ANANDALAYA
PERIODIC TEST -1
Class: XII

विद्या सर्वार्थ साधिका

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Subject: Chemistry (043)	MM : 40
Date : 14-07-2025	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 long 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.

SECTION A

1. For a reaction, $A + B \rightarrow AB$, the order with respect to A and B is 1 and 2 respectively. (1) What will be the change in the rate of reaction if the concentration of A and B doubled?
   (A) Increases four times   (B) Decreases four times
   (C) Increases eight times   (D) Decreases eight times

2. The molar conductance at infinite dilution for CH_3COONa is 92.5 S cm^2 mol^{-1}. Using graph and given information, the molar conductivity of CH_3COOH will be _____. (1)

   (A) 399.4 S cm^2 mol^{-1}
   (B) 175 S cm^2 mol^{-1}
   (C) 22.42 S cm^2 mol^{-1}
   (D) 124 S cm^2 mol^{-1}
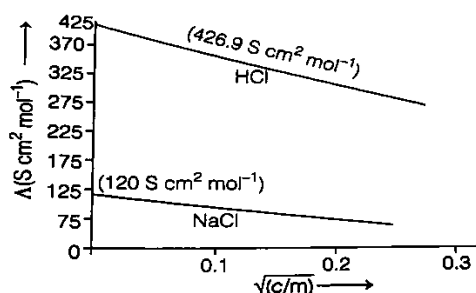
3. If the rate constant for the decomposition of N_2O_5 is 6×10^{-4} s^{-1}, what will be the half-life period for the decomposition of N_2O_5 in seconds? (1)
   (A) 11.55   (B) 115.5   (C) 1155   (D) 1.155

4. The temperature dependence of the rate constant k is expressed as $k = A e^{-\frac{Ea}{RT}}$. When a graph of log k Vs $\frac{1}{T}$ is plotted, we get the graph as shown. What is the value of slope in the graph? (1)
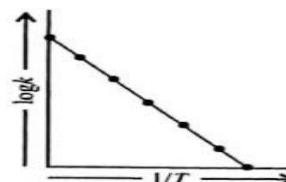
   (A) $\frac{Ea}{RT}$ (B) $\frac{-Ea}{2.303\ R}$ (C) $\frac{-Ea}{2.0303\ RT} \log A$ (D) $\frac{-Ea}{2.303\ T}$

5. A cathode and an anode are the most common components of an electrochemical cell. Which of the following claims about the cathode is correct? (1)
   (A) Oxidation occurs at the cathode   (B) Electrons move into the cathode
   (C) Usually denoted by a negative sign   (D) Usually made up of insulating material

6. The van't Hoff factor for $Na_2SO_4 .10H_2O$ on its complete ionisation is _____. (1)
   (A) 1   (B) 13   (C) 3   (D) 2

7. An unripe mango placed in a concentrated salt solution to prepare pickle, shrivels because _____. (1)
   (A) it gains water due to osmosis.   (B) it loses water due to reverse osmosis.
   (C) it gains water due to reverse osmosis.   (D) it loses water due to osmosis.

8. A solution is prepared by mixing 1 mole of liquid A with 2 moles of liquid B. The total vapour pressure of the resulting solution is 38 torr. The vapour pressures of pure liquids A and B are 45 torr and 36 torr, respectively. The solution _____. (1)
   (A) is an ideal solution.
   (B) shows negative deviation.
   (C) is a minimum boiling azeotrope.
   (D) has $\Delta V = 0$.

9. Which of the following substance has highest solubility in water? (1)
   (A) Ethanol   (B) Toluene   (C) Benzene   (D) Ethane-1,2-diol

10. Observe the given graph carefully. (1)
    The activation energy of the backward reaction, heat of reaction and threshold energy of the reaction respectively are _____.
    (A) $x - y$, y and $x + y - z$
    (B) $x + y + z$, $y + z$ and z
    (C) $x + y$, y and $x + y + z$
    (D) $x + y$, y and $x - y - z$.
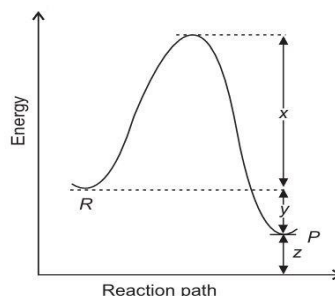
    For question numbers 11 and 12, select the correct answer from the codes (A), (B), (C) and (D) as given below.
    (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
    (B) Both Assertion and Reason are true but Reason is NOT the correct explanation of Assertion.
    (C) Assertion is true but Reason is false
    (D) Assertion is false but Reason is true.

