SRS PU COLLEGE, CHITRADURGA

(in coordination with Narayana Group of Institutions, Hyderabad)

II PU CHEMISTRY ANNUAL EXAM - MARCH 2020

SUBJECT: CHEMISTRY (34) **Max. Marks-70**

INSTRUCTIONS **Time: 3.15 Hrs**

This question paper has 4 parts, all parts are compulsory.

- **Part-A carries 10 marks. Each question carries one mark.**
- **Part-B carries 10 marks. Each question carries two marks.**
- **Part-C carries 15 marks. Each question carries three marks.**
- **Part-D carries 35 marks. Each question carries five marks.**

PART-A

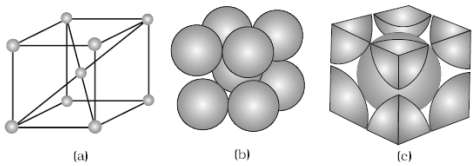
I. Answer all the questions. Each question carries one mark

1. **What is the value of Van't Hoff factor (i) for K_2SO_4**
   Ans: That is approximately three.
2. **10 mL of liquid A is mixed witih 10 mL of liquid B, the volume of the resultant solution is 19.9 mL. What type of deviation is expected form Raoult's law?**
   Ans: Negative deviation.
3. **What is secondary cell?**
   Ans: The cell which can be recharged again.
4. **Identify the order of the reaction from the rate constant $K = 2.3 \times 10^{-6} L\, mol^{-1} s^{-1}$.**
   Ans: Second order reaction.
5. **Give reason. Zeolites are good shape-selective catalyst.**
   Ans: Because of their honey comb like structure.
6. **Iron scraps are advisable and advantageous than zinc scraps for reducing the low grade copper ores. Why?**
   Ans: Because Iron scrap is economically cheaper than zinc scarp.
7. **Complete the reaction.**
   $XeF_6 + H_2O \rightarrow \ ?\ + 2HF$
   Ans: $XeOF_4$
8. **Give reason. In case of optically active alkyl halides S_N1 reactions are accompanied by racemisation.**
   Ans: In S_N1 reactions, the carbocation is formed as intermediate. The carbocation are free of strain and they can rotate in any direction either dextro or leavo or both hence it shows racemisation.
9. **Identify 'A' in the reaction.**
   $$>C{=}O \xrightarrow[HCl]{Zn-Hg} A + H_2O$$
   Ans: $CH_3 - CH_2 - CH_3$ (propane).
10. **Give an example for water soluble vitamin.**
    Ans: Vitamin 'B' and 'C'

PART-B

II. Answer any five of the following questions. Each question carries two marks

11. **Calculate the number of particles present per unit cell in a B.C.C unit cell**
    Ans: Body centred cubic lattice (bcc) contains 8 corner particles and one particle at the centre of the body.



- The contribution of corner atom to the unit cell is $\frac{1}{8}$.
- The contribution of body centre atom to the unit cell is 1.

∴ Number of particles in the unit cell of bcc

$= \left(8 \times \frac{1}{8}\right) + (1 + 1) = 1 + 1 = 2.$

12. A solution of $Ni(NO_3)_2$ is electrolysed 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 = 58.7gma mol^{-1}]

Ans: Given

Current = 5A

Time=20×60=1200 s

charge= current × time

=5×1200

=6000 c

According to the reaction,

$Ni^{2+}_{(aq)} + 2e^- \longrightarrow Ni_{(s)}$

Nickel deposited by 2×96487 c=58.71 g

Therefore, nickel deposited by 6000c=(58.71×6000)/(2 ×96487) g

= 1.825 g

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

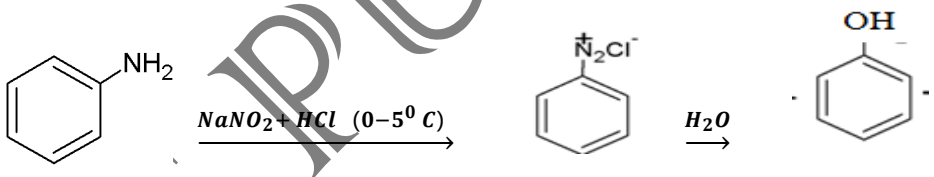
- Nature of the reactants
- Temperature
- Concentration of the reactants
- Catalyst
- Presence of light photochemical reactions.

