



Delhi Public School, Howrah

PREBOARD EXAMINATION (2024-2025)

CLASS - XII

SUBJECT - CHEMISTRY (Code No. 043)

Care must be taken not to write anything on the question paper. All the questions must be attempted in the correct sequence.

TIME - 3 HOURS

F.M. - 70

General Instructions:

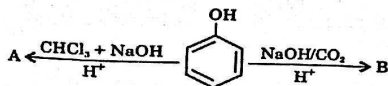
Read the following instructions carefully.

- 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 very 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.

1. Identify A and B:



- A = Salicylaldehyde, B = Salicylic acid
- A = Benzaldehyde, B = Salicylic acid
- A = Benzaldehyde, B = Salicylaldehyde
- A = Salicylic acid, B = Salicylaldehyde

2. Given that the standard electrode potentials (E°) of few metals are,

$$\text{K}^+/\text{K} = -2.93\text{V}$$

$$\text{Ag}^+/\text{Ag} = 0.8\text{V}$$

$$\text{Mg}^{2+}/\text{Mg} = -2.37\text{V}$$

$$\text{Cu}^{2+}/\text{Cu} = 0.34\text{V}$$

$$\text{Cr}^{3+}/\text{Cr} = -0.74\text{V}$$

$$\text{Fe}^{2+}/\text{Fe} = -0.44\text{V}$$

Metals in increasing order of their reducing power are:

- $\text{Ag} < \text{Cu} < \text{Fe} < \text{Cr} < \text{Mg} < \text{K}$
- $\text{Ag} < \text{Fe} < \text{Cu} < \text{Cr} < \text{Mg} < \text{K}$
- $\text{K} < \text{Ag} < \text{Fe} < \text{Cu} < \text{Cr} < \text{Mg}$
- $\text{Cr} < \text{Mg} < \text{K} < \text{Ag} < \text{Fe} < \text{Cu}$

3. A first order reaction has a rate constant $1 \times 10^{-3} \text{ s}^{-1}$. How long will it take 6 g of this reactant to reduce to 3 g?

- 6.93 s
- 69.3 s
- 693 s
- 0.693 s

4.	When $\text{CH}_3\text{CHBrCH}_2\text{CH}_3$ is reacted with alcoholic KOH, the major product is (a) $\text{CH}_3\text{-CH=CH-CH}_3$ (b) $\text{CH}_2\text{=CH-CH}_2\text{-CH}_3$ (c) $\text{CH}_3\text{-CH(OH)-CH}_2\text{-CH}_3$ (d) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$	1										
5.	Match List-I with List-II <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>List-I</th> <th>List-II</th> </tr> </thead> <tbody> <tr> <td>(A) $[\text{Fe}(\text{CN})_6]^{3-}$</td> <td>(i) 5.92 BM</td> </tr> <tr> <td>(B) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$</td> <td>(ii) 0 BM</td> </tr> <tr> <td>(C) $[\text{Fe}(\text{CN})_6]^{4-}$</td> <td>(iii) 4.90 BM</td> </tr> <tr> <td>(D) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$</td> <td>(iv) 1.73 BM</td> </tr> </tbody> </table> Options: (a) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii) (b) (A)-(iv), (B)-(ii), (C)-(i), (D)-(iii) (c) (A)-(ii), (B)-(iv), (C)-(iii), (D)-(i) (d) (A)-(i), (B)-(iii), (C)-(iv), (D)-(ii)	List-I	List-II	(A) $[\text{Fe}(\text{CN})_6]^{3-}$	(i) 5.92 BM	(B) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(ii) 0 BM	(C) $[\text{Fe}(\text{CN})_6]^{4-}$	(iii) 4.90 BM	(D) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	(iv) 1.73 BM	1
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6.	Which of the following statements is true regarding the oxidation of alcohols? (a) Primary alcohols can be oxidised to carboxylic acids, while secondary alcohols form ketones. (b) Secondary alcohols can be oxidised to carboxylic acids, while primary alcohols form aldehydes. (c) Tertiary alcohols are the most easily oxidised among the different types of alcohols. (d) Alcohols do not undergo oxidation reactions under any circumstances.	1										
7.	The IUPAC name of the compound formed when aniline undergo bromination is (a) 2, 4, 6-Tribromoaniline (b) 1, 3, 5-Tribromoaniline (c) 2, 3, 4-Tribromophenol (d) 1, 3, 4-Tribromophenol	1										
8.	Which statement is correct regarding the dehydration of alcohols? (a) Alcohols undergo dehydration to form alkenes in the presence of concentrated acids. (b) Dehydration of alcohols results in the formation of ethers and water. (c) Alcohols dehydrate to yield alkanes and water in the presence of strong bases. (d) Dehydration of alcohols requires high temperatures and strong reducing agents.	1										
9.	Atul is doing an experiment in which he observes a violet colour with sodium nitroprusside in the test of sulphur in an organic compound. This is due to the formation of: (a) $\text{Na}_4[\text{Fe}(\text{CN})\text{NO}]$ (b) $\text{Na}_4[\text{Fe}(\text{CN})\text{NOS}]$ (c) $\text{Na}_3[\text{Fe}(\text{CN})_5\text{NS}]$ (d) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$	1										
10.	What is the oxidation number of Pt in $[\text{Pt}(\text{NH}_3)_4\text{Br}_2]^{2+}$? (a) 4 (b) 6 (c) 2 (d) 3	1										
11.	The gas-phase decomposition reaction of ethane is given below: $\text{C}_2\text{H}_6 \rightarrow \text{C}_2\text{H}_2 + 3\text{H}_2$	1										

