

**BASIC CHEMISTRY**

Time Allowed: 3 Hours

Full Marks: 70

Answer to Question No.1 is compulsory and to be answered first.

This answer is to be made in separate loose script(s) provided for the purpose.

Maximum time allowed is 45 minutes, after which the loose answer scripts will be collected and fresh answer scripts for answering the remaining part of the question will be provided.

On early submission of answer scripts of Question No.1, a student will get the remaining script earlier.

Answer any five questions from Group-A, B & C, taking at least one from each group.

1. Choose the correct answer from the given alternatives (any twenty): 20x1
- i)  $sp^2$  hybridisation is known as – (a)  $BeCl_2$ , (b)  $CCl_4$ , (c)  $BCl_3$ , (d)  $NH_3$ .
  - ii) Permutit is the sodium salt of – (a)  $Al, Si$  &  $O$ , (b)  $B, Si$  &  $O$ , (c)  $C, B, O$ , (d)  $C, O$ .
  - iii) The compound can be prepared is – (a)  $F_2O_5$ , (b)  $OF_6$ , (c)  $NCl_5$ , (d)  $SF_6$ .
  - iv) The primary standard solution is prepared by – (a) oxalic acid, (b) hydrochloric acid, (c) sulphuric acid, (d) sodium hydroxide.
  - v) Rectified spirit is – (a) 96% ethyl alcohol, (b) 95.6% ethyl alcohol, (c) 98% ethyl alcohol, (d) 100% ethyl alcohol.
  - vi) In Rutherford's experiment of atomic model the screen behind the gold foil contains – (a)  $CdS$ , (b)  $Ni_2O_3$ , (c)  $ZnS$ , (d)  $Na_2S$ .
  - vii) Functional group isomer of ethyl alcohol is – (a) acetic acid, (b) ethanol, (c) dimethyl ether, (d) methyl formate.
  - viii) The metal cannot be extracted by carbon-reduction process is – (a) lead, (b) zinc, (c) iron, (d) aluminium.
  - ix) Which quantum number represents sub-shell – (a) principal, (b) azimuthal, (c) magnetic, (d) spin.
  - x) In graphite, the layers are held by force, called – (a) hydrogen bond, (b) van der Waals, (c) covalent bond, (d) co-ordinate bond.
  - xi) The effective number of  $Na^+$  and  $Cl^-$  ions in the unit cell is – (a) 5, (b) 3, (c) 2, (d) 4.
  - xii) The impurity in iron extraction is – (a)  $SiO_2$ , (b)  $Al_2O_3$ , (c)  $ZnO$ , (d)  $CuO$ .
  - xiii) Reaction of ethylene and  $Br_2$  gives – (a)  $\begin{array}{c} CH_2 & - & CH_2 \\ | & & | \\ Br & & Br \end{array}$ , (b)  $CH_3CHBr_2$ , (c)  $BrCH=CHBr$ , (d)  $CH_2=CHBr_2$ .
  - xiv) Phenolphthalein is the correct indicator for titration – (a)  $NH_4OH \sim H_2SO_4$ , (b) oxalic acid ~ sodium hydroxide, (c) sodium hydroxide and acetic acid, (d)  $NH_4OH \sim HCl$ .
  - xv) Hardness of water is expressed in terms of salt – (a)  $MgCO_3$ , (b)  $CaCO_3$ , (c)  $FeCO_3$ , (d)  $FeCl_2$ .

- xvi) Acidic functional group is – (a)  $-NH_2$ , (b)  $-OH$ , (c)  $-COOH$ , (d)  $-CHO$ .
- xvii) Electrolyte in lead storage cell is – (a)  $HCl$ , (b)  $HNO_3$ , (c)  $H_2SO_4$ , (d)  $NaOH$ .
- xviii) Which is not buffer solution – (a)  $NH_4OH + NH_4NO_3$ , (b)  $NaOCOCH_3$ ,  $CH_3COOH$ , (c)  $NaH_2PO_4$ ,  $H_3PO_4$ , (d)  $NH_4Cl + NaCl$ .
- xix) While passing 0.03 F of electricity produces element at electrode – (a) 0.01 Eq, (b) 0.02 Eq, (c) 0.03 Eq, (d) 0.06 Eq.
- xx) The correct electronic configuration of  $Fe^{+3}$  is – (a)  $3d^5 4s^1$ , (b)  $3d^5$ , (c)  $4s^1 3d^4$ , (d)  $3d^4 4s^2$ .
- xxi) Ozonolysis of alkenes requires the reagents – (a)  $O_3$ ,  $Zn$ ,  $H_2O$ , (b)  $O_3$ ,  $Al$ , (c)  $O_3$ ,  $Ni$ ,  $H_2O$ , (d)  $O_3$ ,  $H_2O$ .
- xxii) The metal gives of  $H_2$  gas (on reaction with dilute  $H_2SO_4$ ) is – (a)  $Fe$ , (b)  $Ag$ , (c)  $Cu$ , (d)  $Au$ .
- xxiii) Aluminium chloride exists as – (a) monomer, (b) dimer, (c) trimer, (d) tetramer.
- xxiv) Element used as semiconductor is – (a)  $Cu$ , (b)  $Al$ , (c)  $K$ , (d)  $Si$ .

