QUESTION PAPER–2 : October 2015

PHYSICAL, INORGANIC AND ORGANIC CHEMISTRY

Time : 3 Hours] **[Max. Marks : 70**

Notes : (i) All questions are compulsory.

(ii) Answer to the two sections are to be written in the same answer book.

(iii) Figures at the right hand side indicate full marks.

(iv) Write balanced chemical equations and draw neat and labelled diagrams wherever necessary.

(v) Use of logarithmic table is allowed.

(vi) Answer to every question must be started on a new page.

Section–I

PHYSICAL AND INORGANIC CHEMISTRY

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question : 7

(i) The hybridisation of phosphorus in phosphorus pentachloride is–

(a) dsp^3 (b) sp^3d (c) d^2sp^3 (d) sp^3d^2 **(Ch. 7)**

(ii) The rate constant for a first order reaction is 100 S^{-1}. the time required for completion of 50 % of reaction is–

(a) 0.0693 milliseconds (b) 0.693 milliseconds

(c) 6.93 milliseconds (d) 69.3 milliseconds **(Ch. 5)**

(iii) Silica is added to roasted copper ore during smelting process to remove–

(a) ferrous sulphide (b) ferrous oxide

(c) cuprous sulphide (d) cuprous oxide **(Ch. 6)**

(iv) 96,500 coulombs correspond to the charge on how many electrons?

(a) 1.6×10^{19} (b) 6.022×10^{20}

(c) 6.022×10^{23} (d) 6.022×10^{24} **(Ch. 4)**

(v) For the reaction : $Cl_{2(g)} \rightarrow 2Cl_{(g)}$

(a) ΔH is positive, ΔS is positive

(b) ΔH is positive, ΔS is negative

(c) ΔH is negative, ΔS is negative

(d) ΔH is negative, ΔS is positive **(Ch. 3)**

(vi) The substance 'X'. when dissolved in solvent water gave molar mass corresponding to the molecular formula 'X_3'. The van't Hoff factor (i) is–

(a) 3 (b) 0.33 (c) 1.3 (d) 1 **(Ch. 2)**

(vii) The reaction $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90°$ represents which crystal system?

(a) Orthorhombic (b) Tetragonal

(c) Triclinic (d) Monoclinic **(Ch. 1)**

Q. 2. Answer *any SIX* of the following : 12

(i) Define ebullioscopic constant. Write its unit. **(Ch. 2)**

(ii) State :

(a) Second law of thermodynamics in terms of entropy.

(b) Third law of thermodynamics. **(Ch. 3)**

(iii) What is the hybridisation of carbon atom in diamond and graphite?

0.1 mole of Buckminster fullerene contains how many Kg of carbon?

[Atomic mass of carbon = 12] **(Ch. 1)**

(iv) Draw structure of : (a) Chlorine trifluoride

(b) Chlorine pentafluoride **(Ch. 7)**

(v) Derive an expression for maximum work in isothermal reversible expansion of two moles of an ideal gas. **(Ch. 3)**

(vi) Can copper sulphate solution be stored in an iron vessel? Explain **(Ch. 4)**

(vii) Define : (a) Average rate of reaction.

(b) Instantaneous rate of reaction. **(Ch. 5)**

(viii) Define : (a) Hydrometallurgy

(b) Electrometallurgy **(Ch. 6)**

Q. 3. Answer *any THREE* of the following : 9

(i) What is the action of dioxygen on –

(a) Calcium (b) Iron (c) Carbon disulphide? **(Ch. 7)**

(ii) A solution of glucose in water is labelled as 10 % (w/w). Calculate : (a) molality, (b) molarity of the solution. [Given : Density of solution is 1.20 $g.mL^{-1}$ and molar mass of glucose is 180 $g.mol^{-1}$.] **(Ch. 2)**

(iii) Resistance of conductivity cell filled with 0.1 M KCl solution is 100 ohms. If the resistance of the same cell when filled with 0.02 M KCl solution is 520 ohms, calculate the conductivity and molar conductivity of 0.02 M KCl solution. [Given : Conductivity of 0.1 M KCl solution is 1.29 Sm^{-1}.] **(Ch. 4)**

(iv) Ammonia and oxygen react at high temperature as :

$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$

In an experiment, rate of formation of $NO_{(g)}$ is 3.6×10^{-3} mol $L^{-1}.S^{-1}$.

