12th STD

INSTANT SUPPLEMENTARY EXAM 2023

Reg. No.

Part - III

CHEMISTRY (with answers)

Time Allowed : 3.00 Hours] [Maximum Marks : 70

Instructions :

(1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

Note : Draw diagrams and write equations wherever necessary.

PART - I

Note : (i) Answer **all** the questions. **15 × 1 = 15**

(ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and corresponding answer.

1. Match :

(1)	Cyanide process	(i)	Ultrapure Ge
(2)	Froth floatation process	(ii)	Extraction of Al
(3)	Electrolytic reduction	(iii)	Dressing of ZnS
(4)	Zone refining	(iv)	Extraction of Au

(a) (1) - (i), (2) - (ii), (3) - (iii), (4) - (iv)

(b) (1) - (ii), (2) - (iv), (3) - (i), (4) - (iii)

(c) (1) - (iv), (2) - (iii), (3) - (ii), (4) - (i)

(d) (1) - (iii), (2) - (i), (3) - (iv), (4) - (ii)

2. In diborane, the number of electrons that account for bridged bonds (banana bond) is :

(a) six (b) two (c) four (d) three

3. On hydrolysis, PCl_3 gives :

(a) H_3PO_3 (b) PH_3

(c) H_3PO_4 (d) $POCl_3$

4. In acid medium, potassium permanganate oxidizes oxalic acid to :

(a) oxalate (b) carbon dioxide

(c) acetate (d) acetic acid

5. How many geometrical isomers are possible for $[Pt(Py)(NH_3)(Br)(Cl)]$?

(a) 3 (b) 4 (c) 0 (d) 15

6. Graphite and diamond are :

(a) covalent and molecular crystals

(b) ionic and covalent crystals

(c) both covalent crystals

(d) both molecular crystals

7. The rate constant of a reaction is $5.8 \times 10^{-2}\ s^{-1}$. The order of the reaction is :

(a) First order (b) zero order

(c) Second order (d) Third order

8. Which of the following fluoro – compounds is most likely to behave as a Lewis base?

(a) BF_3 (b) PF_3 (c) CF_4 (d) SiF_4

9. The number of electrons that have a total charge of 9650 coulombs is :

(a) 6.22×10^{23} (b) 6.022×10^{24}

(c) 6.022×10^{22} (d) 6.022×10^{-34}

10. Adsorption of a gas on solid metal surface is spontaneous and exothermic, then:

(a) ΔH increases (b) ΔS increases

(c) ΔG increases (d) ΔS decreases

11. Carbolic acid is :

(a) Phenol (b) Picric acid

(c) benzoic acid (d) phenylacetic acid

12. In the following reaction, $HC \equiv CH \xrightarrow[HgSO_4]{H_2SO_4} X$.

Product 'X' will not give _____

(a) Tollen's test (b) Victor meyer test

(c) Iodoform test

(d) Fehling solution test

13. Secondary nitro alkanes react with nitrous acid to form

(a) red solution (b) blue solution

(c) green solution (d) yellow solution

14. Which of the following vitamins is water soluble?

(a) Vitamin E (b) Vitamin K

(c) Vitamin A (d) Vitamin B

15. Aspirin is :

(a) acetylsalicylic acid (b) benzoyl salicylic acid

(c) chlorobenzoic acid (d) anthranilic acid

PART - II

Note : Answer **any six** questions. Question No. **24** is **Compulsory.** **6 × 2 = 12**

16. Give one example for the following.

(i) icosagen (ii) chalcogen

17. Sulphuric acid is a dehydrating agent. Give example.

18. What are interstitial compounds?

19. Define half life of a reaction.

20. Give two important characteristics of physisorption.

21. Ethylene glycol $\xrightarrow{\text{Con } H_2SO_4} X$ Identify X.

22. What is Formalin? Give its use.

23. What are bio degradable polymers? Give examples.

24. Calculate the concentration of OH^-ion in a fruit juice which contains 2×10^{-3} M, H_3O^+ ion. Identify the nature of the solution.

