



BAL BHARATI PUBLIC SCHOOL  
MID-TERM EXAMINATION (2025-26)  
CLASS - XII  
SUBJECT: CHEMISTRY  
SET-A

TIME: 3 hours

DATE: 22.03.25

Max. Marks: 70

## General Instructions:

Read the following instructions carefully.

- This question paper contains 33 questions. All questions are compulsory.
- Question paper is divided into five sections-Section A, B, C, D and E.
- SECTION A** -question number 1 to 16 are Multiple-choice questions (MCQ) carrying 1 mark each.
- SECTION B**- question number 17 to 21 are Very Short Answer type questions (VSA) carrying 2 marks each.
- SECTION C**- question number 22 to 28 are Short Answer (SA) type questions carrying 3 marks each.
- SECTION D**- question number 29 to 30 are case- based questions carrying 4 marks each.
- SECTION E**- question number 31 to 33 are long answer questions carrying 5 marks each.
- There is no overall choice. However, an internal choice has been provided in few questions. Only one of the choice in such questions have to be attached.
- Use of calculator is not allowed.

## Section - A

1. When chlorobenzene is treated with NaOH at 623 K and 300 atm pressure, it gives sodium phenoxide. However, the same reaction does not occur under normal conditions. The reason is:

- The C-Cl bond in chlorobenzene has partial double bond character due to resonance.
- The C-Cl bond in chlorobenzene is purely ionic and very weak.
- The benzene ring activates the chlorine atom towards nucleophilic substitution.
- NaOH under normal conditions is not a strong base.

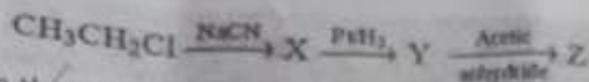
2. Which of the following species can act as the strongest base? 1

- (a) OH<sup>-</sup> (b)  OR<sup>-</sup> (c) C<sub>6</sub>H<sub>5</sub>O<sup>-</sup> (d) Both a and B

3. An organic compound X having molecular formula C<sub>5</sub>H<sub>10</sub>O yields phenyl hydrazone and negative response to the iodoform test and Tollens' test. It produces n-pentane on reduction. X would be:

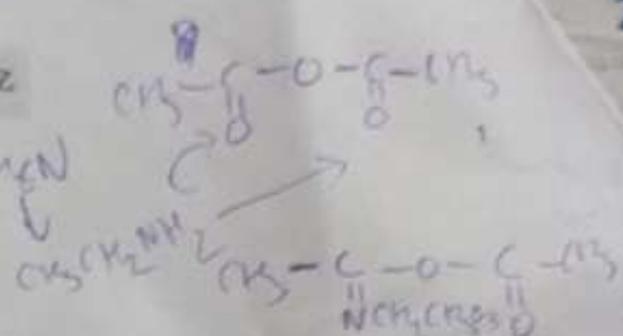
- (a) 3-Pentanone (b)  n-amyl alcohol (c) Pentanal (d) 2-Pentanone 1

4.



In the above sequence of reactions, Z is:

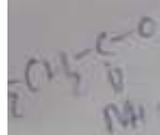
- (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NHCOCH}_3$   
 (b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$   
 (c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CONHCH}_3$   
 (d)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CONHCOCH}_3$



5. A peptide has the sequence: Ala-Gly-Val-Ser.

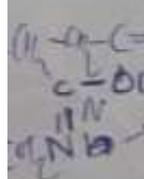
If this peptide undergoes hydrolysis, which of the following will be obtained?

- (a) A mixture of four amino acids with free  $-\text{NH}_2$  and  $-\text{COOH}$  groups  
 (b) A cyclic peptide containing four residues  
 (c) A single amino acid with a long chain  
 (d) Two dipeptides



6. Which of the following reaction of glucose can be explained only by its cyclic structure?

- (a) Glucose forms pentaacetate  
 (b) Glucose reacts with hydroxyl amine to form an oxime.  
 (c) Pentaacetate of glucose does not react with hydroxyl amine to form an oxime.  
 (d) Glucose is oxidized by nitric acid to gluconic acid

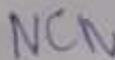


7. Boiling of egg is a common kitchen example of protein denaturation. What actually happens to the egg proteins during boiling?

