

# Sample Paper 3

Class XII 2023-24

## Chemistry

Time: 3 Hours

Max. Marks: 70

### General Instructions:

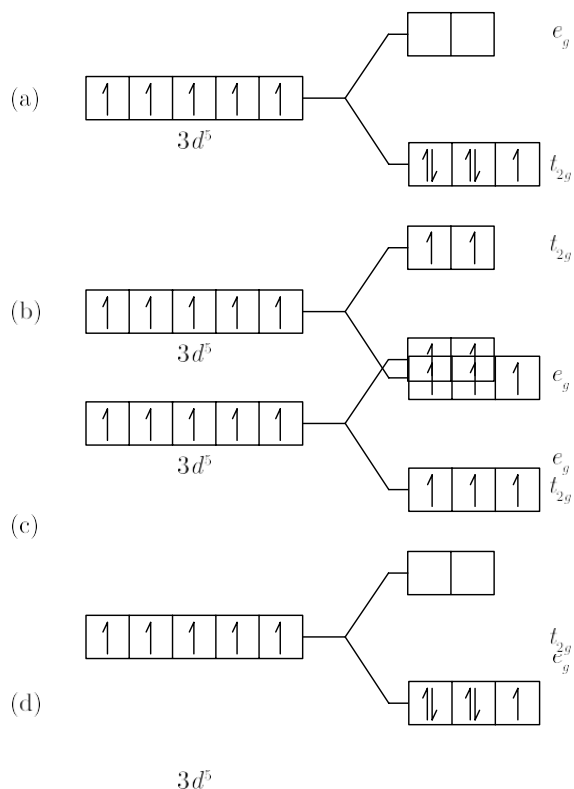
1. There are 33 questions in this question paper with internal choice.
  2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
  3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
  4. SECTION C consists of 7 short answer questions carrying 3 marks each.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

**Directions (Q. Nos. 1-16) :** The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Electrolytic reduction of nitrobenzene in strongly acidic medium gives the final product:  
(a) *p*-aminophenol (b) azobenzene  
(c) aniline (d) phenyl hydroxyl amine
2. The value of rate constant for a first order reaction is  $2.303 \times 10^{-2} \text{ s}^{-1}$ . What will be the time required to reduce the concentration to 1/10th of its initial concentration ?  
(a) 10 s (b) 2303 s  
(c) 23.03 s (d) 100 s
3. Long time nitration of phenol with mixture of conc.  $\text{HNO}_3$  and concentrated  $\text{H}_2\text{SO}_4$  gives:  
(a) picric acid (b) *o*-nitrophenol  
(c) nitrobenzene (d) *p*-nitrophenol
4. The reaction between  $\text{RNH}_2 + \text{CHCl}_3 + \text{KOH (alc.)}$  is known as:  
(a) Coupling reaction  
(b) Carbylamine reaction  
(c) Hoffmann bromamide reaction  
(d) Schmidt reaction

5. Which of the following energy level diagram for  $[\text{FeF}_6]^{3-}$  is correct on the basis of crystal field theory?



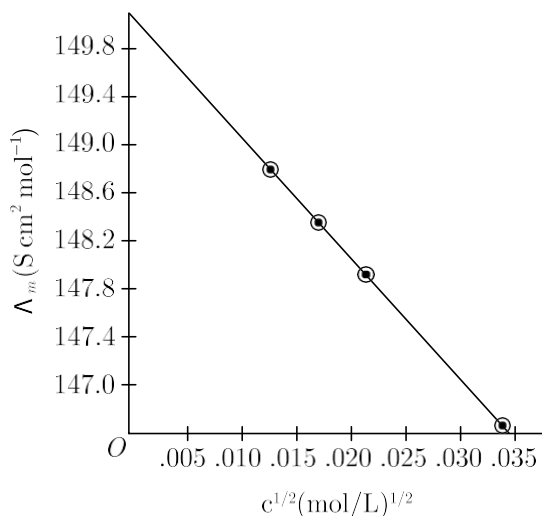
6. Metallic radii of some transition elements are given below:

Element	Fe	Co	Ni	Cu
Metallic radii/pm	126	125	125	128

Which of these elements will have highest density ?

