ΣXEMPLAR POINT ΣP PVT. LTD.

A Complete Institute For Students

CREATING AND SETTING EXAMPLES FOR FUTURE...

CLASS XII : SAMPLE QUESTION PAPER - 1
SUBJECT: CHEMISTRY (043)

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

General instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case - based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. 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. Aldol condensation between two compounds followed by dehydration gives methyl vinyl ketone. Then, the compounds are
   (a) $HCHO$ and CH_3COCH_3
   (b) $HCHO$ and CH_3CHO
   (c) two molecules of CH_3CHO
   (d) two molecules of CH_3COCH_3.

2. The order of reactivities of the following alkyl halides for an S_N2 reaction is
   (a) $RF > RCl > RBr > RI$
   (b) $RF > RBr > RCl > RI$
   (c) $RCl > RBr > RF > RI$
   (d) $RI > RBr > RCl > RF$

3. The ionic conductance depends on
   (a) the nature of the electrolyte
   (b) the size of the ions produced
   (c) change in temperature
   (d) all of these.

4. Match the column-I with column-II and mark the appropriate choice.

|	Column-I (Complex)		Column-II (Isomerism)
(A)	$[Co(NH_3)_6][Cr(CN)_6]$	(i)	Geometrical isomerism
(B)	$[Co(en)_2(NO_2)Cl]Br$	(ii)	Optical isomerism
(C)	$[Pt(en)_2Cl_2]$	(iii)	Coordination isomerism
(D)	$[CoCl_2(NH_3)_4]^+$	(iv)	Linkage isomerism

   (a) (A) → (iv), (B) → (ii), (C) → (iii), (D) → (i)
   (b) (A) → (ii), (B) → (iii), (C) → (i), (D) → (iv)
   (c) (A) → (iii), (B) → (iv), (C) → (ii), (D) → (i)
   (d) (A) → (i), (B) → (iii), (C) → (iv), (D) → (ii)

5. The empirical formula of a non-electrolyte is CH_2O. A solution containing 6 g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution at the same temperature. The molecular formula of the compound is
   (a) $C_2H_4O_2$
   (b) $C_3H_6O_3$
   (c) $C_5H_{10}O_5$
   (d) $C_4H_8O_4$

6. The product (B) of the following reaction is

   $$CH_3Br \xrightarrow[\text{Dry ether}]{Mg} (A) \xrightarrow{H_2O} (B)$$

   (a) CH_3CH_2OH
   (b) CH_3CH_3
   (c) CH_3OH
   (d) CH_4

7. Which of the following tests/ reactions is given by aldehydes as well as ketones?
   (a) Fehling's test
   (b) Tollens' test
   (c) 2,4-DNP test
   (d) Cannizzaro reaction

8. Which factor has no influence on the rate of reaction?
   (a) Molecularity
   (b) Temperature
   (c) Concentration of reactant
   (d) Nature of reactant

9. Which of the following amines will give carbylamine reaction?
   (a) $(C_2H_5)_3N$
   (b) $(C_2H_5)_2NH$
   (c) $C_2H_5NH_2$
   (d) $C_3H_7NHC_2H_5$

10. What will be the freezing point of a 0.5 m KCl solution? The molal freezing point constant of water is 1.86° C m^{-1}.
    (a) −1.86°C
    (b) −0.372°C
    (c) −3.2°C
    (d) 0°C

