TDC(CBCS) Even Semester Exam., 2025

CHEMISTRY

(2nd Semester)

Course No. : CHMDSC/GE–201

(Chemical Energetics, Equilibria and Functional Organic Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *three* of the following questions : 1×3=3

(a) Write down the mathematical expression of first law of thermodynamics.

(b) Define the terms 'isolated system' and 'closed system' in thermodynamics.

(c) What do you mean by bond dissociation energy?

(d) Define the term 'enthalpy'.

2. Answer any *one* of the following questions : 2

(a) Define the terms 'intensive' and 'extensive' properties with examples.

(b) State and explain Hess' law of constant heat summation.

3. Answer any *one* of the following questions : 5

(a) (i) Define integral and differential enthalpy of solution. 2

(ii) Derive Kirchhoff's equation and explain how enthalpy varies with temperature. 3

(b) (i) Find out ΔH value of a reaction

$$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$$

where $\Delta H_{H-H} = 435 \cdot 1$ kJ/mol, $\Delta H_{Br-Br} = 192 \cdot 5$ kJ/mol and $\Delta H_{H-Br} = 368 \cdot 2$ kJ/mol. 2

(ii) Define the term molar heat capacity. Prove that $C_P - C_V = R$ for an ideal gas. 1+2=3

UNIT—II

4. Answer any *three* of the following questions : 1×3=3

(a) Define the term 'pH' of a solution.

(b) What do you mean by strong and weak electrolytes?

(c) What is the difference between ΔG and ΔG°?

(d) Define the term 'homogeneous equilibrium'.

5. Answer any *one* of the following questions : 2

(a) What do you mean by solubility product? Give one application of it.

(b) Define the terms ionic product of water and buffer capacity of solution.

6. Answer any *one* of the following questions : 5

(a) *(i)* What is common-ion effect? Mention one application of this effect. 2

(ii) State and explain Le-Chatelier's principle by taking suitable examples. 3

(b) (i) The value of ΔG° for the phosphorylation of glucose in glycolysis reaction is 13·8 kJ/mol. Find the value of equilibrium constant at 298 K. 2

(ii) Deduce the relationship between K_p and K_c for a general chemical equilibrium reaction. 3

UNIT—III

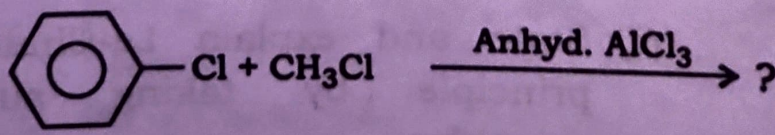
7. Answer any *three* of the following questions : 1×3=3

(a) What happens when ethyl bromide reacts with sodium ethoxide in ethanol?

(b) Give one reaction scheme for the synthesis of chlorobenzene from aniline.

(c) Why are tertiary alkyl halides practically inert to substitution by S_N2 reaction?

(d) Write down the product of the following reaction :



8. Answer any *one* of the following questions : 2

(a) Identify (*A*) and (*B*) from the following reaction :

$$(B) \xleftarrow{\text{aq NaOH}} CH_3{-}CH_2Br \xrightarrow[\Delta]{\text{alc KOH}} (A)$$

(b) Define elimination addition reaction via benzyne intermediate with reaction and mechanism.

9. Answer any *one* of the following questions : 5

(a) *(i)* Predict the products of the following reactions : 2

1) $C_6H_5NH_2 \xrightarrow[CuCl/HCl,\ (0\text{–}5)\ ^\circ C]{NaNO_2/HCl} ?$

2) $CH_3CH_2Cl + AgCN \longrightarrow ?$

(ii) Explain S_N1 reaction with mechanism and give its stereo-chemical aspects. 3

(b) *(i)* Explain the reactivity of alkyl halide and vinyl halide towards nucleophilic substitution reaction. 2

