KSEAB PYQ K (2020)

Kannada

CHEMISTRY

1. What is the value of Van't Hoff factor (i) for K_2SO_4 ?

[PUC 2020]

2. 10 mL of liquid A is mixed with 10 mL of liquid B, the volume of the resultant solution is 19.9 mL. What type of deviation is expected from Raoult's law ?

[PUC 2020]

3. What is a secondary cell ?

[PUC 2020]

4. Identify the order of the reaction from the rate constant $K = 2.3\times10^{-6}$ L mol^{-1} s^{-1}.

[PUC 2020]

5. Give reason. Zeolites are the good shape-selective catalysts.

[PUC 2020]

6. Iron scraps are advisable and advantageous than zinc scraps for reducing the low-grade copper ores. Why?

[PUC 2020]

7. Complete the reaction $XeF_6 + H_2O \rightarrow \ldots + 2HF$

[PUC 2020]

8. Give reason. In the case of optically active alkyl halides, SN_1 reactions are accompanied by racemization.

[PUC 2020]

9. Identify 'A ' in the reaction

$$>C=O \xrightarrow[HCl]{Zn-Hg} A + H_2O$$

[PUC 2020]

10. Give an example of a water-soluble vitamin.

[PUC 2020]

11. Calculate the no. of particles present per unit cell in a B.C.C unit cell.

[PUC 2020]

12. A solution of $Ni(NO_3)_2$ is electrolyzed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of nickel is deposited at the cathode? [molar mass of Ni = 58.7gram mol^{-1}].

[PUC 2020]

13. Mention any two factors which influence the rate of the reaction.

[PUC 2020]

14. Give two reasons. The chemistry of actinoids is more complicated than Lanthanoids.

[PUC 2020]

15. How is phenol prepared from Aniline? Write the equation.

[PUC 2020]

16. Explain Cannizzaro's reaction taking benzaldehyde as an example.

[PUC 2020]

17. (a) Give an example of nonnarcotic analgesics.
(b) Why the use of Aspartame is limited to cold foods and soft drinks ?

[PUC 2020]

18. (a) Why detergents with a straight chain of hydrocarbons are preferred over branched-chain hydrocarbons?
(b) Give one example for detergent with straight-chain hydrocarbon.

[PUC 2020]

19. Write the equations involved in the leaching of alumina from bauxite ore.

[PUC 2020]

20. Mention any three anomalous properties of nitrogen.

[PUC 2020]

21. In the manufacture of sulphuric acid write
(i) The equation with the condition for the oxidation of SO_2 to SO_3.
(ii) Formation of Oleum from SO_3.

22. (a) Complete the following reaction.
(i) $NH_3 + 3Cl_2 \rightarrow \_\_\_\_\_ + 3HCl$
(ii) $Cl_2 + F_2 \xrightarrow{473K} \_\_\_\_$
(b) Write the structure of perchloric acid $(HClO_4)$.

[PUC 2020]

23. (a) Transition elements show the catalytic property. Give two reasons.
(b) Name one 3d series element that does not show a variable oxidation state.

[PUC 2020]

24. Write the equation for the manufacture of potassium dichromate from chromite ore.

[PUC 2020]

25. Using valence bond theory explain geometry hybridization and magnetic property of $[CoF_6]^{3-}$
[Give atomic no. of Co: 27]

[PUC 2020]

26. (a) Mention any two postulated of Werner's theory of coordination compounds.
(b) Indicate the type of Isomerism in the following set of complex compounds.
$[CO(NH_3)_5 SCN]Cl_2$
and $[CO(NH_3)_5 NCS]Cl_2$

[PUC 2020]

27. (a) Calculate the packing efficiency in F.C.C. cubic lattice.
(b) Calcium metal crystallizes in a face-centered cubic lattice with an edge length of 0.556 nm. Calculate the density of the metal. [Atomic mass of calcium 40 g/mol. $N_A = 6.022 \times 10^{23}$ atoms/mol].

[PUC 2020]

28. (a) The Vapour pressure of benzene is 200 mm of Hg. When 2 grams of a non-volatile solute dissolved in 78-gram benzene. Benzene has a vapour pressure of 195 mm of Hg. Calculate the molar mass of the solute. [Molar mass of benzene is 78 gram mol^{-1}].
(b) What are azeotropes? Give an example for binary solutions showing minimum boiling azeotrope.

