<u>DIRECTIONS</u>: THIS EXAMINATION CONTAINS A TOTAL OF 80 ULTIPLE CHOICE QUESTIONS. CARFULLY SELECT THE BEST ANSWER AND BLACKEN ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED.

TIME ALLOWED: 2 ½ HOURS

Notice: you may refer the information given below when you work on some of the questions.

A) Ideal gas constant, R = $8.314 Jmol^{-1}k^{-1} = 0.0821 L.atm\ mol^{-1}\ K^{-1}$

B) Avogadro's number $=6.023x10^{23}\ mol^{-1}$

C) Plank's constant , $h=6.626x10^{-34}$ J s

D) Speed of light, C = $3.0x10^{8}$ m /s

E) Rydberg constant, $R_h = 2.18x10^{-18}J$

F) Faraday's constant(F) =96500c

G) Natural Logarithm of 2 ,ln2 =0.693

H) Water dissociation constant, $K_w = 1.0x10^{-14}$

I) K_f of H_2O = $1.86^0C/m$ and $K_b$of H_2O = $0.512^0C/sm$

Elements symbol	H	Li	B	C	N	O	F	Ne	Na	Mg	Al	S	Cl	Ar	K	Ca	Cu	Kr	I	Au
Atomic number(Z)	1	3	5	6	7	8	9	10	11	12	13	16	17	18	19	20	29	36	53	79
Atomic mass(A)	1	7	10	12	14	16	19	20	23	24	27	32	35.5	40	39	40	64	85	127	197

1. How many electrons can a single orbital hold? s

A. 2n B.2 C. $2\ell + 1$ D. 8

2. Which of the following is **NOT** a valid set of quantum numbers?

A. n = 2, ℓ = 1, mℓ = 0, and ms = -1/2

B. n = 3, ℓ = 0, mℓ = 0, and ms = 1/2

C. n = 2, ℓ = 1, mℓ = -1, and ms = -1/2

D. n = 3, ℓ = 2, mℓ = 3, and ms = 1/2

3. Which variables are linked in the de Broglie equation?

A. frequency and wavelength of a photon

B .wavelength and momentum of a moving electron

C. energy and frequency of a photon

D. work function and threshold frequency of a metal

4. The minimum energy required to remove an electron from potassium metal is $3.7x10^{-19}$ J. How much kinetic energy does the electron have up on leaving the metal surface when a blue light with wave length 451nm cause the photoelectric effect?

A.$7.0x10^{-20}$J B.$4.4x^{-19}$J C.$3.7x10^{-19}$J D. $8.1x10^{-20}$ J

5.Round off 0.035 49 to three significant figures is:

A. 0.04 B. 0.036 C. 0.0355 D. 0.035

6. The diameter of the given star is about 3, 500, 000 m. The scientific notation to represent this diameter is:

A. 3.5×10^5 m B. 35×10^4 m C. 35×10^6 m D. 3.5×10^6 m

7. What are the possible values of n and mℓ for an electron in a 5d orbital?

A. n = 1, 2, 3, 4, or 5 and mℓ = 2

B. n = 1, 2, 3, 4, or 5 and mℓ = -2,-1, 0, +1, or +2

C. n = 5 and mℓ = 2

D. n = 5 and mℓ = -2, -1, 0, +1, or +2

8. Which of the following is **NOT** a laboratory safety rule?

A. You should never mix acids with bases

B. You should tie back your long hair

C. You should never add water to acid

D. All of the above are valid safety rules

9. In Science an educated guess is called a/an:

A. Observation B. Conclusion C. Hypothesis D. Law

10. What type of error will be resulted by the expansion of liquid in a thermometer along the column by increasing working temperature ?
    A. Systematic B. Random C. Gross D. Average
11. The intensive physical properties of a substance are important because they:
    A. Allow us to determine how much of the substance is required in a chemical reaction.
    B. Help us to determine how much the resistor is effective.
    C. Provide information about the atomic structure of the substance.
    D. Help us to identify or characterize the substance.
12. The Heisenberg uncertainty principle states that:
    A. There is an uncertainty in the order of filling the 4s and 3d orbital's when writing the electro configurations in the periodic table.
    B. There is uncertainty in knowing the position and momentum of the electron simultaneously.
    C. There is an uncertainty in the position of the electron in a 2s orbital because there is a node.
    D. There is an uncertainty in obtaining the wave length of a macroscopic particle.
13. What type of atomic orbital is shown below?