14. Give two reasons the chemistry of actinoids is more complicated than Lanthnoids.

Ans: Radioactive nature

5-f orbital present in actinoids is more exposed to the outer environment while 4-f orbital present in lanthonoide are deeply buried,

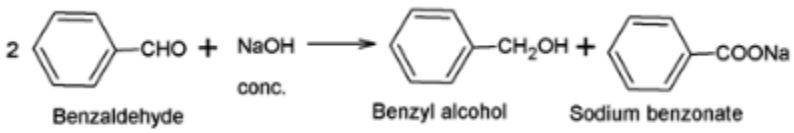
15. How is phenol prepared from Aniline? Write the equation.



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

Ans:

Two molecules of aldehydes which do not contain α –hydrogen atom react with strong alkali and under redox reaction to produce a primary alcohol and a salt of carboxylic acid. This reaction is called Cannizzaro's reaction.



17. a) Give an example for non narcotic analgesics.

b) Why the use of Aspartame is limited to cold foods and soft drinks?

ANS:

a)Example: Aspirin and ibuprofen.

b) Aspartame is unstable to heat and therefore its use as sugar substitute is limited to cold foods and soft drinks.

18.a) Why detergents with straight chain of hydrocarbons are preferred over branched chain hydrocarbons?

b) Give one example for detergent with straight chain hydrocarbon

Ans:

a) Straight chain hydrocarbon chain detergents are soft and biodegradables. Whereas branched chain detergents are hard and non biodegradable that is why they are preferred.

b) Sodium dodecyl benzene sulphonate

PART-C

III. Answer any five of the following questions.

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

Ans: $Al_2O_3.2H_20(s) + 2NaOH(aq) + 3H_2O(l) \xrightarrow{473-523\ K} Na[Al(OH)_4](aq)$

$$SiO_2 + 2NaOH \xrightarrow{473-523\ K} Na_2SiO_3(aq) + H_2O(l)$$

$$2Na\,[Al(OH)_4](aq) + CO_2(g) \longrightarrow Al_2O_3.xH_2O(s) + 2NaHCO_3(aq)$$

$$Al_2O_3.xH_2O(s) \xrightarrow{1470\ K} Al_2O_3(s) + xH_2O$$

20. Write any three anamolous properties of nitrogen.

- It is small in size
- It has high electronegativity
- It has high ionization enthalpy
- It does not have empty d-orbitals.
- It has capacity to form $p\pi - p\pi$ bonds with itself.

21. In the manufacturing of sulphuric acid write

i) The equation with condition for oxidation of SO_2 to SO_3

ii) Formation of Oleum from SO_3.

Ans: i) $2SO_2(g) + O_2 \xrightarrow[720K,2\ atmn]{V_2O_5} 2SO_3(g)$ $\Delta H = -198.6\ kJ\ mol^{-1}$.

ii) $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

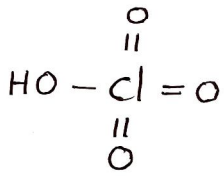
22. a) Complete the following reaction:

i) $NH_3 + 3Cl_2 \rightarrow$ _____ $+ 3HCl$

ii) $Cl_2 + F_2 \xrightarrow{473K}$ _____

b) Write the structure of perchloric acid ($HClO_4$).

ANS: a) i) NCl_3 ii) $2ClF$

b) 

23. a) Trasition elements show catalytric property. Give two reasons.
b) Name one 3d series element that do not show variable oxidation state.

ANS: a) (i) Variable oxidation states
(ii)Large surface area for adsorption of reactant molecules
(iii)The presence of incompletely filled or partially filled d-orbitals
(iv)Formation of intermediate compounds.

b) $Zinc$

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

ANS:

$Step\ I -$ Chromite ore is heated with sodium carbonate in excess of air to from sodium chromate.

$$4\ FeCr_2O_4 + 8Na_2Cr_2O_7 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

$Step\ II -$ The yellow solution of sodium chromate is filtered and acidified with sulphuric acid to give orange solution of sodium dichromate.

$$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$$

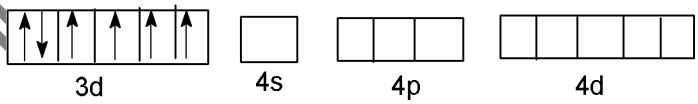
Step III: The solution of sodium dichromate is treated with KCl to form potassium dichromate.

