BOARD QUESTION PAPER : JULY 2017
CHEMISTRY

Time: 3 Hours  Total Marks: 70

Note:

i. All questions are compulsory.
ii. Answers to the two sections are to be written in the same answer book.
iii. Figures to 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

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

i. Which of the following is a basic oxide?
   (A) SiO₂  (B) P₄O₁₀  
   (C) MgO  (D) Al₂O₃

ii. In the representation of galvanic cell, the ions in the same phase are separated by a _______
   (A) single vertical line  (B) comma
   (C) double vertical line  (D) semicolon

iii. An ionic crystal lattice has limiting value of radius ratio as 0.414 to 0.732; the co-ordination number of its cation is _______.
   (A) 6  (B) 4
   (C) 3  (D) 12

iv. The unit of rate constant for zero order reaction is _______.
   (A) t⁻¹  (B) mol dm⁻³ t⁻¹
   (C) mol⁻¹ dm³ t⁻¹  (D) mol⁻² dm⁶ t⁻¹

v. Calcium carbonate used in the extraction of iron acts as _______.
   (A) oxidising agent  (B) reducing agent
   (C) gangue  (D) flux

vi. 10.0 grams of caustic soda when dissolved in 250 cm³ of water, the resultant gram molarity of solution is _______.
   (A) 0.25 M  (B) 0.5 M
   (C) 1.0 M  (D) 0.1 M

vii. 55 L atm of work is obtained when 1.0 mole of an ideal gas is compressed isothermally from a volume of 28.5 L to 18.5 L, the constant external pressure is _______.
   (A) 5.05 atm  (B) 5.5 atm
   (C) 0.05 atm  (D) 0.55 atm
Q.2. Answer any SIX of the following: [12]

i. State Henry’s Law.
   How does solubility of a gas in water varies with temperature?

ii. How is nitric acid prepared by Ostwald’s process?

iii. Classify the following solids into different types:
   a. Ammonium phosphate  
   b. Brass
   c. S8 molecule  
   d. Diamond

iv. Construct a labelled diagram for the following cell:
   \( \text{Zn} \mid \text{Zn}^{2+} (1\text{M}) \parallel \text{H}^+ (1\text{M}) \mid \text{H}_2(\text{g,1atm}) \mid \text{Pt} \)

v. Explain with chemical reactions, why is zinc oxide amphoteric in nature?

vi. Write the names and chemical formulae of any ‘two’ minerals of aluminium.

vii. The rate law for the reaction
   \( 2\text{H}_2(\text{g}) + 2\text{NO}(\text{g}) \rightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) \)
   is given by rate = \( k[\text{H}_2][\text{NO}]^2 \).
   The reaction occurs in the following two steps:
   a. \( \text{H}_2(\text{g}) + 2\text{NO}(\text{g}) \rightarrow \text{N}_2\text{O}(\text{g}) + \text{H}_2\text{O}(\text{g}) \)
   b. \( \text{N}_2\text{O}(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{N}_2(\text{g}) + \text{H}_2\text{O}(\text{g}) \)
   What is the role of \( \text{N}_2\text{O} \) in the mechanism? What is the molecularity of each of the elementary steps?

viii. Write the mathematical expression of the First Law of Thermodynamics for the following processes:
   a. Isothermal  
   b. Adiabatic
   c. Isochoric  
   d. Isobaric

Q.3. Answer any THREE of the following: [9]

i. From the following data for the liquid phase reaction \( \text{A} \rightarrow \text{B} \), determine the order of reaction and calculate its rate constant:

<table>
<thead>
<tr>
<th>t/s</th>
<th>0</th>
<th>600</th>
<th>1200</th>
<th>1800</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A] / mol L(^{-1})</td>
<td>0.624</td>
<td>0.446</td>
<td>0.318</td>
<td>0.226</td>
</tr>
</tbody>
</table>

ii. Calculate the standard enthalpy of combustion of \( \text{CH}_3\text{COOH}_{(l)} \) from the following data:
   \( \Delta H^\circ (\text{CO}_2) = -393.3 \text{ kJ mol}^{-1} \)
   \( \Delta H^\circ (\text{H}_2\text{O}) = -285.8 \text{ kJ mol}^{-1} \)
   \( \Delta H^\circ (\text{CH}_3\text{COOH}) = -483.2 \text{ kJ mol}^{-1} \)

iii. Write the cell representation and calculate equilibrium constant for the following redox reaction:
   \( \text{Ni(s)} + 2 \text{Ag}^{+}_{(aq)} (1\text{M}) \rightarrow \text{Ni}^{2+}_{(aq)} (1\text{M}) + 2\text{Ag(s)} \) at 25°C
   \( E^\circ_{\text{Ni}} = -0.25 \text{ V and } E^\circ_{\text{Ag}} = 0.799 \text{ V} \)

iv. What is the action of concentrated sulphuric acid on the following:
   a. phosphorous pentachloride
   b. copper
   c. potassium chlorate?
Q.4. Answer any ONE of the following: [7]

i. Define:
   a. Molality
   b. Osmotic pressure

Write any ‘two’ advantages of calomel electrode.

