ARADA SUBCITY ADMINISTRATION OF EDUCATIONAL OFFICE

ARADA SUBCITY SECONDARY SCHOOLS FIRST SEMESTER

CHEMISTRY MODEL EXAMINATION FOR GRADE 12

Tiri 2017 E.C (January 2025 G.C) **TIME ALLOWED: 2:30**

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS CHEMISTRY EXAMNATION, IN THIS EXAMINATION, THERE ARE A TOTAL OF 80 MULTIPLE CHOICE QUESTIONS. SELECT THE BEST ANSWER AND BLACKEN ONLY THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED. FOLLOW THE INSTRUCTIONS ON THE ANSWER SHEET AND THE EXAMINATION PAPER CAREFULLY. USE ONLY PENCIL TO MARK YOUR ANSWERS. YOUR ANSWER MARK SHOUD BE HEAVY AND DARK, COVERING THE ANSWER SPACE COMPLETELY, PLEASE ERASE ALL UNNECESSARY MARKS COMPLETELY INCLUDING ANSWERS YOU HAVE CHANGED FROM YOUR ANSWER SHEET.

YOU ARE ALLOWED TO WORK ON THE EXAM FOR 2:30 HOURS. WHEN TIME IS CALLED, YOU MUST IMMIDIATELY STOP WORKING, PUT YOUR PENCIL DOWN, AND WAIT FOR FURTHER INSTRUCTIONS

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAMINATION WILLRESULT IN AN AUTOMATIC DISMISSAL FROM THE EXAMINATION HALL AND CANCELLATION OF YOUR SCORE (S).

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

DO OT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

You may refer to the information given below when you work on some of the questions

PHYSICAL CONSTANTS

a)Gas constant, R=8.314J/molK = 0.0821L.atm/molK

b)Avogadro's number = $6.02 \times 10^{23} mol^{-1}$

c)Planck's constant, h = $6.63 \times 10^{-34} Js$

d)Speed of light, C=$3 \times 10^{8} m/s$

e)Faraday's constant(F)=96500C/mol

ATOMIC NUMBERS(Z) AND ATOMIC WEIGHTS(A)

Elements	Na	Mg	Al	Cr	Mn	Fe	Ni	P	S	Cl
A	23	24	27	52	55	56	59	31	32	35.5
Z	11	12	13	24	25	26	28	15	16	17

I.CHOOSE THE CORRECT ANSWER FROM THE GIVEN ALTERNATIVE(S)

1. According to the Brønsted-Lowry theory, a base is defined as:

A) A proton donor C) A proton acceptor

B) An electron-pair donor D) An electron –pair acceptor

2. Which of the following solid is **Not** amorphous solid?

A) Glass B) Plastics C) Rubber D) Sodium chloride

3. In an ionic bond, electrons are:

A) Shared equally between atoms.

B) Transferred from one atom to another.

C) Shared unequally between atoms.

D) Completely absent.

4. What will happen to the equilibrium position if OH^- ions are added to a solution of acetic acid ($CH_3COOH \rightleftharpoons CH_3COO^- + H^+$)?