    A. 4s B. 4p C.4dZ^2 D. 4f
14. The electron configuration [Ne] $3S^2 3P^6 4S^1$ is an exited state of:
    A. Ca B. Kr C. Al D.K
15. The "plum pudding" model of the atom was devised by:
    A. Dalton B. J.J Thomson C. Rutherford D. Bohr
16. How many lone pairs of electrons are on the sulfur atom in sulfite ion, (SO_3^{2-})?
    A. 0 B. 1 C. 2 D. 3
17. What hybridization change does the carbon atom undergo in the combustion of methane?

$$CH_4\ (g) + 2O_2\ (g) \longrightarrow CO_2\ (g) + 2H_2O\ (g)$$

    A. sp→ sp2 B. sp2 → sp3 C. sp3 → sp D. sp2 → sp

18. The VSEPR theory predicts the molecular geometry of ICl_3 as:
    A. triangular planar
    B. triangular bi pyramidal
    C. triangular pyramidal
    D. T -shaped
19. How many sigma and pi bonds are present in the following molecule?

CH_3-CH=CH-CH_3

    A. 11 sigma bonds and 1 pi bond
    B. 10 sigma bonds and 2 pi bonds
    C. 9 sigma bonds and 2 pi bonds
    D. 8 sigma bonds and 1 pi bond
20. Which is a non-polar molecule containing a non-polar covalent bond?
    A.CS_2 B. I_2 C. CO_2 D. BF_3
21. If the electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^2$, the four electron involved in chemical bond formation will be_____.
    A. $3p^6$ B. $3p^6$**,** $4s^2$ C $3p^6$**,** $3d^2$ D. $3d^2$**,** $4s^2$
22. Which of the following bond angle corresponds to sp2 hybridization?
    A.90° B. 120° C. 180° D. 109°
23. Which among the following is paramagnetic?
    A. N_2 B. N_2^{2-} C. C_2 D. O_2^{2-}
24. Which of the following statements is **NOT CORRECT**?
    A. NaCl being an ionic compound is a good conductor of electricity in the solid state.
    B. ideal geometry and electron set arrangement of the given molecule are the same.
    C. pi- orbital electrons form weaker bonds than sigma orbital electrons.
    D. VSEPR theory can explain the square planar geometry of XeF_4.
25. What is the bond order of F_2^{2-} ?
    A.1 B.2 C.0 D.3
26. The rat eye possibly can view the light with a wave length of 380nm.What is the frequency of this light wave?
    A. $1.17x10^{20}s^{-1}$ B. $1.14x10^{20}s^{-1}$ C. $7.9\ x10^{14}s^{-1}$ D. $3.83x10^{14}s^{-1}$
27. Which of the following has the lowest lattice energy?
    A. LiF B. NaF C. NaCl D. NaI
28. Which properties are identical for elements from the same period?
    A. atomic radius
    B. ionization energy
    C. the number of electron layers
    D. chemical properties

29. Consider the following reaction:

$$N_{2\,(g)} + 3H_{2\,(g)} \longrightarrow 2NH_{3\,(g)}$$

If the rate of formation of NH_3 is 3.0 mL/min. The rate of consumption of H_2 is:

A. 1.5mL/ min B. 4.5mL/min C. 2.0mL/min D. 9.0mL/min

30. An untreated sugar cube does not burn when held over a lighted match. A sugar cube coated with cigarette ash readily ignites and burns. All of the cigarette ash remains after the reaction. The factor that caused this change in rate is the:

A. Nature of reactants. C. Increase in surface area.

B. Increase in concentration D. Presence of a catalyst

31. Consider the following reaction mechanism:

Step1: $NO_2 + NO_2 \longrightarrow N_2O_4$

Step2: $N_2O_4 + CO \longrightarrow CO_2 + NO + NO_2$

The product in the overall reaction is:

A. NO_2 and CO_2 C. CO and NO

B. CO_2 and NO D. NO_2 and NO

32. Consider the reaction: $2A + B \rightarrow C + 2D$. The rate law for this reaction is first order in A and also first order in B. If the rate constant at 25 ^{0}C is $3.01x10^2\ s^{-1}$ .What is the rate of reaction when the concentration of A is 0.47 and the concentration of B is 0.79 M?