A metal crystallises into two cubic faces namely face centered (FCC) and body centered (BCC), whose unit cell edge lengths are 3.5 Å and 3.0 Å respectively. Find the ratio of the densities of FCC and BCC.

Arrange the following oxyacids of chlorine – HClO, HClO₂, HClO₃ and HClO₄ with respect to:
   a. Increasing order of thermal stability.
   b. Increasing order of oxidising power.

ii. An organic substance (M = 169 gram mol⁻¹) is dissolved in 2000 cm³ of water. Its osmotic pressure at 12°C was found to be 0.54 atm. If R = 0.0821 L atm K⁻¹ mol⁻¹, calculate the mass of the solute.

Calculate the number of atoms in a unit cell of a metal crystallising in face centered cubic structure.

Distinguish between isothermal process and adiabatic process.

Mention the names of various steps involved in the extraction of pure metals from their ores.

SECTION – II

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

i. In the following
   \[ \text{H} \]
   \[ \text{C}_2\text{H}_5 - \text{C} = \text{O} + \text{NH}_2\text{OH} \rightarrow \text{A} \xrightarrow{\text{Na/C}_2\text{H}_5\text{OH}, \Delta} \text{B} \]

The compound ‘B’ is _______.
   (A) Propan–1–amine  (B) Propan–2–amine  
   (C) Isopropylamine  (D) Dimethylamine

ii. The stability order for carbocation is _______.
   (A) \( 2^\circ > 3^\circ > 1^\circ \)  (B) \( 3^\circ > 2^\circ > 1^\circ \)  
   (C) \( 3^\circ > 1^\circ > 2^\circ \)  (D) \( 1^\circ > 3^\circ > 2^\circ \)

iii. Effective atomic number rule is used to find _______.
   (A) geometry of complex  
   (B) stability of complex  
   (C) number of isomers of complex  
   (D) number of possible ligands around metal ion in complex

iv. Which one of the following ions is coloured?
   (A) \( \text{Sc}^{3+} \)  (B) \( \text{Zn}^{2+} \)  
   (C) \( \text{Ti}^{4+} \)  (D) \( \text{V}^{2+} \)

v. When phenol is heated with conc. HNO₃ in presence of conc. H₂SO₄ it yields _______.
   (A) o-nitrophenol  (B) p-nitrophenol  
   (C) 2,4,6-trinitrophenol  (D) m-nitrophenol
vi. The secondary structure of protein is determined by _______.
   (A) co-ordinate bond  (B) ionic bond
   (C) hydrogen bond  (D) covalent bond

vii. Ethylidene dichloride when boiled with aqueous solution of NaOH yields _______.
   (A) formaldehyde  (B) acetaldehyde
   (C) acetone  (D) ethyl methyl ketone

Q.6. Answer any SIX of the following: [12]
   i. How is phenol prepared from cumene?
   ii. Write a note on self oxidation-reduction reaction of aldehyde with suitable example.
   iii. Explain basic nature of amines.
   iv. What are antiseptics? Give any ‘two’ examples.
   v. What happens when glucose is treated with
      a. hydroxylamine?  b. hydrogen cyanide?
   vi. Draw the structures of chromate and dichromate ions.
   vii. How is terylene prepared?
   viii. Identify A and B in the following reaction:
        \[
        \text{CH}_3 - \text{Br} + \text{Mg} \xrightarrow{\text{ether}} \text{A} + \text{CO}_2 \xrightarrow{\text{H}^+, \text{H}_2\text{O}} \text{B} + \text{Mg(Br) OH}
        \]

Q.7. Answer any THREE of the following: [9]
   i. How ligands are classified? Explain with suitable examples.
   ii. What is lanthanoid contraction?
      Explain, why lanthanum (Z = 57) forms La$^{3+}$ ion, while cerium (Z = 58) forms Ce$^{4+}$ ion?
   iii. What is the action of the following reagents on propanone?
      a. Phenyl hydrazine
      b. Zn – Hg / conc. HCl
      c. Sodium bisulphite
   iv. Define enzymes.
      How is peptide linkage formed?

Q.8. Answer any ONE of the following: [7]
   i. How is nitroethane converted into:
      a. ethylamine,
      b. N-ethylhydroxylamine,
      c. acetic acid?
      Write names and chemical formulae of monomers used in preparing Buna-N.
      What are soaps? How are they prepared?
   ii. How will you prepare ethanol, propan-2-ol and 2-methylpropan-2-ol from Grignard’s reagent?
      Define optical activity.
      Explain optical activity of lactic acid.