OROMIA EDUCATION BUREAU

GRADE 12 CHEMISTRY FIRST SEMESTER EXAMINATION FOR BOARDING AND NON-BOARDING (SPECIAL) SCHOOLS

FEBRUARY 2017 / 2025

TIME ALLOWED: 1 HOUR AND 30 MINUTES

GENERAL DIRECTIONS

THIS BOOKLET CONTAINS CHEMISTRY FIRST SEMESTER EXAMINATION FOR GRADE 12. IN THIS EXAM THERE ARE A TOTAL OF 50 MULTIPLE CHOICE QUESTIONS, EACH ITEM CARRYING ONE POINT.

THERE IS ONE CORRECT ANSWER FOR EACH QUESTION. CHOOSE THE ALPHABET THAT HOLDS THE CORRECT ANSWER FROM THE GIVEN ALTERNATIVES AND WRITE THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED.

YOU ARE ALLOWED TO WORK ON THE EXAMINATION FOR 1 HOUR AND 30 MINUTES. WHEN TIME IS CALLED, YOU MUST IMMEDIATELY STOP WORKING. THEN, PUT YOUR PEN / PENCIL DOWN AND WAIT FOR FURTHER INSTRUCTION.

ANY FORM OF CHEATING OR AN ATTEMPT TO CHEAT IN THE EXAM SESSION WILL RESULT IN AN OUTOMATIC 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 PROVIDED BEFORE YOU START WORKING ON THE QUESTIONS.

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

YOU MAY USE THE FOLLOWING DATA WHERE NECESSARY.

Acid / Base dissociation constants:

$CH_3COOH = 1.8 \times 10^{-5}$ (p Ka = 4.74) $NH_3 = 1.8 \times 10^{-5}$ $HNO_2 = 4.5 \times 10^{-4}$

$HCN = 6.2 \times 10^{-10}$ $HF = 7.2 \times 10^{-4}$

Reduction Potentials:

$Ag^+ / Ag = +0.80V$ $Cu^{2+} / Cu = +0.34V$ $Fe^{2+} / Fe = -0.44V$ $Zn^{2+} / Zn = -0.76V$

$H_2O / H_2 = -0.83V$ $Al^{3+} / Al = -1.66V$ $Na^+ / Na = -2.71V$

Faraday's Constant = 96,500 C /mol

1. Which salt leaves a basic residue when dissolved in water?
A. NH_4Cl B. CH_3COONH_4 C. KNO_3 D. CH_3COONa

2. The qualitative result of electrolysis is not affected by:
A. Nature of electrode C. Concentration of the electrolyte
B. Time of electrolysis D. Reduction potential

3. For a conjugate acid - base pair, which statement holds true at 25^0C?
A. pH + pOH = 7.0 B. pKa + pK_b = 14.0 C. $K_a + K_b = K_W$ D. p K_a = p K_b

4. Which of the following 0.10M acids has smaller pH than the others in aqueous solution?
A. H_2SO_4 B. H_3O^+ C. HNO_3 D. HF

5. Which combination (mixture) forms a buffer solution?
A. CH_3COOH / CH_3COONH_4 B. H_2CO_3 / Na_2CO_3 C. HF / KF D. $HNO_3 / NaNO_3$

6. Identify the substance that may not act as a Lewis acid.
A. PCl_3 B. Cu^{2+} C. H_3O^+ D. $AlCl_3$

7. Which of the following materials is obtained from the biosphere?
A. Petroleum B. Fat C. Sodium chloride D. Carbon dioxide

8. Identify the statement that does not explain the activity of chemical industries.
A. Consume relatively large quantities of energy during the manufacturing process.
B. Transform raw materials into finished products through chemical reactions.
C. Target their products to be of low price to satisfy the needs of the lower class people.
D. Test the quality of their products during and after manufacturing.

9. Which of the following fertilizes is not a good choice for large scale agricultural process?
A. UAN B. DAP C. Urea D. Ammonia

10. From the given lists, identify the one that is not a part of manufacturing industries in Ethiopia.
A. Food processing B. Fertilizer industry C. Leather industry D. Chemical industry

11. Among the following chemicals, one is an example of a botanical pesticide used in some areas of Ethiopia. Which one is it?
A. Neem leaf B. DDT C. 2, 4 - D D. Malathion

12. A chemical process that uses ammonia as a raw material and regenerates it at the end is:
A. Haber process B. Ostwald process C. DAP production D. Solvay process

13. Chemicals that kill all plant life with which they come in contact are classified under:
A. Non-selective pesticides C. Weed killers
B. Botanical pesticides D. Non-selective herbicides

14. The ionic product of water is $1.0 \times 10^{-12}\ M^2$ at 80^0C. Predict which aqueous solution to be basic at 80^0C.
A. $[H_3O^+] = 10^{-6}$M B. pOH = 8.0 C. $[OH^-] = 10^{-10}$M D. pH = 7.0

15. Which of the following substances cannot act as Bronsted - Lowry acid and base?
A. HCO_3^- B. NH_4^+ C. H_2O D. HS^-

16. The poly protic H_3PO_4 acid dissociates in water medium in three steps with the corresponding dissociation constants K_1, K_2 and K_3. Which substance dissociates with higher pKa - value?
A. H_3PO_4 B. $H_2PO_4^-$ C. PO_4^{3-} D. HPO_4^{2-}

17. An aqueous solution of NH_4CN turns red litmus solution to blue. This indicates that:
A. NH_4^+ ion hydrolyzes more than CN^- ion
B. K_a value of HCN is greater than K_b value of NH_3
C. Only anion of the salt undergoes hydrolysis
D. The hydrolysis constant of CN^- is greater than that of NH_4^+.

