Biyani's Think Tank

Concept based notes

Chemistry I

XII

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Preface

I am glad to present this book, especially designed to serve the needs of the students.

The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the "Teach Yourself" style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director* (*Acad.*) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this Endeavour. They played an active role in coordinating the various stages of this Endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

Lesson - I

Solid State

Q.1 One Crystal is F.C.C. arranged atom A present at a corner as well as body centre. B-atom present at a body diagonal. Calculate the formula?

Ans. A, B.

Q.2 Calculate the atom per unit cell in simple cubic, F.C.C. and B.C.C. ?

Ans Atom per unit cell in simple cubic -

$$\frac{1}{8} \times atom\ at\ a\ corner$$

$$\frac{1}{8} \times 8 = 1\ atom\ per\ unit\ cell$$

$$in\ F.C.C. = \frac{1}{8} \times atom\ at\ a\ corner + \frac{1}{2} \times atom\ at\ a\ face\ centre$$

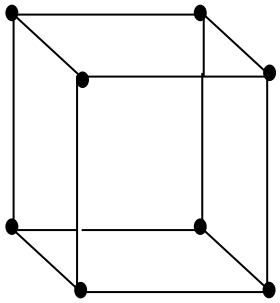
$$= \frac{1}{8} \times 8 + \frac{1}{2} \times 6 = 4\ atom/unit\ cell$$

$$In\ B.C.C. = \frac{1}{8} \times atom\ at\ a\ corner + 1 \times atom\ at\ a\ body\ centre$$

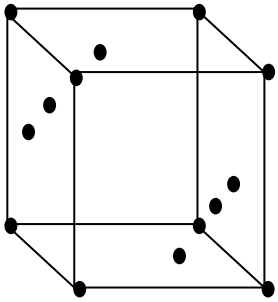
$$= \frac{1}{8} \times 8 + 1 \times 1 = 2\ atom/\ unit\ cell$$

Q.3 Define the simple cubic, F.C.C., B.C.C and E.C.C.?

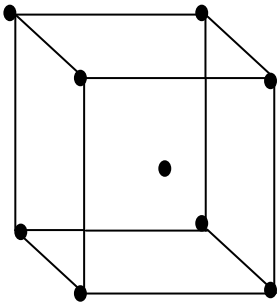
Ans.:



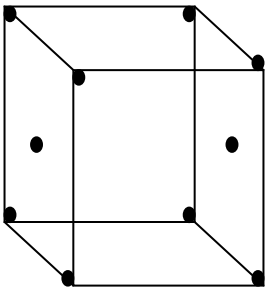
Simple Cubic



F.C.C.



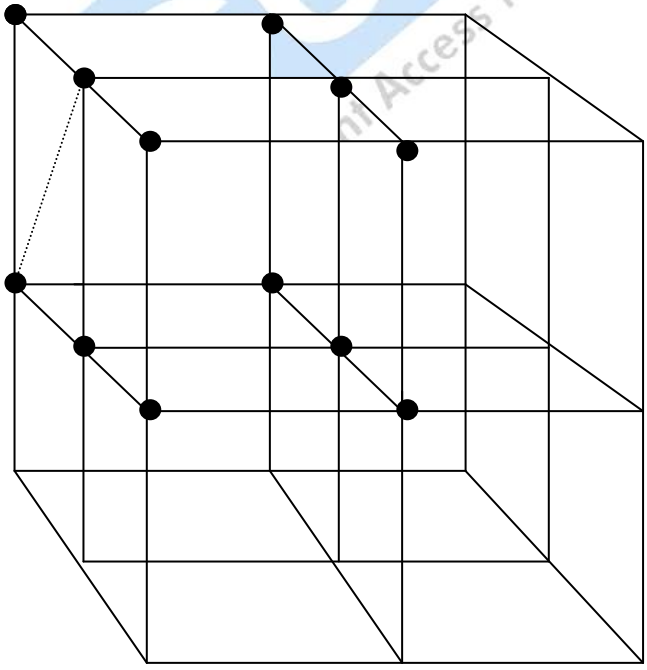
B.C.C.

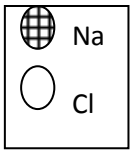


E.C.C.

Q. 4 Explain the structure of NACL and calculate the total vide in NACL crystal?

Ans.:





Q. 5 Fe has body centered cubic lattice structure. The edge length of the unit cell is found to be 286 per what is the radius of an iron atom .

