{KMnO_4}$ E. The structure of E is:

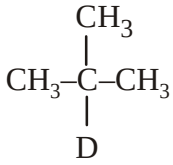
(A) 

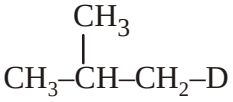
(B) 

(C) 

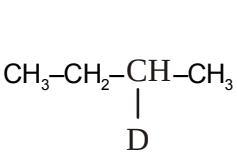
(D) 

886. The compound B $\xrightarrow[Et_2O]{Mg}$ Y $\xrightarrow{D_2O}$ Z. The compound Z is

(A) 

(B) 

(C) $CH_3–CH_2–CH_2–CH_2–D$

(D) 

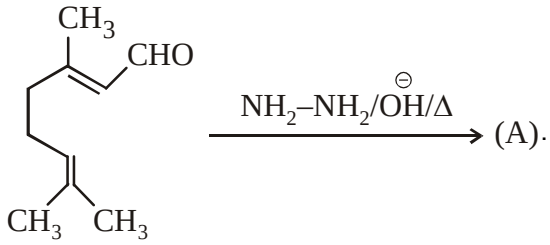
CatalyseR

ALKENES

COMPREHENSION # 108

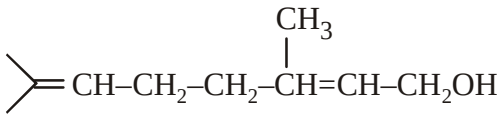
Paragraph for Questions Nos. 887 to 889

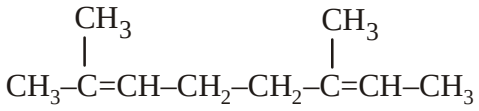
Citral is unsaturated aldehyde found in lemon oil. Fragrance of citral leaves and fruits is due to the presence of this compound.

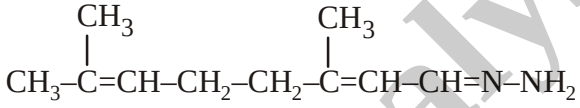
887. 

Citral

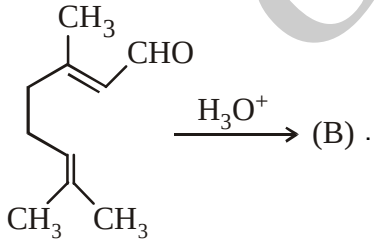
The product (A) is :

(A) 

(B) 

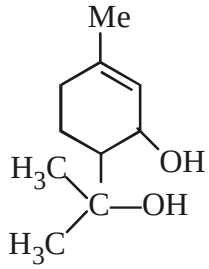
(C) 

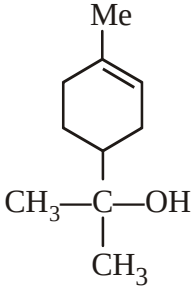
(D) 

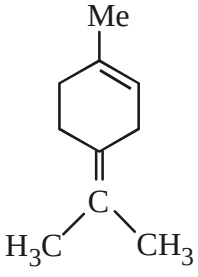
888. 

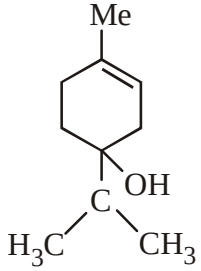
Citral

The product (B) is :

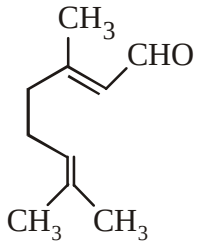
(A) 

(B) 

(C) 

(D) 

CatalyseR

889.  $\xrightarrow{KMnO_4 / H^{\oplus}}$ products .The product(s) is/are :

Citral

(A) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-OH$

(B) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

(C) CO_2

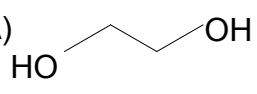
(D) All of these

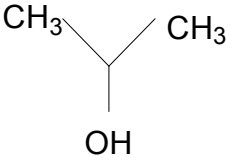
COMPREHENSION # 109

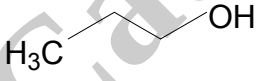
Paragraph for Questions Nos. 890 to 892

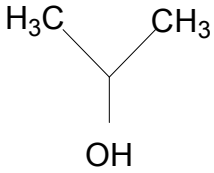
Alkenes can be oxidized in the presence of different reagents to give different products. Alkenes on oxidation in presence of silver at high temperature give cyclic ethers, which also can be synthesized by using per acids Alkenes on reductive ozonolysis give carbonyl compounds in presence of Zinc and H_2O_2. On reaction with acidic $KMnO_4$, it also produces corresponding Carbonyl compound. Alkynes can be also oxidized in presence of such reagents but the products are different.

890. Ethylene on reaction with mCPBA(m-chloro per Benzoic acid) in $CH_2C\ell_2$ forms a compound (X), which on reaction with CH_3MgI and subsequent Hydrolysis gives a compound (Y). (X) and (Y) are respectively

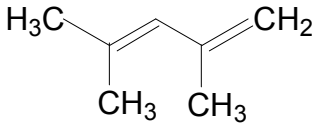
(A)  and 

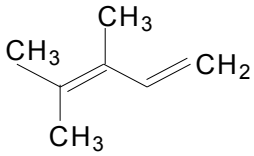
(B)  and 

(C)  and 

(D) H_3C - CHO and 

891. An open chain Hydrocarbon (C_7H_{12}) on ozonolysis produces propanone ; methanal and – oxo – propanal. The Hydrocabon could be 2

(A) 

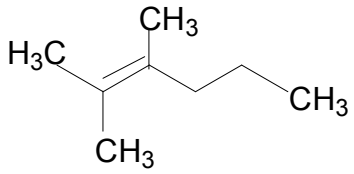
(B) 

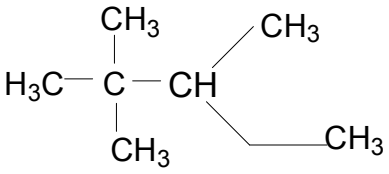
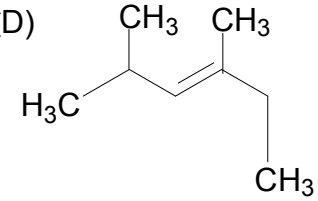
(C) Either of these

(D) CH_3-CH_2COOH

Catalyser

892. A Hydrocarbon (C_8H_{16}) on oxidation with a hot acidified solution of $KMnO_4$ forms 2-Butanone and Isobutyric acid as a product. The Hydrocarbon is

(A) $(CH_3)_2 C = C (CH_2 CH_{3)2}$ (B) 

(C)  (D) 

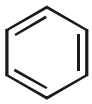
COMPREHENSION # 110

Paragraph for Questions Nos. 893 to 895

An alkene (A) on oxidation with $K_2Cr_2O_7/H_2SO_4$ gives only two moles of gas (X), which turns lime water milky.

893. The 'A' can be:

(A) $H_2C=CH_2$ (B) $CH_2=CH–CH=CH_2$

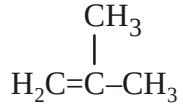
(C)  (D) $CH_2=CH–CH_2–CH=CH_2$

894. 'B' that is next homologous of 'A'. The product/s on oxidation of 'B' are:

(A) Acetic acid (B) Acetic acid and formic acid

(C) Acetone and acetic acid (D) Acetic acid/ CO_2

895. The compound 'C' is the just higher homologous of 'B' but on oxidation does not evolve CO_2. The 'C' is

(A) $H_3C–CH=CH–CH_3$ (B) 

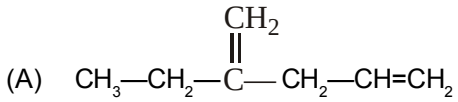
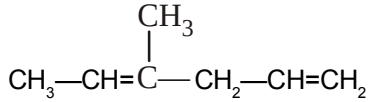
(C) $H_2C=CH–CH_2–CH_3$ (D) None of these

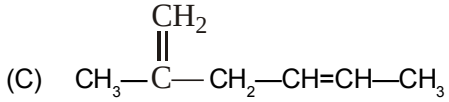
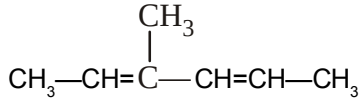
COMPREHENSION # 111

Paragraph for Questions Nos. 896 to 898

An unsaturated hydrocarbon A (C_7H_{12}) absorbs 2 molecule of hydrogen when hydrogenated. On oxidation it gives one molecule each of acetic acid, and acetoacetic acid and on reduction give 2-methylhexane :

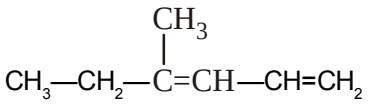
896. The structure of A:

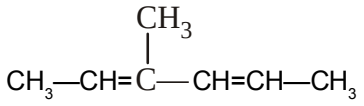
(A)  (B) 

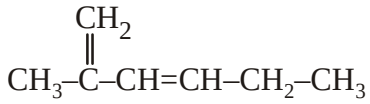
(C)  (D) 

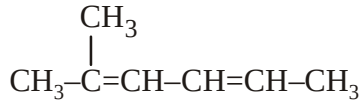
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897. The compound A on heating produces a more stable compound:

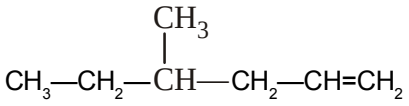
(A) 

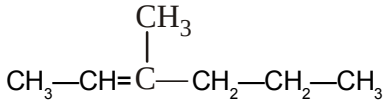
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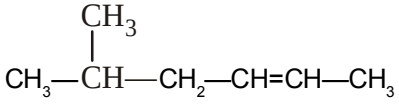
(C) 

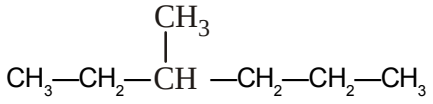
(D) 

898. The A on Birch Reduction with Na/Lq.NH_3 gives:

(A) 

(B) 

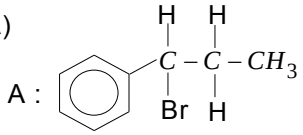
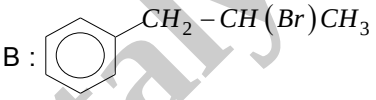
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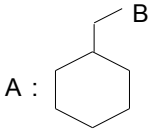
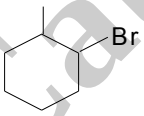
(D) 

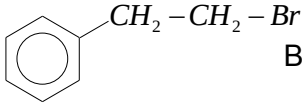
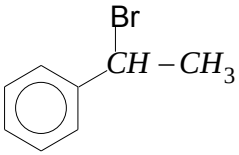
COMPREHENSION # 112
Paragraph for Questions Nos. 899 to 901

Dehydrobromination of (A) & (B) gives same alkene (C). Alkene (C) can regenerate (A) & (B) by the addition of HBr in presence & absence of peroxide respectively. 1, 1 – diphenyl ethane is obtained on reaction of (C) with benzene in the presence of H^+ ions.

