COMMON PRE-BOARD EXAMINATION 2024-25

Subject: CHEMISTRY (043)

Time allowed: 3 Hours **Maximum Marks: 70**

Date:

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 **16 x 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. Which of the following reactions is appropriate for converting acetamide to methanamine?

(A) Hoffmann bromamide reaction
(B) Stephen reaction
(C) Gabriel phthalimide synthesis
(D) Carbylamine reaction

2. Which of the following is **not** an allylic halide?

(A) 4-Bromopent-2-ene
(B) 1-Bromobut-2-ene
(C) 4-Bromobut-1-ene
(D) 3-Bromo-2-methylbut-1-ene

3. Match the catalysts given in Column I with the processes given in Column II and mark the appropriate choice.

Column I	**Column II**
(i) Ni in the presence of hydrogen	(a) Manufacture of polythene
(ii) $PdCl_2$	(b) Manufacture of sulphuric acid
(iii) Finely divided iron	(c) Hydrogenation of fats
(iv) $TiCl_4 + Al(CH_3)_3$	(d) Production of ammonia
(v) V_2O_5	(e) Oxidation of ethyne to ethanal

(A) (i)- (c), (ii) – (e), (iii) – (d), (iv) – (a), (v) – (b)
(B) (i)- (c), (ii) – (a), (iii) – (b), (iv) – (e), (v) – (d)
(C) (i)- (d), (ii) – (a), (iii) – (c), (iv) – (e), (v) – (b)
(D) (i)- (c), (ii) – (e), (iii) – (b), (iv) – (d), (v) – (a)

4. Alkyl halides are immiscible in water though they are polar because

(A) they react with water to form alcohols.
(B) they cannot form hydrogen bonds with water.
(C) C-X bond cannot be broken easily.
(D) they are stable compounds and are not reactive.

5. For a certain reaction, a large fraction of molecules have energy more than the threshold energy; still, the reaction rate is very slow. The possible reasons for this could be that

(A) the colliding molecules could be large in size.
(B) the colliding molecules must be properly oriented for effective collisions.
(C) the rate of reaction could be independent of energy.
(D) one of the reactants could be in excess.

6. Nucleophilic attack on carbonyl carbon changes its hybridisation from

(A) sp to sp^2 hybridisation
(B) sp^2 to sp^3 hybridisation
(C) sp^3 to sp^2 hybridisation
(D) sp to sp^3 hybridisation

7. When one mole of each of the following complexes is treated with excess of $AgNO_3$, which will give the maximum amount of AgCl?

(A) $[Co(NH_3)_6]Cl_3$
(B) $[Co(NH_3)_5Cl]Cl_2$
(C) $[Co(NH_3)_4Cl_2]Cl$
(D) $[Co(NH_3)_3Cl_3]$

8. Denaturation of protein leads to the loss of its biological activity by:

(A) Formation of amino acids
(B) Loss of primary structure
(C) Loss of both primary and secondary structure
(D) Loss of both secondary and tertiary structures

9. Manav poured some potassium chromate solution into a test tube for qualitative analysis. The yellow colour of potassium chromate soon turned orange in colour. Manav realised that this happened because the test tube was not clean and contained a few drops of some liquid. Which of the following were the liquid drops most likely to be?

(A) Drops of water
(B) Methyl orange solution
(C) NaOH solution
(D) HCl solution

10. The rate constant for a first order reaction is 200 $s^{-1.}$ The half-life period of the reaction is:

(A) 3.46×10^{-2} s
(B) 3.46×10^{-3} s
(C) 4.26×10^{-2} s
(D) 4.26×10^{-3} s

11. The correct order of the basic strength of methyl substituted amines in an aqueous solution is:

(A) $(CH_3)_3N > CH_3NH_2 > (CH_3)_2NH$
(B) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$
(C) $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$
(D) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$

12. The reaction of an arene diazonium chloride with aniline in an acidic medium gives a coloured compound. Which of the following occurs during the reaction?

(A) Benzene ring is replaced.
(B) Nitrogen is displaced.
(C) Diazo group is retained.
(D) Amino group is displaced.

For Questions number 13 to 16, two statements are given one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct

explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

13. **Assertion (A):** In a coordination entity $[PtCl_2(en)_2]^{2+}$, only the cis-isomer shows optical activity.