This reaction is investigated at constant temperature and volume. The table below shows the partial pressure ($p_{C_2H_6}$) observed for the above reaction at different times.

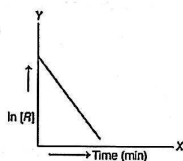
Experiment no.	Time (in mins)	$p_{C_2H_6}$ in mm Hg
1	0	800
2	100	400
3	200	20

The order of the reaction is:

- (a) 0
(b) 1
(c) 2
(d) 3

12. What is the unit of the rate constant of the reaction depicted in the graph?

1



- (a) $\text{mol L}^{-1} \text{sec}^{-1}$
(b) sec^{-1}
(c) mol L^{-1}
(d) $\text{mol}^{-2} \text{L sec}^{-1}$

Given below are two statements labelled as Assertion (A) and Reason (R).

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

13. Assertion (A): Fructose reduces Fehling's solution and Tollens' reagent.

Reason (R): Fructose does not contain any aldehyde group.

1

14. Assertion (A): It is possible to make a cell with a pair of same type of half cells.

Reason (R): Change in concentration in half cells can change the electrode potential even if they are of same type.

1

15. Assertion (A): All collisions of reactant molecules lead to product formation.

Reason (R): Only those collisions in which molecules have correct orientation and sufficient kinetic energy lead to the compound formation.

1

16. Assertion (A): The electrodes which are used to determine the pH of solution are hydrogen gas electrodes, quinhydrone electrodes and gas electrodes.

Reason (R): Electrodes can be made based upon the H^+ concentration of the electrolyte.

1

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) What type of interaction between metal and CO ligands creates a synergic effect?

(b) How is Δ_o value affected by the interaction of CO ligands and metal ion in metal carbonyl?

2

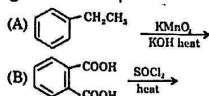
18. Convert the following:

(a) Acetamide to methylisocyanide

(b) Nitrobenzene to acetanilide

2

19. Complete the following chemical equations:



OR

Arrange the following compounds in increasing order of their property as indicated:

(a) CH_3COCH_3 , $\text{C}_6\text{H}_5 - \text{CO} - \text{C}_6\text{H}_5$, CH_3CHO

(reactivity towards nucleophilic addition reactions)

(b) $\text{Cl}_2\text{CH-COOH}$, $\text{Cl-CH}_2\text{-COOH}$, $\text{CCl}_3\text{-COOH}$
(acidic character)

20. A first order reaction takes 30 minutes for 90% decomposition. What is the rate constant?

21. Explain why $[\text{Fe}_6]^{3+}$ is attracted by a magnet.

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. An aromatic hydrocarbon U (C_6H_6) on reaction with aliphatic hydrocarbon V (C_3H_6) in the presence of H_3PO_4 at 250°C gives compound W (C_9H_{12}). W in the presence of O_2 produces compound X (cumene hydroperoxide) which on reaction with hydronium ion gives product Y ($\text{C}_6\text{H}_6\text{O}$) and Z ($\text{C}_3\text{H}_6\text{O}$). Draw the structure of the compounds from U to Z.