899. Compound 'A' & 'B' are

(A) A :  B : 

(B) A :  B : 

(C) A :  B : 

(D) None

900. Hydrolysis of (A) & (B) gives isomeric products (D) & (E). Which of the following statement for D & E is not true ?

(A) Both D & E gives iodoform test
(B) Both D & E gives same alkene upon dehydration
(C) Both D & E reacts with NaOH
(D) None of these

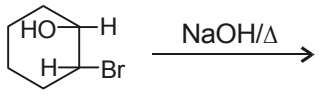
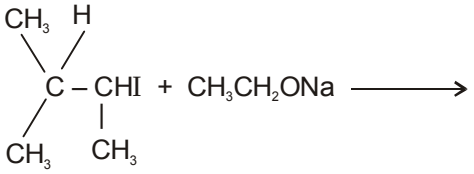
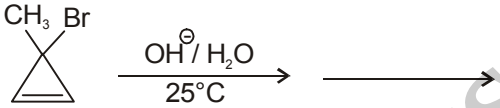
901. A when treated with NBS & then with $NaNH_2$ gives (X), when (X) is reacted with H_2O / H^+ it gives :-

(A) Phenol (B) Acetophenone (C) Benzoic acid (D) None of these

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SECTION IV: MATCH THE FOLLOWING

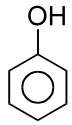
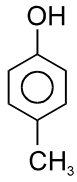
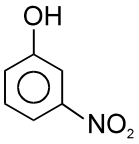
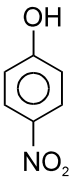
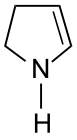
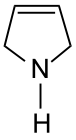
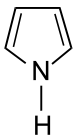
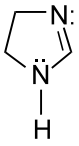
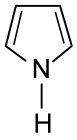
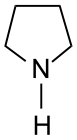
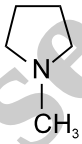
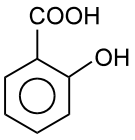
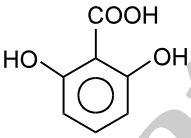
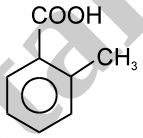
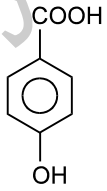
902. Match the reactions with their mechanism types

	List - I	List - II
(a)	$CH_3COCl + NaOH \xrightarrow{25°C}$	(P) S_N1 reaction
(b)		(Q) E2 reaction
(c)		(R) S_N2 (NGP)
(d)		(S) S_N2 (tetrahedral intermediate)

Ans. a → S b → R c → Q d → P

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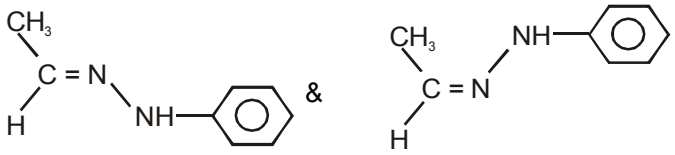
903. Match the following compounds.

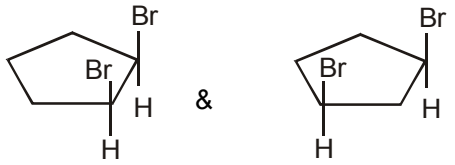
	Column - A				Column - B
	I	II	III	IV	
(A)					(P) II > I > III > IV (Acid strength)
(B)					(Q) I > III > IV > II (Basic strength)
(C)					(R) II > IV > I > III (Basic strength)
(D)					(S) IV > III > I > II (Acid strength)

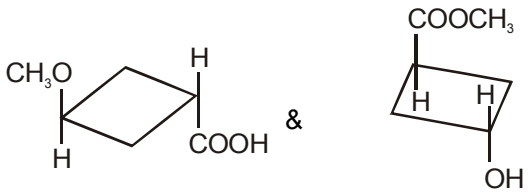
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904. Match the following :

Identify the relationship between following pairs and match for the correct option in next column.

(a)  (P) Functional

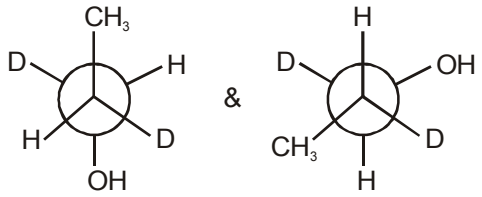
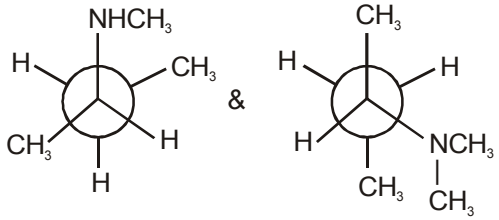
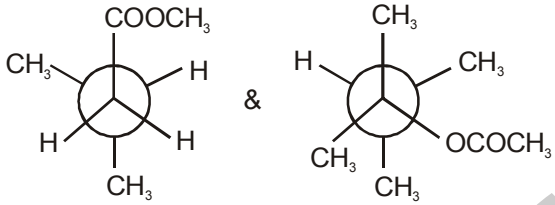
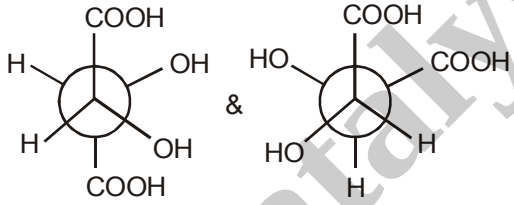
(b)  (Q) Position

(c)  (R) Geometrical

(d)  (S) Metamers

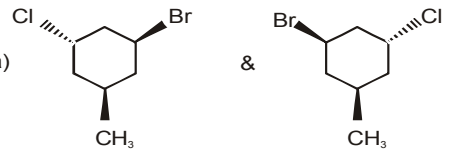
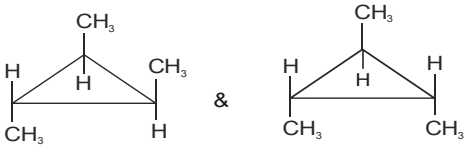
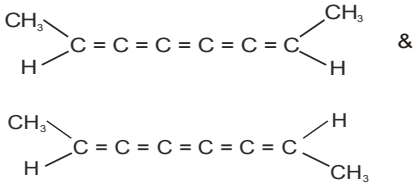
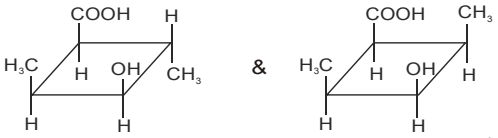
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905. Match the following

Column I	Column II
(a) 	(P) Configurational Diastereomer
(b) 	(Q) Homologs
(c) 	(R) Configurational Enanatiomer
(d) 	(S) Metamers

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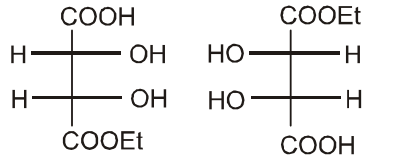
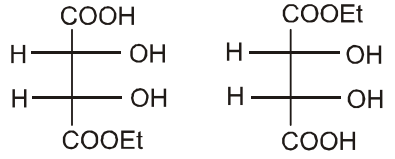
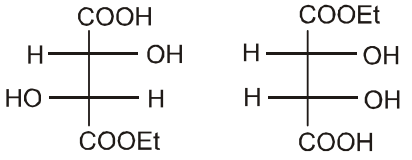
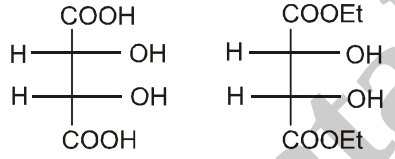
906.

Column - I	Column - II
(a) 	(P) Optical isomers only
(b) 	(Q) identical
(c) 	(R) Geometrical isomers only
(d) 	(S) Both optical and geometrical

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Match the following

907. Match the relationship and properties of the compounds of different pairs given in column I. Only one option of 'I' matches with one option of II and III.

(I) Compounds	(II) Relationship	(III) Properties
(A) 	(J) Enantiomers	(P) These are superimposable over each other
(B) 	(K) Optical Diastereomers	(Q) These have identical density but are nonsuperimposable over each other
(C) 	(L) Meso Compounds	(R) Thse have different value (magnitude) of optical rotation
(D) 	(M) Identical Compounds	(S) Each one of these have two similar chiral centres

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907. Nature of mechanism in terms of unknown A, B, C, D

Column I		Column II	
(a)	$CH_3Cl \xrightarrow{A} CH_3OH$	(P)	S_N1
(b)	$(CH_3)_3CCl \xrightarrow{B} (CH_3)_3C–OH$	(Q)	E_2
(c)	$CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–\underset{\displaystyle Br}{\underset{\vert}{CH_2}} \xrightarrow{C} CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{C}}=CH–CH_3$	(R)	S_N2
(d)	$CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–\underset{\displaystyle Br}{\underset{\vert}{CH_2}} \xrightarrow{D} \underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH=CH_2$	(S)	E_1

XII:

SECTION I: SINGLE OPTION CORRECT

908. A basic substance, A(C_7H_9N), reacts with sodium nitrite and hydrochloric acid at 0ºC to give a salt, B ($C_7H_7ClN_2$). When a solution of B in dilute hydrochloric acid was heated with aqueous copper (I) cyanide and potassium cyanide, a product was obtained which upon complete hydrolysis gave an acid, C($C_8H_8O_2$). This acid could be oxidized to another acid which, on heating, formed an anhydride, D($C_8H_4O_3$). Compound A is:

(A) benzylamine (B) p-toluidine

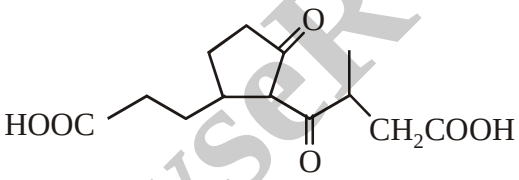
(C) mono-methylaniline (D) o-toludine

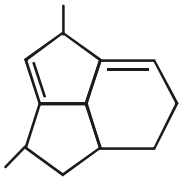
909. Vinyl methyl ether reacts with Cl_2 water. The main product obtained in this reaction is

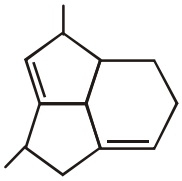
(A) $CH_2(OH)-CH(Cl)-OCH_3$ (B) $ClCH_2-CHO$

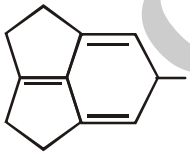
(C) $CH_2-CH(-O-)-OCH_3$ (D) CH_3-CHO

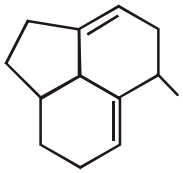
910. Which molecule will give the following decarboxylic acid upon treatment with acidic solution of $KMnO_4$?



(A) 

(B) 

(C) 

(D) 

911. The reaction conditions leading to best yields of $Br - CH_2 - CH = CH_2$ is :

(A) $CH_3 - CH = CH_2 + Br_2/CCl_4 \xrightarrow{h\nu}$

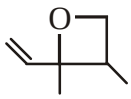
(B) $CH_3 - CH = CH_2 + Br_2 \xrightarrow[\text{vapourphase}]{h\nu}$

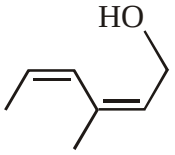
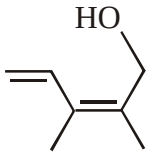
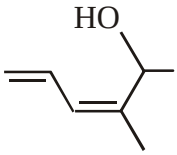
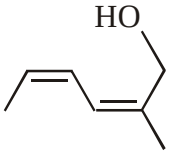
(C) $CH_3 - CH = CH_2 + Br_2 \xrightarrow[\text{vapour phase}]{\text{high temp.}}$

(D) $CH_3 - CH = CH_2 + Br_2/CCl_4 \xrightarrow{Fe}$

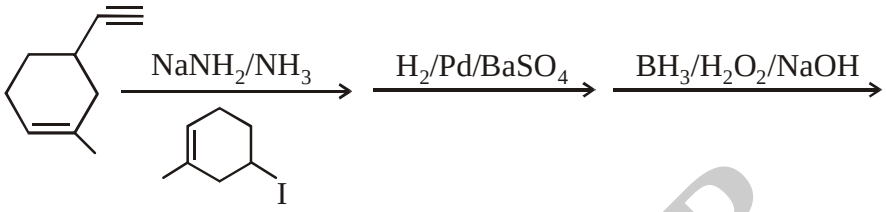
CatalyseR

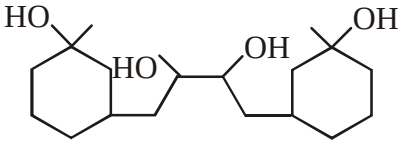
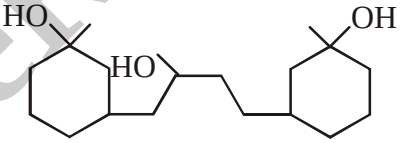
912. When treated with acid, the strained ether shown below is protonated on oxygen, and ring opens to give a resonance-stabilized carbocation. Which diene listed below when treated with acid will give the same carbocation.

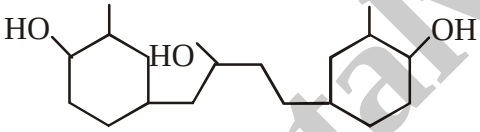
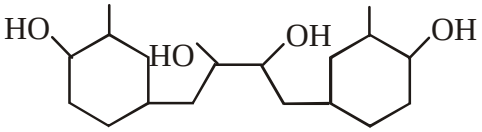


(A)  (B)  (C)  (D) 

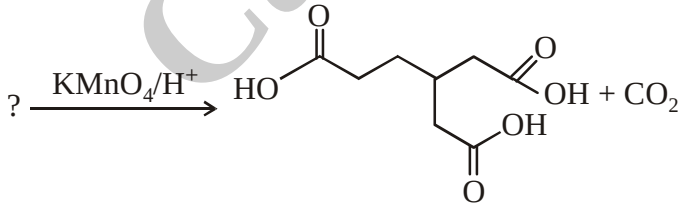
913. What is the product of the following sequence of reaction?

