Devesh Jindal's

The Weavers Institute

TARGET: Class 12th CBSE Boards 2024-25

Chemistry (Solutions and Electrochemistry)

BATCH: 12th   **DURATION: 1 HR 30 min**   **MAX. MARKS: 35**

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose

INSTRUCTIONS

Section A – *From question 1 to 7 are MCQs and 8-9 are assertion and reason based of 1 mark each.*
Section B – *Question no. 10-12 are Very Short Answer Type Questions, carrying 2 marks each.*
Answer to each question should not exceed 40 words.
Section C contains Q.13-14 are Short Answer Type Questions, carrying 3 marks each.
Answer to each question should not exceed 60 words
Section D – *Questions no 15 are case based questions with three sub questions and are of 4 marks each.*
Section-E - Question no. 16-17 are long answer type questions, carrying 5 marks each.
Answer to each question should not exceed 120 words
There is no overall choice in the question paper. However, an internal choice has been provided in few questions. Only one of the choices in such questions have to be attempted.

Section A

1. Which of the following formula represents Raoult's law for a solution containing non-volatile solute?

   (A) $p_{solute} = p°_{solute} \cdot x_{solute}$

   (B) $p = K_H \cdot x$

   (C) $p_{Total} = p_{solvent}$

   (D) $p_{solute} = p°_{solvent} \cdot x_{solvent}$

   Ans Option (D) is correct

2. An azeotropic solution of two liquids has a boiling point lower than either of the two when it MCQ
   (A) shows a positive deviation from Raoult's law.
   (B) shows a negative deviation from Raoult's law.
   (C) shows no deviation from Raoult's law.
   (D) is saturated

3. An unknown gas 'X' is dissolved in water at 2.5 bar pressure and has mole fraction 0.04 in solution. The mole fraction of 'X' gas when the pressure of gas is doubled at the same temperature is
   (A) 0.08   (B) 0.04   (C) 0.02   (D) 0.92
   Ans Option (A) is correct

4. The boiling point of a 0.2 m solution of a nonelectrolyte in water is (K_b for water = 0.52 K kg/mol)
   (A) 100°C   (B) 100.52°C   (C) 100.104°C   (D) 100.26°C
   Ans Option (C) is correct

5. Calculate degree of dissociation (α) of acetic acid if its molar conductivity (Λ_m) is 39.05 Scm²/mol. Given Λ°_{H+} = 349.6 S cm²/mol and $\Lambda^0_{CH3COO-}$ = 40.9 S cm²/mol.
   (A) 0.2   (B) 0.1   (C) 0.05   (D) 1
   option (B)

6. Which of the following option will be the limiting molar conductivity of CH_3COOH if the limiting molar conductivity of CH_3COONa is 91Scm²/mol? Limiting molar conductivity for individual ions are given in the following table.

S.No	Ions	Limiting molar conductivity / Scm²mol⁻¹
1	H^+	349.6
2	Na^+	50.1
3	K^+	73.5
4	OH^-	199.1

   (A) 350 Scm²mol⁻¹
   (B) 375.3 Scm²mol⁻¹
   (C) 390.5 Scm²mol⁻¹
   (D) 340.4 Scm²mol⁻¹
   Ans Option (C) is correct

7. What is the molar conductance at infinite dilution for sodium chloride if the molar conductance at infinite dilution of Na^+ and Cl^- ions are 51.12×10^{-4} Scm²/mol and 73.54×10^{-4} Scm²/mol respectively?
   (A) 124.66 Scm²/mol   (B) 22.42 Scm²/mol
   (C) 198.20 Scm²/mol   (D) 175.78 Scm²/mol
   Ans Option (A) is correct.

8. Assertion: Conductivity of an electrolyte increases with decrease in concentration.
   Reason: Number of ions per unit volume decreases on dilution.
   Ans Option (D) is correct.

9. Assertion (A): A molar solution is more concentrated than molal solution.
   Reason (R): A molar solution contains one mole of solute in 1000 mL of solution.
   Ans Option (A) is correct.

