

APEEJAY COMMON PRE-BOARD EXAMINATION 23-24
CLASS: XII
SUBJECT: CHEMISTRY

TIME: 3 HOURS

Max Marks: 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

Q1 We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentrations 0.1M, 0.01M and 0.001M, respectively. The value of van't Hoff factor for these solutions will be in the order _____.

- (a) $i_A < i_B < i_C$
- (b) $i_A > i_B > i_C$
- (c) $i_A = i_B = i_C$
- (d) $i_A < i_B > i_C$

Q2 If the E° cell for a given reaction has a positive value, then which of the following gives the correct relationships for the value of ΔG° and K_{eq} ?

- (a) $\Delta G^\circ > 0$; $K_{eq} < 1$
- (b) $\Delta G^\circ > 0$; $K_{eq} > 1$
- (c) $\Delta G^\circ < 0$; $K_{eq} > 1$
- (d) $\Delta G^\circ < 0$; $K_{eq} < 1$

Q3 In the graph plotted between $\ln [R]$ and t for a first order reaction, the intercept on Y-axis is:

- (a) $-K$
- (b) $[R]_0$
- (c) $\ln [R]_0$
- (d) $K/2.303$

Q4 $KMnO_4$ is an oxidizing agent. When KI solution is treated with $KMnO_4$ in acidic medium and alkaline medium I^- is oxidized to

- (a) I^- , I_2
- (b) I_2 , IO_3^-

(c) $\text{IO}^- \text{IO}_3^-$

(d) $\text{I}_2, \text{IO}_4^-$

Q5 The crystal field splitting energy for octahedral (Δ_o) complex and tetrahedral (Δ_t) complex is related as

(a) $\Delta_t = 2/9 \Delta_o$

(b) $\Delta_t = 5/9 \Delta_o$

(c) $\Delta_t = 4/9 \Delta_o$

(d) $\Delta_t = 2 \Delta_o$

Q6 The activation energy of a reaction is zero. The rate constant of the reaction:

a) Increase with increase of temperature

b) Decrease with increase of temperature.

c) Decrease with decrease of temperature

d) Is nearly independent of temperature.

Q7 What is the product formed when Cyclohexanone undergoes Clemmensen's reduction?

(a) Cyclohexane carboxylic acid

(b) Cyclohexane

(c) n-hexane

(d) Cyclohexanol

Q8

The correct increasing order of basic strength among p-nitroaniline (I); p-bromoaniline (II); p-toluidine (III) is:

(a) $\text{I} < \text{II} < \text{III}$

(b) $\text{III} < \text{II} < \text{I}$

(c) $\text{II} < \text{I} < \text{III}$

(d) $\text{III} < \text{I} < \text{II}$

Q9

Tertiary butyl alcohol is heated with conc. H_2SO_4 to get alkene which is subjected to ozonolysis. The product of ozonolysis is further treated with LiAlH_4 . The final product is/are:

(a) Tert-butyl alcohol

(b) Mixture of propan-2-ol and Methanol

(c) Mixture of Methanol and Ethanol

(d) Mixture of Ethanol and Formic acid

Q10

Acetone combines with ethylene glycol in dry HCl gas to generate

a) Hemiacetal

b) Cyclic ketal

c) Cyclic acetal

d) Acetal

Q11

A + B in the presence of dil NaOH gives $\text{C}_6\text{H}_5\text{CH}=\text{CHCO}\text{C}_6\text{H}_5$. Identify A and B :

a) A = 1-phenyl ethanal B = Acetophenone

b) A = Benzophenone B = Formaldehyde

c) A = Benzaldehyde B = Acetophenone

d) A = Benzophenone B = Acetophenone

Q12

In comparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M MgCl_2 solution is _____.

(a) the same

(b) about twice

(c) about three times

(d) about six times

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

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

✓ Q13

Assertion: Separation of Zr and Hf is difficult.
Reason: Zr and Hf lie in the same group of the periodic table.