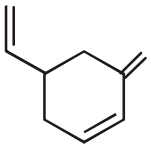
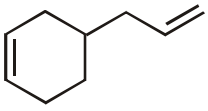


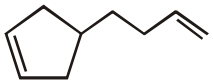
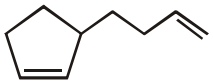
(A)  (B) 

(C)  (D) 

914. Which of the following compounds was the starting material for the oxidation shown below?

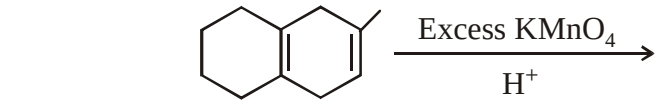


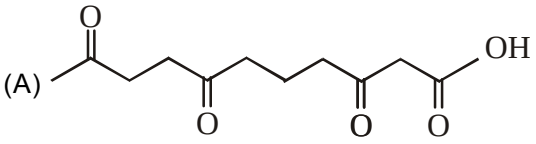
(A)  (B) 

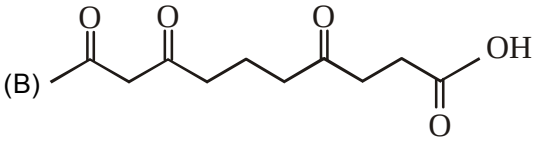
(C)  (D) 

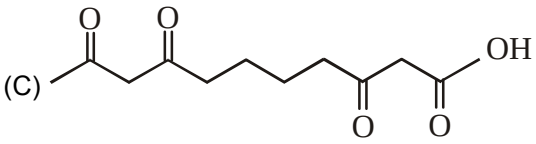
CatalyseR

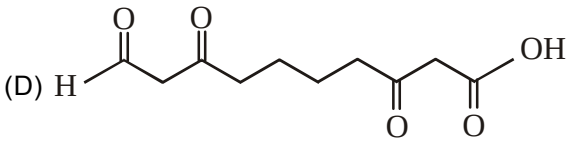
915. What is the final product of the following reaction?



(A) 

(B) 

(C) 

(D) 

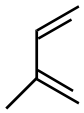
916. The major product on debromination of 1, 2, 3 – Tri bromopropane with alcoholic KOH is :

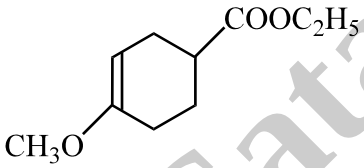
(A) $CH_2 = \underset{\displaystyle Br}{\underset{|}{C}} - \underset{\displaystyle Br}{\underset{|}{CH_2}}$

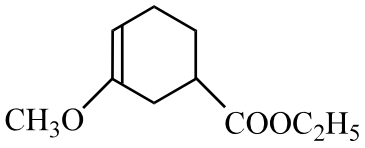
(B) $\underset{\displaystyle Br}{\underset{|}{CH}} = CH - \underset{\displaystyle Br}{\underset{|}{CH_2}}$

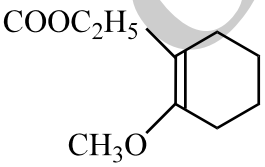
(C) $CH_2 = C = CH - Br$

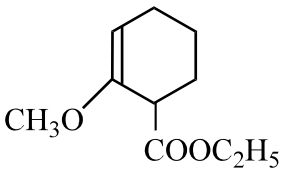
(D) $\underset{\displaystyle OH}{\underset{|}{CH_2}} - \underset{\displaystyle OH}{\underset{|}{CH}} - \underset{\displaystyle OH}{\underset{|}{CH_2}}$

917. CH_3O  $+ CH_2 = CH - COOC_2H_5 \longrightarrow$ The major product is:

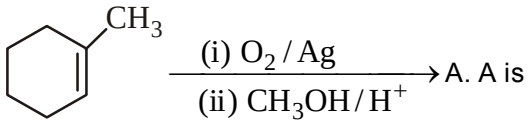
(A) 

(B) 

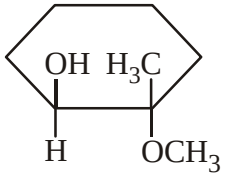
(C) 

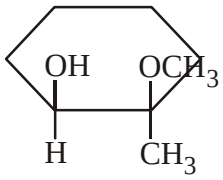
(D) 

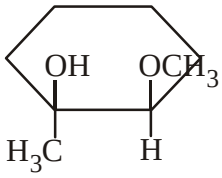
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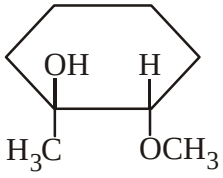
918. 

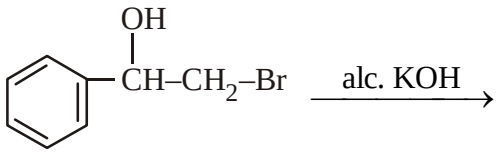
A. A is

(A) 

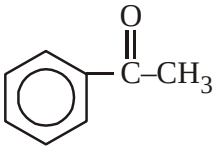
(B) 

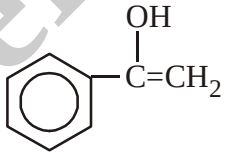
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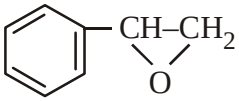
(D) 

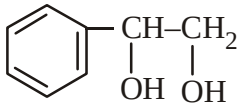
919. 

The product is

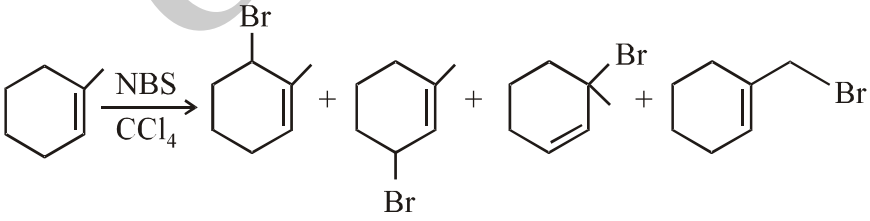
(A) 

(B) 

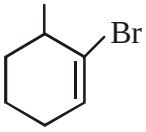
(C) 

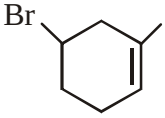
(D) 

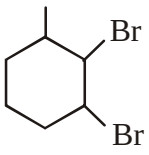
920. Consider the following reaction of 1-methyl cyclohexene with NBS. Four likely products of the reaction are shown below. One of the likely products is not shown, however.

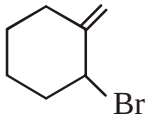


Which of the following is the missing product?

(A) 

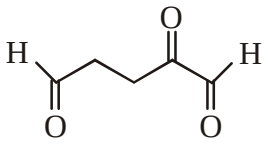
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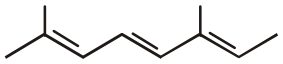
(C) 

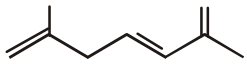
(D) 

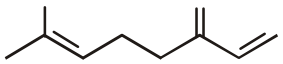
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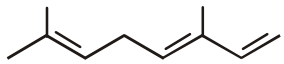
921. Compound X on catalytic hydrogenation gives 2,6-dimethyloctane. On ozonolysis followed by treatment with $Zn–H_2O$, X yields formaldehyde, acetone and a dialdehyde shown below. The most likely structure of starting compound X is:



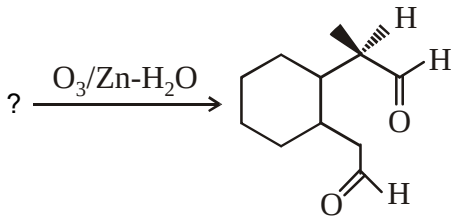
(A) 

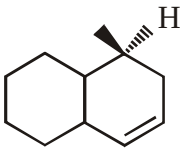
(B) 

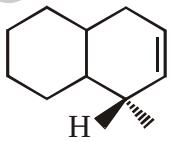
(C) 

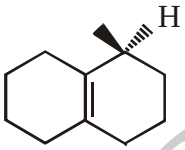
(D) 

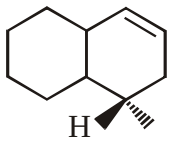
922. Select the best starting material for the following reaction:



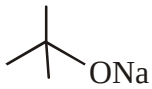
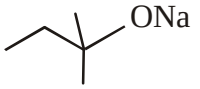
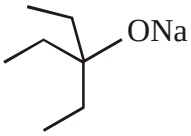
(A) 

(B) 

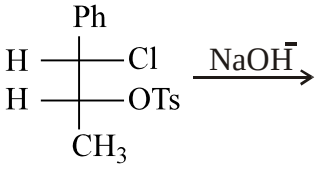
(C) 

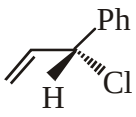
(D) 

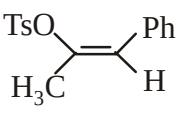
923. When 2-bromo-2, 3-dimethylbutane reacts with any of the bases shown below under E_2 conditions, two alkenes are produced: 2,3-dimethyl-1-butene and 2,3-dimethyl-2-butene. Which one of the above base would produce the highest yield of 2,3-dimethyl-butene?

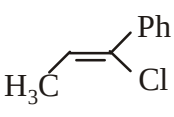
(A) CH_3CH_2ONa (B)  (C)  (D) 

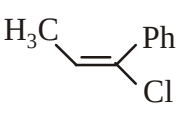
924. Which will be the major product of the following:



(A) 

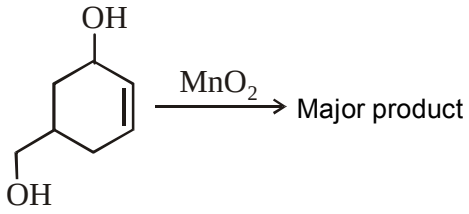
(B) 

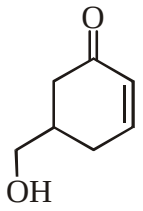
(C) 

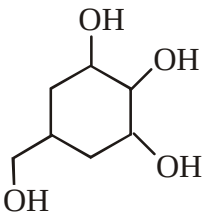
(D) 

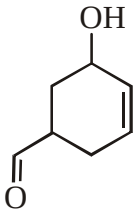
CatalyseR

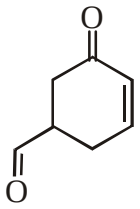
925. Give the major product of the following reaction:



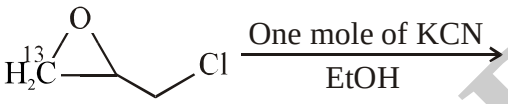
(A) 

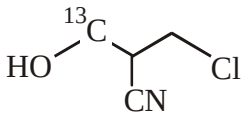
(B) 

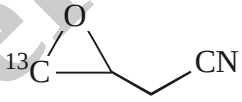
(C) 

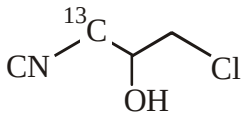
(D) 

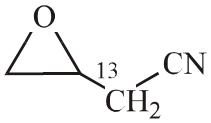
926. If the following *C labelled compound undergo the following reaction, which product would be obtained.



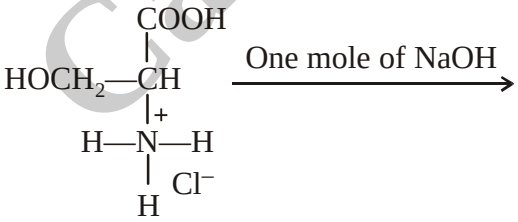
(A) 

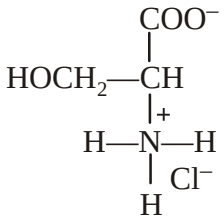
(B) 

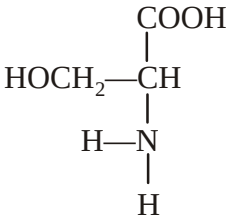
(C) 

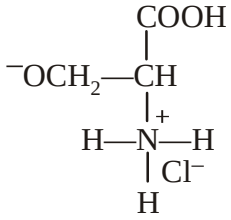
(D) 

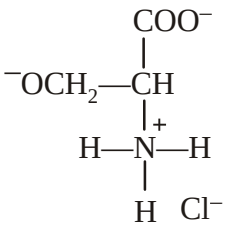
927. What is the major product from the following reaction?