11. Which of the following pair represents anomers?
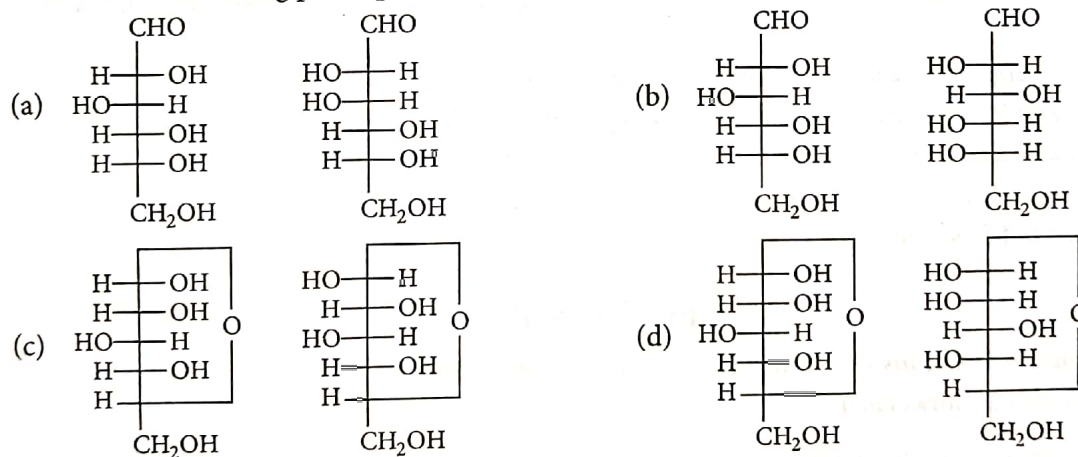
12. Arrhenius equation can be represented graphically as follows :
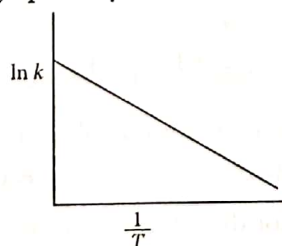
    The (i) intercept and (ii) slope of the graph are
    (a) (i) ln A (ii) E_a/R
    (b) (i) A (ii) E_a
    (c) (i) ln A (ii) $-E_a/R$
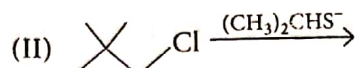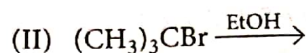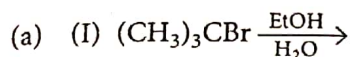   (d) (i) A (ii) $-E_a$

Chemistry

13. **Assertion (A) :** A solution of sucrose in water is dextrorotatory but on hydrolysis in presence of little hydrochloric acid, it becomes laevorotatory.
    Reason (R) : Sucrose on hydrolysis gives unequal amounts of glucose and fructose as a result of which change in sign of rotation is observed.
    (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) :** The standard electrode potential of a half cell has a fixed value.
    Reason (R) : A negative value of standard reduction potential means that reduction takes place on this electrode with reference to standard hydrogen electrode.
    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) :** Catalytic reduction of butanal gives butanol.
    Reason (R) : Aldehydes on reduction give corresponding primary alcohols.
    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) :** In $[Fe(C_2O_4)_3]^{3-}$, the coordination number of Fe is 3.
    Reason (R) : The coordination number is the number of ligand donor atoms to which the metal is directly bonded.
    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 two questions. The following questions are very short answer type and carry 2 marks each.

17. What do you mean by denaturation of protein? Give two examples of denaturation.

18. (i) Identify A, B and C.

    $$C_6H_5-CONH_2 \xrightarrow{Br_2/aq.\ KOH} A \xrightarrow[0\text{-}5°C]{NaNO_2+HCl} B \xrightarrow{KI} C$$

    (ii) Give the decreasing order of reactivity for the following compounds towards coupling with $PhN_2^+Cl^-$.
    I. Phenol   II. Nitrobenzene   II. Aniline

19. Write the reactions with conditions for the following conversions (**any 2**) :
    (i) Methanal to propan-1-ol
    (ii) Benzaldehyde to benzyl alcohol
    (iii) Benzaldehyde to benzophenone

20. Which reaction, in each pair shown below, will show the faster rate of disappearance of starting material?

   (a) (I) $(CH_3)_3CBr \xrightarrow[H_2O]{EtOH}$ (II) $(CH_3)_3CBr \xrightarrow{EtOH}$

   (b) (I) $\underset{}{\diagup\!\!\diagdown}\!\diagup Cl \xrightarrow{CH_3S^-}$ (II) $\underset{}{\diagup\!\!\diagdown}\!\diagup Cl \xrightarrow{(CH_3)_2CHS^-}$

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

   (a) Why is $SOCl_2$ (thionyl chloride) preferred for the preparation of alkyl chloride from alkyl alcohol?
   (b) Which will have a higher boiling point : 1-chlorobutane or 2-methyl-2-chlorobutane? Give reason.

21. 4% NaOH solution (mass/volume) and 6% urea solution (mass/volume) are equimolar but not isotonic. Why?

<div align="center">

SECTION C

</div>

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

22. Explain :
   (a) Alcohols have higher boiling points than alkanes, ethers and alkyl halides of comparable molecular masses.
   (b) Ethanol cannot be used as a solvent with Grignard reagent or $LiAlH_4$.
   (c) The relative acidity of alcohols is in the order of $3° < 2° < 1° < CH_3OH$.

