

DAV PUBLIC SCHOOLS, ODISHA
PRE-BOARD EXAMINATION
(2023-24)

- Please check that this question paper contains 7 printed pages.
- Check that this question paper contains 33 questions.
- Write down the Serial Number of the question in the left side of the margin before attempting it.
- 15 minutes time has been allotted to read this question paper. The question paper will be distributed 15 minutes prior to the commencement of the examination. The students will read the question paper only and will not write any answer on the answer script during this period.

CLASS – XII
SUBJECT: CHEMISTRY

Time: 3 hours

Maximum Marks: 70

General Instructions:

Read the following instructions carefully.

- (a) There are 33 questions in this question paper with internal choice.
- (b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- (c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- (e) SECTION D consists of 2 case-based questions carrying 4 marks each.
- (f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- (g) All questions are compulsory.
- (h) 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.

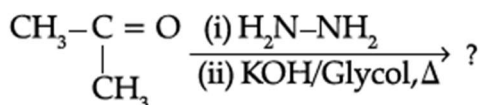
1. Molar conductance of the some electrolytes are listed below,

Electrolyte	KCl	KNO ₃	HCl	NaOAc	NaCl
Λ_m^0 (Scm ² mol ⁻¹)	149.9	145	426.2	91	126.5

Using appropriate molar conductance values, calculate Λ_m^0 of HOAc

- (a) 517.2 (b) 552.7 (c) 390.7 (d) 217.5

2.



- (a) CH₃CH₂CH₃ (b) CH₃CHOHCH₃
 (c) CH₃CH₂CHO (d) CH₃CONHCH₃

3. Which among the following is stored in the liver of animals?

- (a) Amylose (b) Cellulose (c) Amylopectin (d) Glycogen

4. Which of the following acids does not form anhydride upon dehydration in presence of P₂O₅?

- (a) Formic acid (b) Acetic acid (c) Propionic acid (d) n-Butyric acid

5. The addition of HBr is easiest with:

- (a) CH₂ = CHCl (b) ClCH = CHCl
 (c) CH₃-CH = CH₂ (d) (CH₃)₂C = CH₂

6. The number of unpaired electrons in gaseous species of Mn³⁺, Cr³⁺ and V³⁺ respectively are and the most stable species is:

- (a) 4, 3 and 2; V³⁺ (b) 3, 3 and 2; Cr³⁺
 (c) 4, 3 and 2; Cr³⁺ (d) 3, 3 and 3; Mn³⁺

7. In a first order reaction A → B, if k is the rate constant and initial concentration of reactant A is 0.5 M then the half life is:

- (a) ln2/k (b) 0.693/0.5k (c) log2/k (d) log2/k√0.5

8. Which of the following compounds will not undergo an azo coupling reaction with benzene diazonium chloride?

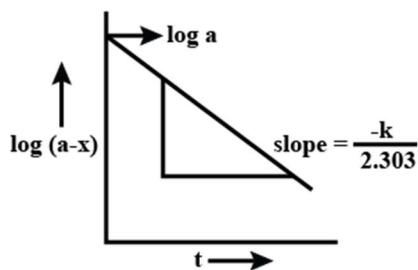
- (a) Aniline (b) Phenol (c) Anisole (d) Nitrobenzene

9. Arrange the following compounds in increasing order of boiling point:

Propan-1-ol, Butan-1-ol, Butan-2-ol, Pentan-1-ol.

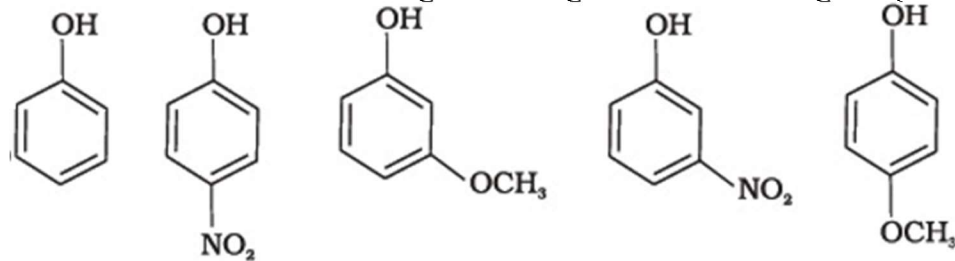
- (a) Propan-1-ol, Butan-2-ol, Butan-1-ol, Pentan-1-ol
 (b) Propan-1-ol, Butan-1-ol, Butan-2-ol, Pentan-1-ol
 (c) Pentan-1-ol, Butan-2-ol, Butan-1-ol, Propan-1-ol
 (d) Pentan-1-ol, Butan-1-ol, Butan-2-ol, Propan-1-ol