- (a) Peptide bonds break, releasing amino acids  
 (b) Primary structure of proteins is lost completely  
 (c) Hydrogen bonds and other weak interactions are disrupted, proteins coagulate  
 (d) Proteins are converted into carbohydrate

8. The source of nitrogen in Gabriel Phthalimide synthesis is:

- (a) Sodium azide  
 (b) Sodium nitrite  
 (c) Potassium cyanide  
 (d) Potassium phthamide



9. Ozonolysis of an organic compound gives formaldehyde as one of the products. This confirms the presence of:

- (a) A vinyl group  
 (b) An isopropyl group  
 (c) An acetylene triple bond

d) Two ethylenic double bonds

10. Which is the correct order of acid strength for the following? 1

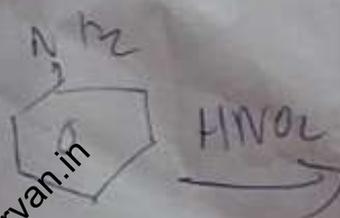
- (a)  $C_6H_5OH > H_2O > ROH$  (b)  $C_6H_5OH > ROH > H_2O$   
(c)  $ROH > C_6H_5OH > H_2O$  (d)  $H_2O > C_6H_5OH > ROH$

11. Chlorobenzene is formed by reaction of chlorine with benzene in the presence of  $AlCl_3$ . Which of the following species attacks the benzene ring in this reaction? 1

- a)  $Cl^-$   
b)  $Cl^+$   
c)  $AlCl_3$   
d)  $[AlCl_4]^+$

12. Aniline reacts with  $HNO_2$  to form: 1

- a)  $C_6H_5N_2Cl$   
b)  $C_6H_5-O-C_6H_5$   
c)  $C_6H_5OH$   
d)  $C_6H_5CHO$



Assertion-Reason Questions: In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choice.

- (a) Assertion and reason both are correct statements, but the reason is the correct explanation for assertion.  
(b) Assertion and reason both are correct statements, but the reason is not a correct explanation for assertion.  
(c) Assertion is a correct statement, but the reason is a wrong statement.  
(d) Assertion is a wrong statement but the reason is correct

13. Assertion (A): The molar conductivity of  $KCl$  increases with dilution.

Reason (R): On dilution, the degree of dissociation of  $KCl$  increases significantly. 1

14 Assertion: N-, Ethyl benzene sulphonamide is insoluble in alkali.

Reason: Sulphonyl group attached to nitrogen atom is strong electron withdrawing group 1

15. Assertion: During Electrolysis of aqueous copper sulphate solution using copper electrodes hydrogen gas is released at the electrode.

Reason: The electrode potential of  $Cu^{2+}/Cu$  is greater than that of  $H^+/H_2$ . 1

16 Assertion: When  $NaCl$  is added to water a depression in freezing point is observed.

Reason: The lowering of vapour pressure of a solution causes depression in freezing point. 1

Section -B

17. Answer the following:

- a) When 50 ml of phenol and 50 ml of aniline are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 ml. Give reason to support your answer.
- b) Ritesh suggested adding salt to the box containing ice. He said this would keep the cold drink bottles cold for a longer time. How will Ritesh justify his suggestion? (1+1=2)

0.5

OR

Answer the following:

- a)  $\text{BaCl}_2$  on reaction with  $\text{Na}_2\text{SO}_4$  in aqueous solution gives white precipitate. If the two solutions are separated by a semi-permeable membrane, will there be appearance of a white precipitate due to osmosis?
- b) Why does water stop boiling when sugar is added to boiling water. (1+1=2)

Q. 18. Answer the following:

- a) Which vitamin is responsible for coagulation of blood? E
- b) What is the difference between native protein and denatured protein? (1+1=2)

1

19. How will you distinguish between the following pairs of compounds?

- a) Chlorocyclohexane and chlorobenzene
- b) Benzyl carbocation is highly reactive towards the  $\text{S}_{\text{N}}1$  reaction. Give reason (1+1=2)

2

20.

