

2/EH-23 (ii) (Syllabus-2015)

2 0 1 6

(April)

CHEMISTRY

(Elective/Honours)

SECOND PAPER

(Inorganic, Organic, Physical)

Marks : 56

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—I

(Inorganic)

(Marks : 19)

1. (a) Define solubility product. The solubility of AgCl in water at 25 °C is 0.00179 g /l. Calculate its solubility product at 25 °C. 2½
- (b) How are pK_a and pK_b values related to strength of acids and bases? Among H_3PO_4 , $H_2PO_4^-$ and HPO_4^{2-} , which one is expected to have the highest value of pK_a and which one the least? 3

(2)

- (c) H_2S is used as group reagent in Group II and Group IIIB in the analysis of cations in qualitative inorganic analysis. Why are Group IIIB cations not precipitated in Group II, all precipitates being in form of their sulphides? 2
- (d) How does a primary standard solution differ from a secondary standard solution? Give two examples of secondary standard substances. 2

OR

2. (a) Discuss briefly the solvent system concept of acids and bases. What are its limitations? 2½
- (b) What are acid-base indicators? Give an example. Explain why phenolphthalein cannot be used as an indicator in the titration of aq. NH_3 against dil. HCl . 2½
- (c) What are Lewis acids and bases? Give an example for each. 2
- (d) Explain the levelling effect of acids and bases with appropriate examples. 2½

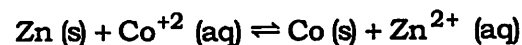
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(3)

3. (a) Describe the process of extraction of copper from its sulphide ore. Write the relevant chemical equation involved. 3
- (b) What is standard electrode potential? Mention two of its applications. 2

- (c) The reaction



occurs in a cell. Write the electrode reactions and calculate the standard e.m.f. of the cell. Given that

$$E^\circ_{\text{Zn}^{2+}/\text{Zn}} = 0.76 \text{ V and } E^\circ_{\text{Co}/\text{Co}^{2+}} = 0.28 \text{ V} \quad 2$$

- (d) What are mixed fertilizers? Give example. Explain why NPK is called a complete fertilizer. 2½

OR

4. (a) Explain, in brief, the process of setting of cement. 3
- (b) Describe how urea is manufactured and write the relevant equations involved. 2½

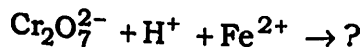
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(Turn Over)

(4)

(c) What are paints and pigments? How are they classified? 2½

(d) Complete and balance the following equation by ion-electron method : 1½

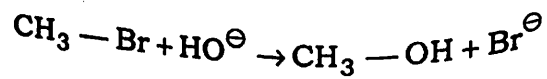


SECTION—II

(Organic)

(Marks : 19)

5. (a) The alkaline hydrolysis of methyl bromide to give methyl alcohol is a typical example of $\text{S}_\text{N}2$ reaction

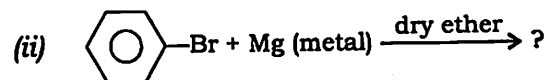
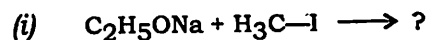


Discuss the mechanism of the reaction and justify why the reaction is designated as $\text{S}_\text{N}2$. 1½+1=2½

(b) Discuss the effect of solvent on $\text{S}_\text{N}1$ reaction rate. 1½

(5)

(c) Complete the following reactions giving correct products : 1×3=3



(d) What is Saytzeff's rule? Considering the reaction between 2-chlorobutane and alcoholic KOH, apply Saytzeff's rule to justify the formation of the major and minor products. 1+1½=2½

OR

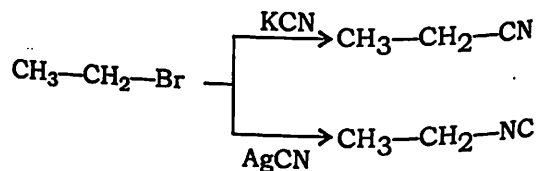
6. (a) Discuss the mechanism of E1cB reaction taking a suitable example. 2½

