SAHODAYA PREBOARD EXAMINATION – 2024-25

- Please check that this question paper contains 8 printed pages.
- Set number given on the top right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Check that this question paper contains 33 questions.
- 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 the period. Students should not write anything in the question paper.

CLASS-XII
CHEMISTRY(043)

Time allowed – 3hours   *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. However an internal choice has been provided in few questions.
(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. Which of the following reaction is **not** explained by the open chain structure of glucose?   1
    (A) Formation of pentaacetate of glucose with acetic anhydride
    (B) Formation of addition product with 2,4-DNP reagent
    (C) Silver mirror formation with Tollen's reagent
    (D) Existence of $\alpha-$ & $\beta -$ forms of glucose

2. Which of the following amine can be prepared by Gabriel phthalimide synthesis?   1
    (A) Isobutyl amine
    (B) Toluene
    (C) N-Methyl benzylamine
    (D) Aniline

3. Which of the following is a diamagnetic ion (Atomic Number of Sc, V, Mn and Cu are 21, 23, 25 & 29)   1

    (A) V^{2+}
    (B) Sc^{3+}
    (C) Cu^{2+}
    (D) Mn^{3+}

4. $KMnO_4$ is not acidified by HCl instead of H_2SO_4 because   1

    (A) H_2SO_4 is stronger acid than HCl
    (B) HCl is oxidized to Cl_2 by $KMnO_4$
    (C) H_2SO_4 is dibasic acid
    (D) Rate is faster in presence of H_2SO_4

5. An electrochemical cell behaves like an electrolytic cell when   1

    (A) $E_{cell} = E_{external}$
    (B) $E_{cell} = 0$
    (C) $E_{cell} > E_{external}$
    (D) $E_{cell} < E_{external}$

6. A first order reaction is 50% completed in 1.26×10^{14} s. How much time would it take for 100% completion?   1

    (A) 1.26×10^{15} sec

    (B) 2.52×10^{14} sec

    (C) 2.52×10^{28} sec

    (D) Infinite

7. Which radioactive isotope would have the longer half-life ^{15}O or ^{19}O? (Given rate constants for ^{15}O and ^{19}O are 5.63×10^{-3} s^{-1} and 2.38×10^{-2} s^{-1} respectively?   1

    (A) ^{15}O
    (B) ^{19}O
    (C) Both will have the same half life
    (D) None of the above, information given is insufficient.
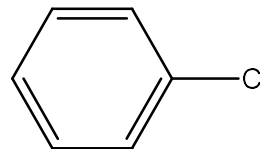
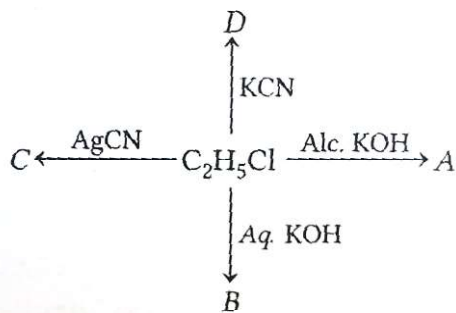8. Consisder the following compounds   1
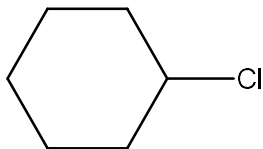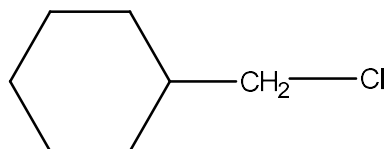
    (I)   (II)   (III)

The correct order of reactivity towards S_N2 reaction:
    (A) I>III>II
    (B) II> III>I
    (C) II>I>III
    (D) III>I>II

9. Identify A, B, C & D 1

$$C \xleftarrow{AgCN} C_2H_5Cl \xrightarrow{Alc.\ KOH} A$$

with D above (via KCN) and B below (via Aq. KOH)

(A) A = C_2H_4, B = C_2H_5OH, C = C_2H_5NC, D = C_2H_5CN
(B) A = C_2H_5OH, B = C_2H_4, C = C_2H_5NC, D = C_2H_5CN
(C) A = C_2H_4, B = C_2H_5OH, C = C_2H_5CN, D = C_2H_5NC
(D) A = C_2H_5OH, B = C_2H_4, C = C_2H_5NC, D = C_2H_5CN