Reason (R): Optical isomerism is common in octahedral complexes involving didentate ligands.

14. **Assertion (A):** In a mercury cell, the cell potential is approximately 1.35V and remains constant during its life.

Reason (R): The overall reaction in mercury cells is represented as:

$Zn\ (Hg) + HgO \rightarrow ZnO\ (s) + Hg(l)$

15. **Assertion (A):** The two cyclic hemiacetal forms of glucose, α- form and β-form are called anomers.

Reason (R): Anomers differ only in the configuration of the hydroxyl group at C-1 in glucose.

16. **Assertion (A):** A catalyst catalyses the spontaneous reactions but does not catalyse the non-spontaneous reactions.

Reason (R): A catalyst changes the Gibbs energy of the reaction and the equilibrium constant of the reaction.

SECTION B **5 x 2= 10**

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) (a) State Henry's law. **2**

(b) Gas (A) is more soluble in water than gas (B) at the same temperature. Which one of the two gases will have the higher value of K_H (Henry's constant) and why?

OR

B) (a) What happens when a pressure greater than the osmotic pressure is applied on the solution side separated from the solvent by a semipermeable membrane?

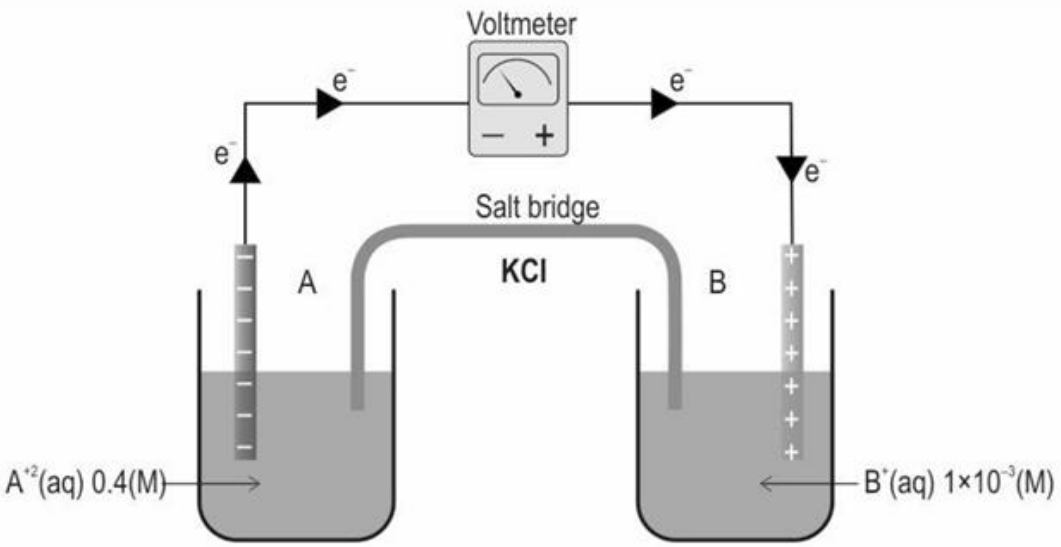
(b) Why does a solution containing a non-volatile solute have a higher boiling point than a pure solvent?

18. Give reasons: **2**

(a) A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless.

(b) Low-spin tetrahedral complexes are not formed.

19. Calculate the emf of the cell given below at STP: **2**



$E°(B^+/B)$ = **0.80 V**, $E°(A^{2+}/A)$ = **-2.37 V.**

20. How do you convert:

(a) Chlorobenzene to Toluene **2**

(b) 2- Bromopropane to 1- Bromopropane

21. (a) Amino acids show amphoteric behaviour. Give reason.

(b) Write the name of one deficiency disease each caused by vitamin B_2 and vitamin B_{12}. **2**

SECTION C **7 x 3= 21**

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

22. (a) Corrosion is essentially an electrochemical phenomenon. Explain the reactions occurring during corrosion of iron kept in an open atmosphere. **2**

(b) In the electrolysis of aqueous sodium bromide, there are two possible anodic reactions: **1**

$2\ H_2O(l) \rightarrow O_2\ (g) + 4\ H^+\ (aq) + 4\ e^-,\ E^0 = 1.23V$

$2\ Br^-\ (aq) \rightarrow Br_2\ (g) + 2\ e^-,\ E^0 = 1.08\ V$

Which reaction occurs at anode and why?