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

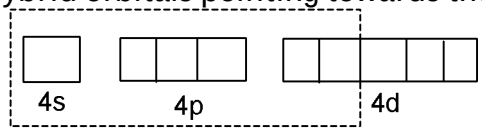
25. Using valence bond theory explain geometry hybridisation and magnetic property of $[CoF_6]^{3-}$. Given atomic number of $Co - 27$.

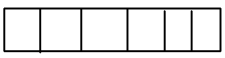
In this complex, the oxidation state of Co is +3. The electronic configuration of cobalt in +3 oxidation state is $[Ar]3d^6 4s^0$.

Orbitals of Co^{3+} ion are represented as

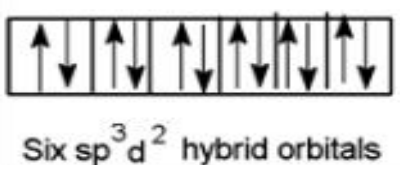


Since F^- ion provides a weak ligand filed, one 4s, three 4p and two outer 4d-orbitals hybridised to yield six sp^3d^2 hybrid orbitals pointing towards the six corners of an octahedron.





These six hybridised orbitals of Co^{3+} overlaps with orbitals of six F^- ligands and six pairs of electrons donated by six F^- to form six coordinate bonds.



Geometry : Octahedral
Magnetic property : paramagnetic
Hybridisation : sp^3d^2

26. a) Mention any two postulates of Werner's theory of co-ordination compound.
b) Indicate the type of isomerism in the following set of complex compound.
$[Co(NH_3)_5SCN]Cl_2$ and $[Co(NH_3)_5NCS]Cl_2$

ANS: a)

- A metal atom in coordination compound posses two types of valences (linkages), namely
  - Primary valences
  - Secondary valences
- The primary valences are ionisable and are satisfied only by negative ions.
- The secondary valences are non ionisable and are satisfied either by neutral molecules or negative ions (called ligands)
- Primary valences correspond to the oxidation state of the central metal atom and secondary valences correspond to the co-ordination number.
- Primary valence may be variable but secondary valences are fixed
- Primary valence is non-directional. But secondary valences are directional. So complexes gives different geometrical shape. Coordination number 6 gives octahedral geometry and coordination number 4 gives tetrahedral geometry.

b) Linkage isomerism

PART-D

IV Answer any Three of the following questions. Each question carries five marks

27. **a)Caluculate the packing efficiency of F.C.C cubic latitice.**

Ans:

The number of atoms per unit cell in fcc structures is four. Each atom is considered as one sphere.

Let the edge length of the unit cell=a
Radius of the sphere=r
Radius of the face diagonal=b
In ABC,

$AC^2 = BC^2 + AB^2$

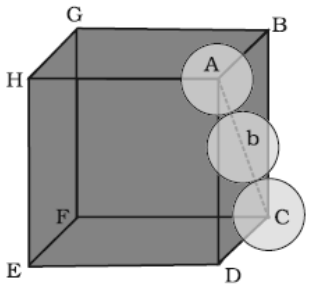
$b^2 = a^2 + a^2$

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

But b=4r

$\therefore \sqrt{2}.a = 4r$

$a = \frac{4}{3}\pi r^3$



Volume of one sphere=$\frac{4}{3}\pi r^3$

Since FCC lattice contains 4 atoms (spheres) per unit cell,

The volume of four spheres in fcc = $4 \times \frac{4}{3}\pi r^3 = \frac{16}{3}\pi r^3$

The total volume of the unit cell =$a^3 = \left(2\sqrt{2}\,r\right)^3$.