Ans. For B.C.C. body diagonal = $\sqrt{3} \times edge\ length$

$= \sqrt{3} \times edge\ length$

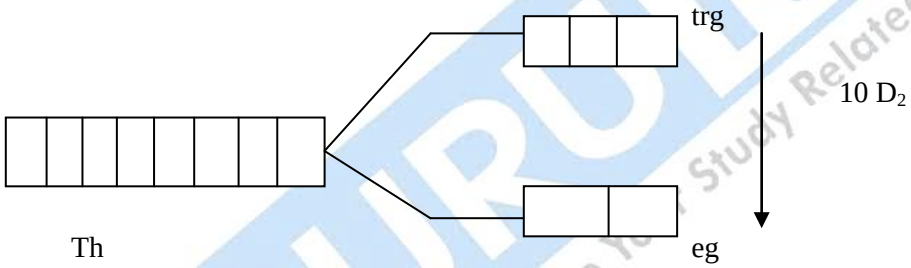
= 495 pm

Atomic Radius = $\frac{Body\ digonal}{4} = \frac{495}{4} = 124\ pm.$

Q. 6 Explain the crystal field theory and calculate the CFSE value of d^5 - configuration.

Ans.: Crystal field Theory :-

According to CFT the d- orbital splitting is e.g. and trg. orbital difference b/w eg or Trg. Orbital is 10 D^2 In which electronic transition it responsible for colour of complex.



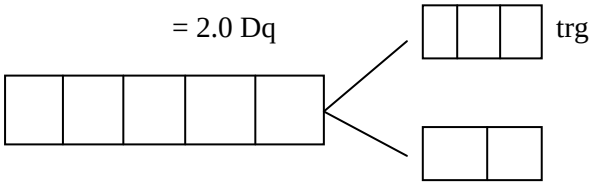
Calculate the CFSE value :

$d^5 = e^4\ g\ t^1\ _2g$

CFSE value = 0.6 × eg electron - 0.4 x no. of trg e^- t_2ge^-

= 0.6 × 4 – 0.4 × 1

= 2.0 Dq



Eg

Q.7 Write the name of the complex

(1) $K_3[Ag(CN)_4]$ (2) $[Ni(CO)_4]$

(3) $[Fe(CO)_5]\ CL_2$ (4) $[Pt\ Cl_4]$

(5) $[Co(NH_3)_2\ CL_2]$ (6) $[Co(NH_4)_4\ Cl_2$

(7) $[Fe\ (NH_3)Cl\ F]$

Ans.: $K_3[Ag(CN)_4]$ - Potassium tetra cyano Arganta (iii)

$[Ni(CO)_4]$ - Tetra Carbonyl Nikel (o)

$[Fe(CO)_5]\ CL_2$ - Tetra Carbonyl Ferous (II) Chloride

$[Pt\ Cl_4]$ - Tetra Choro Platinum (IV)

$[Co(NH_3)_2\ CL_2]$ - Di - amino - dichloro - cobalt (II)

$[Co(NH_4)_4]\ Cl_2$ - Tetra amino cobaltate (II) Chloride

$[Fe\ (NH_3)Cl\ F]$ - Amino Chloro Floro Ferous (II)

Q.8 Specify the oxidation number of the metal in following coordinating entities.

Ans.:

(i) $[Co(CN)H_2O(en)_2]^2$

$x + (-1) + 0 + 2\ (o) = +\ 2$

$x = +3$

(ii) $[Cr\ Cl_3(NH_3)_3]$

$x + 3\ (-1) + 3\ (0) = 0$

$x = +3$

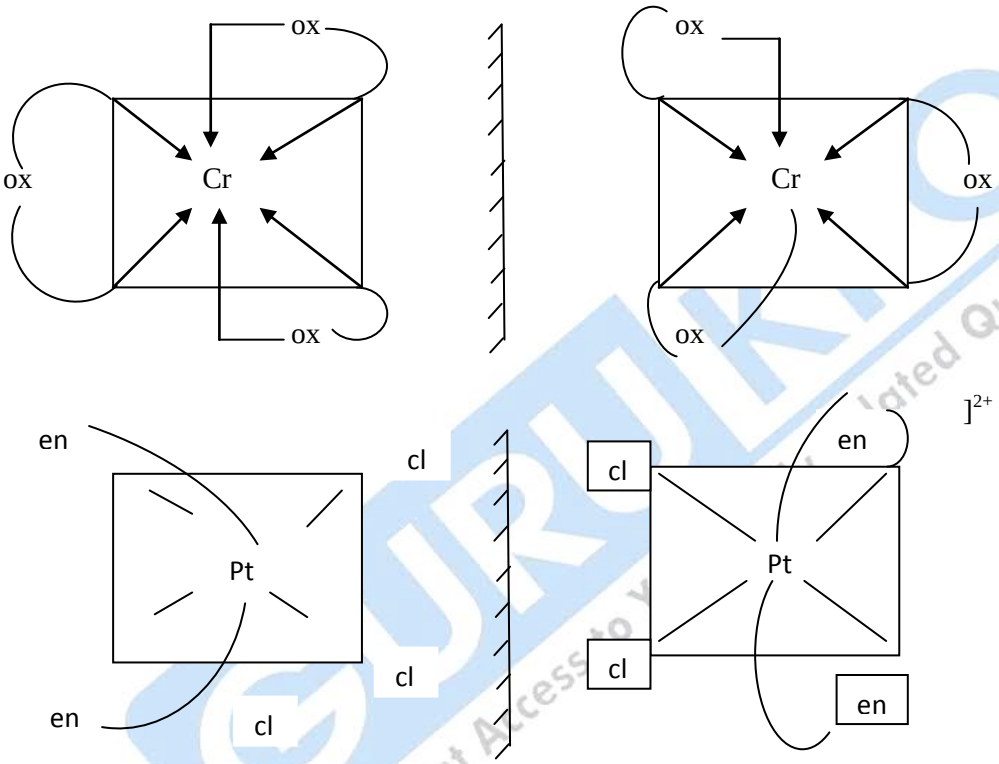
Q.9 Calculate the CFSE value of d^2 system.

Ans.: CFSE = 2 (-4 D2) = -8 Dq or - 0.8 Δ_0

Δ_0 = Octahedral complex

Q.10 Draw the structure of optical isomer of.

Ans.



Q.11 What is the spectrochemical series ?

Ans: The arrangement of the legend in order of increasing field strength is know as petrochemical series.

. I^- <Br< SCN< Cl^-<S^2<F^-<OH^-<$C_2O_4^{2-}$<H_2O<edta^{4-} <NH_3<Cn<CN<Co

Electro Chemistry

Q. 1 What is the electrode pokhial of Mg^{2+}/mg electrode is which con of Mg^{2+} in 0.01 m?

($E^{(-)}Mg^{2+/}Mg$ = - 2.36 V)

Ans.: $Mg^{2+} + 2e^- \xrightarrow{Mg\ Mg\ (S)}$

$$EMg^{2+} = E^o + \frac{0.0591}{2} \log \frac{Mg2+}{Mg}$$

$$= -2.36 + \frac{0.0591}{2} \log (0.01)$$

$$= -2.42\ V$$

Q.2 Which electrolyte in used in dry cell?

Ans. the electrolyte used in dry cell ins pasts of mutual and $zncl_2$ placed in a zin cylinder along mno_2 and carbon surrounding the graph its electrode.

Q.3 Explain the liquid junction potential?

Ans. The potential difference set up across the junction of two Sol electrolytes when they are in direct control each other is called (LJP)

Q.4 Explain the following :

(a) Rusting of Iron becomes rapide in saline water than ordinary water ?

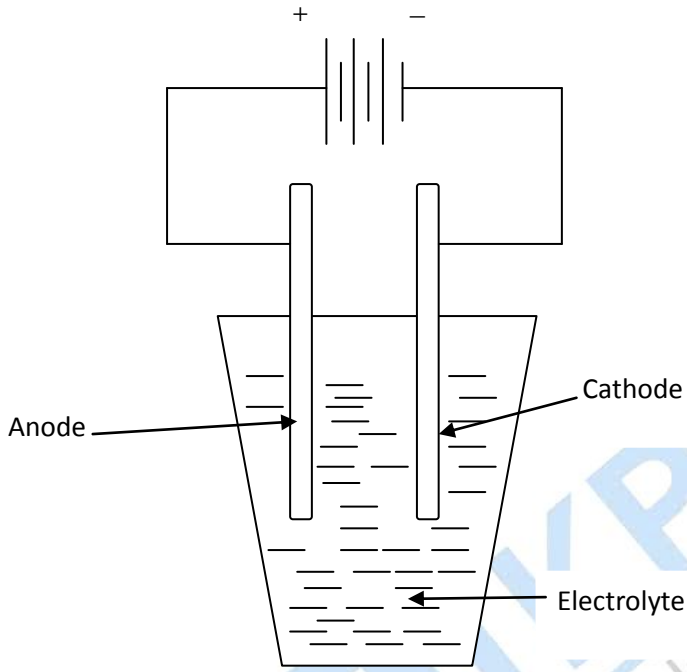
Ans.; The concentration of electrolytes in saline water is much higher than that is ordinary water. The ion present in saline water help in rapid flow of current in miniature electrochemical cell set up on the surface of Iron which made rusting process.