A) Equilibrium shifts to the left

B) Equilibrium shifts to the right

C) The solution becomes more acidic

D) No change occurs

5. Which of the following is **true** about the liquid state of matter?

A) Liquids have a definite volume but take the shape of their container

B) Liquids have a definite shape and volume

C) Liquids have an indefinite volume but a definite shape

D) Liquids have neither a definite shape nor volume

6. What is **true** for the following given reaction?

$$Cr_2O_7^{2-} + 14H^+ + 6Cl^- \rightarrow 2Cr^{3+} + 6Cl_2 + 7H_2O$$

A/ Cr^{3+} is oxidized

B/ Cl^- is reduced to Cl_2

C/ H^+ is reduced to H_2

D/ Cl^- is oxidized to Cl_2

7. What is the conjugate base of H_2CO_3?

A) HCO_3^- B) CO_3^{2-} C) OH^- D) H_3O^+

8. Which gas law relates the pressure and volume of a gas at constant temperature?

A) Boyle's Law

B) Charles's Law

C) Gay-Lussac's Law

D) Avogadro's Law

9. Which of the following best describes metallic bonding?

A) Electrons are shared equally between atoms

B) Electrons are transferred from one atom to another

C) Electrons are delocalized and free to move throughout the metal

D) Electrons are localized around each atom

10. Given a 0.1 M solution of a weak acid ($K_a = 1.8 \times 10^{-5}$), what is the approximate pH of the solution?

A) 2.87 B) 3.45 C) 4.72 D) 5.60

11. What happens to the kinetic energy of particles as a substance moves from a solid to a liquid state?

A) The kinetic energy decreases

B) The kinetic energy increases

C) The kinetic energy remains the same

D) The particles stop moving

12. What type of intermolecular force is responsible for the high boiling point of water?

A) London dispersion forces

B) Hydrogen bonds

C) Ionic bonds

D) Dipole-dipole interactions

13. Why does a buffer solution resist changes in pH? Because

A) it contains only a strong acid

B) it contains a weak acid and its conjugate base

C) it prevents ionization of water

D) it absorbs all added ions

14. What is the wavelength of the yellow sodium emission, which has a frequency of $5.09x10^{14}s^{-1}$?

A) 890nm B) 400nm C) 589nm D) 670nm

15. In a covalent bond, how do atoms achieve a stable electron configuration?

A) By transferring electrons from one atom to another.

B) By sharing electrons.

C) By losing all their electrons.

D) By gaining electrons from other elements.

16. Which of the following is true about the strength of metallic bonds?

A) The strength decreases with increasing atomic size

B) The strength is unaffected by the size of the metal atoms

C) The strength increases with the number of delocalized electrons

D) The strength is the same for all metals

17. Which of the following factors affects the ionization of weak acids?

A) Temperature B) Pressure C) Volume D) Mass

18.The blue color in fireworks is often achieved by heating copper(I)chloride to about 1200^0C.Then the compound emits blue light having a wavelength of 450nm.What is the increment of energy(the quantum) that is emitted at $4.50x10^2$nm by CuCl?

A) $9.93x10^{-19}$J C) $12.1x10^{-2}$J

B) $4.42\ x10^{-19}$J D) $6.1x10^{-5}$J

19. In a molecule of nitrogen (N_2), how many electrons are shared between the two nitrogen atoms?

A) 2 electrons C) 6 electrons

B) 4 electrons D) 10 electrons

20.If the reaction, $Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO_2 + H_2O$ is balanced.

What is the coefficient of HNO_3?

A) 8 B) 3 C) 2 D) 4

21. A sample of gas occupies 10.0 L at 2.0 atm pressure. What will be its volume if the pressure is reduced to 1.0 atm at constant temperature?

A) 5.0 L B) 20.0 L C) 15.0 L D) 10.0 L

22. A salt derived from a weak acid and a weak base will produce a solution whose pH depends on:

A) The strength of the weak acid only

B) The strength of the weak base only

C) The relative strengths of the weak acid and weak base

D) The concentration of the salt

23. At STP, 2 moles of an ideal gas will occupy:

A) 11.2 L B) 22.4 L C) 44.8 L D) 33.6 L

24. A student electrolyzes an aqueous copper sulfate solution using platinum electrodes. What will they observe at the anode?

A) Copper deposition C) Oxygen gas evolution

B). Hydrogen gas evolution D) Chlorine gas evolution

25. If a titration curve shows a sharp pH rise around pH 9, what type of titration is it?

A) Strong acid vs. strong base C) Weak acid vs. strong base

B) Strong acid vs. weak base D) Weak acid vs. weak base

26. Which of the following is the correct order of elements in the Modern Periodic Table?

A) Elements are arranged by increasing atomic number.

B) Elements are arranged by increasing atomic mass.

C) Elements are arranged by increasing chemical properties.

D) Elements are arranged by their colors.

27. Which law states that mass is neither created nor destroyed in a chemical reaction?

A) Law of Definite Proportions C) Law of Multiple Proportions

B) Law of Conservation of Mass D) Dalton’s Law

28. Which of the following is a key characteristic of chemical industries?

A) They avoid the use of chemical reactions

B) They produce only organic compounds

C) They consume large quantities of energy

D) They do not test product quality

29. What is a major environmental concern related to cement manufacturing?

A) Excessive water use C) Excessive gypsum use

B) Carbon dioxide emissions D) Noise pollution

30. According to Dalton's atomic theory, atoms of the same element are:

A) Different in size and mass C) Identical in size and mass

B) Always in motion D) Made up of smaller particles

31. What is the main raw material obtained from the atmosphere for industrial use?

A) Nitrogen gas C) Phosphates

B) Sodium chloride D). Crude petroleum

32. One of the advantages of periodic classification is that it helps in understanding:

A). The periodicity of chemical properties among elements

B). The exact uses of each element in everyday life

C) The number of atoms in a compound.