10. The below plot indicates that the reaction is of



- (a) zero order
 (b) first order
 (c) second order
 (d) third order

11. Mark the correct order of decreasing acid strength for the following compounds.



(i) (ii) (iii) (iv) (v)

- (a) (v)>(iv)>(ii)>(i)>(iii)
 (b) (ii)>(iv)>(i)>(iii)>(v)
 (c) (iv)>(v)>(iii)>(ii)>(i)
 (d) (v)>(iv)>(iii)>(ii)>(i)

12. Why is HCl not used to make the medium acidic in oxidation reactions of KMnO_4 in an acidic medium?

- (a) Both HCl and KMnO_4 act as oxidising agents.
 (b) KMnO_4 oxidises HCl into Cl_2 which is also an oxidising agent.
 (c) KMnO_4 is a weaker oxidising agent than HCl.
 (d) KMnO_4 acts as a reducing agent in the presence of HCl.

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

Assertion(A): The bond angle in alcohols is slightly less than the tetrahedral angle.

Reason(R): In alcohols, the oxygen of the $-\text{OH}$ group is attached to the sp^3 hybridized carbon atom.

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.

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

Assertion(A): In acetaldehyde, the carbonyl carbon acts as a Lewis acid and the carbonyl oxygen acts as a Lewis base.

Reason(R): Carbonyl compounds have substantial dipole moments.

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.

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

Assertion(A): Vitamin D cannot be stored in our body.

Reason(R): Vitamin D is a fat-soluble vitamin.

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.

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

Assertion: Copper does not form copper (II) sulphate on reaction with dil. sulphuric acid.

Reason: The standard potential for $\text{Cu}^{2+}|\text{Cu}$ electrode is negative.

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.

SECTION-B

This section contains 5 questions with internal choice in one question. The following questions are very short answer types and carry 2 marks each.

17. In a reaction between A and B, the initial rate of reaction (r_0) was measured for different initial concentrations of A and B as given below:

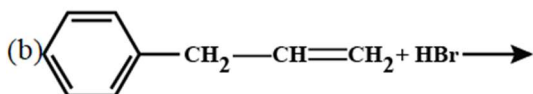
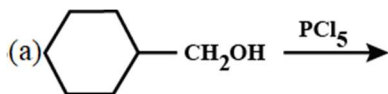
A/ mol L⁻¹	0.20	0.20	0.40
B/ mol L⁻¹	0.30	0.10	0.05
r₀/ mol L⁻¹ s⁻¹	5.07×10^{-5}	5.07×10^{-5}	1.43×10^{-4}

What is the order of the reaction with respect to A and B?

(Given $\log 2 = 0.3010$, $\log 2.82 = 0.451$)

18. H_2S , a toxic gas with rotten egg like smell, is used for the qualitative analysis. If the solubility of H_2S in water at STP is 0.195 m, calculate Henry's law constant.

19. Draw the structure of the major mono halo product in each of the following reactions:



OR

What are the products formed when the following reaction takes place.

(a) Chlorobenzene is treated with $\text{Cl}_2/\text{FeCl}_3$.

(b) Ethyl chloride is treated with AgNO_2 .

20. How will you bring about the following conversions?

(a) Ethanol to 3-Hydroxybutanal

(b) Benzaldehyde to Benzophenone.

21. Name the four bases present in DNA. Which one of these is not present in RNA?

SECTION-C

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

22. Answer any three out of the following.

(a) Write the configuration for d^4 ion if $\Delta_0 < P$.