Q.5 What is the electrolytic cell explain ?

Ans.: Electrolytic cell. The device in which the process of electrolysis in carried out is cell electrolytic cell it consists.

1. Electrolytic tank which made a some non conducting material like glass, wood or bad elite
2. Electrolyte in its dissolved state or molten state.

3. Source of electricity or electrochemical cell or battery.
4. Two metallic rods.



Electrolytic Cell

Q.5 Write the short notes :

Faraday low of electrolysis ;

Ans.: Faradary first law :

The mars of substance liberated at the electrode is directly proportional to the quality of electricity passed

$M \alpha Q$ where Q = Quantity of electricity $M \alpha Q$

I = current $M \alpha IQ$

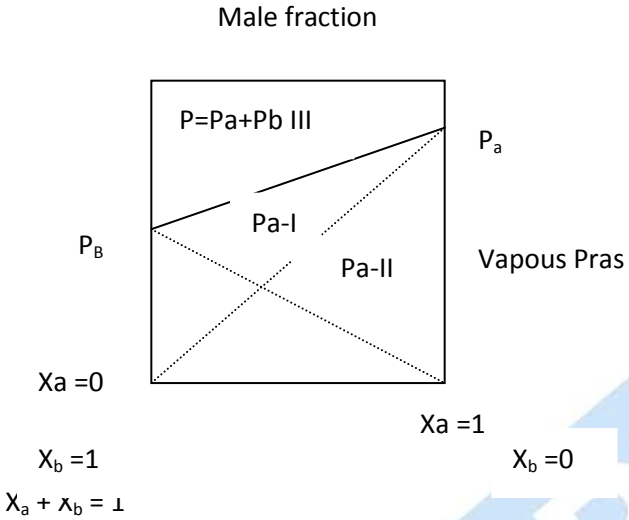
$M \alpha IT$ T = time

$M = z\ It$ Z = Electro chemical equivalent

Solution

Q. 1 Write the result's law of binary solution of volative liquid?

Ans.: When two volatile liquid A and B mixed to form a solution. The vapair phase consist of vapour of Both the component of solution. The partial vapour pressure of each component in expected to depend on the male fortion of corresponding component. So if Pa and Pb are partial pressure of component A and B and X_a and X_b is relative male fraction.



$P_A \propto X_A$

$P_B \propto B_B$

OR

$P_A = P_A^{\circ} X_A$

$P_B = P_B^{\circ} X_B$

$P = P_A + P_B$

$= P_A^{\circ} X_A + P_B^{\circ} X_B$

$P = P_A^{\circ} (1 - X_B) + P_B^{\circ} X_B$

$= (P_B^{\circ} - P_A^{\circ}) X_B + P_A^{\circ}$

$P = (P_A^{\circ} - P_B^{\circ}) X_A + P_B^{\circ}$

The sol which obcy result's low are called ideal solution.

Q.2 What is the ideal or non ideal solution?

Ans.; Ideal solution:

Solution which obey result's low over the entire range of concentration and temperature. The formation of ideal solution menthes involve any change of enthalpy the solution are :

1. It should obey result's low $P_A = P_A X_A$
2. Δ H mixing
3. $\Delta V =$

Mon - Ideal solution

1. $PA \neq P_A^{\circ} X_A$
2. $P_B \neq P_B^{\circ} X_B$
3. Δ H mixing $\neq O$
4. Δ V mixing $\neq O$

Q.4 Solution of service is prepared by dissolving 34.2 g of it in 1000 of water find out freeing point of the solution kq for water is 1.86 k kg

Ans.: Modality of the solution

$= \frac{34.2}{342} = 0.1$

$\Delta Tf = kf \times m = 1.86 \times 0.1 = 0.186\ k$

Pressing point of sol = 273–0.186

= 272.814 k

Q.1 First order reaction is 15 % complete is 20 min. How long will it take to be 60% complete ?