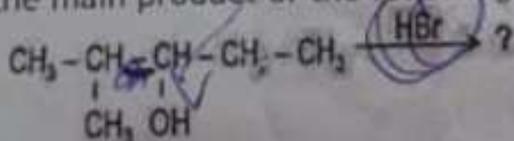
- a) What happens when D-glucose is treated with Acetic Anhydride? Give equation (2)
- b) Doctor advised a 50-year-old woman enough exposure to sunlight and addition of fish and egg yolk to her diet. What is the possible disease diagnosed by the doctor? (1+1=2)

21. Write the mechanism of dehydration of alcohol at 443 K.

(2)

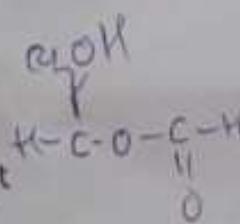
SECTION C

22. a) Predict the main product of the following reaction.

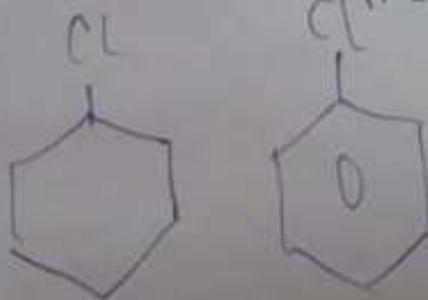


1

b) Write the reaction mechanism to explain why this isomer (the main product in the above reaction) predominates. (1+2=3)



[4]



Handwritten calculations and scribbles at the bottom left of the page.



- Q23. a) Preparation of ether by acid catalysed dehydration of secondary and tertiary alcohol is not a suitable method. Give reason  
 b) Give equation for the following:  
 i. Bromine in  $CS_2$  with phenol  
 ii. Dilute  $HNO_3$  with phenol

(2)

(1+1+1=3)

Q24. Account for the following

- a) On the basis of  $E^0$  values,  $O_2$  gas should be liberated at anode but it is  $Cl_2$  gas which is liberated in the electrolysis of aqueous  $NaCl$ .  
 b) Conductivity of  $CH_3COOH$  decreases on dilution.  
 c) Write the anode and cathode reaction in Lead storage battery during its use.

(2)

(1+1+1=3)

Q25. (a) A 5% solution of  $Na_2SO_4 \cdot 10H_2O$  ( $M_w = 322$ ) is isotonic with 2% solution of non-electrolytic, non-volatile substance X. Find out the molecular weight of X.

(b) Give the values of Van't Hoff factors for  $K_4[Fe(CN)_6]$  and  $K_2SO_4$ . ? (2+1=3)

Q26. Accomplish the following conversions (any three):

- a) Nitrobenzene to benzoic acid  
 b) Benzamide to toluene  
 c) Aniline to benzyl alcohol  
 d) Aniline to 2,4,6-tribromofluorobenzene

(2)

(1+1+1=3)

Q27. Give reasons for the following observations:

- a) Benzophenone does not react with  $NaHSO_3$   
 b) Carboxylic acids are more acidic than alcohols or phenols although all of them have hydrogen atom attached to an oxygen atom (-OH)?

