



CT-2 slot B question and ans key

Chemistry (SRM Institute of Science and Technology)



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

Set- 1

INTERNAL ASSESSMENT – II [FJ-II]

Program : B. Tech.
Course Code & Title : 21CYB101J & Chemistry
Year & Sem. : I Year & I Sem.
Date : 21-11-2024
Time : 8.00-9.00am
Max. Marks : 30 marks

Course Articulation Matrix

At the end of this course, learners will be able to:		POs				
Course Outcomes (CO)		1	2	3	4	5
CO1 Rationalize bulk properties using periodic properties of elements, evaluate water quality parameters like hardness and alkalinity		3		3	2	
CO2 Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions, determine acidic strength and redox potentials of aqueous solution		3	3	3		
CO3 Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries, determine acidic strength and conductance of aqueous solution			3	3	2	
CO4 Utilize the concepts of polymer processing for various technological applications, determine average molecular weight of the polymer		3		3	3	
CO5 Analyze the importance of advanced processing techniques towards engineering applications and measure the acidic strength of aqueous solution		3		3		3

Part-A (10X1 = 10 Marks)

Answer ALL the questions

- When equilibrium is reached inside the two half-cells of the electrochemical cell, what is the net voltage across the electrodes?
(a) > 1 (b) < 1 (c) $= 0$ (d) Not defined
- What will be the Gibbs free energy for the reaction of conversion of ATP into ADP at 293 Kelvin, if the change in enthalpy is 19.07 Kcal and the change in entropy is 90 cal per Kelvin.
(a) 7.3 cal (b) -5.3 cal (c) 7.3 Kcal (d) -7.3 Kcal
- An oxide layer is considered as protective if ratio of volume of oxide layer to volume of base metal is
(a) > 1 (b) > 10 (c) < 1 (d) > 3
- Which of the following factors does not affect the electrode potential of an electrode?
(a) Nature of the electrode (metal) (b) Temperature of the solution
(c) Molarity of the solution (d) Size of the electrode
- Which of the following statement is incorrect?
(a) At constant pressure, $\Delta H = \Delta E + P\Delta V$
(b) Thermodynamic symbol for entropy is S.
(c) Gibbs free energy is a state function.
(d) For an endothermic process, ΔH is negative.
- Rusting of iron in acidic aqueous solution of electrolyte occurs with the evolution of _____ gas.
(a) Nitrogen (b) Chlorine (c) Oxygen (d) Hydrogen

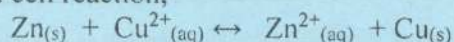
7. According to the convention, the Daniel cell is represented as:
 (a) $\text{Zn} | \text{ZnSO}_4 || \text{CuSO}_4 | \text{Cu}$, $E = 1.09$ volt
 (b) $\text{Zn} | \text{ZnSO}_4 || \text{Cu} | \text{CuSO}_4$, $E = 1.09$ volt
 (c) $\text{ZnSO}_4 | \text{Zn} || \text{CuSO}_4 | \text{Cu}$, $E = 1.09$ volt
 (d) $\text{Zn} | \text{ZnSO}_4 || \text{CuSO}_4 | \text{Cu}$, $E = 1.09$ volt
8. What type of reaction takes place upon treatment of a ketone with HCN to form a cyanohydrin?
 (a) Nucleophilic addition (b) Nucleophilic substitution
 (c) Electrophilic addition (d) Electrophilic substitution
9. How many aromatic isomers of dibromobenzene exist?
 (a) 2 (b) 3 (c) 4 (d) 6
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.
 (b) The vertical lines are oriented towards you and the horizontal lines are oriented away from you.
 (c) Both the horizontal and vertical lines are oriented away from you.
 (d) Both the horizontal and vertical lines are oriented towards you.

Part-B (2 x 10 = 20 Marks)

- 11(a) Derive the expression for the Helmholtz free energy and explain its physical significance. (6 Marks)

(i)

- (ii) For a Daniel Cell involving a cell reaction,



The standard free energy of formation of $\text{Zn}_{(s)}$, $\text{Cu}_{(s)}$, $\text{Cu}^{2+}_{(aq)}$, $\text{Zn}^{2+}_{(aq)}$ are 0, 0, 64.4 kJ/mol and -154 kJ/mol respectively. Calculate the standard EMF of the cell. (4 Marks)

(OR)

- 11(b) Describe potentiometric redox titration with an example and explain its advantages. (6 Marks)

(i)

- (ii) Differentiate between dry corrosion and wet corrosion. (4 Marks)

- 12(a) Write a note on the Pourbaix diagram of iron (Fe). (10 Marks)

(OR)

- 12(b) Explain the SN^1 mechanism with a suitable example. (6 Marks)

(i)

- (ii) Draw the Newman and Sawhorse projections for the eclipsed and staggered conformations of ethane. Which conformation is more stable and why? (4 Marks)

