7. Which of the following corrosion form is depicted in the given figure?
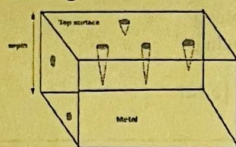
   a) Crevice corrosion   b) Uniform corrosion c) Intergranular corrosion d) Pitting corrosion

8. Which of the following compounds displays optical isomerism?

   a) $CH_2(OH)-CH_2(OH)$ b) $CH_3-CHCl-COOH$ c) $CH_2=CHCl$ d) $CHCl=CHCl$

9. Choose the correct order of leaving group ability in nucleophilic substitution reaction

   a) $H^- > HO^- > Br^- > CH_3COO^-$ b) $CH_3COO^- > Br^- > HO^- > H^-$ c) $Br^- > CH_3COO^- > HO^- > H^-$
   d) $HO^- > CH_3COO^- > Br^- > H^-$

10. Identify the mechanism that the following reaction undergoes:

  a) S_N1 b) S_N2 c) free radical d) Electrophilic

Part – B (2 x 10 = 20 Marks)

11a. i) How much work in joules is done on the system when 1.15atm external pressure causes

    a piston to decrease in volume from 6.55 litres to 3.16 litres?[1L-atm is = 101.3 J](4 Marks)

    ii) Write a short note on internal energy and enthalpy.   (3 +3 Marks)

(OR)

  b. Describe how the Nernst equation can be applied to interpret a redox titration. (10 Marks)

12a. Discuss the oxidation corrosion mechanism, different types of oxide layers that form, and

    how the Pilling–Bedworth rule helps to understand the process.   (10 Marks)

(OR)

  b. Define the term conformers and explain the conformational analysis of n-butane, providing

    sketches of its conformers along with the energy level diagram.   (10 Marks)

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

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

DEPARTMENT OF CHEMISTRY
College of Engineering and Technology
SRM Institute of Science and Technology
Kattankulathur – 603203
INTERNAL ASSESSMENT – II [FJ2]

Program: B.Tech
Course Code & Title: 21CYB101J & Chemistry
Year & Sem: I Year & II Sem

Date: 27 .03. 2025
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 (10 x 1 = 10 Marks)
Answer ALL the Questions

1. Decrease in free energy can be given by -ΔG= _____
   a) nFE   b) n/FE   c) nF/E   d) F/nE

2. Which of the following signs on q and w represent a system that is doing work on the surroundings, as well as losing heat to the surroundings?
   a) +q, +w   b) –q, –w   c) +q, –w   d) –q, +w

3. A spontaneous process
   a) is reversible
   b) is irreversible
   c) may be reversible or irreversible depending on whether equilibrium is maintained throughout the process
   d) may be reversible or irreversible depending on the value of ΔS

4. In voltaic cells, the salt bridge _____ .
   a) is not necessary in order for the cell to work
   b) drives free electrons from one half-cell to the other
   c) allows charge balance to be maintained in the cell
   d) is tightly plugged with firm agar gel through which ions cannot pass

5. The enthalpy of fusion for water is 6.01 kJ/mol. Calculate the entropy change for 1.0 mole of ice melting to form liquid at 273 K.
   a) 22 J/K   b) 14 J/K   c) 220J   d) 37J

6. Which of the following is an example of wet corrosion?
   a) Corrosion of metal in the water   b) Corrosion of iron in the presence of anhydrous calcium chloride
   c) Corrosion of titanium in dry chlorine   d) Corrosion due to furnace gases

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SRM Institute of Science and Technology
Kattankulathur – 603203
INTERNAL ASSESSMENT – II [FJ2]

Program: B.Tech   Date: 27.03.2025
Course Code & Title: 21CYB101J & Chemistry   Time:8.00-9.00AM
Year & Sem: I Year & II Sem   Max. Marks: 30 marks

Course Articulation Matrix

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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 (10 x 1 = 10 Marks)
Answer ALL the Questions

