CHEMISTRY - UNIVERSITY ENTERANCE EXAMINATION 2003/2011-2008/2016

Directions: each of the following questions is followed by four possible alternatives. Read each question carefully and blacken only the letter of your choice on the separate answer sheet provided.

1. What percent is gold in 18 karat gold?
A. 18 B. 89 C. 25 D. 75

2. Which one of the following is colligative property of solvent in a solution?
A. Lowering of vapor pressure C. Boiling point
B. Osmotic pressure D. Change in entropy

3. Which one of the following is the criterion for a spontaneous change using the thermodynamic parameter entropy (S)?
A. $\Delta S_{system} < 0$ C. $\Delta S_{universe} \leq 0$
B. $\Delta S_{system} \leq \Delta_{Surrouding}$ D. $\Delta S_{universe} > 0$

4. Which element corresponds to the electron configuration $[Ne]3s^2\ 3p^1$?
A. Mg B. Al C. Si D. Ga

5. Which bond between the following groups of elements will be the most polar?
A. S-F B. S-Cl C. S-Br D. S-I

6. What is the unit for the rate of a chemical reaction if the concentration is expressed in moles per liter and the time in seconds?
A. $Lmo^{-1}s^{-1}$ B. $MolL^{-1}s^{-1}$ C. s^{-1} D. $molL^{-1}s^{-2}$

7. What is the most important type of solute-solvent interaction in a solution of $CaCl_2$ in water?
A. Dipole- dipole C. hydrogen bonding
B. Dispersion forces D. Ion-dipole

8. A bleaching solution contains 5.2 by mass percent sodium hypochlorite, NaOCl. What is the mass of NaOCl in a bottle containing 2500g of bleaching solution?
A. 90 B. 130 C. 480 D. 520

9. Which of the following is NOT a state function?

A. Work B. Enthalpy C. internal energy D. pressure

10. Which of the following metals has the highest positive oxidation state?
A. Ti B. Cr C. Mn D. Cu

11. Which of the following is NOT a natural polymer?
A. Proteins B. Starch C. Cellulose D. Teflon

12. The coefficients required to correctly balance the reaction below are;
$Al(NO_3)_3 + Na_2S \rightarrow Al_2S_3 + NaNO_3$
A. 2,1,3,2 B. 2,3,1,6 C. 1,1,1,1 D. 4,6,3,2

13. One mole of $(NH_4)_2HPO_4$ contains_____ moles of hydrogen atoms.
A. One B. Five C. six D. nine

14. A 500 g toothpaste sample has 0.2g fluoride concentration, what is the concentration of fluoride in terms of PPM?
A. 200 B.250 C. 400 D.1000

15. Which solution below has the highest concentration of hydroxide ion?
A. PH = 3.21 B.PH = 7.93
C. PH = 9.82 D.PH = 12.59

16. Which substance is reduced in the following reaction?
$Cr_2O_7^{2-} + 6S_2O_3^{4-} \rightarrow 2Cr^{3+} + 3S_4O_6^{2-} + 7H_2O$
A. $Cr_2O_7^{2-}$ B. $6S_2O_3^{2-}$ C. H^+ D.Cr^{3+}

17. Which one of the following pairs CANNOT be mixed together to form a buffer solution?
A. NH_3 and NH_4Cl C. RbOH and HBr
B. $NaC_2H_3O_2$ and $HC_2H_3O_2$ D. H_3PO_4 and KH_2PO_4

18. Which one of the following aqueous solutions will be basic?
A. NaCl B. Na_2SO_4 C. Na_2CO_3 D. $FeCl_3$

19. Consider the reaction:
$CH_4(g) + 4Cl_2(g) \rightarrow CCl_4(g) + 4HCl(g), \Delta H = -434KJ$
What energy change occurs when 1.2 mole of methane reacts?
A. $5.2x10^5$ J are released C. $3.4x10^5$ J are released
B. $5.2x10^5$ J are absorbed D. $3.6x10^5$J are absorbed

20. When electricity is passed through aqueous solution of aluminum chloride, 13.5g of Al are deposited. What must be the number of faradays of electricity passed?

A. 2.0 B. 1.5 C. 1.0 D. 0.5

21. Which of the following is the anodic reaction in the discharge of a lead- acid storage battery?
   A. $Pb\ (s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$
   B. $Pb\ SO_4(s) + 2e^- \rightarrow Pb\ (s) + SO_4^{2-}(aq)$
   C. $PbO_2(s) + SO_4^{2-}\ (aq) + 4H^+ + 2e^- \rightarrow PbSO_4(s) + 2H_2O(I)$
   D. $PbSO_4(s) + 2H_2O\ (I) \rightarrow PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^-$

22. With which one of the following is gold complexed to recover it from its ore?
   A. NO_3^- B. CO_3^{2-} C. SO_4^{2-} D. CN^-

23. For the reaction, $3O_2(g) \rightarrow 2O_3(g)$; $\Delta H = 284KJ$. What are the signs of ΔG and ΔS respectively?
   A. Positive and negative D.Negative and positive
   B. Positive and positive C. Negative and negative

24. Which of the following is NOT true about anode of a voltaic cell?
   A. Reduction Occurs at it.
   B. It is assigned as the negative pole
   C. Electrons flow from it
   D. Cations in solution move away from the surface of the electrode as the redox reaction occurs.

25. What is the orbital hybridization of the oxygen atom in water?
   A. sp B. sp^2 C. sp^3 D. sp^3d

26. Within a specified period, the increase in atomic number is usually accompanied by
   A. An increase in atomic radius and an increase in electronegativity.
   B. A decrease in atomic radius and an increase in electronegativity.
   C. An increase in atomic radius and a decrease in electronegativity.
   D. A decrease in atomic radius and a decrease in electronegativity.

27. Which of the following sets of quantum numbers is not allowed in the hydrogen atom?
   A. $n = 2, l = 1, m_l = -1$ C. $n = 8, l = 7, m_l = -6$
   B. $n = 1, l = 0, m_l = 0$ D. $n = 2, l = 0, m_l = 2$

28. NF_3, BF_3, and ClF_3 all have molecular formulae of the type AF_3. Which molecule(s) has (have) trigonal pyramidal molecular geometry?

A. NF_3 and BF_3 B. BF_3 and ClF_3 C. ONF_3 and ClF_3 D. NF_3

29. Which of the following molecules CANNOT be formed?

A. NCl_3 B. OF_6 C. ONF_3 D. OCl_3

30. Of Br_2, Ne, HCl, and N_2, which one is likely to have the strongest intermolecular dispersion forces?

A. Br_2 B. Ne C. HCl D. N_2

31. Thiosulfate ion is oxidized by iodine according to the following reaction

$I_2 + 2S_2O_3^{2-}(aq) \rightarrow S_4O_6^{2-}(aq) + 2I^-(aq)$

If in a certain experiment, 0.006 mol of $S_2O_3^{2-}$ is consumed in 1.0L of solution each second. At what rates are $S_4O_6^{2-}$ and I^- produced in this solution?

A. 0.012 $molL^{-1}S^{-1}$ ($S_4O_6^{2-}$) and 0.006 $moIL^{-1}S^{-1}$ (I^-)
B. 0.006 mol L^{-1} S^{-1} ($S_4O_6^{2-}$) and 0.006 $moIL^{-1}S^{-1}$(I^-)
C. 0.003$molL^{-1}$ S^{-1} ($S_4O_6^{2-}$) and 0.006 $moll^{-1}$ S^{-1} (I^-)
D. 0.012 $moll^{-1}$ S^{-1} ($S_4O_6^{2-}$) and 0.012 $moll^{-1}$ S^{-1} (I^-)

32. A particular reaction was found to depend on the concentration of the hydrogen ion, $[H^+]$. The initial rate changed as a function of $[H^+]$ as follows:

[H] (M)	0.005	0.01	0.02
Initial rate (M/s)	$3.4x10^{-7}$	$1.7x10^{-7}$	$0.8x10^{-7}$

What is the order of the reaction in $[H^+]$?

A. -1 B. 1 C. 2 D. 0

33. The conversion of ozone into O_2 proceeds in two elementary steps as follows

$O_3(g) \rightarrow O_2(g) + O(g)$
$O_3(g) + O(g) \rightarrow 2O_2(g)$

What is the equation for the overall reaction?

A. $2O_3(g) \rightarrow 3O_2(g)$
B. $2O_3(g) + O(g) \rightarrow 3O_2(g) + O(g)$
C. $O_3(g) + O(g) \rightarrow O_2(g) + 2O(g)$
D. $2O_3(g) + O(g) \rightarrow 3O_2(g)$

34. Which of the following factors does NOT affect the rate of a chemical reaction that is zero order?

A. Concentration of reactants C. Temperature

B. Surface area of reactants D. Presence of a catalyst

35. How would you prepare 0.90 L of $1.2x10^{-2}$ M NaCl aqueous solution?

A. Weigh 0.012g of NaCl dissolve in a small amount of water and dilute to 0.90L
B. Weigh 0.63g of NaCl, dissolve in a small amount of water and dilute to 0.90L
C. Weigh 1.2g of NaCl, dissolve in a small amount of water and dilute to 0.90L
D. Weigh 1.4g of NaCl, dissolve in a small amount of water and dilute to 0.90L

36. Which of the following solutes will produce the largest increases in boiling point upon addition to 1 kg of water?

A. 1 mol of Co $(NO_3)_2$ C. 3 mol of ethylene glycol $(C_2H_6O_2)$
B. 2 mol of KCl D. 1 mole of $CaCl_2$

37. What is the correct order of increasing acid strength in the following species: HBrO, $HBrO_2$, $HBrO_3$, and $HClO_3$?

A. $HBrO < HBrO_2 < HBrO_3 < HClO_3$
B. $HBrO < HBrO_2 < HClO_3 < HBrO_3$
C. $HClO_3 < HBrO_2 < HBrO_2 < HBrO$
D. $HbrO_3 < HBrO_2 < HBrO < HClO_3$

38. A 50.0 ml sample of 0.50 m acetic acid (CH_3COOH, $Ka = 1.8 x10^{-5}$) is titrated with 0.150M NaOH solution. What is the PH of the solution when no NaOH is added?

A. 1.6 B. 2.28 C. 2.58 D.3.17

39. The enthalpy change for the conversion of white phosphorus to red phosphorus is – 17.7 $KJmol^{-1}$. Which of the following statement is true?

A. One mole of red phosphorus will give off more heat when burn in air than one mole of white phosphorus.
B. One mole of white phosphorus will give off more heat when burned in air than one mole of red phosphorus.
C. The heat generated by both types is the same
D. The enthalpy change for the conversion of red phsophorus to white phosphorus will be – 35.4 KJ mol^{-1}

40. Which of the following is not a spontaneous process?

A. The rusting of iron
B. The dissolution of salt in water

C. A clear solution becomes a uniform color after a few drops of dye are added
D. Cleaning a room

41. What are the expected products of the electrolysis of an aqueous solution of $CuCl_2$?
A. Cu and H_2 at the cathode and Cl_2 and O_2 at the anode
B. Cu at the cathode and Cl_2 at the anode
C. Cu and H_2 at the cathode and only Cl_2 at the anode
D. Cu at the cathode and Cl_2 and O_2 at the anode

42. Which is the second most abundant element in the earth's crust?
A. Aluminum B. Silicon C. Oxygen D. Iron

43. The reaction of a dialcohol with diprotic carboxylic acid is an example of
A. A condensation polymerization
B. A copolymer
C. An addition polymerization
D. A thermoset polymer

44. Which of the following is **NOT** a carbohydrate?
A. Glucose B. Cellulose C. Glycine D. starch

45. The exothermic step in the dissolution of a salt in water is
A. Separation of the salt into ions in gaseous state
B. Separation of the water molecules
C. Hydration (solvation) of the ions from the salt
D. Separation of the salt into ions in gaseous state and separation of the water.

46. Which of the following is NOT correct?
A. Addition of a strongly solvated solute decreases the solubility of a gas in liquid
B. For solid dissolved in liquid that is exothermic, increase in temperature increases the solubility
C. The solubility of a substance is its concentration in the saturated solution
D. For solution to occur solvent – solute attractions must overcome solute-solute and solvent-solvent attractions

47. How many milligrams are in 0.2 decigrams?
A. 20 milligrams C. 0.002 milligrams
B.2000 milligrams D. 0.00002 milligrams

48. How many grams of Ca CO_3 will be formed by passing excess CO_2 gas through 100ml of 0.25M Ca $(OH)_2$ solution?

A. 10 grams B. 2 grams C. 2.5 grams D. 5 grams

49. Which one of the following electromagnetic radiation has the longest wavelength?

A. Gamma rays B. Microwaves

C. radio waves D. X-rays

50. What are the possible values of the azimuthal quantum number for an electron in the 4f sub shell?

A. 0,1,2,3 B.1,2,3 C. 3 D. 4

51. Which one of the following is the correct electronic configuration of Ni?

A. $1s^2s^22p^63s^23p^63d^84s^2$ C.$1s^22s^22p^63s^23p^64s^24p^65s^2$

B. $1s^2s^2p^63s^23p^63d^94s^1$ D. $1s^2s^2p^63s^23p^63d^64p^65s^2$

52. What type of hybridization is used by carbon in C_2H_2 (acetylene)?

A. sp B. sp^3 C. sp^2 D.sp^3d

53. Which of the following rate relationships is valid for the reaction

$2NO_2(g) \rightarrow 2NO(g) + O_2(g)$?

A. $\frac{1[No2]}{\Delta t} = \frac{\Delta[NO]}{\Delta t}$ C. $-\frac{1\Delta[NO2]}{2\ \Delta t} = \frac{\Delta[O2]}{\Delta t}$

B. $\frac{\Delta[NO2]}{\Delta t} = \frac{\Delta[O2]}{\Delta t}$ D. $\frac{\Delta[O2]}{\Delta t} = \frac{\Delta[NO]}{\Delta t}$

54. Which of the following statement is NOT correct regarding equilibrium constant? The value of the equilibrium constant does not depend upon the

A. Initial concentration of the reactants

B. Initial concentration of the products

C. Nature of the reactants

D. Presence of a catalyst

55. Consider the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2$ **(g)** in a closed container at equilibrium at a constant temperature. What will be the effect of adding more PCl_5 on the equilibrium concentration of Cl_2 (g)? it

A. Decreases C. Remains unaffected

B. Cannot be predicated without the value of Kp

D. Increases

56. What is the mole fraction of a solute in one molal aqueous solution?

A. 0.009 B.0.018 C. 0.027 D. 0.036

57. Which of the following aqueous solutions will have the lowest freezing point? 0.1 molal solution of

A. Urea B. Acetic acid

C. Sodium chloride D. Calcium chloride

58. When the equation for the following reaction in basic solution is balanced, what is the sum of the coefficients?

$MnO_2 + HO_2^- \rightarrow MnO_4^-$

A. 11 B.31 C. 14 D. 9

59. The standard emf for the cell reaction,

$Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$, is 1.1 V. what would the emf for the cell reaction be when 0.1M Cu^{2+} and 0.1M Zn^{2+} solutions are used at 298K?

A. 1.10V B. 0.10V C. -1.10V D. -0.11

60. Which one of the following is a polyamide molecule?

A. Terylene B. Rayon C. Nylon D. polystyrene

61. Which metal atoms can form ionic bonds by losing electrons from both the outermost and next to outermost principal energy levels?

A. Fe B. Mg C. Pb D. Ca

62. The energy required to remove an electron from an iron atom amounts to 7.21×10^{-19}J. What is the maximum wavelength of light that can perform this?

A. 250nm B.276nm C. 289nm D.300nm

63. What is the molecular geometry of O_3?

A. Trigonal planar B. Bent

C. trigonal pyramidal D. Tetrahedral

64. At 295 K, a 3.0L flask contains 7mol HI, 4mol H_2, and 0.6mol I_2 in equilibrium. What is the value of Kc at 295 k?

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

A. 10.2 B.20.4 C. 30.4 D.61.2

65. The equilibrium constant is 0.09 at 295 K for the reaction $H_2O(g) + Cl_2O(g) \rightleftharpoons 2HOCl(g)$, for which of the following sets of conditions is the system at equilibrium?

A. A 1.0L flask contains 1.0 mol of HOCl, 0.10 of Cl_2O, and 0.1 mol of H_2O

B. A 2.0 L flask contains 0.084 mole of HOCl, 0.80 mole of Cl_2O, and 98 mol of H_2O.

C. A 3.0 L flask contains 0.25 mol of HOCl, 0.0010 mol of Cl_2O, and 0.56 mol of H_2O.

D. A 4.0L flask contains 0.25 mol of HOCl, 0.0010 mol of Cl_2O, and 0.56 mol of H_2O

66. 1000 g of a 55% (mass percentage) nitric acid solution is to be diluted to 20% (mass percentage) nitric acid solution. How many liters of water should be added to the starting solution?