23. Give reason for the following:

(a) Many of the transition elements are known to form interstitial compounds.

(b) The enthalpies of atomisation of transition elements are quite high.

24. The standard electrode potential for the $\text{M}^{3+}/\text{M}^{2+}$ half-cell gives the relative stability between M^{3+} and M^{2+} . The reduction potential values are tabulated as below.

Metal	Standard Reduction Potential (V)
Ti	-0.37
V	-0.26
Cr	-0.41
Mn	+1.51
Fe	+0.77
Co	+1.81

(a) What does the negative values for titanium, vanadium and chromium indicate?

(b) The E° value of the $\text{Mn}^{3+}/\text{Mn}^{2+}$ couple is much more positive than that for $\text{Cr}^{3+}/\text{Cr}^{2+}$ couple or $\text{Fe}^{3+}/\text{Fe}^{2+}$ couple. Explain.

25. (a) What type of linkage is present in proteins?

(b) Write one source and deficiency disease of vitamin B-12.

OR

(a) Write one structural & one functional difference between DNA and RNA.

(b) What are the expected products of hydrolysis of lactose?

26. (a) Predict the products of electrolysis in each of the following:

(i) An aqueous solution of AgNO_3 with platinum electrode.

(ii) An aqueous solution of H_2SO_4 using platinum electrode.

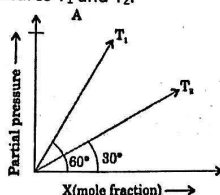
(b) Write the cathode reaction involved in the above two.

27. (a) A non-reducing disaccharide 'X' on hydrolysis with dilute acid gives an equimolar mixture of D-(+)-glucose and D-(-)-fructose. Identify 'X'.

(b) Name the linkage that holds the two units in the disaccharide.

(c) Draw the structures of the product formed in the following reactions.

28. Aquatic animals feel more comfortable in cold water than warm water as the solubility of oxygen in cold water is more than that in warm water. The graph below shows the solubility of oxygen in the water as a function of pressure at different temperatures T_1 and T_2 .



- (a) Based on the above graph, what is the ratio of K_H at T_1 and T_2 ?
 (b) Between T_1 and T_2 which one is greater?

SECTION: D

The following questions are case-based questions. Each question has an internal choice and carries 4 (2+1+1) marks each. Read the passage carefully and answer the questions that follow.

29. Formaldehyde is a commonly known aldehyde with the chemical formula CH_2O . It is used in various industries for manufacturing and as a preservative, but it can also be emitted as a gas from certain building materials, furniture, and household products.

Formaldehyde is known to be a potential indoor air pollutant, and its presence in indoor environments has been associated with health concerns. High levels of formaldehyde exposure have been linked to irritation of the eyes, nose, and throat, as well as respiratory symptoms and allergic reactions. Prolonged exposure to elevated levels of formaldehyde is also associated with more serious health issues, including an increased risk of certain cancers.

- (a) How will you differentiate the following compounds: (any 1)
 (i) Formaldehyde and acetaldehyde
 (ii) Formic acid and acetic acid.
 (b) What is formalin?
 (c) Write the products of Cannizaro reaction of Formaldehyde.

30. Ideal solutions play a vital role in various fields, ranging from chemistry and materials science to everyday consumer products. An ideal solution refers to a mixture where the interactions between the molecules of different components are identical to those between molecules of the same component.

One practical application of ideal solutions can be found in the formulation of automotive antifreeze and coolants. These fluids are used to regulate the temperature of engines and prevent freezing in cold conditions. A common mixture used as an antifreeze is ethylene glycol and water.

