



# 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:

Name:

Duration : 3 Hrs

Max. Marks: 70

Exam 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

- Which of the following aqueous solutions has the highest boiling point? 1  
(a) 0.1M KNO<sub>3</sub> (b) 0.1 M Na<sub>3</sub>PO<sub>4</sub> (c) 0.1M BaCl<sub>2</sub> (d) 0.1 M K<sub>2</sub>SO<sub>4</sub>
- The porous membrane used in reverse osmosis plants is made up of 1  
(a) Cellulose acetate (b) Potassium nitrate (c) Mercuric iodide (d) Starch
- What amount of electric charge is required for the reduction of Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> to Cr<sup>3+</sup>? 1  
(a) 6F (b) 3F (c) 1F (d) 4F
- In lead storage battery, the electrolyte H<sub>2</sub>SO<sub>4</sub> 1  
(a) 38% (b) 48% (c) 32% (d) 80%
- A hypothetical reaction 2p + q → s + r has rate constant as 2.0 × 10<sup>-3</sup> mol lit<sup>-1</sup> sec<sup>-1</sup>  
the order of the reaction is 1  
(a) unpredictable (b) zero (c) one (d) two
- The unit of rate constant of I order reaction 1  
(a) sec<sup>-1</sup> (b) mol lit<sup>-1</sup> sec<sup>-1</sup> (c) lit mol<sup>-1</sup> sec<sup>-1</sup> (d) mol<sup>2</sup> lit sec.
- Which of the following is the most common oxidation state among the lanthanoids? 1  
(a) +3 (b) +4 (c) +2 (d) +5
- Which of the following pairs have the same size? 1  
(a) Fe<sup>2+</sup>, Ni<sup>2+</sup> (b) Zr<sup>4+</sup>, Ti<sup>4+</sup> (c) Zr<sup>4+</sup>, Hf<sup>4+</sup> (d) Zn<sup>2+</sup>, Hf<sup>4+</sup>
- The oxidation state of Fe in [Fe(CN)<sub>6</sub>]<sup>3-</sup> is 1  
(a) +3 (b) +4 (c) +2 (d) -3

10. The IUPAC name of the complex  $K_3[Fe(CN)_6]$  is 1
- (a) Potassium hexacyanidoferrate (II)  
(b) Potassium hexacyanidoferrate (III)  
(c) Potassium hexacyanido iron (II)  
(d) tripotassium hexacyano iron (II).

11. Reaction of  $C_2H_5CH_2Br$  with aqueous sodium hydroxide follows: 1
- (i)  $SN_1$  mechanism (ii)  $SN_2$  mechanism (iii) both (i) and (ii) (iv) Saytzeff rule

12. What is name of following reaction: 1



- (i) Wurtz Reaction (ii) Fitting Reaction (iii) Wurtz- Fitting Reaction (iv) Swartz reaction

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

**Directions:** These questions consist of two statements, each printed as Assertion and Reason. While To answer these questions, you must choose any of the following four responses.

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.  
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.  
(c) If the Assertion is correct but Reason is incorrect.  
(d) If both the Assertion and Reason are incorrect.

13. Assertion: Order and molecularity are the same. 1

Reason: Order is determined experimentally and molecularity is the sum of the stoichiometric coefficient of the determining elementary step.

14. Assertion: Linkage isomerism arises in coordination compounds containing ambidentate ligands. 1

Reason: Ambidentate ligand has two different donor atoms.

15. Assertion: Transition metals and their compounds can act as good catalysts 1

Reason: Transition metals can adopt multiple oxidation states.

16. Assertion: On adding  $NaCl$  to water its vapour pressure increases. 1

Reason: The addition of non-volatile solute increases the vapour pressure.

## 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. (a) Why is the first ionization enthalpy of Cr is lower than that of Zn? 2

(b) Transition elements show high melting points. Why?

18. How much charge is required for the following reductions: 2

(a) 1 mol of  $Al^{3+}$  to Al? (b) 1 mol of  $Cu^{2+}$  to Cu ?

19. (a) What are the units of ebullioscopic constant?

