ANANDALAYA
PERIODIC TEST -1
Class: XII

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Subject: Chemistry (043)	MM: 40
Date : 18-07-2024	Time: 1 Hr. 30 min.

General Instructions:
1. There are 20 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
3. Section A consists of twelve MCQs of 1 mark each, Section B consists of two questions of 2 marks each, Section C consists of two questions of 3 marks each, Section D consists of two questions of 5 marks each and Section E consists two case study-based questions of 4 marks each.
4. There is no overall choice. However, an internal choice has been provided in section D and E. You have to attempt only one of the choices in such questions.
5. Use of calculators is not allowed.

SECTION A

1. A solution of two miscible liquids showing negative deviation from Raoult's law will have: (1)
   (A) increased vapour pressure, increased boiling point
   (B) increased vapour pressure, decreased boiling point
   (C) decreased vapour pressure, decreased boiling point
   (D) decreased vapour pressure, increased boiling point

2. Identify the mixture that shows positive deviations from Raoult's law. (1)
   (A) $(CH_3)_2CO + C_6H_5NH_2$ (B) $CHCl_3 + C_6H_6$
   (C) $(CH_3)_2CO + CHCl_3$ (D) $(CH_3)_2CO + CS_2$

3. In the depression of freezing point experiment: (1)
   (A) Vapour pressure of the solute is less than that of pure solvent.
   (B) Vapour pressure of the solution is more than that of pure solvent.
   (C) Only solute molecules solidify at the freezing point.
   (D) Only solvent molecules solidify at the freezing point.

4. Evaluate the following statements for their correctness and choose the correct answer from the options given (1)
   (i) The elevation in boiling point temperature will be same for 0.1 M NaCl and 0.1 M urea.
   (ii) Azeotropic mixtures boil without change in composition.
   (iii) Osmosis always takes place from hypertonic to hypotonic solution.
   (iv) The density of 32 % solution H_2SO_4 having molarity 4.09 M is approximately 1.26 g/mL

   (A) (ii) and (iii) only   (B) (i), (ii) and (iv) only
   (C) (i) and (iii) only   (D) (ii) and (iv) only.

5. A solution containing 62 g of ethylene glycol in 250 g of water is cooled to minus 10°C. if K_f (1) for water is 1.86 K kg mol^{-1}, the amount of water (in g) separated as ice is:
   (A) 48   (B) 32   (C) 64   (D) 16

6. Identify the factor from the following that does not affect electrolytic conductance of a (1) solution.
   (A) The nature of the electrolyte added.   (B) The nature of the electrode used.
   (C) Concentration of the electrolyte.   (D) The nature of solvent used.

7. The standard electrode potential (M^{3+}/M^{2+}) for V, Cr, Mn and Co are -0.26 V, -0.41 V, (1)
$+1.57$ V and $+1.97$ V respectively. The metal ions which can liberate H_2 from a dilute acid
are _____.
(A) V^{2+} and Mn^{2+} (B) Cr^{2+} and Co^{2+} (C) V^{2+} and Cr^{2+} (D) Mn^{2+} and Co^{2+}

8. For lead storage battery pick the correct statements (1)
(i) During charging of battery, $PbSO_4$ on anode is converted into PbO_2
(ii) During charging of battery, $PbSO_4$ on cathode is converted into PbO_2
(iii) Lead storage battery consists of grid of lead packed with PbO_2 as anode
(iv) Lead storage battery has 38% solution of sulphuric acid as an electrolyte
(A) (i), (ii), (iv) only   (B) (ii), (iii), (iv) only
(C) (ii), (iii) only   (D) (ii), (iv) only

