OROMIA EDUCATION BUREAU

GRADE 12 CHEMISTRY MODEL EXAMINATION 2017/2025

TIME ALLOWED: 2:30 HOURS

GENERAL DIRECTIONS:

THIS BOOKLET CONTAINS CHEMISTRY **MODEL EXAMINATION** FOR **GRADE 12**. IN THIS BOOKLET, THERE ARE TOTAL OF **80** MULTIPLE CHOICE QUESTIONS.

THERE IS ONLY ONE BEST ANSWER FOR EACH QUESTION. CHOOSE THE BEST ANSWER FROM THE GIVEN ALTERNATIVES AND WRITE THE LETTER OF YOUR CHOICE ON THE ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAM QUESTIONS FOR **2:30 HOURS ONLY.** WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING ON THE QUESTIONS AND PUT DOWN YOUR PEN/PENCIL AND WAIT FOR WHAT YOU MIGHT BE TOLD TO DO.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAMINATION WILL RESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAM HALL AND CANCELLATION OF YOUR SCORE.

PLEASE MAKE SURE THAT YOU HAVE WRITTEN ALL THE REQUIRED INFORMATION ON THE ANSWER SHEET BEFORE YOU START TO WORK ON THE EXAM.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. What does Dalton's Atomic Theory state about the nature of matter?
    A. matter consists of indivisible molecule
    B. matter consists of indivisible atom
    C. matter consists of indivisible ions
    D. matter consists of indivisible mixture
2. What discovery resulted from Rutherford's alpha ($\propto$) particle scattering experiment?
    A. Electron
    B. Proton
    C. Nucleus
    D. Positrons
3. If an ion of an element has 3 positive charges, a mass number of 27, and 14 neutrons, how many electrons are present in the ion?
    A. 13
    B. 10
    C. 14
    D. 1
4. How many orbitals does the fourth principal energy level have?
    A. 4 orbitals
    B. 8 orbitals
    C. 32 orbitals
    D. 16 orbitals
5. What does the quantum mechanical model of the atom describe?
    A. Focuses on the probability of locating an electron in a specific position.
    B. Focused on the movement of electron in a fixed circular orbit around the nucleus.
    C. Specifies the exact trajectory of an electron around the nucleus.
    D. Contains several analogies to observable phenomena in the visible world.
6. The Heisenberg Uncertainty Principle states that _____.
    A. No two electrons in the same atom can have the same set of four quantum numbers.
    B. Two atoms of the same element must have the same number of protons.
    C. It is impossible to determine accurately both the position and momentum of an electron simultaneously.
    D. Electrons in atoms' ground states enter energetically equivalent orbitals singly before pairing up in any orbital of the set.

7. An element has two isotopes: one with an abundance of 69.09% and a mass of 62.93 amu, and the other with an abundance of 30.91% and a mass of 64.93 amu. What is the atomic mass of the element?

   A. 63.55 amu
   C. 63.24 amu
   B. 63.34 amu
   D. 63.14 amu

8. Calculate the wavelength of a photon emitted when an electron transitions from the 5^{th} orbit (n=5) to the 2nd orbit (n=2) in an atom.($R_H=1.097x10^7m^{-1}$)

   A. 434 nm.
   C. 453nm
   B. 343nm
   D. 345nm

9. What is the maximum number of electrons that can have the quantum numbers n = 3, ℓ = 1, and m_l = -1?

   A. 14
   C. 10
   B. 6
   D. 2

10. Which of the following quantum numbers can distinguish between two electrons present in the same orbital?

   A. Principal quantum number
   C. Azimuthal quantum number
   B. Magnetic quantum number
   D. Spin quantum number

11. What is the correct ground state orbital diagram electronic configuration of oxygen atom?

   A. $1s^2 2s^2 2p_x^2 2p_y^2 p_z^0$
   C. $1s^2 2s^2 2p_x^2 2p_y^1 2p_z^0$
   B. $1s^2 2s^2 2p_x^2 2p_y^1 p_z^1$
   D. $1s^2 2s^2 2p_x^2 2p_y^2 p_z^0$