A. 0.45 B.1.55 C. 2.30 D.2.72

67. When pure methanol is mixed with water, the solution becomes warm. Is this an ideal solution?

A. Yes, for ideal solution $\Delta H_{soln} = 0$

B. No, for ideal solution $\Delta H_{soln} = 0$

C. Yes, for ideal solution $\Delta H_{soln} = >0$

D. No, for ideal solution $\Delta H_{soln} = <0$

68. What is the percentage of HF molecules ionized in a 0.10 M HF solution ($Ka = 6.8x10^{-4}$)?

A. 2% B. 5% C. 8% D. 10%

69. How does the titration of a strong acid with a strong base differ from titration of a weak acid with a strong base with respect to the quantity of base required to reach the required to reach the equivalence point?

A. The quantity of base required to reach the equivalence point is the same in both titrations.

B. The quantity of base required to reach the equivalence point for the titration of a strong acid with a strong base is higher than for the titration of a weak acid with a strong base.

C. The quantity of base required to reach the equivalence point for the titration of a strong acid with a base is lower than for the titration of a weak acid with a strong base.

D. The quantity of base required to reach the equivalence point the titration of a strong acid with a strong base is slightly higher than for the titration of a weak acid with a strong base.

70. Which of the following reaction is redox reaction?

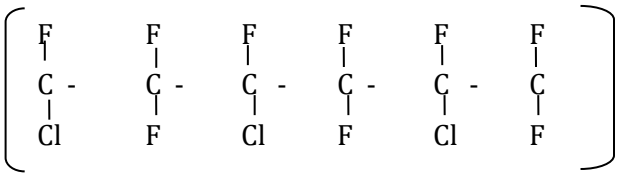
A. $3Se(s) + 4HNO_3\ (aq) \rightarrow 3SeO_2\ (s) + 4NO\ (g) + 2H_2O\ (l)$

B. $CaCl_2\ (aq) + 2AgNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + 2AgCl\ (s)$

C. $BaCO_3\ (s) \rightarrow BaO(s) + CO_2\ (g)$

D. $3Mg(OH)_2\ (s) + 2NH_3\ (g) \rightarrow Mg_3N_2\ (s) + 6H_2O\ (l)$

71. A polymer has the following structure



What is the monomer for this polymer?

A. $CFCl = CF_2$ B.CF_3Cl C. CF_2Cl_2 D.CF_4

72. How many significant figures are there in 0.0500?

A. One B. Three C. Two D. four

73. If 16 grams of O_2 react with excess C_2H_6 how many grams of CO_2 will be formed? The unbalanced equation is:

$\mathbf{C_2H_6\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (g)}$

A. 22 grams B.9 grams C. 13 grams D.12.6 grams

74. Hydrogen atoms are excited to the stationary state designated by the principal quantum number, n = 4 what will be the number of lines (frequencies) emitted by the hydrogen atoms?

A. 1 B.4 C. 6 D.16

75. According to the molecular orbital theory, which one of the following is paramagnetic?

A. F_2 B.H_2 C. NO^+ D.NO

76. For the reaction: $\mathbf{2NO\ (g) + O_2\ (g) \rightarrow 2NO_2\ (g)}$, the following rate data were obtained what is the rate law for the reaction?

A. Rate = K [NO][O_2] C. rate = k [NO]^2[O_2]

B. Rate = k [NO] [O_2]^2 D. rate = k [NO]^2 [O_2]^2

77. The value of K_c for the reaction,

$\mathbf{COCl_2\ (g) \rightleftharpoons CO\ (g) + Cl_2\ (g)}$ is $2.5x10^{-10}$ at 300K. Starting with pure $COCl_2$ (g) in a closed vessel, if the concentration of CO (g) is $1x10^{-5}$ M at equilibrium, what would be the equilibrium concentration of $COCl_2$ (g)

A. 2.5M B.$5x10^5$M C. $2.5x10^{-5}$M D.0.4M

78. An aqueous solution freezes at -0.186^0C ($K_f = 1.86^0$C hg mol-1 $K_b = 0.512^0$C hg mol^{-1}) what is the elevation in boiling point (in ^{0}C)?

A. 0.786 B.0.512 C. 0.512/1.56 D. 0.0512

79. The pK_a of acetyl salicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about 2 to 3 and the pH in the small intestine is about 8. Which one of the following statement is correct? Aspirin is

A. Unionized in the small intestine and in the stomach
B. Completely ionized in the small intestine and in the stomach
C. Ionized in the stomach and almost un ionized in the small intestine
D. Ionized in the small intestine and almost unionized in the stomach

80. A 10ml sample of tartaric acid (a diprotic acid) is titrated with 20ml of 1.0M NaOH. What is the molarity of the acid?

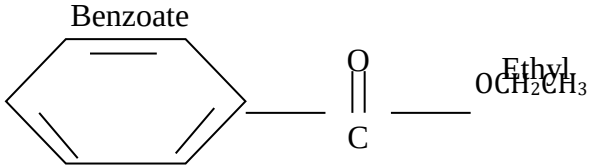
A. 2.0 B.1.0 C. 4.0 D.0.5

University entrance examination (UEE) chemistry, 2004/ 2012

1. The compound $CuCl_2$ emits blue light having a wavelength of 450nm when heated at about 200^0C. What is the increment in energy (quantum) that is emitted at 450nm?
   A. $2.25x10^{-19}$J B. $4.42\ x10^{-19}$J
   C. $8.20x10^{-19}$J D. $16.20\ x10^{-19}$J
2. What is the total number of valence –shell electrons in BrO_3
   A. 20 B. 26 C. 32 D. 36
3. Consider the following phase Diagram for CO_2.What happens when in a CO_2 sample initially at 1 atm and -70^0C, the temperature increases from -70^0C to $-10\ ^0$C at a constant pressure of 60 atm?
   A. $CO_2\ (g) \rightarrow CO_2\ (s)$ C. $CO_2\ (g) \rightarrow CO_2\ (g)$
   B. $CO_2\ (g) \rightarrow CO_2\ (1)$ D. $CO_2\ (g) \rightarrow CO_2\ (1)$
4. What is the name of a base promoted ester hydrolysis reaction?
   A. Acylation B. Esterification
   C. condensation D. saponification
5. A solution is labeled 0.500M HCl. What is $[H^+]$?
   A. 0.5 B. 1.5 C. 1.6 D. 1.69
6. Consider the following reaction:
   $\mathbf{HOCl + H_2O \rightleftharpoons Cl^- + H_3O^+}$
   What will happen if NaOCl is added to the above reaction at equilibrium?
   A. The concentrations of Both HOCl and H_3O^+ would increase
   B. The concentration of both HOCl and H_3O^+ would decrease
   C. The concentrations of HOCl would increase and concentration of H_3O^+ would decrease
   D. The concentration of HOCl would decrease and the concentration of H_3O^+ would increase.
7. Which of the following compounds would be the most basic?
   A. 0.1 M acetic acid
   B. 0.1 M sodium acetate
   C. 0.1 M hydrochloric acid
   D. 0.1 M ammonium chloride
8. How is a buffer solution prepared?
   A. By mixing a weak acid and a strong acid.
   B. By mixing a weak acid and its conjugate base.

C. By mixing a strong acid its conjugate base
D. By mixing a strong acid and its conjugate acid

9. What is the name of the following compound?



A. Benzoate ester
B. Ethyl benzoate
C. Pheny1 butyrate
D. ethylbenzyl ketone

10. Consider the following reaction:

$I_2O_5(s) + 5CO\ (g) \rightarrow I_2\ (s) + 5CO_2\ (g)$

What is the magnitude of the change in the oxidation number of the elements?

A. I, + 5 to 0, C, + 2 to +4
B. I, + 5 to 0, C, + 4 to +4
C. O, + 0 to 0, C, + 2 to +4
D. I, + 4 to 0, C, + 2 to +4

11. Consider the following oxidation – reduction equation:

$2H_2O\ (1) + Al\ (s) + MnO_4^-\ (aq) \rightarrow Al(OH)_4\ (aq) + MnO_2\ (s)$

What are the reducing and oxidizing agents in this reaction?

A. Al (s) is the reducing agent and H_2O is the oxidizing
B. Al (s) is the oxidizing agent and H_2O is the reducing agent.
C. Al (s) is the Oxidizing agent and MnO_4^- (aq) is the reducing agent
D. Al (s) is the reducing agent and MnO_4- (aq) is the oxidizing agent

12. The dye bromothymol blue (HBb) is a weak acid whose ionization can be represented as follows:

$HBb\ (aq) \rightleftharpoons H^+(aq) + Bb^-(aq)$

Which way will the equilibrium shift when NaOH is added?

A. To the left
B. To the right
C. Initially to the left and after a while to the right
D. Initially to the left and after a while to left

13. Which one of the following organic molecules has the highest water solubility?

A. $HOCH_2CH_2CH_2OH$ C. $HOCH_2CH_2CHCH_2OH$
B. $CH_3CH_2CH_2CH_2OH$ D. $CH_3CH_2CH_2CH_2CH_2OH$

14. Which one of the following substances is a non-conductor of electricity?
A. Graphite C. silver (s)
B. $MgCl_2(s)$ D. $H_2SO_4(aq)$

15. Which of the following is NOT a solution?
A. Milk B. Brass
C. whisky D. coca cola drink

16. What is the difference between chlorine – 35 and chlorine – 37?
A. Chlorine – 37 has two more protons than chlorine – 35.
B. Chlorine – 37 has two more neutrons than chlorine – 35.
C. Chlorine – 37 has two more electrons than chlorine – 35.
D. Chlorine – 37 has one more proton and more neutron than chlorine – 35.

17. Which of the following elements has the highest melting point?
A. Iodine B. Tungsten C. mercury D. bromine

18. Which of the following compounds is unlikely to contain ionic bonds?
A. CO B. NaF C. LiCl D. $MgBr_2$

19. Which of the following is a chemical formula that represents an amino acid?
A. CH_4 B. CH_3NH_2
C. CH_3COOH D. NH_2CH_2COOH

20. Which one of the following electromagnetic radiations has the shortest wavelength?
A. X-rays B. UV rays
C. gamma rays D. microwaves

21. Which one of the following statements is NOT true about acids?
A. An acid is a proton donor.
B. An acid is an electrons pair donor.
C. An acid is electron pair acceptor.

D. An acid is a substance that is ionized in water to produce $H^+(aq)$

22. Which term describes the units that make up compounds with covalent bonds?

A. Ions B. Acids C. salts D. molecules

23. What is the number of moles of atoms and the number of atoms in a 10.0-g sample of copper?

A. 0.08 mol Cu atoms and $2.16x10^{23}$ atoms
B. 0.16 mol Cu atoms and $9.63x10^{22}$ atoms
C. 0.16 mol Cu atoms and $9.63x10^{23}$ atoms
D. 0.31 mol Cu atoms and $4.16x10^{23}$ atoms

24. Which of the following is the right order of the steps of a scientific method?

A. Performing experiments – formulating hypothesis – making observations
B. Formulating hypothesis – making observations – performing experiments
C. Making observations – formulating hypothesis – performing experiments
D. Making observation – performing experiments – formulating hypothesis

25. Which group of elements is characterized with ns^2np^2 outer – electron configuration?

A. Group IIA B. Group IVA
C. group IVB D. group III B

26. Consider the following equilibrium:

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

Which of the following mixture, each placed in a closed container and allowed to stand is not capable of reaching the equilibrium given above?

A. Pure $CaCO_3$
B. $CaCO_3$ and CaO
C. Some CaO and a pressure of CO_2 greater than the value of K_p
D. Some $CaCO_3$ and a pressure of CO_2 greater than the value of K_p

27. Which of the following statements is true about esters?

A. Esters can form intermolecular hydrogen bonds.

B. Ester molecules can form intermolecular hydrogen bonds.
C. Ester molecules cannot form intermolecular hydrogen bonds
D. Esters have higher boiling points than alcohols of comparable molecular weight.

28. Consider the following acids:

I. CH_3COOH, ka = $1.8x10^{-5}$ III. HOBr, ka = $2.4x10^{-9}$
II. HCO_2H, ka = $1.8x10^{-4}$ IV. C_6H_5OH, ka = $1.0x10^{-10}$

Which one of the following aqueous solutions will have the highest pH?

A. 0.10 M NaOBr C. 0.10 M C_6H_5OHa
B. 0.10 M HCO_2 Na D. 0.10 M CH_3COONa

29. How much water has to be evaporated from 250 ml of $Ca(OH)_2$ to make it 3 M?

A. 100ml B. 150 ml C. 167 ml D. 200 ml

30. How many ml of water is required to dilute 50 ml of 3.5 M H_2SO_4 to 2.00 M H_2SO_4?

A. 37.5 B. 45 C. 75 D. 87.5

31. Under what conditions the enthalpy change of a process equals the amount of heat transferred into or out of the system?

A. Under constant volume.
B. Under constant pressure.
C. Under constant pressure and volume.
D. Under constant pressure and temperature.

32. A solution at 25^0C contains the metal ions Ni^{2+}, Pt^{2+}, Pd^{2+} all at 1.0 M concentrations. Consider the following standard reduction potentials:

$Ni^{2+} + 2e^- \rightarrow Ni$ $E^0 = -0.23$ V
$Pt^{2+} + 2e^- \rightarrow Pt$ $E^0 = 1.20$ V
$Pd^{2+} + 2e^- \rightarrow Pd$ $E^0 = 0.99$ V

Which metal (s) will plate out first when the solution is electrolyzed?

A.Ni B. Pd C. Pt D. Ni and Pd

33. Which of the following statements is true?

A. A battery is rechargeable.
B. A battery produces electricity spontaneously.
C. A battery has generally no liquid components.

D. A battery produces the same amount of electricity, regardless of composition.

34. Which of the following quantum number/s determine the energy of an electron in a hydrogen atom?

A. n
B. n and l
C. n, l and m
D. n, l, m and s

35. What is the half-life, $t\frac{1}{2}$ for a zero order reaction A → B, (k is rate constant)?

A. ℓn2k B. $[A]^0/2k$ C. $\ell nk[A]^0$ D. $\ell n2[A]^0k$

36. There is a strong covalent bond between the N atoms in nitrogen gas N_2 why, then, does nitrogen have such a low boiling point of -196^0C?

A. The bond between the N-atoms is triple.
B. N is very electronegative, only next to F and O.
C. The strong bond, an intermolecular one, determines the boiling point of the substance.
D. Boling point is determined by intermolecular force, which in this case is weak as the molecule is non-polar.

37. For elements in the left-most column of the periodic table, properties that have increasing values as the atomic number increases include which of the following?

I. Ionization energy II. Atomic radius
III. Atomic mass

A. III only
C. I and II only
B. I, II, and III
D. II and III only

38. Which of the following statement correctly describes a chemical reaction at equilibrium?

A. The concentrations of the products and reactants are equal.
B. The change in the concentrations of the products and reactants is constant.
C. The rate of the forward reaction is less than the rate of the reverse reaction.
D. The rate of the forward reaction is greater than the rate of the reveres reaction.

39. The solubility of sodium selenate, Na_2SeO_4, is 84g/100g of water at 35^0C, what do you call this solution?

A. Diluted
B. Saturated
C. unsaturated
D. supersaturated

40. Which law relates the concentration of a dissolved gas, Cg, to its partial Pressure?

A. Henry's B. Raoult's law
C. Boyle's law D. Ideal gas law

41. What did Rutherford's alpha particle experiment show?

A. Electrons have a negative charge.
B. A proton is a hydrogen atom without electron.
C. Electrons circle the nucleus of an atom in orbits.
D. Most of the mass and all of the positive charge of an atom is found in a tiny nucleus.

42. Which of the statement below best explains why atoms react chemically with each other?

A. When atoms react, they gain protons and are more stable.
B. When atoms react, they lose all their electrons and become more stable.
C. When atoms react, they lose, gain, or share electrons and are then less stable.
D. When atoms react, they lose, gain or share electrons to attain a full outer energy level and then more stable.