(b) On mixing liquid X and liquid Y, the volume of the resulting solution decreases. What type of deviation from Raoult's law is shown by the resulting solution? 2

20. A reaction is first order w.r.t. reactant A as well as w.r.t reactant B. Give the rate law. Also give one point of difference between the average rate and the instantaneous rate. 2

OR

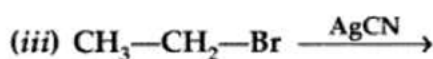
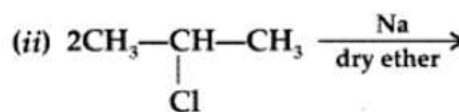
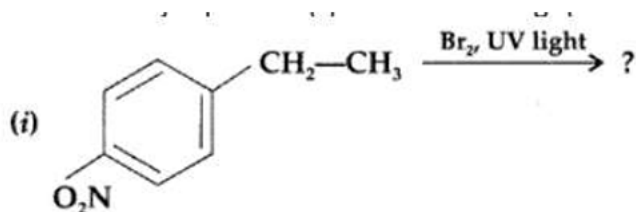
Define pseudo-first-order reaction. Give an example.

21. Describe the shape and magnetic behaviour of following complex  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (At. No.Co=27). 2

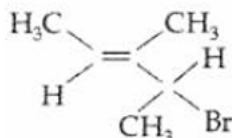
### SECTION C

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

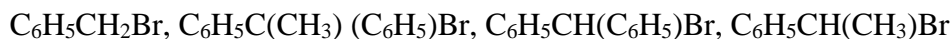
22. Write the major product(s) in the following: 3



23. (a) Give the IUPAC name of the following compound: 3

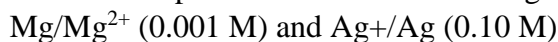


(b) Predict the order of reactivity of the following compounds in the  $\text{S}_{\text{N}}1$  reaction :



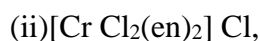
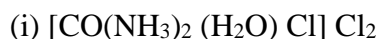
(c) Predict the increase in the order of reactivity of four isomeric bromobutanes in the  $\text{S}_{\text{N}}1$  reaction.

24. A voltaic cell is set up at  $25^\circ\text{C}$  with the following half cells: 3



Determine the cell potential. Given that  $E^0_{\text{Mg}^{2+}/\text{Mg}} = -2.36\text{V}$  and  $E^0_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$ ,  $\log_{10}1 = 1$

25. (a) Name the following coordination compounds according to IUPAC system of nomenclature. 3



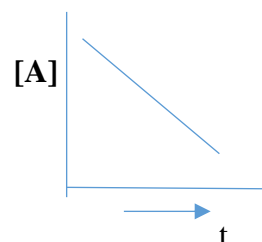
(b) On the basis of crystal field theory, write the electronic configuration of  $d^4$  in terms of  $t_{2g}$  and  $e_g$  in an octahedral field when (i)  $\Delta_0 > P$

26. For a general reaction  $\text{A} \rightarrow \text{B}$ , plot of concentration of A vs time is given in Fig. Answer the following question based on this graph. 3

(i) What is the order of the reaction?

(ii) What is the slope of the curve?

(iii) What are the units of rate constant?



27. Explain by giving reasons:

3

- (a) Transition metals and many of their compounds show paramagnetic behavior
- (b) The enthalpies of atomization of transition metals are high
- (c) Transition metals form alloys and Interstitial compounds

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

3

OR

Henry's law constant for CO<sub>2</sub> in water is  $1.67 \times 10^8$  Pa at 298 K. Calculate the number of moles of CO<sub>2</sub> in 500 ml of soda water when packed under  $2.53 \times 10^5$  Pa at the same temperature.

### 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. Read given passage and answer the questions that follow:

Chemical kinetics deals with rate of chemical reactions, how fast reactants get used up or how fast products are formed in the reaction. Different chemical reactions have different speed. Rate of chemical reaction depends upon concentration of reactants, temperature, pressure especially in gaseous reactions and presence of catalyst. Chemical reaction takes place as a results of collision between reacting molecules. The rate of reaction does not depend upon total number of collisions rather it depends upon number of effective collisions. In a redox reaction, if  $E^\circ_{\text{cell}}$  is +ve,  $\Delta G^\circ$  will be -ve and 'K' equilibrium constant will be high i.e. products formed will be more than the reactants.