(A)

(1+2=3)

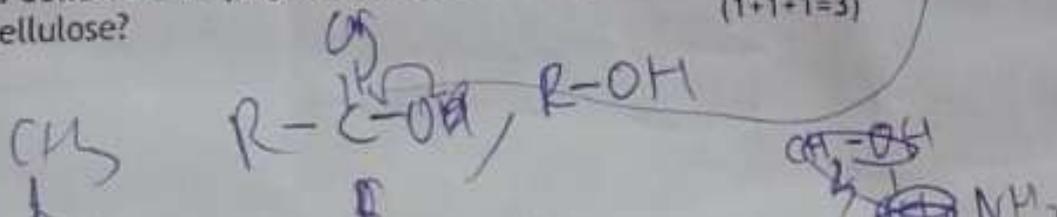
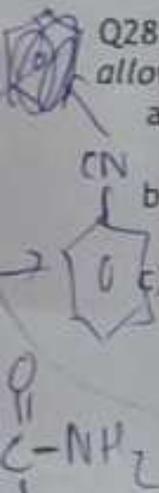
Q28. A patient is diagnosed with diabetes and advised to avoid sucrose but is allowed to take starch in moderate amounts.

a) Give a chemical reason why starch can be consumed but sucrose should be avoided.

b) Hydrolysis of starch gives a product that responds to Fehling's test, but sucrose does not. Explain.

c) Both starch and cellulose are polymers of glucose. Why can humans digest starch but not cellulose?

(1+1+1=3)



Q 30.

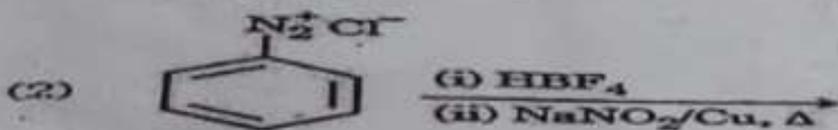
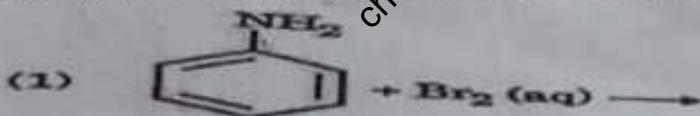
Amines are usually formed from nitro compounds, halides, amides, imides, etc. They exhibit hydrogen bonding which influences their physical properties. In alkyl amines, a combination of electron releasing, steric and hydrogen bonding factors influence the stability of the substituted ammonium cations in protic polar solvents and thus affect the basic nature of amines. In aromatic amines, electron releasing and withdrawing groups, respectively increase and decrease their basic character. 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. Presence of amino group in aromatic ring enhances reactivity of the aromatic amines. Aryl diazonium salts provide advantageous methods for producing aryl halides, cyanides, phenols and arenes by reductive removal of the diazo group.

Answer the following questions:

- Arrange the following in the increasing order of their  $pK_b$  values in aqueous solution:  $C_2H_5NH_2$ ,  $(C_2H_5)_2NH$ ,  $(C_2H_5)_3N$  1
- Aniline on nitration gives a substantial amount of *m*-nitroaniline, though amino group is *o/p* directing. Why? 1
- An aromatic compound 'A' of molecular formula  $C_7H_6O_2$  on treatment with aqueous ammonia and heating forms compound 'B'. Compound 'B' on heating with  $Br_2$  and aqueous  $KOH$  gives a compound 'C' of molecular formula  $C_6H_7N$ . Write the structure of A, B and C. 2

OR

- c) Complete the following reactions given main products :

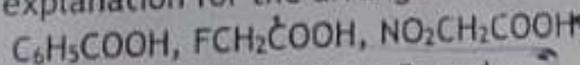


SECTION - E

Q31

a) An organic compound A having molecular formula  $C_8H_{16}O_2$  was hydrolysed with dilute sulphuric acid to get a carboxylic acid (B) and an alcohol (C). Oxidation of C with chromic acid produced B. (C) on dehydration gives But-1-ene. Identify A, B and C.

