December 2014

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 questions from Group-A, B & C, as directed.

1. Choose the correct answer from the given alternatives (any twenty): 1x20

i) Which one has radioactive isotopes? – (a) sodium, (b) calcium, (c) uranium, (d) magnesium.

ii) An orbital can accommodate maximum number of electrons – (a) 1, (b) 2, (c) 3, (d) 4.

iii) The element which has maximum number of valency is – (a) Mn, (b) Fe, (c) Cu, (d) Zn.

iv) Which one has highest electrical conductivity? – (a) Diamond, (b) Graphite, (c) Coke, (d) Gas carbon.

v) What is the unit of Faraday in electrolysis? – (a) ampere, (b) ohm, (c) watt, (d) coulomb.

vi) Which one is a buffer solution? – (a) NH_4OH+NH_4Cl, (b) $NaOH+NH_4OH$, (c) $NaOH+HCl$, (d) $NaCl+NH_4Cl$.

vii) Which one is acidic in nature? – (a) ethanol, (b) acetone, (c) phenol, (d) methanol.

viii) Which one is used as semiconductor? – (a) Cu, (b) Ni, (c) Al, (d) Si.

ix) The primary standard solution is – (a) $K_2Cr_2O_7$, (b) $KMnO_4$, (c) HCl, (d) NaOH.

x) Phenolphthalein indicator is used for titration of –(a) $CH_3COOH+Na_2CO_3$, (b) $CH_3COOH+NaOH$, (c) HNO_3+NH_4OH, (d) $H_2SO_4+Na_2CO_3$.

xi) Temporary hardness of water is due to – (a) $MgCl_2$, (b) $MgSO_4$, (c) $CaCl_2$, (d) $Ca(HCO_3)_2$.

xii) Equivalent weight of H_2SO_4 is – (a) 49, (b) 50, (c) 51, (d) 52.

xiii) The pH of $\left(\frac{N}{10}\right) HCl$ is – (a) 0, (b) 1, (c) 5, (d) 10.

xiv) The regeneration of cation exchange column is done by – (a) HCl, (b) HNO_3, (c) H_2SO_4, (d) H_3PO_4.

xv) The oxidation number of Mn in K_2MnO_4 is – (a) 3, (b) 4, (c) 5, (d) 6.

xvi) Ammonia synthesis by Haber's process is favoured by – (a) low temperature and high pressure, (b) high temperature and high pressure, (c) low temperature and low pressure, (d) high temperature and low pressure.

xvii) The extraction of aluminium is done by the process – (a) carbon reduction, (b) self reduction, (c) electrolytic reduction, (d) none of these.

xviii) German silver is an alloy of – (a) copper, (b) aluminium, (c) silver, (d) iron.

xix) The carbon content is maximum in – (a) wrought iron, (b) cast iron, (c) stainless steel, (d) mild steel.

xx) If one Faraday of electricity is passed through $CuSO_4$ solution, the amount of copper deposited on the electrode is – (a) 63.5gm, (b) 36.5gm, (c) 31.75gm, (d) 13.75gm.

xxi) Compound used in metal welding process is – (a) acetylene, (b) ethylene, (c) ethane, (d) methane.

xxii) The percentage of ethanol in rectified spirit is – (a) 90.5%, (b) 92.6%, (c) 93.6%, (d) 95.6%.

xxiii) Which one has chain isomerism? – (a) methane, (b) ethane, (c) butane, (d) propane.

xxiv) The compound used as insecticide is – (a) ethanol, (b) naphthalene, (c) propanol, (d) acetic acid.

xxv) The catalyst used to prepare NO from NH_3 is – (a) Pt-gauge, (b) Zinc, (c) Silver, (d) Gold.

Group-A

Answer any three questions.

2. a) Write down the electronic configuration of element copper and indicate the variable valencies of copper (Atomic Number of Cu = 29).
   b) Both ethanol and formic acid have same molecular weight but formic acid has higher boiling point than ethanol – Explain. 3+2

3. a) Write the postulate's of Bohr's atomic model regarding electron of atom.
   b) What types of chemical bonds are present in NH_4Cl. 3+2

4. a) How much of Na_2CO_3 is required to prepare 500ml $\left(\frac{N}{10}\right) Na_2CO_3$ solution?
   b) Write down the relation among equivalent weight, atomic weight and valency of an element. 3+2

5. a) Explain basicity of acids and acidity of bases with suitable examples.
   b) Give example of one acid salt and one basic salt. 4+1

6. a) What is pH and pH scale?
   b) What volume of CO_2 will be obtained at STP by decomposing 1kg of $CaCO_3$?
   c) Mention the use of germanium. 2+2+1

Group-B

Answer any two questions.

7. a) State Le Chatelier's principles.
   b) Describe the physico-chemical principles involved in the manufacture of H_2SO_4 by contact process. 3+2

8. a) State Faraday's laws of electrolysis.
   b) A current of 6 amperes is passed through a silver nitrate solution for 10 minutes when 4.028gm of silver is deposited. Calculate the electrochemical equivalent of silver. 3+2

9. a) Explain by electronic theory that oxidation and reduction occur simultaneously.
   b) Balance the equation by ion-electron method:
   $$Cr_2O_7^{-2} + Fe^{+2} + H^+ \rightarrow Cr^{+3} + Fe^{+3} + H_2O$$
   c) Name one compound which has both oxidising and reducing properties. 2+2+1

10. a) Write the electrodes, electrolyte and the reactions involved in dry cell.
    b) What happens when $CuSO_4$ solution is electrolysed using copper electrodes? 3+2

Group-C

Answer any five questions.

11. a) Describe, in brief, the production of steel by L-D process.
    b) What is stainless steel? 4+1

12. a) Write the name and chemical formula of copper ore from which copper is extracted.
    b) What is blister copper?
    c) Explain the purpose of making alloy with suitable examples. 1+2+2

13. a) Write the composition of brass and duralumin. Mention one use of each.
    b) What is nichrome? What is its use?
    c) Name the ore from which aluminium is extracted. What are the impurities normally present in that ore. 2+1+2

14. a) Which salts are responsible for permanent hardness of water?
    b) What are disadvantages of hard water?
    c) How total hardness of water is estimated? 1+2+2

15. a) Explain homologous series with suitable examples.
    b) What are the functional groups of ethanol and acetic acid?
    c) Discuss the difference between chain isomerism and position isomerism with one example of each. 2+1+2

16. a) Write the IUPAC name of the following:

$$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} = CH_2$$

    b) How acetylene is prepared? Write the relevant chemical reaction.
    c) How ethylene is polymerised and why? 1+2+2

17. a) Mention two uses of phenol.
    b) What is thin layer chromatography?
    c) Identify A and B: $CH \equiv CH + O_3 \longrightarrow A \xrightarrow{H_2O} B + H_2O_2$ 1+2+2
