



BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

MID-TERM EXAMINATION 2023-24

CHEMISTRY (043)



Class :XII
Date :09.10.23
Admission No.:

Duration : 3 Hrs
Max. Marks : 70
Roll No.:

General Instructions:

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case-based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.
- Use of log tables and calculators is not allowed.

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section

- Van't Hoff factors x , y and z for association, dissociation and no change of solute in the solution respectively are in the order:
(a) $x < y < z$ (b) $x > z > y$
(c) $x < z < y$ (d) $x > y > z$
- Which one of the following electrolyte has the same value of the van't Hoff factor (i) as that of $\text{Al}_2(\text{SO}_4)_3$ (if all are 100% ionised)
(a) K_2SO_4 (b) $\text{K}_3[\text{Fe}(\text{CN})_6]$
(c) $\text{Al}(\text{NO}_3)_3$ (d) $\text{K}_4[\text{Fe}(\text{CN})_6]$
- An electrochemical cell generally consists of a cathode and an anode. Which of the following statements is correct with respect to the cathode?
(a) Oxidation occurs at the cathode (b) Electrons move into the cathode
(c) Usually denoted by a negative sign (d) Is usually made up of insulating material
- What is the direction of flow of electrons in an electrolytic cell?
(a) Anode to cathode externally (b) Anode to cathode internally
(c) Cathode to anode externally (d) Cathode to anode in the solution
- Which of the following is a not a secondary cell?
(a) Nickel-cadmium cell (b) Lead storage cell
(c) Mercury cell (d) Leclanché cell
- Which of the following conditions are satisfied when the cell reaction in the electrochemical cell is spontaneous?
(a) $\Delta G^\circ > 0$ (b) $E^\circ_{\text{cell}} < 0$
(c) $E^\circ_{\text{cell}} = 0$ (d) $\Delta G^\circ < 0$
- The rate of a reaction is primarily determined by the slowest step. This step is called
(a) rate determining step (b) activation step
(c) reaction rate step (d) none of these.

8. The half-life period of any first order reaction
- is half the specific rate constant
 - is always the same irrespective of the reaction
 - is independent of initial concentration
 - is directly proportional to initial concentration of reactants.
9. In KMnO_4 oxidation number of Mn is
- +2
 - +4
 - +6
 - +7
10. Which of the following would be paramagnetic?
- Zn^{2+}
 - Cu^+
 - Sc^{3+}
 - Mn^{2+}
11. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3]$ is called
- Potassium alumino oxalate
 - Potassium aluminium (III) trioxalate
 - Potassium trioxalato aluminate (III)
 - Potassium tris (oxalato) aluminium.
12. The co-ordination number of cobalt in the complex $[\text{Co}(\text{en})_2\text{Br}_2]\text{Cl}_2$ is
- 4
 - 6
 - 5
 - 2.

Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

- If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
 - If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
 - If the Assertion is correct but Reason is incorrect.
 - If both the Assertion and Reason are incorrect.
13. Assertion : Molarity of a solution in liquid state changes with temperature.
Reason : The volume of a solution changes with change in temperature.
14. Assertion : $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless.
Reason : d-d transition is not possible in $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$.
15. Assertion : Transition metals are good catalysts.
Reason : V_2O_5 or Pt is used in the preparation of H_2SO_4 by contact process.
16. Assertion: The order and molecularity of a reaction are always the same.
Reason: molecularity can be in a fraction.

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Explain why aquatic species are more comfortable in cold water rather than in warm water. 2
18. How much charge is required for the following reductions: 2
- 1 mol of Al^{3+} to Al?
 - 1 mol of Cu^{2+} to Cu ?
19. A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is 2
- doubled, (b) reduced to half?

OR

Define the following:

- (a) Elementary step in a reaction (b) Rate of a reaction

20. In the series Sc(Z = 21) to (Z = 30), the enthalpy of atomisation of zinc is the lowest i.e. 126 kJ mol^{-1} . Why? 2

21. Write the formulas for the following coordination compounds: 2

(a) Tetraammine diaquacobalt(III) chloride

(b) Potassium tetracyanonickelate(II)

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Define the terms, 'osmosis' and 'osmotic pressure'. 3

What is the advantage of using osmotic pressure as compared to other colligative properties for the determination of molar masses of solutes in solutions?

OR

State Henry's law and mention two of its important applications.

23. A voltaic cell is set up at 25°C with the following half cells : 3

Al/Al^{3+} (0.001 M) and Ni/Ni^{2+} (0.10 M)

Determine the cell potential. Given that $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25\text{V}$ and $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66$, $\log_{10} 10 = 1$

24. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their Variation with change in temperature. 3

25. What do you understand by the 'order of a reaction'? Identify the reaction order from each of the following units of reaction rate constant: 3

(i) $\text{mol L}^{-1} \text{ s}^{-1}$ (ii) $\text{L mol}^{-1} \text{ s}^{-1}$

26. When chromite ore FeCr_2O_4 is fused with NaOH in presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl forms an orange coloured crystalline compound (C). Write the formulae of the compounds (A), (B) and (C). 3

27. Explain the bonding nature of the complex $[\text{CoF}_6]^{3-}$. [At number of Co = 27] 3

28. (a) Explain on the basis of valence bond theory that $[\text{Ni}(\text{CN})_4]^{2-}$ ion with square planar structure is diamagnetic and $[\text{NiCl}_4]^{2-}$ ion with tetrahedral geometry is paramagnetic.