PART - III

Note : Answer **any six** questions. Question No. **33** is **Compulsory.** **6 × 3 = 18**

25. What are the limitations of Ellingham diagram.

26. Give the uses of Helium.

27. Mention the oxidation state of the central metal ion, co-ordination number nature of ligand for the complex $K_4[Mn(CN)_6]$.

28. Write the differences between rate and rate constant of a reaction.

29. Why are lyophillic colloidal sols are more stable than lyophobic colloidal sols?

30. Reduction potential of two metals M_1 and M_2 are $E^\circ_{M_1^{2+}|M_1} = -2.3V$ and $E^\circ_{M_1^{2+}|M_2} = 0.2V$ Predict which one is better for coating the surface of iron. Given : $E^\circ_{Fe^{2+}|Fe} = -0.44V$

31. What happens when the following alkenes are subjected to reductive ozonolysis?

32. Write a note on vulcanization of rubber.

33. Identify compounds A, B and C in the following sequence of reactions

$$C_6H_5NO_2 \xrightarrow{Sn/HCl} A \xrightarrow[273K]{NaNO_2+HCl} B \xrightarrow{C_6H_5OH} C$$

PART - IV

Note : Answer **all** the questions. **5 × 5 = 25**

34. (a) (i) Describe a method for refining Nickel.

(ii) Write about the liquation process.

(OR)

(b) (i) Write a note on hydroboration.

(ii) Explain the bleaching action of SO_2.

35. (a) What is lanthanoid contraction? what are its effects?

(OR)

(b) Draw all possible geometrical isomers of the complex $[Co(en)_2Cl_2]^+$ and identify the optically active isomer.

36. (a) Differentiate crystalline solids and amorphous solids.

(OR)

(b) Derive the integrated rate law for a zero order reaction.

37. (a) Explain intermediate compound formation theory of catalysis with an example.

(OR)

(b) Mention the importance of proteins in living organisms.

38. (a) Explain Lucas test to differentiate primary, secondary and tertiary alcohols.

(OR)

(b) Write short notes on:

(i) Schotten – Baumann reaction

(ii) Mustard oil reaction

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ANSWER

PART - I

1. (c) (1) - (iv), (2) - (iii), (3) - (ii), (4) - (i)

2. (c) four

3. (a) H_3PO_3

4. (b) carbon dioxide

5. (a) 3

6. (c) both covalent crystals

7. (a) First order

8. (b) PF_3

9. (c) 6.022×10^{22}

10. (d) ΔS decreases

11. (a) Phenol

12. (b) Victor meyer test

13. (b) blue solution

14. (d) Vitamin B

15. (a) acetylsalicylic acid

PART - II

16. (i) icosagens - Boron

(ii) chalcogens - Oxygen

17. (i) Sulphuric acid is highly soluble in water.

(ii) It has strong affinity towards water.

(iii) Hence it can be used as a dehydrating agent.

(iv) When dissolved in water, it forms mono ($H_2SO_4.H_2O$) and dihydrates ($H_2SO_4.2H_2O$) and the reaction is exothermic.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2SO_4 \longrightarrow 12C + H_2SO_4.11H_2O$$

$$\underset{\text{Formic acid}}{HCOOH} + H_2SO_4 \longrightarrow CO + H_2SO_4.H_2O$$

$$\underset{\text{Oxalic acid}}{(COOH)_2} + H_2SO_4 \longrightarrow CO + CO_2 + H_2SO_4.H_2O$$

18. (i) An interstitial compound or alloy is a compound that is formed when small atoms like hydrogen, boron, carbon or nitrogen are trapped in the interstitial holes in a metal lattice.

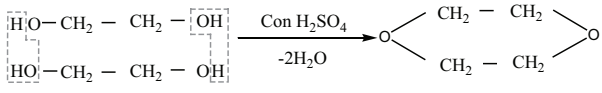
(ii) They are usually non-stoichiometric compounds. Transition metals form a number of interstitial compounds such as TiC, $ZrH_{1.92}$, Mn_4N etc.

19. The half life of a reaction is defined as the time required for the reactant concentration to reach one half its initial value.

20. (i) It is reversible

(ii) It has low heat of adsorption

21. When distilled with Conc. H_2SO_4, glycol forms dioxane



ethane - 1,2 - diol — 1,4 - dioxane

22. (i) 40 % aqueous solution of formaldehyde is known as formalin.