1. 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) $\Delta G < 0$

2. One mole of an ideal gas expands against a constant external pressure of 1 atm from a volume of 10 dm^3 to a volume of 30 dm^3. Calculate work done by the gas in joules. [1L-atm =101.3 J]
   a) 3026 J   b) 2026 J   c)-3026 J   d) -2026J

3. The Helmholtz function F is given by
   a) U-TS   b) U+TS   c) -U-TS   d) -U+TS

4. Which of the following statement is correct with respect to the cathode in an electrochemical cell?
   a) Oxidation occurs at the cathode   b) Electrons move into the cathode   c) Usually denoted by a negative sign   d) Is usually made up of insulating material

5. What is the correct Nernst equation for M^{2+}(aq) + 2e$^-$ → M(s) at 45°C?
   a) $E=E^0+0.0315\log_{10}[M^{2+}]$ b) $E=E^0-0.0315\log_{10}[M^{2+}]$ c) $E=E^\circ+ 0.0425\log_{10}(1/[M^{2+}])$
   d) $E=E^\circ - 0.0425\log_{10}(1/[M^{2+}])$

6. Corrosion of material by furnace gases is classified as _____
   a) wet corrosion   b) dry corrosion
   c) galvanic corrosion   d) crevice corrosion

7. Which of the following is the driving force in galvanic corrosion?
   a) Conductivity of electrolyte b) Crystal structure of metals   c) The potential difference between the two metals d) Temperature of electrolyte

8. Which of the following compounds is a functional group isomer of C_2H_5OH, ethanol?
   a) ethanal, CH_3CHO b) acetic acid, CH_3COOH c) diethyl ether, $(C_2H_5)_2O$ d) dimethyl ether, $(CH_3)_2O$

9. Assign R/S notation for the given compound:

$$CH \equiv C - \underset{\underset{HOH_2C}{}}{\overset{COOH}{\underset{|}{C}}} - H$$
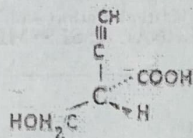
a) R   b) S   c) Neither R nor S   d) both a and b

10. What is the expected product formed from the reaction between 2-butene and Cl_2?

a) 1-chlorobutane   b) 2-chlorobutane   c) 2,3-dichlorobutane   d) 2,2-dichlorobutane

Part -- B (2 x 10 = 20 Marks)

11a. i) Derive Gibbs-Helmholtz equation and mention its significance.   (6 Marks)

ii) The standard enthalpies of formation of $SO_2Cl_{2(g)}$, $H_2O_{(l)}$, $HCl_{(g)}$ and $H_2SO_{4(l)}$ are -364, -286, -92 and -814 $kJmol^{-1}$ respectively. Calculate the standard enthalpy change, ΔH^0_{rxn} for the reaction, $SO_2Cl_{2(g)} + 2H_2O_{(l)} \rightarrow 2HCl_{(g)} + H_2SO_{4(l)}$ (4 Marks)

(OR)

b. i. Explain in detail any one wet corrosion with a neat sketch and give the mechanism.   (6 Marks)

ii. Write cell reactions for the electrochemical cell given, calculate E^0 cell for the reaction:

$Na(s)|Na^+(aq)||Cl_2(g)|Cl^-(aq)$ [$E^0 = -2.7144V$ for Na^+ and for Cl^- is 1.3601V]   (4 marks)

12a. Draw a clear and detailed sketch of the Pourbaix diagram for Iron and explain its key features.   (10 Marks)

(OR)

b. i) Define the terms enantiomers and racemic mixture with an example.   (4 Marks)

ii) Explain the nucleophilic substitution unimolecular (S_N1) reaction mechanism with an example.   (6 Marks)

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

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

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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 [FJ2]

Program: B. Tech.
Course Code & Title: 21CYB101J & Chemistry
Year & Sem: I Year & II Sem
Course Articulation Matrix

Date: 27 -03- 2025
Time: 12:30 – 1:30 pm
Max. Marks: 30 marks

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	1	
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 (10 x 1 = 10 Marks)
Answer ALL the Questions

