NATIONAL EDUCATIONAL ASSESSMENT AND EXAMINATIONS AGENCY (NEAEA)
ETHIOPIAN SECONDARY SCHOOL LEAVING CERTIFICATE EXAMINATION (ESSLCE)
CHEMISTRY, HIDAR 2013/14/NOVEMBER 2021

TIME ALLOWED: $2\frac{1}{2}$ HOURS

BOOKLET CODE: 17 **SUBJECT CODE:05**

1. From the magnitude of the equilibrium constant, K_{eq} one can deduce that
   A. large K_{eq} value indicates that the reaction reaches equilibrium with very little reactants remaining.
   B. small K_{eq} values indicate the reaction yields very higher amounts of products near equilibrium.
   C. K_{eq} will be larger when we have higher amounts of reactants over products.
   D. intermediate K_{eq} value indicates that the reaction does proceed in the forward direction.

2. The statement 'If a system at equilibrium is subjected to a stress, the system will readjust itself to reduce the effects of the stress is known as
   A. Avogadro's principle.
   B. Faradays law.
   C. Le- Chatelier's principle.
   D. Boyle's law.

3. The law of mass action states that
   A. the K_{eq} expression is the ratio of the concentrations of reactants to the products raised to their coefficients.
   B. the rate of a reaction is directly proportional to the product of the concentration of reactants raised to the power of their respective coefficients in the balanced equation.
   C. for a reaction at equilibrium, the reaction quotient, Q is always less than the equilibrium constant, K_{eq}.
   D. a chemical equilibrium is attained only when the reaction is started with reactants.

4. For the reaction between gaseous NO and O_2 to form $NO_2(g)$, what will be the equilibrium constant expression,

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$$

A. $Kp = \frac{(P_{NO2})}{(P_{NO})(P_{O2})}$

C. $Kp = \frac{(P_{NO})^2(P_{O2})}{(P_{NO2})}$

B. $Kc = \frac{[NO2]^2}{[NO]^2[O2]}$

D. $Kp = \frac{(P_{NO2})^2}{[NO]^2[O_2]}$

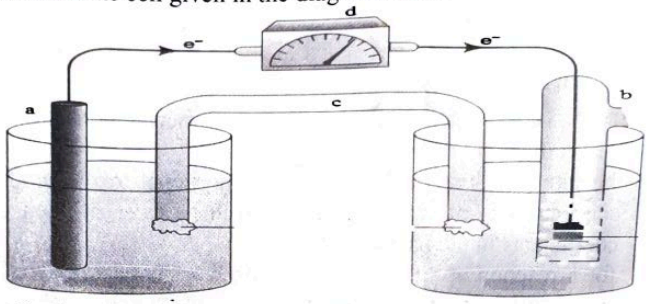
5. The equilibrium constant Kp for the reaction

$2SO_2(g) \longrightarrow 2SO_2(g) + O_2(g)$ is 3.8×10^{-3} Kp at 227 °C.

What is the value of Kc for the reaction at the same temperature?

A. 4.6×10^{-4} mol m^{-3}
B. 1.8×10^{-3} mol m^{-3}
C. 2.3×10^{-4} mol m^{-3}
D. 9.1×10^{-4} mol m^{-3}

6. In the Galvanic cell given in the diagram below



identify the component parts correctly labeled for the letters a, b, c, d and choose the correct one among the following

	a	b	c	d
A.	Copper anode	Zinc cathode	voltmeter	salt bridge
B.	Zinc anode	copper cathode	salt bridge	voltmeter
C.	copper cathode	zinc anode	$CuSO_4$(sol)	voltmeter
D.	Zinc anode	Copper cathode	$ZnSO_4$(sol)	salt bridge

7. The conversion of nitrogen gas into useful nitrogen compounds is known as
   A. Photosynthesis.
   B. Respiration.
   C. Oxidation.
   D. Fixation.