- (a) Cu (b) Fe  
(c) Ni (d) Co
7. Which of the following does not reduce Fehling's solution?  
(a)  $\text{CH}_3\text{CHO}$  (b)  $\text{HCHO}$   
(c)  $\text{CH}_3\text{COOH}$  (d)  $\text{HCOOH}$
8. How much ethyl alcohol must be added to 1L of water so that the solution will freeze at  $-14^\circ\text{C}$  ? ( $K_f$  for water =  $1.86^\circ\text{C/mol}$ )  
(a) 10.5 mol (b) 9.5 mol  
(c) 7.5 mol (d) 8.5 mol

9. The molar conductivity of KCl solutions at different concentrations at 298 K is shown in the graph:



Determine the value of  $\Lambda_m^\infty$  for KCl using the graph.

- (a)  $151.2 \text{ S cm}^2 \text{ mol}^{-1}$  (b)  $149.9 \text{ S cm}^2 \text{ mol}^{-1}$   
 (c)  $150.0 \text{ S cm}^2 \text{ mol}^{-1}$  (d)  $152.0 \text{ S cm}^2 \text{ mol}^{-1}$
10. Consider the following reaction:  

$$\text{CH}_3 - \text{CH} = \text{CH}_2 \xrightarrow[2. \text{ aq. KOH}]{1. \text{ HBr}}$$
 The major end product is :
- (a)  $\text{CH}_3 - \underset{\text{Br}}{\text{CH}} - \text{CH}_3$  (b)  $\text{CH}_3 - \underset{\text{OH}}{\text{CH}} - \text{CH}_3$   
 (c)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Br}$  (d)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$
11. Williamson's synthesis of preparing dimethyl ether is an :
- (a)  $\text{S}_{\text{N}}2$  reaction  
 (b)  $\text{S}_{\text{N}}1$  reaction  
 (c) Elimination reaction  
 (d) Nucleophilic addition reaction
12. In reaction  $A \rightarrow B$ , the rate of reaction is doubled on increasing the concentration of the reactants four times. The order of the reaction is :
- (a)  $\frac{1}{2}$  (b) 2  
 (c) 4 (d) Zero

**Directions (Q. Nos. 13-16) :** Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

- 13. Assertion :**  $(\text{CH}_3)_3\text{COH}$  when heated with conc.  $\text{H}_2\text{SO}_4$  gives iso-butylene as the main product and not di-tertiary butyl ether.  
**Reason :** All alcohols readily dehydrates with conc.  $\text{H}_2\text{SO}_4$ .
- (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(c) Assertion is false but Reason is true.  
(d) Assertion is true but Reason is false.
- 14. Assertion :** In presence of enzyme, substrate molecule can be attacked by the reagent effectively.  
**Reason :** Active sites of enzymes hold the substrate molecule in a suitable position.
- (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(c) Assertion is false but Reason is true.  
(d) Assertion is true but Reason is false.
- 15. Assertion :** Cu cannot liberate hydrogen from acids.  
**Reason :** Cu has positive electrode potential.
- (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(c) Assertion is false but Reason is true.  
(d) Assertion is true but Reason is false.
- 16. Assertion :** Hoffmann's bromamide reaction is given by primary amines.  
**Reason :** Primary amines are more basic than secondary amines.
- (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(c) Assertion is false but Reason is true.  
(d) Assertion is true but Reason is false.

## SECTION-B

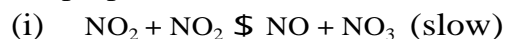
**Directions (Q. Nos. 17-21) :** This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17.  $[\text{Fe}(\text{CN})_6]^{4-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2-}$  are of different colours in dilute solutions. Why?

18. What is the effect of denaturation on the structure of proteins?
19. HgO decomposes on heating but MgO does not. Explain with reason.
20. For the reaction  $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ , the rate of formation of  $\text{NO}_2(\text{g})$  is  $2.8 \times 10^{-3} \text{ M s}^{-1}$ . Calculate the rate of disappearance of  $\text{N}_2\text{O}_5(\text{g})$ .

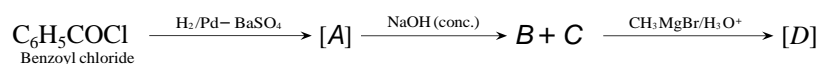
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What do you mean by rate of a reaction? For the reaction  $\text{NO}_2(\text{g}) + \text{CO}(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{NO}(\text{g})$ , the proposed mechanism is as follows :



What is the velocity (rate) of reaction?