1. Among the following, which is an example for extensive property?

   (a) temperature (b) pressure (c) molar entropy (d) enthalpy

2. One of the following is not a state function.

   (a) Heat (b) enthalpy (c) entropy (d) internal energy

3. The molar solubility of $PbBr_2$ is 2.17×10^{-3} M at a certain temperature. Calculate K_{sp} for $PbBr_2$.

   (a) 6.2×10^{-6} (b) 4.1×10^{-8} (c) 3.4×10^{-5} (d) 4.1×10^{-6}

4. The cell potential for Daniell cell is 1.10 V under standard condition. If the standard reduction for potential for Fe^{2+}/Fe is -0.76 V, what is the standard reduction potential for Cu^{2+}/Cu?

   (a) $+0.76$ V (b) $+1.86$ V (c) $+0.34$ V (d) -0.34 V

5. Identify the type of corrosion from the picture given below:
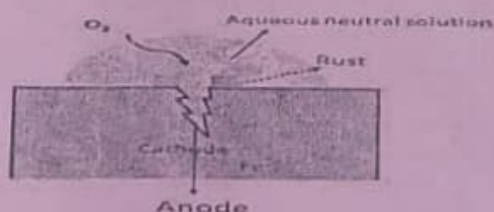
   a) Hydrogen evolution type of wet corrosion (b) dry corrosion (c) oxygen absorption type of wet corrosion (d) liquid metal corrosion

6. The green patches observed on brass utensils are composed of

    (a) Copper chloride (b) Copper oxide (c) Basic copper carbonate (d) Copper hexa-aqua complex

7. According to Pourbaix diagram of iron, which form of the metal exists at pH = 1 and E = 0 V?

    (a) Fe^{2+} (b) Fe^{3+} (c) FeO_4^{2-} (d) Fe_2O_3

8. The internal compensation is exhibited by----.

    (a) D-glucose (b) (d/l)-glycine (c) meso-tartaric acid (d) (+/-)-glutaric acid

9. The infinite number of intermediate conformations are called:

    (a) eclipsed (b) staggered (c) gauche (d) skew

10. Which of the following molecule has an alternating axis of rotation S4?

    (a) methane (b) ethane (c) ethylene (d) benzene

Part – B (2 x 10 = 20 Marks)

11a. (i) Derive Gibbs-Helmholtz equation and explain its significances. [7 marks]

    (ii) Write the equation relating equilibrium constant and the standard Gibbs free energy change of a reaction. Explain what happens when $\Delta G^\circ > 0$, $\Delta G^\circ < 0$ and $\Delta G^\circ = 0$.   [3 marks]

(OR)

b. (i) Calculate the standard EMF of a cell that uses the Mg/Mg^{2+} and Cu/Cu^{2+} half-cell reactions at 25 °C. Write the equations for two half-cells and overall cell reactions that occurs under standard-state condition and calculate overall cell potential.

    Given: $E^\circ_{Mg^{2+}/Mg} = -2.37$ V; and $E^\circ_{Cu^{2+}/Cu} = 0.34$ V.   [6 marks]

    (ii) What is a salt bridge and give its utility?   [4 marks]

12a. (i) Explain briefly the Pilling–Bedworth Rule.   [5 marks]

    (ii) For the reaction of conversion of ATP into ADP at 293 K, the change in enthalpy is 19.07 Kcal/mol, and the change in entropy is 90 Cal per mol per K. Calculate the change in Gibbs free energy for the process.

       [5 marks]

(OR)

b. (i) Describe the conformational analysis of n-butane with a neat sketch of the conformers and potential energy diagram.   [8 marks]

    (ii) What is a nucleophile? Give an example.   [2 marks]

Q. No.	BL	CO	PO	Q.No	BL	CO	PO
1.	2	2	1	10.	2	3	2
2.	2		1	11a. i.	2	2	3
3.	4		1	ii.	4		2
4.	2		1	11.b.i.	3		1
5.	3		2	ii.	2		1
6.	4		2	12.a.i	1		1
7.	2		1	ii.	3		3
8.	2	3	2	12.b.i	2	3	2
9.	1		2				

