

**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) Basic functional group is – (a)  $-\text{COOCH}_3$ , (b)  $-\text{CHO}$ , (c)  $-\text{NH}_2$ , (d)  $-\text{COOH}$ .
  - ii) Unit of electrochemical equivalent weight is – (a) ampere/gm, (b) coulomb/gm, (c) gm/coulomb, (d) coulomb/kg.
  - iii) De Broglie relation for wave nature of electron is – (a)  $\lambda = h/mv$ , (b)  $\lambda h = mv$ , (c)  $\lambda hmv = 1$ , (d)  $\lambda = hmv$ .
  - iv) Which compound is not aromatic? – (a) benzene, (b) phenol, (c) naphthalene, (d) hexane –1–01.
  - v) Spiegel doesn't contain – (a) Mn, (b) C, (c) Fe, (d) Zn.
  - vi) Oxidation number of oxygen in  $\text{OF}_2$  is – (a)  $-2$ , (b)  $+2$ , (c)  $0$ , (d)  $+1$ .
  - vii) Which one is a buffer solution? – (a)  $\text{CH}_3\text{COOH}+\text{HCl}$ , (b)  $\text{NH}_4\text{NO}_3+\text{NaCl}$ , (c)  $\text{NaCl}+\text{HCl}$ , (d)  $\text{NH}_4\text{OH}+\text{NH}_4\text{Cl}$ .
  - viii) Equivalent weight of  $\text{H}_4\text{PO}_4$  is (Molecular weight is M) – (a)  $M/4$ , (b)  $3M$ , (c)  $M/3$ , (d)  $2M/3$ .
  - ix) The secondary standard solution is – (a)  $\text{Na}_2\text{CO}_3$  (anhydrous), (b)  $\text{K}_2\text{Cr}_2\text{O}_7$ , (c)  $\text{NaOH}$ , (d)  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ .
  - x) Which quantum number represents ORBITAL? – (a) magnetic, (b) azimuthal, (c) principal, (d) spin.
  - xi) Which doesn't produce  $\text{H}_2$  gas on reaction with dil  $\text{H}_2\text{SO}_4$ ? – (a) Mg, (b) Cu, (c) Zn, (d) Sn.
  - xii) Detection of carbon-carbon unsaturation is performed with – (a)  $\text{AgNO}_3$ , (b)  $\text{HNO}_3$ , (c)  $\text{Br}_2+\text{CCl}_4$ , (d)  $\text{O}_3$ .
  - xiii) Gas used for welding purpose is – (a)  $\text{C}_2\text{H}_2$ , (b) ethylene, (c) methane, (d) butane.
  - xiv) Formula of calgon is – (a)  $\text{Na}_6(\text{PO}_3)_6$ , (b)  $\text{Na}_3\text{PO}_4$ , (c)  $\text{H}_3\text{PO}_3$ , (d)  $\text{Na}_2\text{HPO}_3$ .
  - xv) Shape of ammonia molecule is – (a) tetrahedral, (b) linear, (c) triangular planar, (d) octahedral.
  - xvi) Very low density of ice is due to – (a) hydrogen bonding and tetrahedral, (b) co-ordinate bonding and tetrahedral, (c) ionic bonding, (d) van der Waals force.



- xvii) pH of 0.01N NaOH solution is – (a) 9, (b) 10, (c) 2, (d) 12.
- xviii) Which shows both as oxidant and reductant? – (a)  $\text{HNO}_3$ , (b)  $\text{HNO}_2$ , (c)  $\text{KMnO}_4$ , (d)  $\text{H}_2\text{S}$ .
- xix) Variable valency is shown by – (a) sulphur, (b) nitrogen, (c) fluorine, (d) oxygen.
- xx) The element showing the activity as semiconductor is – (a) Zn, (b) Ni, (c) Si, (d) Cu.
- xxi) Self reduction process if applicable to extract – (a) Na, (b) Fe, (c) Cu, (d) Al.
- xxii) Acidic compound is – (a) phenol, (b) ethanol, (c) naphthalene, (d) benzene.
- xxiii) Which is the acid salt? – (a)  $\text{Na}_3\text{PO}_4$ , (b)  $\text{K}_2\text{SO}_4$ , (c)  $\text{NaHSO}_4$ , (d)  $\text{Pb}(\text{OH})\text{Cl}$ .
- xxiv) Which belongs to homologous series of methane? – (a)  $\text{C}_2\text{H}_2$ , (b)  $\text{C}_2\text{H}_4$ , (c)  $\text{CH}_3\text{OH}$ , (d)  $\text{C}_4\text{H}_{10}$ .