21. Write the structures of A, B, C and D in the following reactions :



## SECTION-C

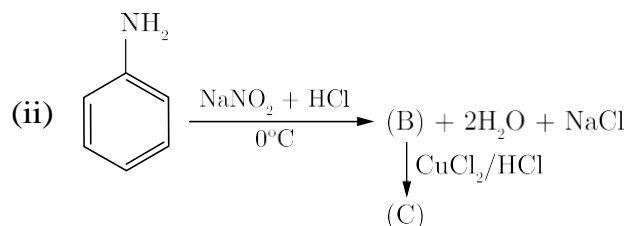
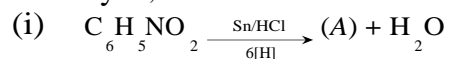
**Directions (Q. Nos. 22-28) :** This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. In a reaction  $2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ , the concentration of  $\text{N}_2\text{O}_5$  decreases from  $0.5 \text{ mol L}^{-1}$  to  $0.4 \text{ mol L}^{-1}$  in 10 minutes, Calculate the average rate of this reaction and rate of production of  $\text{NO}_2$  during this period.
23. Propose the mechanism of the reaction taking place when :
- (-)-2-Bromooctane reacts with sodium hydroxide to form (+)-Octane-2-ol.
  - 2-Bromopentane is heated with KOH(alc.) to form alkene.
24. The following compounds are given to you :
- 2-Bromopentane, 2-Bromo-2-methylbutane, 1- Bromopentane
- Write the compound which is most reactive towards  $\text{S}_{\text{N}}2$  reaction.
  - Write the compound which is optically active.
  - Write the compound which is most reactive towards  $\beta$  elimination reaction.
25. What happens when: (Any three)
- formic acid reacts with conc.  $\text{H}_2\text{SO}_4$ .
  - acetic acid reacts with  $\text{Cl}_2$  in the presence of red P?
  - calcium acetate is heated?
  - $\text{CH}_3 - \text{O} - \text{CH}_3$  is heated with HI.
26.
  - At low pressure and high temperature, water evaporates rapidly, why?
  - Calculate the molality of a solution when 20 g NaOH is dissolved in 440 g of solvent.

27. A solution of  $[\text{Ni}(\text{H}_2\text{O})_6]^{2-}$  is green but a solution of  $[\text{Ni}(\text{CN})_4]^{2-}$  is colourless. Explain.
28. How will you convert (Give only chemical equation):
- Propanamide to ethylamine
  - Ethyl amine to methane
  - Aniline to acetanilide.

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Identify A, B and C in the following equations :



## SECTION-D

**Directions (Q. Nos. 29-30) :** The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Molar conductivity of a solution is the conductance of solution containing one mole of electrolyte, kept between two electrodes having unit length between them and large cross-sectional area, so as to contain the electrolyte. In other words, molar conductivity is the conductance of the electrolytic solution kept between the electrodes of a conductivity cell at unit distance but having area of cross-section large enough to accommodate sufficient volume of solution that contains one mole of the electrolyte.

It is denoted by  $\Lambda_m$ .

The molar conductivity is related to conductivity as:

$$\Lambda_m = k \# V = \frac{1000}{C} \# k = k \# \frac{1000}{\text{Molarity}}$$

Unity of  $\Lambda_m$  (molar conductivity) shall be  $\text{ohm}^{-1} \text{cm}^{-1} \text{mol}^{-1}$  or  $\text{S cm}^2 \text{mol}^{-1}$ .

Thus, knowing molar concentration ( $C$ ) and conductivity ( $k$ ),  $\Lambda_m$  can be calculated.  $\Lambda_{c_m}$  is called molar conductivity at infinite dilution. The molar conductivity of strong electrolytes is found to vary with concentration according to the equation,

$$\Lambda_m^C = \Lambda_{c_m} - A \cdot \sqrt{C}$$

This equation is called Debye-Huckel Onsager equation.

Here,  $A$  is constant depending upon the type of electrolyte taken and nature of solvent and temperature.

In the context of given passage, answer the following questions:

- The molar conductivity of HCl increases with dilution. Can you suggest what may be the reason for this?
- Here are given the different molarities of NaCl. Which of them will exhibit the highest molar conductivity?

0.005 M NaCl, 0.1 M NaCl, 0.5 M NaCl, 0.01 M NaCl.

(iii) Molar conductivity of a solution is  $1.26 \times 10^2 \Omega^{-1} \text{cm}^2 \text{mol}^{-1}$ . Its molarity is 0.01. What will be its specific conductivity?