43. All of the following when added to water will produce an electrolytic solution EXCEPT.

A. $N_2(g)$ B. NaCl (s) C. HCl(g) D. KOH(s)

44. What is the hydroxide ion concentration for a solution with a pH of 10 at 25^0C.?

A. 10^{-14}M B. 10^{-10}MC. 10^{-7} M D. 10^{-4} M

45. Which of the following electron transitions requires the smallest energy to be absorbed by the hydrogen atom?

A. From $n = 1$ to $n = 2$ C. From $n = 3$ to $n = 4$
B. From $n = 2$ to $n = 3$ D. From $n = 4$ to $n = 5$

46. For an electron that has quantum numbers $n = 4$ and $ml = 0$, which of the following is true?

A. It must have the quantum number $n = 0$
B. It must have the quantum number $ml = 0$
C. It must have the quantum number $m_s = + ½$
D. It may have the quantum number $l = 0, 1, 2, 3$

47. Which of the following species has the smallest H-X-H bond angle where X is the central atom?

A. H_2O B. NH_3 C. CH_4 D. BH_3

48. What is the hybridization of phosphorus atom in PCl_5?

A. sp^3d B. sp^3d^2 C. sp^3 D. sp^2

49. The organic compound $CH_3C(O)CH_3$ is:

A. Aldehyde B. Ester

C. carbonyl D. ketone

50. Which molecule has a Lewis structure that does NOT obey the octet rule?

A. NO B. CS_2 C. PF_3 D. HCN

51. Which of the following explains why, at room temperature, I_2 is a solid, Br_2 is a liquid and Cl_2 is a gas?

A. Ionic bonding C. hydrogen bonding

B. Hybridization D. London dispersion forces

52. Which molecule listed below has two sigma (σ) and two pi(π) bonds?

A. N_2 B. C_2H_4 C. N_2F_2 D. HCN

53. Which of the following titrations will have an equivalence point at a pH <7?

A. Strong acid with weak base

B. Weak acid with weak base

C. Strong acid with strong base

D. Weak acid with strong bases

54. How many atoms are present in 22g CO_2?

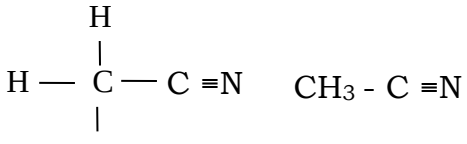
A. $3.01x10^{23}$ B. $6.02x10^{23}$

C. $2x6.02x10^{23}$ D. $1.5x6.02x10^{23}$

55. For which of the following elements is Hund's rule used in writing the electron configuration?

A. C B. B C. Be D. Li

56. What is the hybridization of the carbon atom attached to nitrogen in acetonitrile shown below?



$CH_3 - C \equiv N$

A. sp B. sp^2 C. sp^3 D. sp^4

57. What mass of aluminum is produced in one hour by the electrolysis of molten $AlCl_3$ with a current of 10A?

A. 1.5g B. 2.5g C. 3.4g D. 4.3 g

58. Consider the following reaction:

$2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow S_4O_6^{2-}(aq) + 2I^-(aq)$

If, in an experiment, 0.05mol $S_2O_3^{2-}$ is consumed in 1.0L of solution each second, at what rates are $S_4O_6^{2-}$ and I- produced in this solution?

A. $S_4O_6^{2-} = 0.025$; $I^- = 0.025$
B. $S_4O_6^{2-} = 0.05$; $I^- = 0.05$
C. $S_4O_6^{2-} = 0.025$; $I^- = 0.05$
D. $S_4P_6^{2-} = 0.05$; $I^- = 0.25$

59. All of the following can act as Bronsted – Lowry bases EXCEPT

A. I^- B. NH_3 C. HCO_3^- D. H_2CO_3

60. The reaction **2X+Y→Z** was studied and the following data were obtained.

Expt.	[X]	[Y]	Rate (mole $L.^{-1}. S^{-1}$)
1	3.0	3.0	1.8
2	3.0	1.5	0.45
3	1.5	1.5	0.45

What is the proper rate expression?

A. Rate = K[X] C. Rate = $K[Y]^2$
B. Rate = K[X] D. Rate = $K[X]^2[Y]$

61. If the following reaction is at equilibrium, which one of the following changes will shift the equilibrium to the left?

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} + Heat$

A. Increasing pressure.
B. Decreasing temperature
C. Adding more N_2 and H_2
D. Increasing the volume of the reaction container.

62. The reaction between NO and I_2 is second- order in NO and first –order in I_2. What change occurs in the rate of the reaction if the concentration of NO is doubled and I_2 left unchanged?

A. Double B. Quadruple C. eight times D. three times

63. Which of the following compounds would give the lowest freezing point depression when 100g of each are dissolved in 1 kg of water (k_f for water = 1.860C/m)? Assume complete dissociation.

A. NaCl B. NH_4NO_3
C. $(NH_4)_2SO_4$ D. glucose, $C_6H_{12}O_6$

64. For the reaction **A+B→C+D**, $\Delta H^0 = +40$kJ and $\Delta S^0 = +50$J/k.

Therefore, the reaction under standard conditions is

A. Spontaneous at all temperatures.
B. Non spontaneous at all temperatures
C. Spontaneous at temperatures greater than 800K.
D. Spontaneous only at temperature between 10k and 800k.

65. Which of the following is a conjugate acid/base pair?

A. HCl/OCl^- B. H_3O^+/OH^-
C. NH_4^-/NH_3 D. H_2SO_4/SO_4^{2-}

66. Which of the following is most likely to deviate from ideal gas behavior?

A. He B. Ar C. Cl_2 D. CCl_2F_2

67. Consider the following balanced equation:

$$3Ba(NO_3)_2(aq) + Fe_2(SO_4)_3(aq) \rightarrow 3BaSO_4(s) + 2Fe(NO_3)_3(aq)$$

The net ionic equation to describe this balanced equation is

A. $3Ba^+(aq) + SO_4^{2-}(aq) \rightarrow 3BaSO_4(s)$
B. $3Ba^{2+}(aq) + 3SO4^{2-}(aq) \rightarrow 3BaSO_4(s)$
C. $6NO_3^-(aq) + 2Fe^{2+}(aq) \rightarrow 2Fe(NO_3)_3(aq)$
D. $3Ba^{2+}(aq) + 2NO_3^-(aq) + 2Fe^{3+}(aq) + 3SO_4^{2-}(aq) \rightarrow 3BaSO_4(s) + 2Fe^{3+}(aq) + 6NO_3^-(aq)$.

68. A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of this reaction?

A. 0 B. 1 C. 2 D. 3

69. Suppose reactions A $\rightarrow$B and B $\rightarrow$ A are both elementary processes with rate constants $8x10^2s^{-1}$ and $4x10^4s^{-1}$, respectively. What is the value of the equilibrium constant for the equilibrium? $\mathbf{A \rightleftharpoons B}$

A. $2x10^{-2}$ B. $0.5x10^2$ C. $4x10^2$ D. $4x10^{-2}$

70. Consider the following reaction:

$$\mathbf{CH_3CH_2 - \overset{\overset{O}{||}}{C} - OCH_3 + NaOH},$$

What are the products of this reaction?

A. Sodium acetate and ethanol
B. Sodium acetate and methanol
C. Sodium propionate and methanol
D. Methyl propionic acid and methanol

71. What is the Molarity of a solution containing 10g of sulfuric acid in 500 ml of solution?

A. 0.02 B. 0.03 C. 0.12 D. 0.2

72. The pH at room temperature of a 0.1 M solution of formic acid ($HCHO_2$) was measured to be 4.50. What is the hydrogen ion concentration?

A. $3.16x10^{-5}$ M B. $3.16x10^{-12}$ M
C. $6.32x10^{-3}$ M D. $6.32x10^{-4}$ M

73. What is the change in internal energy, ΔE of a system if it absorbs 300 kJ of heat from the surroundings and does 500 kJ of work on the surroundings?

A. 100KJ B. 200KJ C. 400KJ D. 500KJ

74. For the conversion of C **(diamond) →C (graphite)**, ΔH = -3 KJ. What does this mean?

A. Both are equally stable
B. Graphite is more stable than diamond
C. Diamond is more stable than graphite
D. Graphite has more stable energy than diamond

75. Why does a pressure cooker reduce cooking time?

A. The heat is more evenly distributed.
B. A stronger flame is used for cooking
C. The high pressure tenderizes the food.
D. The boiling point of water inside the cooker is increased.

76. How can silver be plated into nickel?

A. Electricity to a nickel anode in a solution of silver ions
B. Electricity to a silver anode in a solution of nickel ions
C. A solution of nickel ions to react with a piece of silver
D. Electricity to a nickel cathode in a solution of silver ions.

77. Which catalyst is used in the hydrogenation of vegetable oils?

A. Iron B. Nickel
C. platinum D. Molybdenum

78. Which of the following is NOT a carbohydrate?

A. Starch B. glucose C. Glycine D. Cellulose

79. Which element is added to natural rubber to make it harder and reduce its susceptibility to oxidation and chemical attacks?

A. Sulfur B. Silicon C. carbon D. Nitrogen

80. Which of the following ions is the most abundant in sea water?

A. Na^+ B. Ca^{2+} C. CI^- D. HCO

Ethiopian University Entrance Examination (EUEE) Chemistry 2005/2013

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Read each question and carefully blacken the letter of your best choice on the separate answer sheet provided. You may refer to the information given below when you work on some of the questions

1. Which of the following statements is TRUE?

(A) Ultraviolet light has longer wavelength than visible light.

(B) The energy of radiation decreases as the wavelength decreases.

(C) The frequency of radiation increases as the wavelength decreases.

(D) Wave number of an electromagnetic radiation increases as wavelength increases.

2. Which one is ionic compound formed from the reaction between magnesium and nitrogen?

(A) MgN_2 (B) Mg_2N_2 (C) Mg_3N_2 (D) Mg_2N_3

3. Which of the following molecules represents a non-polar covalent bond?

(A) B-C1 (B) C-C1 (C) C1-C1 (D) Mg-C1

4. Which one of the following groups in the periodic table has paramagnetic atoms?

(A) Group zero (C) Group IIB

(B) Group IIA (D) Group IVA

5. Which of the following is NOT a basic SI unit?

(A) Candela (B) Gram (C) Mole (D) Second

6. What is the process that converts liquid vegetable oils to solid fats?

(A) Hydration. (C) Hydrolysis

(B) Hydrogenation (D) Saponification

7. What would be the solubility of $HOCH_2\ (CH_2)_6CH_2OH$ compared to $CH_3\ (CH_2)_6CH_2OH$?

(A) Less soluble in water.

(B) More soluble in water.

(C) The same solubility in water,

(D) More soluble in a non-polar solvent such as dichloromethane.

8. Which of the following gases can be manufactured using the Haber process?

(A) Ammonia (C) Nitrogen

(B) Nitric oxide (D) Nitrogen dioxide

9. Which one of the mixture of the following pairs will NOT give a buffer solution?

(A) HCN and NaCN (C) H_3PO_4 and KH_2PO_4

(B) NH_3 and NH_4C1 (D) HNO_3 and Na NO_3

10. How many types of cubic unit cells are known?

(A) 2 (B) 3 (C) 4 (D) 5

11. Which of the following metal is NOT obtained by commercial electrolytic process?

(A) Ag (B) A1 (C) Cu (D) Na

12. Which of the following metals has the highest electrical and thermal conductivities?

(A) Ag (B) Co (C) Cu (D) Ni

13. Enthalpy is defined as the heat content of the system at constant:

(A) Heat (B)Moles (C) Pressure (D) Volume

14. Which of the following elements is the second most abundant element in the earth`s crust?

(A) Aluminum (B)Iron (C) Oxygen (D) Silicon

15. Which one of the following is TRUE for salts formed from strong acids and strong bases?

(A) No hydrolysis takes place

(B) Produces ions that are proton donors

(C) Produces ions which are proton acceptors.

(D) Depends on the pK_a and pK_b of the parent acids and bases, respectively.

16. What is the number of significant figures in 0.0030050?

(A) 4 (B) 5 (C) 7 (D) 8

17. Which of the following properties of a substance does NOT represent an intensive physical property?

(A) Boiling point (B)Color (C) Density (D) Volume

18. What is the mass of one molecule of water?

(A) $3.0x10^{-23}g$ (C)0.0003g

(B) $1.8x10^{-22}g$ (D) 18.0g

19. Which of the following quantum number (s) is (are) related to the size and energy of an electron in a hydrogen atom?

(A) n (B) n, 1 (C) n, 1, m (D) n, 1, m, s

20. Which of the following plant nutrient will be produced as a result of nitrogen fixation?

(A) Carbohydrate (C) Mineral

(B) Cellulose (D) Protein

21. Which of the following molecules has a trigonal bipyramidal structure?

(A) SF_4 (B) IF_5 (C) $IC1_4$ (D) BrF_5

22. Which of the following represents the general configuration of the transition elements?

(A) ns^2np^6 (C) ns(n-2)f

(B) ns(n-1)d (D)$ns^2np^6(n-1)d^{10}$

23. The total number of electrons participating in the bond formation of carbonate anion, CO_3^{2-}, in the molecule of carbonic acid are:

(A) 16 (B) 10 (C) 8 (D) 5

24. Which of the following crystals possess high electrical and thermal conductivities?

(A) Ionic crystals. (C) Molecular crystals

(B) Metallic crystals (D) Covalent network crystals

25. An electron has a spin quantum numbers, $s = +1/2$ and a magnetic quantum number, $m_l = +1$. In which of the following orbital will it NOT be present?

(A) s-orbital (B)p-orbital (C) d-orbital (D) f-orbital

26. Which of the following statements is TRUE about equilibrium reaction?

(A) No more reactants are transformed into products.

(B) There are equal amounts of reactants and products.

(C) The rate constant for the forward reactions equals that of the reverse reaction

(D) The rate for the forward reactions equals that of the reverse reactions.

27. Three gases are in equilibrium in a closed chamber sealed with a piston. The following equilibrium is established.

$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$

What will happen if the piston is pushed into the chamber?

(A) The mole fraction of N_2 increases.
(B) The mole of N_2 decreases.
(C) The mole fraction of N_2 remains the same.
(D) The mole fraction of N_2 increases and then decreases.

28. Which of the following reactions will produce an alkyl carboxylic acid?
(A) Heating a methyl ketone with acid and iodine.
(B) Reacting an alkyl halide with hydrogen gas and platinum.
(C) Reacting an alcohol with ozone.
(D) Oxidation of primary alcohol with hot permanganate or chromate.

29. Which of the following statements is NOT TRUE?
(A) Naturally derived soaps consist of a soluble salt of a long chain fatty acid.
(B) Triacylglycrerols are esters of glycerol and long chain carboxylic acids.
(C) Long chain carboxylic acids are known as fatty acids.
(D) The major acidic component of vinegar is formic acid.

30. What is a valid rate expression for the following reaction?

$$2NO + 2H_2 \rightarrow N_2 + 2H_2O$$

(A) $\frac{1}{2}\frac{\Delta[H_2]}{\Delta t}$ (C) $-\frac{1}{2}\frac{\Delta[NO]}{\Delta t}$
(B) $-\frac{1}{2}\frac{\Delta[H_2O]}{\Delta t}$ (D) $-\frac{\Delta[N_2]}{\Delta t}$

31. Which of the following is the most important type of solute-solvent interaction in a solution of n-butanol in water?
(A) Dispersion (C) Dipole-dipole
(B) Ion-dipole (D) Hydrogen bonding

32. What is the product of the hydrolysis of esters in the presence of a mineral acid catalyst?
(A) Alcohol (C) Ether
(B) Carbon dioxide (D) Ketones

33. To which organic functional group does the following molecular representation, i.e., R_1R_2CHCOH belong? (R_1 and R_2 represent different alkyl chains)
(A) Amides (C) Ethers
(B) Aldehyde (D) Organic acids

34. What is the quantity of water, in mL, required to prepare 0.5 M of HCl from a concentrated solution of 3.5 M in 50mL is?

(A) 50mL (C) 300mL
(B) 100mL (D) 350mL

35. What is the name of triacylglycerol (triglycerides) that is solid at room temperature?

(A) Lecithin (B) Fat (C) Wax (D) Oil

36. Given the following equilibrium and equilibrium constants:

(I) $HC_2H_3O_2 + H_2O \rightleftharpoons H_3O^+ + C_2H_3O_2^-$; $K_a = 1.80x10^{-5}$
(II) $H_2CO_3 + H_2O \rightleftharpoons H_3O^+ + HCO_3^-$; $K_a = 4.20x10^{-7}$
(III) $NH_4^+ + H_2O \rightleftharpoons H_3O^+ + NH_3$; $K_a = 5.6x10^{-10}$
(IV) $HCOOH + H_2O \rightleftharpoons H_3O^+ + COOH^-$ $K_a = 1.80x10^{-4}$

What is the strength of the acids in DECREASING order?

(A) I, IV, II and III (C) III, II, I and IV
(B) II, III, IV and I (D) IV, I, II and III

37. Given the reaction: $H_2PO_4^- + H_2O \rightarrow H_3O^+ + HPO_4^{2-}$

Which of the following represents a conjugate acid-base pair?

(A) $H_2PO^-_4$ and H_2O (C) $H_2PO^-_4$ and H_3O^+
(B) $H_2PO^-_4$ and HPO_4^{2-} (D) H_2O and HPO_4^{2-}

38. Which of the following statements is TRUE about colligative properties?

(A) Both vapor pressure and freezing point increase when a non-volatile solute is added to a solvent.
(B) Both freezing point and boiling point increase when a non-volatile solute is added to a solvent.
(C) Both vapor pressure and boiling point decrease when a non-volatile solute is added to a solvent.
(D) Colligative properties depend only upon the number of solute particles in a solution and not upon their identity.