Ans.: $t = \frac{2.303}{k} \log \frac{a}{(a-x)}$

where t = 20 min , a=100, x=15

$20 = \frac{2.303}{20} \log \frac{100}{85}$

K = 0.00813 min^{-1}

again Reaction complete 60%

t 60% = $\frac{2.303}{k}\log\frac{a}{(a-x)}$

Now a = 100 (a-x) = 100-60

= $\frac{2.303}{0.0813}\log\frac{100}{100-60} = \frac{2.303}{0.0813}\log\frac{100}{40}$

= 112.7 min.

Q. 2 What are photochemical reaction? give an example to illulrate the course of photochemical reaction.

Ans.: Photochemical Rx are those reaction which take place only when these are exposed to radiation these reaction are initiated when one of the reaction molecule absorbs the photo and producers the proactive species.

$H_2 + Cl_2 \longrightarrow HCL$

Reaction in 3-step

1. $Cl_2 \longrightarrow Cl^o + Cl^o$ in tilting step
2. $Cl^o + H_2 \longrightarrow Hcl + H$ Propagating step
   $H^o + Cl_2 \longrightarrow Hcl + Cl^o$
3. $Cl^o + Cl^o \longrightarrow Cl_2$
   $H^o + CL^o \longrightarrow Hcl$ Terminating step
   $H^o + H^o \longrightarrow H_2\,g$

Q.3 For the reation

$2\,N_2O_{5\,(g)} \longrightarrow 4\,NO_2\,(g) + O_{2\,(g)}$

of the concentration of NO_2 increase by 3.0 x 10^{-3} mol is six second then what is the rate of Reaction

Ans.: Rate of Reaction = $+\frac{1}{4}\frac{[NO_2\ ]}{\Delta t} = \frac{1}{4} \times \frac{3\times10^{-3}}{6}$

$= 1.25 \times 10^{-4}\frac{mole}{litt}.sec$

Q.4 What is the difference b/w molecularity and order of Rx?

Ans.

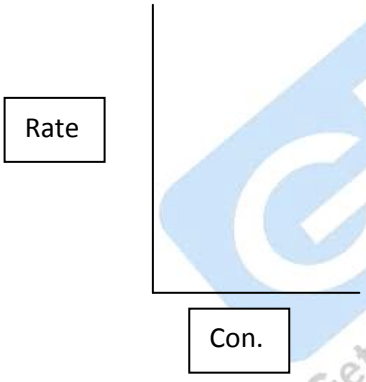
	Moleculority	Order of Reaction
1.	It is number of reacting species undergoing simultaneous Collision in the reaction	1. It is sum of the power of the concentration term in the rate low expansion
2.	It is a theoretical concept	2. It is experimentally
3.	It can have integer value	3. It can have fractional value
4.	It can be zero	4. Cannot be zero

Q.3 Draw the schematic graph showing how the rate of a first order reaction change change In con. of the reactions.

Ans.: Rate of I^{st} order reaction ins directly proportional to moler concentration of the reatant?

Rate α concentration

So graph is straight line as know in the following figure .



Unit of I^{st} order reaction = mole/Lit see.

Q.4 Identify the reaction order from each of following rate constant.

Ans.:

1. $K = 3.1 \times 10^{-4}\ S^{-1}$ I^{st} Order

2. $K = 4.2 \times 10^{-5}\ 2\ mol^{-1}\ sec^{-1}$ II order

3. $K = 6.5 \times 10^{-4}$ mol L^{-1} S^{-1} Zero Order

Q.5 First order kihetic -

$$R \longrightarrow P$$

a O

(a-x) x

According to rate low

$$\frac{d[R]}{dt} = k\,(a-x)$$

$$\int \quad dx/dt=k\,(a\text{-}x)$$

-Ln (a–x) = kt + c

When t=0

X=0

C = –ln a

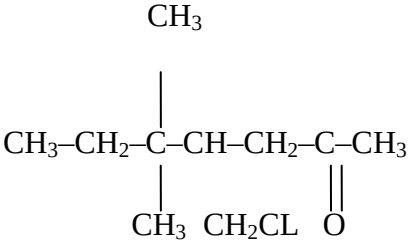
–ln (a–x) = kt – ln a

$K= \frac{1}{t}$ [ln(a–x) – ln a]