A. 112 M^2s^{-1} B. 53M^3s^{-1} C. 71M^2s^{-1} D. 333M^2s^{-1}

33. For the reaction: $2A + 3B \rightarrow 4C + 5D$, the rate of the reaction in terms of Δ [C] would be written as :

A. + Δ[C] /Δt C. + 4 Δ[C] /Δt

B. -1/4 Δ[C] /Δt D. +1/4 Δ[C] /Δt

34. In an electrolysis experiment, a current was passed through two cells connected in series. The first cell contains AU $(NO_3)_3$ solution and the second cell contains $CUSO_4$ solution. 9.54gm of gold was deposited in the first cell .What mass of copper is deposited on the cathode in the second cell?

A. 20.2gm B. 4.7gm C. 6.2gm D. 9.4gm

Questions 35-36 refers to the following reaction:

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

$\Delta H° = -198$ kJ mol^{-1}. The equilibrium constant for this reaction at 830 °C is $0.25atm^{-1}$.

35. Which one of the following is the correct expression for the equilibrium constant?

A. $Kc = \frac{[SO_3]}{[SO_2][O_2]}$

C. $Kc = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$

B. $Kc = \frac{[SO_3]^2 T}{[SO_2]^2[O_2]}$

D. $Kc = \frac{[SO_2]^2[O_2]}{[SO_3]^2}$

36. If the temperature is increased the amount of SO_3 (g) produced will:

A. increase
C. remains the same.
B. decrease
D. increase, then decrease

37. A student adds 6.00 g of a solid to 30.0 mL of water. What is the concentration of this solution expressed as mass/mass percent? (Assume the density of water is 1gm/mL).

A. 0.167% (m/m)
C. 16.7% (m/m)
B. 0.200% (m/m)
D. 20.0% (m/m)

38. The following reaction is at equilibrium:

Cl_2 (g) + $3F_2$ (g) $\rightleftharpoons$ $2ClF_3$ (g)

How will the system respond if the pressure is decreased at a constant temperature?

A. The reaction will shift to the left.
B. The reaction will shift to the right.
C. There will be no change to the equilibrium position.
D. The concentration of the product will increase.

39. What is the conjugate base of $H_2PO_4^-$?

A. OH^-
B. PO_4^{3-}
C. HPO_4^{2-}
D. H_3PO_4

40. Consider the following equilibrium: $N_{2\,(g)} + O_{2\,(g)} + Q \rightleftharpoons 2NO_{(g)}$

When the temperature is increased, the equilibrium shifts to the

A. left and K_{eq} increases.
C. right and K_{eq} decreases
B. left and K_{eq} decreases
D. right and K_{eq} increases

41. The equilibrium of the reaction: $N_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3\,(g)}$ will shift to product side when:
    A. Kp >1 B. Q < Kp C. Q = Kp D. Q = 2Kp
42. What will happen during the electrolysis of aqueous solution of $CuSO_4$ in the presence of Cu electrodes?
    A. Hydrogen gas will evolve at cathode.
    B. Copper will dissolve at anode
    C. Oxygen gas will be released at anode.
    D. Copper will deposit at anode.
43. Vulcanization makes rubber _____
    A. more elastic C. soluble in inorganic solvent
    B. crystalline D. stiffer
44. Which of the following is addition polymer?
    A. Nylon B. Polyester C. Bakelite D.Polystyrene
45. Polyethylene has which of the following monomers?
    A. CH_2 B. C_2H_4 C. CH_4 D. C_2H_6
46. Which of the following is needed in order for a condensation polymer to be networked?
    A. at least one of the starting molecules must be di functional.
    B. at least one of the starting molecules must be tri functional.
    C. both starting materials must be di functional
    D. both starting materials must only be mono functional.
47. A 0.010M acid solution has a pH of 2.00. The acid could be
    A. HNO_3 B. H_2SO_3 C. HCOOH D. CH_3COOH
48. Which of the following salts dissolves in water to produce a basic aqueous solution?
    A. $KClO_4$ B. $MgSO_4$ C. NH_4NO_3 D. LiF
49. A buffer solution can be formed by dissolving equal moles of
    A. KBr and Na_3PO_4 C. HCl and NaOH
    B.HF and NaF D. CH_3COOH and NaCl
50. Consider the following: PO_4^{3-}, HPO_4^{2-}, $H_2PO_4^-$, H_3PO_4.The term amphiprotic can be used to describe:
    A. PO_4^{3-}only C. $HPO_4^{2-}$and $H_2PO_4^-$only
    B. PO_4^{3-}, HPO_4^{2-}, $H_2PO_4^-$only D.HPO_4^{2-}, $H_2PO_4^-$, H_3PO_4 only
51. What volume of 0.300 M HNO_3 is needed to neutralize completely 25.0 mL of 0.250 M $Sr(OH)_2$?
    A. 10.4 mL B. 15.0 mL C. 20.8 mL D. 41.7 mL

52 .What is the net ionic equation for the neutralization reaction of $2HF_{(aq)}$ with $Sr(OH)_{2(aq)}$.