✓ Q14

Assertion: C_2H_5OH is a weaker base than Phenol but is a stronger nucleophile than Phenol.

Reason: In Phenol the lone pair of electrons on Oxygen is withdrawn towards the ring due to resonance.

✓ Q15

Assertion: In monohaloarenes, further electrophilic substitution occurs at ortho and para positions.

Reason: Halogen atom is a ring deactivator.

✓ Q16

Assertion: The pentaacetate of glucose does not react with hydroxylamine.

Reason: Glucose contains free aldehyde group.

SECTION B

✓ Q17

15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at $-0.34^\circ C$. What is the molar mass of the substance? (K_f for water = $1.86 K kg mol^{-1}$)

✓ Q18

The experimental data for decomposition of N_2O_5 [$2N_2O_5 \rightarrow 4NO_2 + O_2$] in gas phase at 318K are given below:

t/s	0	400	800	1200	1600	2000	2400	2800	3200
$10^2 \times [N_2O_5] / mol L^{-1}$	1.63	1.36	1.14	0.93	0.78	0.64	0.53	0.43	0.35

(a) What is the rate law? ?

(b) Calculate the half life period for the reaction.

✓ Q19

- a) Explain why $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.
- b) Ammonolysis of alkyl halide is not a good method to prepare pure primary amines.

OR

Account for the following :

- a) pK_b of aniline is more than that of methyl amine .
- b) Aniline does not undergo Friedel-Craft's reaction

✓ Q20

An alkyl chloride (A), on reaction with magnesium in dry ether followed by treatment with ethanol gave 2-methylbutane. Write all the possible structures of (A).

✓ Q21

Which reactions of D-Glucose cannot be explained by open chain structure. How can cyclic structure of glucose explain these reactions.

SECTION C

Q22 (a) A sample of water was found to contain dissolved oxygen (O_2) to the extent of 5 ppm and hardness due to Mg^{2+} is 15 ppm. Calculate the amount of O_2 and number of Mg^{2+} in 1 litre of water (density of water = 1 g/mL). 3

(b) What volume of 98% sulphuric acid ($d = 1.84 \text{ g cm}^{-3}$) and what mass of water must be required to prepare 500 cm^3 of 15% solution of H_2SO_4 ($d = 1.10 \text{ g cm}^{-3}$)? [$H = 1, S = 32, O = 16 \text{ u}$] 3

Q23 A strip of nickel metal is placed in a 1 molar solution of $Ni(NO_3)_2$ and a strip of silver metal is placed in a 1 molar solution of $AgNO_3$. An electrochemical cell is created when the two solutions are connected by a salt bridge and the two strips are connected by wires to a voltmeter. 3

(i) Write the balanced equation for the overall reaction occurring in the cell.

(ii) Calculate the cell potential, E , at 25°C for the cell if the initial concentration of $Ni(NO_3)_2$ is 0.100 molar and the initial concentration of $AgNO_3$ is 1.00 molar. ($E^\circ_{Ni^{2+}/Ni} = -0.25\text{V}$ and $E^\circ_{Ag^+/Ag} = 0.80\text{V}$)

Q24 (a) For a reaction $A + B \rightarrow P$, the rate is given by $\text{Rate} = k[A][B]^2$ 3

(i) How is the rate of reaction affected if the concentration of B is doubled?

(ii) What is the overall order of reaction if A is present in large excess?

(b) A first order reaction takes 30 minutes for 50% completion. Calculate the time required for 90% completion of this reaction. ($\log 2 = 0.3010$). 3

Q25 State a reason for each of the following situations: 3

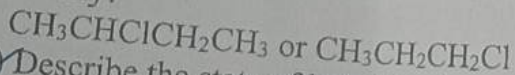
(i) Co^{2+} is easily oxidized to Co^{3+} in presence of a strong ligand.

(ii) CO is a stronger complexing reagent than NH_3 .

