विद्या सर्वार्थ साधिका

ANANDALAYA

PERIODIC TEST – 2

Class: XII

Subject: Chemistry MM: 70

Date 21-09-2022 Time: 3 Hrs

General Instructions:

1. There are 31 questions in this question paper. All questions are compulsory.
2. Section A: Q. No. 1 to 4 are case based questions having four MCQs or Assertion Reasoning type or very short answer type based on the given passage each carrying 1 mark
3. Section B: Q. No. 5 to 14 are MCQs and Q 15- Q18 are Assertion Reasoning based questions and carry 1 mark each.
4. Section C: Q. No. 19 to 23 are short answer questions and carry 2 marks each.
5. Section D: Q. No. 24 to 28 are long answer type [I] questions and carry 3 marks each.
6. Section E: Q. No. 29 to 31 are long answer type [II] questions and carry 5 marks each.
7. There is no overall choice. However internal choices have been provided.
8. Use of calculators and log tables is not permitted.

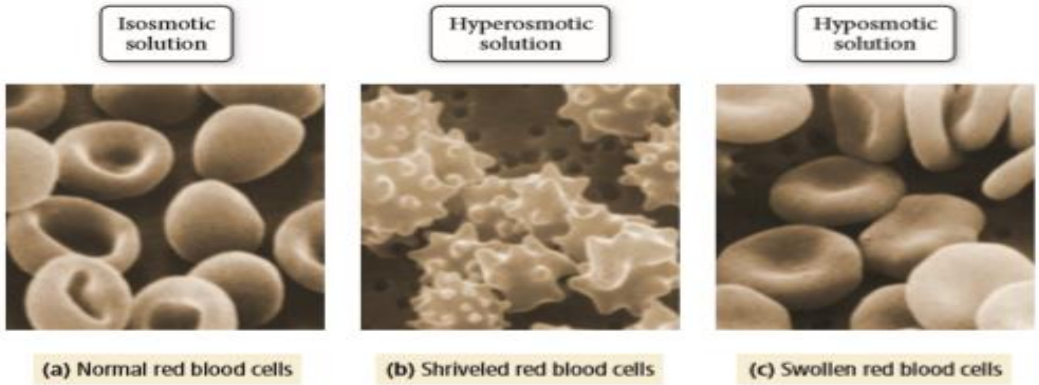
SECTION A

1. **Read the passage and answer the following questions:** (4)

Colligative Properties and Medical Solutions

Doctors and other health care workers often administer solutions to patients. The osmotic pressure of these solutions is controlled to ensure the desired effect on the patient. Intravenous (IV) solutions— those that are administered directly into a patient's veins—must have osmotic pressures equal to those of body fluids. These solutions are called isosmotic (or isotonic) Figure (a)). Solutions having osmotic pressures greater than those of body fluids are hyperosmotic. These solutions take water out of cells and tissues. When a human cell is placed in a hyperosmotic solution, it tends to shrivel as it loses water to the surrounding solution (Figure (b)). Solutions having osmotic pressures less than those of body fluids are hypoosmotic. These solutions pump water into cells. When a human cell is placed in a hypoosmotic solution—such as pure water, for example—water enters the cell, sometimes causing it to burst (Figure (c)).

When intravenous fluids are given in a hospital, the majority of the fluid is usually an isosmotic saline solution—a solution containing 0.9 g NaCl per 100 mL of solution. In medicine and in other health-related fields, solution concentrations are often reported in units that indicate the mass of the solute per given volume of solution. Also common is percent mass to volume—which is the mass of the solute in grams divided by the volume of the solution in millilitres times 100%. In these units, the concentration of an isotonic saline solution is 0.9% mass/volume.