- (b) Which of the following is more stable complex and why?
 $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Co}(\text{en})_3]^{3+}$
- (c) Why are low spin tetrahedral complexes not formed?
- (d) Write the IUPAC name of $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$.
23. A voltaic cell is set up at 25°C with the following half-cells:
 Al/Al^{3+} (0.001 M) and Ni/Ni^{2+} (0.50 M)
 Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential.
 (Given: $E_{\text{Ni}^{2+}/\text{Ni}}^\circ = -0.25\text{V}$ and $E_{\text{Al}^{3+}/\text{Al}}^\circ = -1.66\text{V}$, $\log 8 = 0.9031$)
24. Write the product of acid catalysed dehydration of ethanol at 443K with suitable mechanism.
25. You are given four organic compounds "A", "B", "C" and "D". The compounds "A", "B" and "C" form an orange-red precipitate with 2,4 DNP reagent. Compounds "A" and "B" reduce Tollen's reagent while compounds "C" and "D" do not. Both "B" and "C" give a yellow precipitate when heated with iodine in the presence of NaOH. Compound "D" gives brisk effervescence with sodium bicarbonate solution. Identify "A", "B", "C" and "D" given the number of carbon atoms in three of these carbon compounds is three while one has two carbon atoms. Give an explanation for your answer.
26. (a) What type of interactions are responsible for making the α -helix structure stable.
 (b) Write the reactions when D- glucose reacts with:
 (i) Br_2 water (ii) HNO_3
27. (a) Out of $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-Br}$ and $\text{CH}_2=\text{CH-CH}_2\text{-Br}$ which one is more reactive towards aq.KOH and why?
 (b) Identify the major product formed when neopentyl bromide reacts with alcoholic NaOH.
28. (a) For a decomposition reaction, the values of k at two different temperatures are given below:
 $k_1 = 2.15 \times 10^{-8} \text{ L mol}^{-1} \text{ s}^{-1}$ at 650 K
 $k_2 = 2.39 \times 10^{-7} \text{ L mol}^{-1} \text{ s}^{-1}$ at 700 K
 Calculate the value of activation energy for this reaction. ($\log 11.11 = 1.046$) ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)
 (b) In some cases it is found that a large number of colliding molecules have energy more than threshold energy but yet the reaction is slow. Why?

SECTION-D

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

29. According to Valence bond theory the metal atom or ion under the influence of ligands can use its $(n-1)d$, ns , np or ns , np , nd orbitals for hybridisation to yield a set of equivalent orbitals of definite geometry such as octahedral, tetrahedral, square planar and so on. These hybridised orbitals are allowed to overlap with ligand orbitals that can donate electron pairs for bonding. Strong ligands have a tendency to pair up the d -electrons of a metal cation or atom to provide the necessary orbitals for hybridization. On the other hand, weak ligands do not have a tendency to pair up the d -electrons. The d orbital used in hybridization may be either **inner $(n-1)$ d-orbitals** or **outer n d-orbitals**. The complex formed by inner $(n-1)$ d -orbitals, is called the **inner orbital complex** whereas the complex formed by outer d -orbital is called the **outer orbital complex**. If unpaired electrons are present within the complex, then the complex is paramagnetic in nature while if all the electrons are paired then the complex is diamagnetic in nature.

The following table shows the hybridization and geometry possible for coordination compounds based on their coordination Number.

Coordination number	Type of hybridisation	Distribution of hybrid orbitals in space
4	sp^3	Tetrahedral
4	dsp^2	Square planar
5	sp^3d	Trigonal bipyramidal
6	sp^3d^2	Octahedral
6	d^2sp^3	Octahedral

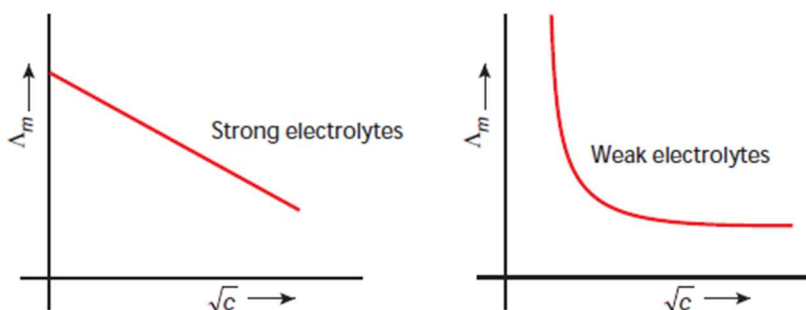
Answer the following questions:

- (a) Explain why $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ has magnetic moment value of 5.92 BM whereas $[\text{Fe}(\text{CN})_6]^{3-}$ has a value of only 1.74 BM.
- (b) Draw the shape of $[\text{Fe}(\text{CO})_5]$.
- (c) Explain based on valence bond theory that $[\text{Ni}(\text{CN})_4]^{2-}$ ion with square planar structure is diamagnetic and the $[\text{NiCl}_4]^{2-}$ ion with tetrahedral geometry is paramagnetic.