(A) 

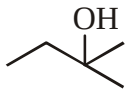
(B) 

(C) 

(D) 

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928. Which of the following is (are) not a feasible Grignard synthesis:

(i) $CH_3CH_2COOCH_3 + CH_3MgBr \xrightarrow{H_3O^+}$ 

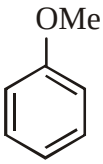
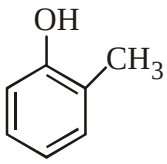
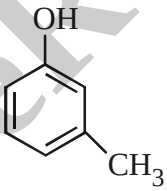
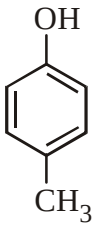
(ii) $HC\equiv C—CH_2CHO + CH_3MgBr \xrightarrow{H_3O^+} HC\equiv C—CH_2CH(OH)CH_3$

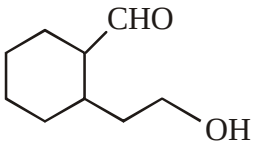
(iii) $CH_3CH(Cl)CH_2CHO + CH_3MgBr \xrightarrow{H_3O^+} CH_3CH(Cl)CH_2CH(OH)CH_3$

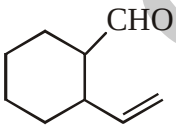
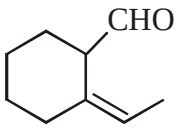
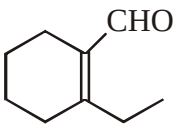
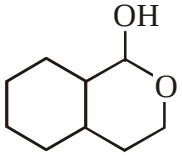
(iv)  $+ CH_3MgBr \xrightarrow{H_3O^+} CH_3CH_2CH_2OH$

(A) (i), (ii) (B) (i), (iii) (C) (ii), (iii) and (iv) (D) (ii) and (iii)

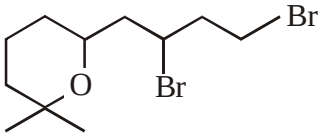
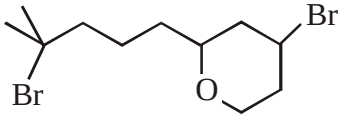
929. A compound X(C_7H_8O) is is insoluble in water, dilute HCl and aqueous $NaHCO_3$ but dissolve in dilute NaOH. When X is treated with bromine-water, it is converted into a compuond of formula, $C_7H_5OBr_3$. Compund X is:

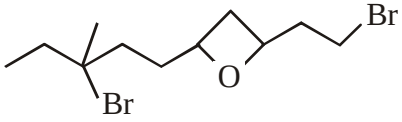
(A)  (B)  (C)  (D) 

930.  Major

(A)  (B)  (C)  (D) 

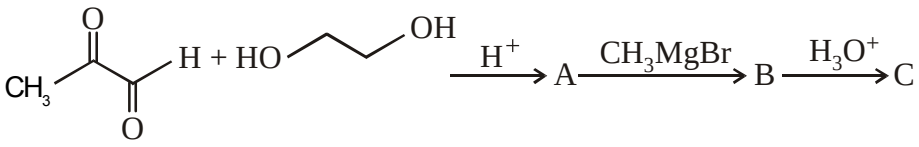
931. When 1,3,9-tribromo-9-methyl-5-decanol is treated with a strong base, the major product will be?

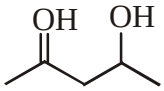
(A)  (B) 

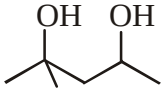
(C)  (D) None

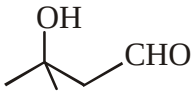
CatalyseR

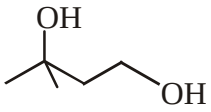
932. What is the product, C of the following sequence of reactions?



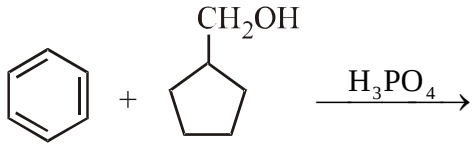
(A) 

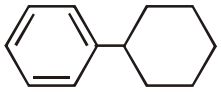
(B) 

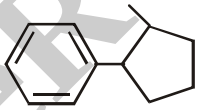
(C) 

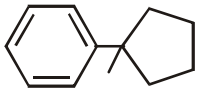
(D) 

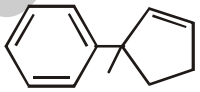
933. Give the major product of the following reaction:



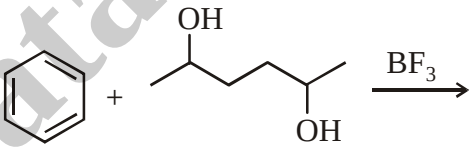
(A) 

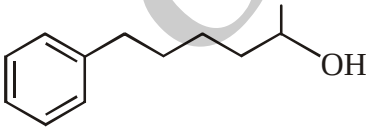
(B) 

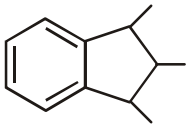
(C) 

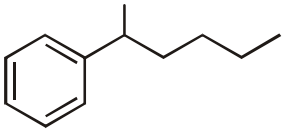
(D) 

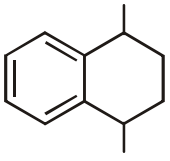
934. Give the major product of the following reaction:



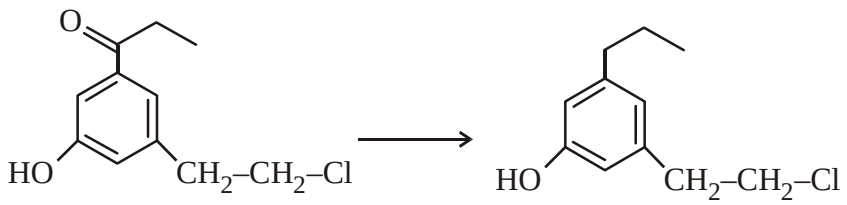
(A) 

(B) 

(C) 

(D) 

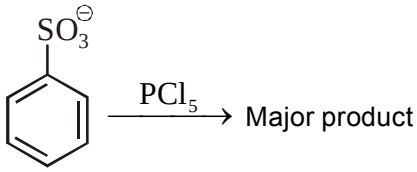
935. Which of the following reagent should not be used for the following conversion

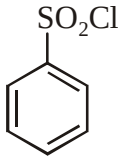


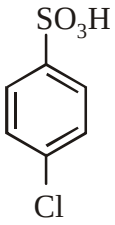
(A) Zn–Hg/HCl
(B) NH_2–NH_2/OH^-
(C) P + HI
(D) All of these

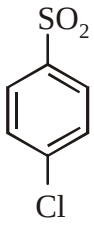
CatalyseR

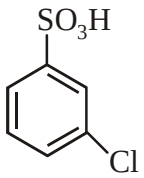
936. Give the major product of the following reaction:



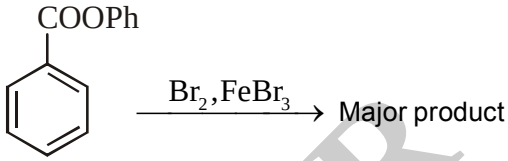
(A) 

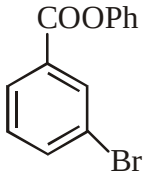
(B) 

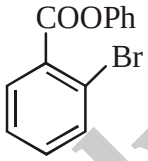
(C) 

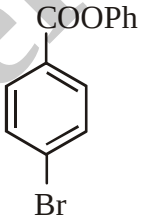
(D) 

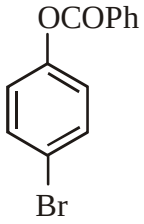
937. Give the major product of the following reaction:



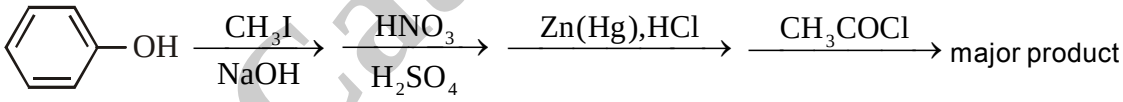
(A) 

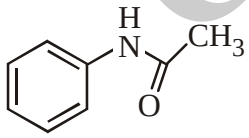
(B) 

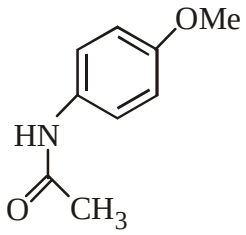
(C) 

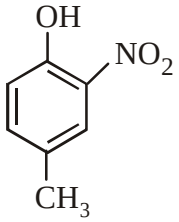
(D) 

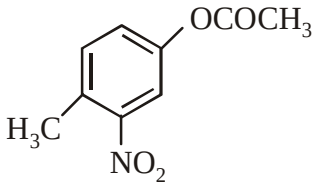
938. Give the major product from the following reaction sequence:



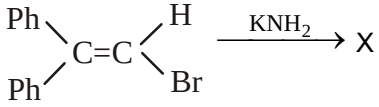
(A) 

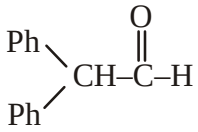
(B) 

(C) 

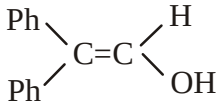
(D) 

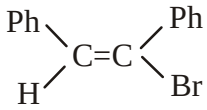
CatalyseR

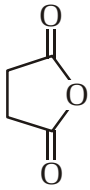
939. 

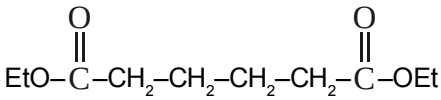
(A) 

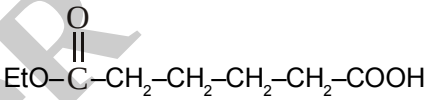
(B) Ph–C≡C–Ph

(C) 

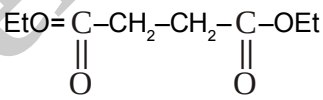
(D) 

940.  + EtOH $\xrightarrow{\Delta}$? $\xrightarrow{e^-}$? The final proudct is:

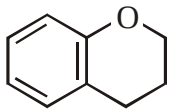
(A) 

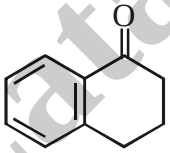
(B) 

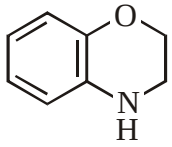
(C) $CH_2=CH_2$

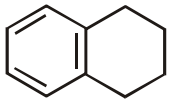
(D) 

941. Rank the following compunds in decreasing order of reactivity in electrophilic aromatic substitution reaction:–

(I) 

(II) 

(III) 

(IV) 

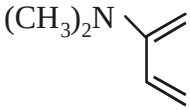
(A) IV > I > III > II

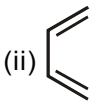
(B) III > I > IV > II

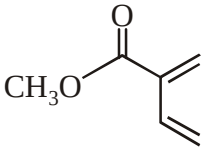
(C) I > III > IV > II

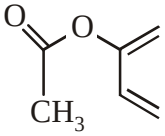
(D) III > II > I > IV

942. Increasing rate of reaction in a Diels-Alder reaction

(i) 

(ii) 

(iii) 

(iv) 

(A) iii < ii < iv < i

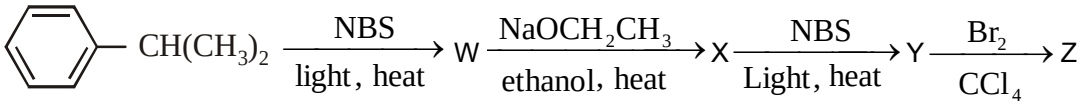
(B) ii < i < iv < iii

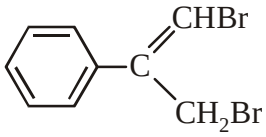
(C) i < iv < iii < ii

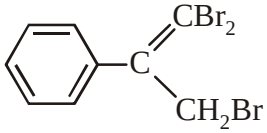
(D) iv < iii < ii < i

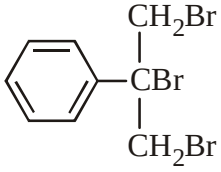
CatalyseR

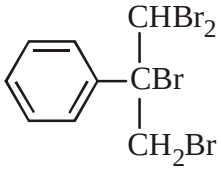
943. What is compound Z?