(i) Blood cells retain their normal shape in solution which are: (1)

(A) hypotonic to blood (B) isotonic to blood

(C) hypertonic to blood (D) equinormal to blood

(ii) Isotonic solutions have same: (1)

(A) molar concentration (B) molality (C) normality (D) None of these

(iii) As a result of osmosis, the volume of more concentrated solution: (1)
(A) gradually decreases (B) gradually increases
(C) is not affected (D) suddenly increases
(iv) Which of the following pairs of solution are isotonic at the same temperature? (1)
(A) 0.1 M Ca $(NO_3)_2$ and 0.1 M Na_2SO_4 (B) 0.1 M NaCl and 0.1 M Na_2SO_4
(C) 0.1 M urea and 0.1 M $MgCl_2$ (D) 0.2 M urea and 0.1 M NaCl

2. **Read the passage and answer the following questions:** (4)

In an electrolytic cell, electrical current drives a particular chemical reaction. In a sense, the electrons act as a reactant and therefore have a stoichiometric relationship with the other reactants and products. Unlike ordinary reactants, for which we usually measure quantity as mass, for electrons we measure quantity as charge. For example, consider an electrolytic cell used to coat copper onto metals. The half-reaction by which copper is deposited onto the metal is:

$$Cu^{2+}(aq) + 2\ e^- \rightarrow Cu(s)$$

For every 2 mol of electrons that flow through the cell, 1 mol of solid copper is plated. We can write the stoichiometric relationship: 2 mol electrons: 1 mol Cu(s) We can determine the number of moles of electrons that flow in a given electrolytic cell by measuring the total charge that flows through the cell, which in turn depends on the magnitude of the current and on the time that the current runs. The relationship between charge and the number of moles of electrons is given by Faraday's constant, corresponds to the charge in coulombs of 1 mol of electrons.F = 96,485C/mol e^-

(i) Consider the reaction: $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ What is the quantity of electricity in coulombs needed to reduce 1 mol of $Cr_2O_7^{2-}$? (1)

(ii) A silver cup is plated with silver by passing 965 coulombs of electricity. The amount of Ag deposited is: (atomic mass of silver is 108 u) (1)
(A) 107.89 g (B) 9.89 g (C) 1.0002 g (D) 1.08 g

(iii) What mass of calcium in grams would be deposited if 1F of electricity is passed through molten calcium chloride? (1)

(iv) If a current of 0.5 ampere flows through a metallic wire for 2 hours, then how many electrons would flow through the wire? (1)

3. Read the passage given below and answer the following questions: (4)

THE EFFECT OF TEMPERATURE ON RATES

The collision model, which assumes that reactions occur as a result of collisions between molecules, helps explain why the magnitudes of rate constants increase with increasing temperature. The greater the kinetic energy of the colliding molecules, the greater is the energy of collision. The minimum energy required for a reaction to occur is called the activation energy, Ea. A collision with energy Ea or greater can cause the atoms of the colliding molecules to reach the activated complex (or transition state), which is the highest energy arrangement in the pathway from reactants to products. Even if a collision is energetic enough, it may not lead to reaction; the reactants must also be correctly oriented relative to one another in order for a collision to be effective. Because the kinetic energy of molecules depends on temperature, the rate constant of a reaction is very dependent on temperature. The relationship between k and temperature is given by the Arrhenius equation: $k = Ae^{\frac{-Ea}{RT}}$. The term A is called the frequency factor; it relates to the number of collisions that are favourably oriented for reaction. The Arrhenius equation is often used in logarithmic form:

$$\ln k = \ln A - Ea/RT.$$

Thus, a graph of ln k versus 1/T yields a straight line with slope -Ea/R.

In the following questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices on the basis of the above passage.

(A) Both Assertion and Reason are correct statements, and Reason is the correct explanation of the Assertion.
(B) Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the Assertion.
(C) Assertion is correct, but Reason is incorrect statement.
(D) Assertion is incorrect, but Reason is correct statement

(i) Assertion: For each ten degrees rise of temperature the specific rate constant is nearly doubled. (1)
Reason: Energy-wise distribution of molecules in a gas is an experimental function of temperature

(ii) Assertion: If the activation energy of a reaction is zero, temperature will have no effect on the rate constant. (1)
Reason: Lower the activation energy, faster is the reaction.

(iii) Assertion: All collision of reactant molecules leads to product formation. (1)
Reason: Only those collisions in which molecules have correct orientation and sufficient kinetic energy lead to compound formation.