Packing efficiency=$\frac{Volume\ of\ four\ spheres\ in\ unit\ cell}{Total\ volume\ of\ the\ unit\ cell} \times 100$

Packing efficiency=$\frac{\frac{16}{3}\pi r^3}{(2\sqrt{2}\,r)\text{^}3} \times 100 = 74\%$

Note: 74% of unit cell is occupied by atoms the rest 26% is empty space in fcc structures
The packing fraction in fcc structure (ccp)=0.74
The fraction of empty space in fcc structures (ccp) 0.26

The packing efficiency in hcp is same as in ccp. But the method of calculation is different.

b)Calcuim metal crystallizes in a face centered cubic lattice with 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].
Ans: by data
a = 0.556 nm = 0.556×10^{-7}cm
Z = 4
m = 40 N = 6.022×10^{23}
d =?
d = zm/a^3N

$$d = \frac{4 \times 40}{(0.556 \times 10^{-7})^3 (6.022 \times 10^{23})}$$

$$d = \frac{160}{130.5}$$

d = 1.545 g/cm^3

28.

a)Vapour pressure of benzene is 200 mm of Hg. When 2 gram of a non-volatile solute dissolved in 78 gram benzene. Benzene has vapour pressure of 195 mm of Hg. Calculate the molar mass of the solute. [molar mass of benzene is 78 gram mol^{-1}]
Ans: By data
WB = 2 gram
MB =?
MA = 78 $\frac{g}{mol}$.
P^0 = 200 $mm\ of\ Hg$.
P = 195 $mm\ of\ Hg$.

$$\frac{P^0 - p}{P^0} = \frac{WB \times MA}{MB \times WA}$$

$$\frac{200-195}{200} = \frac{2 \times 78}{MB \times 78}$$

$$\frac{5}{200} = \frac{2}{MB}$$

$$\therefore MB = \frac{400}{5}$$

MB = 80 g/mol.

b) **What are azeotropes? Give an example for binary solutions showing minimum boiling azeotrope**
Ans: Binary liquid mixtures having the same composition in liquid and vapour phase and boil at a constant temperature are called azeotropic mixtures.
Example: 95% Ethylalcohol and 5% water by volume (rectified spirit). Show minimum boiling azeotropic

29.

a) **Calculate the e.m.f. of the cell in which the following reaction takes place.**
$Ni + 2Ag^+_{(0.002M)} \rightarrow Ni^{2+} + 2Ag_{(0.160M)(S)}$

Given $E^0_{cell} = 1.05\ V$.
Ans: By data
E^0_{cell} = 1.05 V.
$[Ni^{+2}]$ = $(0.160M)$
$[Ag^+]$ = $(0.002M)$
$[E = E^0 - \frac{0.059}{n} \log[Ni^{+2}] / [Ag^+]^2$

$E = 1.05 - \frac{0.059}{2} \log \frac{0.160}{(2\times10^{-3})^2}$

$E = 1.05 - 0.0295 \log \frac{0.160}{4\times10^{-6}}$

$E = 1.05 - 0.0295 \log \frac{0.160\times10^{6}}{4}$

$E = 1.05 - 0.0295 \log 40 \times 10^{3}$

$E = 1.05 - 0.0295 [\log 40 + \log 10^{3}]$

$E = 1.05 - 0.0295 \times 4.6021$

$E = 1.05 - 0.13576195$

$E = 0.8642v$

b) i) **State Kohlrausch's law of Independent Migration of ions**

Ans: The law states that the molar conductance of an electrolyte at infinite dilution is equal to the sum of the ionic conductance of cation and anion respectively.

ii) **What is meant by limiting molar conductivity.**

Ans: The conductivity of electrolytic solution at infinite dilution is called limiting molar conductivity.

30.a) **Derive an Integrated rate equation for a first order reaction.**

Ans: Consider a first order reaction,

$$R \rightarrow P$$

a first order reaction is one in which the rate is directly proportional to first power of the reactant concentration.