12. An element M is in group 3^{rd} of the periodic table, the formula for its nitride is___

   A. MN
   C. M_3N_2
   B. M_5N_3
   D. M_2N_3

13. Atoms of elements that are in the same group have the same number of_____.

   A. Protons
   C. Valence electrons
   B. Neutrons and protons
   D. neutrons

14. Which statement about the alkali metals is correct?

   A. They form negative ions with one negative charge
   C. They have very large atomic masses
   B. They are usually gases
   D. They are extremely reactive

15. Which one of the following is not a property of metals?

A. Conductivity
C. Ductility
B. Brittility
D. Malleability

16. Which of the following has the largest first ionization energy?

A. K
C. Li
B. Na
D. Rb

17. What is the formal charge of nitrogen in the nitrate ion (NO_3^-) when one of the oxygen atoms forms a double bond with the nitrogen atom?

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

18. Which of the following molecules or compounds **does not** follow the octet rule?

A. PCl_3
C. $AlCl_3$
B. NF_3
D. OF_2

19. Why does sodium chloride not conduct electricity in its solid form?

A. It has a giant covalent molecular structure
B. Ions in its structure only have single negative and single positive charges
C. Ions in its structure are in fixed positions
D. It contains no free electrons.

20. Which of the following **is not** a property of substances with ionic bonding?

A. High melting point
C. Soluble in polar solvents
B. Crystallinity
D. Conductor in the solid state

21. Why are metals excellent conductors of electricity?

A. Metal atoms are arranged in a regular lattice.
B. Metal ions are very close to each other
C. Metal ions are free to move through the lattice
D. Electrons are free to move through the lattice

22. Which type of substance is most likely soft, has a low melting point, and is a poor conductor of electricity?

A. an ionic solid
C. a metallic solid
B. a molecular solid
D. network solid

23. What is the outcome when a single atom supplies both electrons needed to form a covalent bond?

A. Ionic bond
B. Covalent bond
C. Metallic bond
D. Co-ordinate bond

24. What types of weak forces act between molecules?

A. Molecular forces
B. Intermolecular forces
C. Intramolecular forces
D. Extra molecular forces

25. What type of bond is formed when two identical atoms share electron pairs and exert force on each other?

A. non-polar covalent bond
B. double covalent bond
C. polar covalent bond
D. ionic bond

26. What is the bond order in O_2^+?

A. 3.5 B. 2 C. 1.5 D. 2.5

27. Antibonding molecular orbitals are produced by

A. Constructive interaction of atomic orbitals.
B. Destructive interaction of atomic orbitals
C. The overlap of the atomic orbitals of two negative ions
D. Bothe constructive and destructive interaction of atomic orbital

28. Which species contains a sp^2-hybridized atom?

A. BeH_2 B. BH_3 C. NH_3 D. H_3O^+

29. What are the conditions for gas like Carbon monoxide to obey the ideal gas laws?

A. low temperature and low pressure
B. high temperature and high pressure
C. high temperature and low pressure
D. low temperature and high pressure

30. The kinetic theory of gases predicts that total kinetic energy of gas depends on

A. Pressure, temperature and volume of the gas
B. Volume of the gas
C. Temperature of the gas
D. Pressure of the gas

31. The density of a gas A is twice that of gas B. Molecular mass of A is half of the molecular mass of B. The ratio of the partial pressure of A and B is__

A. ¼ B. 4/1 C. ½ D. 2/1

32. The pH of an HCl solution is 4, indicating that the molarity of the solution is?

A. 0.001M. B. 4.0M. C. 0.4M. D. 0.0001M.

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

A. is capable of donating one or more H^+
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 autoionization of the solvent