(b) Why are unsymmetrical alkanes generally not prepared by Wurtz reaction? 2

(c) Using the concept of resonance, illustrate why haloarenes are *ortho*- and *para*-directing towards electrophilic substitution reactions. 2

(6)

- (d) Explain why different products are formed in the following reaction with proper justification : $1\frac{1}{2} + 1\frac{1}{2} = 3$



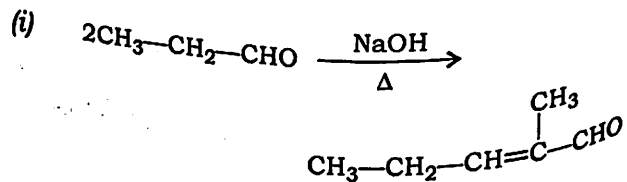
7. (a) Writing appropriate reactions involved, illustrate how you will distinguish among primary, secondary and tertiary alcohols using Victor Meyer's test. 3

- (b) With the help of chemical reactions, show what happens when—

(i) glycerol is treated with three equivalent amount of HI;

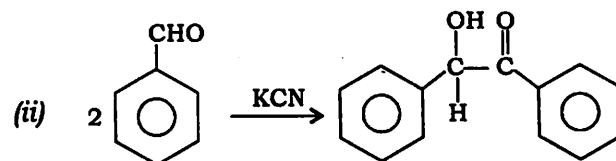
(ii) ethylene glycol reacts with HCl at 160°C . $1 + 1 = 2$

- (c) Write the mechanisms of the following reactions :



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(7)



What is the role of cyanide in this reaction? $2 + 2 + \frac{1}{2} = 4\frac{1}{2}$

OR

8. (a) Why is phenol more acidic than alcohol? $1\frac{1}{2}$

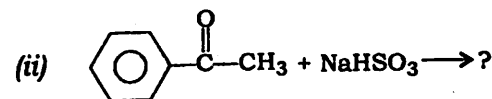
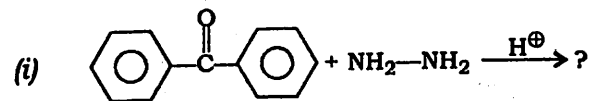
- (b) Write the correct mechanisms of the following name reactions : $2 \times 2 = 4$

(i) Perkin reaction

(ii) Kolbe's reaction of phenol

- (c) How can you convert cumene to phenol? 2

- (d) Write the products of the following reactions : $1 \times 2 = 2$



(8)

SECTION—III

(Physical)

(Marks : 18)

9. (a) What are intensive and extensive properties? 1+1=2

(b) Derive the relation

$$C_p - C_v = nR$$

The terms have their usual meanings. 3

- (c) Define the following : 1+1=2

(i) Degree of polymerization

(ii) Weight average molecular mass

- (d) One mole of an ideal gas is heated at constant pressure from 0 °C to 100 °C. Calculate the work done. 2

OR

10. (a) Derive an expression for work done in isothermal reversible expansion of a gas. 3

(b) Describe osmometry method used to determine the molecular mass of macromolecules. 3

(c) What is Joule-Thomson effect? 1

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(Continued)

(9)

- (d) Six moles of an ideal gas expand isothermally and reversibly from a volume of 1 dm³ to a volume of 10 dm³ at 27 °C. What is the maximum work done? Express the result in joules. 2

11. (a) State and explain Hess's law of constant heat summation by giving one example. 2+1=3

(b) Derive Langmuir adsorption isotherm. 3

(c) Define the following : 1×3=3

(i) Enthalpy of formation

(ii) Enthalpy of combustion

(iii) Enthalpy of neutralization

OR

12. (a) Derive Kirchhoff's equations. 3

(b) Define physisorption and chemisorption. Give one example of each. 1½+1½=3

(c) Calculate the enthalpy of combustion of methane at 25 °C. 3

Given :

$$\Delta H_f^\circ (\text{CH}_4) = -74.8 \text{ kJ mol}^{-1}$$

$$\Delta H_f^\circ (\text{CO}) = -110.5 \text{ kJ mol}^{-1}$$

$$\Delta H_f^\circ (\text{H}_2\text{O}) = -288.9 \text{ kJ mol}^{-1}$$

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