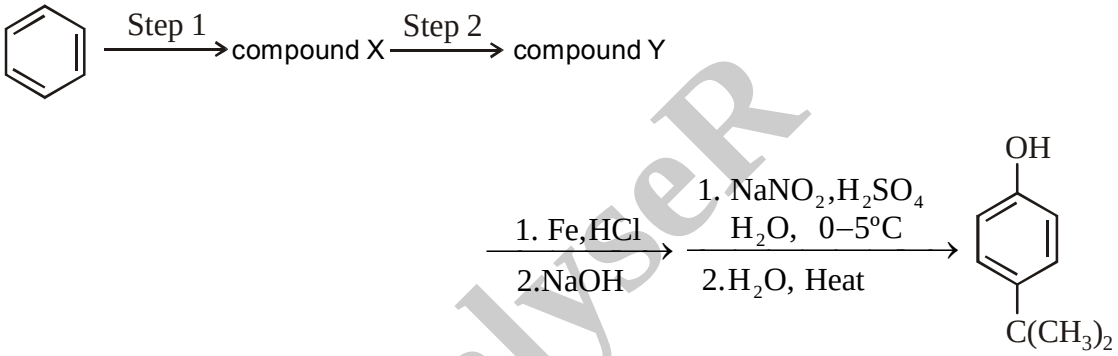
(A) 

(B) 

(C) 

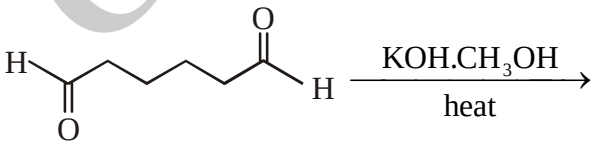
(D) 

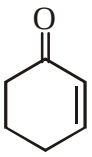
944. Which reagent is best suited for step 1 in the synthesis shown?

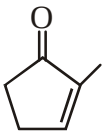


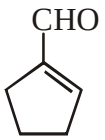
(A) A mixture of HNO_3 and H_2SO_4
(B) $(CH_3)_3CCl$, $AlCl_3$
(C) Br_2, $FeBr_3$
(D) N-bromosuccinimide, benzoyl peroxide, CCl_4, heat

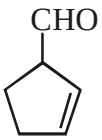
945. What is the product of the following intramolecular aldol condensation reaction?



(A) 

(B) 

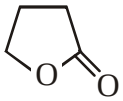
(C) 

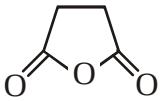
(D) 

946. Which one of the following reacts with ammonia at the fastest rate?

(A) 

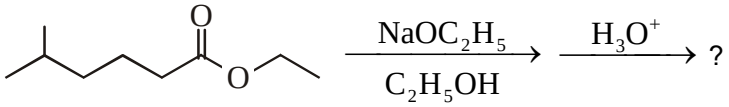
(B) 

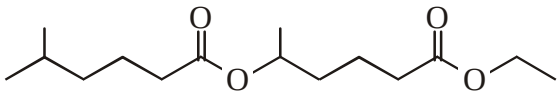
(C) 

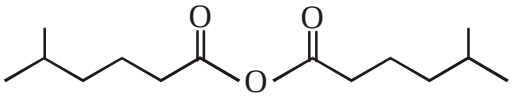
(D) 

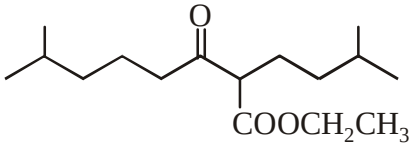
CatalyseR

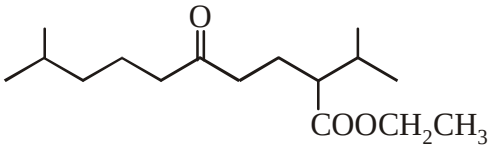
947. What is the major product of the following reaction?



(A) 

(B) 

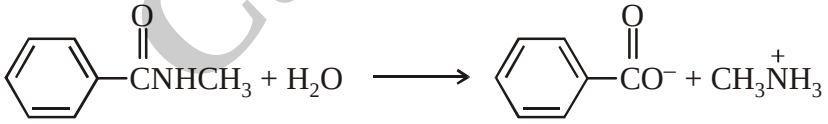
(C) 

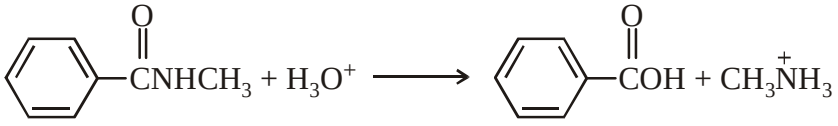
(D) 

948. Which balanced equation best describes the hydrolysis of the compound shown? The reaction is carried out at a pH of 2.

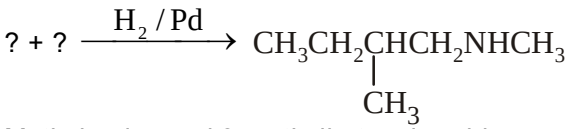
(A) 

(B) 

(C) 

(D) 

949. Which pair of reagents would be used to make the following amine by reductive amination?



(A) Methylamine and 2-methylbutanoic acid
(B) Methylamine and 2-methylbutanal
(C) Ammonia and 3-methyl-2-pentanone
(D) dimethylamine and 2-butanone

CatalyseR

950. Which of the following synthetic routes gives the best yield of meta-bromoaniline starting with benzene?

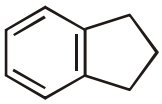
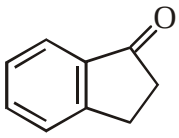
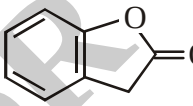
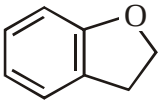
(A) Benzene $\xrightarrow[FeBr_3]{Br_2} \xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[(2)\ NaOH]{(1)\ Sn,\ HCl}$

(B) Benzene $\xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[(2)\ NaOH]{(1)\ Sn,\ HCl} \xrightarrow[FeBr_3]{Br_2}$

(C) Benzene $\xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[FeBr_3]{Br_2} \xrightarrow[(2)\ NaOH]{(1)\ Sn,\ HCl}$

(D) Benzene $\xrightarrow[(2)\ NaOH]{(1)\ Sn,\ HCl} \xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[FeBr_3]{Br_2}$

951. Which of the following undergoes electrophilic aromatic substitution at the fastest rate?

(A)  (B)  (C)  (D) 

SECTION II: MORE THAN ONE OPTION CORRECT

952. In which of the following compounds formation of diazocompound is not possible

(A) $C_6H_5NH_2$ (B) $C_6H_4(NH_2)(CH_3)$

(C) $C_6H_5CH_2NH_2$ (D) $C_6H_5N(CH_3)_2$

953. Diazomethane reacts with

(A) RCOOH (B) RCH_2OH in presence of HBF_4

(C) C_6H_5OH in presence of NaOH (D) Alkenes

954. Which of the following polymers are used as fuels in rocket propellents:

(A) Acrylic rubber (B) Chloroprene (C) Polybutadiene (D) Polyurethane

955. Which of the following carbohydrates on treatment with excess of phenylhydrazine gives same osazone

(A) Glucose (B) nannose (C) fructose (D) Galactose

956. Which are generally used for preparing derivative of aldehydes and ketones.

(A) hydroxylamine hydrochloride (B) 2,4-dinitrophenylhydrazine

(C) Phenylhydrazine hydrochloride (D) hydrogen cyanide

957. P-chloro anilline and anillinium hydrochloride can be distinguished by

(A) Carbylamine test (B) $NaHCO_3$

(C) $AgNO_3$ (D) Sandmeyers reaction

958. A new carbon-carbon bond formation is possible in:

(A) Cannizaro's reaction (B) Friedel-Crafts alkylation

(C) Clemmenson reduction (D) Riemer Tiemann reaction

CatalyseR

959. When methyl Iodide is treated with ammonia, the product obtained is
(A) Methyl amine (B) Dimethyl amine (C) Trimethylamine (D) None

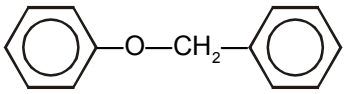
960. Which of the following are hydroxy acids
(A) Lactic acid (B) Tartaric acid (C) Citric acid (D) Succinic acid

961. Carboxylic acids can be directly reduced to primary alcohols by
(A) $LiAlH_4$ (B) $Na + C_2H_5OH$ (C) $NaBH_4$ (D) H_2

962. A mixture of calcium acetate and calcium formate are heated then they yield
(A) Acetone (B) Acetaldehyde (C) formic acid (D) Acetic acid

963. Which will under go aldol condensation?
(A) Acetaldehyde (B) Propanaldehyde
(C) Benzaldehyde (D) Trideutroacetaldehyde

964. For acetone and aldehyde which of the followning statements are true.
(A) Both react with HCN (B) Both gives Iodoform test
(C) Both react with NaOH to give polymer (D) Both can be reduced to alcohols

965. When  treated with HI produces
(A) $C_6H_5CH_2I$ (B) C_6H_5OH (C) C_6H_5I (D) $C_6H_5CH_2OH$

966. Ethyl alcohol on oxidation with $K_2Cr_2O_7$ gives
(A) Formic acid (B) Formaldehyde (C) Acetic acid (D) Acetaldehyde

967. When ethyl bromide reacts with alcoholic $AgNO_2$ it yields
(A) Ethane (B) Ethene (C) nitroethane (D) Ethylnitrite

968. Which of the following are organo metallic compound?
(A) $CH{\equiv}CNa$ (B) C_2H_5SNa (C) C_2H_5MgI (D) C_2H_5ONa

969. The reaction of the following with I_2/NaOH gives yellow precipitate
(A) $ICH_2COCH_2CH_3$ (B) $CH_3COOCOCH_3$
(C) CH_3CONH_2 (D) $CH_3CH(OH)CH_2CH_3$

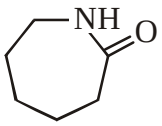
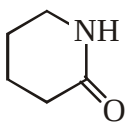
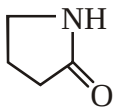
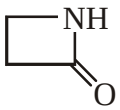
970. Which of the following will not give a ppt with $AgNO_3$:
(A) $CHCl_3$ (B) KCl (C) CCl_4 (D) H_3Cl

SECTION III: COMPRHENSIONS

COMPREHENSION # 113

Paragraph for Questions Nos. 971 to 973

An organic lactum (A) on acid hydrolysis produced B an amino acid. B on treatment with nitrous acid gives (C). (C) on heating with concentrated H_2SO_4 produces a lactone (D). (A) can also be synthesized by the reaction of cyclopentanone with hydroxylamine followed by treatment of product with concentrated H_2SO_4.

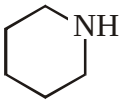
971. The structure of lactam is
(A)  (B)  (C)  (D) 

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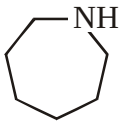
972. The lactone (C) on reaction with $LiAlH_4$ gives

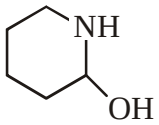
(A) 1,6-hexanediol (B) 1,5-pentanediol
(C) 1,4-butanediol (D) 1,7-heptanediol

973. The lactam A upon reaction with $LiAlH_4$. Produces.

(A) 

(B) 

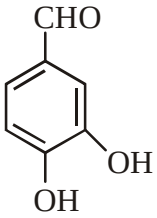
(C) 

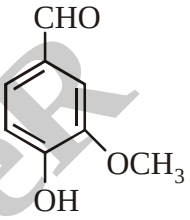
(D) 

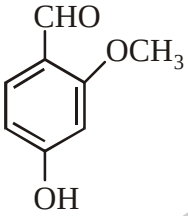
COMPREHENSION # 114
Paragraph for Questions Nos. 974 to 976

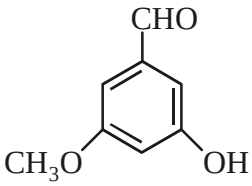
Vanillin (A) $C_8H_8O_3$ is isolated from vanilla beans, which gives intense blue colour with neutral $FeCl_3$ and also gives the tollen's test. It reacts with conc. HBr to give a compound B. One mole of vanillin gave one mole of AgI with zeise's methoxy estimations. Compund B on oxidation with Tollen's reagent gave catechol and also can be prepared from catechol by Gattermann KOCH reaction.