8. CO_2 is released into the atmosphere by one of the following processes
   A. Animals eat plants and release CO_2 by photosynthesis.
   B. Plants consume atmospheric carbon dioxide during photosynthesis.
   C. Utilization of electrical energy as energy sources.
   D. Natural fires and volcanoes release CO_2 into the air.

9. One of the following is **NOT** a common application of silicon
   A. in the control of the frequency of television transmissions.
   B. in the construction of transistors and microprocessors.
   C. in coating iron to prevent it from rusting.
   D. in the production of polish body parts cars.

10. One of the following is **NOT** among the chemical properties of silicon
   A. silica is resistant to attack by all acids except HF, which it reacts to give SiF_4 and H_2O_2
   B. silicon reacts with CH_3Cl at 300 °C in the Cu as a catalyst by further reactions with H_2O yields the polymer$[(CH_3)_2SiO_2]_n$
   C. silicon occurs as silica(SiO_2) and silicate compounds containing the silicate ion(SiO_4^{-4})
   D. silica dissolves in hot molten Na_2CO_3 to give Na_4SiO_4 and CO_2

11. The branch of chemistry that is involved in separation, identifying and determining the relative amounts of components in a sample of material is known as
   A. analytical chemistry.
   B. biochemistry.
   C. inorganic chemistry.
   D. physical chemistry.

12. Significant figures are figures with
   A. measured values with the highest accuracy.
   B. measured values with the highest precision.
   C. exactly known digits with the last digit uncertain.
   D. measured values with the highest uncertainty.

13. For the determination of the density of a new ceramic, a student measured the mass of a piece on an analytical balance and obtained 3.8056 gram and its volume 2.5 mL by displacement of water in a graduated cylinder. The correct reported density of the ceramic should be
A. 1.5224 g/mL
B. 1.5222 g/mL
C. 3.5 g/mL
D. 1.5 g/mL

14. The scientific method is
A. a method of arriving at an organized body of knowledge based on reproducible experiments and observations.
B. a collection of scientific guesses and hypotheses by seeking patterns in the observations.
C. the result of fortunate, accidental discovery in the development of science.
D. the sum total of unique guidelines for the practice of science in the world.

15. One of the following is **NOT** a cause of uncertainty in measurement?
A. The person doing the experiment
B. The type of material measured
C. The environment where the measurement is made
D. The measuring device

16. Hydrogen bonding occurs in compounds that contain H-N, H-O and H-F bonds. These bonds are stronger than the ordinary dipole-dipole interactions because
A. the H-N, H-O and H-F bonds are less polar than ordinary covalent bonds.
B. the partially positive H of one molecule is attracted to the partially negative lone pairs on the N, O or F of another molecule.
C. the H-N, H-O and H-F bonds are non-polar and thus do not interact with neighboring molecules.
D. the small sizes of N, O and F makes these atoms so electropositive that their covalently bonded H is highly negative.

17. Which of the following is an example of exception to the octet rule?
A. CCl_4
B. NH_3
C. PCl_5
D. H_2O

18. Which of the following pair is true about the general properties of the different types of crystalline solids

Type of solid	Hardness	Melting point	Conduction of heat of electricity
I. Ionic	Hard	High	Good
II. Covalent	Hard	High	Poor
III. Molecular	Soft	Low	Good
IV. Metallic	Soft to hard	Low to high	Good

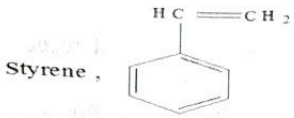
A. II and III
B. I and III
C. I and IV
D. I and II

19. When the boiling point of hydrides of group VIA elements, H_2O, H_2S, H_2Se and H_2Te are arranged in the order of increasing boiling point. The trend is $H_2Te < H_2Se < H_2S < H_2O$, water having the highest boiling point, this is due to
A. the basic different structures of each hydride.
B. the small size of O compared to the other group VIA elements.
C. hydrogen bonding present in H_2O molecules.
D. increasing boiling points with increasing molecular mass.