23. (a) What is osmotic pressure?
   (b) A solution containing 4 g of a non-volatile organic solute per 100 cm^3 was found to have an osmotic pressure equal to 500 cm Hg, at 27 °C. Calculate the molar mass of the solute.
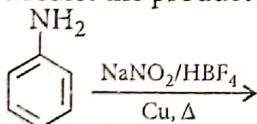
24. (i) How will you convert :
   (a) Benzene into aniline
   (b) 3-Methylaniline into 3-nitrotoluene
   (ii) Give one chemical test to distinguish between aniline and *N*-methylaniline.
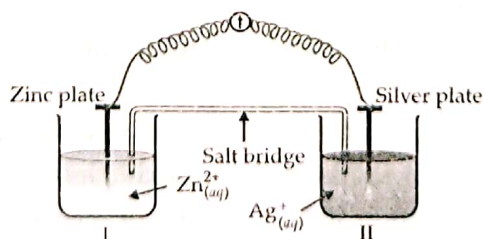
<div align="center">OR</div>

   (i) Account for the following :
       (a) Like ammonia, amines are good nucleophiles.
       (b) Aryl amines are weaker bases than alkyl amines.
   (ii) Predict the product of the following reaction :

   $\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow[Cu, \Delta]{NaNO_2/HBF_4}$

25. Consider the figure and answer the questions (i) to (vi) given below:

   (i) Redraw the diagram to show the direction of electron flow.
   (ii) Does silver plate act as the anode or cathode?
   (iii) What will happen if salt bridge is removed?
   (iv) When will the cell stop functioning?
   (v) How will concentration of Zn^{2+} ions and Ag^+ ions be affected when the cell functions?
   (vi) How will the concentration of Zn^{2+} ions and Ag^+ ions be affected after the cell becomes 'dead'?
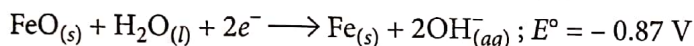
Chemistry

26. Give the plausible explanation for the following :
    (a) Glucose does not give Schiff's test.
    (b) The two strands in DNA are not identical but are complementary.
    (c) What products would be formed when a nucleotide from DNA containing thymine is hydrolysed?

27. (i) Write chemical equations and reaction conditions for the conversion of
    (a) Chlorobenzene to phenol
    (b) Propene to 1-bromopropane
    (c) Chlorobenzene to toluene.
    (ii) Predict all the alkenes that would be formed by dehydrohalogenation of the following halides with sodium ethoxide in ethanol and identify the major alkene.
    (a) 1-Bromo-1-methylcyclohexane
    (b) 2-Chloro-2-methylbutane

28. Using crystal field theory, draw energy level diagram, write electronic configuration of the central metal atom/ion and determine the magnetic moment value for the following : $[FeF_6]^{3-}$, $[Fe(H_2O)_6]^{2+}$.

SECTION D

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. The Edison storage cell is represented as : $Fe_{(s)} | FeO_{(s)} | KOH_{(aq)} | Ni_2O_{3(s)} | Ni_{(s)}$

    The half-cell reactions are :

    $Ni_2O_{3(s)} + H_2O_{(l)} + 2e^- \longrightarrow 2NiO_{(s)} + 2OH^-_{(aq)}$; $E° = +0.40$ V

    $FeO_{(s)} + H_2O_{(l)} + 2e^- \longrightarrow Fe_{(s)} + 2OH^-_{(aq)}$; $E° = -0.87$ V

    Answer the following questions :
    (a) Write the cell reaction taking place at anode and cathode.
    (b) What is the cell EMF?

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

    How does cell EMF depend on the concentration of KOH?
    (c) What is the maximum amount of electrical energy that can be obtained from one mole of Ni_2O_3?

30. The lanthanoid series is a unique class of 15 elements with relatively similar chemical properties. They have atomic number ranging from 57 to 71, which corresponds to the filling of the 4*f* orbitals with 14 electrons. This configuration leads to phenomenon known as lanthanoid contraction. The lanthanoids are sometimes referred to as the 'rare earth elements', leading to misconception that they are rare. In fact, many of the rare earth elements are more common than gold, silver and in some cases, lead. The lanthanoids are commonly found in nature as a mixture in a number of monazite ($LnPO_4$) and bastnaesite ($LnCO_3F$) in the +3 oxidation state.

    The chemical and physical properties of lanthanoids provide the unique features that set them apart from other elements. Lanthanoids are most stable in the +3 oxidation state. Yb and Sm though stable in the +3 state, also have accessible +2 oxidation states. The ease of accessibility of both oxidation states is quite important in chemical synthesis and these elements act as Lewis acid in the +3 oxidation state and single electron reductant in the +2 oxidation state.

