

This question paper contains 4 printed pages]

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S. No. of Question Paper : 1520

Unique Paper Code : 217261

E

Name of the Paper : CHPT-202 : Physical Chemistry/Organic Chemistry

Name of the Course : B.Sc. (Prog.) Physical Science/ Life Science/ Applied Science

Semester : II

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Use separate answer-sheets for Section A and Section B.

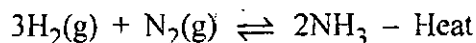
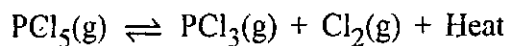
Use of scientific calculator is permitted.

Section A

(Physical Chemistry)

Attempt any *three* questions. *All* questions carry equal marks.

1. (a) State the Le Chatelier's principle and predict the effect of temperature and pressure on the following : 5



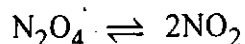
- (b) How ΔG of a chemical reaction is related with ΔS and ΔH ? Explain the significance of positive, negative and zero ΔG values. 5
- (c) Write the Handerson's equation for the pH of a buffer solution. 2½

P.T.O.

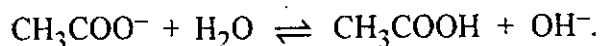
2. (a) Calculate the entropy change when 1 mole of ethanol is evaporated at 351 K. The molar heat of vaporization is $39.84 \text{ kJ mol}^{-1}$. 5
- (b) Derive the first law of thermodynamics. What are its limitations? 5
- (c) Enthalpy of neutralization of all acids/bases, is constant 57.3 kJ/mol in dilute aqueous solution. Explain in brief. $2\frac{1}{2}$
3. (a) Calculate the pH of a solution of 10^{-7} M HCl at 25°C . 5
- (b) Prove that : 5

$$C_p - C_v = [P + (\delta E/\delta V)_T] (\delta V/\delta T)_p$$

- (c) Explain common ion effect with *one* example. $2\frac{1}{2}$
4. (a) The degree of dissociation of N_2O_4 is 16.7% at 298 K and 1 atm. Calculate the equilibrium constant K_p and K_c . Dissociation process is represented as : 4



- (b) Hydrolysis of CH_3COONa is represented by :



Show that degree of hydrolysis is given by the relation : 5

$$h = \sqrt{\frac{K_w}{K_a \cdot c}}$$

- (c) Derive the Kirchhoff's equation showing the variation of ΔH with temperature. $3\frac{1}{2}$

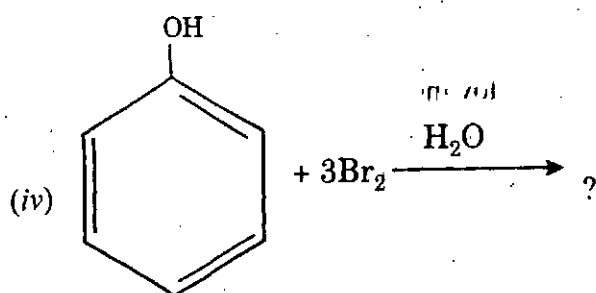
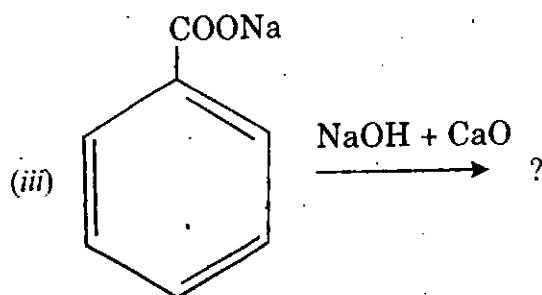
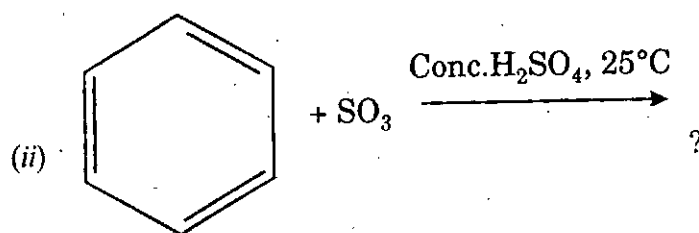
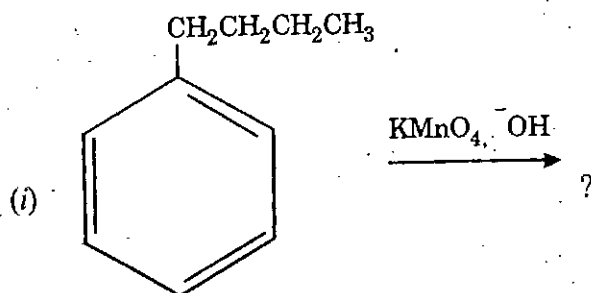
Section B

(Organic Chemistry)

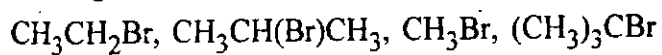
Attempt any *three* questions.

5. (a) Explain Friedel-Craft alkylation with mechanism by taking a suitable example.

(b) Complete the following reactions :



(c) Rank the following halides in the decreasing order of $\text{S}_{\text{N}}1$ reactivity :



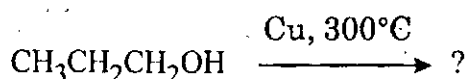
(d) What are the products obtained when phenol is nitrated. Why is dil HNO_3 used for nitration and not conc. HNO_3 ? Give the reaction with mechanism. 3.4, 2.3½

P.T.O.

6. (a) How will you synthesize $\text{CH}_3\text{CH}_2\text{OCH}_3$ using Williamson ether synthesis and what are the products if this ether reacts with HI.
- (b) When 1-bromobutane reacts with $\text{C}_2\text{H}_5\text{ONa}/\text{C}_2\text{H}_5\text{OH}$, 90% 1-Ethoxybutane and 10% But-1-ene is formed. Explain the reaction and the ratio of the product formed.
- (c) Explain why chlorobenzene does not undergo nucleophilic substitution reaction. Using the Elimination-Addition mechanism explain the formation of aniline from chlorobenzene using NaNH_2 .

(d) Complete the reaction :

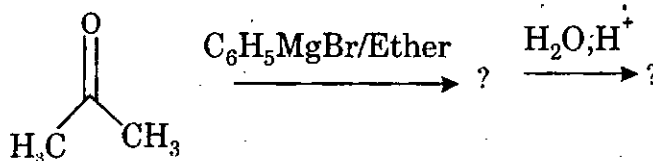
3,3,4,2½



7. (a) Describe Lucas test to distinguish between a primary, secondary and tertiary alcohol.
- (b) Give steps involved in the formation of phenol from benzene by cumene hydroperoxide method.
- (c) Explain Cannizzaro reaction by taking suitable example with its mechanism.

(d) Complete the following reaction :

3,3½,4.2



8. (a) Write notes on any *four* of the following :

- (i) Reimer-Tiemann reaction
- (ii) Gattermann-Koch reaction
- (iii) Houben-Hoesch condensation
- (iv) Schotten-Baumann reaction
- (v) Iodoform reaction

(b) Explain why allyl chloride is more reactive than vinyl chloride towards nucleophilic substitution.

10,2½