20. Given the following catalyzed reactions
I. $2SO_2(s) + O_2(g) \longrightarrow 2SO_3(g)$; $V_2O_5(s)$ as a catalyst
II. $OCl^-(aq) + I^-(aq) \longrightarrow OI^-(aq) + Cl^-(aq)$; $OH^-(aq)$ as inhibitor
III. $CO(s) + H_2(g) \longrightarrow CH_4(g) + H_2O(g)$; Ni(s) as a catalyst
IV. $CO(s) + H_2(g) \longrightarrow HCHO(g)$; Cu (s) as a catalyst
Which reactions is examples for homogeneous catalysis?
A. II
B. I and II
C. IV
D. II and III

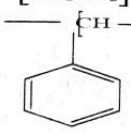
21. Which one the following is a common reaction of tin?
    A. $Sn(s) + H_2O(g) \longrightarrow SnO_2(s)$
    B. $Sn(s) + dil.2HCl(aq) \longrightarrow SnCl_2(aq) + H_2(g)$
    C. $Sn(s) + 2Cl_2(g) \longrightarrow SnCl_2(s)$ in cold media
    D. $Sn(s) + 2H_2O(g) \longrightarrow Sn(OH)_4(s)$

22. The monomer of natural rubber is
    A. 2-methyl-1,3-butadiene(isoprene)
    $CH_2=C(CH_3)-CH=CH_2$
    B. 2-chloro-1,3-butadiene(chloroprene)
    $H_2C=C(Cl)-CH=CH_2$



    C.
    D. 1,3-butadiene
    $H_2C=CH-CH=CH_2$

23. All of the following are examples of addition polymers **EXCEPT**
    A. $-[CH_2\text{-}CHCl]_n-$
    B. $-[CH_2\text{-}CH_2]_n-$
    C. $-[CH_2CH_2]_n-[CH_2\text{-}CH(CH_3)]_n-$



    D.

24. One of the following examples of polymers is correctly matched with its uses.
    A. Polypropylene; electrical insulation
    B. Polyethylene; food containers
    C. Polytetrafluoroethylene; making shoes
    D. Polyvinyl chloride; making pipes

26. Natural polymers are
A. polymers produced by condensation reaction of monomer units.
B. polymers produced by the addition reaction of monomer units.
C. polymers produced by the substitution of one or more atoms in the monomer units.
D. polymers found in some substances like rubber in nature.

27. Oils are unsaturated fatty acids. The process of converting oils to solid fats involves
A. saponification with NaOH
B. esterification of the acids.
C. halogenations of the C-C double bonds.
D. hydrogenation of the C-C double bonds.

27. A chemistry teacher has added different reactants and reagents in three different test tubes as described below
I. Into the test tube A he added ethanol, sodium dichromate, sulphuric acid.
II. Into the test tube B he added acetaldehyde, sodium borohydride and water.
III. Into the tube C he added methyl acetate and ethanol and sodium hydroxide.
In which test tube would a reaction takes place that provide acetic acid?
A I and II
B. III
C. I
D. II and III

28. The difference between colloids and suspension is that
A. most colloids and suspensions appear cloudy.
B. colloidal particles are small enough and do not settle down unlike in a suspension.
C. colloids are as transparent as solutions.
D. both colloids and suspensions are heterogeneous mixtures.

BOOKLET CODE: 17 **SUBJECT CODE:05**

29. The solubility of a substance is the amount of a substance that
    A. dissolves more amount of solute than it can normally dissolve.
    B. gives an unsaturated solution of the substance at given temperature.
    C. dissolves double the amount of solute than it can normally dissolve.
    D. gives a saturated solution of the substance at a given temperature.