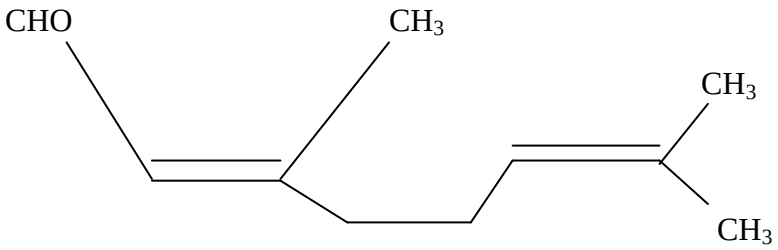
$K = \frac{2.303}{t} \log \frac{a}{(a-x)}$

Q.1 Give the IUPAC Name of the following compound.

Ans.:



4- Chloromethyl–S–ethyl–S–Methyl heptan–2–one



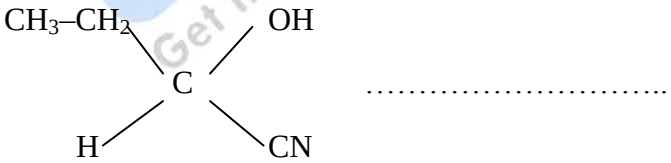
1,3,7 – dimethylocta –2,6 – dien–1–al

3. $CH_3–CH(CH_3)–CH_2–CH_2–C(=O)–CH_2–Cl$

1- Chlor - 5 –methyl hexe -2-one

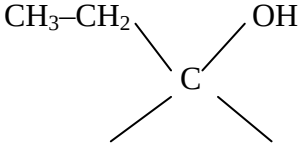
Q.2 Complete the following reaction with apropriate stru.

Ans. $CH_3–CH_2–C(=O)–H$ $\xrightarrow[LiAitcy]{KCN/H_2SO_4}$ D



……..

$Liaitl_4$



1-Amino butane 2 + 01

H CH_2NH_2

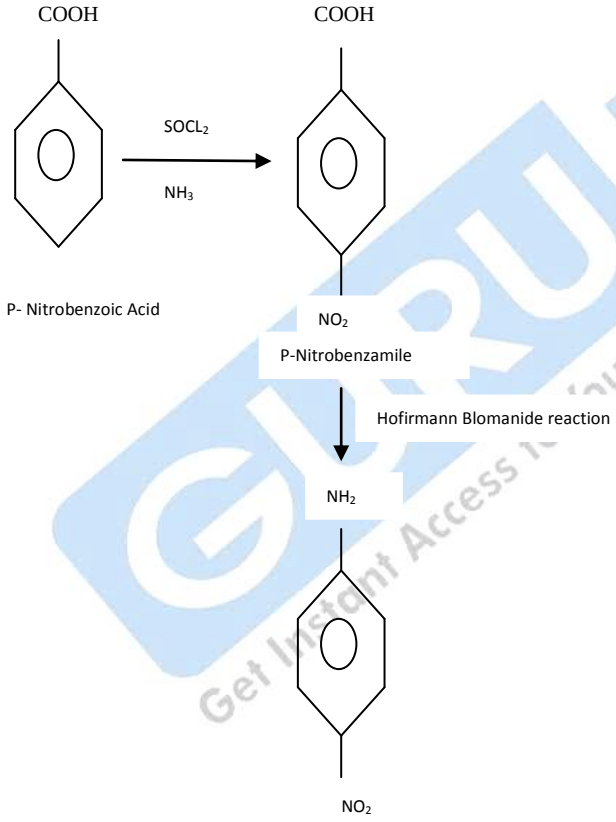
Q.3 Write chemical reaction to effect the following transformations.