(b) Give evidence that $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_4\text{SO}_4]\text{Cl}_2$ are ionisation isomers. 2+1

SECTION D

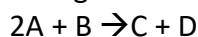
The following questions are case -based questions. Each question carries 4 marks. Read the passage carefully and answer the questions that follow

29. Coordination compounds are formulated and named according to the IUPAC system. 4

A few rules for naming coordination compounds are : (I) In the ionic complex, the cation is named first and then the anion. (II) In the coordination entity, the ligands are named first and then the central metal ion. (III) When more than one type of ligands are present, they are named in alphabetical order of preference without any consideration of charge. Choose the correct answer in the following.

- (i) The IUPAC name of the complex $[\text{Pt}(\text{NH}_3)_3\text{Br}(\text{NO}_2)\text{Cl}]\text{Cl}$ is
 (a) triamminechlorobromonitroplatinum(IV) chloride
 (b) triamminebromonitrochloroplatinum(IV) chloride
 (c) triamminebromidochloridonitroplatinum (IV) chloride
 (d) triamminenitrochlorobromoplatinum(IV) chloride
- (ii) The IUPAC name of $[\text{Ni}(\text{CO})_4]$ is
 (a) tetracarbonylnickel(II)
 (b) tetracarbonylnickel(0)
 (c) tetracarbonylnickelate(II)
 (d) tetracarbonylnickelate(0).
- (iii) As per IUPAC nomenclature, the name of the complex $[\text{Co}(\text{H}_2\text{O})_4(\text{NH}_3)_2]\text{Cl}_3$ is
 (a) tetraaquadiammincobalt(II) chloride
 (b) tetraaquadiammincobalt(III) chloride
 (c) diamminetetraaquacobalt(II) chloride
 (d) diamminetetraaquacobalt(III) chloride.
- (iv) As per IUPAC nomenclature, the name of the complex $[\text{Cr}(\text{H}_2\text{O})_3(\text{NH}_3)_2]\text{Cl}_3$ is
 (a) tetraaquadiammincobalt(II) chloride
 (b) tetraaquadiammincobalt(III) chloride
 (c) diamminetetraaquachromium(II) chloride
 (d) diamminetriaquachromium(III) chloride.

30. The following results have been obtained during the kinetic studies of the reaction:



2+2

Experiment	[A]/mol L ⁻¹	[B]/mol L ⁻¹	Initial rate of formation of D/mol L ⁻¹ min ⁻¹
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

- (a) Determine the rate law. (b) Determine the rate constant for the reaction.

SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. (a) What is corrosion? Explain the electrochemical theory of rusting of iron and write the reactions involved in the rusting of iron. [3+2]

(b) State and explain Kohlrausch law.

OR

(a) Write the name of the cell which is generally used in inverters. Write the reactions taking place at the anode and the cathode of this cell. 3+2

(b) A solution of $\text{Ni}(\text{NO}_3)_2$ is electrolyzed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of Ni is deposited at the cathode?

32. (a) For a decomposition reaction the values of rate constant k at two different temperatures are given below : 3+2

$$k_1 = 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1} \text{ at } 650 \text{ K} \quad k_2 = 2.15 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1} \text{ at } 700 \text{ K}$$

Calculate the value of activation energy for this reaction. ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

(b) Write two differences between 'order of reaction' and 'molecularity of reaction'.

OR

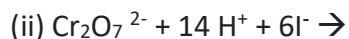
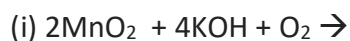
(a) A reaction is first order in A and second order in B. 3+2

- (i) Write differential rate equation.
 - (ii) How is rate affected when concentration of B is tripled?
 - (iii) How is rate affected when concentration of both A and B is doubled?
- (b) What is molecularity of a reaction?

33. (a) Account for the following:

3+2

- (i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4.
 - (ii) Cr^{2+} is a strong reducing agent.
 - (iii) Cu^{2+} salts are coloured while Zn^{2+} salts are white.
- (b) Complete the following equations:



OR

(a) Account for the following:

3+2

- (i) Zn is not considered as a transition element.
- (ii) Transition metals form a large number of complexes.
- (iii) Transition elements have high enthalpy of atomisation.

(b) Account for the following:

- (i) Mn^{2+} compounds are more stable than Fe^{2+} compounds towards oxidation to their +3 state.
- (ii) Cr^{2+} is reducing and Mn^{3+} oxidizing when both have d^4 configuration.

*****end of paper*****