#### Group-A

2. a) Show the chemical bonding in  $\text{NaF}$ ,  $\text{H}_3\text{O}^+$ ,  $\text{NH}_4^+$ .  
 b) Explain why  $\text{KHF}_2$  exists but  $\text{KCl}_2$  doesn't.  
 c) Write the postulates of Bohr's atomic model regarding electron.  
 d) State – (i) Pauli exclusion principle, (ii) Hund's rule. 3+2+3+2
3. a) Why is diamond extremely hard, has very high melting point and non-conductor of electricity but graphite is a good electrical conductor and lubricant?  
 b) Draw the unit cell diagram of sodium chloride and hence calculate the effective number  $\text{Na}^+$  and  $\text{Cl}^-$  ions.  
 c) Solubility product of  $\text{BaSO}_4$  is 'q'? What is the value of solubility?  
 d) Define buffer solution. 3+3+2+2
4. a) Calculate the number of atoms in 0.053g  $\text{Na}_2\text{CO}_3$ .  
 b) How much volume of  $\text{H}_2$  gas at NTP is produced on reaction between 0.653gm Zn and dilute HCl?  
 c) Why is ethyl alcohol soluble in water but ether doesn't?  
 d) Explain 'common ion effect' with example. 3+2+2+3

#### Group-B

5. a) Define Faraday.  
 b) Write the electrodes, electrolyte and reactions in lead storage cell.  
 c) What are the products on electrolysis of  $\text{CuSO}_4$  solution using – (i) Pt, (ii) Cu electrodes? Explain. 2+4+4
6. a) Write the physio-chemical principles to prepare sulphuric acid by contact process.  
 b) Define chemical equilibrium.  
 c) State La Chatellier's principle.  
 d) Write two points on Arrhenius theory of electrolytic dissociation. 4+2+2+2
7. a) Balance by oxidation number or ion electron method:  
 i)  $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{N}_2\text{O} + \text{H}_2\text{O}$   
 ii)  $\text{Zn} + \text{NaOH} + \text{NaNO}_2 \rightarrow \text{NH}_3 + \text{Na}_2\text{ZnO}_2$   
 b) Write the name of one red-ox indicator.  
 c) How can you prepare 200ml; 0.08(N) HCl from 12(N) HCl solution? (3x2)+1+3

#### Group-C

8. a) Mention the reactions occurring in blast furnace for extraction of iron.  
 b) Write the composition of carbon in three types of iron.  
 c) Write the electrode, electrolyte and reactions only to extract Al metal.  
 d) Why aluminium extraction is not possible by carbon reduction method? 3+2+3+2



9. a) Which type of water should be used for boiler purpose and why?  
 b) Write the softening of hard water by ion exchange resin method (principles and reactions only).  
 c) One litre of a sample of hard water contains 0.0555g  $\text{CaCl}_2$  and 0.0240g  $\text{MgSO}_4$ . Calculate the hardness in ppm unit.  
 d) Which is more pure and why – distilled water or ion-exchange resin treated water? 2+3+3+2
10. a) Write the IUPAC name:  
 i)  $\text{Cl}-\text{CH}_2-\text{CH}=\text{CH}_2$   
 ii)  $\begin{array}{c} \text{CH}_2 & - & \text{CH}_2 \\ | & & | \\ \text{OH} & & \text{OH} \end{array}$   
 b) Write the products:  
 i)  $\text{CH} \equiv \text{CH} \xrightarrow[\text{H}_2\text{SO}_4]{\text{Hg}^{+2}}$   
 ii)  $\text{CH}_2 \equiv \text{CH}_2 \xrightarrow[\text{KMnO}_4]{\text{alkaline}}$   
 c) How is rectified spirit prepared?  
 d) What is power alcohol? 2+4+3+1