[PUC 2020]

29. (a) Calculate the e.m.f. of the cell in which the following reaction takes place.

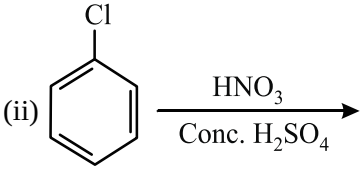
$$Ni + 2Ag^{+}_{(0.002\,M)} \rightarrow Ni^{2+}_{(0.16\,eM)} + 2Ag_{(s)}$$

Given $E^0_{cell} = 1.05\,V$
(b) (i) State Kohlrausch's law of Independent Migration of ions.

30. (a) Derive an integrated rate equation for a first-order reaction.
(b) According to collission theory write two factors responsible for effective collisions.

31. (a) Write a note on Dialysis.
(b) What is the effect on ΔH and ΔS during the process of adsorption?
(c) Give an example of heterogeneous catalysis.

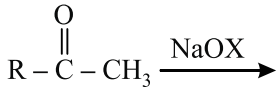
32. (a) Explain the mechanism for the conversion of tertiary butyl bromide to tertiary butyl alcohol.
(b) Complete the following reactions:
(i) $CH_3 - CH = CH_2 + HI \rightarrow$
(ii)



(iii) $CH_3CH_2Br \xrightarrow{Alco\ AgCN}$

33. (a) Explain the mechanism of acid-catalyzed dehydration of ethanol to ethene.
(b) How does anisole react with methyl chloride?

34. (a) How is benzoyl chloride converted into benzaldehyde? Write the equation and name the equation.
(b) Write a general equation for the formation of carboxylic acid from the Grignard reagent.
(c) Complete the reaction



35. (a) Mention the I.U.P.A.C. name of
$(CH_3)_2 - N - CH_3$.
(b) How is Aniline is prepared from nitrobenzene?
(c) Give the equation for the conversion of aniline to 4-Bromo aniline.

36. (a) Write a chemical reaction to elucidate
1. Glucose contains five -OH groups.
2. Glucose contains six carbon atoms in a straight chain.
(b) Explain the denaturation of proteins with examples.
(c) Name the sugar moiety present in DNA.

37. (a) Name the monomers present in the following polymers.
(i) PVC
(ii) Neoprene
(iii) Nylon-6
(b) Explain the Vulcanisation of rubber.

Solutions

1. $K_2SO_4 \rightarrow 2K^+ + SO_4^{2-}$

$i = \frac{3}{1} = 3$

2. Negative or –ve

3. A secondary cell after use can be recharged so that it can be used again.

4. Second-order reaction

5. ZSM - 5 as they have honeycomb-like porous structure and pore sizes ranging between 260–740 pm

6. Iron scraps are economically cheaper than Zinc Scraps. iron reduction of low-grade copper ore is thermodynamically feasible, and utilizing scrap iron is far more sustainable/advantageous for low-grade ores than using more reactive, expensive zinc

7. $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

8. S_N1 reactions involve the formation of a planar carbocation intermediate, allowing nucleophilic attack from both sides, which leads to **both** retention and inversion (i.e., racemization)

9. Text Solution:

$> C = O \xrightarrow[HCl]{Zn-Hg} > CH_2 + H_2O$

10. Vitamin - C.

11. Number of particles (atoms) in BCC unit cell

$= \frac{1}{8} \times 8$ (at corners) +1 (at body center)

$= 1 + 1$

= 2 particles

12. $Ni(NO_3)_2 \rightarrow Ni^{2+} + 2NO_3^-$

$\underset{26\,mumole}{Ni^{2+}} + 2e \rightarrow Ni \;\; 58.76\,\mu g/m$

$W = Zit = \frac{\text{molar mass}}{nF} \times i \times t$

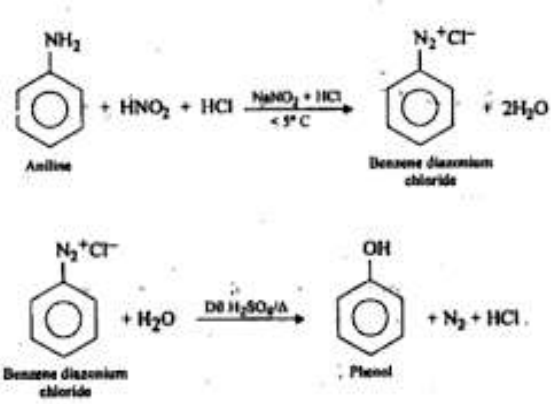
$W = Zit = \frac{58.7}{2 \times 96500} \times 5 \times 20 \times 60\,s = 0.365\,g$

13.
- The concentration of the reactants or pressure of the reactants
- Temperature
- Catalyst
- Nature of the reactants and their physical states.