9. Which of the following is given to a fuel cell's cathode? (1)
(A) Hydrogen   (B) Nitrogen   (C) Oxygen   (D) Chlorine

10. Which one of the following graphs between molar conductivity (λm) versus $\sqrt{c}$ is correct? (1)
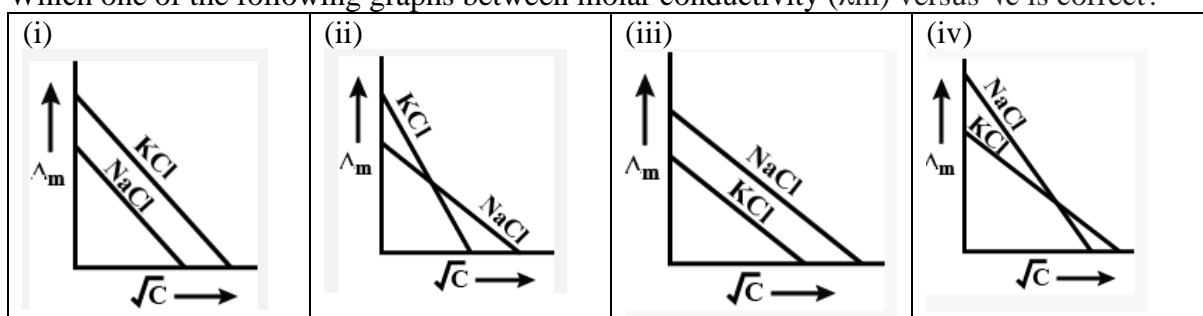
(A) (i)   (B) (ii)   (C) (iii)   (D) (iv)

For question numbers 11 and 12, two statements are given-one labelled Assertion and the
other labelled Reason. Select the correct answer to these questions from the codes (A), (B),
(C) and (D) as given below.
(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
(B) Both Assertion and Reason are true but Reason is NOT the correct explanation of
    Assertion.
(C) Assertion is true but Reason is false
(D) Assertion is false and Reason is also false.

11. **Assertion:** Azeotropic mixtures are formed only by non-ideal solutions and they may have (1)
boiling points either greater than both the components or less than both the
components.
Reason: The composition of the vapour phase is same as that of the liquid phase of an
azeotropic mixture.

12. **Assertion:** The resistivity for a substance is its resistance when it is one meter long and its (1)
area of cross section is one square meter.
Reason: The SI units of resistivity is ohm metre (m).

SECTION B

13. Suggest the most important type of intermolecular attractive interaction in the following pairs. (2)
(i) n-hexane and n-octane (ii) I_2 and CCl_4 (iii) $NaClO_4$ and water (iv) methanol and acetone

14. Calculate the number of grams of aluminium produced in 1.00 h by the electrolysis of molten (2)
$AlCl_3$ if the electrical current is 10.0 A.

SECTION C

15. The osmotic pressure of a solution containing 5.87 mg of an unknown protein per 10.0 mL of solution is 2.45 Torr at 25 °C. Find the molar mass of the unknown protein. (3)

16. Consider a redox reaction for which E° is a negative number. (3)
    (a) What is the sign of $\Delta G°$ for the reaction?
    (b) Will the equilibrium constant for the reaction be larger or smaller than 1?
    (c) Can an electrochemical cell based on this reaction accomplish work on its surroundings?

SECTION D

17. Write the half reactions occurring at the anodic and cathodic regions during corrosion of iron. Explain the role of each of the following in promoting corrosion: moisture, electrolytes, and acids (5)

OR

Write the half-reaction occurring at the anode and the cathode for electrolysis for each reaction: (a) a mixture of molten $AlBr_3$ and $MgCl_2$ (b) an aqueous solution of LiI and $CuBr_2$. Give reason for your choice. [E° Al^{3+}/Al = - 1.66 V (aqueous), E° Mg^{2+}/Mg = -2.37 V (aqueous), E° Cl_2/Cl^- = 1.36 V, E° $Br^2/Br-$ = 1.09 V, E° Cu^{2+}/Cu = 0.52 V, E° Li^+/Li = -3.04 V, E° I_2/I^- = 0.54 V]

18. (a) State Raoult's law for a solution containing volatile components. Name the solution which follows Raoult's law at all concentrations and temperatures. (5)
    (b) Calculate the boiling point elevation for a solution prepared by adding 10 g of $CaCl_2$ to 200 g of water.
    (K_b for water = 0.512 K kg mol^{-1}, Molar mass of $CaCl_2$ = 111 g mol^{-1})

SECTION E

Questions 19 and 20 are Case Study Based questions and are compulsory. Each question carries 4 marks.