30. 50 mL of the supernatant saturated solution of NaCl was taken in an evaporating dish (weight = w_o) and evaporated over a Bunsen burner until all the water has evaporated and dry sodium chloride is left in the evaporating dish. The evaporating dish with the dry sodium chloride is weighed (weight = w_1). Given the following information, w_o = 47.5 g and w_1 = 66.2. Calculate the solubility of NaCl in water assuming 50 mL of the solution is equal to 50 mL of the solvent
    A. 113.7 g/100 g of water
    B. 37.4 g/100 g of water
    C. 187 g/100 g of water
    D. 18.7 g/100 g of water

31. One of the following given pairs represents examples of buffer systems
    A. NH_4Cl/H_2O and H_2O/CH_3COONa
    B. NaOH/HCl and HNO_3/KOH
    C. NH_4OH/NH_4Cl and CH_3COOH/CH_3COONa
    D. NH_4OH/CH_3COOH and NH_4Cl/CH_3COONa

32. The reaction between a weak acid and strong base as represented by the reaction between acetic acid and NaOH gives a basic solution because

$$CH_3COOH + NaOH \longrightarrow Na^+ + CH_3OO^- + H_2O$$

    A. CH_3COO^- as a strong base picks up H^+ and causes excess OH^- ions.
    B. Na^+ is a strong acid and causes high concentration of H^+
    C. CH_3COOH does not produce sufficient amount of H^+ ions.
    D. the OH^- ions from NaOH are not completely neutralized.

33. An acid is a substance that
    A. produces more OH^- ions in water than H^+ ions.
    B. has a bitter taste.
    C. donates a pair of electrons to a chemical species.
    D. donates a proton in a chemical reaction.

34. One of the following given masses of acids constitutes the corresponding equivalent of the acid
    A. $HCl = 36.5\ g = 2$ equivalents
    B. $H_2SO_4 = 98\ g = 2$ equivalent
    C. $H_3PO_4 = 98\ g = 2$ equivalents
    D. $H_2SO_4 = 49\ g = 4$ equivalents

35. One of the following pairs shows Bronsted-Lowry acids behavior in water?
    A. H_3O^+ and NH_3
    B. HNO_3 and NO_3^-
    C. HCl and NH_4^+
    D. HPO_4^{2-} and PO_4^{3-}

36. Covalent compounds are liquids or gases at room temperature and have low melting and boiling points. Which of the following statements explains these properties of covalent compounds?
    A. The unit of particles in covalent compounds are ions.
    B. The intermolecular forces of attraction in covalent compounds are strong.
    C. Covalent compounds exist as separate molecules.
    D. There are no forces of attraction between the molecules in covalent compounds.

37. Both carbonyl sulphide, COS (SCO), S=C=O and carbon dioxide (CO_2) O=C=O are linear molecules. COS is polar whereas CO_2 is non-polar. this is because
    A. the C=O bonds in both COS and CO_2 are polar.
    B. CO_2 has a net dipole moment of zero.
    C. sulphur is more electronegative than oxygen.
    D. regions of high negative charge is distributed equally around the central atom in COS.

38. Which of the following statements is true about the formation of CH_4 according to valence bond theory?
    A. The 2s and three 2p orbitals in carbon hybridize to form four sp^3 orbitals.
    B. The 2s and two 2p orbitals in carbon hybridize to form three sp^2 orbitals.
    C. Carbon can form two hybrid orbitals as it has got only two half-filled orbitals.
    D. The 2s and one 2p orbitals in carbon hybridize to form two sp orbitals.

39. Phosphorus (Z=15) has the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^3$, what kind of hybridization does phosphorus undergo in the formation of phosphorus pentachloride(PCl_5)?
    A. sp^3d
    B. sp^3
    C. sp
    D. sp^2

40. One of the following reactions illustrates the formation of coordinate covalent bond?
    A. $Be + 2F_2 \rightarrow BeF_2$
    B. $NaOH + HCl \rightarrow NaCl + H_2O$
    C. $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2$
    D. $NH_3 + HCl \rightarrow NH_4^+ + Cl^-$

41. In the production of NH_3 by the Haber process according to the equation
    $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\Delta H = -92$ KJ mol^{-1}
    What are the favorable conditions for the production of high yield of NH_3?
    A. High pressure and low temperature
    B. Law pressure and low temperature
    C. Low pressure and high temperature
    D. High pressure and high temperature

42. Which one of the following statements describes laboratory and industrial preparation of acetic acid respectively?
A. Reduction of ethanol by $NaBH_4$ and fermentation of propanol.
B. Reduction of toluene by $KMnO_4$ and reduction of ethanol by sodium dichromate.
C. The oxidation of ethanol by sodium dichromate and fermentation of ethanol.
D. Oxidation of toluene by $KMnO_4$ and fermentation of ethanol.