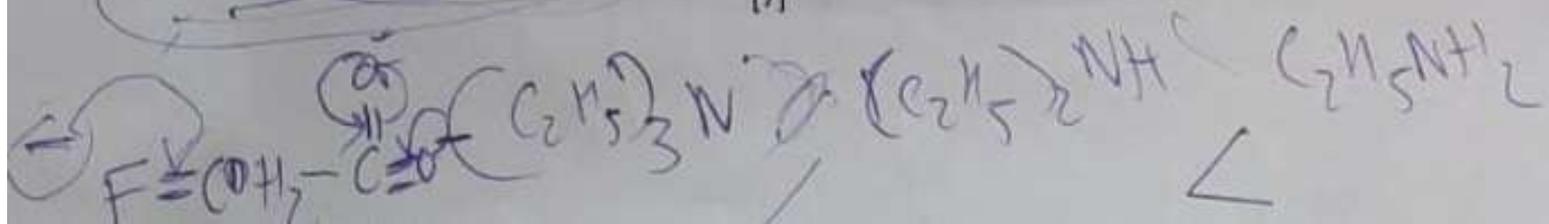
b) Arrange the following in decreasing order of their acidic strength. Give explanation for the arrangement.



c) Convert Ethanal to But-2-enal

(3+1+1=5)

[7]



or

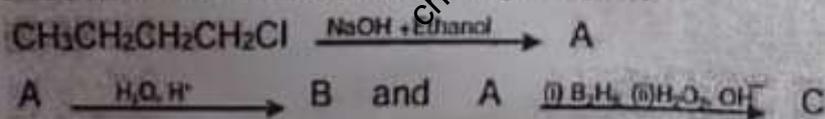
a) An aromatic compound 'A' (Molecular formula  $C_8H_8O$ ) gives positive 2, 4-DNP test. It gives a yellow precipitate of compound 'B' on treatment with iodine and sodium hydroxide solution. Compound 'A' does not give Tollens or Fehling's test. On drastic oxidation with potassium permanganate it forms a carboxylic acid 'C' (Molecular formula  $C_7H_6O_2$ ), which is also formed along with the yellow compound in the above reaction. Identify A, B and C and write all reactions involved.

b) Can Gattermann-Koch reaction be considered similar to Friedel-Crafts acylation? Discuss. (3+2=5)

Q32. Explain the following:

- Toluene on treatment with  $Cl_2$  in sunlight gives benzyl chloride whereas when treated with  $Cl_2$  in dark gives chlorobenzene and p-chlorobenzene.
- Finkelstein reaction is carried out in the presence of dry acetone.
- neo pentylchloride has lower boiling point than isopentylchloride.
- 

Consider the reaction and identify B and C



(1x5=5)

Or

a) A hydrocarbon of molecular mass  $72 \text{ g mol}^{-1}$  gives a single monochloro derivative and two dichloro derivatives on photo chlorination. Give the structure of the hydrocarbon.

b) Why can aryl halides not be prepared by reaction of phenol with HCl in the presence of  $ZnCl_2$ ?

c) tert-Butylbromide reacts with aq. NaOH by  $S_N1$  mechanism while n-butylbromide reacts by  $S_N2$  mechanism. Why? (2+1+2=5)

Q33. A galvanic cell is set up using a zinc rod immersed in a  $1 \text{ M Zn}^{2+}$  solution as the anode and a copper rod immersed in a solution containing  $Cu^{2+}$  ions with a concentration of  $0.10 \text{ M}$  as the cathode. A salt bridge connects the two half-cells.

- a) Explain the electron flow in the external circuit and the ionic movement in the salt bridge when the cell is in operation.
- b) The concentration of  $\text{Cu}^{2+}$  is reduced to 0.01 M, while the concentration of  $\text{Zn}^{2+}$  is increased to 2 M. How does this affect the EMF of the cell? Calculate the new EMF using the Nernst equation.
- c) If the temperature of the cell is raised to 298 K, calculate the change in Gibbs free energy ( $\Delta G^\circ$ ) for the cell reaction under standard conditions.

