(1)

Paper Code 81124 Q.P. 63654
Chemistry

Semester I- Paper II **Set 2**

Q.1.A) Select the correct option and complete the following statements **(Any twelve)**

i. b
ii. a
iii. c
iv. c
v. b
vi. c
vii. c
viii. c
ix. a
x. b
xi. b
xii. a
xiii. c (chiral carbon)
xiv. b (diastereoisomers)
xv. a ($-CH_3$)
xvi. b (optically inactive)
xvii. a (d rsymmetry)
xviii. b (4)

B) State whether the following statements are True or False **(Any Three)**

i. True
ii. True
iii. True
iv. False
v. True
vi. False

C) Match the following columns **(Any Five)**

i. d (Slowest step)
ii. f (p-azoxy phenetole)
iii. e (P_2O_5)
iv. a. ($NaOH$).
v. c (plane of symmetry)
vi. b (bonds project behind the plane of paper)

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Paper II **Set 2**

Q.2.(A)

First order reaction is when the rate of the reaction is proportional to the first power of the concentration of the reactant

$A \longrightarrow$ products

Let 'a' mol/dm^3 be the initial concentration of the reactant at time — **1 mark**

'x' mol/dm^3 of the reactant react at time t and get converted to products

(a-x) mol/dm^3 will be the concentration of reactant at time t — **1 mark**

Rate $dx/dt = k(a-x)$ where 'k' is the rate constant

$$\int_{x=0}^{x=x} dx/(a-x) = k \int_{t=0}^{t=t} dt$$

$-\ln(a-x) = kt + \text{constant}$ ..... (1)

when t=o .... x=o .....substituting in eq (1)

$\therefore -\ln a = \text{constant}$

Substituting $-\ln a$ in constant in eq (1)

$\therefore -\ln(a-x) = kt - \ln a$

$kt = -\ln(a-x) + \ln a$

$k = \frac{1}{t} \ln \frac{a}{(a-x)}$

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

3 marks

Q.2.(B)

Rate constant of a reaction.: It is the proportionality constant related to the rate of a particular reaction. It is the rate of reaction when the molar concentration of each of the reaction is unity **1 mark**

Pseudo first order reaction with an example: **4 marks**

Pseudo first order reaction are generally bimolecular reactions , follow first order reaction i.e the rate depends on change in concentration of one of the reactants only.

Ex: Acid catalysed hydrolysis of methyl acetate

$CH_3COOCH_3 + H_2O \xrightarrow{H^+} CH_3OH + CH_3COOH$

The reactants taking part in the reaction are ester and water therefore it's a bimolecular reaction. Acid is a catalyst. Form the above reaction, the rate depends on the concentration of ester and water the rate equation can be given as,

$\mathbf{Rate = k [CH_3COOCH_3] [H_2O]}$

When the concentration of water is taken in excess compared to ester , the concentration of water does not change much during the course of the reaction. The rate of the reaction can be said to be independent of the change in the concentration of water. Taking the term for change of concentration of water in the above reaction to be zero we can write the effective rate equation as,

Rate = k [CH_3COOCH_3]

The reaction behaves as a first-order reaction which could have actually happened in a higher order such reactions are termed as pseudo-first order reactions.

Q.2.(C)

Given: A 2nd order reaction ; t = 50 mins ....undergoes 40% completion .

To find: rate constant 'k' and half life time '$t_{½}$'

Solution:

Let 'a' = 100 then x =40 a-x = 100-40 =60 t = 50 mins **1 mark**

i) To find rate constant

$$k = \frac{x}{a(a-x)} \times \frac{1}{t}$$ **1 mark**

$$k = \frac{40}{100 \times 60} \times \frac{1}{50}$$

$k = 1.33 \times 10^{-4}$ mol^{-} dm^3 s^{-1} **1 mark**

ii) To find half life time

$k = 1.33 \times 10^{-4}$ mol^{-} dm^3 s^{-1} : a = 100

$t_{1/2} = 1 / ak$ **1 mark**

$t_{1/2} = 1 / (100 \times 1.33 \times 10^{-4})$

$t_{1/2}$ = 75.19 mins **1mark**

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Q2. (D)

