December 2018

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) Secondary standard solution is prepared from – (a) NaOH, (b) Oxalic Acid, (c) $K_2Cr_2O_7$, (d) Na_2CO_3 anhydrous.

ii) Which quantum indicates shell number? – (a) azimuthal, (b) spin, (c) magnetic, (d) principal.

iii) Sp hybridization is known in – (a) BCL_3, (b) $CeCl_2$, (c) CH_4, (d) NH_3.

iv) Formula of CALGON is – (a) $Na_6(PO_3)_6$, (b) Na_2HPO_4, (c) Na_3PO_4, (d) Na_2HPO_3.

v) Fe can be replaced from $FeSO_4$ solution using – (a) Cu, (b) Pb, (c) Al, (d) Ag.

vi) Electrolyte for traditional DRY CELL is – (a) H_2SO_4, (b) MnO_2, NH_4Cl, H_2O, (c) NaCl, MnO_2, (d) NH_4Cl, NaCl.

vii) Which can act both as oxidant and reductant? – (a) $KMnO_4$, (b) SO_2, (c) $K_2Cr_2O_7$, (d) H_2SO_4.

viii) Number of coordinate bond in O_3 molecule is – (a) 0, (b) 3, (c) 2, (d) 1.

ix) Buffer solution is – (a) NH_4NO_3+KNO_3, (b) Hcl+NaCl, (c) NH_4NO_3+NH_4OH, (d) NaCl+HNO_3.

x) In ice, arrangement of H_2O molecules is – (a) tetrahedral, (b) linear, (c) triangular, (d) square planner.

xi) 46gm Na is how much gm equivalent? – (a) 1, (b) 2, (c) 3, (d) 4.

xii) Acid salt is – (a) $KHSO_4$, (b) Na_2SO_3, (c) K_3PO_4, (d) KNO_3.

xiii) Variable valency is shown by – (a) O, (b) N, (c) Cl, (d) F.

xiv) De Broglie equation for wave nature of electron is – (a) $v = \frac{m}{h}\lambda$, (b) $\lambda \times h \times m = 1$, (c) $h = \frac{\lambda}{mv}$, (d) $\lambda = \frac{h}{mv}$.

xv) The effective number of Na^+ and Cl^- ions is unit cell is – (a) 3, (b) 4, (c) 3, (d) 1.

xvi) To deposit 0.04 equivalent Zn through electrolysis of $ZnSO_4$, electricity required is – (a) 0.02 F, (b) 0.04 F, (c) 0.06 F, (d) 0.03 F.

xvii) Ore of copper is – (a) $CuFeS_2$, (b) $CuSO_4$, (c) $CuCl_2$, (d) $CuCO_3$.

xviii) Catalyst used to convert NO from NH_3 is – (a) Mo, (b) P+dust, (c) Pt–gauze, (d) Pd.

xix) Correct electronic configuration if $_{24}Cr$ is – (a) $4s^1 3d^5$, (b) $4s^2 3d^4$, (c) $4s^2 4p^3 3d^1$, (d) $4s^2 4p^4$.

xx) 'Spiegel' contains – (a) Fe, Mo, C, (b) Fe, Si, Mn, (c) Fe, C, Pt, (d) Fe, C, Man.

xxi) Permutit used to remove hardness of water is sodium salt of anion formed by – (a) B, Al, O, (b) Al, Si, O, (c) S, O, Al, (d) B, S, O.

xxii) Unsaturation of carbon-carbon is detected by – (a) $K_2Cr_2O_7$, (b) H_2SO_4, (c) $NaNO_2$, (d) Br_2+CCl_4.

Group-A

2. a) Show the bonding in N_2O, CaO, H_2SO_4.
   b) Ethyl alcohol is water soluble but dimethyl ether doesn't – why?
   c) Explain 'δ' bond and 'Π' bond taking the example of ethylene.
   d) What is Aufban principle? 3+2+3+2

3. a) Explain with diagram of chemical bonding why diamond is extremely hard and non-conductor of electricity but graphite is good electrical conductor and acts as lubricant.
   b) Write Bohr's theory of electrons in his atomic model.
   c) What happens in solubility of AgCl due to addition of $AgNO_3$ solution to the precipitated AgCl? Explain.
   d) Which is more stable and why? Fe^{+2} and Fe^{+3} 3+3+2+2

4. a) How much volume of CO_2 is produced at NTP on reaction between 0.25g $CaCO_3$ with excess dilute HCl?
   b) Calculate the number of atoms in 0.034gm NH_3.
   c) What is meant by buffer solution? Give example of one acid and one basic buffer solution. 3+3+4

Group-B

5. a) State Faraday's laws of electrolysis.
   b) Write the electrodes, electrolyte and reactions in lead storage cell.
   c) Mention the products during electrolysis of $CuSO_4$ solution using – (i) Pt electrodes, and (ii) Cu electrodes. 3+4+3

6. a) How can you prepare 350ml 0.2N HCl from 12N HCl?
   b) Calculate the oxidation number of 'S' in H_2SO_3 and 'Cr' in K_2CrO_4.
   c) Balance by ion-electron method:
      i) $NO_3^- + Zn \rightarrow Zn^{+2} + NO + H_2O$
      ii) $Cl^- + Cr_2O_7^{-2} \rightarrow Cr^{+3} + Cl_2 + H_2O$ 3+3+4

7. a) What are meant by exothermic and endothermic reactions? Give example.
   b) How is sulphuric acid manufactured by CONTACT process? Write the physic-chemical principles only.
   c) Explain the nature of aqueous sodium oxalate. 4+4+2

Group-C

8. a) Write the IUPAC name:

i)
$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$$

ii) $CH_2 = CH - CH_2 - CH_2OH$

iii) $CH_3\ O\ CH_2CH_3$

b) Write the products:

i) $CH_2 = CH_2 \xrightarrow[ii)\ Zn + H_2O]{i)\ O_3}$

ii) $CH \equiv CH \xrightarrow[H_2SO_4]{Hg^{+2}}$

c) How is rectified spirit prepared from starch?

d) Define 'homologous series'. 3+2+3+2

9. a) How is copper extracted from 'Copper Matte'?

b) What are the ingredients required to extract aluminium from pure Al_2O_3?

c) Mention the raw materials to get iron from roasted ore.

d) Write the composition and use of alloy – (i) Nichrome, (ii) Bell Metal. 2+2+2+(2+2)

10. a) 1 litre of a sample of hard water contains 0.0111gm $CaCl_2$ and 0.0120gm $MgSO_4$. Calculate the amount of hardness in ppm unit.

b) Mention two reactions of hard water using cation exchange resin and two reactions using anion exchange resin. Write the conclusion after resin heated water.

c) What is meant by hardness of water?

d) Why hard water cannot be used for boiler? 3+3+2+2