Calculate –

(a) Rate of disappearance of ammonia

(b) Rate of formation of water. **(Ch. 5)**

Q. 4. Answer *any ONE* of the following : 7

(i) What is the effect of temperature on solubility of a gas in a liquid? **(Ch. 2)**

Explain refining of nickel by Mond process. **(Ch. 6)**

State Kohlrausch's law of independent migration of ions. **(Ch. 4)**

Silver crystallises in F.C.C. (face-centred cubic crystal) structure. The edge length of the unit cell is found to be 408.7 pm. Calculate density of the unit cell : **(Ch. 1)**

[Given : Molar mass of silver is 108 $g.mol^{-1}$]

(ii) Write 'four' uses of hydrochloric acid. Write chemical formula of the following oxoacids of chlorine :

(a) Hypochlorous acid (b) Chlorous acid

(c) Chloric acid (d) Perchloric acid **(Ch. 7)**

The equilibrium constant Kp for the reaction

$H_{2(g)} + I_{2(g)} \rightleftharpoons 2\ HI_{(g)}$ is 130 at 510 K.

Calculate ΔG° for the following reaction at the same temperature :

$2\ HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$

[Given : $R = 8.314\ J.K.^{-1}mol^{-1}$] **(Ch. 3)**

Section – II

INORGANIC AND ORGANIC CHEMISTRY

Q. 5. Select and write the most appropriate answer from the given alternatives for each sub-question : 7

(i) Which among the following reducing agents is 'not' used to reduce acetaldehyde to ethyl alcohol?

(a) Na-Hg and water (b) Zn1Hg and conc. HCl

(c) H_2–Raney Ni (d) Li-AlH_4/H^+ **(Ch. 12)**

(ii) Acetaldehyde, when treated with which among the following reagents does 'not' undergo addition reaction?

(a) ammonia (b) hydroxyl amine

(c) ammonical silver nitrate (d) semicarbazide **(Ch. 12)**

(iii) What is natural rubber?

(a) cis-1, 4-polyisoprene (b) neoprene

(c) Trans-1. 4-polyisoprene (d) Butyl rubber **(Ch. 15)**

(iv) What is salvarsan?

(a) An antiseptic (b) an antibiotic

(c) An antifertility drug (d) An analgesic **(Ch. 16)**

(v) Which among the following vitamins is also known as riboflavin?

(a) B_1 (b) B_2 (c) B_6 (d) B_{12} **(Ch. 14)**

(vi) The amine which reacts with nitrous acid to give yellow oily compound is :

(a) Ethyl amine (b) Isopropyl amine

(c) Secondary butyl amine (d) Dimethyl amine **(Ch. 13)**

(vii) What is the molecular formula of chromyl chloride?

(a) CrO_2Cl_2 (b) $CrOCl_2$ (c) $CrCl_3$ (d) Cr_2OCl_2 **(Ch. 8)**

Q. 6. Answer *any SIX* of the following : 12

(i) Identify 'A' and 'B' in the following reaction :

$$CH_3 - CH = CH_2 \xrightarrow{HBr} \text{'A'} \xrightarrow{\text{alc.KOH}} \textbf{(Ch. 10)}$$

(ii) Distinguish between Lanthanoids and Actinoids. **(Ch. 8)**

(iii) How are the following compounds prepared?

(a) Benzyl alcohol from benzyl chloride

(b) Propan-1-ol from propanal **(Ch. 10)**

(iv) What is the action of acetic anhydride on

(a) Ethyl amine? (b) Diethyl amine? **(Ch. 13)**

(v) What are monosaccharides? Draw ring structure of α-D-(+)-glucopyranose. **(Ch. 14)**

(vi) Explain the following terms :

(a) Cationic detergents **(Ch. 16)**

(b) Tranquillizers **(Ch. 16)**

(vii) What is Stephen reaction? **(Ch. 12)**

(viii) Explain Sidgwick's electronic theory with suitable example. **(Ch. 9)**

Q. 7. Answer *any THREE* of the following : 9

(i) What is the action of nitrous acid on

(a) Primary nitroalkane (b) Secondary nitroalkane

(c) Tertiary nitroalkane? **(Ch. 13)**

(ii) What is peptide linkage? How is tripeptide formed? **(Ch. 14)**

(iii) Write the reactions involved in the preparation of

(a) Teflon (b) Orlon (c) PVC **(Ch. 15)**

(iv) what is the position of iron (Z = 26) in periodic table? Explain why is Fe^{3+} more stable than Fe^{2+}. **(Ch. 8)**

Q. 8. Answer *any ONE* of the following : 7

(i) Discuss the mechanism of alkaline hydrolysis of bromomethane. **(Ch. 10)**

How is carbolic acid prepared from chlorobenzene?

(Ch. 11)

What is the action of bromine water on carbolic acid?

(Ch. 11)

Write chemical test to distinguish between carbolic acid and alcohol. **(Ch. 11)**

(ii) Explain cationic complexes and anionic complexes of co-ordination compounds. **(Ch. 9)**

Write the structure and IUPAC names of isomeric aldehydes having molecular formula $C_5H_{10}O$. **(Ch. 12)**

Draw the structure of aspirin. **(Ch. 16)**