OR

- (c) $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital complex whereas $[\text{Ni}(\text{NH}_3)_6]^{2+}$ is an outer orbital complex. Explain.

30. The conductivity of an electrolytic solution varies with the concentration of the solutions of different electrolytes. For comparing the conductances of the solutions of different electrolytes, it is essential that the solutions should have equal volumes and they must contain a definite amount of the electrolytes which give ions carrying the same total charge. The conducting power of an electrolytic solution can be expressed in terms of equivalent conductance and molar conductance. The equivalent conductance of a solution does not vary linearly with concentration and it is related to specific conductance. The effect of equivalent conductance can be studied by plotting values against the square root of the concentration. The following two figures show the behaviour of strong and weak electrolytes with the change in concentration.



Answer the following questions:

- (a) What is meant by 'limiting molar conductivity'?
- (b) The molar conductivity of a 1.5 M solution of an electrolyte is found to be $138.9 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the conductivity of this solution.

OR

- (b) It is not possible to determine the molar conductivity of weak electrolytes at infinite dilution graphically. Do you agree with this? Justify your answer.
- (c) Solutions of two electrolytes 'A' and 'B' are diluted. The conductivity of 'B' increases 1.5 times while that of A increases 25 times. Which of the two is a strong electrolyte? Justify your answer.

SECTION-E

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

31. Answer any five of the following:

- Why Zinc is not regarded as a transition element?
- The second and third rows of transition elements resemble each other much more than they resemble the first row. Why?
- Why does Copper have exceptionally positive $E_{M^{2+}/M}^0$ value?
- How is the variability in oxidation states of transition elements different from that of non-transition elements?
- Write the reaction for preparation of K_2MnO_4 from MnO_2 ?
- Name a member of the lanthanoid series which is well known to exhibit a +2 oxidation state.

32. (a) What is the effect of temperature on the solubility of glucose in water?

- Rahul collected a 10mL each of fresh water and ocean water. He observed that one sample labeled "P" froze at 0°C while the other "Q" at -1.3°C . Rahul forgot which of the two, "P" or "Q" was ocean water. Help him identify which container contains ocean water, giving rationalization for your answer.
- Calculate Van't Hoff factor for an aqueous solution of $K_3[Fe(CN)_6]$ if the degree of dissociation (α) is 0.852. What will be boiling point of this solution if its concentration is 1 molal? ($K_b=0.52 \text{ K kg/mol}$)

OR

- Two elements **A** and **B** form compounds having the formula **AB₂** and **AB₄**. When dissolved in 20g of benzene (C_6H_6), 1 g of **AB₂** lowers the freezing point by 2.3 K whereas 1.0 g of **AB₄** lowers it by 1.3 K. The molar depression constant for benzene is $5.1 \text{ K kg mol}^{-1}$. Calculate the atomic masses of **A** and **B**.
- What type of deviation from Raoult's Law is expected when phenol and aniline are mixed with each other? What change in the net volume of the mixture is expected? Graphically represent the deviation.

33. A colourless substance 'A' (C_6H_7N) is sparingly soluble in water and gives a water-soluble compound 'B' on treatment with mineral acid. On reacting with $CHCl_3$ and alcoholic potash 'A' produces an obnoxious smell due to the formation of compound 'C'. The reaction of 'A' with benzenesulphonyl chloride gives compound 'D' which is soluble in alkali. With $NaNO_2$ and HCl , 'A' forms compound 'E' which reacts with phenol in an alkaline medium to give an orange dye 'F'. Identify compounds **A, B, C, D** and **E** and write all the reactions involved.

OR

- Account for the following :
 - The pK_b value for aniline is more than that for methylamine.
 - Ethylamine is soluble in water whereas aniline is not soluble in water.
 - Aniline does not undergo Friedel-Crafts reaction.
- How will you distinguish between the following pairs of compounds :
 - Aniline and Benzylamine
 - Aniline and N-methylaniline