34. HA is a weak acid. Which equilibrium corresponds to the equilibrium constant K_b for A^-?

A. $HA\ (aq) + H_2O\ (l) \rightleftharpoons H_2A\ (aq) + OH\text{-}(aq)$
B. $A\text{-}\ (aq) + H_3O+\ (aq) \rightleftharpoons HA\ (aq) + H_2O\ (l)$
C. $A\text{-}\ (aq) + H_2O\ (l) \rightleftharpoons HA\ (aq) + OH\text{-}\ (aq)$
D. $A\text{-}\ (aq) + OH\text{-}\ (aq) \rightleftharpoons HOA^{2-}\ (aq)$

35. What characteristic is always exhibited by a buffer solution?

A. Keeps the pH less than 7.
B. Contains equimolar amounts of acid and its conjugate base.
C. Keeps the pH constant if small quantities of acid or base are added.
D. Resists changes in pH if small quantities of acid or base are added.

36. What is the pH of 500 mL of solution containing 0.37 grams of $Ca(OH)_2$?

A. 11 B. 12 C. 2 D. 3

37. The reaction of ammonia with water can be represented by $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$ Which is the acid-conjugate base pair?

A. NH_3 and OH^- C. H_2O and OH^-
B. NH_3 and NH_4^+ D. H_2O and NH_4^+

38. If 0.20 mol/L CH_3COOH and 0.50 mol/L CH_3COO^- together make a buffer solution, calculate the pH of the solution if the acid dissociation constant of CH_3COOH is 1.8×10^{-5}.

A. 2.09. C. 3.98.
B. 5.14. D. 2.65.

39. Which of the following is the correct definition of the rate of a chemical reaction?

A. The amount of product formed at equilibrium

B. The change in concentration of reactants or products per unit time

C. The total time required for a reaction to complete

D. The energy required to start a reaction

40. Which factor affects the rate constant k of the chemical reactions?

A. Reaction Concentration

B. Reaction Mechanism

C. Temperature

D. Presence of Catalyst

41. For the first order reaction, what is the unit of the rate constant k?

A. mol/(L.s)

B. s^{-1}

C. L/(mol.s)

D. $L^2/(mol^2.s)$

42. The rate of chemical reaction doubles when the temperature is increased from 298K to 308K, what is the approximate activation energy? (R= 8.314J/(mol.K), ln2=0.693).

A. 53KJ/mol B. 43KJ/mol C. 35KJ/mol D. 28KJ/mol

43. Which expression represents the half-life ($t_{1/2}$) of zero-order reaction?

A. $t0.5 = \frac{\ln 2}{k}$

B. $t0.5 = \frac{[A]_o}{2k}$

C. $t0.5 = \frac{[A]_o}{k}$

D. $t0.5 = \frac{1}{k[A]_o}$

44. In the reaction: $2NO + Cl_2 \rightarrow NOCl$, the rate law is: Rate = $[NO]^2 [Cl_2]$. What is the overall reaction order?

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

45. Which statement about the reaction mechanism is correctly described?

A. The slowest step determines the reaction rate

B. All elementary steps must have the same rate

C. The intermediate concentration always increase

D. The overall rate law includes all reactant in the mechanism

46. For the reaction $A \rightarrow B+C$, the rate law is: rate = $k[A]^2$, If the change in concentration decreased by halves of its initial concentration, how does the rate change?
    A. No change
    B. Doubles
    C. Halves
    D. Reduced to one-fourth
47. The role of catalyst in a chemical reaction is:
    A. Increases the reaction rate by raising the activation energy.
    B. Decreases the reaction rate by lowering activation energy.
    C. Increases the reaction rate by lowering activation energy.
    D. Shifts the equilibrium position.
48. Which of the following statement best describes a system at equilibrium?
    A. The forward reaction rate is zero.
    B. The concentration of reactants and products are equal
    C. The forward and reverse reaction rate are equal
    D. The total pressure of the system is constant
49. For the reaction $N_2\,(g) + 3H_2\,(g) \leftrightarrow 2NH_3\,(g)$, what happens to the equilibrium position if the pressure is increased by decreasing volume?
    A. Shift to the right
    B. No change in equilibrium position
    C. Shift to the left for the reaction
    D. The reaction stops

50. The equilibrium constant K_C for the reaction: $2SO_2\,(g) + O_2\,(g) \leftrightarrow 2SO_3\,(g)$ is 10 at 500K. What is the value of K_C for the reverse reaction at the same temperature?