39. What is the pH of 0.005 M solution of Ca $(OH)_2$?

(A) 2.3 (B) 10 (C) 12 (D) 14

40. What is the equivalent weight of HNO_3, as an oxidizing agent, in the following balanced reaction?

$3Fe^{2+} + 4H^+ + NO_3^- \rightarrow 3Fe^{3+} + NO + 2H_2O$

(A) 10.50 (B)15.75 (C) 21.00 (D) 31.50

41. How many kilojoules of heat are absorbed when 20 g of NaC1(s) is decomposed into Na (s) and Cl_2 (g) at constant pressure according to the following reaction?

$2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$ $\Delta H = -821.8KJ$

(A) -281.0 (B)-140.5 (C) +140.5 (D) +281.0

42. In the electroplating of nickel from a solution containing Ni^{2+} ion, what will be the weight of the metal deposited on the cathode by a current of 8 A flowing for 500 minutes?

(A) 73g (B) 103g (C) 117.4g (D) 145g

43. A 1M solution of Cu $(NO_3)_2$ is placed in a beaker with a strip of Cu metal. A 1M of $SnSO_4$ is placed in a second beaker with a strip of Sn metal. The two beakers are then connected by a salt bridge and the two metal electrodes are then connected by a salt bridge and the metal electrodes are connected by wires to a voltmeter. Which of the following electrode serves as the anode and which electrode gains mass?

Given the E^0 $Cu^{2+}/Cu=0.34V$ and $E^0Sn^{2+}/Sn=-0.14V$

(A) Anode, Sn, Sn electrode gains mass.

(B) Anode, Sn, Cu electrode gains mass.

(C) Anode, Cu, Sn electrode gains mass.

(D) Anode, Cu, Cu electrode gains mass.

44. Which of the following metal alloys does NOT contain tin?

(A) Brass (B) Bronze

(C) Pewter (D) Plumber`s solder

45. The indicator Bromthymol Blue (HBb) is a weak acid with $Ka=1.0x10^{-7}$ ionizes as follows:

HBb (aq, yellow) $\rightleftharpoons$ H^+(aq, colorless) + In^-(aq), blue)

Which way will the equilibrium shift when NaOH is added and what will the color of the NaOH solution be containing this indicator?

(A) Equilibrium will shift to the right and the color of NaOH solution will turn green.

(B) Equilibrium will shift to the right and the color of NaOH solution will turn blue.

(C) Equilibrium will shift to the left and the color of NaOH solution will turn yellow.

(D) Equilibrium will shift to the left and the color of NaOH solution will turn blue.

46. What are the raw materials required to synthesize nylon 66, a specific kind of nylon?

(A) Diacids (C) adipic acid and Diamines

(B) Diamines (D) Polyethylene

47. Which of the following substances are added to natural rubber to toughen it?

(A) Calcium (B) Carbon (C) Nitrogen (D) Sulfur

48. What is the quantity of heat required to raise the temperature of 80 g of ethanol from 25^0 C to 75^0 C? (specific heat of ethanol=$2.46Jg^{-1}K^{-1}$)

(A) 2.46KJ (B)4.0KJ (C) 9.84KJ (D) 18.68KJ

49. Consider the following gaseous reaction at 25^0C

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$ ΔH=-802KJ (exothermic). Which energy change would occur if 3.2 moles of CH_4 is completely combusted?

(A) $2.57x10^3$KJ will be released.
(B) $2.57x10^3$ KJ will be absorbed.
(C) $6.43x10^3$KJ will be released.
(D) $6.43x10^3$ KJ will be absorbed.

50. What structural feature is usually needed to present in order for an addition polymer to be produced?

(A) A carbon-carbon sigma bond.
(B) A carbon-oxygen pi bond.
(C) A carbon-oxygen sigma bond.
(D) A carbon-carbon pi bond.

51. Which of the following is the most important ingredients used for production of DAP fertilizer?

(A) Ammonia and phosphoric acid.
(B) Nitric acid, urea and phosphoric acid.
(C) Phosphoric acid, urea and ammonia.
(D) sulfuric acid, ammonia and urea.

52. Which of the following biomolecules forms a zwitterions either higher or lower pH?

(A) Cellulose (B) Glucose (C) Protein (D) Starch

53. Which of the following form of synthetic rubbers can be vulcanized to greatly enhance its mechanical strength?

(A) Neoprene (C) Butyl rubber
(B) Isoprene (D) Styrene-butadiene rubber

54. What is the range in the number of carbon atoms of the monosaccharide's that are found in nature?

(A) 3 to 7 (B)4 to 10 (C) 4 to 12 (D) 5 to 12

55. What is the number of chloride ions (Cl^-) present in $1.0x10^{-5}$ mol of $AlCl_3$?

(A) 1.80×10^{19} (C) 6.02×10^{23}
(B) 6.02×10^{-18} (D)6.02×10^{28}

56. What is the Kelvin scale (K) corresponding to the temperature readings when the degree Celsius (^{0}C) is identical to the degree Fahrenheit (^{0}F)?

(A) 0 K (B) 37 K (C) 233 K (D) 273 K

57. What is the wavelength associated with an electron of mass, m=9.11x10^{-28} g, travelling at 40% of the velocity of light?

(A) 6.06 x 10^{-15}m (C) 6.06 x 10^{-12}m

(B) 2.42 x 10^{-15}m (D) 2.42 x 10^{-11}m

58. The quantum numbers listed below are for four different electrons in an atom.

I. n = 4, 1 = 0, m1 = 0, ms = +½ 4s

II. n = 3, 1 = 1, m1 = 1, ms = +½ 3p

III. n = 4, 1 = 2, m1 = 0, ms = +½ 4d

IV. n = 4, 1 = 1, m1 = 0, ms = -½ 4p

When these sets of quantum numbers are arranged in order of increasing energy, one may get.

(A) I < II < III < IV (C) II < I < IV < III

(B) I < III < II < IV (D) IV < III < II < I

59. Which of the following hybrid orbital's is favoring the formation of trigonal biphyramidal?

(A) sp^3d (B) sp^3(C) sp^3d^2(D) sp^3d^3

60. What are the two principal polysaccharide forms of starch?

(A) Aldohexose and ketopentose

(B) Amylase and amylopectin

(C) Maltose and cellobiose

(D) Sucrose and lactose

61. For the reaction:

$$2A + B \rightarrow C$$

The following experimental results were obtained:

Experiment	[A]	[B]	Rate (mol $L^{-1}s^{-1}$)
1	0.50	0.50	0.300
2	0.50	0.25	0.075
3	0.25	0.25	0.075

What is the value of the rate constant?

(A) 0.6 mol L^{-1} s^{-1} (C) 1.2 L $mol^{-1}s^{-1}$

(B) 0.6 L mol^{-1} s^{-1} (D) 2.4 mol $L^{-1}s^{-1}$

62. Increase in temperature of rate of a given reaction is due to the increase in the:

(A) Extent of molecular dissociation.
(B) Activation energy of the reaction.
(C) Frequency of collision of the reacting species.
(D) Numerical value of the rate constant of the reaction.

63. If a piece of aluminum (Al) foil measuring 24cm by 31cm has a mass of 10.35g, (density of Al = 2.70 g cm^{-3}). What is the thickness of the foil in millimeters?

(A) $5.15x10^{-3}$ (B) $5.15x10^{-2}$ (C) 3.833 (D) 744

64. What sizes of particles and velocities can one consider quantum effect?

(A) Particles with very large mass and large velocities.
(B) Particles with large mass and small velocities.
(C) Particles with very small mass and large velocities.
(D) Particles with small mass and small velocities.

65. Which one of the following molecules/molecular ions is paramagnetic according to the molecular orbital theory?

(A) O_2^{2-} (B) O_2 (C) F_2 (D) O_2^{2+}

66. The reaction for the formation of nitrosyl chloride

$$2NO(g)+Cl_2(g) \rightleftharpoons 2NOCl(g)$$

Was studied at 25^0C. The value of K_p for this reaction at 25^0C is 1.9×10^3 atm^{-1}. What is the value of K at 25^0 C?

(A) $1.9x10^{-3}$L/mol (C) $4.6x10^4$L/mol
(B) $3.8x10^{-3}$L/mol (D) $4.6x10^5$L/mol

67. Which of the following reactions will convert carboxylic acids to primary amines?

(A) Decarboxylation with HBr and peroxide, then reaction of the alkyl bromide with ammonia.
(B) Reduction of the acid to the alcohol with NaOH/formaldehyde, then reaction with ammonium chloride and heat.
(C) A two-step conversion, first to the amide with ammonia and heat, and then by reduction with lithium aluminum hydride or hydrogen plus catalyst.
(D) Lactase fermentation in the presence of ammonia atmosphere.

68. A solution was prepared by adding 48 g of methanol (CH_3OH) into 81g of water (H_2O). What is the mole fraction of methanol in this solution?

(A) 0.25 (B) 0.75 (C) 1.5 (D) 4.5

69. A solution was prepared by dissolving 3.75 g of pure hydrocarbon in 95.0 g of cyclohexane. The boiling point of pure cyclohexane was observed to be 80.70^0C and that of the solution was 81.45^0C. What is the approximate molecular weight of the hydrocarbon?
(K_b for cyclohexane = 2.79^0C/m)

(A) 71.0g/mol (B)105 g/mol (C) 147 g/mol(D) 312 g/mol

70. Which of the following molecules has a dipole moment?

(A) XeF_4 (B) BCl_3 (C) SO_3 (D) CH_4

71. To 0.2 M solution of a weak monoprotic acid, HA, enough quantity of its sodium salt, NaA, was dissolved to give a concentration of 0.2 M of the salt, what will be the acid concentration, $[H_3O^+]$, in the final solutions? (K_a of HA = $1.80x10^{-5}$)

(A) $3.60x10^{-6}$M (C) $1.80x10^{-5}$M

(B) $1.00x10^{-5}$M (D) $1.90x10^{-3}$M

72. Gaseous petrol in a combustion system has done 375 kJ of work during its expansion in the piston. Simultaneously, it absorbed 586 kJ of heat from the engine. What is the internal energy change during the process?

(A) +211 KJ (B) +961 KJ (C) -211 KJ (D) -961 KJ

73. Which of the following reactions is expected to have negative value of entropy change ΔS?

(A) $C_6H_6(s) + 6O_2(g) \longrightarrow 6CO_2(g) + 6H_2O(1)$

(B) $CaCO_3(s) \longrightarrow CaO\ (s) + CO_2(g)$

(C) $N_2O_4(g) + Cl_2(g) \longrightarrow 2NOCl\ (g) + O_2(g)$

(D) $2SO_2(g) + O_2\ (g) \longrightarrow 2SO_3(g)$

74. Consider the following unbalanced redox reaction in acidic solution:

$$MnO^-_4 + Fe^{2+} \longrightarrow Mn^{2+} + Fe^{3+}$$

What is the change in oxidation state for both the substances oxidized and reduced, and the coefficients of Fe^{2+} and Mn^{2+}, respectively, after balancing?

(A) 2 and 7, and 2 and 5 (C) 1 and 5, and 5 and 1

(B) 3 and, 2 and 5 and 1 (D) 2 and 5, and 5 and 2

75. A 50 mL solution of H_2SO_4 of 0.250 M is titrated with NaOH solution of unknown concentration. The endpoint against phenolphthalein indicator was signaled when 41.0 mL

of NaOH was added. What is the concentration of NaOH solution?

(A) 0.10 M (B) 0.25 M (C) 0.41 M (D) 0.50 M

76. What is the pH of an aqueous solution prepared to contain $1.3x10^{-3}$M sodium nitrite ($NaNO_2$) if the acid dissociation equilibrium constant, K_a, for nitrous acid (HNO_2) is $5.1x10^{-4}$?$K_w 1.0x10^{-14}$

(A) 3.1 (B) 5.1 (C) 6.0 (D) 7.3

77. What reactions occur at the anode and cathode when an aqueous solution of Na_2SO_4 is electrolyzed?

(I) $S_2O_8^{2-} + 2e^- \longrightarrow 2SO_4^{2-}$ **E^o red=** 2.01V

(II) $O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$ **E^o red=** 1.23V

(III) $2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$ **E^o red=** -0.82V

(IV) $Na^+ + 1e^- \longrightarrow Na$, **$E^o$ red=** -2.71V

(A) H_2 at cathode and O_2 at anode

(B) Na at cathode and $S_2O_8^{2-}$ at anode

(C) H2 at cathode and $S_2O_8^{2-}$ at anode

(D) Na at cathode and O_2 at anode

78. Which synthetic polymer is produced from Caprolactam?

(A) Nylon-6 (C) Teflon

(B) Nylon 6, 10 (D) Terylene

79. For the following hypothetical equation, in aqueous solution, what is the correct representation of the cell notation?

$A(s) + B^{2+}(aq) \longrightarrow A^{2+}(aq) + B(s)$

(A) $A(s)/A^{2+}(aq) \parallel B^{2+}(aq)/B(s)$

(B) $B^{2+}(aq)/B(s) \parallel A^{2+}(aq)/A(s)$

(C) $A^{2+}(aq)/A(s) \parallel B(s)/B^{2+}(aq)$

(D) $B(s)/B^{2+}(aq) \parallel A^{2+}(aq)/A(s)$

80. How many mL conc. HNO_3 and how many mL of water are required to prepared 500 mL of 0.1 M HNO_3 from a conc. 13 M HNO_3?

(A) 1 mL HNO_3 and 496.15 mL H_2O

(B) 2 mL HNO_2 and 500 mL H_2O

(C) 3.85 mL HNO_3 and 500 mL H_2O

(D) 3.85 mL HNO_3 and 496.15 mL H_2O

Ethiopian University Entrance Examination (EUEE) Chemistry 2006/2014

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Read each question and carefully blacken the letter of your best choice on the separate answer sheet provided. You may refer to the information given below when you work on some of the questions

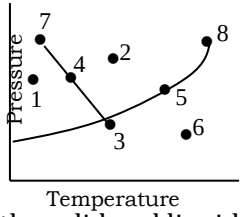
1. Which of the following is NOT a conjugate acid-base pair?
   A. HNO_3/NO_3^- C. NH_3/NH_2^-
   B. H_2SO_4/HSO_4^- D. H_3O^+/OH-
2. Which of the following is correct?
   A. 1L=1dm^3 C. 10L=1dm^3
   B. 1L=10dm^3 D. 1L=1m^3
3. Commercially, liquid vegetable oils are converted to solid fats such as margarine by:
   A. Hydrogenation C. Saponification
   B. Hydration D. Oxidation
4. What is the chemical name for Aspirin?
   A. Acetyl salicylic acid B. Salicylic acid
   C. Methyl salicylate D. Sodium salicylate
5. Which of the following statement(s) is (are) true of an ideal liquid-liquid solution?
   I. It obeys PV = nRT?
   II. It obeys Raoult's law.
   III. Solute-solute, solvent-solvent, and solute-solvent interactions are very similar.
   IV. Solute-solute, solvent-solvent, and solute-solvent interactions are quite different.
   A. II, II and III C. II and III
   B. I, II and IV D. II and IV
6. The unit cell in a certain lattice consists of a cube formed by an anion at each corner, an anion in the center, and a cation at the center of each face. How many cations and how many anions does the unit cell have?
   A. 5 anions and 6 cations. C. 2 anions and 3 cations.
   B. 5 anions and 3 cations. D. 3 anions and 4 cations.
7. In a reaction, A + B → product, the rate is doubled when the concentration of B is doubled, and rate increases by a factor

of 8 when the concentrations of both the reactants (A and B) are doubled, the rate law for the reaction can be written as:

A. Rate = k [A] [B] B. Rate = k$[A]^2$[B]

C. Rate = k [A] $[B]^2$ C. Rate = k $[A]^2$ $[B]^2$

8. Answer the following question using the phase diagram below.



At which point can only the solid and liquid phases coexist?

