

Board Question Paper: October 2013

Chemistry

Time: 3 Hrs

Total Marks: 70

Note:

- All questions are compulsory.
- Answer to both sections should be written in the same answer book.
- Figure to the right hand side indicate full marks.
- Draw neat, labelled diagrams and write balanced equations wherever necessary.
- Use of logarithmic table is allowed.
- Answer to every new 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:

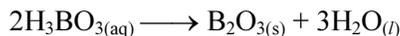
[7]

- In Van Arkel method of refining metal, impure zirconium is converted to unstable volatile compound by heating it with _____.
(A) oxygen (B) chlorine
(C) bromine (D) iodine
- The temperature at which vapour pressure of a liquid becomes equal to the atmospheric pressure is _____.
(A) melting point (B) boiling point
(C) 273 K (D) 373 K
- Which of the following parameters are correct for triclinic lattice?
(A) $\alpha = \beta = \gamma = 90^\circ$ and $a = b = c$ (B) $\alpha \neq \beta \neq \gamma = 90^\circ$ and $a \neq b \neq c$
(C) $\alpha = \gamma = 90^\circ$, $\beta \neq 90^\circ$ and $a \neq b \neq c$ (D) $\alpha \neq \beta \neq \gamma \neq 90^\circ$ and $a \neq b \neq c$
- Which mixture is used for respiration by deep sea divers?
(A) He + O₂ (B) Ne + O₂
(C) Ar + O₂ (D) Kr + O₂
- For the reaction, $2\text{N}_2\text{O}_{5(g)} \longrightarrow 4\text{NO}_{2(g)} + \text{O}_{2(g)}$ in liquid bromine, which of the following rate equation is INCORRECT?
(A) $-\frac{1}{2} \frac{d[\text{N}_2\text{O}_5]}{dt}$ (B) $-\frac{1}{4} \frac{d[\text{NO}_2]}{dt}$
(C) $\frac{d[\text{O}_2]}{dt}$ (D) $\frac{1}{4} \frac{d[\text{NO}_2]}{dt}$
- For a certain reaction, $\Delta H = -50 \text{ kJ}$ and $\Delta S = -80 \text{ J K}^{-1}$, at what temperature does the reaction turn from spontaneous to non-spontaneous?
(A) 6.25 K (B) 62.5 K
(C) 625 K (D) 6250 K
- What is the ratio of volumes of H₂ and O₂ liberated during electrolysis of acidified water?
(A) 1 : 2 (B) 2 : 1
(C) 1 : 8 (D) 8 : 1

Q.2. Answer any THREE of the following:

[9]

- i. Calculate ΔH° for the following reaction:



Given that,

- a. $\text{H}_3\text{BO}_{3(\text{aq})} \longrightarrow \text{HBO}_{2(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$, $\Delta H_1^\circ = -0.02 \text{ kJ}$
- b. $\text{H}_2\text{B}_4\text{O}_{7(\text{s})} \longrightarrow 2\text{B}_2\text{O}_{3(\text{s})} + \text{H}_2\text{O}_{(\text{l})}$, $\Delta H_2^\circ = 17.3 \text{ kJ}$
- c. $\text{H}_2\text{B}_4\text{O}_{7(\text{s})} + \text{H}_2\text{O}_{(\text{l})} \longrightarrow 4\text{HBO}_{2(\text{aq})}$, $\Delta H_3^\circ = -11.58 \text{ kJ}$
- ii. Calculate molarity and molality of 6.3% solution of nitric acid having density 1.04 g cm^{-3} .
(H = 1, N = 14, O = 16)
- iii. What is the action of chlorine (Cl) on the following:
- a. Cold and dilute caustic soda
- b. Hot and concentrated caustic soda
- c. Potassium bromide solution
- iv. Calculate the number of atoms present in 2 gram of crystal which has face-centred cubic (FCC) crystal lattice having edge length of 100 pm and density 10 g cm^{-3} .