Therefore, according to rate law,

$Rate\ \alpha\ [R]^1$

$Rate = k[R]^1$ .... (1)

Where k is rate constant or velocity constant

But, Rate= $-\frac{d[R]}{dt}$

$-\frac{d[R]}{[R]} = k[R]$ .... (2)

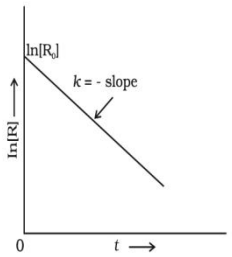


Fig. A plot between ln[R] and t for a first order reaction

Rearrange the equation (2), we get

$\frac{d[R]}{[R]} = -kdt$ .... (3)

Integrate equation (3)

$\int \frac{1}{[R]} d[R] = -k \int dt$

$\ln[R] = -kt + I$ ....(4)

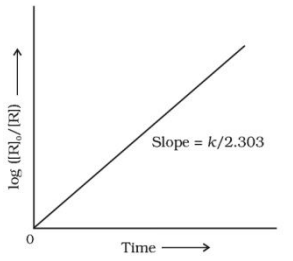


Fig. Plot of log $[R]_0/[R]$ vs time for a first order reaction

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

$\ln[R]_0 = -k \times 0 + I$

Where I is called integration constant

$I = \ln[R]_0$

Substituting the value of I in equation (4) we get,

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

$kt = \ln[R]_0 - \ln[R]$

$kt = \ln \frac{[R]_0}{[R]}$

$kt = 2.303 \ln \frac{[R]_0}{[R]}$

$k = \frac{2.303}{t} \log_{10} \frac{[R]_0}{[R]}$

This is the expression for the rate constant of a first order reaction.

b) **According to collision theory write two factors responsible effective collisions.**

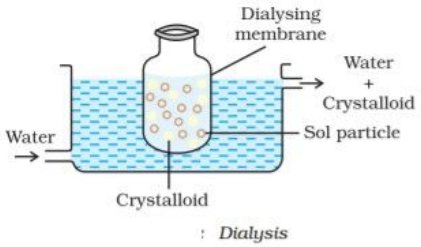
Ans: According to collision theory

- Molecules must collide with sufficient energy known as activation energy.
- Molecules must collide with proper orientation.

31.

a) Write a note on Dialysis.

Ans: Dialysis is a process used to remove true solution or excess electrolyte impurity from a colloidal solution by means of diffusion through a suitable semipremeable membrane.



: *Dialysis*

In this method, an impure colloidal solution is taken in a semipermeable membrane (parchment paper bag) and it is kept in a vessel containing moving water. The true solution impurities diffuse through the membrane into the outer water leaving pure colloidal solution in the parchment paper bag.

b) What is the effect on ΔH and ΔS durinhg the process adsorption?

Ans: ΔH *is* negative and ΔS is negative during adsorption.

c) Give an example for heterogeneous catalysis.

Ans: $N_{2(g)} + 3H_{2(g)} \xrightarrow{Fe(s)} 2NH_3$

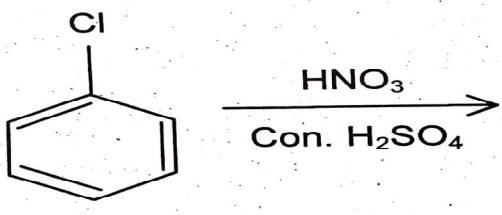
PART-D

V. Answer any three of the following questions.

32. **a) Explain S_N1 mechanism for the conversion of tertiary butyl bromide to tertiary butyl alcohol.**

b)

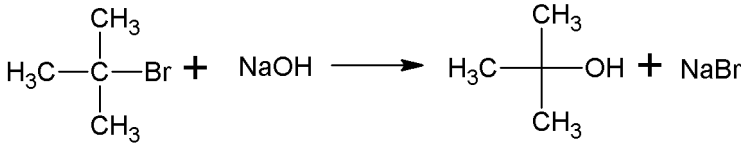
i) $CH_3 - CH = CH_2 + HI \longrightarrow$

ii) 

iii) $CH_3CH_2Br \xrightarrow[\text{Aq. Ethanol}]{\text{AqCN}}$

ANS:

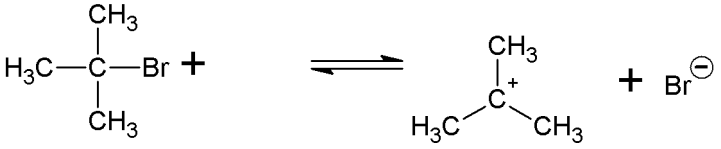
a) Tertiary butyl bromide on hydrolysis with aqueous $NaOH$ gives tertiary butyl alcohol.