43. Which of the following is true about carboxylic acids?
A. Methanoic, Ethanoic and Citric acids are monocarboxylic acids.
B. Carboxylic acid with the formula RCOOH.
C. Citric acid is a typical dicarboxylic acid.
D. Propanedioic acid is the simplest dicarboxylic acid.

44. What is the IUPAC name for the branched carboxylic acid CH_3-CH(Cl)-$CH(CH_3)$-$CH(CH_3)$-COOH
A. 4-chloro-2, methyl 1-pentanoic acid.
B. 1, 2-dimethyl-4-chloro 1-pentanoic acid.
C. 4-chloro-1-methyl 1-pentanoic acid.
D. 4- chloro-2, 3-dimethyl 1-pentanoic acid.

45. Esters are characterized by the following properties **EXCEPT**
A. esters have lower boiling point compared to the carboxylic acid and alcohols.
B. esters have pleasant odors of perfumes and food flavoring.
C. esters have higher boiling point than carboxylic acid and alcohols.
D. all esters are soluble in inorganic solvents and organic.

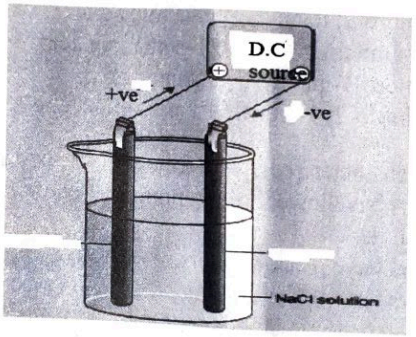
46. The sanitizer in wide use for protection against Covid-19 is labelled 83% alcohol. How can one scientifically check the concentration? This can be done by
A. experimentation.
B. forming a hypothesis.
C. making observation.
D. collection of data.

47. The correct electronic configuration for chromium (Cr, Z=24) is
A. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^6$
B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4d^2$
C. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$
D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

48. According to Hund's rule equal energy(degenerate) orbitals are filled with
A. maximum number of unpaired electrons with parallel spins.
B. two electrons of opposite spins placed in the first orbitals.
C. maximum number of unpaired electrons with opposite spins.
D. two electrons of parallel spins placed in the first orbital.

49. In the modern periodic table
A. elements with similar properties are placed in the same period.
B. non -metals are placed on the right hand side of the periodic table.
C. transition and inner transition elements are placed in the middle of the periodic table.
D. metals are placed on the right hand side of the periodic table.

50. The electrolysis of liquid (molten) NaCl in the set-up for the electrochemical cell is given in the following figure below



Which of the following statements is true about the electrolysis of molten sodium chloride?
A. Na is oxidized at the anode.
B. Cl_2 is formed at the cathode.
C. O_2 is produced at the anode due to oxidation of water.
D. The net reaction produces Cl_2 at the anode and Na at the cathode.

BOOKLET CODE: 17 13 **SUBJECT CODE:05**

51. In the reaction mixture of the two species NH_4OH and NH_4Cl

$NH_4OH \rightleftharpoons NH_4^+ + OH^-$

$NH_4^+Cl^- \longrightarrow NH_4^+ + Cl^-$

Which one of the is true about the reaction mixture?