10. Which is the correct order of acidic strength of the following? 1
   (A) $C_6H_5OH > H_2O > CH_3OH > CH \equiv CH$
   (B) $H_2O > C_6H_5OH > CH_3OH > CH \equiv CH$
   (C) $C_6H_5OH > CH_3OH > H_2O > CH \equiv CH$
   (D) $C_6H_5OH > CH \equiv CH > CH_3OH > H_2O$

11. A compound (A) with molecular formula $C_5H_{10}O$ forms a phenyl hydrazone and gives negative 1
   Tollen's and Iodoform test. The compound (A) on reduction gives n-pentane. Hence compound
   'A' is:
   (A) Pentan-3-one
   (B) Pentanal
   (C) Pentanol
   (D) Pentan-2-one

12. Oxidation of cyclohexene using acidified $KMnO_4$ gives 1

   (A) Hexane-1,6-dioic acid

   (B) Hexane-1,6-dial

   (C) Cyclohexane carboxylic acid

   (D) Cyclopentane carboxylic acid

13. Assertion (A): Conductivity decreases with decrease in concentration of the electrolyte. 1
   Reason (R): Number of ions per unit volume that carry the current in a solution decrease on
   dilution.
   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. Assertion (A): Hydrolysis of (-)2-bromooctane proceeds with inversion of configuration.   1
    Reason (R): This reaction proceeds through the formation of a carbocation.
    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. Assertion (A): Compounds containing -CHO group are easily oxidised to corresponding   1
    carboxylic acids.
    Reason (R): Carboxylic acids can be reduced to alcohols by treatment with LiAlH₄.
    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. Assertion (A): The two strands in double strand helix structure of DNA are complementary to   1
    each other.
    Reason (R): Disulphide bonds are formed between specific pairs of bases.
    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.
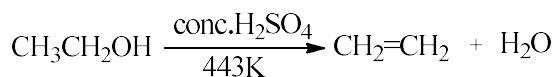
SECTION-B

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

17. (a) What type of deviation from Raoult's law is shown by a mixture of phenol and aniline? Give   2
       Reasons.
    (b) What type of azeotrope is formed by the above mixture?

18. A graph is plotted between ln[R] and t(s). On the basis of the graph, answer the following   2
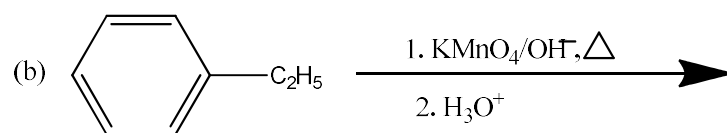   questions.
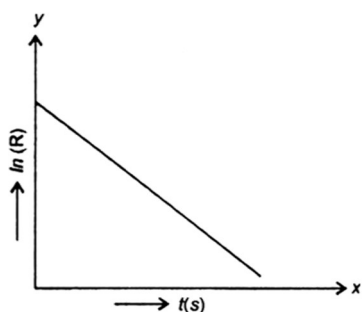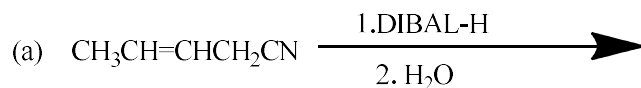

    (a) What does the slope of the line indicate?
    (b) What is the order of the reaction?

19. Write the mechanism of the following reaction: 2

$$CH_3CH_2OH \xrightarrow[443K]{conc.H_2SO_4} CH_2=CH_2 + H_2O$$

20. Predict the product in the following reaction: 2

(a) $CH_3CH=CHCH_2CN \xrightarrow[\text{2. } H_2O]{\text{1.DIBAL-H}}$

(b) $-C_2H_5 \xrightarrow[\text{2. } H_3O^+]{\text{1. } KMnO_4/OH^-, \triangle}$

OR

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

(a) Benzaldehyde, p-Tolualdehyde, p-Nitrobenzaldehyde, Acetophenone (reactivity towards HCN)

(b) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$, $CH_3CH_2CH_2COOH$ (acidic strength)

21. (a) What is the basic structural difference between starch and cellulose? 2

(b) Which amino acid is optically inactive?