    Answer the following questions :
    (a) On the basis of Lanthanoid contraction, explain the following :
        (i) Nature of bonding in La_2O_3 and Lu_2O_3.
        (ii) Radii of 4*d* and 5*d* elements.

(b) Name a member of the lanthanoid series which is well known to exhibit +2 oxidation state.

(i) Eu

(ii) Gd

(iii) Pr

(iv) Tb

(c) Name a member of the lanthanoid series which is well known to exhibit +4 oxidation state.

(i) Ce

(ii) Pr

(iii) Dy

(iv) All of these

OR

Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of the following statements is incorrect?

(i) Because of the large size of the Ln(III) ions the bonding in its compounds is predominantly ionic in character.

(ii) The ionic sizes of Ln(III) decrease in general with increasing atomic number.

(iii) Ln(III) compounds are generally colourless.

(iv) Ln(III) hydroxides are mainly basic in character.

SECTION E

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

31. (a) A compound 'A' (C_2H_6O) on oxidation by PCC gave 'B', which on treatment with aqueous alkali and subsequent heating furnished 'C'. 'B' on oxidation by $KMnO_4$ forms a monobasic acid 'D' with molar mass 60 g mol^{-1}. On reduction with $LiAlH_4$, 'D' forms 'A'. Identify 'A', 'B', 'C' an 'D'.

(b) Which acid of each pair shown here would you expect to be stronger?

(i) CH_3CO_2H or CH_2FCO_2H

(ii) F_3C—⟨ ⟩—COOH or

H_3C—⟨ ⟩—COOH

OR

(a) Given reason :

(i) Phenol gives tribromophenol on bromination with bromine water but monobromophenol on bromination with CS_2.

(ii) Phenol is acidic while hexanol is neutral towards a solution of NaOH.

(iii) *m*-Aminophenol is stronger acid than *o*-aminophenol.

(b) (i) Carboxylic acids are higher boiling liquids as compared to corresponding aldehydes, ketones or alcohols. Explain.

(ii) How is acetone obtained from 2-bromopropane?

32. (a) The activation energy of a reaction is 75.2 kJ mol^{-1} in the absence of a catalyst and 50.14 kJ mol^{-1} with a catalyst. How many times will the rate of reaction increase in the presence of the catalyst if the reaction proceeds at 25°C? ($R = 8.314$ J K^{-1} mol^{-1})

(b) Explain the following terms :

(i) Rate of a reaction

(ii) Activation energy of a reaction

(c) The decomposition of phosphine (PH_3), proceeds according to the following equation :

$4PH_{3(g)} \rightarrow P_{4(g)} + 6H_{2(g)}$
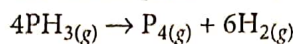
It is found that the reaction follows the following rate equation : Rate $= k[PH_3]$

The half-life period of PH_3 is 37.9 s at 120°C.

(i) How much time is required for $\frac{3}{4}$th of PH_3 to decompose?

(ii) What fraction of the original sample of PH_3 remains behind after 1 minute?

OR

(a) How much time is required for the 50% completion of a zero order reaction?

(b) How does the value of rate constant vary with reaction concentration?

(c) Draw a schematic graph showing how the rate of a first order reaction changes with change in concentration of the reactant.

(d) Rate of a reaction is given by Rate $= k[A]^2[B]$

What are the units for the rate and the rate constant for this reaction?

33. (a) (i) Why is Cr^{2+} reducing and Mn^{3+} oxidising in nature when both have d^4 configuration?

(ii) Explain how $[Ti(H_2O)_6]^{3+}$ becomes purple coloured ?

(b) Draw the structure and write the hybridisation state of Co in cis-$[Co(NH_3)_4Cl_2]^+$.

OR

(a) (i) The outer electronic configuration of two members of the lanthanoids are as follows :

$4f^1\, 5d^1\, 6s^2$ and $4f^7\, 5d^0\, 6s^2$.

What are their atomic numbers? Predict the oxidation states exhibited by these elements in their compounds.

(ii) Ionisation enthalpies of Ce, Pr and Nd are higher than Th, Pa and U. Why?

(iii) Describe the variability of oxidation states in the first row of the transition elements (Sc – Cu) and indicate the general trend.

(b) Explain with example homoleptic and heteroleptic complexes.