A. 1 B. 2 C. 3 D. 4

9. Which electron transition in a hydrogen atom released the largest energy?

A. n = 2 → n = 1 C. n = 6 n = 3

B. n = 4 → n = 2 D. n = 7 → n = 6

10. The simplest formula for a compound containing Mn^{4+} and O^{2-} is.

A. MnO C. Mn_2O_4

B. MnO_2 D. Mn_4O_2

11. What is the ratio of energy of a photon of 300 nm wavelength radiation to that of 600 nm radiation?

A. 1:2 B. 1:1 C. 2:1 D. 3:1

12. Which one of the following chemicals is used to disinfect water?

A. Fluorine C. Oxygen

B. Nitrogen D. Chlorine

13. During the titration of a known volume of a strong acid with a strong base, there is

A. a steady increase in pH.

B. a sharp increase in pH around the end point.

C. a steady decrease in PH.

D. a sharp decease in pH around the end point.

14. A solution with a pH of 7.5 would be described as:

A. Very basic C. Slightly acidic

B. Slightly basic D. Very acidic

15. The electrolysis of molten NaCl is an industrial process. What does the electrolysis produce?

A. Na and Cl_2 C. Na^+ and Cl^-
B. H_2 and O_2 D. NaOH and Cl_2

16. Butane burns in oxygen according to the equation below. $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(1)$. If 11.6 g of butane is burned in11.6gm of oxygen, which is the limiting reagent?
A. Butane C. Neither
B. Oxygen D. Both oxygen and butane
17. A beaker filled to the 100 mL mark with salt (the salt has a mass of 100g) and another beaker to the 100 mL mark with water (the water has a mass of 100g) are mixed together in a bigger beaker until the salt is completely dissolved. What will be the mass of the solution?
A. It will be much more than 200 g.
B. It will be much smaller than 200 g.
C. It will be exactly 200 g
D. It will be slightly more than 200 g.
18. Which one of the following is **NOT** an intensive property?
A. Mass C. Colour
B. Temperature D. Density
19. Which of the following is natural polymer?
A. Nylon B. PNC C. Cotton D. Dacron
20. Which of the following metals forms a volatile compound during the extraction process?
A. Fe B. Co C. Ni D. Cu
21. Which one of the following atoms in its ground state has the greatest number of unpaired electrons?
A. $_{13}Al$ B. $_{14}Si$ C. $_{15}P$ D. $_{16}S$
22. Which statement is true about chemical reactions at equilibrium?
A. The forward and backward reactions proceed at equal rates.
B. The forward and backward reactions have stopped.
C. The concentrations of the reactants and products are equal. D. The forward reaction is exothermic
23. Which compound contains both covalent and ionic bonds?
A. Sodium carbonate, Na_2CO_3
B. Magnesium bromide, $MgBr_2$
C. Dichloromethane, CH_2Cl_2

D. Ethanoic acid, CH_3COOH

24. Which set of quantum numbers (n, l, m_1, m_s) is not possible?
A. 1,0,0,1/2 C. 1,0,0,-1/2 B. 1,1,0,1/2 D. 2,1,-1,1/2

25. Which of the following particles contains more electrons than neutrons?
I. $^{1}_{1}H$ II. $^{35}_{17}Cl^-$ III. $^{39}_{19}K^+$
A. I only C. I and II only
B. II only D. II and III only

26. Which molecule or ion does **NOT** have a tetrahedral shape?
A. XeF_4 B. $SiCl_4$ C. BF_4^- D. NH_4^-

27. Why are metals soft and malleable?
A. Because they are very shiny.
B. Because they experience electrostatic repulsion.
C. Because of the presence of mobile electrons.
D. Because the metal cations can slip over other fairly easily

28. In which region of the periodic Table would the element with the electronic structure below be located?
$1s^22s^22p^63s^23p^63d^{10}4s^24p^64d^65s^2$
A. Group 6 C. s block
B. Noble gases D. d block

29. Which factors will influence the rate of the reaction shown below? $NO_2(g) + CO(g) \rightleftharpoons No(g) + CO_2(g)$
I. The number of collisions per second
II. The energy of the collisions
III. The geometry with which the molecules collide
A. I only C. I and II only
B. II only D. I, II and III

30. How many π bonds are present in CO_2?
A. One B. Two C. Three D. Four

31. Which pair of monomers forms polyesters?
A. Difunctional alcohol, difunctional organic acid
B. Difunctional alcohol, difunctional amino acid
C. Ethylene, ethylene D. Amino acid, amino acid

32. Which changes will increased the amount of $SO_3(g)$ at equilibrium?
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ $\Delta H^0 = -197kJ$
I. Increasing the temperature
II. Decreasing the volume

III. Adding a catalyst

A. I only C. I and III only

B. II only D. I, II and III

33. Which compound is a carboxylic acid?

A. CH_3COOH C. $(CH_3)_2CHOOCH_3$

B. $(CH_3CO)_2O$ D. $(CH_3)_2O$

34. The mechanism of a reaction is shown below.

$HOOH + I^- \rightarrow HOI + OH^-$ (slow)

$HOI + I^- \rightarrow I2 + OH^-$ (fast)

$2OH^- + 2H3O^+ \rightarrow 4\ H2O$ (fas)

What is the rate law based on this mechanism?

A. Rate = k [HOOH][I^-] C. Rate = k [HOOH][I^-]^2

B. Rate = k [HOOH]^2[I^-] D. Rate = k [HOOH]

35. What is the equilibrium constant expression for the following reaction? $2Hg(g) + O_2(g) \rightleftharpoons 2HgO(s)$

A. $K = 1/([Hg]^2\ [O_2])$

B. $K = [Hg]^2\ [O_2]$

C. $K = [HgO]^2 / ([Hg]^2\ [O_2])$

D. $K = [2HgO]/([2Hg]\ [O_2])$

36. A triacylglycerol that is solid at room temperature is called

A. Lecithin B. Fat C. Wax D. Oil

37. Which compound is an ester?

A. CH_3COOH C. C_2H_5CHO

B. $CH_3OC_2H_5$ D. $HCOOCH_3$

38. If a solute dissolves in an endothermic process,

A. H bonds must exist between solvent and solute.

B. Strong ion-dipole forces must exist in the solution.

C. The entropy of the solution must be greater than that of its pure components.

D. The solute must be a gas.

39. A solution is made by dissolving 250.0 g of potassium chromate crystals (K_2CrO_4, molar mass, 194.2 g/mol) in 1.00 kg of water. What will be the freezing point of the solution? (K_f for water is 1.86^0c/m).

A. -8.87^0C C. -5.73^0C

B. -7.18^0C D. -1.86^0C

40. How many moles of sodium hydroxide are present in 2.5L of 0.5 M aqueous solution?

A. 0.2 B. 0.5 C. 1.25 D. 12.5

41. Which species **CANNOT** act as a Lewis acid?
    A. NH_3 B. BF_3 C. Fe^{2+} D. $AlCl_3$
42. Which of the following statements is true?
    A. A universal indicator is a mixture of indicators that will give a different color for a different pH.
    B. Phenolphthalein is a universal indicator.
    C. A universal indicator can only be used in either strongly acidic or basic solution.
    D. The colour of a universal indicator is red in a weak acid.
43. Three acids, HA, HB, HC have the following K_a values. $K_a(HA)=1 \times 10^{-5}$ $K_a(HB)=2 \times 10^{-5}$ $K_a(HC)=1 \times 10^{-6}$. What is the correct order of increasing acid strength (weakest first)?
    A. HA, HB, HC C. HC, HA, HB
    B. HC, HB, HA D. HB, HA, HC
44. If the solute-solvent interactions are greater than the solute-solute and solvent-solvent interactions, what will be the total vapor pressure of the solution?
    A. Greater than that calculated from Raoult's law.
    B. Less than that calculated from Raoult's law.
    C. The same as calculated from Raoult's law.
    D. Raoult's law cannot be applied fro such interactions.
45. Which of the following procedures will produce a buffered solution?
    I. Equal volumes of 0.5 M NaOH and 1 M HCl solution are mixed.
    II. Equal volume of 0.5 M NaOH and 1 M CH_3 COOH solutions are mixed.
    III. Equal volumes of 1 M $NaCH_3CO_2$ and 1 M CH_3COOH solutions are mixed.
    IV. Equal volumes of 1.0 M NaOH and 1 M HCl solutions are mixed
    A. I B. III C. I and II D. II and III
46. For which conversion is an oxidizing agent required?
    A. $2H^+(aq) \rightarrow H_2(g)$ C. $SO_3(g) \rightarrow SO_4^{2-}(aq)$
    B. $2Br^-(aq) \rightarrow Br_2(aq)$ D. $MnO_2(s) \rightarrow Mn^{2+}(aq)$
47. What volume of 0.500 M NaOH is required to neutralize 25.0 mL of 1.2 M H_2SO_4? (Assume complete ionization of the acid)

A. 60 mL B. 9 mL C. 100 mL D. 120 mL

48. A gas is confined to a cylinder under constant atmospheric pressure. When the gas undergoes a particular chemical reaction, it releases 135 kJ of heat to its surroundings and does 63 kJ of P-V work on its surroundings. What are the values of H and ΔE for the process?
    A. $\Delta H = 135kJ, \Delta E = 63kJ$
    B. $\Delta H = -135kJ, \Delta E = -63kJ$
    C. $\Delta H = 135kJ, \Delta E = 198kJ$
    D. $\Delta H = -135kJ, \Delta E = -198kJ$
49. The oxidation numbers of nitrogen in NH_3, HNO_3 and NO_2 are _____ respectively.
    A. -3, -5, +4 C. -3, + 5, -4
    B. +3, +5, +4 D. -3, +5, +4
50. Which statement about the following reaction is correct?
    $2\ FeS(s) + 3CO_2(g) \rightarrow Fe_2O_3(s) + 3CO(g)\ \Delta H^0 = +26.6\ kJ$
    A. 26.6 kJ of energy are released for every mole of Fe reacted.
    B. 26.6 kJ of energy are absorbed for every mole of Fe reacted
    C. 53.2 kJ of energy are released fro every mole of Fe reacted.
    D. 13.3 kJ of energy are absorbed for every mole of Fe reacted.
51. Which of the following metals is extracted by thermal reduction process?
    A. Cu B. Fe C. Al D. Mg
52. The two standard electrode potentials involved in the nickel-cadmium rechargeable cell are given below. Calculate the ΔG^o in kJ of the cell.
    $NiO_2(s) + 2H_2S(1) + 2e \rightarrow Ni(OH)_2(s) + 2OH \quad E^0 = +0.49V$
    $Cd(OH)_2(s) + 2e \rightarrow Cd(s) + OH\ (aq) \quad E^0 = -0.76V$
    A. -184 B. -153 C. -241 D. -206
53. Which of the following is a synthetic rubber produced from Caprolactam (CPL)
    A. Nylon 6, 10 C. Teflon
    B. Terlyene D. Nylon 6
54. Which one of the following reactions is **NOT** a redox reaction?
    A. $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

B. $2Na(s) + Cl_2(f) \rightarrow 2NaCl(s)$

C. $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

D. $Cu^{21}(aq) + Zn(s) \rightarrow Cu(s) + Zn^{2+}(aq)$

55. The half-reaction for formation of magnesium metal upon electrolysis of molten $MgCl_2$ is:

$$Mg^{2+} + 2e^- \longrightarrow$$

What is the mass of magnesium formed upon passage of a current of 60.0 A for a period of 2.00×10^3 s?

A. 5.0 g B. 10.0 g C. 15.1 g D. 30.2 g

56. An aqueous solution is 70.0% nitric acid (HNO_3)by mass. What is the concentration of HNO_3 expressed in molality?

A. 0.559 B. 8.62m C. 11.1m D. 37.0m

57. Which of the following is a natural polymer?

A. Polythene C. Nylon

B. Polysaccharides D. Terylene

58. What is the ionization energy of an iron atom if it requires a radiation of 276 nm to completely remove its outer most electron in the gaseous state?

(plank's constant, $h=6.626 \times 10^{-34}$Js, speed of light, $c=3 \times 10^8$ms-1)

A. 7.21×10^{-19}J C. 7.21×10^{-19}J

B. 7.21×10^{-19}kJ D. 7.21×10^{19} kJ

59. Which of the electron configurations describes the ground state electron configuration of Cl^-?

A. $1s^2 2s^2 2p^6 3s^2 3p^6$ C. $2s^2 2s^2 2p^6 3p^1$

B. 1s22s22p63s1 D. $1s^2 2s^2 2p^6 3s^2 3p_x^2 3p_y^1$

60. When 0.68 is divided by 14.364, the actual answer is 0.0473405. What will be the correct answer?

A. 0.05 B. 0.047 C. 0.0473 D. 0.04734

61. What is the correct molecular electronic configuration for the molecular ion , B_2+?

A. $\sigma_{1s}^2 \sigma^*_{1s}^2 \sigma_{2s}^2 \sigma^*_{2s}^2 \sigma_{2p}^2$ C. $\sigma_{1s}^2 \sigma^*_{1s}^2 \sigma_{2s}^2 \sigma^*_{2s}^2 \pi_{2px}^1$

B. $\sigma_{1s}^2 \sigma^*_{1s}^2 \sigma_{2s}^2 \sigma^*_{2s}^2 \pi_{2py}^2$ D. $\sigma_{1s}^2 \sigma^*_{1s}^2 \sigma_{2s}^2 \sigma^*_{2s}^2 \pi_{2px}^1 \pi_{2py}^1$

62. Which of the following molecules or ions will exhibit delocalized bonding? NO_2^-, NH_4^+, N_3^-

A. NO_2^- and N_3^- C. NO_2^-

B. NH_4^+ and N_3^- D. NO_2^- and NH_4^+

63. Based on molecular orbital theory, the bond order of H_2, H_2^+, and H_2^- are _____, respectively.
    A. 1, 0, and 0 C. 1, 0, and ½
    B. 1, 1/2, and 0 D.1, 1/2, and ½
64. How many 3d electrons are preset in the ground state of chromium atom?
    A. 4 B. 5 C. 6 D. 10
65. When the following substances are arranged in order of increasing melting point (lowest melting point first), the correct order is:
    A. $CH_3CH_2CH_3$, CH_3COCH_3, $CH_3CH_2CH_2OH$
    B. $CH_3CH_2CH_3$, $CH_3CH_2CH_2OH$, CH_3COCH_3
    C. CH_3COCH_3, $CH_3CH_2CH_2OH$, $CH_3CH_2CH_3$
    D. $CH_3CH_2CH_2OH$, $CH_3CH_2CH_3$, CH_3COCH_3
66. The half-life for the first order decomposition of nitro methane, CH_3NO_2, at 500K is 650 seconds. If the initial concentration of CH_3NO_2 is 0.500M, what its concentration be (M) after 1300 seconds have elapsed?
    A. 0.125 B. 0.140 C. 0.250 D. 0.425
67. In a zero-order reaction for every 10^0 rise of temperature, the rate is doubled. If the temperature is increased from 10^0C to 100^0C, the rate of the reaction will become.
    A. 64 times C. 256 times
    B. 128 times D. 512 times
68. Which of the following mathematical relationships between K, K_1 and K_2 is correct?

$$CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g) \quad K$$
$$Fe(s) + CO_2(g) \rightleftharpoons FeO(s) + Co(g) \quad K_1$$
$$Fe(s) + H_2O(g) \rightleftharpoons FeO(s) + H_2(g) \quad K_2$$

A. $K = K_1 + K_2$ B. $K = K_1 \times K_2$ C. $K = k_1/K_2$ D. $K = K_2/K_1$

69. Which of the following gives the correct order of decreasing acidity of carboxylic acids?
    A. Cl_3CCOOH, $Cl_2CHCOOH$, FCH_2COOH, CH_3COOH
    B. FCH_2COOH, CH_3COOH, $Cl_2CHCOOH$, Cl_3CCOOH
    C. CH_3COOH, FCH_2COOH, $Cl_2CHCOOH$, Cl_3CCOOH
    D. $Cl_2CHCOOH$, CH_3COOH, FCH_2COOH, Cl_3CCOOH
70. The value of K_c for the following equilibrium reaction is 4.0 at a temperature o 373 K.

$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 +$$

What mass of ethyl ester ($CH_3COOC_2H_5$) would be present in the equilibrium mixture if 15 g of acetic acid and 11.5 g of ethanol were mixed and equilibrium was established at this temperature?

A. 5.2 B. 10.1 C. 12.6 D. 14.1

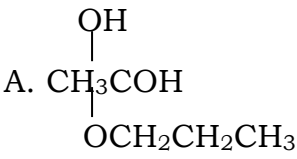
71. Which of the following is true about an open system?
    A. A system that exchanges both energy and matter with its surroundings.
    B. A system that cannot exchange both matter and energy with its surroundings.
    C. A system that only exchanges matter with its surroundings.
    D. A system that only exchanges energy with its surroundings.
72. Which of the following statements is true about the percent ionization of a weak acid?
    A. It decreases with increasing concentration.
    B. It increases with decreasing concentration.
    C. It increases with increasing concentration.
    D. It decreases with decreasing concentration.
73. What is the value of ΔH for the reaction S(s)→S(g)?

    $S(s) + O2(g) \rightarrow SO2(g)$, $\Delta H=-395kJ$

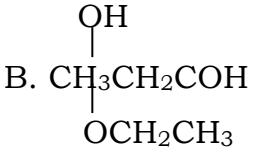
    $S(g) + O2(g) \rightarrow SO2(g)$, $\Delta H=-618kJ$

    A. -1013 kJ C. +223 kJ
    B. -223kJ D. +1013 kJ

74. Which of these compounds is the ester formed from the reaction of acetic acid and 1-propanol?

A. 

C. 

B. 

D. 

