QP-CLA 2-Set 2-Answer Key

Chemistry (SRM Institute of Science and Technology)

DEPARTMENT OF CHEMISTRY **SET 2**
College of Engineering and Technology
SRM Institute of Science and Technology
Kattankulathur – 603203

IINTERNAL ASSESSMENT – II-Answer Key

Program: B. Tech.	Date: 19/11/2022
Course Code & Title: 21CYB101J & Chemistry	Duration: 12.30 – 1.30 pm
Year & Sem: I Year & I Sem	Max. Marks: 30 Marks

Part- A (10 x 1 = 10 Marks)

Answer ALL The Questions

1. Nernst equation for an electrode is based on the variation of electrode potential of an electrode with
   (c) both a and b
2. Which of the following condition is satisfied when the cell reaction in the electrochemical cell is spontaneous?
   (d) $\Delta G^\circ < 0$
3. During an adiabatic expansion of 3 moles of a gas, the change in internal energy was found to be equal to -100 J. The work done during the process is equal to:
   (b) 100 J
4. Which of the following is correct for the net entropy change in an irreversible process?
   (a) It is positive
5. Which of the following option describes the limitations of Pourbaix diagrams?
   (d) Rate of reaction is not predicted and it neglects the impurities of working conditions
6. Anhydrous inorganic liquid metal surface in absence of moisture undergoes _____.
   (b) Dry corrosion
7. Which of the following materials will undergo corrosion?
   (d) Metals, Non-metals, Ceramics, Plastics and Rubbers
8. In an isothermal process, the internal energy of gas molecules
   (c) remains constant
9. The isomerism which exists between CH_3CHCl_2 and CH_2ClCH_2Cl is
   (c) Position
10. Which of the following is true about Fischer Projection?
    (**a)** The vertical lines are oriented away from you and the horizontal lines are oriented toward you.

Part- B (2 x 10 = 20 Marks)

11 a. i. What is an electrochemical cell? Explain with an example and neat diagram. Give cell notation and reactions involved for a given example. (10 Marks)
Definition – 2 mark, Labelled and neat diagram – 4 marks, Cell notation – 2 marks, Half-cell and overall reaction – 2 marks.

OR

b. i. Calculate the standard free-energy change (ΔG°) at 25°C for the reaction
$H_{2(g)} + O_{2(g)} \rightleftharpoons H_2O_{2(l)}$
At 25°C, the standard enthalpy change (ΔH°) is −187.78 kJ/mol, and the absolute entropies of the products and reactants are:

$S°(H_2O_2)$ = 109.6 J/(mol.K),

$S°(O_2)$ = 205.2 J/(mol.K), and

$S°(H_2)$ = 130.7 J/(mol.K).

Is the reaction spontaneous as written? What does ΔG say about the rate of this reaction? (6 Marks)

$$\begin{aligned}\Delta S^\circ &= S^\circ(\mathrm{H_2O_2}) - [S^\circ(\mathrm{O_2}) + S^\circ(\mathrm{H_2})] \\ &= [1\ \mathrm{mol\ H_2O_2} \times 109.6\ \mathrm{J/(mol \cdot K)}] \\ &\quad - \{[1\ \mathrm{mol\ H_2} \times 130.7\ \mathrm{J/(mol \cdot K)}] + [1\ \mathrm{mol\ O_2} \times 205.2\ \mathrm{J/(mol \cdot K)}]\} \\ &= -226.3\ \mathrm{J/K\ (per\ mole\ of\ H_2O_2)}\end{aligned}$$

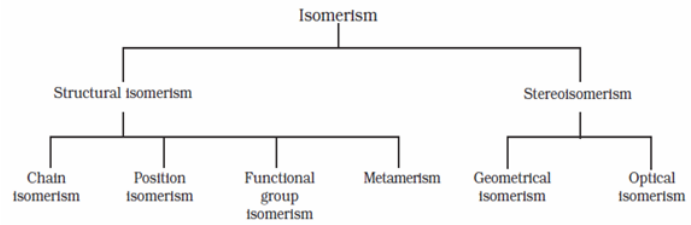
$$\begin{aligned}\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ &= -187.78\ \mathrm{kJ/mol} - (298.15\ \mathrm{K})[-226.3\ \mathrm{J/(mol \cdot K)} \times 1\ \mathrm{kJ/1000\ J}] \\ &= -187.78\ \mathrm{kJ/mol} + 67.47\ \mathrm{kJ/mol} = -120.31\ \mathrm{kJ/mol}\end{aligned}$$

The negative value of ΔG° indicates that the reaction is spontaneous as written. In this particular case, the enthalpy term dominates, indicating that the strength of the bonds formed in the product compensate for the unfavourable ΔS° term (as ΔS° is negative). ΔG says nothing about the kinetics.

Calculation of ΔS° - 3 marks, calculation of ΔG° - 2 marks, Spontaneity and Kinetics of reaction – 1 mark

ii. Compare and contrast wet and dry corrosion. (4 Marks)
Definition and any three points of comparison (1 mark each)

12 a. i. What is isomerism? How is it classified? Write a note on geometrical isomerism. (6 Marks)



Definition and classification into different types – 3 marks, Explanation of geometrical isomerism with examples – 3 marks.

ii. Draw Sawhorse projections for the eclipsed and staggered conformations of ethane. Which of these conformations is more stable and why? (4 Marks)
Drawing of eclipsed and staggered conformation (3 Marks)
More stable conformation and its reason (1 Mark)

OR

b. i. Derive the expression and explain the significance of Helmholtz function. (6 Marks)
Definition and explanation (2 Marks)
Derivation (4 Marks)

ii. What are intensive and extensive properties? Give two examples of each. (4 Marks)
Intensive properties definition with examples – 2marks
Extensive properties definition with examples – 2marks