23. (a) Which is the last element in the series of actinoids? Write the electronic configuration of this element. **1**

(b) The ionic radii of certain elements of the 3rd transition series are tabulated below: **2**

Arrange the elements in the decreasing order of atomic number. Also, define the phenomenon seen in this table.

Element	Ionic radii
X^{+3}	87 pm
Y^{+3}	106 pm
Z^{+3}	95 pm

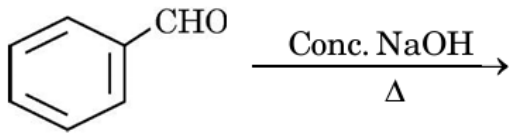
24. A) An organic compound with the molecular formula $C_9H_{10}O$: **3**

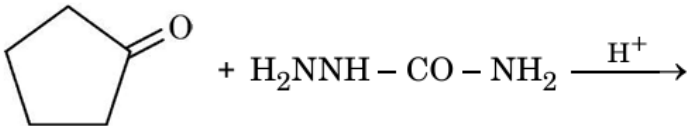
a. forms the 2,4-DNP derivative.
b. does not reduce Tollens' reagent.
c. forms iodoform when reacted with sodium hypoiodite.
d. gives 1,2-benzenedicarboxylic acid on oxidation.

Determine the compound's structure and illustrate how you utilized the provided information to identify it.

OR

B) (a) pKa value of 4-nitrobenzoic acid is lower than that of benzoic acid. Give reason.
(b) Write the products of the following reactions:

(i) 

(ii) 

25. (a) Describe the chemical reaction that occurs when D-glucose is treated with bromine water. **3**
(b) Define an invert sugar.
(c) What products would be formed when a nucleotide from DNA containing thymine is hydrolysed?

26. Anu wanted to prepare alcohol using methyl magnesium bromide. He took three different compounds P, Q, and R. Compound P forms an alcohol with molecular formula C_2H_6O. Compounds Q and R are isomers with the molecular formula C_3H_6O. Compound Q does not form any silver mirror with Tollen's reagent. **3**

(a) Give the IUPAC name of compound P.

(b) Give the IUPAC names of the compounds formed from Q and R.

(c) Write the reaction showing the formation of the primary and tertiary alcohols using methyl magnesium bromide.

27. Give reasons for the following: **3**

(a) 2-Bromobutane is optically active but 1-Bromobutane is optically inactive.
(b) Chlorobenzene is extremely less reactive towards a nucleophilic substitution reaction.
(c) Thionyl chloride is preferred while preparing haloalkanes from alcohol.

28. The molar conductivity of 0.025 mol L^{-1} methanoic acid is 46.1 S cm^2 mol^{-1}. Calculate its degree of dissociation and dissociation constant. **3**

Given (H^+) = 349.6 S cm^2 mol^{-1} and $(HCOO^-)$ = 54.6 S cm^2 mol^{-1}.

SECTION D **2 x 4= 8**

The following questions are case-based questions. 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. In a reaction, the rates of disappearance of different reactants or rates of formation of different products may not be equal but the rate of reaction at any instant of time has the same value expressed in terms of any reactant or product. Further, the rate of reaction may not depend upon the stoichiometric coefficients of the balanced chemical equation. The rate of reaction depends upon the experimental conditions such as concentration of reactants (pressure in case of gases), temperature and catalyst. The exact powers of molar concentrations of reactants on which the rate depends are found experimentally and expressed in terms of the order of the reaction. Each reaction has a characteristic rate constant depending upon temperature. The units of the rate constant depend upon the order of reaction.

Answer the following questions:

(a) Write the unit of the rate constant for a reaction of order 'n'.
(b) Define pseudo first-order reaction with an example. **1**
(c) The rate of a certain reaction is given by, rate=$k[H^+]^n$. The rate increases 100 times when the pH changes from 3 to 1. What is the order (n) of the reaction? **1**

OR

(c) What will be the effect of temperature on rate constant? Justify your answer with Arrhenius equation. **2**

30. Raju took three amines P, Q, and R. The three amines were added to Hinsberg's reagent. The products were added to aqueous NaOH and the observations were tabulated as follows:

Amines	**Observations after the addition of the products formed to aq. NaOH solutions**
P	The product is soluble in aq. NaOH
Q	The product is insoluble in aq. NaOH
R	The product is insoluble in aq. NaOH

1

(a) What is Hinsberg's reagent? Name another reagent that can replace this one. **1**

(b) Draw the structure of an amine with 3 carbon atoms, which does not react with Hinsberg's reagent and write the IUPAC name of the compound.