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

INTERNAL ASSESSMENT – II [FJ2]

Set - 2

Program: B. Tech.
Course Code & Title: 21CYB101J & Chemistry
Year & Sem: I Year & II Sem

Date: 27 -03- 2025
Time:12:30 – 1:30 pm
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	
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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 (10 x 1 = 10 Marks)
Answer ALL the Questions

1. Which of the following properties describe entropy?
   a) state function, intensive property
   b) state function, extensive property
   c) path function, extensive property
   d) path function, intensive property

2. The entropy of an isolated system can never _____
   a) decrease   b) be zero   c) increase   d) none of the mentioned

3. Which of the following occurs without a change in the internal energy?
   a) Isochoric process   b) Isenthalpic process   c) Steady-state process
   d) Isentropic process

4. If the temperature of the source is increased, the efficiency of a heat engine _____
   a) Increases   b) decreases   c) remains constant   d) first increases and
   then becomes constant

5. In the Pourbaix diagram of iron, which form of the metal exists at pH = 0 and E = 1.2 V?
   (a) Fe^{2+} (b) Fe^{3+} (c) FeO_4^{2-} (d) Fe_2O_3

6. Passivity is not the reason for inertness for one of the following:
   (a) Gold   (b) Aluminum   (c) Chromium   (d) Nickel

7. For $Cu(OH)_2$, $K_{sp} = 1.6 \times 10^{-19}$. What is the molar solubility of $Cu(OH)_2$?
   (a) 6.4×10^{-7} M   (b) 3.4×10^{-7} M   (c) 4.0×10^{-10} M   (d) 2.7×10^{-11} M

8. Identify the conformations from the given structures:
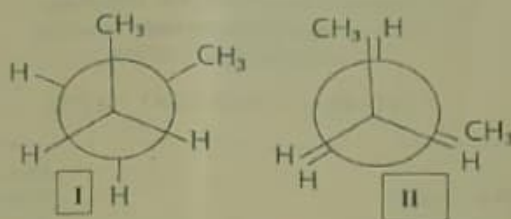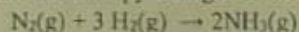

(a) I-Gauche and II-Eclipsed (b) I-Gauche and II-Gauche (c) I-Eclipsed and II-Gauche (d) both I and II are Eclipsed forms

9. Which of the following has the best leaving group?
   (a) CCl_4 (b) $CHCl_3$ (c) CH_3F (d) CH_3I

10. 1,2-Dichlorobeneze and 1,4-dichlorobeneze are the examples of
    (a) Chain isomers   (b) position isomers   (c) metamers   (d) stereoisomers

Part – B (2 x 10 = 20 Marks)

11a. (i) Describe the construction of Daniell cell (clearly indicate the electrodes, electrolytes, half-cell reactions, overall reaction, and cell potential).   [6 marks]

(ii) Calculate the entropy change for the following reaction at standard condition:
$$N_2(g) + 3 H_2(g) \rightarrow 2NH_3(g)$$
The standard molar entropies are given as:
$S^\circ(H_2) = 130.6\ J\ mol^{-1}\ K^{-1}$
$S^\circ(N_2) = 191.5\ J\ mol^{-1}\ K^{-1}$
$S^\circ(NH_3) = 192.5\ J\ mol^{-1}\ K^{-1}$.   [4 marks]

(OR)

b. What is corrosion? Give its types. Compare the hydrogen evolution type with oxygen absorption type of wet corrosion with suitable reactions.   [10 marks]

12a. (i) Derive Nernst equation and explain any one application.   [7 marks]

(ii) Explain with chemical equation what happens when a copper rod is dipped into a solution containing $AgNO_3$.   [3 marks]

(OR)

b. (i) By applying Cahn-Ingold-Prelog rules determine the R/S convention for the following molecule (explain steps).   [5 marks]
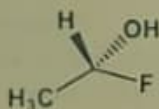
(ii) Explain any two structural isomerism with an example for each.   [5 marks]

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

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