    A. 0.1 B. 10 C. 0.01 D. 1.0

51. If the equilibrium constant K_p of the reaction is much greater than 1, what does this implies about the reaction?

    A. Reactants are favored
    B. Products are favored
    C. The system is at equilibrium
    D. The reaction is exothermic

52. Which of the following changes will decrease the value of the equilibrium constant for an exothermic reaction?

A. Increasing the pressure
C. Increasing the temperature
B. Decreasing the concentration
D. Adding an inert gas

53. For the reaction: $CO\,(g) + H_2O\,(g) \leftrightarrow CO_2\,(g) + H_2\,(g)$, the equilibrium constant K_C is 4. If $[CO] = [H_2O] = 0.2M$ and $[CO_2] = [H_2] = 0.4M$, What is the reaction quotient (Q_C) and in which direction will the reaction proceed?

A. $Q_C = 4$, no shift
C. $Q_C = 8$, shifts left
B. $Q_C = 2$, shifts right
D. $Q_C = 1$, shifts right

54. If K_C for the reaction: $2NOCl\,(g) \leftrightarrow 2NO\,(g) + Cl_2\,(g)$ is 0.1 a $25^{O}C$. what will happen if additional [NO] is added to the system?

A. The reaction shifts to the right
B. The reaction shifts to the left
C. The equilibrium constant decreased
D. The equilibrium remain unchanged

55. For the gaseous equilibrium reaction: $2HI\,(g) \leftrightarrow H_2\,(g) + Cl_2\,(g)$, which of the following affect the equilibrium position?

A. Pressure of the reactants
B. Volume of the product
C. Concentration of the reactants
D. Addition of the catalyst

56. The IUPAC name of $CH_3CH_2CH(OH)CH_2CH_2CH_3$ is:

A. 4-Hexanal
C. Dipropyl ether
B. 3-Hexanol
D. 4-Hexanol

57. Which of the following reaction convert an alcohol into an alkene?

A. Oxidation
C. Dehydration
B. Reduction
D. Substitution

58. Which properties of aldehydes and ketones is primarily responsible for their ability to undergo nucleophilic reactions?

A. Presence of hydroxyl group
C. Weak hydrogen bonding
B. Planar carbonyl group
D. High boiling point

59. The reaction of carboxylic acid with alcohol in the presence of acid catalyst produces:

A. Aldehyde
C. Ether
B. Ester
D. Ketone

60. Which compound can react with both $NaHCO_3$ and alcohol to form ester?

A. CH_3CH_2CHO
C. $CH_3OCH_2CH_3$
B. $CH_3COOCH_2CH_3$
D. $CH_3CH_2CH_2COOH$

61. Which of the following is true about saponification of fats and oils?

A. Produces glycerol and fatty acid
C. Produces fatty acid and ester
B. Produces glycerol and soap
D. Produces alcohol and soap

62. Which of the following reaction involves the loss of electrons in the redox reactions?

A. Reduction
C. Neutralization
B. Disproportionation
D. Oxidation

63. Which electrode is a site of reduction in any electrochemical cells?

A. Cathode
C. Both anode and cathode
B. Anode
D. Neither cathode and anode

64. Which of the following correctly describes a galvanic cell?

A. Converts electrical energy in to chemical energy
B. Has a negative cathode and positive anode electrode.
C. Converts chemical energy in to electrical energy
D. Operates only when connected to an external power