Q.3. Answer any SIX of the following:

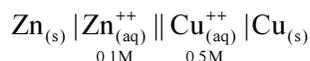
[12]

- i. NF_3 is possible, but NF_5 is not. Why?
- ii. State and explain Faraday's second law of electrolysis.
- iii. Describe 'froth floatation process' for concentration of sulphide ore.
- iv. Distinguish between molecularity and order of reaction.
- v. What are the conditions for spontaneous and non-spontaneous reactions in terms of free energy change? Define entropy.
- vi. Draw the structure of $\text{H}_4\text{P}_2\text{O}_6$ hypophosphoric acid. What is the action of heat on potassium permanganate?
- vii. State Henry's law. How does solubility of a gas in water varies with the temperature?
- viii. What are Schottky defect and Frenkel defect?

Q.4. Answer any ONE of the following:

[7]

- i. a. Write electrode reaction and net cell reaction for fuel cell. Calculate e.m.f. of the following cell at 25°C .



Standard reduction potential (SRP) of Zn and Cu are -0.76 V and 0.334 V respectively.

- b. Define isotonic solutions.
- c. Derive the relation $\Delta H - \Delta U = \Delta nRT$.
- ii. a. Define activation energy. Calculate activation energy for a reaction of which rate constant becomes four times when temperature changes from 30°C to 50°C .
(Given $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$).
- b. Draw a neat, well labelled diagram of electrolytic cell for extraction of aluminium.
- c. Write electronic configuration and two uses of neon. ($Z = 10$).

SECTION – II

Q.5. Select and write the most appropriate answer:

[7]

- i. When KOH solution is added to potassium dichromate solution the colour of solution changes to yellow, because _____.
(A) chromate ion changes to dichromate ion
(B) dichromate ion changes to chromate ion
(C) oxidation number of chromium changes from + 6 to + 4
(D) oxidation number of chromium changes from + 4 to +6
- ii. But-1-ene on reaction with HCl in the presence of sodium peroxide yields _____.
(A) n-butyl chloride
(B) isobutyl chloride
(C) secondary butyl chloride
(D) tertiary butyl chloride
- iii. 3-Methylbutane-2-ol on heating with HI gives _____.
(A) 2-iodo-3-methylbutane (B) 2-iodo-2-methylbutane
(C) 1-iodo-3-methylbutane (D) 1-iodo-2-methylbutane
- iv. IUPAC name of $C_6H_5 - CH_2 - \overset{\overset{O}{||}}{C} - CH_2 - CH_2 - CH_2 - CH_3$ is _____.
(A) 1-Phenylhexan-2-one (B) 6-Phenylhexan-5-one
(C) 1-Benzylhexan-5-one (D) Dodecan-5-one
- v. Iodoform is used as an _____.
(A) antiseptic (B) antibiotic
(C) insecticide (D) anaesthetic
- vi. Stachyose is an example of _____.
(A) monosaccharides (B) disaccharides
(C) trisaccharides (D) tetrasaccharides
- vii. The Ziegler-Natta catalyst is used in the preparation of _____.
(A) LDPE (B) PHBV
(C) PAN (D) HDPE

Q.6. Answer any THREE of the following:

[9]

- i. How is phenol converted into the following?
 - a. benzene
 - b. benzoquinone
 - c. picric acid
- ii. Explain the mechanism of aldol addition reaction.
- iii. Enlist the properties of glucose that can not be explained on the basis of open chain structure of it.
- iv. How is nitromethane prepared from the following?
 - a. alkyl halide
 - b. α -halogen carboxylic acid
 - c. α -nitroalkene

Q.7. Answer any SIX of the following:

[12]

- i. How is methoxy benzene prepared from carbolic acid?
- ii. State the superiority of crystal field theory over valence bond theory.
- iii. How is benzophenone prepared from benzonitrile?
- iv. Explain Hoffmann bromamide degradation reaction.
- v. What are hormones? State the function of insulin.
- vi. How are polymers classified on the basis of polymerisation process?
- vii. Describe 'any two' chemical methods of food preservation.
- viii. Write observed electronic configuration of elements from first transition series having half filled d-orbitals.

Q.8. Answer any ONE of the following:

[7]

- i.
 - a. What is lanthanoid contraction? Explain the cause and effects of lanthanoid contraction.
 - b. Write the structure of melamine.
 - c. Explain the mechanism of cleaning action of soap.
- ii.
 - a. Explain optical activity of lactic acid.
 - b. Draw a neat, labelled energy profile diagram for SN^1 reaction mechanism.
 - c. Write applications of co-ordination compounds in medicine and electroplating.
 - d. Explain the structure of carbonyl functional group.