No.	BL	CO	PO
1	2	2	2
2	4		2
3	1		1
4	2		2
5	1		3
6	4		2
7	2		1
8	3	3	2
9	2		3
10	3		4

Q. No.	BL	CO	PO
11a. (i)	1	2	1
(ii)	2		2
11b. (i)	3		3
(ii)	1		1
12a.	2	3	2
12b. (i)	3		2
(ii)	2		3

ANSWER KEY
INTERNAL ASSESSMENT – II [FJ-II]

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Part-A (10X1 = 10 Marks)

- (c) = 0
- (d) -7.3 Kcal
- (a) > 1
- (d) Size of the electrode
- (d) For an endothermic process, ΔH is negative.
- (d) Hydrogen
- (a) $\text{Zn} | \text{ZnSO}_4 || \text{CuSO}_4 | \text{Cu}$, $E = 1.09$ volt
- (a) Nucleophilic addition
- (b) 3
- (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) Derive the expression for the Helmholtz free energy and explain its physical significance.
(i) **Ans: Derivation – 5 marks, Significance – 1 Mark**

- (ii) For a Daniel Cell involving a cell reaction,
 $\text{Zn}_{(s)} + \text{Cu}^{2+}_{(aq)} \leftrightarrow \text{Zn}^{2+}_{(aq)} + \text{Cu}_{(s)}$

The standard free energy of formation of $\text{Zn}_{(s)}$, $\text{Cu}_{(s)}$, $\text{Cu}^{2+}_{(aq)}$, $\text{Zn}^{2+}_{(aq)}$ are 0, 0, 64.4 kJ/mol and -154 kJ/mol respectively. Calculate the standard EMF of the cell. (4 Marks)

Ans:

$$\begin{aligned}\Delta G^{\circ}_{\text{rec}} &= \Delta G^{\circ}_{\text{f}(\text{prod})} - \Delta G^{\circ}_{\text{f}(\text{react})} \\ &= (-154 + 0) - (0 + 64.4) = -218.4 \text{ kJ/mol} \\ E^{\circ} &= -\Delta G^{\circ}_{\text{rec}}/nF \\ &= 1.13 \text{ V}\end{aligned}$$

(OR)

- 11(b) Describe potentiometric redox titration with an example and explain its advantages. (6 Marks)
(i)

Ans: Explanation with example including working and reference electrode, reactions involved, Cell notation, expression for emf and 3 plots)

- (ii) Differentiate between dry corrosion and wet corrosion. (4 Marks)
Ans: Any 4 points – 4 marks

12(a) Write a note on the Pourbaix diagram of iron (Fe).

(10 Marks)

(i) Ans: Neat and labelled diagram: 3 Marks

Explanation of 5 curves with chemical reactions: 3 marks

Explanation of regions 2 marks

Characteristics and significance of diagram : 2 marks

(OR)

12(b) Explain the SN^1 mechanism with a suitable example.

(6 Marks)

(i) Ans: Two step mechanism with suitable example: 4 marks

Explanation: 2 marks

(ii) Draw the Newman and Sawhorse projections for the eclipsed and staggered conformations of ethane. Which conformation is more stable and why?

(4 Marks)

Ans: Newman projection (eclipsed and staggered): 1.5 marks

Sawhorse projection (eclipsed and staggered): 1.5 marks

Explanation of stable conformation with reason: 1 mark



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Set- 2

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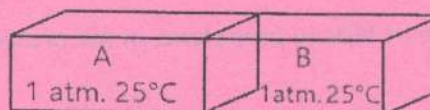
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Part-A (10X1 = 10Marks)

Answer ALL the questions

- The equilibrium constant for a cell reaction, $\text{Cu}_{(s)} + 2\text{Ag}^+_{(aq)} \leftrightarrow \text{Cu}^{2+}_{(aq)} + 2\text{Ag}_{(s)}$ is 4×10^{16} . Find $E^\circ_{\text{(cell)}}$ for the cell reaction.
(a) 0.63 V (b) 0.49 V (c) 1.23 V (d) 3.24 V
- An isolated box, equally partitioned, contains two ideal gasses A and B as shown. When the partition is removed, the gases mix. The changes in enthalpy (ΔH) and entropy (ΔS) in the process respectively are:



- (a) Zero, positive (b) Zero, negative (c) Positive, zero (d) Negative, zero
- Passivity is not reason for inertness of the following:
(a) Au (b) Al (c) Ti (d) Ni
 - In a reaction, the change in entropy is given as 2.4 cal/K and the change in Gibbs free energy is given as 3.4 kcal, then the change in heat at the temperature of 20 °C is:
(a) 4.1 cal (b) 3.4 cal (c) 3.4 Kcal (d) 4.1 Kcal
 - Mercury covered by a layer of mercurous chloride in contact with saturated potassium chloride solution is a description of which of the following types of electrodes?
(a) Chlorine (b) Potassium (c) Calomel (d) Silver/Silver chloride