(a) Benzoic acid to Benzyl amine

$C_6H_5–C(=O)–OH \xrightarrow{Socl_2} C_6H_5–C(=O)–cl \xrightarrow{NH_3} C_6H_5–C(=O)–NH_2$

(II) $H_3O^{-+} + C_6H_5–CH_2–NH_2$

(b)

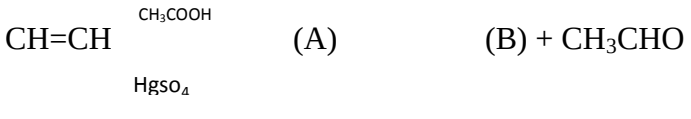


(c) Hexonoic acid to henahenitric

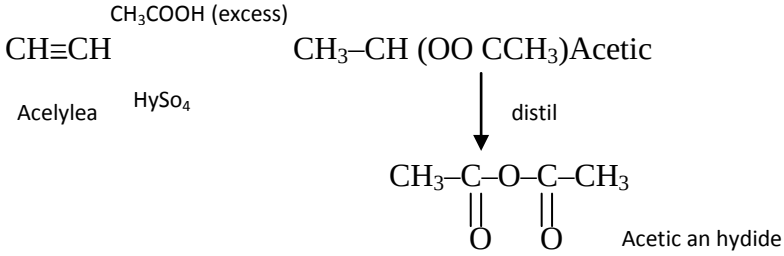
$CH_3–(CH_2)_4–COOH \xrightarrow[NH_3]{Socl_2} CH_3–(CH_2)_4–CONH_2 \xrightarrow{P_2O_{10}B} CH_3–(CH_2)_4–C\equiv N$

(d) Identify (A) and B is the following sequence of reaction

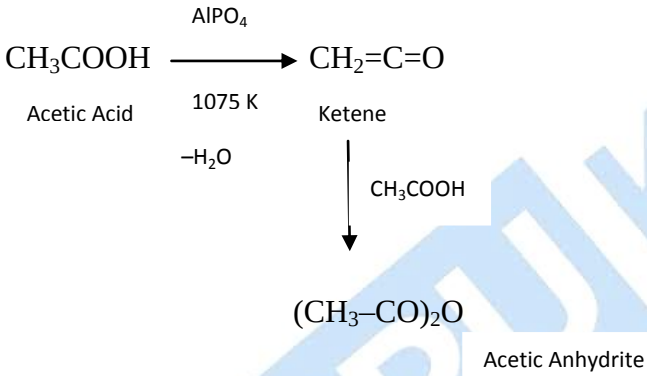
(i)



(ii)



(ii)



Q.1 Write the characteristics of enzymes catalysts?

(i) Highly efficiency -enzyme catalysts in croos the speed of Rx " by $10^{\&+}10^{20}$ time

(ii) Extremely small quantities

(iii) Optimum temperature and PH

(iv) Control

Q.2 What is difference b/w physisoption and chemisorptions ?

S.No.	Physisoption	Checisonption
1	Low erithaply of adsorption usually of the order of - 20 to -40 kj/mole	High enthaply of adsorption usually of the order of -200 to 400 kj/mole
2	Forces of attraction are under wall's forces	Forces of attraction are chemical bond forces
3	It is Reversible	It is irreversible
4	It is not very specific	It is highly specific
5	It usually form multi molecular layers on the adsorbent	

Q. 3 Explain with digram

Ans. (i) Tyndall effect - The scatting of light from the

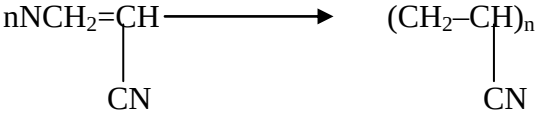
Q. Write the short note :

(i) PAN (ii) PMMA

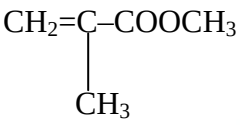
(i) PAN – Polyaerylonitrile

Starting material – Aerylonitrite (CH_2=CH–CN) Reaction

Pdymerijation of acrylonitrile is presence persoxide give polaerylonitrile

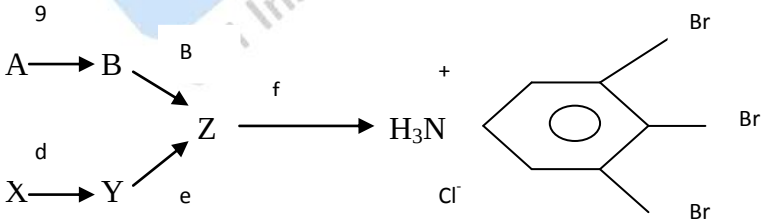


(ii) Starting material – methyl metharylate



Reaction : The monomer methyl methacrylate is itself abstained by treating acetone cyano-hydir C CH_3–OH–H_2SO_4, which brings about simultanow dehydration hydrolysis and crterification this upon polymerization in presence of a radical initiator give poly (methy methacrylate)

Q.



Ans.: