

DEPARTMENT OF CHEMISTRY
College of Engineering and Technology
SRM Institute of Science and Technology
Kattankulathur – 603203

SET – 1

INTERNAL ASSESSMENT – II [FJ2]

Program: B.Tech

Course Code & Title: 21CYB101J & Chemistry

Year & Sem: I Year & I Sem

Date: 25/11/2024

Time : 8.00 - 9.00am.

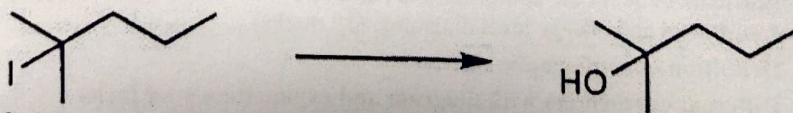
Max. Marks: 30

ANSWER KEY

Part – A (10 x 1 = 10 Marks)

Answer ALL The Questions

- At standard conditions a hypothetical reaction has $\Delta H^\circ = -66.3 \text{ kJ}$ and $\Delta S^\circ = -18.7 \text{ J/K}$. What is the ΔG° for this reaction?
d) -60.72 kJ
- Processes are always spontaneous, regardless of temperature, when _____ (H and S refer to the system)
c) $\Delta H < 0$ and $\Delta S > 0$
- A reaction is at equilibrium at a given temperature and constant pressure when _____
b) $\Delta G_{\text{rxn}} = 0$
- In a reversible process $\Delta_{\text{sys}} + \Delta_{\text{surr}}$ is
b) zero
- For a reaction that has an equilibrium constant of 3×10^{-3} , which of the following statements must be true?
c) ΔG° is positive
- In Pourbaix diagram the following reaction, $\text{Fe}^{3+} + e^- \rightarrow \text{Fe}^{2+}$ is
b) pH independent
- The dissolution of ammonium nitrate in water is a spontaneous endothermic process. It is spontaneous because the system undergoes _____
c) an increase in entropy
- Among the following, but-2-ene reacts slowest with?
a) HF
- By analysing the starting material and the product, the following reaction given below can be classified as



c) $\text{S}_{\text{N}}1$

- 2-methyl butane and dimethyl propane exhibit _____ isomerism
a) skeletal

Part – B (2 x 10 = 20 Marks)

11. a. Derive Nernst equation and give its significance and applications (10 marks)

Derivation : 4 marks

Significance : 2 marks

Applications : 4 marks (redox or acid-base in detail)

(OR)

- b. i. A reaction at equilibrium releases 25 Joules of heat energy at 37 °C. What is the entropy change for this reaction? (5 marks)

To solve this problem, we must make use of the following equation:

$\Delta G = \Delta H - T\Delta S$. At equilibrium, the value of ΔG is 0. Therefore, we can simplify the equation. $0 = \Delta H - T\Delta S$. $T\Delta S = \Delta H$ or $\Delta S = \Delta H/T$.

$$37^{\circ}\text{C} + 273 = 310\text{K}$$

$$\Delta S = \frac{\Delta H}{T} = \frac{-25\text{J}}{310\text{K}} = -0.0806 \frac{\text{J}}{\text{K}}$$

- ii. The concentration of lead ions in a saturated solution of PbI_2 at 25 °C is $1.3 \times 10^{-3}\text{M}$. What is its K_{sp} ? (5 marks)

Writing the K_{sp} expression : 1 mark

Determining the concentration of the ions : 2 marks

Final answer : 2 marks

$$\begin{aligned} K_{\text{sp}} &= [\text{Pb}^{2+}][\text{I}^{-}]^2 \\ &= (1.30 \times 10^{-3})(2.60 \times 10^{-3})^2 \\ &= (1.30 \times 10^{-3})(6.76 \times 10^{-6}) \end{aligned}$$

$$K_{\text{sp}} = 8.79 \times 10^{-9}\text{M}$$

12. a. With a neat sketch explain all the salient features of Pourbaix diagram of Iron (10 marks)

Pourbaix diagram for Iron – 3 Marks

Explanation on 3 regions + 3 areas + equations on lines – 2+2+3 Marks

(OR)

- b. Elucidate in detail the conformational analysis of n-butane by sketching its conformers and energy level diagrams. (10 marks).

Definition of conformers – 1 Mark

Different conformers with diagram and explanation – 6 Marks

Energy level diagram – 3 Marks