(c) Which of the above amine(s) have the structural formula of R-NH-R? Justify your answer. **2**

OR

(c) Which of the above amines may be prepared by the Gabriel phthalimide synthesis? Give reason with a suitable example.

SECTION E **3 x 5= 15**

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

31. A) (a) When an oxide of manganese P is fused with KOH in the presence of an oxidising agent and dissolved in water, it gives a dark green solution of compound, Q. Compound Q is disproportionate in neutral or acidic medium to give a purple compound R. Identify the compounds P, Q and R. Also, write the equations of the reactions involved. **2**

(b) Write down the IUPAC name of the following complex and indicate the electronic configuration and coordination number. Also, give the stereochemistry of the complex. **3**

$K[Cr(H_2O)_2(C_2O_4)_2].3H_2O$

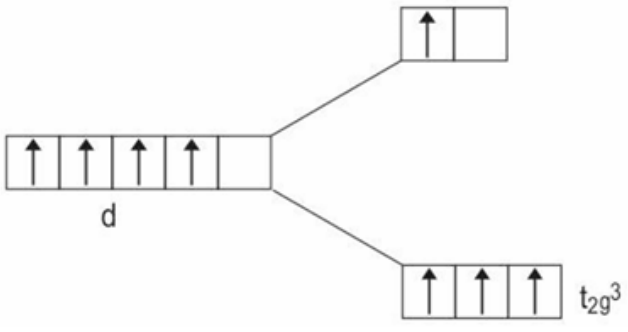
OR

B) (a) Calculate the 'spin only' magnetic moment of Ni^{2+} (aq) if Z= 28. **2**

(b) Write the correct IUPAC name of the following coordination compound. Name the type of isomerism exhibited by the complex. **1**

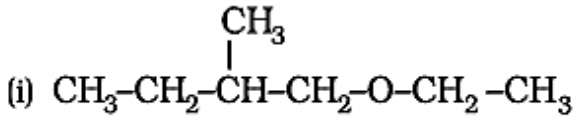
$[Cr(NH_3)_5(NCS)][ZnCl_4]$

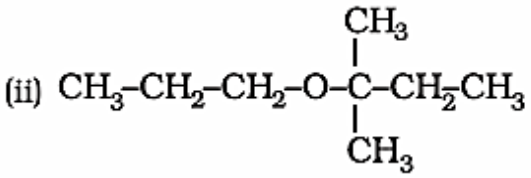
(c) A transition metal M has d^4 configuration in its M^{2+} state, where n = 4. The crystal field splitting for the M ion is given below : **2**



Is M^{2+} ion reducing or oxidising in nature? Explain.

32. A) (a) Give the major products that are formed by heating each of the following ethers with HI. **2**





(b) Write the equations involved in the following reactions: **3**

i. Kolbe's Reaction

ii. Etard Reaction

iii. Hell Volhard Zelinsky reaction

OR

B) How will you bring about the following conversions? **5**

(a) Phenol to picric acid

(b) Anisole to 4-methoxy toluene

(c) Phenol to benzoquinone

(d) 1-Decanol to decanoic acid

(e) Benzaldehyde to benzyl alcohol

33. A) (a) The elevation of the boiling point of 1M KCl solution is nearly double that of 1M sugar solution. Give reason. **2**

(b) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. **3**

Calculate the freezing point of 10% glucose in water, if the freezing point of pure water is 273.15 K.

[Given: Molar mass of sucrose=342 g mol^{-1} and molar mass of glucose =180 g mol^{-1}]

OR

B) (a) On mixing liquid X and liquid Y, the volume of the resulting solution decreases. What type of deviation from Raoult's law is shown by the resulting solution? What change in temperature would you observe after mixing liquids X and Y? What type of azeotropic mixture will be formed by such a solution? **2**

(b) A 0.01m aqueous solution of $AlCl_3$ freezes at -0.068°C. Calculate the percentage of dissociation. [Given: K_f for water = 1.86 K Kg mol^{-1}] **3**

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