(ii) It is used as a preservative for biological specimens and in leather tanning.

(iii) It is used in the production of thermo setting plastic known as bakelite.

23. (i) The materials that are readily decomposed by microorganisms in the environment are called biodegradable.

Examples:

Polyhydroxy butyrate (PHB)

Poly-3-hydroxy butyrate-co-3-hydroxyl valerate (PHBV)

(ii) Biodegradable polymers are used in medical field such as surgical sutures, plasma substitute etc… these polymers are decomposed by enzyme action and are either metabolized or excreted from the body.

24. Given that $H_3O^+ = 2 \times 10^{-3}$M

$K_w = [H_3O^+][OH^-]$

$\therefore [OH^-] = \frac{K_w}{[H_3O^+]} = \frac{1\times10^{-14}}{2\times10^{-3}} = 5\times10^{-12}$M

$2 \times 10^{-3} >> 5 \times 10^{-12}$

i.e., $[H_3O^+] >> [OH^-]$, hence the juice is acidic in nature.

PART - III

25. (i) Ellingham diagram is constructed based only on thermodynamic considerations.

(ii) It does not tell anything about the rate of the reaction.

(iii) The interpretation of ΔG is based on the assumption that the reactants are in equilibrium with the products which is not always true.

26. (i) Helium and oxygen mixture is used by divers in place of air oxygen mixture. This prevents the painful dangerous condition called bends.

(ii) Helium is used to provide inert atmosphere in electric arc welding of metals.

(iii) Helium has lowest boiling point hence used in cryogenics (low temperature science).

(iv) It is much less denser than air and hence used for filling air balloons.

27. $K_4[Mn(CN)_6]$

Potassium hexacyanomanganate(II)

(i) Oxidation state of manganese

$4(+1) + x + 6(-1) = 0$

$4 + x - 6 = 0$

$x - 2 = 0$

$x = 2$

Oxidation state of Manganese = +2

(ii) Coordination number = 6

(iii) CN^- is a strong field ligand

(iv) Paramagnetic (one unpaired) monodentate.

(v) Magnetic moment $\mu = \sqrt{n+(n+2)}$

$= \sqrt{1(1+2)}$

$= \sqrt{3} = 1.732$ BM

(vi) Electronic configuration = $d^{5+}: t^5_{2g}\, e^\circ_g$

28.

S. No	Rate of a reaction	Rate constant of a reaction
1.	It represents the speed at which the reactants are converted into products at any instant	It is a proportionality constant
2.	It is measured as decrease in the concentration of the reactants or increase in the concentration of products.	It is equal to the rate of reaction, when the concentration of each of the reactants is unity
3.	It depends on the initial concentration of reactants.	It does not depend on the initial concentration of reactants.

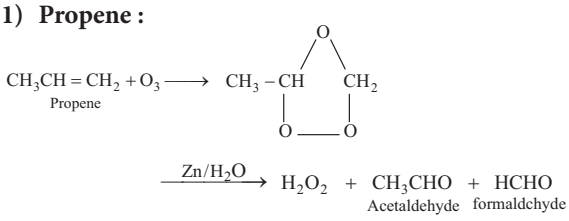
29. (i) In lyophillic colloids or sols definite attractive force or affinity exists between dispersion medium and dispersed phase.

Examples: sols of protein and starch. They are more stable and will not get precipitated easily.

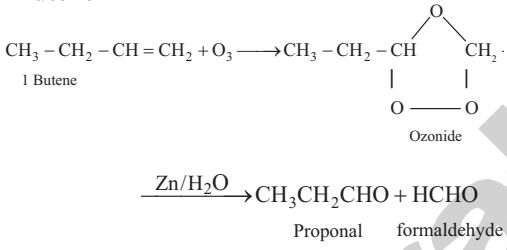
(ii) In a lyophobic colloids, no attractive force exists between the dispersed phase and dispersion medium. They are less stable and precipitated readily.

30. Oxidation potential of M_1 is more +ve than the oxidation potential of Fe which indicates that it will prevent iron from rusting.