14. a. **Variable Oxidation States**: Actinoids exhibit a much wider range of oxidation states (e.g., +3, +4, +5, +6, and +7) than lanthanoids. This occurs because the 5f,6d ,7s orbitals are all comparable in energy.

b. **Radioactivity**: All actinoids are radioactive. Many have very short half-lives and are only available in microscopic quantities, which makes traditional laboratory experimentation extremely difficult.

15.



16. Aldehyde which does not have an α-hydrogen atom, undergo self-oxidation and reduction reaction on heating with conc. alkali. In this reaction, one molecule of the aldehyde is reduced to alcohol while another is oxidized to carboxylic acid salt.

17. (a) Analgesics are chemicals used to reduce body pain without causing impairment of consciousness. Examples:

- Non-narcotic analgesic – Aspirin
- Narcotic analgesic – Morphine.

(b) Unstable to heat hence limited to cold foods and soft drinks.

18. (a) straight-chain hydrocarbon detergents are preferred because they are **biodegradable**, whereas branched-chain hydrocarbons resist bacterial degradation and cause environmental pollution

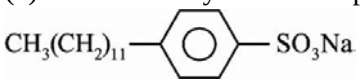
(b) Sodium dodecylbenzene-sulphonate Anionic detergents are sodium salts of sulfonated long-chain alcohols or hydrocarbons.

Ex:

(i) Sodium lauryl sulphate

$CH_3(CH_2)_{10}CH_2OSO_3Na$

(ii) Sodium dodecylbenzene sulphonate



These are used in toothpaste.

19. (a) Bauxite ore is heated with a concentrated solution of NaOH at 473 K to 523 K and 35-36 bar pressure. Al_2O_3 dissolves out as sodium aluminates leaving behind impurities.

$$Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2Na[Al(OH)_4]$$

(b) The aluminate in solution is neutralized by passing CO_2 gas and hydrated Al_2O_3 is precipitated.

$$2Na[Na(OH)_4] + 2CO_2 \rightarrow Al_2O_3 \cdot 3H_2O + 2NaHCO_3$$

(c) Hydrated alumina is filtered, dried, and heated to give pure alumina.

$$Al_2O_3 \cdot 3H_2O \xrightarrow{AlO\,(1770\,K)} Al_2O_3 + 3H_2O$$

20. Nitrogen shows the following anomalous properties.

- The smaller size
- High electronegativity.
- High ionization enthalpy.
- Non-availability of d-orbitals.

21. (i) Catalytic oxidation of SO_2 with O_2 in presence of V_2O_5 catalyst gives SO_3

$$2SO_2 + O_2 \xrightarrow[2bar,\,720\,K]{VO} 2SO_3$$

(ii) SO_3 gas is absorbed in Conc. H_2SO_4 to produce oleum. Dilution of oleum with water gives H_2SO_4 of the desired concentration.

$$H_2SO_4 + SO_3 \rightarrow H_2S_2O_7$$

$$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$$

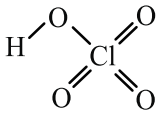
22. (a) Ammonia reacts with excess of chlorine forming nitrogen trichioride.

$$NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$$

(i) Ammonia reacts with excess of chlorine forming nitrogen trichioride. $NH_3 + 3Cl_2 \rightarrow NCl_3 + 3HCl$

(ii) 2ClF

(b) Perchloric acid $HClO_4$



23. (a) Transition metal and its compounds are known for their catalytic activity.

- This is because of transition metals.
- Adopt multiple oxidation states.
- Form intermediate complexes.
- Lowers the activation energy of the reaction.

(b) (Zn)/Zinc. or Scandium(Sc)

24. **Step–1:** Potassium dichromate is prepared by fusion of chromite ore $[FeOCr_2O_3]$ with sodium carbonate with an excess of air.

$$4FeO.Cr_2O_3 + 8Na_2CO_3 + 7O_2 \rightarrow 2Fe_2O_3 + 8Na_2CrO_4 + 8CO_2$$

Step–2: The yellow solution of sodium chromate is filtered and acidified with sulphuric acid. The orange solution of sodium dichromate is obtained.