(iv) Assertion: Rate constants determined from Arrhenius equation are fairly accurate for simple as well as complex molecules. (1)
Reason: Reactant molecules undergo chemical change irrespective of theirorientation during collision

4 **Read the passage given below and answer the following questions:** (4)
Oxidation of alcohols to aldehydes is partial oxidation; aldehydes are further oxidized to carboxylic acids. Conditions required for making aldehydes are heat and distillation. In aldehyde formation, the temperature of the reaction should be kept above the boiling point of the aldehyde and below the boiling point of the alcohol. Reagents useful for the transformation of primary alcohols to aldehydes are normally also suitable for the oxidation of secondary alcohols to ketones.

(i) Which of the following alcohols can be obtained from HCHO? (1)
(A) Methanol (B) Ethanol (C) Propanol (D) All of these

(ii) Ethanol can be converted into ethanal by: (1)
(A) Catalytic hydrogenation (B) Treatment with $LiAlH_4$
(C) Treatment with pyridinium chlorochromate (D) Treatment with $KMnO_4$

(iii) Which of the following species can act as the strongest base**?** (1)
(A) Hydroxide (B) Alkoxide (C) Phenoxide (D) m-Nitro phenoxide

iv) Arrange the following compounds in increasing order of boiling point: Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol. (1)
(A) Propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol
(B) Propan-1-ol, butan-1-ol, butan-2-ol, pentan-1-ol
(C) Pentan-1-ol, butan-2-ol, butan-1-ol, propan-1-ol
(D) Pentan-1-ol, butan-1-ol, butan-2-ol, propan-1-ol

OR

Read the passage given below and answer the following questions: (4)
Williamson synthesis is one of the best methods for the preparation of ethers. It involves the treatment of an alkyl halide with a suitable sodium alkoxide. Williamson's synthesis involves nucleophilic substitution of the halogen atom of an alkyl halide by an alkoxide group as shown below: $R—O^- Na^+ + R'X \rightarrow R—O—R' + NaX$. When alkyl halide used in the reaction is primary, Williamson's synthesis proceeds via SN2 mechanism leading to the formation of an ether. This method is a versatile method for the synthesis of both symmetrical and unsymmetrical ethers.

(A) Why Williamson's synthesis is not applicable when the alkyl halide used is tertiary? (1)
(B) How would you obtain allyl phenyl ether? (1)
(C) What happens when benzyl ethyl ether reacts with HI? (1)
(D) Name the alkyl halide and sodium alkoxide used to synthesise tert-butyl ethyl ether. (1)

SECTION B

5. The value of Henry's constant K_H is _____. (1)
(A) greater for gases with higher solubility (B) greater for gases with lower solubility
(C) constant for all gases. (D) not related to the solubility of gases.

6. Considering the formation, breaking and strength of hydrogen bond, predict which of the following mixtures will show a positive deviation from Raoult's law? (1)
(A) Methanol and acetone (B) Chloroform and acetone
(C) Nitric acid and water (D) Phenol and aniline

7 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

8. A solution containing 10 g per dm^3 of urea (molar mass 60 g mol^{-1}) is isotonic with 5% solution of non-volatile solute, MB of solute is (1)
(A) 300 g mol^{-1} (B) 350 g mol^{-1} (C) 200 g mol^{-1} (D) 250 g mol^{-1}

OR

Conc. H_2SO_4 is 98 % H_2SO_4 by mass has d = 1.84 g cm^{-3}. Volume of acid required to make one litre of 0.1 M H_2SO_4 is: (1)
(A) 5.55 mL (B)10 mL (C) 20 mL (D) 30 mL

9. Using the data given below find out the strongest reducing agent. (1)
E^0 $Cr_2O_7^{2-}$ / Cr^{+3} = 1.33 V, E^0 Cl_2 / Cl^{-} = 1.36 V, E^0 MnO_4^{-} / Mn^{2+} = 1.51 V,
E^0 Cr^{3+}/Cr = - 0.74 V
(A) Cl^- (B) Cr (C) Cr^{3+} (D) Mn^{2+}

