2025

(November-December)

CHEMISTRY

Paper: CHM-C-101

Introductory Chemistry - I

Time: 2 Hours   **Total Mark: 45**   **Pass Marks: 14**

(The figures in the right margin indicate full marks of the questions)

SECTION - A

(Inorganic Chemistry)

1. Choose the correct answer from the followings: 1x2=2

   a) Which of the following represents the correct set of quantum numbers of a 3p electron:

   i) $3, 2, 1, +\frac{1}{2}$ ii) $3, 2, -1, +\frac{1}{2}$

   iii) $3, 1, 1, 0$ iv) $3, 1, 1, -\frac{1}{2}$

   b) The correct polarizability order for the following species is:

   i) $I^- > Br^- > Cl^- > F^-$ ii) $F^- > Cl^- > Br^- > I^-$

   iii) $Cl^- > F^- > Br^- > I^-$ iv) $Cl^- > Br^- > I^- > F^-$

2. Answer any *two* of the following questions: 2×2=4

   a) The ionisation energy of boron is unexpectedly lower than the ionisation energy of its preceding element beryllium. Explain.

   b) Why is NaCl soluble in water whereas AgCl is insoluble in water? Explain.

   c) What is resonance energy? Draw the resonating structures of CO_3^{2-}.

3. Answer any *three* the following questions: 3×3=9

   a) Calculate the electronegativity of carbon atom following Allred-Rochow's approach. The covalent radius of carbon atom is 0.77 A⁰.   3

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b) The central atom in CH_4, NH_3 and H_2O involves sp^3 hybridisation, but the bond angles are 109.5°, 107° and 104.5° respectively. Explain. 3

c) Using **VSEPR theory**, predict the structure of the following:
XeF_4 and ClF_3 $1\frac{1}{2}+1\frac{1}{2}=3$

d) What do mean by lattice energy of an ionic crystal? 1+2=3
Calculate the lattice energy of KCl from the following data.
i) Sublimation energy of K (S) = 102.5 kJmole^{-1}
ii) Dissociation energy of Cl_2 (D) = 230.5 kJmole^{-1}
iii) Ionization energy of K(g) (ΔH_{IE}) = 450.6 kJmole^{-1}
iv) Electron affinity of Cl_2(g) E (ΔH_{EA}) = –350.2 kJmole^{-1}
v) Heat of formation of KCl (ΔH_f) = –420.4 kJmole^{-1}

SECTION B
(Physical Chemistry)

4. Choose the correct answer from the followings: $1\times2=2$

(a) Select the correct relation:
i) rms velocity $= \frac{\sqrt{2RT}}{M}$
ii) $mean\ velocity = \frac{\sqrt{3T}}{M}$
ii) most probable velocity $= \sqrt{2RT}/M$
iv) $rms > most\ probable > average$

(b) Which of the properties is parachor related to-
i) Surface tension ii) Molar volume
iii) Both a and b iv) None of the above

5. Answer any **two** of the followings: $2\times2=4$
a) Write the physical significance of the constants 'a' and 'b' in Van der Waal's equation. 1+1=2
b) What do you mean by compressibility factor 'Z' of a gas? Show graphically the variation of Z with pressure of a real gas at a constant temperature. 1+1=2

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c) Calculate the average internal energy of CO_2 gas at 300 K using law of equipartition of energy. 2

6. Answer any **three** of the followings: $3\times3=9$
a) Calculate the Boyle Temperature T_b for CO_2 gas, assuming it to be a van der Waal gas. Given 'a' for CO_2 is 3.59 atm dm^{6}mol^{-2} and 'b' = 0.0427 dm^{3}mol^{-1}. 3
b) Why liquid drops are spherical in nature? Describe a laboratory method for determining the surface tension of a liquid. 1+2=3
c) Prove that the viscosity of a gas is proportional to the square root of absolute temperature. 3
d) Discuss Maxwell's distribution of molecular velocities. What is the effect of temperature on this distribution. 2+1=3

SECTION C
(Organic Chemistry)

7. Choose the correct answers from the followings: $1\times2=2$
a) Which is the most stable carbocation?
i) $(C_6H_5)_3C^+$ ii) $(C_6H_5)_2CH^+$
iii) $C_6H_5CH_2^+$ iv) $C_6H_5CH_2CH_2^+$

b) Which of the following would generate carbenes on exposure to UV-light?
i) CH_2N_2 ii) CH_3Cl
iii) CH_3COOH iv) C_2H_4

8. Answer any **two** of the followings: $2\times2=4$
a) Using Huckel's rule, predict the aromaticity of the ollowing:

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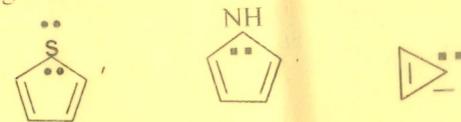
b) Distinguish between kinetically and thermodynamically controlled reaction.

c) 'All nucleophiles are Lewis bases, but all bases cannot be nucleophiles.' Explain.

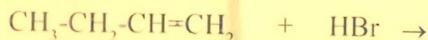9. Answer any *three* of the followings: $3 \times 3 = 9$

a) Arrange the following in the increasing order of

$$FCH_2COOH, \ ClCH_2COOH, \ BrCH_2COOH, \ CH_3COOH$$
(acidity)

$$R_3N, \ RNH_2, \ R_2NH, \ NH_3 \text{ (basicity in aqueous solution)}.$$
Explain the order. $1\frac{1}{2} + 1\frac{1}{2} = 3$

b) Write the major product formed in the following reaction. Give the mechanism of the reaction–   3

$$CH_3\text{-}CH_2\text{-}CH\text{=}CH_2 \quad + \quad HBr \quad \rightarrow$$

c) Why is Corey House reaction preferred for the preparation of unsymmetrical alkenes? Explain with examples.   3

d) Complete the following reactions: (any *three*) $1 \times 3 = 3$

   i) $CH_3\text{-}CH\text{=}CH\text{-}CH_3 \ + \ KMnO_4$ solution $\rightarrow$

   ii) $C_6H_5Br + CH_3Br$ (in presence of Na in dry ether medium) $\rightarrow$

   iii)
$$\begin{array}{l} CH_2 \\ \| \\ CH \\ | \\ CH \\ \| \\ CH_2 \end{array} \quad + \quad \begin{array}{l} CH_2 \\ \| \\ CH_2 \end{array} \quad \xrightarrow{\text{Heat}}$$

   iv) $CH_3\text{—}CH\text{=}CH\text{—}CH_3 \xrightarrow{\ O_3\ }$

   v)
$$\begin{array}{l} CH_2 \\ \| \\ CH_2 \end{array} \quad \xrightarrow{CH_3COO(OH)}$$

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