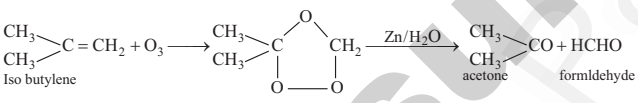
31. **1) Propene :**



2) 1 – Butene



3) Isobutylene



32. (i) The process of mixing natural rubber with sulphur is called vulcanization.

(ii) Natural rubber is mixed with 3-5% sulphur and heated at 100-150°C causes cross linking of the cis-1,4-polyisoprene chains through disulphide (-S-S-) bonds.

(iii) The physical properties of rubber can be altered by controlling the amount of sulphur that is used for vulcanization.

(iv) In sulphur rubber, made with about 1 to 3% sulphur is soft and stretchy.

(v) When 3 to 10% sulphur is used the resultant rubber is somewhat harder but flexible.

33. A - Aniline ($C_6H_5NH_2$)

B - Benzenediazonium Chloride ($C_6H_5 - N_2^+Cl^-$)

C - Phenol (C_6H_5OH)

PART - IV

34. **(a) (i) Mond process for refining nickel :**

(i) The impure nickel is heated in a stream of carbon monoxide at around 350K.

(ii) The nickel reacts with the CO to form a highly volatile nickel tetracarbonyl.

(iii) The solid impurities are left behind.

$$Ni_{(s)} + 4CO_{(g)} \xrightarrow{350\ K} [Ni(CO)_4]_{(g)}$$

(iv) On heating the nickel tetracarbonyl around 460K, the complex decomposes to give pure metal.

$$[Ni(CO_4)]_{(g)} \xrightarrow{460\ K} Ni_{(s)} + 4CO_{(g)}$$

(ii) (1) Liquation is employed to remove the impurities with high melting points from metals having relatively low melting points.

(2) In this process, the crude metal is heated to form fusible liquid and allowed to flow on a sloping surface.

(3) The impure metal is placed on sloping hearth of a reverberatory furnace and it is heated just above the melting point of the metal in the absence of air, the molten pure metal flows down and the impurities are left behind.

(4) The molten metal is collected and solidified.

(OR)

(b) (i)

(1) Diborane adds on to alkenes and alkynes in ether solvent at room temperature.

(2) This reaction is called hydroboration and is highly used in synthetic organic chemistry, especially for anti Markovnikov addition.

$$B_2H_6 + 6RCH = CHR \longrightarrow 2(RCH_2{-}CHR)_3B$$

(ii) Bleaching action of sulphur dioxide: In presence of water, sulphur dioxide bleaches coloured wool, silk, sponges and straw into colourless due to its reducing property.

$$SO_2 + 2H_2O \longrightarrow H_2SO_4 + 2(H)$$

$$\underset{\text{Coloured}}{X} + 2(H) \longrightarrow \underset{\text{Colourless}}{XH_2}$$

However, the bleached product (colourless) is allowed to stand in air, it is reoxidised by atmospheric oxygen to its original colour. Hence bleaching action of sulphur dioxide is temporary.

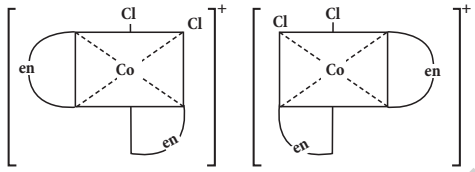
35. (a) As we move across 4f series, the atomic and ionic radii of lanthanoids show gradual decrease with increase in atomic number. This decrease in ionic size is called lanthanoid contraction.

Consequences of lanthanoid contraction:

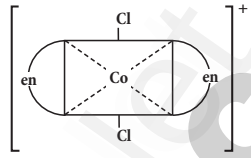
1. **Basic nature:** As we from Ce^{3+} to Lu^{3+}, the basic character of Ln^{3+} ions decrease. Due to the decrease in the size of Ln^{3+} ions, the ionic character of Ln –OH bond decreases (covalent character increases) which results in the decrease in the basic nature.
2. **Similarities among lanthanoids:** In the complete f-series only 10 pm decrease in atomic radii and 20pm decrease in ionic radii is observed. Because of this very small change in radii of lanthanoids, their chemical properties are quite similar.
3. The elements of the second and third transitition series resemble each other more closely than the elements of the first and second transition series.