10. Standard electrode potential for Sn^{4+}/Sn^{2+} couple is +0.15 V and that for the Cr^{3+}/Cr couple is – 0.74 V. The two couple in their standard states are connected to make cell. The cell potential will be: (1)
(A) +1.19 V (B) 0.89 V (C) +0.18 V (D) +1.83 V

11 On increasing temperature, (1)
(A) ionic conductance increases and electronic conductance decreases.
(B) ionic conductance decreases and electronic conductance increases.
(C) both ionic and electronic conductance increase.
(D) both ionic and electronic conductance decrease

12 The half-life period of a first order reaction is 1386 seconds. The specific rate constant of the reaction is: (1)
(A) 0.5 x 10^{-2} s^{-1} (B) 0.5 x 10^{-3} s^{-1} (C)5.0 x 10^{-2} s^{-1} (D) 5.0 x 10^{-3} s^{-1}

13 The activation energy of a reaction can be determined from the slope of which of the following graph: (1)
(A) ln k Vs 1/T (B) ln k Vs T (C) ln k/T Vs T (D) T/ln k Vs 1/T

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14 Assertion : 2-bromopentane on reaction with alcoholic KOH gives but-1-ene as the major product: (1)
Reasoning: It is nucleophilic elimination reaction.

15 Assertion: The instrument used for measuring optical rotation is polarimeter. (1)
Reasoning: Dextro-rotatory glucose produces energy in our body.

16 Assertion : Optically active tertiary halide undergoes SN1 mechanism (1)
Reasoning: Racemic product is obtained in SN1 mechanism.

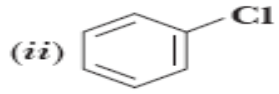
17 Assertion: Ortho-nitrophenol is more acidic than phenol (1)
Reasoning: Nitro group is electron donating group and therefore stabilizes the ortho-nitro phenoxide ion.

18 Assertion: The C-O-C bond angle in ethers is slightly less than the tetrahedral angle. (1)
Reasoning: It is due to the repulsive interaction between the two alkyl groups in ethers

SECTION C

19 Complete the following reactions: (2)

(i) $CH_3Cl + KCN \longrightarrow ?$

(ii)  $+ CH_3Cl \xrightarrow{AlCl_3} ? + ?$

OR

What are ambident nucleophiles? Explain with the help of chemical equations. (2)

20 Name the reagents used in the following reactions: (2)
(A) Bromination of phenol to 2,4,6-tribromophenol
(B) Butan-2-one to Butan-2-ol
(C) Friedel–Crafts alkylation of anisole
(D) Oxidation of primary alcohol to carboxylic acid.

OR

Tert-Butyl bromide reacts with aq. NaOH by S_N1 mechanism while n-butyl bromide reacts by S_N2 mechanism. Why? (2)

21 Give one chemical test each to distinguish between the following pairs of compounds: (2)
(i) Phenol and Benzoic acid
(ii) 1-Propanol and 2-Propanol

22 The molar conductivity of 1.5 M solution of an electrolyte is found to be 138.9 S cm^2 mol^{-1}. Calculate the conductivity of this solution. (2)

OR

In the electrolysis of aqueous sodium bromide, there are two possible anodic reactions: (2)
$2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$, E° = 1.23 V
$2Br^-(aq) \rightarrow Br_2(g) + 2e^-$, E° = 1.08 V
Which reaction occurs at anode and why?

23 The rate constant for a first order reaction is 60 s^{-1}. How much time will it take to reduce the concentration of the reactant to 1/10th of its initial value? (2)

OR

In a first order reaction, the concentration of the reactant is reduced from 0.6 mol L^{-1} to 0.2 mol L^{-1} in 5 minutes. Calculate the rate constant of the reaction. (2)

SECTION D

24 A strip of nickel metal is placed in a 1 molar solution of Ni $(NO_3)_2$ and a strip of silver metal is placed in a 1-molar solution of $AgNO_3$. An electrochemical cell is created when the two solutions are connected by a salt bridge and the two strips are connected by wires to a voltmeter. (3)
(i) Write the balanced equation for the overall reaction occurring in the cell and calculate the cell potential.
(ii) Calculate the cell potential, E, at 25 °C for the cell if the initial concentration of Ni $(NO_3)_2$ is 0.100 molar and the initial concentration of $AgNO_3$ is 1.00 molar.
[E^0 Ni^{2+}/Ni = – 0.25 V, E^0 Ag^+/Ag = 0.80 V, log 10^{-1} = – 1]

