

BOARD QUESTION PAPER : MARCH 2015

CHEMISTRY

Time: 3 Hours

Total Marks: 70

Note:

- All questions are compulsory.
- Answers to the two sections are to be written in the same answer book.
- Figures to the right hand side indicate full marks.
- Write balanced chemical equations and draw neat and labelled diagrams, wherever necessary.
- Use of logarithmic table is allowed.
- 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]

- p-type semi-conductors are made by mixing silicon with impurities of _____.
(A) germanium (B) boron
(C) arsenic (D) antimony
- Amongst the following, identify the criterion for a process to be at equilibrium.
(A) $\Delta G < 0$ (B) $\Delta G > 0$
(C) $\Delta S_{\text{total}} = 0$ (D) $\Delta S < 0$
- Colligative property depends only on _____ in a solution.
(A) number of solute particles (B) number of solvent particles
(C) nature of solute particles (D) nature of solvent particles
- The charge of how many coulombs is required to deposit 1.0 g of sodium metal (molar mass 23.0 g mol^{-1}) from sodium ions?
(A) 2098 C (B) 96500 C
(C) 193000 C (D) 4196 C
- What is the chemical composition of malachite?
(A) $\text{CuO} \cdot \text{CuCO}_3$ (B) $\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$
(C) $\text{CuO} \cdot \text{Cu}(\text{OH})_2$ (D) $\text{Cu}_2\text{O} \cdot \text{Cu}(\text{OH})_2$
- The element that does NOT exhibit allotropy is _____.
(A) As (B) Sb
(C) Bi (D) N
- The integrated rate equation for first order reaction $A \rightarrow \text{products}$ is _____.
(A) $k = 2.303 t \log_{10} \frac{[A]_0}{[A]_t}$ (B) $k = -\frac{1}{t} \ln \frac{[A]_t}{[A]_0}$
(C) $k = \frac{2.303}{t} \log_{10} \frac{[A]_t}{[A]_0}$ (D) $k = \frac{1}{t} \ln \frac{[A]_t}{[A]_0}$

Q.2. Answer any SIX of the following:

[12]

- i. Define the following terms:
 - a. Enthalpy of fusion
 - b. Enthalpy of atomization
- ii. Derive van't Hoff general solution equation.
- iii. Explain impurity defect in stainless steel with diagram.
- iv. Derive the relation between half life and rate constant for a first order reaction.
- v. Draw neat and labelled diagram of dry cell.
- vi. Explain the structure of sulphur dioxide.
- vii. What is calcination? Explain it with reactions.
- viii. Arrange the following reducing agents in the order of increasing strength under standard state conditions. Justify the answer.

Element	Al _(s)	Cu _(s)	Cl _(aq) ⁻	Ni _(s)
E°	-1.66 V	0.34 V	1.36 V	-0.26 V

Q.3. Answer any THREE of the following:

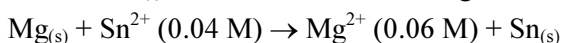
[9]

- i. Determine whether the reactions with the following ΔH and ΔS values are spontaneous or non-spontaneous. State whether the reactions are exothermic or endothermic.
 - a. $\Delta H = -110 \text{ kJ}$, $\Delta S = +40 \text{ J K}^{-1}$ at 400 K
 - b. $\Delta H = +40 \text{ kJ}$, $\Delta S = -120 \text{ J K}^{-1}$ at 250 K
- ii. $1.0 \times 10^{-3} \text{ kg}$ of urea when dissolved in 0.0985 kg of a solvent, decreases freezing point of the solvent by 0.211 K . $1.6 \times 10^{-3} \text{ kg}$ of another non-electrolyte solute when dissolved in 0.086 kg of the same solvent depresses the freezing point by 0.34 K . Calculate the molar mass of the another solute.
(Given molar mass of urea = 60)
- iii. Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law with $t_{1/2} = 3 \text{ hours}$. What fraction of the sample of sucrose remains after 8 hours?
- iv. Explain how does nitrogen exhibit anomalous behaviour amongst group 15 elements.

