Subject: Chemistry (043)

Marks: 25

Name: _____

Grade: XII

Time: 1 Hour

Date: 28-07-2025

General Instructions:

I. The question paper comprises five sections - A to E. There are 12 questions in the question paper. All questions are compulsory.

II. Section - A, Question Nos. 1 to 6 are Multiple Choice Questions (MCQs) and Assertion - Reason Type Questions, carrying 1 mark each.

III. Section - B, Question Nos. 7 and 8 are Short Answer Type Questions, carrying 2 marks each.

IV. Section - C, Question Nos. 9 and 10 are Short Answer Type Questions, carrying 3 marks each.

V. Section - D, Question No. 11 is a Case Based Question carrying 4 marks.

VI. Section - E, Question No. 12 is a Long Answer Type Question carrying 5 marks.

VII. There is no overall choice. However, internal choices have been provided in some questions. Attempt only one of the alternatives in such questions.

VIII. Use of calculators and log tables is not permitted.

IX. Atomic masses of some elements: H= 1u, C = 12u, N= 14u, He = 4u, Ca = 40u, Na = 23u, O = 16u, Cl = 35.5u and S= 32

SECTION – A

Question Nos. 1 to 4 are multiple-choice questions. Choose the most appropriate answer:

1. While charging the lead storage battery _____. [1]
   (a) $PbSO_4$ anode is reduced to Pb
   (b) $PbSO_4$ cathode is reduced to Pb
   (c) $PbSO_4$ cathode is oxidised to Pb
   (d) $PbSO_4$ anode is oxidised to PbO_2

2. Which of the following statements is not correct about an inert electrode in a cell? [1]
   (a) It does not participate in the cell reaction.
   (b) It provides a surface either for oxidation or for reduction reactions.
   (c) It provides a surface for conduction of electrons.
   (d) It provides a surface for redox reactions.

3. Which of the following aqueous solutions should have the highest boiling point? [1]
   (a) 1.0 M NaOH   (b) 1.0 M Na_2SO_4 (c) 1.0 M NH_4NO_3 (d) 1.0 M KNO_3

4. On the basis of the information given below, mark the correct option. [1]
   Information:
   (A) In a bromoethane and chloroethane mixture, intermolecular interactions of the A - A and B - B types are nearly the same as A - B type interactions.
   (B) In an ethanol and acetone mixture, A - A or B - B type intermolecular interactions are stronger than A - B type interactions.
   (C) In a chloroform and acetone mixture, A - A or B - B type intermolecular interactions are weaker than A - B type interactions.
   (a) Solutions (B) and (C) will follow Raoult's law.
   (b) Solution (A) will follow Raoult's law.
   (c) Solution (B) will show negative deviation from Raoult's law.
   (d) Solution (C) will show positive deviation from Raoult's law.

In Question No. 5 and 6, two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

5. Assertion (A): Azeotropic mixtures are formed only by non-ideal solutions and they may have boiling points either greater than both the components or less than both the components. [1]

    Reason (R): The composition of the vapour phase is the same as that of the liquid phase of an azeotropic mixture.

6. Assertion (A): During electrolysis of aqueous copper sulphate solution using copper electrodes, hydrogen gas is released at the cathode. [1]

    Reason (R): The electrode potential of Cu^{2+}/Cu is greater than that of H^+/H_2.

SECTION – B

7. For the cell: $Zn(s) \mid Zn^{2+}(2M) \mid\mid Cu^{2+}(0.5\ M) \mid Cu(s)$ [2]

    (a) Write an equation for each half-reaction.

    (b) Calculate the cell potential at 25 °C.

    (Given: $E^0 Zn^{2+}/Zn = -0.76$ V; $E^0 Cu^{2+}/Cu = +0.34$ V, log 4 = 0.6021)

8. If N_2 gas is bubbled through water at 293 K, how many millimoles of N_2 gas would dissolve in 1 litre of water? Assume that N_2 exerts a partial pressure of 0.987 bar. Given that Henry's law constant for N_2 at 293K is 76.48 kbar. [2]

SECTION – C

9. What would be the molar mass of a compound if 6.21 g of it dissolved in 24.0 g of chloroform forms a solution that has a boiling point of 68.04 °C? The boiling point of pure chloroform is 61.7 °C and the boiling point elevation constant, K_b for chloroform is 3.63 °C/m. [3]

10. (a) Calculate the λ^0_m for Cl^- ion from the data given below: $\Lambda^0_m\ MgCl_2 = 258.6\ Scm^2 mol^{-1}$ and $\lambda^0_m\ Mg^{2+} = 106\ Scm^2 mol^{-1}$ [1]

    (b) The cell constant of a conductivity cell is 0.146 cm^{-1}. What is the conductivity of a 0.01 M solution of an electrolyte at 298 K, if the resistance of the cell is 1000 ohm? [2]

SECTION – D

11. Read the passage given below and answer the questions that follow:

    Solutions are homogeneous mixtures of two or more substances. An ideal solution follows Raoult's law. The vapour pressure of each component is directly proportional to their mole fraction if both solute and solvent are volatile. The relative lowering of vapour pressure is equal to the mole fraction of solute if only the solvent is volatile. Non-ideal solutions form azeotropes, which cannot be separated by fractional distillation. Henry's law is a special case of Raoult's law applicable to gases dissolved in liquids. Colligative properties depend upon the number of particles of solute. Relative lowering of vapour pressure, elevation in boiling point, depression in freezing point and osmotic pressure are colligative properties that depend upon the mole fraction of solute, molality and molarity of solutions. When a solute undergoes either association or dissociation, the molecular mass determined by colligative property will be abnormal. The

12   Consider three surfaces, A, B and C, which are placed perpendicular to the electric field 'E'. These   [1×4]
     surfaces are equidistant from each other.
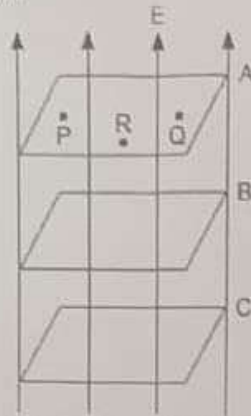
(i) If a charge +q is moved from 'P' to point 'Q' via a point 'R' on the surface A, then how much work is
done in this case?

  (a) qE   (b) qV   (c) qF   (d) Zero

(ii) What will happen if the electric field becomes parallel to these surfaces in part (i)?
  (a) Work done will be zero.
  (b) Force due to the electric field will be zero.
  (c) Some work will be done.
  (d) None of the above.

(iii) Consider that these surfaces are not at equal distances, then what will it represent?
  (a) The electric field is zero.
  (b) The electric field is constant.
  (c) The electric field is not constant.
  (d) The potential difference between P and Q is positive.

(iv) What will happen if surfaces 'B' and 'C' intersect in the same field?
  (a) There will be two directions of electric fields, which is not possible for equipotential surfaces.
  (b) There will be two directions of electric fields, indicating equipotential surfaces.
  (c) It will not affect the direction of the electric field.
  (d) None of the above.

OR

The nature of the equipotential surface for a point charge is:
  (a) Ellipsoid with charge at foci.
  (b) Sphere with charge at the centre of the sphere.
  (c) Sphere with a charge on the surface of the sphere.
  (d) Plane with a charge on the surface.