11. A: If a solution contains both H^+ ions and Na^+, the H^+ ions are reduced first at cathode. (1)
    R: Cations with higher E^0 value are reduced first at cathode.

12. A: Conductivity of solution does not depend upon the dilution process. (1)
    R: Greater the dilution of an electrolyte lesser will be the conductivity of the solution.

SECTION B
13. The conductivity of 0.001028 mol L^{-1} acetic acid is 4.95×10^{-5} S cm^{-1}. Calculate its degree of dissociation if Λ^0_m for acetic acid is 390.5 S cm^2 mol^{-1}. (2)

14. Two different solutions of sucrose of same molality prepared in different solvents will have the same depression in freezing point. True or false? Justify your answer. (2)

SECTION C
15. Ethylene glycol (Molar mass = 62 g/mol) is used as an antifreeze agent. Calculate the amount of ethylene glycol to be added to 4 Kg of water to prevent it from freezing at − 6 ℃. (K_f for water is 1.85 K kg mol^{-1}) (3)

16. (a) State Faraday's second law of Electrolysis. (3)
    (b) What will the quantity of charge required to obtain one mole of Aluminium from Al_2O_3?
    (c) Write the chemical reactions that occur at the anode and the cathode during the operation of a lead storage battery.

SECTION D

17. (a) Suggest the most important type of intermolecular attractive interaction in the following pairs. (i) I_2 and CCl_4 (ii) $NaClO_4$ and water   (5)

(b) Determine the amount of $CaCl_2$ (i = 2.47, Molecular mass = 111 g/mol) dissolved in 2.5 litre of water such that its osmotic pressure is 0.75 atm at 27° C.

(c) The boiling point of a pure solvent is always lower than that of its solution. The graph shows the elevation in boiling point for two different solutions, labelled as solution 1 and solution 2. Based on the graph, which solution contains a higher concentration of solute?
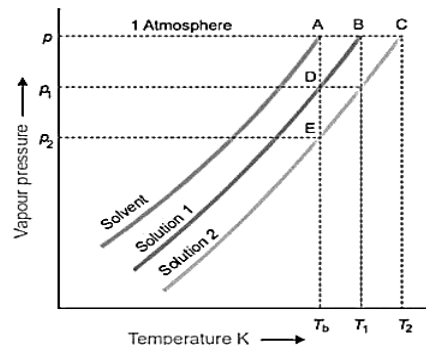
OR

(a) Arrange Ethanol, Water, Acetone and Hexane in increasing order of their solubility in diethyl ether (dipole moment – 0).

(b) Observe the given image showing red blood cells placed in three different solutions labelled A, B, and C. Based on the condition of the cells, identify each solution as isotonic, hypertonic, or hypotonic.
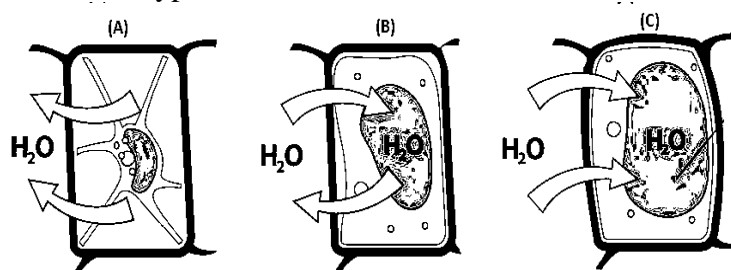
(c) Two gases, A and B, are equally soluble at 1 atm pressure. When the pressure is increased to 3 atm, gas A becomes more soluble than gas B. What can you infer about the Henry's constant (k_H) values for gases A and B?

18. (a) Why does the rate of a reaction not remain constant throughout the reaction process?   (5)

(b) Show that in a first order reaction, time required for completion of 99.9% is 10 times of half-life ($t_{1/2}$) of the reaction.

(c) In the Arrhenius equation, what does the factor $e^{-Ea/RT}$ represent?