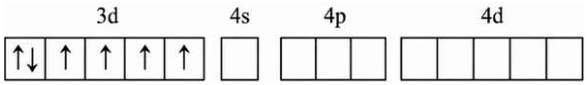
$$2Na_2CrO_4 + 2H^+ \rightarrow NaCr_2O_7 + H_2O + 2Na^+$$

Step–3: The sodium dichromate solution is treated with a potassium chloride solution to get potassium dichromate.

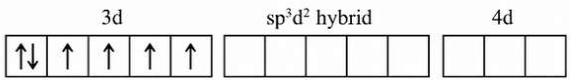
$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$

Orange crystals of potassium dichromate crystalize out.

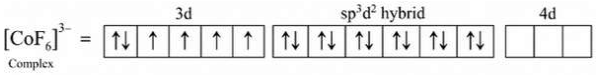
25. (i) Orbitals of Co^{3+} ion



(ii) In Co^{3+} ion sp^3d^2 hybridization takes place d^2 hybridized orbitals of Co^{3+}



(iii) Six pairs of electrons, one from each F-ion occupy the six hybrid orbitals. Thus, the complex has octahedral geometry and paramagnetic in nature due to the presence of four unpaired electrons.



For $\left[CoF_6\right]^{3-}$ Complex:

(i) Type of hybndisation : sp^3d^2

(ii) Geometry : Octahedral

(iii) Magnetic property : Paramagnetic.

26. (a) In co-ordination compounds, metal atom shows two types of valencies.

- Primary valency
- Secondary valency.

2. The primary valency is ionizable and is satisfied by negative ions.

3. The secondary valency is non-ionizable and is satisfied by negative ions or neutral molecules.

4. The primary valency is the oxidation number and secondary valency is the co-ordination number of the metal atom.

(b) Linkage isomerism.

27. (a)

A Let 'a' : be the edge length of the cube

'b' : be the face diagonal

'r' : is the radius of the sphere b = 4r

In $\triangle ABC$

$b^2 = a^2 + a^2$

$b^2 = 2a^2$

$b = \sqrt{2} \times a$

$4r = \sqrt{2} \times a$

$a = \frac{4}{\sqrt{2}} r$

$a = 2\sqrt{2r}$

Volume of the cube $= a^3 = \left(2\sqrt{2r}\right)^3$

Each unit cell of CCP structure contain 4 spheres.

Volume of the four spheres $= 4 \times \frac{4}{3}\pi r^3$

$$\text{Packing efficiency} = \frac{\text{Volume of 4 atoms in the unit cell}}{\text{Total volume of the unit cell}} \times 100$$

$$= \frac{4 \times \frac{4}{3}\pi r^2}{\left(2\sqrt{2}r\right)^3} \times 100$$

Packing Efficiency = 74%

(b) $d = \frac{ZM}{N_A a^3} = \frac{4 \times 40}{6.022 \times 10^{23}} \times \left(0.556 \times 10^{-7}\ \text{cm}\right)^3$

$$= \frac{160}{6.022 \times (0.556)^3 \times 10^{-21} \times 10^{21}} = 1.546\,\text{g/cm}^3$$

28. (a) 8 gm/mol

(b) Binary mixture boils at the same temperature without undergoing any change in composition is known as an azeotropic mixture.

Example: Mixture of ethanol and water. The solution at a specific composition has a constant boiling point Less than either of the two pure components is called minimum boiling azeotrope.

Example: 95% ethanol and 5% water forms minimum boiling azeotrope at a constant temperature of 78°C.

29. (a) Data: $\left[Ni^{2+}\right] = 0.10\,\text{M} \left[Ag^+\right] = 0.002\,\text{M}$

$Ni(s) + 2Ag^+ \rightarrow Ni^{2+} + 2Ag(s)$

$n = 2$

$E^E_{eall} = 1.05\,\text{V}$

Formula : $E_{cell} = E^e_{cell} - \frac{0.0591}{2} \log \frac{\left[Ni^{2-}\right]}{\left[Ag^*\right]^2}$

$E_{cell} = 1.05 - \frac{0.0591}{2} \log \frac{[0.100]}{[0.002]^2}$

$E_{cell} = 1.05 - 0.1299 = 0.92\,\text{V}$

(b) (i) Limiting the molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte.