974. The structure of A is

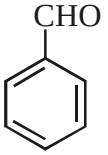
(A) 

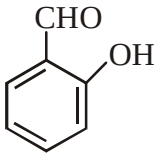
(B) 

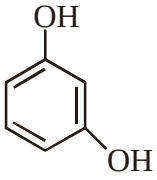
(C) 

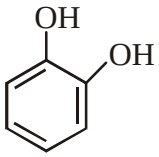
(D) 

975. Compound B on heating with Zinc dust will give 'X'. 'X' is

(A) 

(B) 

(C) 

(D) 

976. In the above question If X reacts with acetic anhydride in presence of CH_3COONa at 180ºC gives.

(A) Cinnamic acid (B) Crotonic acid (C) Pyruvic acid (D) Acetic acid

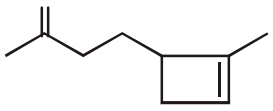
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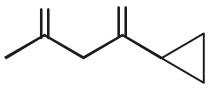
COMPREHENSION # 115

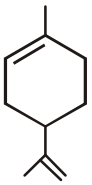
Paragraph for Questions Nos. 977 to 979

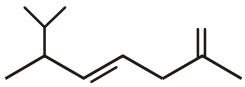
Limonene (A) is a naturaly occuring hydrocarbon with fragence of lemons. When (A) is hydogenated over Pd/C it absorbs 2 moles of hydrogen and produce 4-methyl-1-isopropyl cyclohexane. When (A) is treated with Ozone, followed by reduction two products are isolated i.e. formaldehyd and diketone.

977. The structure of 'A' is:

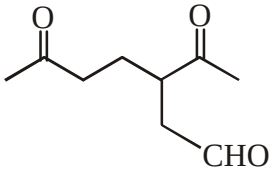
(A) 

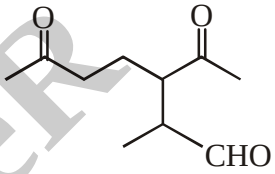
(B) 

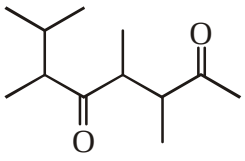
(C) 

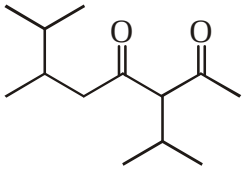
(D) 

978. Identify the diketone,

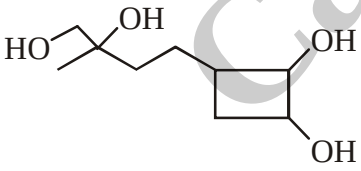
(A) 

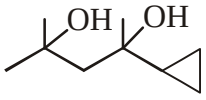
(B) 

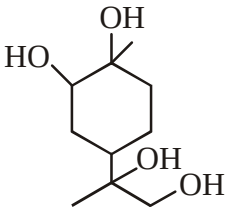
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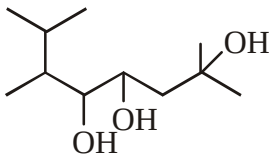
(D) 

979. The compound A on reaction with OsO_4 gives

(A) 

(B) 

(C) 

(D) 

CatalyseR

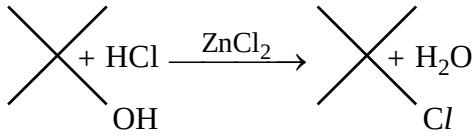
ALCOHOLS

COMPREHENSION # 116

Paragraph for Questions Nos. 980 to 982

Alcohol and considered as a best starting material far preparing alkyl halides. Most common reagent used for this are HX, PCl_5, PCl_3, $SOCl_2$. Among the halogen acid the order of reactivity is HI > HBr > HCl > HF & for Alcohol 3° > 2° > 1° CH_3–OH.

In the case of 1° Alcohol when we use HX rearrangement occurs and mixture of product farm but if we use PCl_3 or $SoCl_2$ it occurs v/a SN^2.

980.  this reaction occurs

(A) within a minutes (B) when temperature is 0 – 100°c

(C) after 5 minutes (D) Reaction does not take place

981. Which of the following is not true

(A) $SOBr_2$ is less stable and SOI_2 does not exist

(B) In preparing alkyl halide from Alcohol the best method is application of $SOCl_2$

(C) 3° Alcohal react with HX via SN^1 pathway.

(D) optically active alcohal (1°) react with PCl_3 give the racemic mixture

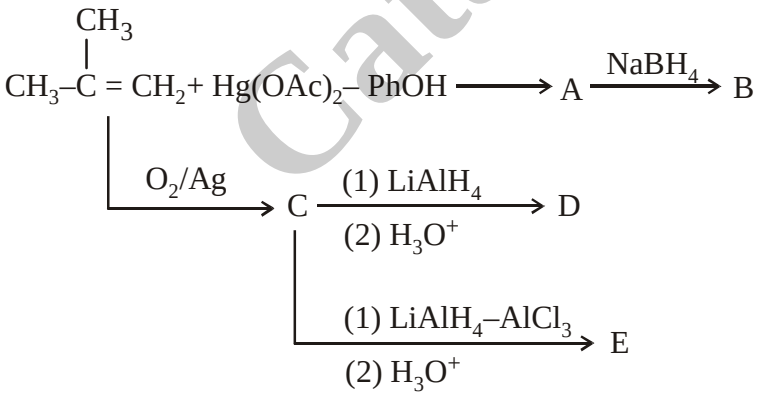
982. R – OH + A → R – C*l*

Which of the following should be taken as A to give the highest yield & no separation of product will required ?

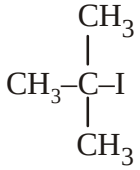
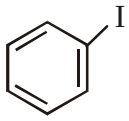
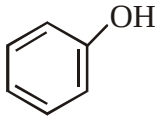
(A) PCl_5 (B) PCl_3 (C) $SOCl_2$ (D) $HCl/ZnCl_2$

COMPREHENSION # 117

Paragraph for Questions Nos. 983 to 985

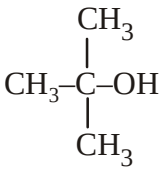


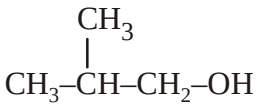
983. The compound B $\xrightarrow{HI}$

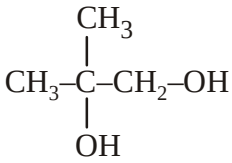
(A)  (B)  (C)  (D) Both (A) and (C)

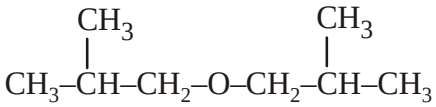
CatalyseR

984. The compound D is:

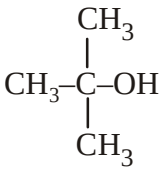
(A) 

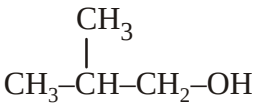
(B) 

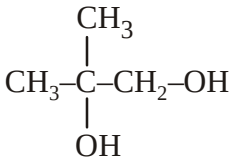
(C) 

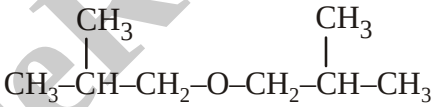
(D) 

985. The compound E is:

(A) 

(B) 

(C) 

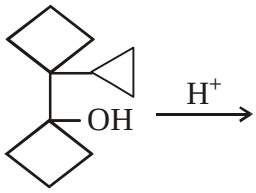
(D) 

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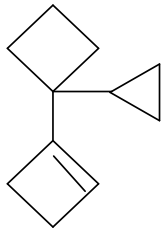
COMPREHENSION # 118

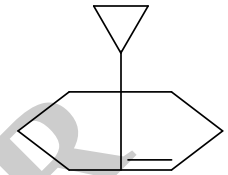
Paragraph for Questions Nos. 986 to 988

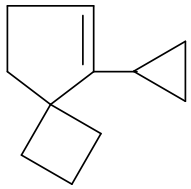
Protonation of organic compounds gives a lots of product having great synthetic application. Alcohols, alkenes and many other groups react with H^+ ion to give carbocation which may undergo rearrangement to from stable carbocation. In general the stability of carbocation is $3^0 > 2^0 > 1^0$

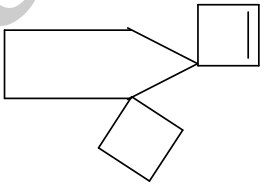
986. 

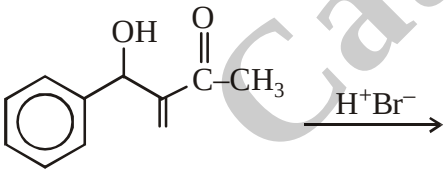
Rearranged alkene product after rearrangement at low temperature will be mainly

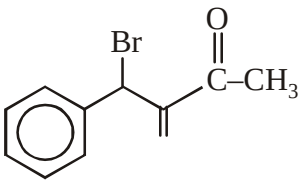
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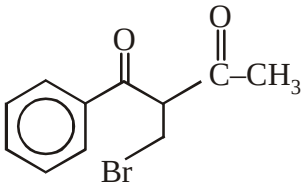
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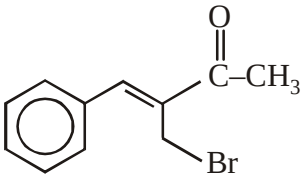
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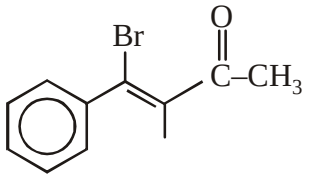
(D) 

987. 

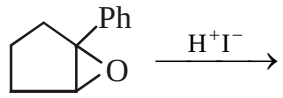
(A) 

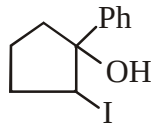
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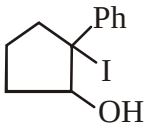
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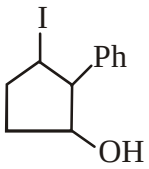
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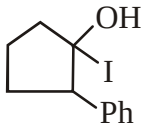
CatalyseR

988. 

(A) 

(B) 

(C) 

(D) 

SECTION IV: MATCH THE FOLLOWING

989. Match the following :

(I) Alcohol		(II) Water solubility in g/100 mol
(a)	Butan-1-ol	(P) 0.6
(a)	Pentan-1-ol	(Q) 2.7
(c)	Hexane-1-ol	(R) 9.1
(d)	2-Methyl propan-1-ol	(S) 10.0

990. The polarimeter readings in an experiment to measure the rate of inversion of cane suger (1st order reaction) were as follows

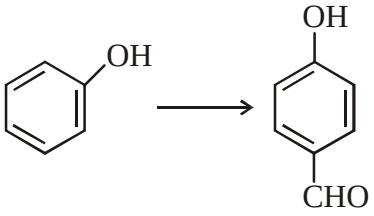
time (min)	:	0	30	∞
angle (degree)	:	30	20	– 15

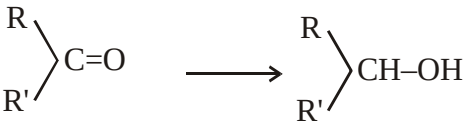
Then match the following :

	Column I		**Column II**
(a)	The half life of the reaction	(i)	131 min.
(b)	The solution is optically inactive at	(ii)	7.5°
(c)	The equimolar mixture of the products	(iii)	82.7 min.
(d)	The angle at half time	(iv)	laevorotatory

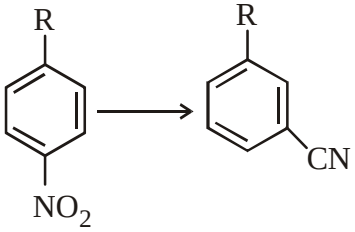
CatalyseR

991. For the following conversions mater with the correct reagent?

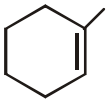
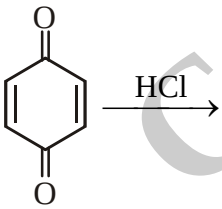
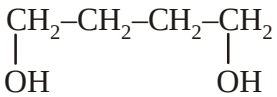
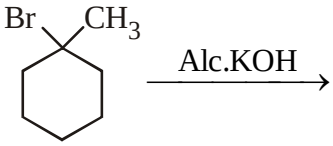
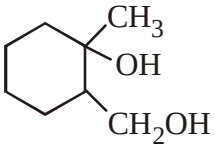
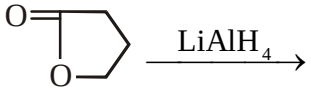
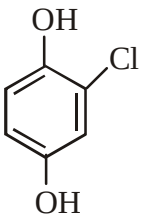
(a)  (P) $[CH_3)_2CHO]_3Al$