#### Group-A

2. a) Calculate the number of atoms in 0.011 gm  $CO_2$ .  
 b) Ethyl alcohol has higher boiling point than dimethyl ether – Why?  
 c) How much gm of  $NH_3$  is formed by reaction of 0.0535 gm  $NH_4Cl$  with  $NaOH$ ?  
 d) What happens during passing dry  $HCl$  gas through saturated solution of  $NaCl$  – explain. 3+2+3+2
3. a) Mention two defects of Bohr's theory on electrons.  
 b) Show the bonding in – (i)  $HNO_2$ , (ii)  $MgCl_2$ .  
 c) What are meant by inter and intramolecular hydrogen bonding? Give example.  
 d) Define: Lewis theory of acidity. 2+3+3+2
4. a) Explain why does ice float in water?  
 b) Define pH of a solution.  
 c) Calculate the pH of 0.0001 (N)  $HCl$  solution.  
 d) State Pauli Exclusion Principle and Hund's Rule. 2+2+2+4

#### Group-B

5. a) 20 ml 0.4 (N)  $H_2SO_4$  is mixed with 80 ml 0.5 (N)  $NaOH$  solution. What is the nature and strength of final solution?  
 b) Balance by ion electron method:  
 i)  $MnO_4^- + H^+ + S^{2-} \rightarrow Mn^{+2} + S + H_2O$   
 ii)  $Cl_2 + OH^- \rightarrow Cl^- + OCl^- + H_2O$   
 c) Calculate the oxidation number of – (i)  $Cr$  in  $K_2Cr_2O_7$ , (ii) Two 'N' in  $NH_4NO_3$ . 3+4+3
6. a) Write the electrodes, electrolyte and reactions in DRY CELL.  
 b) Electricity of 4 ampere is passed for 483 seconds through a solution to deposit 0.5 gm of a metal of equivalent weight 25. Find out the value of Faraday.  
 c) Derive the relation between chemical and electrochemical equivalent weight of an element. 5+3+2
7. a) State La Chatelliar's principle.  
 b) Write the physic-chemical principles to prepare – (i)  $NH_3$  by Haber's process, (ii)  $HNO_3$  by Ostwald's process.  
 c) What are the electrode, electrolyte used for Nickel plating on iron metal? 2+(3+3)+2



**Group-C**

8. a) Explain permanent and temporary hardness with examples.  
b) Write the principles and reactions of permutit process for removal of hardness of water.  
c) How  $Na_2EDTA$  is applied to estimate hardness of water? Briefly mention it. 3+3+4
9. a) Write the reactions and principles to extract copper metal.  
b) Mention the principles to manufacture steel, including reactions.  
c) Explain whether the reaction,  $Al + CuSO_4 = Cu + Al_2(SO_4)_3$ . 5+3+2
10. a) Write the IUPAC name:  
i) 
$$\begin{array}{ccccccc} CH_3 & - & CH & - & CH & - & COOH \\ & & | & & | & & \\ & & Br & & Cl & & \end{array}$$
  
ii)  $CH \equiv C - CH - I$
- b) Write the products:  
i)  $CH_2 = CH_2 \xrightarrow[\text{KMnO}_4]{\text{alkaline}}$   
ii)  $CH \equiv CH \xrightarrow[\Delta]{\text{Cu Tube}}$
- c) How ethylene and acetylene separated from their mixture?  
d) What is methylated spirit? 2+(2+2)+2+2