If the molar conductivity of cation is denoted by λ_+^0 and that of anion λ_-^0 $\wedge_m^\circ = v_+\lambda_+^0 + v_-\lambda_-^0$

Where v_+ and v_- are the number of cations and anions per formula unit of an electrolyte.

(ii) Molar conductivity of an electrolyte solution at infinite dilution (when concentration approaches zero) is called limiting molar conductivity.

30. (a) Consider a zero-order reaction.

$R \rightarrow P$

$$\text{Rate} = \frac{-d[R]}{dt} = k[R]0$$

where k is rate constant for zero order reaction.

$$\frac{-d[R]}{dt} = k$$

$$d[R] = -k.dt$$

Integrating both sides

$$\int d[R] = -\int k \cdot dt$$

$$[R] = -kt + 1 \quad \ldots(1)$$

I is constant in integration.

At $t = 0, [R] = [R]_0$ where $[R]_0$ is initial concentration of the reactant.

Substituting in equation (1)

$[R]_0 = -k \times 0 + 1; l = [R]_0$

Substituting ' l ' value in equation (1)

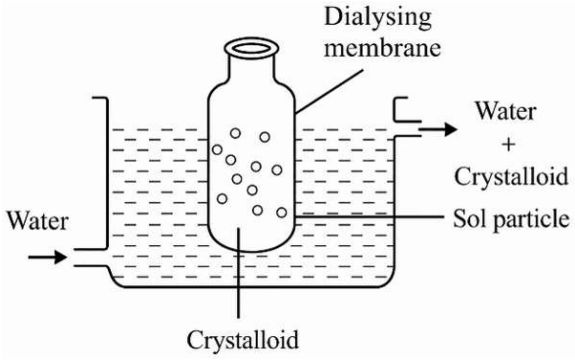
$$[R] = -kt + [R]_0$$

$$k = \frac{[R]_0 - [R]}{t}$$

(b) The activation energy of the reactant.

Proper orientation of the molecules.

31. (a) It is a process of removing a dissolved substance from a colloidal solution by means of diffusion through a suitable membrane.



The bag of suitable membrane containing the colloidal solution is suspended in a vessel through which freshwater is continuously flowing. The molecules and ions diffuse through the membrane into the outer water and the pure colloidal solution is left behind.

(b) During adsorption ΔH becomes –ve [decreases], ΔS becomes +ve [increases] and ΔG becomes ve [decreases].

(c) A catalytic process in which the reluctant and the catalyst are in different phases is known as heterogeneous catalysis.

Example (1) : Oxidation of sulphur dioxide to sulphur trioxide in presence of platinum catalyst.

$$2SO_2(g) + O_2(g) \xrightarrow{Pt(s)} 2SO_3(g)$$

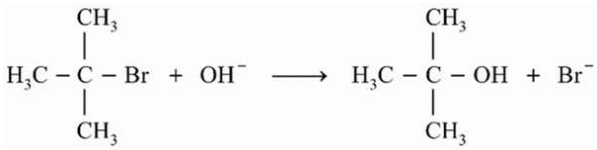
Example (2) : Combination of hydrogen and nitrogen to form ammonia.

$$N_2(g) + 3H_2(g) \xrightarrow{Fe(s)} 2NH_3(g)$$

Example (3) : Hydrogenation of vegetable oil

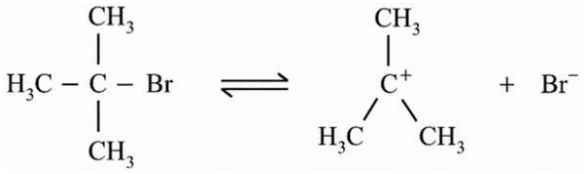
$$\text{Vegetable oil}(l) + H_2(g) \xrightarrow{Ni(s)} \text{Vanaspathi(s).}$$

32. (a) The reaction between tert-butyl bromide and hydroxide ion gives tert-butyl alcohol. The rate of reaction depends only on the concentration of tert-butyl bromide. Hence it is a nucleophilic first order substitution reaction.

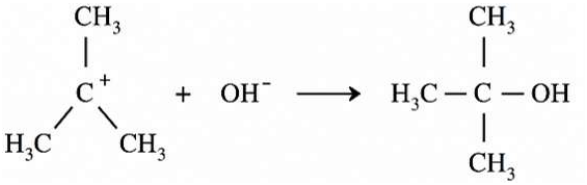


Mechanism:

Step 1: Polarised C - Br undergoes cleavage to produce planar carbocation.