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. Calculate emf of the following cells at 25^0C : 3
   Fe/Fe^{2+} (0.001M) // H^+(0.01M)/$H_2(g)$ (1 bar)/Pt(s)
   (Given $E^0_{Fe^{2+}/Fe} = -0.44V$, $E^0_{H^+/H_2} = 0.00V$, $\log 10 = 1$)

23. (a) Show that in case of a first order reaction the time taken for the completion of 99% reaction 3
   is twice the time required for 90% completion of the reaction.
   (b) The conversion of X $\longrightarrow$Y follows second order kinetics. If the concentration of X is increased
   to three times, how will it affect the rate of formation of Y?

24. (a) When a coordination compound $NiCl_2.6H_2O$ is mixed with $AgNO_3$ solution 2 moles of AgCl 3
   are precipitated per mole of the compound. Write the structural formula of the complex and
   secondary valency of Nickel ion.
   (b) Write the IUPAC name of the ionisation isomer of $[Co(NH_3)_5(SO_4)]Cl$.
   (c) What are ambidentate ligands? Give an example.

25. (a) Identify the major product when 1-Bromo-1-methylcyclohexane is heated with alc. KOH. 3
   (b) Grignard reagents should be prepared under anhydrous conditions .Why?
   (c) What happens when chlorobenzene is treated with methyl chloride and sodium metal in dry
   ether?

26. Carry out the following conversions: 3

    (a) Phenol to Benzoquinone

    (b) Cumene to Phenol

    (c) Phenol to Salicylaldehyde

27. Write the reactions involved in the following: 3

    (a) Wolff-Kishner Reduction

    (b) Cannizzaro Reaction

    (c) HVZ Reaction

28. (a) Differentiate between: 3
        (i) Fibrous and Globular protein
        (ii) Nucleoside and Nucleotide
    (b) Name the disease caused by the deficiency of Vitamin A.

<div align="center">OR</div>

    (a) Write the reaction when glucose reacts with (i) Conc.HNO_3 (ii) Acetic anhydride.

    (b) What is denaturation of protein?

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SECTION-D
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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. Valence bond theory considers the bonding between the metal ion and the ligands as purely   4
    covalent. On the other hand, crystal field theory considers the metal-ligand bond to be ionic
    arising from electrostatic interaction between the metal ion and the ligands. In coordination
    compounds, the interaction between the ligand and the metal ion causes the five d-orbitals to split
    up. This is called crystal field splitting and the energy difference between the two sets of energy
    level is called crystal field splitting energy. The crystal field splitting energy (Δ_o) depends upon
    the nature of the ligand. The actual configuration of complexes is divided by the relative values
    of Δ_o and P (pairing energy). If $\Delta_o <$ P, then complex will be high spin. If $\Delta_o >$ P, then complex
    will be low spin.

    (a) (i) On the basis of crystal field theory, write the electronic configuration of d^6 in an
           octahedral complex when $\Delta_o >$ P and $\Delta_o <$ P   .

        (ii) Out of $[CoCl_6]^{3-}$ and $[Co(C_2O_4)_3]^{3-}$ which complex is more stable and why?

    (b) How is the crystal field splitting energy for octahedral(Δ_o) and tetrahedral (Δ_t) complex is
    related?
<div align="center">OR</div>
    Why $[Ni(H_2O)_6]^{2+}$ is green while a solution of $[Ni(CN)_4]^{2-}$ is colourless?

    (c) Arrange the following complex ions in the increasing order of their wavelength :
        $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$, $[Co(CN)_6]^{3-}$.

30. Electricity can be produced when electrons move from one element to another in redox reaction. 4
    Typically, electrochemistry deals with the overall reactions when multiple redox reactions occur
    simultaneously, connected via some external electric current and a suitable electrolyte. In other
    words, electrochemistry is also concerned with chemical phenomena that involve charge
    separation.
    The dissociation of charge often involves charge transfer that occurs homogeneously or
    heterogeneously between different chemical species. A spontaneous chemical process is one
    which can take place on its own, and in such a process, the Gibbs free energy of a system
    decreases. In electrochemistry, spontaneous reaction results in the conversion of chemical into
    electrical energy. The reverse process is also possible when a non- spontaneous chemical reaction
    occurs by supplying electricity. These interconversions are carried out in equipment called an
    electrochemical cell. In the process of electrolysis, the decomposition of a substance takes place
    by passing an electric current. 1 mole of electric charge when passed through a cell will discharge
    half mole of divalent metal ion. This was first formulated by Michael Faraday in the form of Laws
    of electrolysis.

