



WEST BENGAL STATE UNIVERSITY  
B.Sc. Major 2nd Semester Examination, 2024

CEMDSC202T-CHEMISTRY (MAJOR)

Time Allotted: 2 Hours

Full Marks: 50

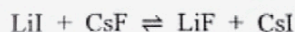
The figures in the margin indicate full marks.  
Candidates should answer in their own words and adhere to the word limit as practicable.  
All symbols are of usual significance.

GROUP-A

1. Answer any *ten* questions from the following:

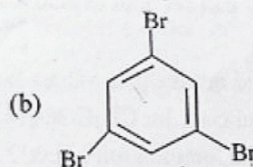
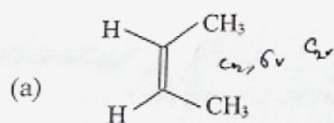
2×10 = 20

- (i) In between  $\text{BF}_3$  and  $\text{BCl}_3$  which one is more acidic and why?  $\text{P} \text{ o} \text{ e} \text{ l}_3 + \text{H}_2\text{O}$   
 (ii) Find out the pH of  $10^{-8}$  M HCl solution.  
 (iii) When  $\text{POCl}_3$  is dissolved in water, acidity will increase / decrease / remain unchanged — Explain with proper justification.  
 (iv) Using the HSAB principle comment on which direction the following equilibrium is likely to proceed:



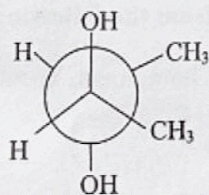
(v) Define 'Super acid' with an example.

(vi) Find out the symmetry elements present in the following molecules:

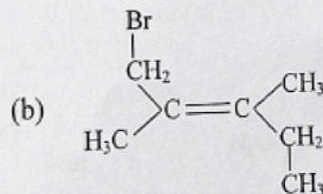
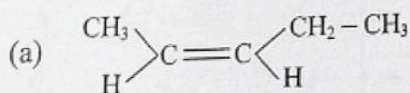


(vii) Draw the most stable and least stable isomers of 3-bromobutan-2-ol in Newman Projection.

(viii) Label each asymmetric carbon in the following compound as R or S nomenclature.



(ix) Assign E/Z configurations to each of the following alkenes:



(x) Designate (S) -  $\text{CH}_2\text{OH} - \text{CHOH} - \text{CHO}$  as D/L nomenclature.



- (xi) What do you understand by homogeneous catalysis? Give an example.  
 (xii) Write down the Arrhenius equation connecting rate constant of a reaction with its activation energy and explain the terms.  
 (xiii) Justify or criticize the statement 'For any reaction, the rise of temperature will inevitably cause enhancement of reaction rate'.  
 (xiv) Explain 'Primary Kinetic Salt Effect'.  
 (xv) A first order reaction is 75% complete in 32 minutes. Calculate its half-life.

**GROUP-B**

Answer any six questions taking two questions from each unit 5×6 = 30

**Unit-1**

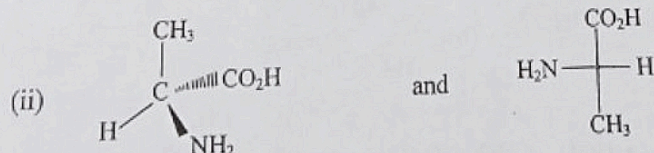
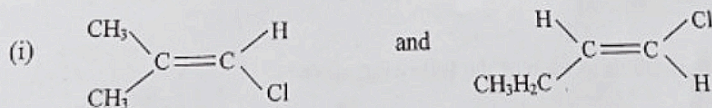
Answer any two questions from the following 5×2 = 10

2. (a) In between  $\text{BMe}_3$  and  $\text{BPh}_3$ , which one is more acidic and why? 2  
 (b) In the light of solvent system theory, justify the nature of  $\text{BiN}$  in liquid ammonia. 2  
 (c) Explain when  $\text{HNO}_3$  can act as a base. 1
3. (a) In between  $\text{H}_3\text{PO}_4$  and  $\text{H}_3\text{PO}_3$ , which one is more acidic and why? 2  
 (b) Explain the following observations using HSAB principle: 2
- $$\text{R}-\text{Cl} \xrightarrow{\text{KCN}} \text{R}-\text{CN}$$
- $$\text{R}-\text{Cl} \xrightarrow{\text{AgCN}} \text{R}-\text{NC}$$
- (c) Why  $\text{HS}^-$  and  $\text{HSO}_4^-$  can act both as acid and base? 1
4. (a) Using Pauling rule find out the  $\text{pK}_a$  values for  $\text{H}_3\text{PO}_3$ . 2  
 (b) Find out the suitable indicator for  $\text{CH}_3\text{COOH}$  vs  $\text{NaOH}$  titration. Give proper reason. 2  
 (c) What do you mean by 'Common ion effect'? 1

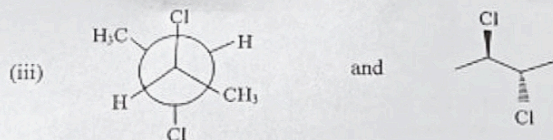
**Unit-2**

Answer any two questions from the following 5×2 = 10

5. (a) Label the following pairs of compounds as homomers, constitutional isomers, diastereomers or enantiomers. 3





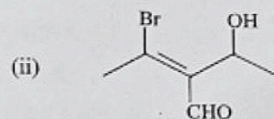
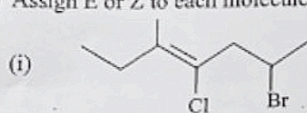


(b) All epimers are diastereomers, but all diastereomers are not epimers. Justify the statement with suitable examples. 2

8. (a) Justify the following statements with suitable examples: 3

- (i) The *E*-isomer of an alkene will not necessarily be the *trans* isomer.  
 (ii) All meso-compounds are optically inactive in spite of the presence of more than one chiral center.

(b) Assign E or Z to each molecule. 2



7. (a) Draw the energy profile diagram of 1,2-dihydroxyethane as a function of dihedral angle. Also draw the structures of anti, gauche and eclipsed conformations and compare their relative stabilities. 3

(b) Draw the most stable conformer of *n*-butane for the rotation around C<sub>2</sub> - C<sub>3</sub> bond and label that conformer with Klyne-Prelog terminology. 2

### Unit-3

Answer any two questions from the following

5×2 = 10

8. (a) At 25°C the half-life period for the decomposition of N<sub>2</sub>O<sub>5</sub> is 2.05×10<sup>4</sup> s and is independent of the initial concentration of N<sub>2</sub>O<sub>5</sub>. 1+2

(i) What is the order of the reaction?

(ii) What length of time is required for 80% of N<sub>2</sub>O<sub>5</sub> to decompose?

(b) Show that the ratio of  $t_{1/2}/t_{3/4}$  of any *n*<sup>th</sup> order reaction (*n* ≠ 1) with identical initial concentration of the reactants, can be written as a function of *n* alone. 2

9. (a) Explain Activation Energy with the help of a diagram. 3

(b) What is the unit of pre-exponential factor (A) for a first order reaction? 2

10. (a) Initial rate of a first order reaction becomes three times when the temperature increases from 400 K to 420 K. If the half-life period of the reaction at 400 K is 10 minutes, find out the time needed for 25% conversion of the reactant into product at 420 K, and the energy of activation. 3

(b) Write a short note on Lindemann hypothesis. 2

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