SECTION E

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

19. Electrochemistry is the branch of chemistry that deals with the relationship between electrical energy and chemical changes. It plays a crucial role in many industries and everyday applications, from batteries to electroplating and corrosion prevention.

Electrochemical Cell: An electrochemical cell is a device that converts chemical energy into electrical energy through spontaneous redox reactions.

Example: Daniel cell (Zn–Cu cell), dry cell, lead-acid battery (during discharge).

Electrolytic Cell: An electrolytic cell uses electrical energy to drive a non-spontaneous chemical reaction.

Example: Electrolysis of water, electroplating, extraction of metals like aluminium.

Both types of cells demonstrate fundamental electrochemical principles but work in opposite ways. Electrochemical cells power our devices and vehicles, while electrolytic cells help us produce pure metals, electroplate objects, and split compounds.

(a) When E(ext.) > 1.1 V, how the direction of electron and current change in Daniell cell? (1)

(b) Write the Nernst equation for the following Galvanic cells at 298 K. (1)
$$Pt(s)|Br^-(0.010 \text{ M})|Br_{2\ (l)}||H^+(0.030 \text{ M})| H_2 (g) (1 \text{ bar})|Pt(s).$$

(c) What mass of Silver (At. Mass =108 u) could be placed on a spoon from elctrolysis of (2)
AgNO$_3$ solution by one ampere current for 10 minutes?

OR

(c) Value of standard electrode potential for the oxidation of Cl$^-$ ions is more positive than
that of water, even then in the electrolysis of aqueous sodium chloride, Cl$^-$ oxidised at
anode instead of water. Give reason.

20. Graphs play a vital role in chemical kinetics as they help visualize the relationship between
various parameters such as concentration, time, temperature, and reaction rate. They allow
chemists to:
Determine reaction order: By plotting concentration vs. time or rate vs. concentration, the
order of a reaction can be identified.
Calculate rate constants: Slope and intercepts from kinetic graphs help determine rate
constants and other kinetic parameters.
Understand mechanisms: Graphs reveal whether a reaction follows simple or complex
pathways.
Analyse temperature effects: Distribution curves like the Maxwell-Boltzmann graph show
how temperature affects the fraction of molecules with enough energy to react.
Overall, graphs make it easier to interpret experimental data and develop models to explain
and predict chemical behaviour.

(a) What are the similarities and differences between graphs A and B? (1)

A

B
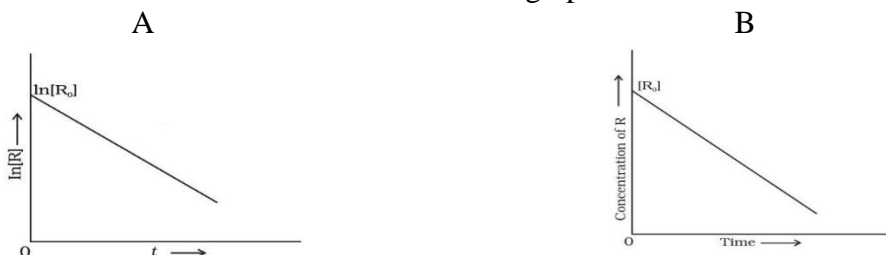
(b) Write one point of difference between Molecularity and order of the reaction. (1)

(c) You are given two graphs of $t_{1/2}$ vs $[R]_0$ (Initial concentration of reactant). Identify the (2)
graph for zero order reaction. Also, what will be the value of it's slope?
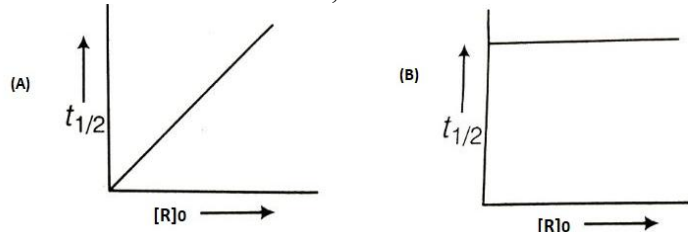
OR

(c) The following graph shows the Maxwell-
Boltzmann distribution curve, which
illustrates the temperature dependence of
the rate of a reaction.
  (i) What do you infer from the graph?
  (ii) What does the marking 'A' and 'B' in
      the graph indicates?