Ethylene glycol is added to water to lower its freezing point and raise its boiling point, making it more effective as an engine coolant. Ideally, an ethylene glycol-water mixture would exhibit ideal behaviour, meaning that the vapour pressure of the mixture would be directly proportional to the mole fraction of each component.

- (a) If liquids A and B form an ideal solution, then what is the Gibbs free energy of mixing? Why?

OR

- (a) Provide an example of a real-life application where ideal solutions play a vital role.
 (b) Name any two examples of ideal solutions?
 (c) How does adding salt to water affect the boiling point of the solution?

SECTION: E

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

31. (a) Arrange the following in the decreasing order of their basic strength in aqueous solutions:
 CH_3NH_2 , $(\text{CH}_3)_2\text{NH}$, $(\text{CH}_3)_3\text{N}$ and NH_3
 (b) State Hoffmann bromamide degradation reaction and also write its reaction.
 (c) How will you convert Benzene to Aniline?

OR

A hydrocarbon A (C_4H_8) on reaction with HCl gives a compound B ($\text{C}_4\text{H}_9\text{Cl}$) which on reaction with 1 mole of NH_3 gives a compound C ($\text{C}_4\text{H}_{11}\text{N}$). On reacting with NaNO_2 and HCl (low temperature) followed by

treatment with water, compound C yields optically active alcohol(s). Ozonolysis of 'A' gives 2 moles of acetaldehyde. Identify the compounds 'A' to 'D'.

32. (a) The table below gives data about four different gaseous compounds.

	Chemical Formula	Atmospheric lifetime (approx. years)	Boiling point (°C)
P	CCl ₃ F	45	24
Q	CCl ₂ F ₂	114	-29.8
R	CClF ₂ CClF ₂	300	3.5
S	CF ₄	60,000	-46

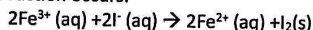
- (i) State one problem caused by compound Q in the atmosphere.
 (ii) Which two out of the four compounds are more suitable to be used as a refrigerant in refrigerators and why?
 (b) Which class of compounds is more likely to undergo nucleophilic substitution: Haloalkanes or Haloarenes?
 (c) Why haloarenes are less reactive towards nucleophilic aromatic substitution reactions compared to alkyl halides (haloalkanes)?

OR

- (a) Which type of reaction is typically used to replace a halogen atom in a haloarene with another functional group?
 (b) How are haloarenes classified based on the position of the halogen atom in relation to the aromatic ring?
 (c) Give reason for the following:
 (i) n-Butyl bromide has a higher boiling point than t-butyl bromide.
 (ii) Racemic mixture is optically inactive.

33. (a) The resistance of a conductivity cell containing 0.001M KCl solution at 298K is 1500 Ohm. What is the cell constant if conductivity of 0.001M KCl solution at 298 K is $0.146 \times 10^{-3} \text{ S cm}^{-1}$.

- (b) The cell in which the following reaction occurs:



has E° cell = 0.236 Volt at 298 K

Calculate the standard Gibbs energy and the equilibrium constant of the reaction.

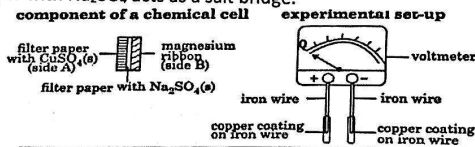
OR

(a) Shrestha take battery of an electronic device for doing experiment on it. After doing experiment she observes two things that are:

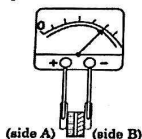
- (i) it can be used for the long period of time.
 (ii) active materials which are used up in this battery can be reproduced by passing current through the cell in opposite direction.

On the basis of above observations find out which type of battery it is and how it works?

- (b) The diagram given below show the component of a chemical cell, an experimental setup, and how the pointer of the voltmeter deflects when the set-up is connected to the component. Note that in the chemical cell, a filter paper with Na_2SO_4 acts as a salt bridge.



The pointer of the voltmeter deflects to a positive reading when a few drops of water are added to the component



Why does the pointer of the voltmeter deflect as shown when a few drops of water are added to the component?