(OR)

(b)



Two cis $[Co(en)_2Cl_2]^+$ isomers (optically active)



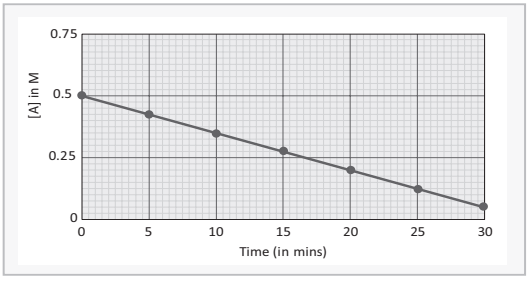
One trans $[Co(en)_2Cl_2]^+$ isomer (optically inactive)

36. (a)

Crystalline Solids	Amorphous Solids
Long range orderly arrangement of constituents.	Short range, random arrangement of constituents.
Definite shape	Irregular shape
Generally crystalline solids are anisotropic in nature	They are isotropic* like liquids
They are true solids	They are considered as pseudo solids (or) super cooled liquids
Definite heat of fusion	Heat of fusion is not definite
They have sharp melting points.	Gradually soften over a range of temperature and so can be moulded.
Eg: NaCl, diamond, etc	**Eg:** Rubber, plastics, glass, etc

(OR)

(b) A reaction in which the rate is independent of the concentration of the reactant over a wide range of concentration is called as zero order reaction. Let us consider the following by hypothetical zero order reaction.



A plot of [A] Vs time for a zero order reaction $A \longrightarrow$ product with initial concentration of [A] = 0.5 M and $k = 1.5 \times 10^{-2}\ mol^{-1}L^{-1}\ min^{-1}$

The rate law can be written as

$$\text{Rate} = k[A]^0 \quad ...(1)$$

$$\frac{-d[A]}{dt} = k(1) \quad \therefore ([A]^0 = 1)$$

$$\Rightarrow -d[A] = kdt$$

Integrate the above equation between the limits of $[A_0]$at zero time and [A] at some later time 't',

$$-\int_{[A_0]}^{[A]} d[A] = k\int_0^t dt$$

$$-([A])_{[A_0]}^{[A]} = k(t)_0^t$$

$$[A_0]-[A] = kt \quad ...(2)$$

$$k = \frac{[A_0]-[A]}{t}$$

Equation (2) is in the form of a straight line

$$y = mx + c$$

$$\text{ie., } [A] = -kt + [A_0]$$

$$\Rightarrow \quad y = c + mx$$

A plot of [A] vs time gives a straight line with a slope of $-k$ and y - intercept of $[A_0]$.

37. (a) **The intermediate compound formation theory :** A catalyst acts by providing a new path with low energy of activation. In homogeneous catalysed reactions a catalyst may combine with one or more reactant to form an intermediate which reacts with other reactant or decompose to give products and the catalyst is regenerated.

Consider the reactions :

$A + B \rightarrow AB$ ...(1)

$A + C \rightarrow AC$ (intermediate) ...(2)

C is the catalyst

$AC + B \rightarrow AB + C$ ...(3)

Activation energies for the reactions (2) and (3) are lower compared to that of (1). Hence the formation and decomposition of the intermediate accelerate the rate of the reaction.

Example : The mechanism of Fridel crafts reaction is given below

$$C_6H_6 + CH_3Cl \xrightarrow[AlCl_3]{\text{anhydrous}} C_6H_5CH_3 + HCl$$

The action of catalyst is explained as follows

$$CH_3Cl + AlCl_3 \longrightarrow [CH_3]^+ [AlCl_4]^-$$

It is an intermediate.

$$C_6H_6 + [CH_3^+][AlCl_4]^- \longrightarrow C_6H_5CH_3 + AlCl_3 + HCl$$

(OR)

(b) **Importance of proteins :** Proteins are the functional units of living things play vital role in all biological processes

(i) All biochemical reactions occur in the living systems are catalysed by the catalytic proteins called **enzymes**.

(ii) Proteins such as keratin, collagen acts as structural back bones.

(iii) Proteins are used for transporting molecules (Haemoglobin), organelles (Kinesins) in the cell and control the movement of molecules in and out of the cells (Transporters).