75. A lab instructor is preparing 5.0 liters of a 0.10 M $Pb(NO_3)_2$ (formua mass 331) solution. What is the mass required?
    A. 165.5 g of $Pb(NO_3)_2$ and add 5.0 kg of H_2O.
    B. 165.5 g of $Pb(NO_3)_2$ and add H2O until the solution has a volume of 5.0 liters.
    C. 33.1 g of $Pb(NO_3)_2$ and add H2O until the solution has a volume of 5.0 liters.
    D. 33.1 g of $Pb(NO_3)_2$ and add 5.0 liter of H2O.
76. Which of the following NOT a characteristic of the electrolytic cell containing aqueous solution of NaCl used in the manufacture of sodium hydroxide?
    A. The sodium hydroxide solution is produced in the electrolytic cell.
    B. The electrolyte must be a dilute solution of NaCl.
    C. Hydrogen is produced at the cathode.
    D. The production of chlorine gas occurs at the anode
77. The kinetic date below is for the reaction:

    $$A + B \rightarrow C$$

    From these data what are the orders of the reaction with respect to A and B?

[A]	[B]	Initial Rate (mold m^{-3} sec^{-1})
0.1	0.1	1×10^{-5}
0.1	0.2	4×10^{-5}
0.2	0.1	1×10^{-5}

    A. order of A = 1 order of B =0
    B. order of A = 0 order of B = 2
    C. order of A = 0 order of B = 4
    D. order of A = 1 order of B = 2
78. Which of the following metals has the highest electrical and thermal conductivities of any metal?
    A. Ag B. Cu C. Ni D. Co
79. Which of the following is a linear polymer?
    A. High density polyethene (HDPE)
    B. Low density polyethene (LDPE)
    C. Bakelite
    D. Vulcanized rubber
80. Which of the following is the most important source for the extraction of iron?
    A. Hematite B. Bauxite C. Chalcopyrite D. Sphalerite

Ethiopian University Entrance examination (EUEE) Chemistry
Ginbot 2007/ June 2015

BOOKLET CODE: 29 **SUBJECT CODE: 05**

DIRECTIONS: Each of the following questions is followed by four possible alternatives. Choose the best answer and blacken the letter of your choice on the separate answer sheet provide.

1. The conversion of nitrogen gas to nitrates by bacteria is called

   A. nitrification. C. exertion.

   B. nitrogen fixation. D. denitrification.

2. What kind of energy is converted in a galvanic cell?

   A. Chemical energy is converted into electrical energy.

   B. Chemical energy is converted to heat.

   C. Chemical energy is obtained into chemical energy.

   D. Electrical energy is converted into chemical energy.

3. The process of solute particles being surrounded by solvent particles is known as

   A. saturation. C. solvation

   B. agglomeration. D. dehydration.

4. According to the Arrhenius concept, an acid is a substance that

   A. is capable of donation one or more H^+ to any solvent.

   B. causes an increase in the concentration of H^+ in aqueous solutions.

   C. can accept a pair of electrons to form a coordinate covalent bond.

   D. reacts with the solvent to form the cation formed by auto ionization of that solvent.

5. A system which can exchange both matter and energy with its surroundings in said to be a/an

   A. isolated system. C. ideal system.

B. open system. D. closed system.

6. The first step of the scientific method involves

A. forming a hypothesis.

B. making observations.

C. performing an experiment.

D. prediction the result of an experiment.

7. of the three types of radioactivity characterized by Rutherford, which of the following are particles?

A. γ-rays

B. β-rays

C. α- rays and β -rays

D. α-rays, β-rays, and γ-rays

8. Which one of the following represents an acceptable possible set of quantum numbers (in the order n, 1, m_1, m_s) for an electron in an atom?

A. 2, 1, 0, 0 C. 2, 1, -1, 1/2

B. 2, 0, 2, -1/2 D. 2, 0, 1, -1/2

9. The type of compound that is most likely contain a covalent bond is the one that is

A. a solid metal.

B. composed of only nonmetals.

C. composed of a metal from the far left and a non-metal from far right of the periodic table.

D. held together by the electrostatic forces between oppositely charged ions.

10. According to valence bond theory. Which orbitals on bromine atoms overlap in the formation of the bond in Br_2?

A. 3s B. 3p C. 4s D. 4p

11. Which of the following is correct?

A. 1L = 1dm^3 C. 10 L = 1cm^3

B. 1L = 10 dm^3 D. 1L = 0.1dm^3

12. The most abundant metal on the surface of the earth is

A. Fe B. Al C. Ca D. Na

13. For the acid – base equilibrium,

$$HCO_3^- + H_2O \rightleftharpoons H_2CO_3 + OH^-$$

the BrØnsted – Lowry acids are

A. H_2O and OH^-
B. HCO_3^- and OH^-
C. H_2O and H_2CO_3
D. HCO_3^- and H_2CO_3

14. The enthalpy of combustion of solid carbon to form carbon dioxide is -393.5 KJ/mol carbon and the enthalpy of combustion of carbon monoxide to form carbon dioxide is -283.3 KJ/mol CO. What is the enthalpy of the following reaction?

$$2C(s) + O_2(g) \longrightarrow 2CO(g)$$

A. -110.4 KJ C. +172.9 KJ
B. -220.8 KJ D. -1354.0 KJ

15. The decreasing order of electrochemical characteristics of some metals is given as: Mg > Al > Zn > Cu > Ag. What will happen if a copper spoon is used to stir a solution of aluminum nitrate (Al $(NO_3)_3$)?

A. There is no reaction.

B. The solution becomes blue.

C. the spoon will get coated with aluminum.

D. an alloy of copper and aluminum is formed.

16. The distance between two carbon atoms in a diamond is 154 pm.

A. 7.7 x 10^{-5}mm C. 1.54 x 10^{-7}mm

B. 7.7 x 10^{-7}mm D. 1.54 x 10^{-9}mm

17. How many orbitals are there in an atom with n = 4?

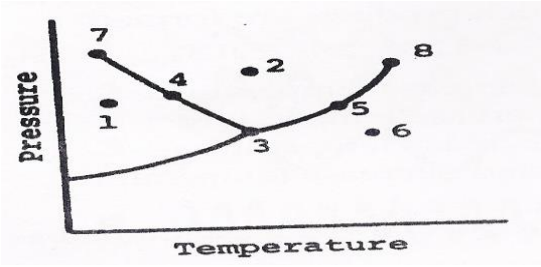
A. 2 B. 8 C. 16 D. 25

18. How May sigma and pi bonds are present in the following molecule?

$H_3C - CH = CH - CH_3$

A. 8 σ bonds and 1 π bond
B.8 σ bonds and 2 bond
C.10 σ bonds and 2 π bond
D. 11 σ bonds and 1 π bond

19. At which point can only the solid and liquid phases coexist in the phase diagram of water given below?



A. 3 B. 4 C. 5 D. 8

20. What type of solute-solvent interaction should be the most important in a solution of iodine in carbon tetrachloride?

A. London forces C. Ion-dipole forces
B. Ionic bonding D. Dipole-dipole forces

21. In the reaction

$(2SO_2 + O_2 \rightleftharpoons 2SO_3, K_{eq} = 100)$

What will be the concentration of O_2, if the concentration of SO_2 is the same as that of SO_3?

A. $[O_2] = [SO_2]$ C. $[O_2] = 100M$
B.$[O_2] = 0.01M$ D. $[O_2] = 0.1M$

22. For the gas phase reaction

$N_2 + O_2 \rightleftharpoons 2NO$, $\Delta H = +180KJ\ mol^{-1}$, the value of K changes with the

A. Change in pressure.
B.Introduction of NO.

C.Change in concentration of N_2.

D. Change in temperature.

23. Considering the reaction below, in which of the following will the effect of concentration and temperature simultaneously cause an increase in the rate at which products are formed?

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CO_{2(g)} + CaCl_{2(aq)} + H_2O_{(1)} + \text{heat}$$

A. Decrease [HCl] and decrease temperature.

B.Increase [HCl] and increase temperature.

C.Increase [HCl] and decrease temperature.

D. Grind up the $CaCO_3$ and decrease temperature.

24. The decomposition of nitrosyl chloride was studied as

$$2NOCl_{(g)} \underset{\leftarrow}{\rightarrow} 2NO_{(g)} + Cl_{(g)}$$

The following data were obtained where

$$Rate = -\frac{\Delta[NOCl]}{\Delta t}$$

$[NOCl]_0$ (molecules/cm^3)	Initial Rate (molecules/cm^3.s)
3.0×10^{16}	5.98×10^4
2.0×10^{16}	2.66×10^4
1.0×10^{16}	6.64×10^4
4.0×10^{16}	1.06×10^5

What is the rate law in the above decomposition?

A. $r = k[NOCl]^2$

B.$r = k[NOCl]$

C. $r = k[NOCl]\ [NO]$

D. $r = k[NOCl]\ [Cl]$

25. Considering the mechanism for a reaction below, which of the following statements is correct?

Step 1: $HBr + O_2 \rightarrow HOOBr$

Step 2: $HBr + HOOBr \rightarrow 2HOBr$

Step 3: $2HOBr + 2HBr \rightarrow 2Br_2 + 2H2O$

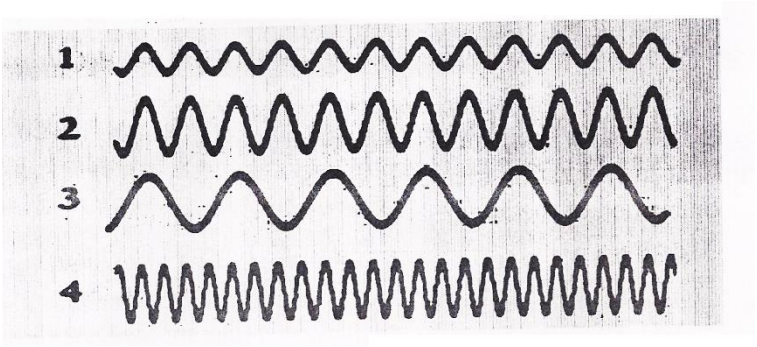
A. Br_2 is a reactant.

B.HBr is a product.

C.HOBr is a catalyst.

D. HOOBr is a reaction intermediate

26. Consider the four electromagnetic waves shown below.



Which of the electromagnetic waves has the highest frequency.

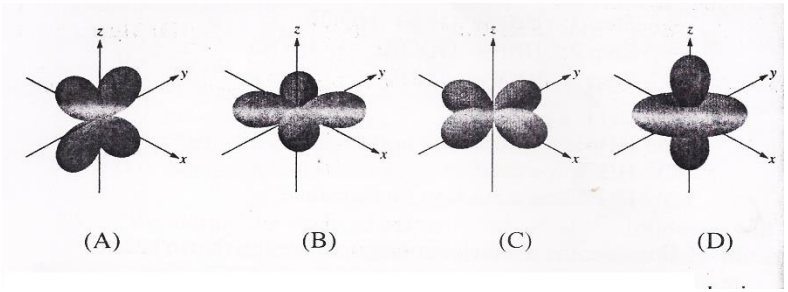
A. 1 B. 2 C. 3 D. 4

27. The wave number of an electromagnetic radiation is 1×10^{-5} cm^{-1}. What is the frequency of this radiation?

A. 3×10^{8} s^{-1} C. 3×10^{10} s^{-1}

B. 3×10^{6} s^{-1} D. 3×10^{15} s^{-1}

28. Which of the following diagrams describes the electron density of d_{xy} orbital?



29. Which of the following ionic compounds has the greatest lattice energy?

A. LiF B. LiCl C. LiBr D. LiI

30. What hybridization change does the carbon atom undergo in the combustion of methane?

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

A. sp ⟶ sp^2 C. sp3 ⟶ sp

B.sp^2 ⟶sp^3 D. sp2 ⟶sp

31. How many unpaired electrons are there in the Lewis structures of a N_3^{3-} ion?

A. 0 B. 1 C. 2 D. 3

32. The maximum number of electrons in p-orbital with n = 6, m = 0 is

A. 12 B. 6 C. 16 D. 14

33. A solution in an electrolytic cell contains Cu^{2+} (E^0 = 0.34V), Ag^+ (E^0 = 0.80 V), and Zn^{2+} (E^0 = -0.76 V). If the voltage is initially very low and slowly increased, in which order will the metals be plated out not the cathode?

A. Zn^{2+}> Cu^{2+}> Ag^+ C. Ag^+> Zn^{2+}> Cu^{2+}

B. Cu^{2+}> Zn^{2+}> Ag^+ D. Ag^+ > Cu^{2+}> Zn^{2+}

34. Which one of the following metals is extracted by thermal reduction process?

A. Al B. Cu C. Fe D. Mg

35. Which of the following transitions will emit maximum energy in the hydrogen atom?

A. n = 4 → n = 3 C. n = 2 n = 1

B. n = 4 → n = 2 D. n = 3 → n = 2

36. A lipid is any substance of biochemical origin that is

A. soluble in both water and non polar solvents.

B. insoluble in both water and non-polar solvents.

C. soluble in water but insoluble in non-polar solvents.

D. soluble in non-polar solvents and insoluble in water.

37. What is the molarity of a 5g hydrogen peroxide (H_2O_2) in 100 mL solution that is used for hair bleaching?

A. 0.015 M B. 0.15 M C. 1.5 M D. 3 M

38. What is the concentration of sodium chloride in water needed in order to produce a aqueous solution that has an identical osmotic pressure (isotonic) with blood (π=7.70 atm at 25^{0}C)?

A. 0.003 mol L^{-1} C. 0.1575 mol L^{-1}

B. 0.006 mol L^{-1} D. 0.315 mol L^{-1}

39. If $NaNO_2$ is added to a solution of HNO_2, which of the following statements is true?

A. The pH of the solution will increase.

B. The pH of the solution will decrease.

C. The pH will remain the same.

D. The equilibrium will not be affected.

40. The acid-base indicator bromocresol green is a weak acid. The yellow acid and blue base forms of the indicator are present in equal concentrations in a solution when the pH is 4.68. What is the pK_a of bromocresol green?

A. 4.48 B. 4.68 C. 5.68 D. 6.68

41. What is the final concentration of Cl^- ion when 250 mL of 0.20M $CaCl_2$ solution is mixed with 250 mL of 0.40M KCl solution (Assume additive volumes.)

A. 1.60M B. 0.40M C. 0.20M D. 6.60M

42. If a student wishes to prepare approximately 100 milliliters aqueous solution of 6 M HCl using 12 M HCl, which procedure is correct?

A. Adding 50 mL of 12 M HCl to 50 mL of water while the mixture steadily.

B. Adding 25 mL of 12 M HCl to 50 mL of water while the mixture steadily.

C. Adding 50 mL of water to 50 mL of 12 M HCl while the mixture steadily.

D. Adding 25 mL of water to 50 mL of 12 M HCl while the mixture steadily.

43. Chemically, fats and oils are

A. acids B. alcohols C. esters D. aldehyde

44. Which of the following is used in the reaction of saponification?

A. Strong base C. Hydrogen

B. Strong acid D. Nickel

45. The concentration of nitrate ion in a solution 0.900 M aluminum nitrate is

A. 0.90 B. 0.45 C. 0.30 D.2.7

46. Which one of the following compound does NOT follow the octet rule?

A. CS_2 B. PBr_3 C. IBr D. BrF_5

47. The molecular geometry of the H_3O^+ ion is

A. linear C. bent

B. tetrahedral D. trigonal pyramidal

48. The reaction $A + 3B = 2C + D$ is first order with respect to reactant A and second order with respect to reactant B. If the concentration of A is doubled and the concentration of B is halved, the rate of the reaction would _____ by a factor of _____.

A. increase, 2 C. increases, 4

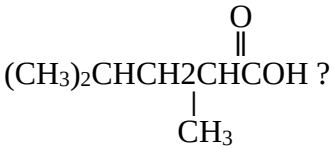
B. decrease, 2 D. decreases, 4

49. The conventional equilibrium constant expression (K_c) for the system

$$2ICl(s) \rightleftharpoons I_2(s) + Cl_2(g) \text{ is}$$

A. $[I_2][Cl_2]/[ICl]_2$
B. $[I_2][Cl_2]/2[ICl]$
C. $[Cl_2]$
D. $([I_2] + [Cl_2)/2[ICl]$

50. What is the IUPAC name for the compound



A. 2, 4-dimethylpentanoic acid
B.1, 1, 3-trimethylbutanoic acid
C.1-hydroxy- 2, 4-dimethylpentanone
D. 2-carboxyisohexane

51. For the reaction,

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

the rate of disappearance of H_2 is 0.01 mol L^{-1} min^{-1}. The rate of appearance of NH_3 would be

A. 0.01 mol L^{-1} min^{-1}
B.0.02 mol L^{-1} min^{-1}
C.0.007 mol L^{-1} min^{-1}
D. 0.002 mol L^{-1} min^{-1}

52. The hybridization of the central atom in the XeF4 molecule is

A. sp^2 C. sp^3d

B. sp^3 D. sp^3d^2

53. Standard electrode potential for Sn^{4+} / Sn^{2+} couple is +0.15 V and that Cr^{3+} / Cr couple is -0.74 V. These two couples in their standard state are connected to make a spontaneous electrochemical reaction. The cell potential will be

A. +1.83 V C. +0.89 V

B . +1.19 V D. +0.18 V

54. Bakelite is obtained from phenol by reacting with

A. HCHO C. CH_3CHO

B. $(CH_2OH)_2$ D. CH_3COCH_3

55. In which one of the following numbers are all of the zeros significant?

A. 100.090090 C. 0.1000

B. 0.143290 D. 00.0030020

56. PKa values of three acids X, Y and Z are 4, 5 and 3 respectively. Which of the following represents the correct order of acid strength?