Tertiary butyl bromide Tertiary butyl alcohol

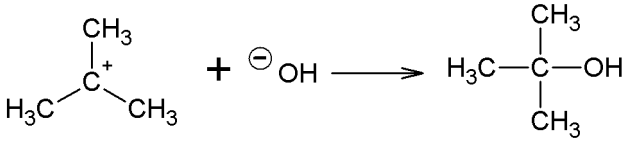
Mechanism: S_N1 mechanism involves two step:

I step:(slow step): Tertiary butyl bromide ionizes slowly to give sp^2 hybridized planar tertiary butyl carbocation and bromide ion.



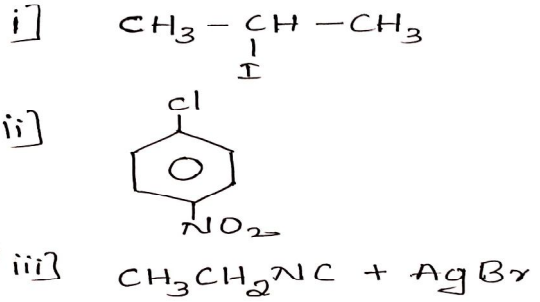
Tertiary butyl bromide — tertiary butyl carbocation

II step: (Fast step)→ The nucleophile OH^- from aqueous $NaOH$ attacks planar carbocation on either side to give tertiary butyl alcohol.



tertiary butyl alcohol

b)

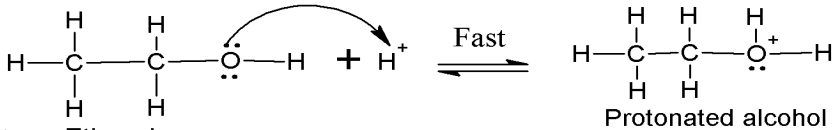


33.

a) Explain the mechanism for acid catalysed dehydration of ethanol to ethene.

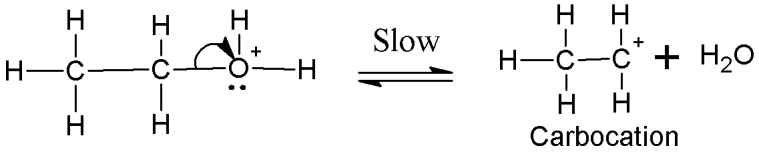
b) How does anisole react with methyl chloride?

ANS: a) Step1: Formation of protonated alcohol



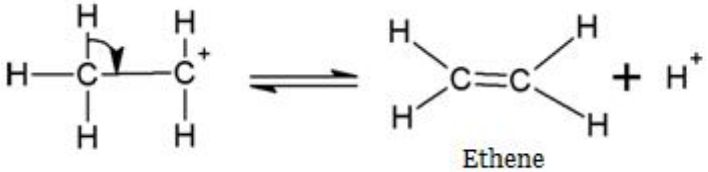
Ethanol — Protonated alcohol (Ethyl oxonium ion)

Step2: Formation of carbocation: Protonated alcohol loses the water molecule to form the carbocation. It is the slowest step and hence, the rate determining step of the reaction.



Carbocation

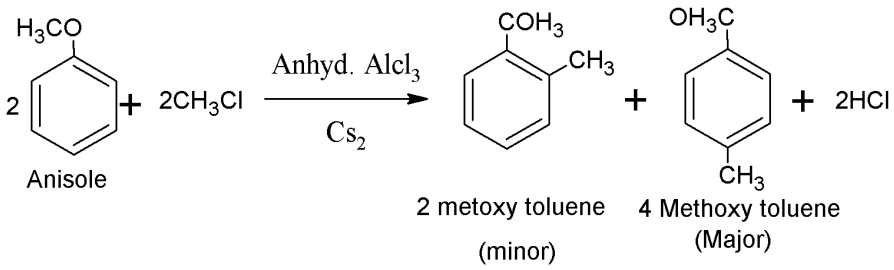
Step3: Elimination of proton: Elimination of proton from carbocation form an alkene.



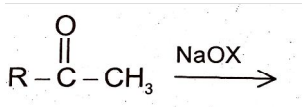
Ethene

b) Anisole reacts with alkyl halide in the presence of anhydrous aluminium chloride as a catalyst to give ortho and para alkyl anosole.