A. The presence of NH_4^+ ion suppresses the dissociation of the weak base NH_4OH

B. The NH_4^+ ion is a spectator ion in the reaction mixture.

C. The reaction equilibrium is shifted towards the right due to the presence of NH_4^+ ions.

D. The presence of NH_4^+ in the reaction mixture makes the solution more basic.

52. Which one the following is correct about K_w at different temperature?

The ionic product of water K_w equals

$K_w = 1.0 \times 10^{-14}$ at 25 °C $\sqrt{Kw} = 1x10^{-7}$

$K_w = 2.92 \times 10^{-14}$ at 40 °C $\sqrt{Kw} = 1x10^{-7}$

A. At 40 °C pure water is no more neutral.

B. Water is dissociate to a higher extent at 40 °C than at 25 °C.

C. Hydroxyl ion concentration is higher at 40 °C than hydrogen ion concentration.

D. Hydrogen ion concentration at 25 °C is higher than at 40 °C.

53. What is reduction? Reduction is

A. loss of electrons and decrease in oxidation number.

B. gain of electrons and increase in oxidation number.

C. gain of electrons and no change in oxidation number.

D. gain of electrons and decrease in oxidation number.

BOOKLET CODE: 17

54. During the electrolysis of dilute aqueo in solution are H^+, OH^+ and SO_4^{2-} discharged at the cathode and anode, re
    A. Anode = $SO_4^{2-}(aq) + 4H^+(aq) + 2e^-$
       Cathode = $2H^+(aq) + 2e^-$ →
    B. Anode = $4OH^-(aq)$ → H
       Cathode = $2H^+(aq) + 2e^-$ →
    C. Anode = $2H_2O(l)$ → $O_2(g)$
       Cathode = $2H^+(aq) + 2e$ →
    D. Anode = $4OH^-(aq)$ → H_2O
       Cathode = $2H_2O(l) + 2e^-$ →

55. Which one of the following is **NOT** electrochemical cells?
    A. The overall cell potential is calculate
       $E^o_{cell} = E_{cathode} - E_{anode}$
    B. Electrons flow spontaneously from n
    C. The difference in the electrical potent
       that is positive cell.
    D. E^o_{cell} is greater than zero for non-spo

56. The "like dissolves like " rule accounts for o
    A. The solubility of C_2H_6 in H_2O
    B. The solubility of C_6H_6 in CCl_4
    C. The insolubility of I_2 in H_2O
    D. The solubility of KBr in C_7H_8

57. Which of the following concentration units is
    A. ppm (parts per million) = *mass of sol*
    B. mass percentage = $\frac{mass\ of\ solute}{mass\ of\ solvent} x\ 10$
    C. mass percentage = $\frac{mass\ of\ solute}{mass\ of\ solution} x\ 10$
    D. ppb (parts per billion) = *mass of solut*

58. The concentrated sulphuric acid H_2SO_4 we use in the laboratory is 98% H_2SO_4 by mass and has a density of 1.83 g/ mL. Below are given the concentrations of the acid in various units. which of the given alternatives correctly describes the concentration of the acid?

	Molarity	Normality	Mole fraction
A.	36.6 M	18.3 N	0.1
B.	18.3 M	36.6 N	0.9
C.	1.83 M	3.66 N	0.9
D.	18.3 M	3.66 N	0.9

59. How do you prepare 500mL of 1N $Ca(OH)_2$ solution?
(Ca= 40, H=1, O= 16)
A. By dissolving 74 g of $Ca(OH)_2$ in 500.mL of solution.
B. By dissolving 37 g of $Ca(OH)_2$ in 1 liter of solution.
C. By dissolving 37 g of $Ca(OH)_2$ in 500.mL of solution.
D. By dissolving 74 g of $Ca(OH)_2$ in 1 liter of solution.