(b)  (Q) KCN/150°C

(c) $C_6H_5N_2Cl \longrightarrow C_6H_5CN$ (R) $CHCl_3$ + NaOH

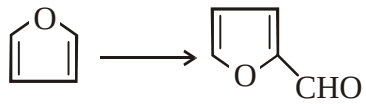
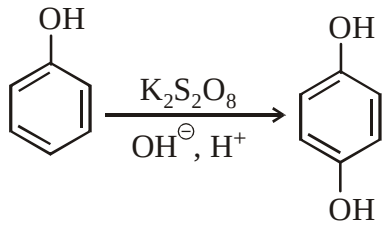
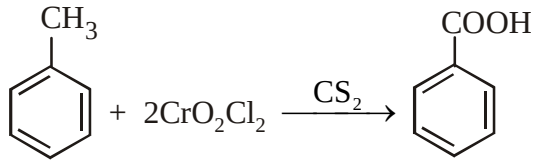
(d)  (S) HCN/CuCN

992. Match the following column

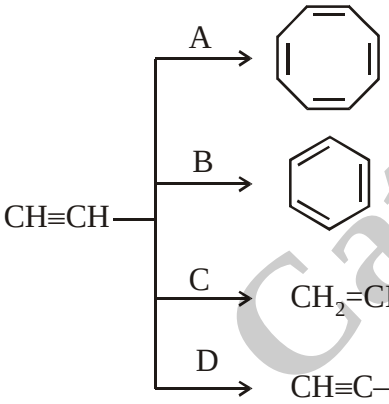
	Column I		Column II
(a)		(P)	
(b)		(Q)	
(c)		(R)	
(d)		(S)	

CatalyseR

993. Match the following

	Column I	Column II
(a)		(P) Elbs per sulphate oxidation reaction
(b)		(Q) Etards reaction
(c)		(R) Gattermann Aldehyde synthesis
(d)	$RCONH_2 \longrightarrow RNH_2$	(S) Hoffmann's Bromamide reaction

994. Identify A,B,C,D from P,Q,R,S



(P) $NH_4Cl–Cu_2Cl_2$

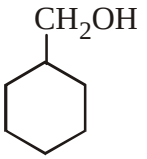
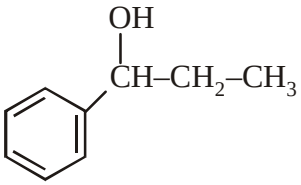
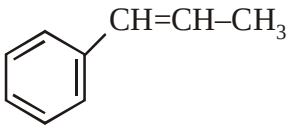
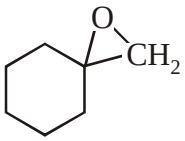
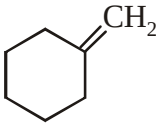
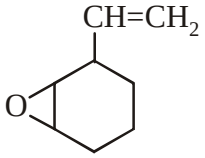
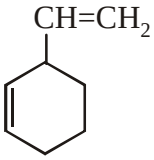
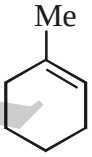
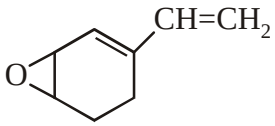
(Q) $Cu_2Cl_2/CH_3OH/Pyridine/Air$

(R) $Ni(CN)_2$

(S) Red hot Fe

CatalyseR

995. Match the following question

Column I		Column II	
(a)		(P)	
(b)		(Q)	
(c)		(R)	
(d)		(S)	
		(T)	

996. Match the following

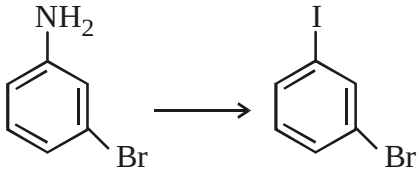
Column I		Column II	
(a)	$CH_3–CH=CH–CH_2Cl + KOH\ (aq) \rightarrow$major	(P)	But-2-en-1-ol
(b)	$CH_3–\underset{\displaystyle Cl}{\underset{\vert}{CH}}–CH=CH_2 + Ag_2O(Moist) \rightarrow$major	(Q)	But-3-en-2-ol
(c)	$C_2H_5Cl + Ag–O–N=O \rightarrow$ major product	(R)	Ethyl nitrite
(d)	$C_2H_5Cl + K–O–N=O \rightarrow$ major product	(S)	Nitro ethane

997. Match the following column

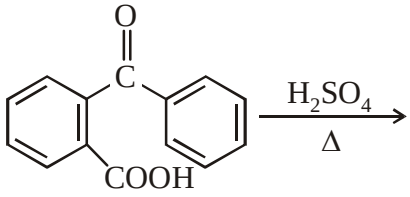
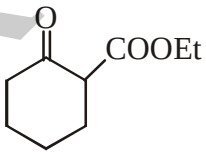
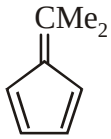
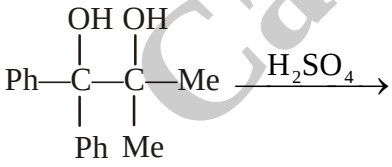
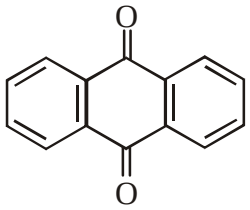
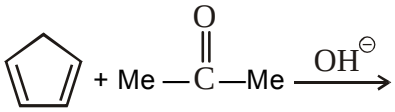
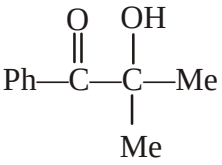
Column I		Column II	
(a)	$FeCl_3$	(P)	CH_3CHO, CH_3COCH_3
(b)	Fehling's solution	(Q)	$HCOOH$, CH_3OH
(c)	Aqueous solutions of KOH + dil. HNO_3 + $AgNO_3$	(R)	But-1-yne and But-2-yne
(d)	Aqueous KOH + 4-DNP	(S)	Benzene and cyclohexene

CatalyseR

998. Match the following column

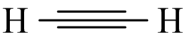
	Column I		Column II
(a)	m-dinitro benzene to m-nitro anilline	(P)	$NaBH_4$
(b)	$CH_3–CH=CH–CHO \rightarrow CH_3–CH=CH–COOH$	(Q)	Tollen's reagent
(c)	$C_6H_5–CH=CH–CHO \rightarrow C_6H_5CH=CH–CH_2OH$	(R)	$\xrightarrow[KI]{NaNO_2+HCl,0–5^oC}$
(d)		(S)	$(NH_4)_2S$

999. Match the following column

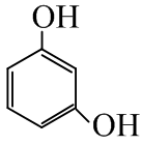
	Column I		Column II
(a)		(P)	
(b)	$EtOOC(CH_2)_5COOEt \xrightarrow{OEt^{\ominus}}$	(Q)	
(c)		(R)	
(d)		(S)	

CatalyseR

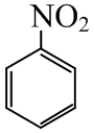
1000. Match the four starting materials (P, Q, R, S) given List – I with reaction schemes (I, II, III, IV) provided in list II & select the correct answer using the code given below the lists.

(P) 

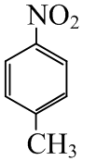
1. (i) $KMnO_4, HO^{\ominus}, heat$.
   (ii) $H^{\oplus}, H_2O$.
   (iii) $SOCl_2$.
   (iv) NH_3 .
   $\longrightarrow C_7H_6N_2O_3$

(Q) 

2. (i) Sn / HCl .
   (ii) CH_3COCl .
   (iii) $Conc.H_2SO_4$.
   (iv) HNO_3 .
   (v) $dil.H_2SO_4, Heat$.
   (vi) $HO^{\ominus}$.
   $\longrightarrow C_6H_6N_2O_2$

(R) 

3. (i) Red hot iron, 873 K
   (ii) fuming $HNO_3, H_2SO_4, heat$.
   (iii) H_2S, NH_3 .
   (iv) $NaNO_2 \cdot H_2SO_4$.
   (v) Hydrolysis
   $\longrightarrow C_6H_5NO_3$

(S) 

4. (i) conc. $H_2SO_4, 60°C$.
   (ii) conc. HNO_3 , conc. H_2SO_4 .
   (iii) dil. H_2SO_4 , heat
   $\longrightarrow C_6H_5NO_4$.

	P	Q	R	S
(A)	1	4	2	3
(B)	3	1	4	2
(C)	3	4	2	1
(D)	4	1	3	2

CatalyseR

JEE ADVANCED REVISION PACKAGE - AnswerKey (CHEMISTRY)

Qs.	Ans.	Qs.	Ans.	Qs.	Ans.	Qs.	Ans.
1	D	51	BD	101	A	151	A
2	C	52	AB	102	D	152	D
3	B	53	ABC	103	A	153	A
4	B	54	ABC	104	C	154	A
5	A	55	ABCD	105	C	155	A
6	D	56	C	106	C	156	D
7	B	57	A	107	D	157	A-(R),B-(RS),C-(Q),D-(R)
8	D	58	A	108	D	158	500
9	D	59	C	109	A	159	70
10	B	60	D	110	B	160	3233
11	B	61	B	111	D	161	4800
12	A	62	A	112	B	162	300
13	D	63	D	113	A	163	5
14	D	64	B	114	C	164	81
15	C	65	A	115	B	165	9
16	C	66	D	116	A	166	2.62,3.38
17	A	67	D	117	C	167	5
18	A	68	D	118	C	168	35
19	C	69	A	119	A	169	4
20	D	70	B	120	B	170	7519
21	B	71	A	121	B	171	$9.8\times10^{14}\,Hz$
22	D	72	D	122	A	172	3
23	A	73	B	123	A	173	4247
24	D	74	A	124	C	174	32.24
25	C	75	B	125	C	175	1
26	B	76	A	126	A	176	390
27	ABC	77	B	127	A	177	120
28	AD	78	A	128	C	178	1033
29	ABCD	79	D	129	D	179	75
30	BCD	80	A	130	A	180	8349
31	ABC	81	B	131	C	181	(i)5,25,(ii)3.863
32	BC	82	D	132	B	182	$9.8\times10^{14}\,Hz$
33	BD	83	C	133	C	183	D
34	ABCD	84	C	134	A	184	B
35	ABC	85	C	135	D	185	B
36	CD	86	B	136	D	186	B
37	BCD	87	C	137	B	187	A
38	ABCD	88	C	138	D	188	A
39	BC	89	D	139	B	189	C
40	AD	90	B	140	A	190	D
41	CD	91	D	141	A-(Q),B-(S),C-(P),D-(R)	191	A
42	AB	92	C	142	A-(QR),B-(PS),C-(PS),D-(QR)	192	C
43	ABC	93	C	143	D	193	B
44	BC	94	C	144	C	194	B
45	AD	95	B	145	A	195	D
46	BC	96	A	146	A	196	B
47	AD	97	B	147	A-(Q),B-(P),C-(S),D-(R)	197	B
48	ABCD	98	C	148	A-(P,Q),B-(P,Q,R),C-(P,Q,R,S),D-(P,Q,R,S)	198	A
49	ABD	99	C	149	A	199	B
50	ACD	100	B	150	A-(p),B-(pq),C-(r),D-(s)	200	A