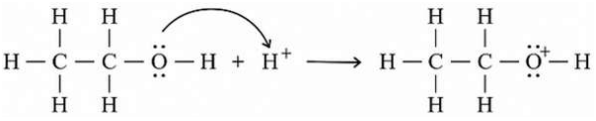


Step 2: The carbocation is then attacked by a nucleophile on either side to form tort-butyl alcohol.

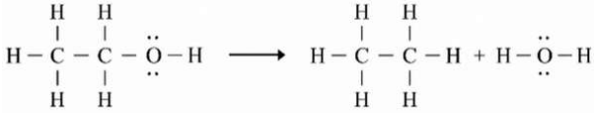


(b)

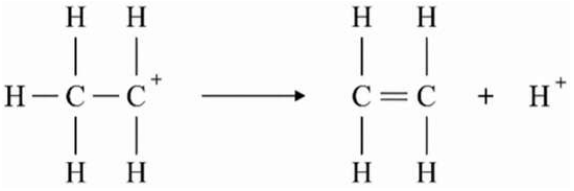
33. (a) Step 1: Formation of protonated alcohol



Step 2: Formation of carbocation

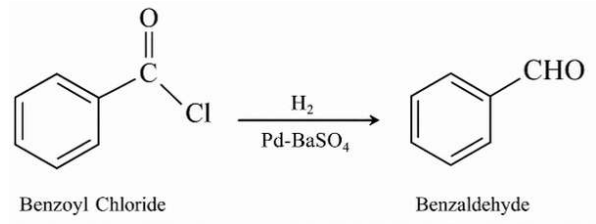


Step 3: Formation of ethene by the elimination of a proton

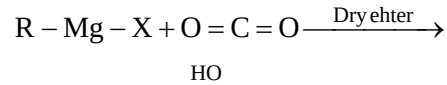


(b) Anisole undergoes bromination with bromine in ethanoic acid to form ortho bromoanisole and para-bromoanisole.

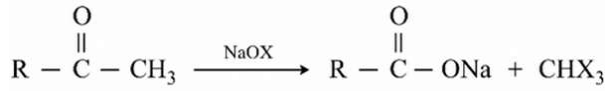
34. (a) When benzoyl chloride (acid chloride) is hydrogenated with catalyst palladium on barium sulphate, benzaldehyde is obtained.



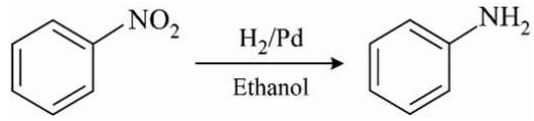
(b) Grignard reagents react with solid carbon dioxide (dry ice) to form salts of carboxylic acids, which on acidification gives carboxylic acid.



(c)



35. (a) Common name: Trimethylamine
IUPAC Name: N, N-Dimethylmethanamine
(b) Nitro compounds are reduced to amines by passing hydrogen gas in the presence of finely divided nickel, palladium or platinum catalyst.



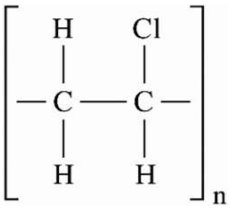
(c)

36. (a) 1. Acetylation of glucose with acetic anhydride gives glucose Penta acetate which confirms the presence of five OH groups.
2. its molecular formula is found to be.
(b) When protein is subjected to change in temperature and change in pH, it loses its biological activity. This is called denaturation of protein During denaturation primary structure will not be affected.
Example:

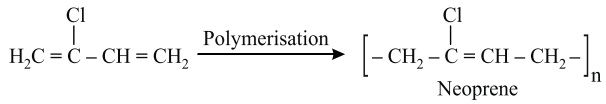
- Coagulation of egg white
- Curdling of milk.

(c) β-D-2-deoxyribose

37. (a) (i) Monomer - Vinyl Chloride
Partial Structure



(ii) Neoprene is formed by the addition of free radical polymerization of chloroprene.



(iii) Monomer: Caprolactam

Partial structure: $\left[-\mathrm{HN}\left(\mathrm{CH}_2\right)_5 \mathrm{CO}\right]_n$

(b) Vulcanization is a process of heating rubber with sulphur at a temperature range between 373K and 415 K.