Given:

Standard electrode potentials:

$$E^\circ(\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V},$$

$$E^\circ(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$$

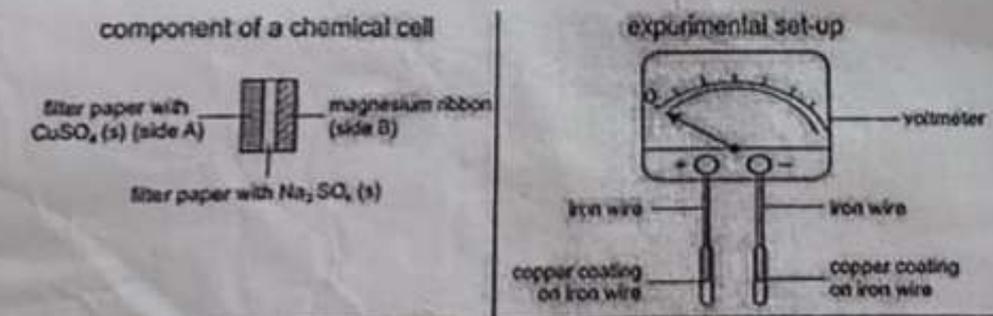
Faraday constant,  $F = 96500 \text{ C/mol}$

$$R = 8.314 \text{ J/mol}\cdot\text{K}, \quad \text{Log } 2 = 0.3010$$

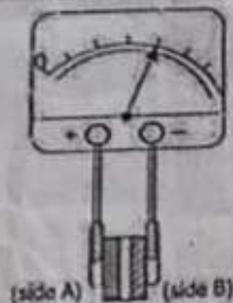
(1+2+2=5)

or

- a) The conductivity of a solution containing 1 gram of anhydrous  $\text{BaCl}_2$  in  $200 \text{ cm}^3$  of water has been found to be  $0.0058 \text{ S cm}^{-1}$ . What are the molar conductivity and equivalent conductivity of the solution? (At. Wt. of Ba=137 and Cl=35.5)
- b) How many coulombs of electricity is required for complete oxidation of 90g of  $\text{H}_2\text{O}$ .
- c) The diagrams below show the component of a chemical cell, an experimental set-up, 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  $\text{Na}_2\text{SO}_4$  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?  
Write Reaction occurring at anode and cathode in the above set up.

(2+1+2=5)

Handwritten calculations:

$$\begin{array}{r} 64 \\ 7 \overline{) 45} \\ \underline{- 42} \\ 30 \\ \underline{- 28} \\ 2 \end{array}$$

SECTION D

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.

Q29 The lowering of vapour pressure of a solution causes a lowering of the freezing point compared to that of the pure solvent. We know that at the freezing point of a substance, the solid phase is in dynamic equilibrium with the liquid phase. Thus, the freezing point of a substance may be defined as the temperature at which the vapour pressure of the substance in its liquid phase is equal to its vapour pressure in the solid phase. A solution will freeze when its vapour pressure equals the vapour pressure of the pure solid solvent. According to Raoult's law, when a non-volatile solid is added to the solvent its vapour pressure decreases and now it would become equal to that of solid solvent at lower temperature. Thus, the freezing point of the solvent decreases. Depression in freezing point is a colligative property. It is found to be related to molality.

Answer the following questions:

a) A solution containing 50g of ethylene glycol in 200g of water is cooled to  $-9.3^{\circ}\text{C}$ . The amount of ice that will separate out will be ( $K_f = 1.86\text{K m}^{-1}$ )

- i. 18.71 g
- ii. 28.71 g
- iii. 38.71 g
- iv. 48.71 g

b) The unit of cryoscopic constant is :

- i.  $\text{K kg mol}^{-1}$
- ii.  $\text{K mol kg}^{-1}$
- iii.  $\text{K mol kg}^{-2}$
- iv.  $\text{K kg mol}^{-2}$

c) Between 2 M glucose and 1 M glucose solution, which one has a lower freezing point and why?

or

a. An experiment was carried out in the laboratory, to study depression in freezing point. 1M aqueous solution of  $\text{Al}(\text{NO}_3)_3$  and 1 M aqueous solution of glucose were taken. From the given figure identify solution 1 and solution 2. Give a plausible reason for your answer.