65. The standard electrode potential of the half-cell is measured under standard conditions, which include:

A. P=1atm, T=25^{O}C, and 1.0M
C. P=1atm, T=50^{O}C, and 1.0M
B. P=1atm, T=37^{O}C, and 0.1M
D. P=760mmHg, T=100^{O}C, and 0.2M

66. Which of the following represents faraday's first law of electrolysis?

A. Amount of charge required to deposit one mole of substance is constant.
B. The amount of species deposited at electrode is directly proportional to the charge passed.
C. The rate of electrolysis is independent of the current used
D. Energy of electrolysis is depends on resistance of the electrolyte

67. In electrolyte cell, the flow of electrons occurs:
    A. From anode to cathode in external circuit
    B. From cathode to anode in external circuit
    C. From anode to cathode within the electrolyte
    D. From anode to cathode within the electrolyte
68. What is the role of salt bridge in a galvanic cell?
    A. Connect the two cells to allow the electron flow.
    B. To maintain the electrical neutrality by allowing ions flow.
    C. Increase the voltage of the cell.
    D. Prevent the mixing of different electrolyte.
69. The standard electrode potential (EMF) of galvanic cell that contain the CuSO4 and ZnSO4 solution is: (Given: $E^{O}Cu^{2+}/Cu(s)$ =0.34V, $E^{O}Zn^{2+}/Zn(s)$ =-0.76V).
    A. +0.42V B. -0.42V C. -1.10V D. +1.10V
70. If a 0.1mole of electrons are passed through electrolytic cell, how many grams of copper (Cu) will deposited on the cathode electrode?
    A. 32g B. 6.4g C. 3.2g D. 64g
71. The electrolysis of a concentrated NaCl solution at both electrodes of the cell reaction produces:
    A. Na(s) and $Cl_2(g)$
    B. Na (s) and H_2 (g)
    C. NaOH, O_2 (g) and NaOH
    D. $H_2(g)$, $Cl_2(g)$ and NaOH
72. Which of the following is the correct condition for a redox reaction to be spontaneous in a Voltaic cell?
    A. The cell potential (E°cell) must be negative
    B. The cell potential (E°cell) must be positive
    C. The reaction must occur at a high concentration of ions
    D. The electrode potential must be equal for both half-cells

73. What is the primary role of industrial chemistry in society?
    A. To develop consumer electronics
    B. Produce chemicals that are essential for manufacturing, agriculture, and daily life
    C. To regulate environmental pollution
    D. To provide free education in chemistry
74. Which type of natural resource is used by chemical industries in large quantities to produce synthetic materials like plastics?
    A. Non-renewable resources
    B. Renewable resources
    C. Biotic resources
    D. Natural gas
75. Which of the following is the primary raw material in the production of sulfuric acid (H_2SO_4) via the Contact Process?
    A. Phosphate rock
    B. Nitrogen
    C. Sulfur
    D. Phosphorous
76. Which of the following is an important use of Na_2CO_3 (Sodium carbonate) in industry?
    A. Fertilizer production
    B. Glass manufacturing
    C. Dye production
    D. Pharmaceuticals
77. Which of the following is a primary agricultural use of DAP (Diammonium Phosphate)?
    A. Pest control
    B. Soil pH adjustment
    C. Fertilizer to promote plant growth
    D. Fungicide application
78. What is the primary difference between soap and detergents?
    A. Detergents are natural, while soaps are synthetic
    B. Soaps are more effective in hard water, while detergents are not
    C. Soaps are solids, while detergents are liquids
    D. Soaps are derived from animal fates, while detergents are synthetic compounds

79. Which types of cements produced by grinding clinker with a small amount of gypsum?

A. Rapid hardening cements
B. Low heat cements
C. Ordinary Portland cements(OPC)
D. Sulphate resistance cements

80. Which of the following is the major ingredient in traditional ceramics?

A. Silicon carbide
B. Alumina
C. Feldspar Titinium carbide
D. Feldspar