A. X > Y > Z C. Y > X > Z

B. Z > X > Y D. Z > Y > X

57. The following data were collected at the endpoint of a titration performed to find the molarity of HCl solution.

Volume of acid (HCl) used = 14.4 mL

Volume of base (NaOH) used = 22.4 mL

Molarity of standard base (NaOH) = 0.20M

One the basis of the above data, what is the molarity of the acid solution?

A. 1.6 M B. 0.64 M C. 0.31 M D.13 M

58. The enthalpies of formation of gaseous N_2O and NO at 298 K are 82KJ/mol and 90 KJ/mol, respectively. The enthalpy change for the reaction $N_2O(g) + ½\ O_2(g) \rightarrow 2NO(g)$ is

A. -8 kJ B. 98 kJ C. -74 kJ D. 8 kJ

59. How many electrons will appear when the following half-reaction is balances?

$S_4O_6^{2-} \rightarrow S_2O_3^{2-}$

A. 3 B. 2 C. 4 D. 1

60. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milli ampere current. The time required to liberate 0.01 mol of H_2 gas at the cathode is

A. 9.65×10^4 s C. 28.95×10^4 s

B. 19.3×10^4 s D. 38.6×10^4 s

61. Which of the following statements is true?

A. All forms of electromagnetic radiation are visible.

B. Radio waves have shorter wavelengths than visible light.

C. Ultraviolet light has longer wavelengths than visible light.

D. the frequency of radiation increases as the wavelength decreases.

62. Natural rubber is a polymer of

A. butadiene C. neoprene

B. isoprene D. styrene

63. The PK_a of a weak nonoperatic acid is 4.8. What should be the ratio of [Acid]/[Salt] of a buffer, if PH = 5.8 is required?

A. 0.1 B. 1.0 C. 2.0 D. 10

64. If the enthalpy change for a certain reaction A → B is -12 KJ at 300K, what would be the entropy change in the surroundings?

A. -40 J/K C. -3.6×10^6 J/K

B. 40 J/K D. 3.6×10^6 J/K

65. During the electrolysis of an aqueous solution of copper sulphate using platinum electrodes, the reaction takes place at the anode is

A. $Cu^{2+} + 2e^- \rightarrow Cu$

B. $Cu \rightarrow Cu^{2+} + 2e^-$

C. $2H_2O \rightarrow 4H^+ + O_2 + 4e^-$

D. $4H^+ + O_2 + 4e^- \rightarrow H_2O$

66. The decomposition of carbon disulfide CS2, to carbon mono sulfide, CS, and sulfur is first order with $k = 2.8 \times 10^{-7}\ S^{-1}$ at 1000^0C. What is the half-life of the reaction below at 1000^0C?

$CS2 \rightarrow CS + S$

A. 5.0×10^7 s C. 3.8×10^5 s

B. 4.7×10^{-6} x D. 2.5×10^6 s

67. AT 445^0C, K_c for the following reaction is 0.020.

$2HI\ (g) \rightleftharpoons H_2(g) + I_2\ (g)$

A mixture of H_2, I_2, and HI in a vessel at 445^{0}C has the following concentration: [HI] = 2.0 M, [H_2] = 0.50 M and [I_2] = 0.10 M. Which one of the following statements concerning the reaction quotient, Q_c, is true for the above system?

A. Q_c is less than Kc; more HI will be produced.
B. Q_c is greater than Kc; more HI will be produced.
C. Q_c is less than Kc; more H_2 and I_2 will be produced.
D. Q_c is grater than Kc; more H_2 and I_2 will be produced.

68. The dissolution of water in octane (C_8H_{18}) is prevented by

A. dipole-dipole attraction between octane molecules.

B. hydrogen bonding between water molecules.

C. London dispersion forces between octane molecules.

D. repulsion between like-charged water and octane molecules.

69. The solubility of oxygen gas in water at 25 ^{o}C and 1.0 atm pressure of oxygen is 0.041g/L. The solubility of oxygen in water at 3.0 atm and 25 ^{o}C is _____g/L

A. 0.014 B. 0.31 C. 0.041 D. 0.123

70. An aqueous solution contains 0.100 M NaOH at 25 ^{o}C. The pH of the solution is?

A. 0.100 B. 1.00 C. 7.00 D. 13.0

71. Which of the following metals forms a volatile compound that is taken as an advantage for its extraction?

A. Co B. Fe C. Ni D. W

72. ΔH for solid to liquid transitions for compound A is 2.73 kcal/mol and for compound B is 3.0 kcal/mol. The melting point for compound A is 0^{o}C and the melting point for compound B is 30^{o}C. The entropy changes ΔS_A and ΔS_B at the two transition temperatures are related as

A. $\Delta S_A = \Delta S_B$ C. $\Delta S_B < \Delta S_A$

B. $\Delta S_A < \Delta S_B$ D. $\Delta S_A = \frac{300\Delta S_A}{273}$

73. Which of the following describes the balanced molecular equation when perchloric acid is mixed with solid iron (III) hydroxide?

A. $HClO_4(aq) + Fe(OH)_3(s) \rightarrow H_2O(1) + FeClO_4(aq)$

B. $3\ HClO_4(aq) + Fe(OH)_3(s) \rightarrow 3H_2O\ (1) + Fe(ClO_4)_3\ (aq)$

C. $3\ HOClO_2\ (aq) + Fe(OH)_3(s) \rightarrow 3H_2O(1) + Fe(ClO_3)_3\ (aq)$

D. $HOClO_2(aq) + Fe(OH)_3(s) \longrightarrow H_2O(1) + Fe(ClO_3)\ (aq)$

74. A 0.1 M solution of HCl is dissolved in water. What species of ions are present at equilibrium, and what will be their equilibrium concentrations?

A. $[H_3O^+] = 0.1M$	$[OH^-] = 10^{-13}M$	$[Cl^-] = 0.1\ M$
B. $[H_3O^+] = 0.1M$	$[OH^-] = 1.0\ M$	$[Cl^-] = 0.1\ M$
C. $[H_3O^+] = 0.1M$	$[OH^-] = 10^{-13}M$	$[Cl^-] = 0\ M$
D. $[H_3O^+] = 10^{-13}M$	$[OH^-] = 1.0\ M$	$[Cl^-] = 0.1$

75. The following bases and their conjugate acids (as the chlorides) are available in the laboratory: NH_3 ($K_b = 1.8 \times 10^{-5}$), C_6H_5N ($K_b = 1.7 \times 10^{-9}$), $CH_3CH_2NH_2$ ($K_b = 6.4 \times 10^{-4}$) and CH_3NH_2 ($K_b = 4.4 \times 10^{-4}$). Which of these acid-base pairs are the best to prepare a buffer solution having a PH of about 9?

A. NH_3 + conjugate acid

B. C_6H_5N + conjugate acid

C. CH_3NH_2 + conjugate acid

D. $CH_3CH_2NH_2$ + conjugate acid

76. Which of the following molecules has a dipole moment?

A. XeF_2 B. IF_3 C. BF_3 D. SF_5^+

77. A compound is formed by the combination of V and X as follows.



What is the empirical formula for the compound?

A. VX B. V_2X C. V_3X D. V_3X_2

78. At 298 K the following two gaseous equilibria involving SO_2 SO_3 and O_2 are established.

$SO_2(g) + 1/2\ O_2(g) \rightleftharpoons SO_3$; K_1

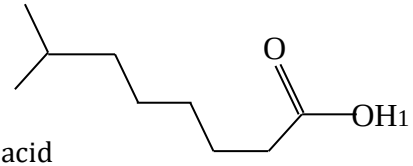
$2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$; K_2

Which of the following equilibrium expression is correct?

A. $K_1 = K_2$ C. $K_2 = 1/K_1^2$

B. $K_2 = K_1^2$ D. $K_2 = 1/K_1$

79. Which of the following is an acceptable IUPAC name for the organic compound shown below?



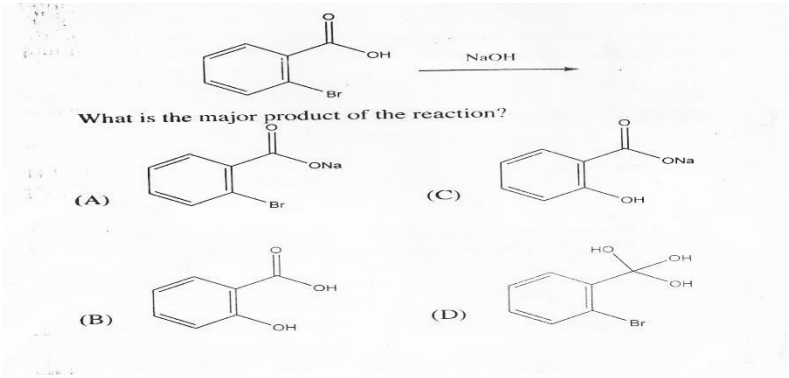
A. Octanoic acid

B. 7 – Methyl heptanoic acid

C. δ- Methyl heptanoic acid

D. 7 – Methyl octanoic acid

80. Given the following reaction:



ETHIOPIAN UNIVERSITY ENTRANCE EXAMINATION (EUEE) CHEMISTRY
SENE 2008/ JULY 2016 BOOKLET
CODE: 74

Atomic Numbers (Z) and Atomic weights (A)

Element	H	He	Li	B	C	N	O	F	Ne
Z	1	2	3	5	6	7	8	9	10
A	1.0	4.0	6.9	10.8	12.0	14.0	16.0	19.0	20.2

Na	Mg	S	Ci	Ca
11	12	16	17	20
22.98	24.30	32.1	35.5	40.1

Element	Cr	Mn	Fe	Co	Ni	Cu	Zn
Z	24	25	26	27	28	29	30
A	52.0	54.9	55.9	58.9	58.7	63.5	65.4

Ag	Cd	Au	Hg
47	48	79	80
107.9	112.4	197.0	200.6

1. If we increase the concentration of a reactant, what happens to the collisions between particles?
   A. There are more collisions
   B. There are fewer collisions
   C. There are the same number of collisions, but they have less energy
   D. There are the same number of collisions, but they have more energy
2. A drug decomposes by zero-order kinetics with a rate constant of 2 mg ml^{-1} $month^{-1}$. If the initial concentration is 100 mg mL^{-1}, how long will it take the drug to decompose by 10%?
   A. 2 months C. 5months
   B. 3 months D. 4months
3. The value of K_{eq} at the same temperature for the reaction below

$$SO_2\,(g) + NO_2\,(g) \leftrightarrows SO_3\,(g) + NO\,(g)$$

What is the value of Keq at the same temperature for the reaction below?

$2SO_2\ (g) + 2NO_2\ (g) \leftrightarrows 2SO_3\ (g) + 2NO\ (g)$

A. 0.25 C. 0.50
B. 0.062 D. 16

4. Which of the following would react to form pentylethanoate?
   A. 1- propanol and pentanoic acid
   B. Ethanol and pentatonic acid
   C. 1- pentanol and ethanoic acid
   D. Ethanol and Ethanoic acid
5. Which of the foolowign is correct when 34495 is rounded to three significant figures?
   A. 345 C. 344
   B. 34500 D. 3840
6. What is the first step of the scientific method?
   A. Making observations
   B. Forming a hypotheses
   C. Performing and experiment
   D. Predicting the result of an experiment
7. Which of the following are **NOT** electromagnetic waves?
   A. Infrared waves C. Radio waves
   B. Gamma wave D. sound waves
8. What is the distance that a radio wave will travel in 0.250s?
   A. 1.2×10^7m C. 7.5×10^7m
   B. 12×10^7m D. 5.6×10^7m
9. Which one of the following is **NOT** a form of chemical bonding?
   A. Covalent bonding C. Ionic bonding
   B. Metallic bonding D. Hydrogen bonding
10. Which of the following statements is true about covalent bonding?
    A. Covalent bonds are least likely to be formed between atoms of the same element.
    B. Covalent bonds are least likely to be formed between atoms of different elements on the right side of the periodic table

C. Covalent bonds are least likely to be formed between an element in Group IA and an element is Group VIIA

D. Covalent bonds are least likely to be formed by head of the group elements with high ionization energies

11. Which one of the following combination **CANNOT** produce a buffer solution?
    A. $HClO_4$ and $NaClO_4$
    B. HCN and NaCN
    C. HNO_2 and $NaNO_2$
    D. NH_3 and $(NH_4)_2SO_4$

12. How many moles of NH_4Cl must be added to 1.5L of 0.2 M solution of NH_3 to form a buffer whose pH is 9.00 ($K_b = 1.8 \times 10^{-5}$)?
    A. 0.36 C. 0.54
    B. 0.65 D. 0.8

13. What mass of magnesium is plated out upon electrolysis from molten $MgCl_2$ using a current of 60 A for a period of 4000 seconds?
    A. 30 g C. 60 g
    B. 24 g D. 72 g

14. For a voltaic (or galvanic) cell using Ag, Ag^+(1.0 M) and Zn, Zn^{2+} (1.0 M) half –cells, which of the following statements is **INCORRECT**?
    A. The zinc electrode is the anode.
    B. Electrons will flow through the external circuit from the zinc electrode to the silver electrode.
    C. The mass of the zinc electrode will decrease as the cell operates.
    D. Reduction occurs at the zinc electrode as the cell operates

15. The difference between fats and oils is that:
    A. Oils are liquid at room temperature.
    B. Oils have more calories
    C. Oils are solid at room temperature
    D. Fats are liquid at room temperature

16. What kind of solution forms when gasoline evaporates in air?

A. Gas in gas solution
B. Gas is liquid solution
C. Liquid in liquid solution
D. Liquid is gas solution

17. What is the solvent in 70% alcohol solution?
A. Water C. Sugar
B. alcohol D. Kerosene

18. How many moles of H_2SO_4 are needed to prepare 5.0 liters of a 2.0 M solution of H_2SO_4
A. 2.5 B. 5.0 C.20 D. 10

19. What is the balanced net ionic equation for the reaction of $CaCl_2$ and $AgNO_3$?
A. $CaCl_2(aq)+2AgNO_3\ (aq) \rightarrow a(No_3)_2\ (aq) +2AgCI(s)$
B. $Ca^{2+}\ (aq) + 2CI(aq) +2Ag^{+}(aq)+2NO_3^{-}(aq) \rightarrow Ca^{2+}(aq)+ 2NO_3^{-}(aq)+2AgCI(s)$
C. $Cl^{-}(aq) + Ag^{+}(aq) \rightarrow 2AgCl(s)$
D. $2Cl^{-}(aq) + 2Ag^{+}(aq) \rightarrow 2AgCI(s)$

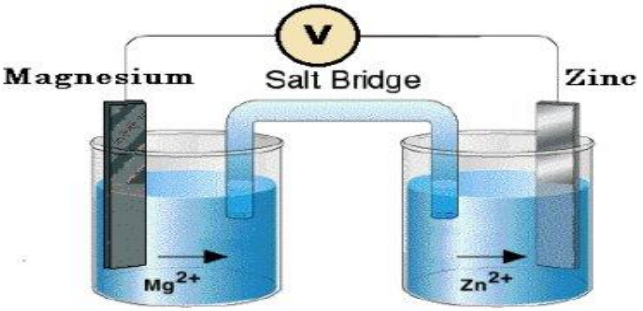
20. The K_a of hypochlorous acid (HCIO) is 3.0×10^{-8}, at 25^0c. What is the % ionization of hypochlorous acid in a 0.015 M aqueous solution of HCIO at 25^0c?
A. 2.1×10^{-5} C. 1.4×10^{-2}
B. 0.14 D. 3.3×10^{-1}

21. When a small amount of crystal solute is added to the supersaturated solution, the solute crystals will:
A. Grow bigger
B. Slightly dissolve
C. remain unchanged
D. dissolve completely

22. What is the molality of a solution that contains 51.2 g of naphthalene, $C_{10}H_8$, in 500 ml of carbon tetrachloride?
The density of CCl_4 is 1.60 g/ml
A. 0.750 m C. 0.840 m
B. 0.500 m D. 1.69 m

23. What is the ionization constant for a weak acid, HA, that is 1.60% ionized in 0.0950 M solution?
A. 2.69×10^{-3} C. 2.47×10^{-5}
B. 3.77×10^{-2} D. 9.91×10^{-6}

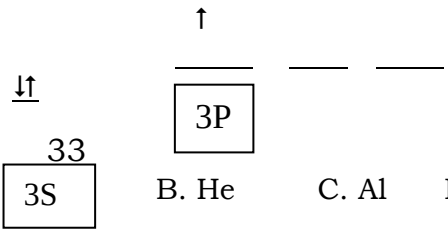
24. Which of the following is correct?
    A. 1 Pa= $10Nm^{-2}$
    B. 1 N = 10kg m s^{-2}
    C. 0.00072 = 7.2 x 10^{-3}
    D. 1 L = $1dm^3$
25. For the galvanic cell shown below, which one of the following statement is correct?