(ii) Explain the following reactions with examples : 1×3=3

(1) Sandmeyer reaction

(2) Gattermann reaction

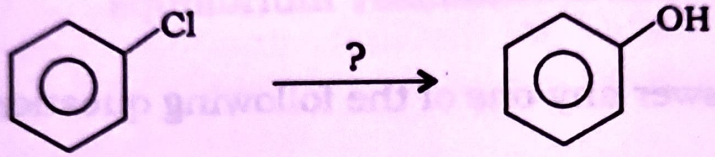
(3) Williamson's ether synthesis

UNIT—IV

10. Answer any *three* of the following questions : 1×3=3

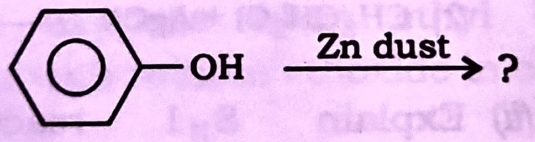
(a) How can you prepare 1-chlorobutane from butanol?

(b) Mention the proper reagent for the following reaction :



(c) Write down the IUPAC name of $CH_3OCH_2CH_2CH_3$.

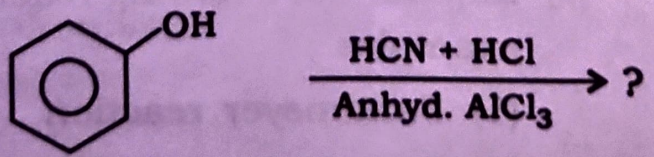
(d) Write down the product of the following reaction :

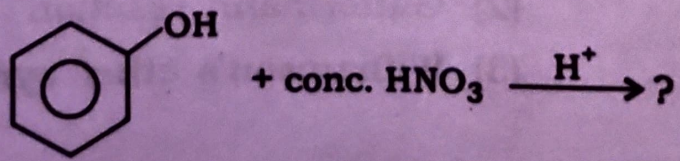


11. Answer any *one* of the following questions : 2

(a) How can primary, secondary and tertiary alcohols be distinguished by Lucas test? Explain with reactions.

(b) Write down the product of the following : 1×2=2

(i) 

(ii) 

12. Answer any *one* of the following questions : 5

(a) *(i)* What happens when 1°, 2° and 3° alcohols are treated separately with reduced Cu at high temperature? Give reactions. 2

(ii) Explain aldol condensation reaction with reaction and mechanism. 3

(b) *(i)* What is Reimer-Tiemann reaction of phenol? Give one example of it. 2

(ii) Explain the following with proper chemical reactions : 1½×2=3

(1) Clemmensen reduction

(2) Pinacol-pinacolone rearrangement

UNIT—V

13. Answer any *three* of the following questions : 1×3=3

(a) What are meso compounds?

(b) Define chiral centre. Provide one example.

(c) What is reducing sugar? Give one example.

(d) Draw the pyranose ring structure of α-D-glucose.

14. Answer any *one* of the following questions : 2

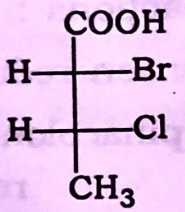
(a) Define mutarotation of sugar and explain the mechanism of mutarotation.

(b) Define enantiomerism and diastereomerism with examples.

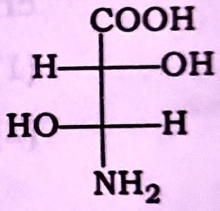
15. Answer any *one* of the following questions : 5

(a) *(i)* Designate *R* / *S* configuration to the chiral centres of the following compounds : 2

1)



2)



(ii) Draw the open chain structures of glucose and fructose. 2

(iii) What is the basic difference between anomer and epimer? 1

(b) *(i)* Define the terms 'racemic mixture' and 'Walden inversion'. 2

(ii) Define *E* and *Z* isomers with examples. 2

(iii) Draw the structure of sucrose. 1

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