6. A process is carried out at constant volume and at constant entropy. It will be spontaneous if:
 (a) $\Delta H < 0$ (b) $\Delta U < 0$ (c) $\Delta A < 0$ (d) $\Delta G < 0$
7. The entropy of an isolated system always _____ and reaches _____ when equilibrium is reached.
 (a) remains constant, maximum (b) decreases, minimum
 (c) increases, maximum (d) decreases, constant
8. The isomers which can be inter converted through rotation around a single bond are termed as:
 (a) Tautomers (b) positional isomers (c) conformers (d) diastereomers
9. Which of the following statements is **not** correct?
 (a) Fischer projection represents the molecule in an eclipsed conformation
 (b) Newman projection can be represented in eclipsed, staggered and skew conformations
 (c) Fischer projection of the molecule is its most stable conformation
 (d) In Sawhorse projections, the lines are inclined at an angle of 120° to each other
10. The reactivity order of alkyl halides in SN^1 mechanism is
 (a) $CH_3X > 1^\circ > 2^\circ > 3^\circ$ (b) $CH_3X < 1^\circ < 2^\circ < 3^\circ$
 (c) $CH_3X > 3^\circ > 2^\circ > 1^\circ$ (d) $CH_3X > 3^\circ > 1^\circ > 2^\circ$

Part-B (2 x 10 = 20 Marks)

- 11(a) Describe the construction and working of an electrochemical cell, provide an example to illustrate its operation. (6 Marks)
- (ii) Calculate the entropy change for methane combustion from the given thermodynamic data. The Standard entropies of the substances involved in the above reaction are: $\Delta S^\circ(J/K, mol)$ of $CH_{4(g)} = 186$, $O_{2(g)} = 205$, $CO_{2(g)} = 214$ and $H_2O_{(l)} = 70$ (4 Marks)
- (OR)**
- 11(b) (i) Derive Nernst equation and explain its significance in electrochemistry. (6 Marks)
- (ii) Define entropy and explain its significance in thermodynamic and natural processes. (4 Marks)
- 12(a) Explain mechanisms of dry corrosion and wet corrosion, providing the chemical reaction involved in each process. (10 Marks)
- (OR)**
- 12(b) (i) Explain the addition of HBr to propylene, in the presence and absence of peroxide. (8 Marks)
- (ii) Define diastereomers with an example. (2 Marks)

No.	BL	CO	PO
1	2	2	2
2	4		2
3	1		1
4	2		2
5	1		3
6	4		2
7	2		1
8	3	3	2
9	2		3
10	3		4

Q. No.	BL	CO	PO
11a (i)	1	2	1
(ii)	2		2
11b (i)	3		3
(ii)	1	3	1
12a	2		2
12b (i)	3		3
(ii)	2	3	4

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Part-A (10X1 = 10Marks)

- 1 (b) 0.49 V
- 2 (a) Zero, positive
- 3 (a) Au
- 4 (d) 4.1 Kcal
- 5 (c) Calomel
- 6 (b) $\Delta U < 0$
- 7 (c) increases, maximum
- 8 (c) conformers
- 9 (c) Fischer projection of the molecule is its most stable conformation
- 10 (b) $\text{CH}_3\text{X} < 1^\circ < 2^\circ < 3^\circ$

Part-B (2 x 10 = 20 Marks)

11. Describe the construction and working of an electrochemical cell, provide an example to illustrate its operation. (6 marks)
 - (i) **Ans:**
 Neat and labelled diagram: 3 marks
 Oxidation reduction reactions: 2 marks
 Cell notation and emf : 1 mark
 - (ii) Calculate the entropy change for methane combustion from the given thermodynamic data. The Standard entropies of the substances involved in the above reaction are: $\Delta S^\circ(\text{J/K. mol})$ of $\text{CH}_4(\text{g}) = 186$, $\text{O}_2(\text{g}) = 205$, $\text{CO}_2(\text{g}) = 214$ and $\text{H}_2\text{O}(\text{l}) = 70$ (4 marks)
Ans:
 Balanced chemical equation: 1 marks
 Calculation: 3 marks
 $\Delta S^\circ_{\text{reaction}} = [\sum \text{Standard entropies of products} - \sum \text{Standard entropies of reactants}]$
 $\Delta S^\circ = [214 + 2 \times 70] - [186 + 205 \times 2] = -242 \text{ J/K}$

(OR)

- 11.(b) Derive Nernst equation and explain its significance in electrochemistry. (6 marks)
 - (i) **Ans:**
 Derivation: 6 marks
 Applications: 2 marks
 - (ii) Define entropy and explain its significance in thermodynamic and natural processes. (4 marks)
Ans: Definition: 1 mark; Significance: 3 marks

- 12.(a) Explain mechanisms of dry corrosion and wet corrosion, providing the chemical reaction involved in each process. (10 marks)

Ans:

Mechanism of dry corrosion with equation: 2 marks

Three types of wet corrosion with equations: 6 marks

(OR)

- 12.(b) Explain the addition of HBr to propylene, comparing the reaction in the presence and absence of peroxide. (10 marks)

(i)

Ans:

In presence of peroxide (anti-Markovnikov's addition) with example and explanation: 5 marks

In absence of peroxide (Markovnikov's addition) with example and explanation: 5 marks

(ii)

Define diastereomers with an example.

Ans:

Definition: 1 mark; Example: 1 mark