60. The Ka of acetic acid CH_3COOH is 1.8×10^{-5}. What is the percent ionization of 1M CH_3COOH?
A. 1.42 C. 4.2
B. 3.6 D. 1.34

61. The mathematical expressions for Faraday's first law is summarized as
A. $m = \frac{MIt}{nF}$ C. $m = \frac{It}{F}$
B. $n = \frac{mIt}{MF}$ D. $M = \frac{mIt}{nF}$

BOOKLET CODE: 17 **SUBJECT CODE:05**

62. In the electrolysis of copper sulphate solution using graphite electrodes, O_2 is liberated at the anode and copper metal is deposited at the cathode. If the electrolysis of $CuSO_4$ is performed using copper electrode, what happens at the anode and cathode?
    A. At the anode H_2 is liberated, whereas copper is deposited at the cathode.
    B. At the anode the copper electrode dissolves and copper metal is deposited at the cathode.
    C. No electrochemical reaction takes place involving copper.
    D. At the anode copper is reduced, whereas copper is oxidized at the cathode.

63. The statement 'the amount of a substance consumed or produced in an electrolytic cell is directly proportional to the amount of electricity that passes through the cell' is known as
    A. Raoult's law.
    B. Dalton's law.
    C. Henry's law.
    D. Faraday's law.

64. Given the following electromotive series of selected metals with their standard reduction potentials

Metal	Cu	Pb	Ni	Cd	Zn	Al	Ca	K
E°/V	+0.34	-0.13	-0.25	-0.40	-0.76	-1.66	-2.87	-2.93

Which of the following statements is correct about reactivity of the metals?
    A. K is the strongest reduction agent among the metal silver.
    B. Cu is the strongest reducing agent in the group.
    C. Pb is more easily oxidized than Al.
    D. The reaction $Cu + Zn^{2+} \longrightarrow Cu^{2+} + Zn$ is spontaneous.

65. One of the following is **NOT** true about the effects of corrosion?
    A. It causes enormous damage to buildings, bridges, ships and cars.
    B. It causes deterioration of metals by spontaneous chemical process.
    C. Corrosion forms protection oxide layers to prevent damage.
    D. Damage from corrosion costs billions of dollars annually.

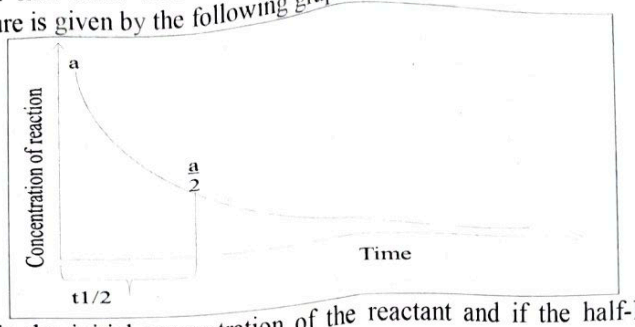
66. Which statement is true about catalysts?
A. A positive catalyst decreases the rate of a reaction by increasing the activation energy.
B. A catalyst slows down or speeds up a reaction, itself being consumed.
C. The role of a catalyst is to increase or decrease the rate of a reaction by lowering or increasing the activation energy.
D. A negative catalyst increases the rate of a reaction by decreasing the value of activation energy.

67. According to the transition state theory
A. in the activated complex, the original bonds are weakened and the new bonds are partially formed.
B. the collision between two reacting species results in the formation of an activated complex, which has less energy than both the reactants and products.
C. the standard reaction enthalpy (ΔH^0) depends on the magnitude of the activation energy (E_a).
D. the activation energy is the energy that must be absorbed or released by reactants to reach the activated complex.

68. Which of the following is true about the rate constant?
A. The value of a rate constant tells us how fast or slow a reaction is.
B. It expresses the relationship between the rate of a chemical reaction and the volume of reacting species.
C. A small rate constant indicates a faster reaction and a larger rate constant indicates a slower reaction.
D. The value of a rate constant is independent of reaction conditions.

BOOKLET CODE: 17 **SUBJECT CODE:05**

69. For a first order reaction, the concentration versus time of the reaction mixture is given by the following graph



If a is the initial concentration of the reactant and if the half-life is 1hr, after how many hours would be the concentration of reactant reduced to a/32?