A. $HF_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)} + F^-_{(aq)}$

B. $HF_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + F^-_{(aq)}$

C. $2HF_{(aq)} + Sr(OH)_{2(aq)} \rightarrow SrF_{2(aq)} + 2H_2O_{(l)}$

D. $2H^+_{(aq)} + 2F^-_{(aq)} + Sr^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow SrF_{2(aq)} + 2H_2O_{(l)}$

53. The indicator phenolphthalein can be described by the following equilibrium equation:

$$\underset{\text{Colorless}}{HIn} + H_2O \rightleftharpoons H_3O^+ + \underset{\text{pink}}{In^-}$$

HCl is added to a slightly pink sample of this indicator. After equilibrium has been re- established, how do the $[H_3O^+]$ and the color of the solution compare with the original equilibrium?

A. $[H_3O^+]$ decreases, Color of Solution turn pinker

B. $[H_3O^+]$ decreases, Color of Solution turns colorless

C. $[H_3O^+]$ increase, Color of Solution turns pinker

D. $[H_3O^+]$ increase, Color of Solution turns colorless

54. Which molecule is a fatty acid?

A. $(CH_3)_2CH\ (CH_2)_3COOH$ C. $CH_2CHCOOH$

B. $CH_3\ (CH_2)_7CH = CH\ (CH_2)_7COOH$ D. CH_3COOH

55. An ester has the structural formula: $CH_3CH_2COOCH(CH_3)_2$ on hydrolysis, the ester would produce:

A. ethanoic acid and propan-1-ol.

B. propanoic acid and propan-1-ol.

C. ethanoic acid and propan-2-ol.

D. propanoic acid and propan-2-ol

56. Oils are generally ____ at room temperature and are obtained from _____.

A. solids, animals C. liquids, plants

B. liquids, animals D. solids, plants

57. In chemical terms, soaps can best be described as:

A. mixed esters of fatty acids. C. simple esters of fatty acids.

B. salts of long chain fatty acids. D. long chain acids.

58. What is the concentration of Li^+ in 200.0 mL of 1.5 M $Li_2SO_4^{2-}$solution?

A. 0.30 M B. 0.60 M C. 1.5 M D. 3.0 M

59. The base-dissociation constant, K_b, for pyridine, C_5H_5N, is 1.4×10^{-9}. The acid-dissociation constant, K_a, for the pyridinium ion, $C_5H_5NH^+$, is _____.

A. 7.1×10^{-6} B. 1.4×10^{-5} C. 1.0×10^{-7} D. 1.4×10^{-23}

60. What is the freezing point of solution prepared by dissolving 90gm of $C_6H_{12}O_6$ in 200gm of water?

A. 0^0C B. -2.1^0C C. -1.8^0C D. 2.1^0C

61. Which of the following is an extensive property of a system?

A. Surface tension C. Viscosity
B. refractive index D. internal energy

62. Zinc blend is:

A. ZnS B. ZnO C. Zn_2SiO_4 D. $ZnO.Fe_2O_3$

63. Zone refining is a method Used to obtain:

A. Very high temperature C. Ultra-pure Germanium
B. Ultra-pure aluminum D. Ultra-pure oxides

64. The equilibrium constants for each of the following reactions are given:

$N_2(g) + O_2(g) \rightarrow 2NO(g)$, $Kc_1 = 4.3 \times 10^{-25}$

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$, $Kc_2 = 6.4 \times 10^{9}$

What is Kc for the combined reaction?