D) The physical appearance of each element.

33. Which subatomic particle has a mass closest to that of a proton?

A) Electron B) Photon C) Neutron D) Positron

34. What role does industrial chemistry play in society?

A) Reduces technological development

B) Limits chemical product manufacturing

C) Prevents resource utilization

D) Supports economic growth and industrial development

35. Which of the following elements is correctly matched with its block belongs to in the periodic table?

A) Na. Mg .and Cl - s- block C). P. S .and Cl- p- block

B) Fe , Mn and P - d- block D) Cr. Ni .and Al- p- block.

36. What does the Aufbau principle state about the filling of electron orbitals?

A) Electrons will fill the orbitals in order of increasing energy.

B) Electrons will fill the orbitals in order of increasing atomic number.

C) Electrons will fill the orbitals from higher to lower energy

D) Electrons will fill the orbitals randomly.

37. Which natural resource is most crucial for energy production in developing countries?

A) Biomass C) Hydropower

B) Crude oil D). Solar energy

38. Which industry significantly contributes to Ethiopia's agricultural economy?

A). Sugar industry C) Glass industry

B). Cement industry D). Paper industry

39. Which of the following best describes the Rutherford gold foil experiment?

A) Discovered the electron

B) Showed that atoms are mostly empty space with a dense nucleus

C) Proposed the planetary model of the atom

D) Demonstrated the law of multiple proportions

40. What is the primary industrial process for manufacturing ammonia?

A) Ostwald process C). Haber-Bosch process

B) Solvay process D) Contact process

41. Why does the electron configuration of chromium (Cr, atomic number 24) deviate from the expected [Ar] $4s^2$ $3d^4$?

A) Chromium prefers a half-filled 3d subshell for stability.

B) Chromium has fewer protons than expected.

C) Chromium's 4s orbital is filled before the 3d.

D) Chromium's 4p orbital is partially filled.

42. Which renewable resource can directly be used for generating electricity?

A). Solar energy C) Crude petroleum

B). Coal D) Magnesium

43. Which of the following is the correct value of the angular momentum quantum number (l) for a d-orbital?

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

44. Which resource is classified as non-renewable?

A) Fossil fuels B) Vegetation C). Solar energy D) Water

45. How many unpaired electrons are present in the electron configuration of carbon ($1s^2$ $2s^2$ $2p^2$)?

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

46. Which raw material is primarily used in glass manufacturing?

A) Limestone B) Silica C) Gypsum D) Alumina

47. Which of the following forms of electromagnetic radiation has the shortest wavelength?

A) Radio waves C) Ultraviolet waves

B) Infrared waves D) Gamma rays

48. Which local Ethiopian alcoholic beverage is commonly made using traditional methods?

A) Wine B) Beer C) Vodka D) Araki

49. When an electron in a hydrogen atom jumps from the n = 3 level to the n = 2 level, what happens to the energy of the photon emitted?

A) It decreases, and the wavelength becomes longer.

B) It increases, and the wavelength becomes shorter.

C) It remains constant.

D) It decreases, and the wavelength remains unchanged.

50. What is used in the Contact Process for sulfuric acid production?

A) Iron oxide C).Platinum

B) Vanadium (V) oxide D). Palladium

51. Which method is commonly used to preserve food in Ethiopia?

A) Vacuum packing C) Sun drying

B). Chemical preservation D) Pasteurization

52. What is the main purpose of tanning in leather production?

A) To make leather waterproof

B) To remove hair from hides

C) To improve the color of leather

D) To convert raw hides into durable leather

53. What by product of sugar manufacturing is used to produce ethanol in Ethiopia?

A) Sugarcane leaves B) Bagasse C) Lime. D) Molasses

54. Which material is added to cement to control its setting time?

A) Silica B).Gypsum C). Lime D) Alumina

55. What does the period number of an element indicate in the Modern Periodic Table?

A) The energy level or shell in which the valence electrons are found

B) The number of protons in the atom.

C) The number of valence electrons

D) The atomic number of the element.

56. What is the primary product of sugar manufacturing?

A) Glucose B) Sucrose C) Ethanol D). Maltose

57. Which of the following is **NOT** a characteristic of transition elements?

A) They are metals with high densities

B) They are good conductors of heat and electricity.

C) They tend to form colored compounds.