A. 4 hr
B. 1 hr
C. 3 hr
D. 5 hr

70. The mathematical expression

$\log k = (\frac{-Ea}{2.3303R})\frac{1}{T} + \log A$ derived from the Arrhenius equation is of important as it shows

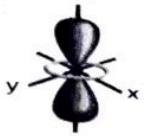
A. for a given value of activation energy the value of the rate constant increases as the temperature increases.
B. reactions with larger activation energies have higher values of k and are therefore faster.
C. for a given value of activation energy, the value of the rate constant decreases as the temperature increases.
D. reactions with larger activation energies, the value of the rate constant decreases as the temperature increases.

71. Which of the following is true about isotopes? Isotopes of an element have

A. different number of neutrons and the same number protons.
B. the same number of electrons and neutrons.
C. the same atomic mass but different atomic numbers.
D. different physical and chemical properties.

72. The following diagrammatic representations shows the shape for various orbitals. Which one represents the d_z^2 orbitals?

A.

B. 

C.

D.

73. Sliver (Z=47) has several known isotopes, but two occur naturally, ^{107}Ag and ^{109}Ag. Given the following mass spectrometric data, calculate the atomic mass of Ag

Isotope	Mass(amu)	Abundance (%)
^{107}Ag	106.90509	51.84
^{109}Ag	108.90476	48.16

A. 107.94 amu
B. 108.9 amu
C. 107.86 amu
D. 107.4 amu

74. Which statement correctly describes Heisenberg's uncertainty principle?
A. A particle with a mass moving at a given speed can be described by the wave characteristics of material particles.
B. If we measure the momentum of a particle precisely then its position will be correspondingly precise.
C. Both the location and the momentum of a subatomic particle like the electron cannot be precisely known.
D. A small particle like the electron can behave both as a particle and a wave.

BOOKLET CODE: 17 **SUBJECT CODE:05**

75. Which of the following statement is correct about energy changes when an electron changes its energy level?
   A. When an electron falls from a higher energy level to a lower energy level, the energy is equal to the difference between the two energy levels is observed.
   B. When an electron jumps from a lower energy level to a higher level, the photon emitted is equal to the difference between the two energy levels.
   C. When an electron falls from a higher energy level to a lower energy level, the energy is higher than the difference between the two energy levels is emitted.
   D. When an electron jumps from a lower energy level to a higher energy level, the energy is equal to the difference between the two energy levels is absorbed.

76. According to the Lewis definition of an acid, an acid is a substance that
   A. accepts a H^+ ion.
   B. dissociates in water to yield H_3O^+
   C. accepts a pair of electrons.
   D. donates an OH^- ion.

77. Water is a weak electrolyte, because
   A. it can accept a proton from an acid and donate a proton to a base.
   B. it has a very high ionic product, Kw.
   C. it acts both as Bronsted-Lowry acid and base.
   D. it undergoes a reversible dissociation with a very low ionic product, Kw.

BOOKLET CODE: 17 21 **SUBJECT CODE:(**

78. Which of the following reactions represent the amphiprotic behavior (water

A. $HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$ and $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

B. $HCl + H_2O \longrightarrow H^+ + Cl$ and $NaOH + H_2O \longrightarrow Na^+ + OH^-$

C. $H_2O + H^+ \rightleftharpoons H_3O^+$ and $NH_3 + H^+ \rightleftharpoons NH_4^+$

D. $H_3O^+ + OH^- \longrightarrow 2H_2O$ and $H^+ + OH^+ \longrightarrow H_2O$

79. For an acidic solution, which of the following is correct?

A. pH > pOH and pKw - pH < 7
B. pH = pOH and pH = 1/2pKw = 7
C. for acidic solution pH < 7 and $[H^+] < 1x10^{-7}$
D. pH < pOH and pKw - pH > 7

80. What is the pH of 0.25 M HF solution at 25°C. The ionization of the weal acid, HF is given by

$HF(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + F^-(aq)$, k_a for HF is 6.8×10^{-4}

A. 1.89
B. 12.1
C. 1.741
D. 12.3

THE END