CatalyseR

AnswerKey

Qs.	Ans.	Qs.	Ans.	Qs.	Ans.	Qs.	Ans.
201	C	251	BCD	301	B	351	D
202	A	252	AB	302	B	352	B
203	A	253	ABCD	303	D	353	B
204	D	254	AB	304	B	354	D
205	D	255	ACD	305	C	355	C
206	B	256	ABCD	306	C	356	B
207	D	257	AC	307	A	357	B
208	A	258	ABCD	308	B	358	A
209	B	259	BD	309	A	359	A
210	C	260	ABC	310	B	360	A
211	D	261	AC	311	A	361	C
212	C	262	ABC	312	B	362	B
213	A	263	AC	313	C	363	C
214	D	264	BCD	314	B	364	C
215	D	265	ABD	315	C	365	B
216	B	266	AC	316	B	366	A
217	B	267	ABCD	317	B	367	D
218	D	268	ABC	318	C	368	BD
219	C	269	AD	319		369	A
220	AB	270	AC	320	A	370	B
221	ABCD	271	AC	321	C	371	D
222	BC	272	AC	322	A	372	C
223	BC	273	AC	323	A	373	A
224	CD	274	ABC	324	B	374	A
225	ABC	275	AB	325	A	375	D
226	BC	276	A	326	D	376	(a)-(v),(b)-(vi),(c)-(iv),(d)-(ii),(e)-(vii),(f)-(iii),(g)-(i)
227	BCD	277	A	327	C	377	A
228	BCD	278	C	328	A	378	C
229	BC	279	D	329	B	379	A-(PQ),B-(R),C-(QT),D-(S),E-(U)
230	AD	280		330	C	380	A-(iv),B-(i),C-(ii),D-(iii)
231	BC	281	B	331	A	381	
232	ABC	282	D	332	B	382	A-(ii),B-(i),C-(iv),D-(iii)
233	BC	283	A	333	D	383	A
234	AC	284	B	334	C	384	B
235	ABC	285	A	335	D	385	A-(ii),B-(iii),C-(v),D-(vii),E-(vii)
236	AD	286	B	336	D	386	B
237	ABC	287	D	337	D	387	A
238	ABC	288	B	338	A	388	A-(ii),B-(ii),C-(v),D-(i),E-(iii),F-(iv)
239	CD	289	C	339	C	389	A-(v),B-(vi),C-(vii,viii),D-(iv),E-(ii),F-
240	AC	290	D	340	C	390	A-(ii),B-(i),C-(iii),D-(iii),E-(ii)
241	ABC	291	C	341	A	391	A-(ii),B-(i),C-(i),D-(ii),E-(iii)
242	AC	292	A	342	C	392	A-(v),B-(iv),C-(i),D-(iii),E-(ii)
243	AB	293	A	343	A	393	A-(ii),B-(i),C-(iv),D-(iii)
244	ABCD	294	B	344	C	394	A-(v),B-(iv),C-(ii),D-(iii),E-(i)
245	ABC	295	D	345	B	395	A
246	BC	296	C	346	D	396	D
247	ABCD	297	C	347	C	397	A
248	ACD	298	C	348	A	398	C
249	AC	299	D	349	A	399	C
250	AC	300	B	350	B	400	18.12

CatalyseR

AnswerKey							
Qs.	Ans.	Qs.	Ans.	Qs.	Ans.	Qs.	Ans.
401	107	451	C	501	A	551	A-(QS),B-(R),C-(P),D-(QR)
402	685.3mL	452	B	502	C	552	495´10-4kJ/mol
403	15.50%	453	A	503	B	553	2
404	55	454	B	504	B	554	4
405	40	455	D	505	C	555	2
406	238	456	A	506	C	556	3.2
407	83.27	457	D	507	A	557	560
408	7957	458	C	508	B	558	5
409	265	459	C	509	B	559	72
410	86	460	A	510	B	560	7.6
411	(i)5,(ii)interstitial	461	AB	511	A	561	4.8
412	(a)V=5.95´103mL, (b)0.2118dpspermL	462	ABC	512	B	562	25
413	66.13mm,0.6563	463	ABD	513	B	563	70
414	25	464	ABCD	514	B	564	31kJmol-1
415	1/5,3/4,150mm	465	BC	515	C	565	1532.7kJ
416	2.165	466	ABC	516	A	566	5.2kJ
417	m=1,n=1	467	ACD	517	B	567	0
418	5	468	BCD	518	A	568	4.48
419	14	469	ACD	519	A	569	25
420	3	470	CD	520	A	570	0.768
421	8560	471	ABC	521	C	571	C
422	50	472	B	522	B	572	B
423	14	473	BD	523	C	573	C
424	561.8cm3	474	CD	524	C	574	A
425	A	475	ACD	525	B	575	B
426	D	476	ABD	526	D	576	A
427	D	477	ACD	527	A	577	D
428	D	478	B	528	C	578	A
429	D	479	AB	529	B	579	B
430	A	480	ABCD	530	A	580	A
431	D	481	ABC	531	BD	581	B
432	D	482	ABC	532	B	582	C
433	A	483	ABCD	533	C	583	C
434	D	484	ABD	534	A	584	C
435	B	485	ABD	535	A	585	B
436	D	486	CD	536	A-(PR),B-(QS),C-(PRS),D-(PR)	586	B
437	B	487	CD	537	A-(c),B-(d),C-(a),D-(b)	587	D
438	D	488	CD	538	A-(QR),B-(QRS),C-(SD),D-(PS)	588	NOTAVAILABLE
439	C	489	ABC	539	A-(QR),B-(PQRS),C-(PS),D-(PQR)	589	A
440	B	490	ACD	540	A-(RS),B-(R),C-(P),D-(Q)	590	B
441	C	491	ABD	541	A-(PQR),B-(PR),C-(PQ),D-(QS)	591	C
442	B	492	BC	542	A-(Q),B-(R),C-(P),D-(S)	592	B
443	C	493	AD	543	A-(P),B-(Q),C-(R),D-(S)	593	A
444	D	494	ABC	544	A-(PQ),B-(PR),C-(PS),D-(P)	594	C
445	B	495	AB	545	A-(Q),B-(R),C-(P),D-(S)	595	C
446	B	496	B	546	A-(R),B-(P),C-(S),D-(Q)	596	D
447	D	497	B	547	A-(C),B-(A),C-(B),D-(D)	597	C
448	C	498	C	548	A	598	C
449	B	499	C	549	C	599	A
450	A	500	D	550	A-(b),B-(c),C-(f),D-(e)	600	B

CatalyseR

AnswerKey

Qs.	Ans.	Qs.	Ans.	Qs.	Ans.	Qs.	Ans.
601	A	651	ACD	701	B	751	D
602	B	652	ABCD	702	D	752	C
603	A	653	ABCD	703	B	753	D
604	B	654	AD	704	D	754	A
605	C	655	AB	705	B	755	D
606	A	656	ABC	706	D	756	D
607	C	657	ABC	707	A	757	D
608	B	658	ABC	708	A	758	
609	BCD	659	ABC	709	B	759	C
610	ACD	660	AB	710	A	760	B
611	AB	661	AC	711	B	761	A
612	ABD	662	AB	712	A	762	B
613	AB	663	C	713	A	763	B
614	BC	664	D	714	B	764	C
615	AB	665	B	715	B	765	A
616	ACD	666	C	716	A	766	A
617	BC	667	D	717	B	767	B
618	CD	668	C	718	A	768	D
619	BC	669	C	719	A	769	C
620	ABCD	670	B	720	C	770	A
621	ABCD	671		721	A	771	A
622	ABCD	672		722	A	772	B
623	BD	673	C	723	C	773	C
624	AD	674	A	724	B	774	D
625	ABC	675	B	725	B	775	A-(P),B-(QR),C-(S),D-(RS)
626	C	676	A	726	D	776	A-(PQR),B-(QRS),C-(PQ),D-
627	AC	677	A	727	D	777	A-(P),B-(R),C-(Q),D-(PQS)
628	AB	678	C	728	C	778	A-(PR),B-(PQ),C-(PS),D-(QS)
629	ABC	679	A	729	C	779	A-(QRS),B-(Q),C-(P),D-(RS)
630	BC	680	A	730	B	780	A-(PR),B-(Q),C-(R),D-(PS)
631		681	B	731	C	781	A-(d),B-(e),C-(a),D-(b),E-(c),F-
632		682	D	732	A	782	A-(c),B-(a),C-(d),D-(b)
633	ABD	683	A	733	C	783	A-(P),B-(PQS),C-(PQRS),D-(PS)
634	AC	684	A	734	C	784	A-(PQS),B-(Q),C-(PR),D-(P)
635	BC	685	C	735	A	785	A
636	ACD	686	B	736	B	786	A-(S),B-(P),C-(Q),D-(R)
637	AB	687	D	737	C	787	A-(S),B-(Q),C-(R),D-(P)
638	ACD	688	B	738	D	788	A-(d),B-(c),C-(a),D-(b)
639	CD	689	B	739	C	789	A-(d),B-(b),C-(a),D-(g),E-(c),F-
640	ABC	690	A	740	C	790	A-(v),B-(ii),C-(i,iv),D-(iii),E-
641	ACD	691	C	741	B	791	A-(iii,iv,v),B-(i),C-(v),D-(iii),E-
642	ABC	692	C	742	D	792	A-(b),B-(c),C-(f),D-(e)
643	D	693	B	743	B	793	A-(QRS),B-(RS),C-(PQ),D-(PQ)
644	NOTAVAILABLE	694	D	744	D	794	A-(Q),B-(R),C-(S),D-(P)
645	BC	695	C	745	A	795	A
646	AB	696	B	746	B	796	D
647	ABC	697	A	747	C	797	A-(R),B-(PR),C-(RS),D-(Q)
648	BCD	698	A	748	D	798	A-(T),B-(R),C-(Q),D-(S),E-(P),F-
649	ABD	699	A	749	A	799	A-(R),B-(P),C-(Q)
650	ABCD	700	A	750	A	800	A-(Q),B-(R),C-(T),D-(S)

CatalyseR

AnswerKey

Qs.	Ans.	Qs.	Ans.	Qs.	Ans.	Qs.	Ans.
801	A-(R),B-(P),C-(Q),D-(S)	851	C	901	B	951	D
802	A-(v),B-(vii),C-(i),D-(vi),E-(ii),F-(viii),G-	852	D	902	A-(S),B-(R),C-(Q),D-(P)	952	CD
803	A-(PR),B-(PR),C-(Q),D-	853	D	903	A-(S),B-(R),C-(Q),D-(P)	953	ABCD
804	A-(pqr),B-(pqr),C-(p)	854	B	904		954	ACD
805	A-(s),B-(q),C-(p),D-(r)	855	D	905	A-(R),B-(Q),C-(Q),D-(P)	955	ABC
806	A-(s),B-(r),C-(q),D-(t),E-	856	A	906	A-(P),B-(Q),C-(R),D-(S)	956	ABC
807	A-(S),B-(Q),C-(R),D-(P)	857	D	907	A-(R),B-(P),C-(Q),D-(S)	957	BC
808	1	858	A	908	D	958	BD
809	6	859	B	909	B	959	ABC
810	28	860	A	910	D	960	ABC
811	2	861	A	911	C	961	ABC
812	6360	862	A	912	B	962	AB
813	9	863	B	913	C	963	ABC
814	5	864	CD	914	B	964	AB
815	36	865	AB	915	C	965	AB
816	0	866	C	916	A	966	CD
817	650	867	C	917	A	967	CD
818	5	868	D	918	A	968	AC
819	10	869	A	919	A	969	AD
820	2	870	A	920	D	970	ACD
821	0	871	BC	921	C	971	B
822	15	872	B	922	B	972	B
823	3	873	C	923	D	973	B
824	6	874	B	924	D	974	B
825	18	875	C	925	A	975	A
826	3	876	C	926	D	976	A
827	4	877	D	927	A	977	C
828	3	878	C	928	D	978	A
829	400	879	B	929	C	979	C
830	5	880	B	930	D	980	A
831	4	881	A	931	B	981	D
832	3	882	B	932	B	982	C
833	24	883	D	933	A	983	D
834	6	884	B	934	D	984	A
835	A	885	A	935	B	985	B
836	D	886	D	936	A	986	C
837	B	887	B	937	D	987	C
838	B	888	A	938	B	988	B
839	D	889	D	939	B	989	A-(R),B-(Q),C-(P),D-(S)
840	B	890	C	940	A	990	A-(R),B-(P),C-(S),D-(Q)
841	D	891	C	941	B	991	A-(R),B-(P),C-(S),D-(Q)
842	C	892	D	942	A	992	A-(R),B-(S),C-(P),D-(Q)
843	C	893	A	943	B	993	A-(R),B-(P),C-(Q),D-(S)
844	C	894	D	944	B	994	A-(Q),B-(S),C-(P),D-(Q)
845	B	895	A	945	C	995	A-(S),B-(P),C-(Q),D-(R)
846	A	896	C	946	D	996	A-(PQ),B-(Q),C-(S),D-(R)
847	A	897	D	947	C	997	A-(S),B-(R),C-(Q),D-(P)
848	A	898	C	948	D	998	A-(S),B-(Q),C-(P),D-(R)
849	A	899	C	949	B	999	A-(R),B-(P),C-(S),D-(Q)
850	C	900	A	950	B	1000	C

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