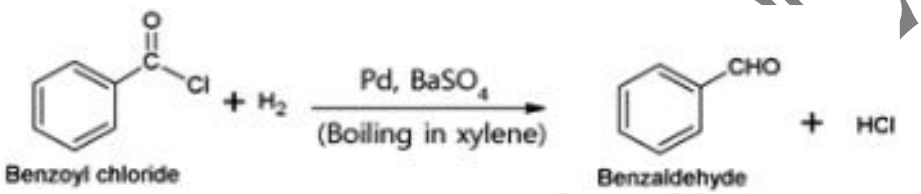
Example:



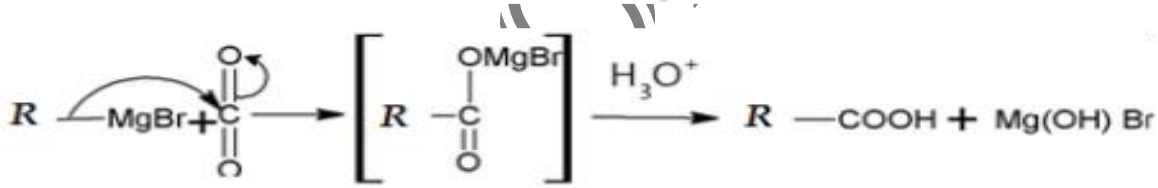
34. **a) How is benzoyl chloride converted into benzaldehyde. Write the equation and name the equation.**
b) Write a general eqation for the formation of carboxylic acid from Grinard reagant.
c) complete the reaction:



ANS: a) Benzoyl chloride on reduction with H_2 in presence of palladium catalyst supported by barium sulphate give Benzaldehyde. This reaction is called Rosemund's reduction.

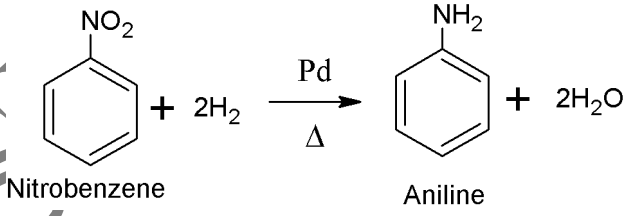


b)

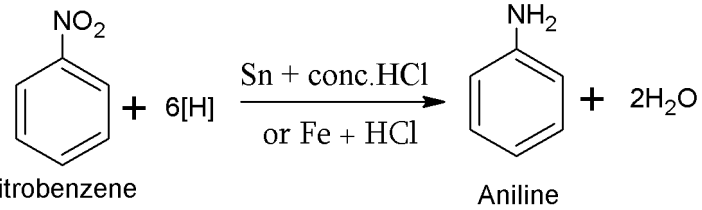


c) $CHX_3 + R - COONa + 2NaOH + 3NaCl$

35. **a) Mention the IUPAC name of $(CH_3)_2 - N - CH_3$**
b) How is Aniline is preparatiuon from nitro benzene?
c) Give the eqation for the convertion of aniline to $4 - Bromo\ aniline$.
ANS:
a) $N, N - Dimethylmethanamine$
b)

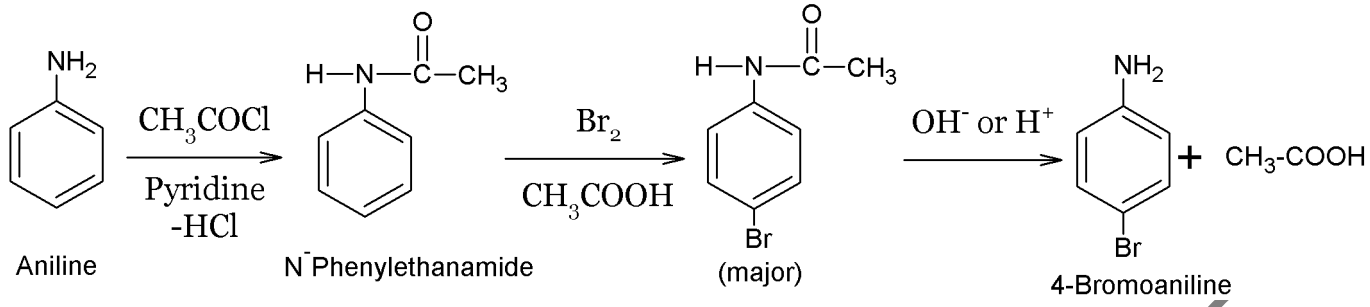


OR



Nitro compounds can also be reduced to amines by heating with Sn and conc. HCl or Fe and conc.

c) Aniline reacts with acetylchloride (acylation) to give acetanilide which on bromination gives p-bromoacetanilide. The hydrolysis of p-bromoacetanilide gives p-bromoaniline.



