STD: XII

COMMON QUARTERLY EXAMINATION – 2017

CHEMISTRY ANSWER KEY

PART – I

S.NO	ANSWER	S.NO	ANSWER	S.NO	ANSWER
1	d. both b and c	11	b. q=0	21	c. solid in gas
2	a. H_2	12	b. - ,-	22	d. Breath analysis
3	b. $O^{2-} > F^- > Na^+ > Mg^{2+}$	13	b. 75 [(1-0.25) = 0.75x100=75	23	b. Benzyl benzoate
4	d. Kilo Joule Mol^{-1}	14	a. $K_1 > k_2$	24	c. HI
5	d. C_6H_5Cl	15	b. 2 : 1	25	c. Methoxy benzene
6	c. O	16	C. 6.932 X 10^{-2} min^{-1}	26	a. 1
7	d. +6	17	a. Kp > Kc	27	b. CH_3- CH(OH) - COOH
8	b. Actinides	18	b. mol lit^{-1} sec^{-1}	28	A. formic acid
9	c. FeO	19	b. Fe	29	b. CCl_3-COOH
10	a. 3	20	a. Silver sol	30	d. 3-hydroxy butanal

16. t ½ = 600 sec= 10 min; k_1 = 0.693 / 10 min = 0.0693 min^{-1} = 6.93 x 10^{-2} min^{-1}

PART II

31. Bond order:

It is half the difference between number of electrons in bonding molecular orbitals (N_b) and number of electron in Anti-bonding molecular orbitals (N_a). ..... 1 ½ m

Bond order = ½ (N_b - N_a) ..... 1 ½ m

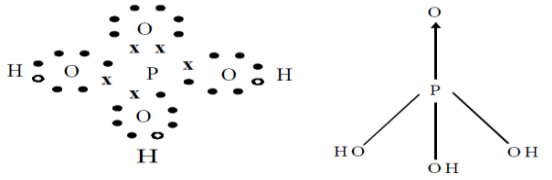
32. The ionization energy of C > O ?

$_6C$: $1s^2$ $2s^2$ $2p^2$, $_5B$: $1s^2$ $2s^2$ $2p^1$ 1M

[C > B] Due to * Higher nuclear charge of Carbon than Boran. 1M

* Higher electron affinity of C than B 1M

33. Electron dot structure of H_3PO_4



..... 3M

34. Prove that P_2O_5-Dehydrating Agent

P_2O_5 Remove water from many inorganic and organic compounds like H_2SO_4 and several organic compounds. 2m

$H_2SO_4 \xrightarrow{P_4O_{10}/-H_2O} SO_3$

$RCONH_2 \xrightarrow{P_4O_{10}/-H_2O} RCN$ 1m

35. d- block elements exhibit variable Oxidation States?

* These elements have several (n-1)d and ns electrons. ..... 1 ½ m
* The energies of (n-1) d and ns orbitals are fairly close to each othe. ..... 1 ½ m

36. Action of Gold with Aqua regia :

* $2Au + 9HCl + 3HNO_3 \longrightarrow 2AuCl_3 + 6H_2O + 3\ NOCl$ 3m

(Auric chloride)

37. Composition and uses of Nicrome:

Nichrome : Cr = 15%, Ni = 60% ,Fe = 25% : It is used in resistance wires for electrical heating ... 3m

38. Super conductor:

The ability of certain ultra cold substance to conduct electricity without resistance is called super conductivity. Those substances are super conductors. 3m

39. Gibb's free energy:

Thermally available energy to do work by a system

G=H-TS (at const-T&P) (state function) 3m

H = enthalpy, S= entropy, T= Temperature in Kelvin.

40. ΔS calculation

$$H_2O\ (s) \xrightarrow{0^{\circ}C} H_2O\ (l)$$

Ice 273 K Water liquid

$$\Delta S_{fusion} = \frac{\Delta H_{fusion}}{Tm(K)} = \frac{6008\ J.mol^{-1}}{(0+273)\ K}$$ ..... 1 + 1 m

$$\therefore \Delta S_{fusion} = 22.007\ J\ mol^{-1}\ K^{-1}.$$ ..... ½ + ½ m

41. Chemical equilibrium is dynamic in nature –why?

At equilibrium the reactant and products are in reaction mixture in **definite amount**.

The equilibrium concentrations do not change under constant temperature, pressure and catalysts.

(or) Rate of forward reaction is equal to rate of reverse reaction 3m

42. Le- Chatelier's principle.

If a system at equilibrium is subjected to a disturbance or stress, then the equilibrium Shifts in the direction that tends to nullify the effect of the disturbance or stress. 3m

43. Threshold energy:

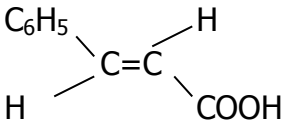
All colliding molecules must possess certain minimum energy called as the **threshold energy** which is needed to make the collisions effective and successful. 3m

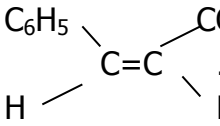
44. Delta:

When river water meets the sea water, the electrolytes present in sea water coagulate the colloidal solution of clay which get deposited with the formation of delta. 3m

45. Cinnamic acid E- Z Structure:

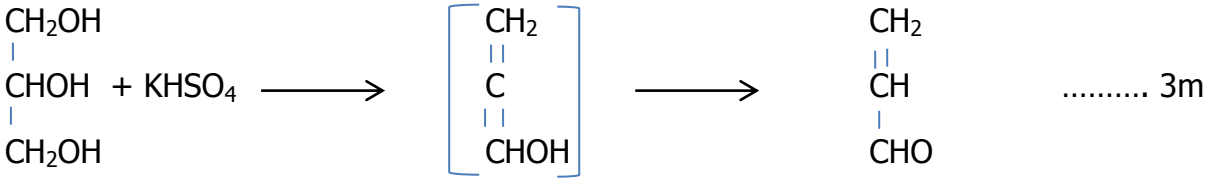
C_6H_5-CH=CH-COOH





... 1 ½ +1 ½ M

47. Glycerol react with $KHSO_4$:



Glycerol Unstable Acrolein 3m

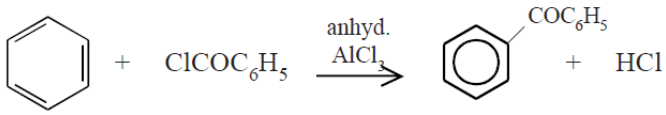
Glycerol involves β- elimination with $KHSO_4$ to give acroline.

48. Alcohols cannot be used as solvent for Grignard reagent – Why ?

Strongly basic substances like organometallic compounds are decomposed by alcohol.

ROH + CH_3MgBr → RO-Mg-Br + CH_4 ..... 3m

49. Preparation of benzophenone by Friedal - craft reaction:



.....3m

50. Uses of Oxalic acid :

1. for removing ink stains and iron stains.
2. as mordant in dyeing and calico printing. ..... (any 3) 3m
3. in manufacture of ink and metal polishes.
4. Redox titration.

51. Tests for carboxylic acid

1. Aqueous solution of carboxylic acids turn blue litmus into red colour.
2. Carboxylic acids give **brisk effervescence** with sodium bi-carbonate due to the evolution of carbon-di-oxide. ..... (2 only) .. 3m
3. On warming carboxylic acids with alcohol and concentrated sulphuric acid it forms ester which is identified from its **fruity odour.**

PART III **7 X 5 = 35**

SECTION A

52. Derive de-Broglie's equation.

Plank's quantum theory, **$E=h\nu$**

ν= frequency of the wave, h = Plank's constant

Einstein equation, **$E = mc^2$**

m = mass of photon, c = velocity of light

$h\nu = mc^2$

$h.c/\lambda = mc^2$;

$\lambda=h/mc$

$\lambda=h/mv$ (or)

$\lambda=h/p$ (mv = p)

Significance: 1. Construction of electron Microscope.

2. Study of surface structure of solids.

53. 6.Explain the extraction of Silver from Silver coin.

Silver coins **(Ag-Cu)**

↓ Con- HNO_3

$AgNO_3 + Cu(NO_3)_2$. (The solution is boiled to expel excess of nitric acid)

↓ con.HCl

AgCl

AgCl is separated and converted to silver by fusing with excess Na2CO3.

$4AgCl + 2Na_2CO_3 \rightarrow 4Ag\downarrow + 4NaCl + 2CO_2 + O_2$

Obtained silver is purified by fusion with **borax** and followed by electrolytic purification.

54. Explain the extraction of Potassium dichromate from its ore.

1. Ore: Chromite - $FeO.Cr_2O_3$

2. Conversion of chrome iron ore to sodium chromate

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

3. Conversion of Na_2CrO_4 to $Na_2Cr_2O_7$

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

4.Conversion of sodium dichromate into potassium dichromate

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

55.

Lanthanides	Actinides
i) Binding energies of 4f electrons are higher.	i) Binding energies of 5f electrons are lower.
ii) 4f electrons have greater shielding effect.	ii) 5f electrons have poor shielding effect.
iii) Most of their ions are colourless.	iii) Most of their ions are coloured U^{3+} (red)
iv) They are paramagnetic but magnetic properties can be easily explained.	iv) They are also paramagnetic but their magnetic properties are very difficult to interpret.
v) They do not form complexes easily.	v) They have much greater tendency to form complexes.
vi) Their compounds are less Basic	vi) Their compounds are more basic.

SECTION B

56. Give the various statements of II-law of thermodynamics.

i) Kelvin- Planck statement

"It is impossible to construct an engine which operated in a complete cycle will absorb heat from a single body and convert it completely to work without leaving some changes in the working system".

ii) Clausius statement:

"It is impossible to transfer heat from a cold body to a hot body by a machine without doing some work".

iii) Entropy statement:

'A process accompanied by increase in entropy tends to be spontaneous".

iv) "Efficiency of a machine can never be cent percent".

v)

$$\% \text{ Efficiency} = \frac{(T_1 - T_2)}{T_1} \times 100,$$

By II law, $T_2 < T_1$ % efficiency less than 100.

57. Give the characteristics of Gibb's free energy.

1) Free energy is defined as G = (H-TS). 'G' is a state function.
2) G-Extensive property. ΔG- become intensive property , when the system is closed.
3) G has a single value for the thermodynamic state of the system.
4) ΔG<0 - spontaneous , ΔG = 0 – equilibrium, ΔG > 0 - non- spontaneous
5) ΔG = ΔH – TΔS. ΔH = ΔE + PΔV and ΔE = q – w. But TΔS = q
   ΔG = q - w + PΔV – q . **ΔG = - w + PΔV = network.**

58. Kp – Kc Value for dissociation of PCl_5:

$$PCl_{5(g)} \leftrightharpoons PCl_{3(g)} + Cl_{2(g)}$$

$$K_c = \frac{[PCl_3][Cl_2]_e}{[PCl_5]_e} = \frac{x/V \times x/V}{(a-x)/V} = \frac{x^2}{V^2} \times \frac{V}{(a-x)}$$

$$K_c = \frac{x^2}{(a-x)V}$$

$$K_p = \frac{p_{PCl_3} \cdot p_{Cl_2}}{p_{PCl_5}} \text{ atm}$$

$$X = \frac{\text{Number of moles dissociated}}{\text{Total number of moles present initially}}$$

$$K_p = \frac{x^2 P}{(1-x^2)} \text{ atm}$$

59. **(i) Consecutive reactions**

`The reactions in which the reactant forms an intermediate and the intermediate forms the product in one or many subsequent reactions are called as consecutive or sequential reactions.

A (Reactant) → B (Intermediate) → C (product)

Example : soapanification of diester in presence of alkali.

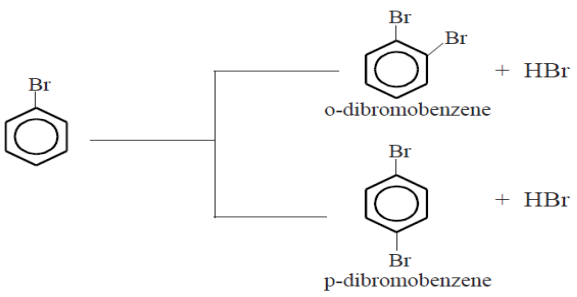
$$R'OOC-(CH_2)_n-COOR \xrightarrow{k_1} R'OOC-(CH_2)_n-COOH \xrightarrow{k_2} HOOC-(CH_2)_n-COOH$$

(ii) Parallel reactions

In these group of reactions, one or more reactants react simultaneously in two or more pathways to give two or more products. The parallel reactions are also called as side reactions.

Example:

Bromination of bromobenzene :



SECTION C

60. Preparation of Anisole:

1. Williamsons synthesis :

By heating sodium phenoxide with methyl iodide.

$$C_6H_5O^- Na^+ + CH_3 - I \longrightarrow C_6H_5 - O - CH_3 \text{ (Anisole)} + I^- + Na^+$$

2. Using diazomethane :

$$C_6H_5 - O - H + CH_2 - N_2 \longrightarrow C_6H_5 - O - CH_3 + N_2$$

diazomethane

3. Manufacture of ether :

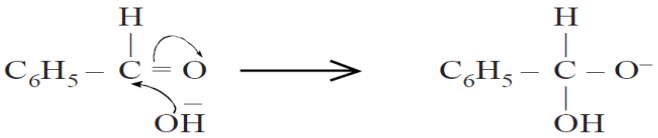
$$C_6H_5OH + (CH_3)_2SO_4 \xrightarrow{NaOH} C_6H_5\ O\ CH_3 + CH_3.HSO_4$$

61. Cannizaro reaction :

Because of the **absence** a**-hydrogen.** It involves self oxidation and reduction of benzaldehyde when heated with concentrated NaOH.

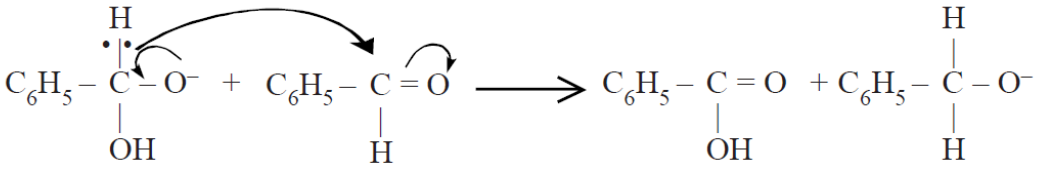
$$\underset{\text{Benzaldehyde}}{C_6H_5CHO} + \underset{\text{Benzaldehyde}}{C_6H_5CHO} \xrightarrow{NaOH} \underset{\text{Sodium benzoate}}{C_6H_5COONa} + \underset{\text{Benzyl alcohol}}{C_6H_5CH_2OH}$$

I step.



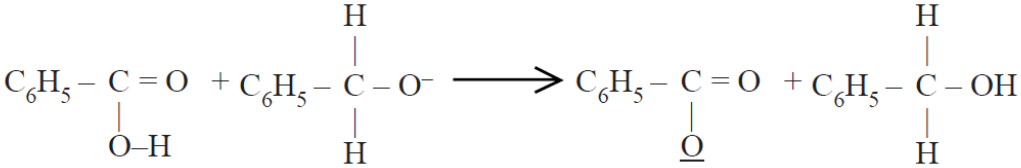
Nucleophilic attack by OH- ion

II step.



Transfer of hydride ion from the anion to carbonyl carbon of another molecule.

III step.



Benzyl oxide ion pickups the acidic proton.

62. Reducing property of Formic acid:

Formic acid is unique because it contains both an aldehyde group and carboxyl group also. Hence it **can act as a reducing** agent.

It reduces Fehling's solution, Tollens reagent and decolourises pink coloured $KMnO_4$ solution.

$$HCOOH + (O) \longrightarrow H_2O + CO_2$$

(a) Formic acid reduces ammoniacal silver nitrate solution (Tollen's reagent)to metallic silver.

$$HCOOH + Ag_2O \longrightarrow H_2O + CO_2 + 2Ag^{-} \text{ (metallic silver)}$$

(b) Formic acid reduces Fehling's solution. It reduces blue coloured cupricions to red coloured cuprous ions.

$$HCOO^{-} + 2Cu^{2+} + 5OH^{-} \longrightarrow CO_3^{2-} + Cu_2O + 3H_2O$$

(blue) (red)

63. Isomerism in Ethers:

i) Functional Isomerism

Ethers are functional isomers of alcohols as both have the same general formula $C_nH_{2n+2}O$.

Molecular formula	Ethers	Alcohols
$C_4H_{10}O$	$CH_3–CH_2–O–CH_2–CH_3$ Diethyl ether $CH_3–O–CH_2–CH_2–CH_3$ Methyl n-propyl ether $CH_3–O–CH(CH_3)–CH_3$ Methyl isopropyl ether	$CH_3–CH_2–CH_2–CH_2–OH$ n-butyl alcohol $CH_3–CH(CH_3)–CH_2–OH$ Isobutyl alcohol $CH_3–CH_2–CH(OH)–CH_3$ sec.butyl alcohol $CH_3–C(CH_3)(CH_3)–OH$ tert.butyl alcohol

ii) Metamerism:

Molecules with same formula, same functional group, differing only in the nature of the alkyl group attached to oxygen.

$CH_3 O CH_2 CH_2 CH_3$	$CH_3 CH_2 O CH_2 CH_3$	$CH_3 O CH CH_3 CH_3$
methyl n-propylether	diethylether	methyl isopropylether

PART IV **4 X 10 = 40**

64. (a) Variation of Ionisation energy along the group and period:

The energy required to remove the most loosely bound electron from an isolated atom in the gaseous state in known as Ionisation Energy.

$$\text{Atom} + \text{Energy} \longrightarrow \text{Positive Ion} + \text{Electron (g)}$$

In a period, the value of ionisation potential increases from left to right with breaks where the atoms have somewhat stable configurations. Due **to increasing of nuclear charge.**

In a group, the ionisation potential decreases from top to bottom. Due to **increasing of size**.

(b) Anamalous Nature of Fluorine:

1. Fluorine is the most reactive element among halogen.
2. Hydrofluoric acid is a weak acid whereas the other hydrohalic acids are strong acids.
   ..... H– F..... H– F..... H–F.
3. AgF is soluble in water while the other AgX are insoluble.
4. Being strongly electronegative it can have only a negative oxidation state.
5. HF attacks glass while others do not.
6. It does not form any polyhalides.

65. (a) Pauling's Method to find the radii of an ion.

Pauling has found four crystals namely **NaF, KCl, RbBr and CsI**.
In each ionic crystal the cation and anions are isoelectronic with inert gas configuration.

NaF crystal : Na^+ : 2, 8 } Ne type configuration
F^- :2, 8 }

KCl crystal : K^+ : 2, 8, 8 } Ar type configuration
Cl^- : 2, 8, 8 }

i) The sum of the radii will be equal to the inter nuclear distance between them.

$r(C^+) + r(A^-) = d(C^+–A^-)$ (1)

where $r(C^+)$ = radius of cation, $r(A^-)$: radius of anion,

$d(C^+–A^-)$ = internuclear distance between C^+ and A^- ions in C^+A^- ionic crystal

ii) For a given noble gas configuration, the radius of an ion is **inversely proportional** to its effective nuclear charge. i.e.

$$r(C^+) \quad \alpha \quad \frac{1}{Z^*(C^+)} \qquad (2)$$

$$r(A^-) \quad \alpha \quad \frac{1}{Z^*(A^-)} \qquad (3)$$

where,

$Z^*(C^+)$ & $Z^*(A^-)$ are the effective nuclear charges of cation (C^+) and anion (A^-) respectively. On combining (2) & (3)

$$\frac{r(C^+)}{r(A^-)} = \frac{Z^*(A^-)}{Z^*(C^+)} \qquad (4)$$

(b) **Ramsay - Raleigh's method:**

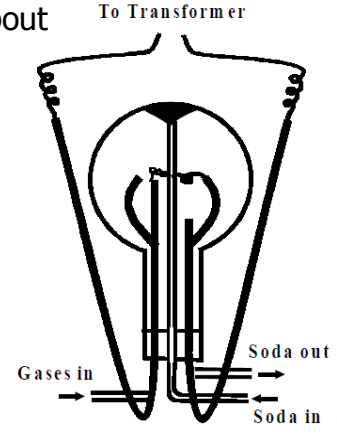
*A mixture of air and oxygen is passed into a glass globe of about 50 litres capacity.
*Two platinum electrodes about 6000 - 8000 volts

$$N_2 + O_2 \rightarrow 2\,NO$$

$$2\,NO + O_2 \rightarrow 2NO_2$$

$$2NO_2 + 2NaOH \rightarrow NaNO_3 + NaNO_2 + H_2O$$

*Oxygen if any is removed by introducing alkaline pyrogallol in the globe.

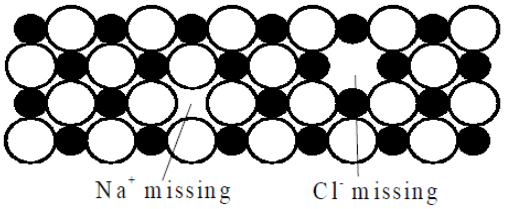


66. (a) Most common point defects:

Schottky defects:

Example:(NaCl) Ionic crystal

1. Lattice points are unoccupied. It is called lattice vacancies.
2. Crystal remains neutral
(missing no.ofcation = missingno.of anion).
3. Size of anion = cation Size of anion > cation



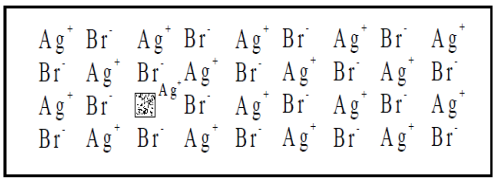
Frenkel defects:

Example:(AgBr) Ionic crystal

An ion occupies an interstitial position between the lattice points.

Crystal remains neutral.

(no. of cation = no.of anion)



(b) chemical methods to prepare colloids.

(i) **Double decomposition**:

$As_2O_3 + 3\ H_2S \longrightarrow As_2S_3 + 3\ H_2O$

arsenious oxide — (Yellow) Arsenic sulphide

(ii) **Oxidation :**

$2H_2S + SO_2 \longrightarrow 2H_2O + 3\ S$

Sulphur sol

(iii) **Reduction:**

$AgNO_3$ + tannic acid $\longrightarrow$ Ag Sol

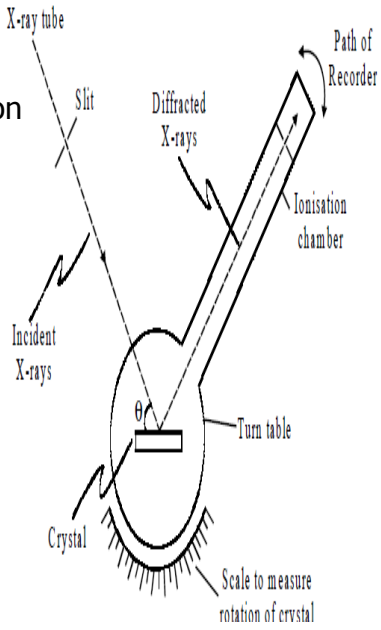
$AuCl_3$ + tannic acid $\longrightarrow$ Au Sol

(iv) **Hydrolysis:**

$FeCl_3 + 3H_2O \longrightarrow Fe(OH)_3$ (red sol)$+ 3HCl$

67. (a) the Bragg's spectrometer method.

Studying crystals using X rays. X-rays is allowed to fall on the crystal mounted on a rotating table with scale and vernier, From which the angle of incidence, θ can be measured.Crystal table carries an ionisation chamber. X ray ionize the gas present inside. Due to ionization current is produced , which is direct measure of intensity of reflected beam from the crystal. current is measured from the electrometer. These values are plotted in the form of graph.



For NaCl,

the maximum reflection for 100 plane Order of reflection.

Angle of reflection (θ)	Sin values	Ratio
5.9°	0.103	1:2:3
11.85°	0.205	
18.15°	0.312	

The ratio confirms the correctness of Bragg's equation.

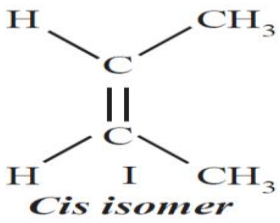
(b)

S.NO	SIMPLE REACTION	COMPLEX REACTION
1	Occurs in single step	Occurs in multi (or) many steps
2	Overall order values are small. (1,2,3)	Overall order values are large and greater than 3.0.
3	No side reactions	Many side reactions are present.
4	Products are formed directly from the reactants	products are not formed directly involving the reactants
5	Experimental rate constant values agree with the calculated values.	Experimental overall rate constant values differ from the calculated values.

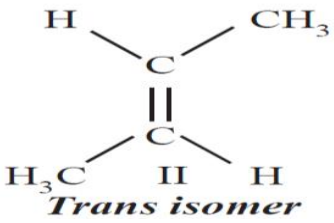
68. (a) Cis – Trans isomerism:

Isomerism that arises out of difference in the spatial arrangement of atoms or groups about the doubly bonded carbon atoms is called **Geometrical isomerism**. These isomers are not mirror images of each other. Rotation about C=C is not possible at normal conditions and hence the isomers are isolable.

If different atoms or groups are bonded to the 'C=C' bond in a molecule, more than one spatial arrangement is possible. For example, 2-butene exists in two isomeric forms.



Cis isomer

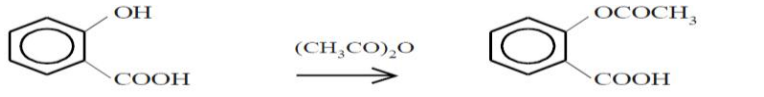


Trans isomer

The isomer in which **similar groups** lie on the same side is called **'cis isomer' (I)**. The other in which similar groups lie in **opposite direction** is called **'Trans isomer' (II)**. This isomerism is called 'Cis-Trans' isomerism.

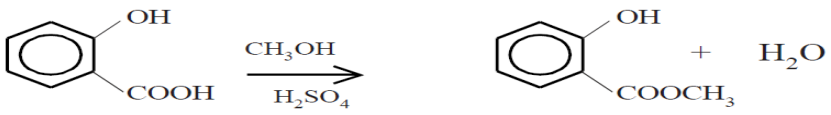
(b) Conversions:

1. salicylic acid ⟶ asprin



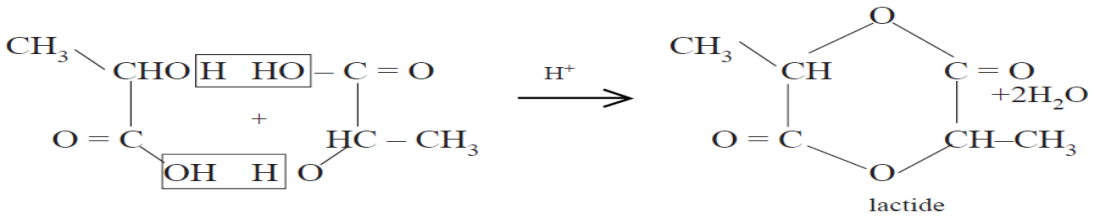
Acetyl salicylic acid or Aspirin

2. salicylic acid ⟶ methyl salicylate



(Methyl salicylate)

3. Lactic acid ⟶ Lactide



lactide

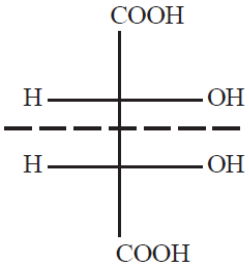
69. (a) Optical activity of Tartaric acid:

Tartaric acid is dihydroxy dioic acid, having two identical chiral carbon atoms. The enantiomers of tartaric acid, have the same magnitude but different sign of optical rotation. They have object-mirror image relationship.

(*d, l* pair of tartaric acid)

In the *d*-isomer, each of the two asymmetric carbon atoms rotate the plane of the polarised light towards right leading to overall dextro rotation. In the same way in the /- isomer, the overall rotation is laevo.

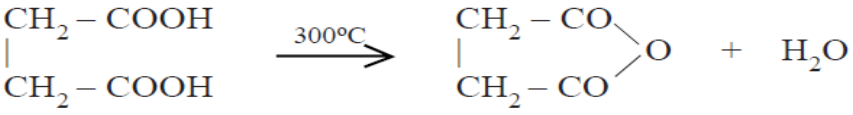
There is another optical isomer for tartaric acid in which one Asymmetric carbon atom is dextrorotatory and the other laevorotatory-both rotating to the same extent in opposite directions. The net result is, that this isomer becomes optically inactive and is called the "Meso" isomer.



(b) Action of heat on oxalic acid and succinic acid:

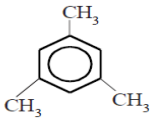
(i) Oxalic acid on heating at 373 K – 378 K loses water of hydration. On further heating it decomposes to formic acid and carbon dioxide.

(ii) Succinic acid on heating to 300°C loses a molecule of water to form anhydride.



70. (a) * C_3H_6O is Acetone [$CH_3 - CO - CH_3$] (A)

* $CH_3 - CO - CH_3 \xrightarrow{zn\ /\ Hg - HCl} CH_3 - CH_2 - CH_3$, (B)

* $3\ CH_3 - CO - CH_3 \xrightarrow{con.\ H_2SO_4}$  $+ \ 3\ H_2O$ (C)

(b) * Sulphide ore of group 12 is Zinc blende , Zn S

* $2\ ZnS + 3\ O_2 \xrightarrow{1200\ K} 2\ ZnO + 2\ SO_2$

(A)

* $ZnO + C \xrightarrow{1673\ K} Zn + CO$

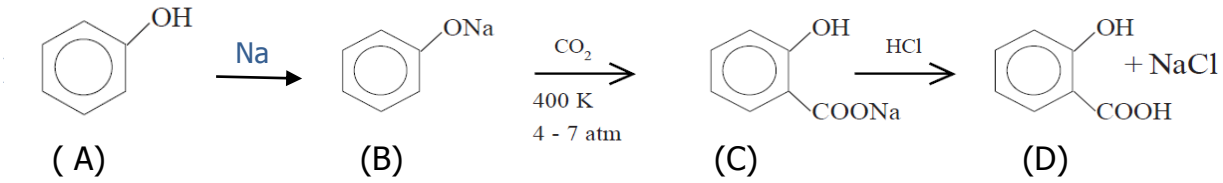
(B)

* Carbonate of this element is **(c)** Zinc carbonate (calamine) is used as skin ointment.

(or)

(c)

C_6H_6O (A) Gives violet colour with ne.$FeCl_3$ is Phenol (C_6H_5OH).



(A) (B) (C) (D)

(d) Group 11 and period 4 element extracted from pyrite ore is **Copper** (Cu) **(A)**

$$2Cu + O_2 \xrightarrow{\text{Below } 1370\ K} 2CuO$$

(B) Cupric oxide

$$4Cu + O_2 \xrightarrow{\text{Above } 1370\ K} 2Cu_2O$$

(C)
Red cuprous oxide.

BY

S. JOSEPH SURESH, MSc., MEd .,
9994342531
AKSHAYA ACCADEMY, ODDANCHATRAM
DINDIGUL.