D) They are highly reactive with water

58. Which glass type is commonly used in laboratory equipment due to its resistance to chemical corrosion?

A) Soda-lime glass C) Quartz glass

B) Silicate glass D) Borosilicate glass

59. Which ions are preferentially discharged at the cathode during the electrolysis of copper (II) sulfate using platinum electrodes?

A) Cu^{2+} ions B) OH^{-} ions C) H^{+} ions D) SO_4^{2-} ions

60. Which type of crystal structure would be best suited for a substance that is hard, has a high melting point, and is a good insulator?

A) Molecular crystal C) Metallic crystal

B) Covalent network crystal D) Ionic crystal

61. Why are isotopes of an element chemically similar?

A) They have different energy levels.

B) They have the same number of neutrons.

C) They have different atomic masses.

D) They have the same number of protons and electrons.

62. A student is asked to balance the redox reaction using the half-reaction method. What is the first step?

A) Balance oxygen atoms

B) Identify oxidation and reduction half-reactions

C) Add water molecules

D) Balance hydrogen atoms

63. Which of the following is the strongest type of chemical bond?

A) Covalent bond C) Metallic bond

B) Hydrogen bond D) Ionic bond

64. Who discovered the nucleus of an atom?

A) Niels Bohr B) J.J. Thomson C) James Chadwick D) Ernest Rutherford

65. What determines the ions preferentially discharged during electrolysis?

A) Temperature C) Voltage applied

B) Reactivity series and ion concentration D). Electrode size

66. According to Bohr's atomic model, where are electrons located?

A) Embedded in a positive sphere

B) Randomly distributed inside the nucleus

C) Fixed orbits around the nucleus

D) In stationary energy clouds

67. What happens if the salt bridge in a voltaic cell is removed?

A) The voltage increases

B) The reaction continues unaffected

C) The flow of ions stops and the cell stops working

D) The electrodes dissolve

68. Design an experiment to determine the mass of silver deposited when a current of 2 A is passed through silver nitrate for 30 minutes. What formula would you use?

A) m= VIt B) m = MIt /nF C) m= zQ D) m= nF

69. Why do ionic compounds have high melting points?

A) They have weak intermolecular forces

B) They consist of covalent bonds

C) They have no molecular structure

D) The strong electrostatic attraction between ions requires a large amount of energy to break

70. Who proposed the first atomic theory based on experimental evidence?

A) J.J. Thomson C) Ernest Rutherford

B) Niels Bohr D) John Dalton

71. Which of the following is **NOT** a common industrial application of electrolysis?

A) Electroplating C) Metal extraction

B) Electro-refining D) Nuclear fusion

72. Which of the following molecules would likely exhibit sp^3 hybridization in its central atom?

A) CO_2 B) BF_3 C) H_2O D) PCl_5

73. Which model of the atom is referred to as the "plum pudding model"?

A) Thomson's Model C) Rutherford's Model

B) Dalton's Model D) Bohr's Model

74. Which bonding theory explains the formation of covalent bonds through the overlap of atomic orbitals?

A) Valence bond theory C) Lewis dot theory

B) Molecular orbital theory D) VSEPR theory

75. Which of the following molecules has a linear molecular geometry?

A) Water (H_2O) C) Methane (CH_4)

B) Ammonia (NH_3) D) Carbon dioxide (CO_2)

76. Create a cell diagram for a voltaic cell using Zn and Cu electrodes in their respective sulfate solutions. How will it be represented?

A) $Zn(s)/Cu^{+2}(aq)$ // $Cu^{+2}(aq)$ / $Cu(s)$

B) $Cu(s)/Cu^{+2}(aq)$ // $Zn^{+2}(aq)$ / $Zn(s)$

C) $Zn^{+2}(aq)$ /$Zn(s)$ // $Cu(s)$ / $Cu^{+2}(aq)$

D) $Zn(s)/Zn^{+2}(aq)$ // $Cu^{+2}(aq)$ / $Cu(s)$

77. Which type of covalent bond is formed when electrons are shared equally between two atoms?

A) Polar covalent bond C) Non-polar covalent bond

B) Ionic bond D) Coordinate bond

78. What is the hybridization of the central atom in a molecule of carbon dioxide (CO_2)?

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

79. A current of 5A flows for 2 hours during electrolysis. What is the total charge passed?

A) 180 C B) 3600 C C) 1,800 C D) 36,000 C

80. What is the bond angle in a molecule with a tetrahedral geometry, such as methane (CH_4)?

A) 90° B) 120° C) 180° D) 109.5°