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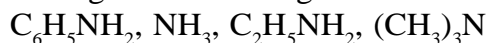
(iv) The conductivity of 0.00241 M acetic acid is  $7.896 \times 10^{-5} \text{S cm}^{-1}$ . What shall be the molar conductivity of the solution in  $\text{S cm}^{-1} \text{mol}^{-1}$  ?

**30.** Amines constitute an important class of organic compounds derived by replacing one or more hydrogen atoms of ammonia molecule by alkyl/ aryl groups. Amines are usually formed from nitro compounds, halides, amides, etc. They exhibit hydrogen bonding which influences their physical properties. Alkyl amines are found to be stronger bases than ammonia. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. Reactions of amines are governed by availability of the unshared pair or electrons on nitrogen. Influence of the number of hydrogen atoms at nitrogen atom on the type of reactions and nature of products is responsible for identification and distinction between primary, secondary and tertiary amines. Reactivity of aromatic amines can be controlled by acylation process.

In the context of given passage, answer the following questions :

(i) Why does aniline not give Friedel-Crafts reaction?

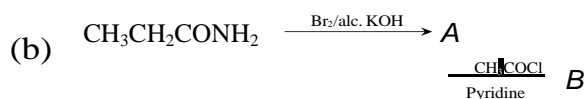
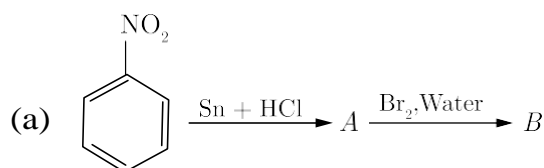
(ii) Arrange the following in the increasing order of their  $pK_b$  values :



(iii) How can you distinguish between  $\text{CH}_3\text{CH}_2\text{NH}_2$  and  $(\text{CH}_3\text{CH}_2)_2\text{NH}$  by Hinsberg test?

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(iv) Write the structures of A and B in the following reactions:



## SECTION-E

**Directions (Q. Nos. 31-33) :** The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

**31.** (i) Calculate the mass of Ag deposited at cathode when a current of 2 amperes was passed through a solution of  $\text{AgNO}_3$  for 15 minutes.

(Given : Molar mass of Ag =  $108 \text{g mol}^{-1}$ ,  $1F = 96500 \text{C mol}^{-1}$ )

(ii) What do you mean by fuel cell?

(iii) Write Cu, Na, Mg and Ag in the decreasing order of electrochemical series with the help of the following reactions :



32. (i) Write the reaction involved in the following :
- Etard reaction
  - Stephan reduction
- (ii) How will you convert the following in not more than two steps :
- Benzoic acid to Benzaldehyde
  - Acetophenone to Benzoic acid
  - Ethanoic acid to 2-hydroxyethanoic acid.

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- (i) An organic compound [A] with molecular formula  $\text{C}_8\text{H}_{16}\text{O}_2$  was hydrolysed with dilute sulphuric acid to give a carboxylic acid [B] and an alcohol [C]. Oxidation of [C] with chromic acid produced [B]. The alcohol [C] on dehydration gave but-1-ene. Write equations for the reactions involved.
- (ii) How many asymmetric carbon atoms are created during the complete reduction of benzil ( $\text{PhCOCOPh}$ ) with  $\text{LiAlH}_4$ ? Also write the number of possible stereoisomers formed as the product.

33. (i) Account for the following :
- Copper (I) compounds are white whereas Copper (II) compounds are coloured.
  - Chromates change their colour when kept in an acidic solution.
  - Zn, Cd, Hg are considered as *d*-block elements, but not as transition elements.
- (ii) Calculate the spin-only moment of  $\text{Co}^{2+}$  ( $Z = 27$ ) by writing the electronic configuration of Co and  $\text{Co}^{2+}$ .

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- (i) Following are the transition metal ions of 3d series :



(Atomic numbers :



Answer the following :

- Which ion is most stable in an aqueous solution and why?
  - Which ion is a strong oxidising agent and why?
  - Which ion is colourless and why?
- (ii) Complete the following equations :
- $2\text{MnO}_4^- + 16\text{H}^+ + 5\text{S}^{2-} \rightarrow$
  - $\text{KMnO}_4 \xrightarrow{\text{heat}}$