Q.4. Answer any ONE of the following:

[7]

- i. Niobium crystallises as body centred cube (BCC) and has density of 8.55 kg dm^{-3} . Calculate the atomic radius of niobium.
(Given: Atomic mass of niobium = 93)
Write one statement of first law of thermodynamics and its mathematical expression.
Write the reactions involved in the zone of reduction in blast furnace during extraction of iron.
- ii. Write molecular formulae and structures of the following compounds:
 - a. Dithionic acid
 - b. Peroxymonosulphuric acid
 - c. Pyrosulphuric acid
 - d. Dithionous acid

Calculate E_{cell} and ΔG for the following at 28°C :

$$E_{\text{cell}}^{\circ} = 2.23 \text{ V}$$

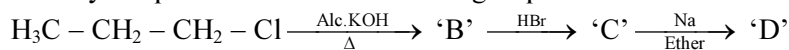
Is the reaction spontaneous?

SECTION – II

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

[7]

i. Identify the product 'D' in the following sequence of reactions:



- | | |
|------------------------|-------------------------|
| (A) 2,2-dimethylbutane | (B) 2,3-dimethylbutane |
| (C) hexane | (D) 2,4-dimethylpentane |
- ii. Which of the following complexes will give a white precipitate on treatment with a solution of barium nitrate?
- | | |
|--|--|
| (A) $[\text{Cr}(\text{NH}_3)_4\text{SO}_4]\text{Cl}$ | (B) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_2$ |
| (C) $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{SO}_4$ | (D) $[\text{CrCl}_2(\text{H}_2\text{O})_4]\text{Cl}$ |
- iii. What is the geometry of chromate ion?
- | | |
|---------------------|----------------|
| (A) Tetrahedral | (B) Octahedral |
| (C) Trigonal planar | (D) Linear |
- iv. Primary and secondary nitroalkanes containing α -H atom show property of _____.
- | | |
|-----------------------|---------------------------|
| (A) chain isomerism | (B) tautomerism |
| (C) optical isomerism | (D) geometrical isomerism |
- v. In phenol carbon atom attached to –OH group undergoes _____.
- | | |
|--------------------------|------------------------|
| (A) sp^3 hybridisation | (B) sp hybridisation |
| (C) sp^2 hybridisation | (D) no hybridisation |
- vi. Identify the strongest acid amongst the following.
- | | |
|--------------------------|-------------------------|
| (A) Chloroacetic acid | (B) Acetic acid |
| (C) Trichloroacetic acid | (D) Dichloroacetic acid |
- vii. Which of the following vitamins is water soluble?
- | | |
|-------|-------|
| (A) A | (B) D |
| (C) E | (D) B |

Q.6. Answer any SIX of the following :

[12]

- i. Write a note on Friedel Craft's acylation.
- ii. How is ethylamine prepared from methyl iodide?
- iii. What are antibiotics? Give 'two' examples.
- iv. Explain, why are boiling points of carboxylic acids higher than corresponding alcohols.
- v. How are proteins classified on the basis of molecular shapes?
- vi. What are interstitial compounds? Why do these compounds have higher melting points than corresponding pure metals?
- vii. Write the structures and IUPAC names of the following compounds:
 - a. Adipic acid
 - b. α -methyl butyraldehyde
- viii. Explain with examples, branched and linear polymers.

Q.7. Answer any THREE of the following:

[9]

- i. On the basis of valence bond theory explain the nature of bonding in $[\text{CoF}_6]^{3-}$ ion. Write the IUPAC name of $[\text{Co}(\text{NO}_2)_3(\text{NH}_3)_3]$.
- ii. Define lanthanoid contraction. Explain its effects.
- iii. Write mechanism of Aldol addition reaction.
- iv. Define carbohydrates. What are reducing and non-reducing sugars?

Q.8. Answer any ONE of the following:

[7]

- i. Write a note on Gabriel phthalimide synthesis.
What are biodegradable polymers and non-biodegradable polymers? Write 'one example' of each.
Explain cationic detergents.
- ii. How is carboic acid prepared from the following compounds:
 - a. Aniline
 - b. Chlorobenzene and steam at 698 K?Draw structure of DDT. Write its environmental effects.
Mention 'two' physical properties of carboic acid.