Section B

10. 18 g of glucose, $C_6H_{12}O_6$ (Molar Mass = 180 g mol⁻¹) is dissolved in 1 kg of water in a saucepan. At what temperature will this solution boil? (K_b for water = 0.52 K kg mol⁻¹, boiling point of pure water = 373.15 K)

11. Solutions of two electrolytes 'A' and 'B' are diluted. The limiting molar conductivity of 'B' increases 1.5 times while that of 'A' increases 25 times. Which of the two is a strong electrolyte? Justify your answer Graphically showing the behaviour of 'A' and 'B'.

12. Give reasons:

(a) A decrease in temperature is observed on mixing ethanol and acetone.

(b) Potassium chloride solution freezes at a lower temperature than water.

Section C

13. Give reasons for the following:

(a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.

(b) Aquatic animals are more comfortable in cold water than in warm water.

(c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

14. Calculate $\Lambda_r G°$ and log K_c for the following cell:

$Ni(s) + 2 Ag^+(aq) \rightarrow Ni^{2+}(aq) + 2 Ag(s)$
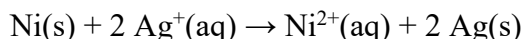
Given that E° cell = 1.05 V, 1 F = 96,500 C/mol

Ans: $K_c = 3.41 \times 10^{35}$

Section D

15. Read the passage given below and answer the following questions: The potential difference between the two electrodes of a galvanic cell is called the cell potential and is measured in volts. The cell potential is the difference between the electrode potential (reduction potential) of the cathode and anode. It is called the electromotive force (emf) of the cell when no current is drawn through the cell. It is now an accepted convention that we keep the anode on the left and the cathode on the right while representing the galvanic cell. A galvanic cell is generally represented by putting a vertical line between metal and electrolyte solution and putting a double vertical line between the two electrolytes connected by a salt bridge. In a galvanic cell, the following cell reaction occurs:

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$
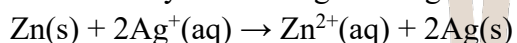
E°cell = +1.56 V

A. What is the direction of the flow of electrons?
   a) First from silver to zinc, then the direction reverses
   b) Silver to zinc
   c) First from zinc to silver, then the direction reverses
   d) Zinc to silver
   Ans. Option (D) is correct.

B. How will concentration of Zn^{2+} ions and Ag^+ ions be affected when the cell functions?
   a) Concentration of both Zn^{2+} and Ag^+ ions increase
   b) Concentration of Zn^{2+} increases and Ag^+ ions decreases
   c) Concentration of Zn^{2+} decreases and Ag^+ ions increases
   d) Concentration of both $Zn2+$ and $Ag+$ ions decreases
   Ans. Option (B) is correct.

C. Name the cell which is generally used in inverters?
   a) Mercury cell
   b) Leclanche cell
   c) Lead storage battery
   d) Lithium-ion battery
   Ans. Option (C) is correct
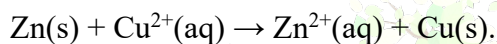
OR

Which cell uses a 38% solution of sulphuric acid as an electrolyte?
   a) Lead storage cell
   b) Leclanche cell
   c) Lithium-ion battery
   d) Fuel cell
   Ans. Option (A) is correct

D. The standard electrode potential for Daniel cell is 1.1V. Calculate the standard Gibbs energy for the reaction:
   $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$.
   a) 215.36 kJ mol^{-1}
   b) −212. 27 kJ mol^{-1}
   c) 212.27 kJ mol^{-1}
   d) −218 kJ mol^{-1}
   Ans. Option (B) is correct

Section E

16. (a) 30 g of urea (M = 60 g mol^{-1}) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.
    (b) Write two differences between ideal solutions and non-ideal solutions.

17. (a) Calculate e.m.f. of the following cell:
    $Zn(s)|Zn^{2+}$ (0.1 M) $\|$ (0.01 M) $Ag^+|Ag(s)$
    Given: $E^o_{Zn2+/Zn}$ = -0.76 V, $E^o_{Ag+/Ag}$ = +0.80
    [Given: log 10 = 1]
    (b) X and Y are two electrolytes. On dilution molar conductivity of 'X' increases 2.5 times while that Y increases 25 times. Which of the two is a weak electrolyte and why?