- (a) Write the relation between (Activation Energy)  $E_a$  and 'A' (Arrhenius constant). 2
- (b) What is meant by activation energy? What does  $e^{-E_a/RT}$  represent? 2

OR

(b) In a reaction,  $2A \rightarrow \text{Products}$ , the concentration of A decreases from  $0.5 \text{ mol L}^{-1}$  to  $0.4 \text{ mol L}^{-1}$  in 10 minutes. Calculate the rate during this interval? 2

30. Complex compounds play an important role in our daily life. Werner's theory of complex compounds says every metal atom or ion has primary valency (oxidation state) which is satisfied by -vely charged ions, ionizable where secondary valency (coordination number) is non-ionisable, satisfied by ligands (+ve, -ve, neutral) but having lone pair. Complex compounds are name according to IUPAC system. Valence bond theory helps in determining shapes of complexes based on hybridisation, magnetic properties, outer or inner orbital complex. Complex show ionisation, linkage, solvate and coordination isomerism also called structural isomerism. Some of them also show stereoisomerism i.e. geometrical and optical isomerism. Ambidentate ligand are essential to show linkage isomerism. Polydentate ligands form more stable complexes than unidentate ligands. There are called chelating agents. EDTA is used to treat lead poisoning, cis-platin as anticancer agents. Vitamin B<sub>12</sub> is complex of cobalt. Haemoglobin, oxygen carrier is complex of Fe<sup>2+</sup> and chlorophyll essential for photosynthesis is complex of Mg<sup>2+</sup>.

- (a) What is the oxidation state of Ni in [Ni(CO)<sub>4</sub>]? 1
- (b) Out Cis - [Pt(en)<sub>2</sub> Cl<sub>2</sub>]<sup>2+</sup> and trans (Pt(en)<sub>2</sub> Cl<sub>2</sub>)<sup>2+</sup> which one shows optical isomerism? 1
- (c) One mole of CrCl<sub>2</sub> . 6H<sub>2</sub>O reacts with excess of AgNO<sub>3</sub> to yield 2 mole of AgCl. Write formula of complex. Write IUPAC name also. 2

OR

**SECTION E**

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

31. What happens when 5

- (a) n-butyl chloride is treated with alcoholic KOH,
- (b) bromobenzene is treated with Mg in the presence of dry ether,
- (c) chlorobenzene is subjected to hydrolysis,
- (d) ethyl chloride is treated with aqueous KOH,
- (e) methyl chloride is treated with KCN

OR

(a) Haloalkanes react with KCN to form alkyl cyanides as the main product while AgCN forms isocyanides as the product. Explain. 2+3

(b) How will you bring about the following conversions?

- (i) Ethanol to Ethene
- (ii) Propene to 1-nitropropane
- (iii) Toluene to benzyl alcohol

32. (a) Write the reactions taking place at cathode and anode in lead storage battery when the battery is in use. What happens on charging the battery? 3

(b) The standard electrode potential for Daniel cell is 1.1 V. Calculate the standard Gibbs energy for the cell reaction. ( $F = 96,500 \text{ C mol}^{-1}$ ) 2

Or

(a) Explain Faraday's Law of Electrolysis 2

(b) From the given cells: Lead storage cell, Mercury cell, Fuel cell and Dry cell Answer the following: 3

- (i) Which cell is used in hearing aids?
- (ii) Which cell was used in Apollo Space Programme?
- (iii) Which cell is used in automobiles and inverters?

33. When a chromite ore (A) is fused with Sodium carbonate in free excess of air and the product is dissolved in water, a yellow solution of the compound(B) is obtained. After treatment of this yellow solution with Sulfuric acid, compound (C) can be crystallized from the solution. When compound (C) is treated with KCl, orange crystals of compound(D) crystallize out. Identify A to D and also explain the reactions. 5

OR

When an oxides of Manganese (A) is fused with KOH in presence of an oxidizing agent and dissolved in water , it gives a dark green solution of compound (B). The compound (B) disproportionate in neutral or acidic solution to give purple compound(C). An alkaline solution of Compound (C) oxidizes KI solution to a compound (D) and compound (A) is also formed. Identify compounds A to D and also explain the reactions involved.

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