25 Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration for strong and weak electrolytes. (3)

26 What is a fuel cell? What is the most common type of fuel cell, and what reactions occur at its anode and cathode? (3)

27 How are the following conversions carried out? (3)
(A) Propene to Propan-1-ol (B) 1-bromo propane to 2-bromopropane
(C) Toulene to benzyl alcohol

OR

Explain why (3)
(A) the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride?
(B) alkyl halides, though polar, are immiscible with water?

(C) Grignard reagents should be prepared under anhydrous conditions?

28 (A) Explain the difference between the rate law for a reaction and the integrated rate law for a reaction. What relationship does each kind of rate law express? (3)

(B) What does the term half-life mean? Write the expressions for the half lives of zero-order and first-order reaction.

OR

What is an Arrhenius plot? Explain the significance of the slope and intercept with the help of a diagram. (3)

SECTION E

29 (A) Define the following terms: (3)

(i) Azeotrope (ii) Osmotic pressure (iii) Colligative properties

(B) Calculate the molarity of 9.8% (w/w) solution of H_2SO_4 if the density of the solution is 1.02 g mL–1. (Molar mass of H_2SO_4 = 98 g mol^{-1}) (2)

OR

(A) Non-ideal solutions exhibit either positive or negative deviations from Raoult's law. What are these deviations and how are they caused? (2)

(B) What mass of NaCl (molar mass = 58.5 g mol^{-1}) must be dissolved in 65 g of water to lower the freezing point by 7.50 °C? The freezing point depression constant, K_f for water is 1.86 K kg mol^{-1}. Assume van't Hoff factor for NaCl is 1.87. (3)

30 (A) Why does the rate of a reaction not remain constant throughout the reaction process? (1)

(B)Express the rate of the following reaction in terms of disappearance of hydrogen in the reaction: (1)

$$3H_2\,(g) + N_2\,(g) \rightarrow 2NH_3\,(g).$$

(C) Following graph is a plot of the rate of a reaction vs concentration of the reactant. What the order of the reaction? (1)

(d) Calculate the overall order of a reaction which has the rate expression (1)

(i) Rate = k $[A]^{1/2}$ $[B]^{3/2}$ (ii) Rate = k $[A]^{3/2}$ $[B]^{-1}$

(e) Define threshold energy of a reaction. (1)

OR

(A)A first order reaction has rate constant k = 5.5 × 10^{-14} s^{-1}. Find the half-life of the reaction. (2)

(B) Define the following: (i) Rate constant 'k' (ii) Activation energy (E_a) (2)

(C) In some cases, it is found that a large number of colliding molecules have energy more than threshold value, yet the reaction is slow. Why? (1)

31 (A) Out of (CH_3) C ─ Br and (CH_3) C ─ I which one is more reactive towards S_N1 and why? (1)

(B) Why dextro and laevo rotatory isomers of butan-2-ol are difficult to separate by fractional distillation. (1)

(C) Out of cyclohexyl chloride and cyclohexyl chloromethane which one is more reactive towards S_N2 reaction and why? (1)

(D) Out of Chlorobenzene and 4-chloronitrobenzene which one is more reactive towards S_N2 reaction and why? (1)

(E) Out of 3-methylbutan-1-ol and 1,2-dimethylpropan-1-ol which one is more optically active and why? (1)

OR

(A) An alkene (C_7H_{12}) gives 1-chloro-1-methylcyclohexane by reaction on reaction with HCl. Write the reactions involved. (1)

(B) A hydrocarbon C_5H_{12} (MM=70 u) gives a single mono- chloro derivative and two di-chloro derivatives on photo chlorination. Give the structure of the products. (2)

(C) Convert ethyl chloride to propanoic acid. (2)