36. a) Write a chemical reactions to elucidate

i) Glucose contains five –OH groups

ii) Glucose contains six carbon atoms in a straight chain.

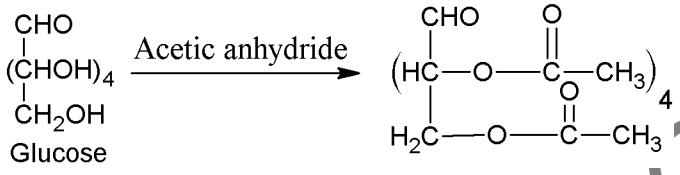
b) Explain denaturation of proteins with example.

c) Name the sugar moiety present in DNA.

ANS:

a)

i)



ii)

$$C_6H_{12}O_6 \xrightarrow[Red\ P]{HI.\Delta} CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$$

Glucose **n-hexane**

b) Coagulation of proteins is called denaturation or the loss of biological activity of protein by heating or change in pH and presence of salts is called denaturation. During denaturation of protein, 2^o *and* 3^o structures destroyed but 1^o structure is intact.

c) De oxy ribose sugar

37. a) Name the monomers present in the following polymers

i) PVC

ii) Neoprene

iii) Nylon-6

b) Explain vulcanisation of rubber.

Ans:

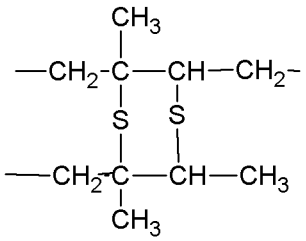
a)

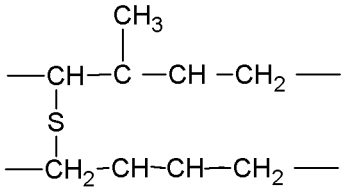
i) Vinyl Chloride

ii) Chloroprene or 2-chloro 1,3-buta diene

iii) caprolactum

b) The process of heating natural rubber with calculated amount of sulphur (5 to 8 %) or sulphur compounds (S_2Cl_2) at a temperature of 373 K *to* 413 K to make it hard and tough. During vulcanization, sulphur forms disulphide cross links at the reactive sites of double bonds and therefore vulcanized rubber becomes hard and tough.





NEET/CET ಕ್ರಾಶ್‌ಕೋರ್ಸ್

ಮಾರ್ಚ್ 26ರಿಂದ ಪ್ರಾರಂಭ

CET: 27 ದಿನಗಳು। **NEET:** 37 ದಿನಗಳು

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- 5ನೇ ದಿನ ಗ್ರ್ಯಾಂಡ್ ಟೆಸ್ಟ್
- ಪ್ರತಿದಿನ **SYNOPSIS DISCUSSIONS**
- ಪ್ರತಿ ವಿಷಯದಲ್ಲಿ ಕನಿಷ್ಠ 60 ಪ್ರಶ್ನೆಗಳ **DISCUSSION**
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ಎಸ್.ಆರ್.ಎಸ್. ಚಾಣಕ್ಯ

ಪಿಯು ಹೊಸ್ಟಿಲಲ್ಲಿರುವ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ವಿಶೇಷ ಬ್ಯಾಚ್‌ಗಳು

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- ಪಿಯು ಸಿಲಬಸ್‌ನ ಪರಿಚಯ ಹಾಗು ವಿವರಣೆಯೊಂದಿಗೆ ತರಬೇತಿ
- ಉಚಿತ ತರಬೇತಿ, ಉಚಿತ **study material.**

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ಆನ್‌ಲೈನ್ ನೋಂದಣಿಗೆ srspucollege.inನ್ನು ಬಳಸಿ.