    (a) How many seconds does it take to reduce 3 moles of Fe^{3+} to Fe^{2+} with 2A of current?

    (b) Write the electrolysis products of aqueous solution of $CuCl_2$ using Pt electrode.

    <div align="center">OR</div>

    Λ_m of CH_3COOH increases drastically where as that of CH_3COONa increases gradually

    on dilution. Explain

    (c) Write the reaction involved in the the cell used in hearing aids.

SECTION – E

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

31. (a) Complete the following chemical equations: 5

    (i) $Cr_2O_7^{2-}$ (aq) + H_2S(g) + H^+(aq) →

    (ii) $MnO_4^- + I^- + H_2O \longrightarrow$
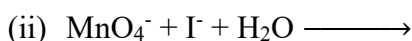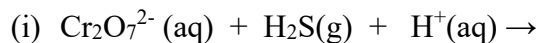
    (b) How would you account for the following?

    (i) The oxidizing power of oxoanions are in the order : $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$.

    (ii) Transition metal forms complex compounds.

    (iii) Zr and Hf have identical atomic sizes.
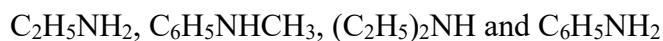
    <div align="center">OR</div>

    (a) Write the equations involved in the preparation of $KMnO_4$ from pyrolusite ore (MnO_2).

    (b) Out of $CuCl_2$ and Cu_2Cl_2 which one is more stable in aqueous solution and why?

    (c) What is mischmetal? Write one of its use.

    (d) Why Cr^{2+} is stronger reducing agent than Fe^{2+} in aqueous solution?
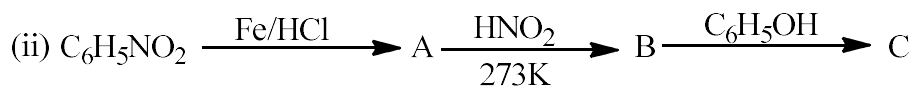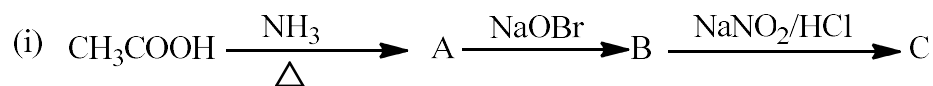
32. (a) Acetylation of aniline reduces its activation effect. Give reason.   5

(b) Arrange the following in decreasing order of the pK_b values

   $C_2H_5NH_2$, $C_6H_5NHCH_3$, $(C_2H_5)_2NH$ and $C_6H_5NH_2$

(c) Identify A , B and C in the following reactions:

(i) $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{NaOBr} B \xrightarrow{NaNO_2/HCl} C$

(ii) $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow[273K]{HNO_2} B \xrightarrow{C_6H_5OH} C$

OR

(a) A compound 'X' on reduction with tin metal and HCl gives a compound 'Y' with molecular formula C_6H_7N. Compound X on reaction with chloroform and alcoholic KOH produces obnoxious smell of carbylamine due to the formation of Z. Identify the compound X, Y and Z. Write the chemical reactions involved in it.

(b) Give any suitable chemical test to distinguish between the following pairs of compounds:

   (i) Ethylamine and aniline.

   (ii) Methylamine and dimethylamine.

33. (a) The depression in the freezing point of water observed for the same molar concentrations of   5
acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order as stated above. Explain.

(b) Why is the vapour pressure of an aqueous solution of glucose lower than that of water?

(c) What mass of NaCl must be dissolved in 65.0 g of water to lower the freezing point of water by 7.50^0C? The freezing point depression constant (K_f) for water is 1.86 K kg /mol. Assume the van't Hoff factor for NaCl is 1.87. (Molar mass of NaCl = 58.5 g/mol.)

OR

(a) At the same temperature, CO_2 gas is more soluble in water than O_2 gas. Which one of them will have higher value of K_H and why?

(b) How does the size of blood cells change when placed in aqueous solution containing more than 0.9%(mass/volume) sodium chloride?

(c) 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionized. Calculate the boiling point of the solution. (Given K_b for water = 0.52 K kg mol^{-1}).