$N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$

A. 3.7×10^{-13} B. 6.1×10^{-14} C. 2.8×10^{-15} D. 8.9×10^{-16}

65. What is the $[H_3O^+]$ at the equivalence point for the titration between HBr and KOH?

A. 1.0×10^{-9} M B. 1.0×10^{-7} M C. 1.0×10^{-5} M D. 0.0 M

66. How many calories are required to increase the temperature of 6 g of alcohol from 11^0C to 21^0C? (The specific heat of alcohol is $0.60 cal/g\ ^0C$)

A. 70.0cal B. 36.0cal C. 76.0cal D. 119.0cal

67. Which of the following is **NOT CORRECT**?

A. ΔG is zero for a reversible reaction.
B. ΔG is negative for a spontaneous reaction.
C. ΔG is positive for a spontaneous reaction.
D. ΔG is positive for a non-spontaneous reaction.

68. When the net ionic equations: $Fe^{2+} + Cr_2O_7^{2-} \rightarrow Cr^{3+} + Fe^{3+}$ is balanced by ion electro method in acidic medium , the coefficient of : Fe^{2+}, $Cr_2O_7^{-2}$, Cr^{3+}, Fe^{3+} become respectively:

A. 6, 1, 2, 6 B.3, 1, 2, 3 C.5, 1, 2, 5 D. 1, 1, 2, 1

69. A solution that has the maximum solute can it dissolves in the solvent is called

A. limiting reagent C. super saturated

B. excess reagent D. saturated

70. What is the oxidation number of chromium in the ionic compound ammonium dichromate, $(NH_4)_2Cr_2O_7$?

A. +3 B. +6 C. +4 D. +7

71. The following reaction occurs in basic solution. Identify the oxidizing agent.

$H_2O_{(l)} + Zn_{(s)} + NO_3^{--}{}_{(aq)} + OH^-_{(aq)} \rightarrow Zn(OH)_4^{2-}{}_{(aq)} + NH_{3\,(aq)}$

A. Zn(s) C. $H_2O_{(l)}$

B. $NO_3^-(aq)$ D. $NH_{3\,(aq)}$

72. Which of the following statements about electrochemical cells is true?

A. Reduction occurs at the anode

B. An element with a high love for electrons is likely to be easily oxidized

C. Anode is used as an oxidizing agent.

D. Only oxidation half–reactions are useful

73. Given the electrochemical reaction shown below , if the standard reduction potential of Ag^+/Ag is +0.80 V, and the standard reduction potential of Cu^{2+}/Cu is +0.34V, what is E°_{cell} for the following cell notation?

Cu / Cu^{2+} (aq) // Ag^+ (aq) / Ag

A. +1.26 V B. +0.85 V C. +0.46 V D.-0.37 V

74. While discharging the lead storage battery _____.

A. $PbSO_4$ is reduced to Pb. C. Pb is reduced to $PbSO_4$.

B. $PbSO_4$ is oxidized to PbO_2. D. PbO_2 is reduced to $PbSO_4$.

75. How many grams of aluminum metal can be produced by the electrolysis of Al_2O_3 passing a current of 6 amperes for 96,500s through the cell?

A. 54gm B. 0.67gm C. 0.02gm D. 162gm

76. When equal volumes of the following four 0.1mol dm^{-3} aqueous solutions are arranged in order of increasing P^H value, what is the correct order?
    A. $CH_3COOH < HNO_3 < CH_3CH_2NH_2 < KOH$
    B. $HNO_3 < CH_3COOH < CH_3CH_2NH_2 < KOH$
    C. $CH_3CH_2NH_2 < HNO_3 < CH_3COOH < KOH$
    D. $KOH < CH_3CH_2NH_2 < CH_3COOH < HNO_3$

77. What is ΔH for the following reaction?

$$C_2H_{4\,(g)} + H_{2\,(g)} \rightarrow C_2H_{6\,(g)}$$, When:

(ΔHf^0 for $C_2H_{4(g)}$ = 52.5 kJ/mol and ΔHf^0 for $C_2H_{6\,(g)}$ = –84.7 kJ/mol)

A. –137.2 kJ B. 32.2 kJ C. –32.2 kJ D. 137.2 kJ

78. Which of the following ores contains CO_3^{-2}?
    A. Bauxite B. Dolomite C. Epsomite D. Cassiterite

79. If a laboratory assistant dilute 5 mL of 0.15 M NaCl solution to a final volume of 5 L , what is the final concentration of NaCl solution?
    A. 15000 M B. 0.0015 M C. 0.00015M D. 0.150M

80. Tin does not react with:
    A. dilute perchloric acid C. concentrated nitric acid
    B. chlorine gas D. cold water