A. n
e zinc electrode, zinc ions are formed
B. The electrode potential is measured by the voltmeter
C. The following reaction takes place at the magnesium electrode: $Mg^{2+} + 2e^- \rightarrow Mg$
D. Electrons flow from the zinc electrode to the magnesium electrode.

26. Which is the most common ore used for the extraction of copper?
    A. CuO C. $CuCO_3$
    B. $CuSO_4$ D. $CuFeS_2$
27. Which of the following material has maximum ductility?
    A. Nickel C. Mild steel
    B. Aluminum D. Copper
28. Which of the following statements about polyvinyl chloride is **NOT** correct?
    A. PVC can be used in making water pipes
    B. PVC is stiff
    C. PVC is softened on heating
    D. The monomer of PVC is CHCl = CHCl

29. Which of the following is a natural polymer?
    A. Keratin
    B. Polythene
    C. Cellulose
    D. Polymentyl methacrylate
30. Which of the following does **NOT** affect the solubility of a gas dissolved in a liquid?
    A. Nature of solute and solvent
    B. Pressure
    C. Temperature
    D. Rate at which the gas dissolves
31. What values of l are permitted for an electron with n= 4?
    A. 1,2,3 C. 0,1,2,3,4
    B. 1,2,3,4 D. 0,1,2,3
32. Which of the following electrons, identified only by their n and l quantum numbers have the highest energy?
    n = 3, 1= 0 n =4, 1 = 1
    n = 3, 1= 2 n = 4, 1= 2
    n = 3, 1= 2
    A. n = 3, 1= 2 C. n = 4, 1= 2
    B. n =4, 1 = 1 D. n = 3, 1= 0
33. What is the maximum number of unpaired electrons is a d sub shell?
    A. 2 B. 5 C. 3 D. 4
34. The following energy level diagram represents the outermost shell of what ground state element



A. B. He C. Al D. Be

35. Which of the following represents a tentative explanation of certain scientific law?
    A. Hypothesis C. Experimentation
    B. Observation D. Theory
36. In order to advance to the level of a theory, a hypothesis should
    A. Be obviously accepted by most people
    B. Be repeatedly confirmed by experimentation
    C. Be a fully functional experiment
    D. Report the past experience
37. Which of the following types of rays combine to form atoms of helium?
    A. Gamma (γ) rays C. alpha (α)
    B. Beta (β) D. X-rays
38. What is the relationship between frequency (V), wavelength (λ) and the speed of light (C).
    A. $\frac{\lambda}{\nu} = C$ C. $\frac{hc}{\lambda} = v$
    B. $vc=h\lambda$ D. $C= v\lambda$
39. What is the magnitude of quantum energy and the frequency for an object whose wavelength is 0.6×10^{-6} m?
    A. 3.31×10^{-19}J, 5 x 10-14 S^{-1}
    B. 3.98×10^{-40} J, 2×10^{-15} S^{-1}
    C. 1.99×10^{-25} J, 3.98×10^{-40} S^{-1}
    D. 9.94×10^{-12} J, 1.99×10^{-25} S^{-1}
40. What new concept did Bohr adapt and use to formulate his model of the atom?
    A. Electromagnetic theory developed by Maxwell
    B. The quantum concept developed by Planck
    C. Photoelectric theories developed by Thompson
    D. Neuron theory developed by Chadwick
41. Formic acid, which is released by ants, has a molecular formula of HCOOH. What are the possible hybridizations that exist the molecule?
    A. Sp^2 and sp^3 C. sp, sp^2 and sp^3
    B. Sp and sp^3 D. sp and sp^2
42. What would happen to the O_2 molecule upon ionization to O_2^+?

A. The bond length will increase and the bond energy will increase.
B. The bond length will increase and the bond energy will decrease.
C. The bond length will decrease and the bond energy will increase.
D. The bond length will decreases and the bond energy will decrease.

43. For a first – order reaction, a plot of _____ ___versus _____is linear.

A. $\frac{1}{[A]_t}$, t C. $[A]_t$, t

B. $Ln\frac{1}{[A]_t}$, t D. $Ln[A]_t$, t

44. The rate law of the overall reaction is rate = $K[A]^2$

Which of the following will **NOT** increase the rate of the reaction?

A. Increasing the concentration of reactant A
B. Increasing the concentration of reactant B
C. Increasing the temperature of the reaction
D. Adding a catalyst for the reaction

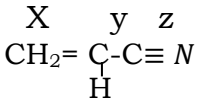
45. How many bonding pairs and lone pairs respectively the ion ICl_4^- has?

A. 3,2 B.4,2 C.5,1 D.4,1

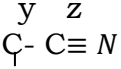
46. Which of the following molecules does **NOT** have a tetrahedral central atom?

A. SF_4 B. AlH_4^-
C. BF_4^- D. $SiCl_4$

47. Acrylonitrile has the following Lewis structure with designation of X,Y, and Z for each carbon atom:



What will be the value of the bond angle and geometry of?



H

A. 109°,tetrahedral C. 180° , linear
B. 120° , trigonal pyramidal D.90° , T-shaped

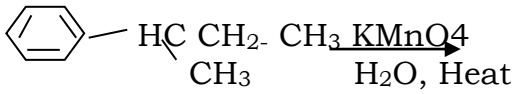
48. Antimony (Sb) is a group VA element. What will be the molecular geometry and number of lone pair electrons, respective that exist in the ion $[SbCl_5]^{2-}$?
A. Seesaw, 1 C. seesaw,2
B. Square planar , 2 D.Linear,3

49. Which of the following molecules does **NOT** have trigonal bipyramidal electron-pair geometry?
A. SF_4 C. XeF_2
B. ClF_3 D.BrF_5

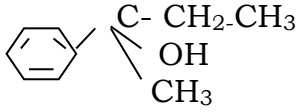
50. How many atomic orbitals are required for Sp^3 hybridization?
A. 2 B. 6 C. 4 D. 8

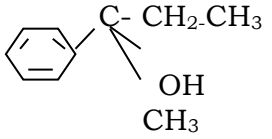
51. Which of the following is **NOT** true about carbonyl group in carbonyl compounds?
A. Carbonyl group contain 3δ – bond and 1π-bond
B. The carbon oxygen bond is both longer and weaker
C. The bond angle of carbonyl group is about 120°c
D. Carbonyl compounds may be hydrolyzed

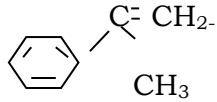
52. Consider the following reaction

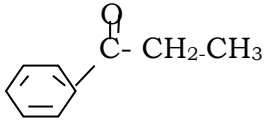


What will be the main product of the reaction above?

A. 

B. 

D. 

C. 

53. Which of the following statements concerning the carbonyl group in aldehydes and ketones is **NOT** true?
    A. The bond is polar, with a slight negative charge on the oxygen atom.
    B. The bond angles about the central carbon atom are 120o
    C. In condensed form, the carbonyl group cab e written as CHO
    D. The bond is polar. Therefore, carbonyl groups readily form hydrogen bonds each other.
54. Which of the following statements concerning fats and oils is incorrect?
    A. They are also called triacylglycerols.
    B. They are also called triglycerides
    C. They are fatty acid salts
    D. They are glycerol trimesters.
55. Which of the following statement(s) is (are) applicable to a balanced chemical equation of an elementary reaction?
    I. Order is same as molecularity.
    II. Order is less than the molecularity.
    III. Order is greater than the molecularity.
    IV. Molecularity can never be zero.
    A. I B. II C. I, IV D. I,III

56. At high pressure, the following reaction is zero order

$$NH_3\,(g) \xrightarrow[1130\ K,\ Pt]{} N_2\,(g) + 3H_2\,(g)$$

    I. Rate of reaction = rate constant
    II. Rate of reaction depends on the concentration of ammonia.

III. Rate of decomposition of ammonia remains constant until ammonia decomposes completely

IV. Further increase in pressure will change the rate of reaction

A. I B. I, III, IV C. I,II D. I, II, IV

57. Which of the following expressions is correct for the rate of reaction given below?

$$5Br^-(aq) + BrO_3^-(aq) + (aq) + 6H^+(aq) \longrightarrow 3Br_2(aq) + 3H_2O(I)$$

A. $\frac{\Delta [Br]}{\Delta t} = 5\Delta \frac{[H]}{\Delta t}$

B. $\Delta \frac{[Br]}{\Delta t} = 5/6\Delta \frac{[H]}{\Delta t}$

C. $\Delta \frac{[Br]}{\Delta t} = 6/5\Delta \frac{[H]}{\Delta t}$

D. $\Delta \frac{[Br]}{\Delta t} = 6\Delta \frac{[H]}{\Delta t}$

58. Rate law for the reaction A + 2B → C is found to be

Rate = k [A][B]

If the concentration of reactant 'B' is double, keeping the concentration of 'A' constant, what will be the value of rate constant?

A. The same C. quadrupled

B. Halved D. double

59. The following equilibrium constants were determined at 300°C.

$2N_2O\ (g) \leftrightarrows 2N_2\ (g) + O_2\ (g) \quad K_C = 4.0 \times 10^{18}$

$N_2\ (g) + O_2(g) \leftrightarrows 2NO(g) \quad K_C = 4.0 \times 10^{-31}$

What will be the equilibrium constant at 300OC for the gaseous reaction o f $2N_2O\ (g) + O_2\ (g) \leftrightarrows 4NO\ (g)$?

A. 3.2×10^{-12} C. 5.0×10^{50}

B. 2×10^{-13} D. 1.6×10^{-49}

60. When 0.50 mol of N_2O_4 is placed in a 4.0 liter reaction vessel and heated to 400 K, 80% of the N_2O_4 decomposes to NO_2 gas as follows:

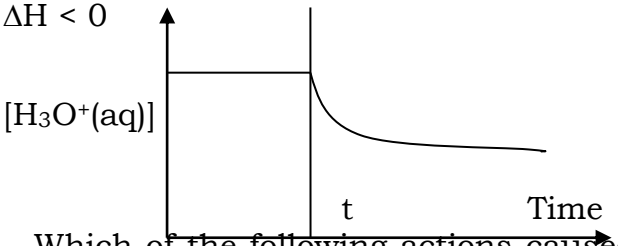
$$N_2O_4\ (g) + O_2\ (g) \leftrightarrows 4NO\ (g)$$

What will be the value of K_p, in units of pressure, at 400 K for this reaction?

A. 2.62 C. 50.48
B. 13.12 D. 16.20

61. Consider the following graph, which relates to the equilibrium system:

$CH_3COOH\ (aq) + H_2O \leftrightarrows CH_3COO^-\ (aq) + H_3O^+(aq)$; $\Delta H < 0$



Which of the following actions caused the change in the concentration of $[H_3O^+(aq)]$ at time t?

A. Addition of $CH_3COO^-(aq)$
B. Addition of HCI
C. Decreasing of temperature
D. Increasing the volume of the container

62. Sodium acetate spontaneously crystallizes out of a supersaturated solution on standing. Which of the following is true for the thermodynamic quantities of this system for such a process?

A. $\Delta S < 0, \Delta H < 0$ C. $\Delta S > 0, \Delta G < 0$
B. $\Delta G < 0 \Delta H > 0$ D. $\Delta S > 0, \Delta H > 0$

63. In which of the following systems will the position of equilibrium shift to the left upon an increase in pressure, but to the right upon an increase in temperature?

A. $CO_2(g) + H_2(g) \leftrightarrows CO(g) + H_2O(g)$ $\Delta H>0$
B. $C_2H_4(g) + H_2O(g) \leftrightarrows C_2H_4OH(g) +$ $\Delta H<0$
C. $C_2H_6(g) \leftrightarrows C_2H_4(g) + H_2(g)$ $\Delta H>0$
D. $2SO_2(g) + O_2(g) \leftrightarrows 2SO_3(g)$ $\Delta H<0$

64. The hydrogen used in the Haber process is made by the following reaction.

CH_4 (g) + H_2O (g) ⇆ CO (g) + $3H_2$(g); ΔH_f^o= +206 KJ

Which of the following sets of conditions will favor the formation of H_2?

A. Low pressure and high temperature
B. Low pressure and low temperature
C. High pressure and low temperature
D. High pressure and high temperature

65. Which of the following types of compounds are expected products from the saponification of a fat?

A. Glycerol and fatty acid salts
B. Glycerol and fatty acids
C. Fatty acid salts and fatty acids
D. Glycerol, fatty acid salts and fatty acids

66. Which one of the following statement best describes the standard enthalpy of formation of any element?

A. The value of ΔH^o_f (element) depends on temperature
B. The value of ΔH^o_f (element) is zero for any element in the standard state
C. The value of ΔH^o_f (element) is zero only at element the solid state
D. The value of ΔH^o_f (element) is zero only at absolute zero temperature.

67. Equal masses of He and Ne are placed in a sealed container. What is the partial pressure of Ne, if the total pressure is 6 atm?

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

68. What is molarity of a solution made by dissolving 10g of glucose ($C_6H_{12}O_6$) in sufficient water to form 200 ml solution?

A. 0.18 C. 0.362
B. 0.251 D. 0.278

69. In which direction will the following equilibrium shift, if a solution of CH_3CO_2Na is added?

CH_3COOH (aq) ⇆ $CH_3CO_2^-$(aq) + H^+(aq)

A. The equilibrium shift to the right (more products)

B. No change
C. The equilibrium shifts to the left(more reactant)
D. Cannot be predicted

70. A 1.0 M solution of a weak acid is found to dissociate by only 1.37%. Which of the following acid is it likely to be?
    A. HF $Ka=7.2 \times 10^{-4}$
    B. HNO_2 $ka=6.9 \times 10^{-4}$
    C. CH_3COOH $Ka=1.8 \times 10^{-5}$
    D. HCOOH $Ka=1.9 \times 10^{-4}$

71. Which of the following statements concerning is petroleum **INCORRECT**?
    A. It is a renewable energy source
    B. It is a fossil fuel
    C. It is mixture consisting mainly of hydrocarbons
    D. It was formed from marine organisms, which died millions of years ago.

72. A 1.0×10^{-4} M solution has a pH of 10.00. The solute is a
    A. Weak acid
    B. Weak acid
    C. strong base
    D. strong acid

73. The four most abundant metals in the earth's crust in decreasing order of abundance are:
    A. Oxygen, Silicon, Aluminum and Iron
    B. Aluminum, Iron Calcium and Magnesium
    C. Iron, Aluminum, Silicon, and Oxygen
    D. Silicon, Aluminum, Magnesium, and Sodium

74. A polysaccharide is a polymer made up of which kind of monomers?
    A. Amino acids
    B. Nucleotides
    C. Simple sugars
    D. Alternating sugar and phosphate groups

75. What is the molar solubility of $Fe(OH)_3$ in a solution that is buffered at pH = 3.50 at 25°C?
    (K_{sp} ($Fe(OH)_3$ = 4×10^{-38})
    A. 1×10^{-5}
    B. 1.1×10^{-6}
    C. 2.0×10^{-6}
    D. 1.26×10^{-6}

76. What is the purpose of a salt bridge in an electrochemical cell?
    A. To provide a source of ions to react at the anode and cathode
    B. To maintain electrical neutrality in the half-cell through migration of ions
    C. To provide means of electrons to travel from the cathode to the anode
    D. To provide means of electrons to travel from the anode to the cathode
77. What is galvanized iron?
    A. Iron that is coated with tin
    B. Iron that is coated with zinc
    C. Iron that is coated with chromium
    D. Iron that is coated with aluminum
78. The standard cell potential (E^o) for the reaction below is 1.10V. What is the cell potential for this reaction when $[Cu^{2+}] = 1 \times 10^{-5}$ M and $[Zn^{2+}] = 1$ M?

$$Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(S)$$

    A. 1.10 B. 0.95 C. 1.20 D. 1.35
79. Which of the following statements is true?
    A. The more positive the value of E_{red}^o, the greater the driving force for reduction.
    B. The more exothermic the value of E_{red}^o, the greater the driving force for reduction.
    C. The more endothermic the value of E_{red}^o, the greater the driving force for reduction.
    D. The more negative the value of E_{red}^o, the greater the driving force for reduction.
80. Which of the following types of elements are good oxidizing agents?
    A. Alkali metals
    B. Halogens
    C. Lanthanides
    D. Transition elements