18. Assess the significance of sulfuric acid in the industrial production of DAP?
A. H_2SO_4 is one of the raw materials in the production of DAP
B. The acid is used in the production of H_3PO_4 by reacting with $Ca_3(PO_4)_2$
C. H_2SO_4 is used as a dehydrating agent in DAP production
D. The acid is used as a catalyst in the manufacturing process

19. What is the formula of washing soda?
A. $Na_2CO_3.10H_2O$ B. $NaHCO_3$ C. Na_2CO_3 D. $Na_2SO_4.7H_2O$

20. Which of the following statements does not express NaOH?
A. It is stable, translucent and crystalline base
B. NaOH is used in the concentration of alumina (Al_2O_3) from its ore in the aluminium extraction
C. It is produced by the Castner - Kellener process
D. NaOH is industrially obtained by heating a mixture of soda ash, ammonia and water.

21. Which industrial process requires lower pressure condition at the bottle - neck step?
A. Solvay process B. Haber process C. Ostwald process D. Contact process

22. Which pair denotes weak acids?
A. 98% CH_3COOH and 98% H_2SO_4 C. 2% H_2SO_4 and 2% CH_3COOH
B. 2% H_2SO_4 and 98% CH_3COOH D. 2% CH_3COOH and 98% CH_3COOH

23. Which of the following indicators is colorless in acidic medium?
A. Methyl orange B. Litmus C. Bromo thymol blue D. Phenolphthalein

24. To 25.0mL of an unknown concentration of NaOH is added two drops of litmus solution. If this solution titrated with 0.10M HCl, the end point is detected when the color of the solution just turns:
A. Orange B. White C. Red D. Blue

25. What is the product of a reaction between aqueous solutions of HSO_3^- and HSO_4^-?
A. SO_3^{2-} and SO_4^{2-} B. SO_3^{2-} and H_2SO_4 C. HSO_3^+ and SO_4^{2-} D. H_2SO_3 and SO_4^{2-}

26. What does Faraday's law explain?
A. The significance of concentration on electrolysis
B. The amount of product obtained by electrolysis
C. The dependence of electrolysis on preferential discharge of ions
D. The type of the product during electrolysis

27. When the equation: $I_2 + HNO_3\ (aq) \rightarrow HIO_3\ (aq) + NO_2\ (g)$; is balanced to the smallest whole number ratio in acidic medium, the coefficient of H_2O would be:
A. 2 B. 3 C. 4 D. 6

28. Batteries are preferred than Daniel's cell because:
A. Batteries are economical C. Batteries are portable and do not require salt bridge
B. The electrolyte in Daniel cell is wet D. Daniel cell generates only 1.10V

29. In the industrial preparation of soda ash, what is the purpose of slaking of lime?
A. $Ca(OH)_2$ is used to regenerate NH_3 from NH_4Cl
B. Slaked lime is one of the raw materials of the process
C. Slaked lime removes impurities from the reaction vessel
D. Slaked lime reacts with sodium hydrogen carbonate to generate soda ash

30. 2, 4, 5 - T is:
A. Organophosphate pesticide C. Chlorophenoxy acid herbicide
B. Organochlorine pesticide D. Botanical herbicide

31. A buffer solution is made from 0.01M HA (weak acid) and 0.10M salt of the acid (NaA). If K_a of the weak acid is $1.0 \times 10^{-5} M^2$, what is the pH of the solution?
A. 4.0 B. 5.0 C. 5.0 - log 2 D. 6

32. Auto ionization of water produces H_3O^+ and OH^- ions. What are the ions formed by auto ionization of liquid ammonia, NH_3?
A. $N_2H_4^-$ and $2H^+$ B. NH_2^- and NH_4^+ C. NH_2^- and NH_3^- D. NH_4^+ and NH_4OH

33. Trichloro acetic acid dissociates in water according to the following equation.

$$CCl_3COOH\ (aq) + H_2O\ (\ell) \rightarrow CCl_3COO^-\ (aq) + H_3O^+\ (aq)$$

If the initial concentration and equilibrium concentrations of the acid and H_3O^+ are 0.40M and 0.30M, respectively, which of the following conclusion cannot be made about this process?
A. % dissociation = 75 B. pH = 1.0 - log 3 C. $[CCl_3COO^-] = 0.30M$ D. $Ka = 0.09M^2$

34. Which of the following statements is correct regarding binary compounds and oxidation states?
A. In binary compounds made of different elements, halogens always take -1 oxidation state
B. Hydrogen takes +1 oxidation state in all of its compounds
C. The compound of formula F_2O is named diflouro oxide
D. Nitrogen and oxygen always take negative oxidation states

35. You are asked to design a galvanic cell similar to the Daniel cell from silver and copper electrodes. Which procedure should you follow?
A. Make silver metal the anode of the electro chemical cell
B. Connect the two electrodes by an external wire so that electrons flow from silver to copper
C. Use $CuSO_4$ aqueous solution as an electrolyte at the cathode
D. Dip each electrode to an aqueous solution that contains the respective ions.