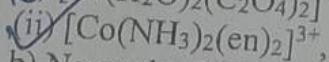
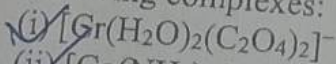
(iii) The molecular shape of $Ni(CO)_4$ is not the same as that of $[Ni(CN)_4]^{2-}$

Q26 (i) Arrange the four isomeric bromobutanes compounds of each set in order of reactivity towards S_N2 displacement. 3

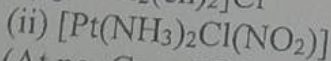
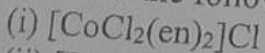
(ii) Which one of the following compounds is more easily hydrolyzed by KOH and why?



Q27 a) Describe the state of hybridization and the magnetic behaviour of the following complexes: 3

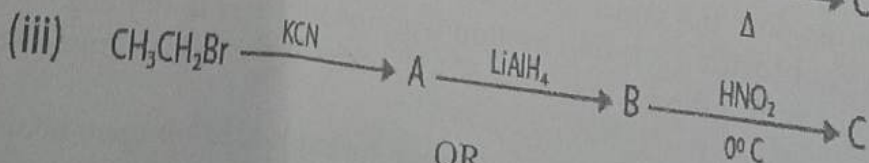
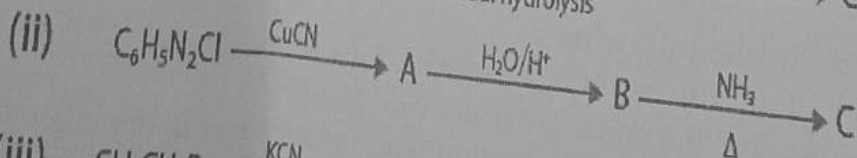
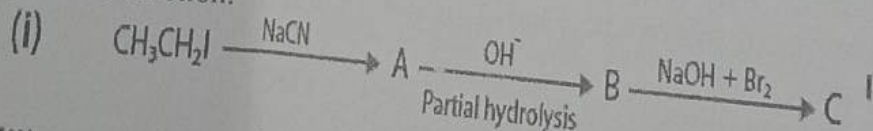


b) Name the following coordination compounds and draw their structures:



(At no. $Co = 27, Pt = 78$)

(a) Complete the reaction:



OR

Describe Hinsberg method for the identification of primary, secondary and

tertiary amines. Also write the chemical equations of the reactions involved.

SECTION D

Q29

Read the given passage and answer the questions that follow:

Alcohols and phenols are the most important compounds used in our daily life. Alcohols are prepared by hydration of alkenes, fermentation of glucose, reduction of aldehydes, ketones, carboxylic acids, and esters. Alcohols are soluble in water. Boiling points increase with an increase in molar mass and decrease with branching. Alcohols on dehydration give alkene at 443K, follow the carbocation mechanism. Excess of alcohol at 413K on dehydration with conc. H_2SO_4 also follows a carbocation mechanism but gives diethyl ether. Alcohols undergo nucleophilic substitution reactions, esterification with carboxylic acids and derivatives like amides, acid halides, acid anhydride. Phenol is prepared from cumene, diazonium salts, anisole, chlorobenzene. Phenol is used to prepare salicylaldehyde, salicylic acid, aspirin, methyl salicylate, *p*-benzoquinone. Phenol undergoes electrophilic substitution reaction at *o* & *p*-position. Ethers are functional isomers of alcohols, have low boiling points. Ethers are used as solvents. Unsymmetrical ethers are prepared by Williamson synthesis. Ethers react with HI and undergo $\text{S}_{\text{N}}1$ or $\text{S}_{\text{N}}2$ mechanisms depending upon the stability of carbocation formed. Aromatic ethers like anisole undergo electrophilic substitution at *o* & *p*-position.

Answer the following questions

1. Give the IUPAC name of salicylaldehyde.
2. Out of tert.butyl alcohol, and *n*-butanol, which will undergo dehydration faster and why?
3. Give the reaction when phenol is oxidised with acidified potassium dichromate in the presence of conc sulphuric acid.
4. Why is C—OH bond length in CH_3OH longer than C—OH bond length in phenol?