19. Read the passage and answer the questions given below:
    The study of the conductivity of electrolyte solutions is important for the development of electrochemical devices, for the characterisation of the dissociation equilibrium of weak electrolytes and for the fundamental understanding of charge transport by ions. The conductivity of electrolyte is measured for electrolyte solution with concentrations in the range of 10^{-3} to 10^{-1} mol L^{-1} as solution in this range of concentrations can be easily prepared. The molar conductivity (Am) of strong electrolyte solutions can be nicely fit by Kohlrausch equation. $\Lambda_m = \Lambda^0_m - Kc^{\frac{1}{2}}$, where Λ_m is the molar conductivity, Λ^0_m is the limiting molar conductivity (the molar conductivity in the limit of zero concentration when the ions do not interact with each other), K is a coefficient of proportionality to be obtained from the experiment. The molar conductivity of weak electrolytes, on the other hand, is dependent on the degree of dissociation of the electrolyte. In general, if an electrolyte on dissociation gives ν_+ cations and ν_- anions then its limiting molar conductivity is given by:
    $$\Lambda^0_m = \nu_+ \lambda^0_+ + \nu_- \lambda^0_-$$

    (i) Which statement about the term infinite dilution is correct? (1)
       (A) Infinite dilution refers to hypothetical situation when the ions are infinitely far apart.
       (B) The molar conductivity at infinite dilution of NaCl can be measured directly in solution.
       (C) Infinite dilution is applicable only to strong electrolytes.
       (D) Infinite dilution refers to a real situation when the ions are infinitely far apart.

    (ii) Which of the following is a strong electrolyte in aqueous solution? (1)
       (A) HNO_2 (B) HCN   (C) NH_3 (D) HCI

(iii) If the molar conductivities at infinite dilution for NaI, CH_3COONa and $(CH_3COO)_2Mg$ (2)
are 12.69, 9.10 and 18.78 S cm^2 mol^{-1} respectively at 25 ^{0}C, then the molar conductivity of MgI_2 at infinite dilution is (a) 25.96 S cm^2, mol^{-1} (b) 390.5 S cm^2 mol^{-1} (c) 189.0 S cm^2 mol^{-1} (d) 3.89 x 10^{-2} S cm^2 mol^{-1}

OR

(iii) Which of the following is the correct order of molar ionic conductivities of the following ions in aqueous solutions? Give reason
(A) $Li^+ < Na^+ < K^+ < Rb^+$ (B) $Li^+ > Na^+ > K^+ > Rb^+$
(C) $Rb^+ < Na^+ < Li^+ < K^+$ (D) $Li^+ < Rb^+ < Na^+ < K^+$

20. Read the passage given below and answer the following questions:
Boiling point or freezing point of liquid solution would be affected by the dissolved solids in the liquid phase. A soluble solid in solution has the effect of raising its boiling point and depressing its freezing point. The addition of non-volatile substances to a solvent decreases the vapor pressure and the added solute particles affect the formation of pure solvent crystals. According to many researches the decrease in freezing point directly correlated to the concentration of solutes dissolved in the solvent. This phenomenon is expressed as freezing point depression and it is useful for several applications such as freeze concentration of liquid food and to find the molar mass of an unknown solute in the solution. Freeze concentration is a high-quality liquid food concentration method where water is removed by forming ice crystals. This is done by cooling the liquid food below the freezing point of the solution. The freezing point depression is referred as a colligative property and it is proportional to the molar concentration of the solution (m), along with vapour pressure lowering, boiling point elevation, and osmotic pressure. These are physical characteristics of solutions that depend only on the identity of the solvent and the concentration of the solute. The characters are not depending on the solute's identity.

(i)   When a non-volatile solid is added to pure water it will: (1)
(A) Boil above 100ºC and freeze above 0ºC
(B) Boil below 100ºC and freeze above 0ºC
(C) Boil above 100ºC and freeze below 0ºC
(D) Boil below 100ºC and freeze below 0ºC

(ii) Colligative properties are: (1)
(A) Dependent only on the concentration of the solute and independent of the solvent's and solute's identity.
(B) Dependent only on the identity of the solute and the concentration of the solute and independent of the solvent's identity.
(C) dependent on the identity of the solvent and solute and thus on the concentration of the solute.
(D) dependent only on the identity of the solvent and the concentration of the solute and independent of the solute's identity.

(iii) Assume three samples of juices A, B and C have glucose as the only sugar present in them. The concentration of sample A, B and C are 0.1M, .5M and 0.2 M respectively. For which juice the freezing point will be the highest? Give reason.   (2)
(A) A   (B) B   (C) C   (D) All have same freezing point

OR

(iii) Identify which of the following is a colligative property and define the same.
(A) freezing point   (B) boiling point
(C) osmotic pressure   (D) all of the above