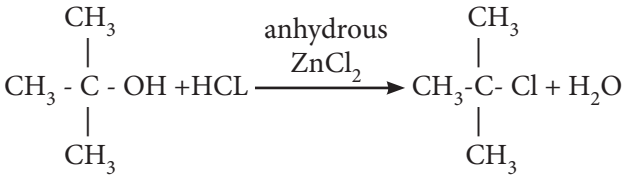
(iv) Antibodies help the body to fight various diseases.

(v) Proteins are used as messengers to coordinate many functions. Insulin & glucagon control the glucose level in the blood.

(vi) Proteins act as receptors that detect presence of certain signal molecules and activate the proper response.

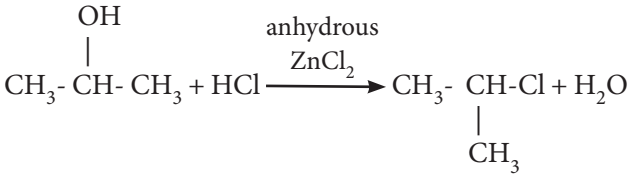
(vii) Proteins are also used to store metals such as iron (Ferritin) etc

38. (a) **Lucas Test:** When alcohols are treated with Lucas agent (a mixture of concentrated HCl and anhydrous $ZnCl_2$) at room temperature, tertiary alcohols react immediately to form a turbidity due to the formation of alkyl chloride which is insoluble in the medium.

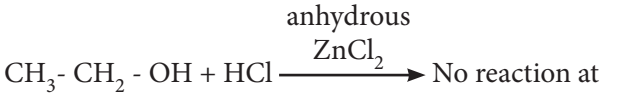


2-methylpropan-2-ol — 2-chloro-2-methylpropane (immediate appearance of turbidity)

Secondary alcohols react within 10 minutes to form a turbidity of alkyl chloride where primary alcohols do not react at room temperature.



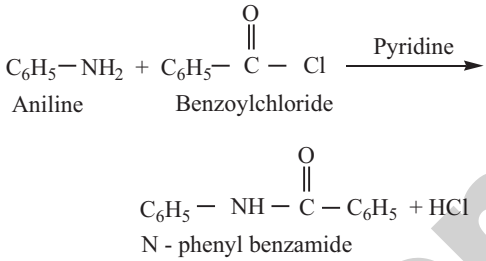
propan-2-ol — 2-chloropropane (slow appearance of turbidity



ethanol — (Turbidity appears only on heating)

(OR)

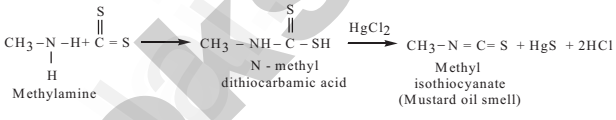
(b) (i) Schotten – Baumann reaction : Aniline reacts with benzoylchloride (C_6H_5COCl) in the presence of NaOH to give N – phenyl benzamide. This reaction is known as Schotten – Baumann reaction. The acylation and benzoylation are nucleophilic substitutions.



Aniline — Benzoylchloride — N - phenyl benzamide

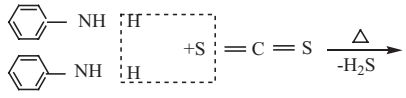
(ii) Mustard oil reaction :

(a) When primary amines are treated with carbon disulphide (CS_2), N - alkyldithio carbamic acid is formed which on subsequent treatment with $HgCl_2$, gives an alkyl isothiocyanate.

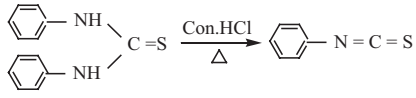


Methylamine — N - methyl dithiocarbamic acid — Methyl isothiocyanate (Mustard oil smell)

(b) When aniline is treated with carbon disulphide, or heated together, S-diphenylthio urea is formed, which on boiling with strong HCl , phenyl isothiocyanate (phenyl mustard oil), is formed.



Aniline



S - diphenyl thiourea — Phenyl isothiocyanate

These reactions are known as Hofmann – Mustard oil reaction. This test is used to identify the primary amines.

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