36. Which statement about electrolytic and galvanic cells is true?
A. The process in both cases is spontaneous
B. Chemical reaction produces electrical energy
C. The electrode which serves as source of electrons has a negative sign
D. Anode is the positive electrode where reduction takes place

37. Which of the following steps is not appropriate in the production of H_2SO_4 by Contact process?
A. Burning sulfur at a higher temperature to obtain sulfur dioxide
B. Catalytic oxidation of sulfur dioxide into sulfur tri oxide
C. Using moderate temperature and high pressure at the bottle neck step
D. Adding a measured amount of water to *oleum* ($H_2S_2O_7$) to obtain the required concentration of H_2SO_4

38. Comparison of aluminum and iron hard wares reveals that utensils made of iron corrode more than that of aluminum. This is because:

A. The charge on aluminium ion is greater than that of iron.
B. Aluminium metal forms a protective oxide layer which renders it from oxidation
C. The oxidation potential of aluminium is greater than that of iron
D. Aluminium metal does not react with air and moisture

39. Which of the following statements may not be true about 1.0 Faraday of electricity?

A. It is the total charge carried by 6.02×10^{23} electrons
B. It is the charge carried by one electron multiplied by Avogadro number
C. It is the amount of electricity that discharges one mole of any substance
D. It discharges 1.0 equivalent of any substance during electrolysis

40. What is ΔG^0 for the following reaction?

$Al\ (s) + Fe^{2+}\ (1.0M) \rightarrow Al^{3+}\ (1.0M) + Fe\ (s)$;

A. -1216 kJ B. -608 kJ C. -405 kJ D. -203 kJ

41. Which statement about corrosion holds true?

A. If iron comes in contact with zinc in moist air, iron corrodes because it acts as anode
B. If iron and copper come in contact with moist air, rusting of iron is prevented because copper supplies electrons to iron
C. Galvanized iron is protected from corrosion because zinc acts as anode and supplies electrons
D. Corrosion of iron takes place even in the absence of water provided that there is oxygen

42. A research chemist adds a measured amount of HCl gas to pure water at 25^0C and obtained a solution whose $[H_3O^+]$ is 4.0×10^{-6}M. Which conclusion is true regarding this solution?

A. pH = 6 + log 4 B. $[OH^-] = 2.5 \times 10^{-10}$ C. pOH = 9 - log 2.5 D. It is a weak acid

43. Based on K_a values of the given acids, what can be said about strength of the acids and their conjugate bases?

A. Acid strength: HNO_2 > HF C. Base strength: NO_2^- > CN^-
B. Acid strength: HCN > HF D. Base strength: CN^- > F^-

44. Design a buffer solution that maintains a pH of 6.74 using CH_3COOH and CH_3COONa. The ratio of $[CH_3COOH]$ to $[CH_3COONa]$ must be (p Ka = 4.74)

A. 2 B. 10^2 C. 10 D. 10^{-2}

45. What is the effect of adding solid CH_3COONa to an aqueous solution of CH_3COOH?

A. Percent dissociation of CH_3COOH will increase
B. There will be an increase in concentration of H_3O^+
C. pH of the resulting solution increases
D. Concentration of CH_3COOH decreases

46. Arrange the following 0.10M salt solutions in decreasing order of pH.

1. NH_4CN 2. NH_4Cl 3. CH_3COONa 4. CH_3COONH_4

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

47. Which electro chemical reaction produces more voltage?

A. $Zn\ (s) + Cu^{2+}(aq)$ C. $Cu(s) + Ag^+(aq)$
B. $Al\ (s) + Cu^{2+}(aq)$ D. $Al\ (s) + Zn^{2+}(aq)$

48. What is the cell potential, E_{Cell}, at 25^0C for the following cell notation?

$Al\ (s) / Al^{3+}\ (1.0M) // Cu^{2+}\ (0.001M) / Cu$

A. 1.8312V B. 2.47044 V C. 1.9112 V D. 1.8904 V

49. Which of the following is not among the purposes of a salt bridge in the Daniel Cell?

A. Allows electrical contact between the two half-cell electrolytes
B. Overcomes accumulation of excess charge in each half-cell
C. Electrons move through it from anode to cathode
D. Maintains electrical neutrality in the cell

50. How can you explain the process of electroplating?

A. The object to plated (metal or graphite -coated plastic) constitute the anode
B. Metal is deposited on the cathode because of reduction of ions of the electrolyte
C. The electrolyte is an aqueous solution of the salt of the anode metal electrode
D. There must be two half-cell compartments separated by a salt bridge for electroplating.