Q30

Amino acids contain amino ($-\text{NH}_2$) and carboxyl ($-\text{COOH}$) functional groups. Depending upon the relative position of amino group with respect to carboxyl group, the amino acids can be classified as α , β , γ , δ and so on. Only α -amino acids are obtained on hydrolysis of proteins. Amino acids are classified as acidic, basic or neutral depending upon the relative number of amino and carboxyl groups in their molecule. Equal number of amino and carboxyl groups makes it neutral; more number of amino than carboxyl groups makes it basic and more carboxyl groups as compared to amino groups makes it acidic. The amino acids, which can be synthesised in the body, are known as nonessential amino acids. On the other hand, those which cannot be synthesised in the body and must be obtained through diet, are known as essential amino acids. Amino acids are usually colourless, crystalline solids. These are water-soluble, high melting solids and behave like salts rather than simple amines or carboxylic acids. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitter ion. This is neutral but contains both positive and negative charges. In zwitter ionic form, amino acids show amphoteric behaviour

as they react both with acids and bases. Proteins can be classified into two types on the basis of their molecular shape.

- (a) The melting points and solubility in water of amino acids are generally higher than that of the corresponding halo acids. Explain.
- (b) What are essential and non-essential amino acids?
- (c) What do you mean by Zwitter ion? How do you explain the amphoteric behaviour of amino acids?

OR

- (c) Differentiate between globular and fibrous proteins.

SECTION E

5

Q31

- (a) b) Limiting molar conductivities of NH_4Cl , NaOH and NaCl are respectively 129.8, 217.4 and 108.9 S cm^2 and the molar conductivity of 10^{-2} M solution of NH_4OH is 9.33 $\text{S cm}^2 \text{mol}^{-1}$. Calculate the degree of dissociation of NH_4OH
- (b) Explain and graphically show the change in Molar Conductivity for strong and weak electrolyte with respect to concentration.

OR

- a) Three Faradays of electricity are passed through molten Al_2O_3 , aqueous solution of CuSO_4 and molten NaCl taken in different electrolytic cells. Calculate the ratio of the amount of Al, Cu and Na deposited at the cathodes.
[Assume: Al, Cu and Na are depositing at cathode]
- b) Write the anode and cathode reactions and the overall cell reaction occurring in the use of a lead storage battery?

Q32

- (a) How will you bring about the following conversions:
 - (i) Ethanol to 3-hydroxybutanal (ii) Benzaldehyde to Benzophenone
- (b) An alkene 'A' (Mol. formula C_5H_{10}) on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling's test and also forms iodoform on treatment with I_2 and NaOH . Compound 'C' does not give Fehling's test but forms iodoform. Identify the compounds A, B and C. Write the reaction for ozonolysis and formation of iodoform from B and C.

OR

- (a) How will you bring about the following conversions:
 - (i) Benzene to m-nitrobenzaldehyde (ii) Bromobenzene to benzoic acid
- (b) An organic compound (A) with molecular formula $\text{C}_2\text{Cl}_3\text{O}_2\text{H}$ is obtained when (B) reacts with Red P and Cl_2 . The organic compound (B) can be obtained on the reaction of methyl magnesium chloride with dry ice followed by acid hydrolysis.
 - (i) Identify A and B
 - (ii) Write down the reaction for the formation of A from B. What is this reaction called?

(iii) Give any one method by which organic compound B can be prepared from its corresponding acid chloride

Q33 (**Explain giving reasons:**

- ✓ (i) Transition metals and many of their compounds show paramagnetic behaviour.
- ✓ (ii) The enthalpies of atomisation of the transition metals are high.
- ✓ (iii) The transition metals generally form coloured compounds.
- ✓ (iv) Transition metals and their many compounds act as good catalyst.
- ✓ (v) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing.
- ✓ (vi) Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidised.
- ✓ (vii) $E^0_{M^{2+}/M}$ for Cu is positive (0.34V). Cu is the only metal in the first series of transition element showing this behaviour.