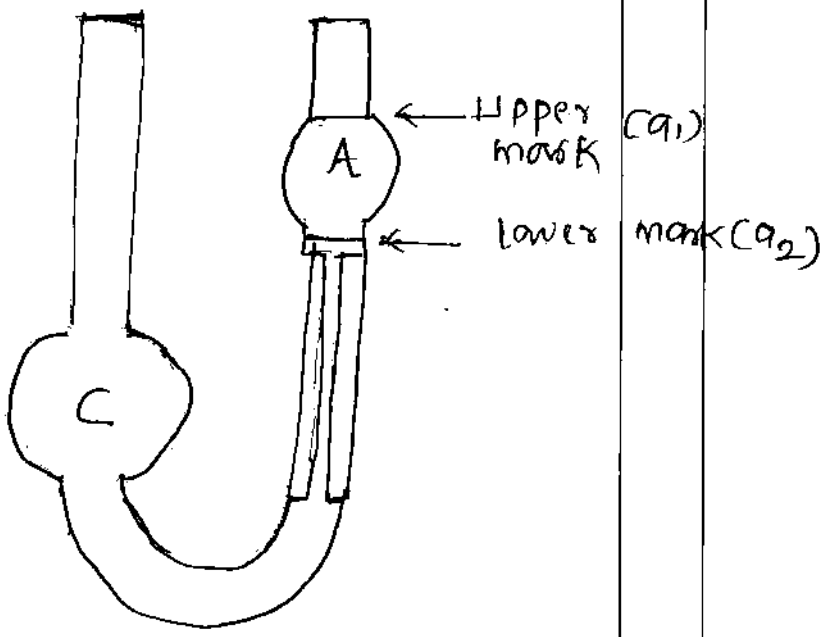
Definition- 1 Mark
Equation – 1 Mark
Diagram- 1 Mark
Procedure- 2 Marks

Viscosity of Liquid- The resistance offered to the flow by a liquid is a characteristic property, this resistance is called Viscosity.

Procedure-

i) Ostwald's Viscometer consists of bulb 'A' with mark above (a_1) and below(a_2) and attached to a capillary tube and a storage bulb (C).
ii) A definite volume of liquid is introduced in to C and sucked in to tube above mark 'a_1'.
iii) The time required to flow the liquid from marks a_1 and a_2 is determined. The viscometer is cleaned, dried.
iv) The experiment is repeated with water.
v) Since, t_l, t_w, d_l, d_w and η_w are known η_l is calculated as

$$\eta_l = t_l/t_w \times d_l/d_w \times \eta_w$$



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Q. No.

Page No.....

Marks

2.(E).

Solution -

Given,

$n_1 = 29, \quad n_2 = 86.$

$d_1 = 0.70$

$d_2 = 0.997$

$\gamma_1 = 72.8 \times 10^{-3}$

$\gamma_2 = ?$

$$\frac{\gamma_1}{\gamma_2} = \frac{n_2 d_1}{n_1 d_2}$$ → 1 mark

$$\therefore \quad \gamma_2 = \frac{n_1}{n_2} \cdot \frac{d_1}{d_2} \cdot \gamma_1$$

$$= \frac{29}{86} \times \frac{0.70}{0.997} \times 72.8 \times 10^{-3}$$

$$= 0.3372 \times 0.7021 \times 72.8 \times 10^{-3}$$

3 marks

$$= 17.2352 \times 10^{-3} \text{ N/m}.$$ → 1 mark.

(5)/17

Q. No.		Marks
2 (F)	Definition of liquid crystal - 1 Mark Naming of different classes - 1 Mark Explanation of each class with example - 3 Marks liquid Crystals - A substance which flows like a liquid but has some degree of ordering in the arrangement of its molecules is called liquid crystals. Liquid Crystals are classified into three catagories - (i) Smectic liquid crystals - Flow in layers in different planes and sheets gliding over each other. It has non - Newtonian motion Examples :- ethyl - azoxy benzoate, ethyl - p - azoxy cinnamate (ii) Nematic liquid crystals :- They flow more readily. Their flow is Newtonian. They have thread like structure. Examples p - azoxy anisol, p - methoxy cinnamic acid (iii) Chloesteric liquid Crystals :- These have some nematic and smectic characteristics. They have high non - Newtonian flow. Example - Chloesteryl benzoate.	

Q3

(A) The reluctance of ns electron pair from taking part in bonding is called inert pair effect.

Oxidation states of group 15 are +3, +5 & -3

Among the +ve oxidation states the stability of +3 O.S increases and that of +5 O.S decreases from N to Bi due to inert pair effect. N cannot form compounds like NF_5, NCl_5 etc while P can. In -3 O.S, the elements have the tendency to act as electron pair donors.

The elements of group 16 have $ns^2 np^4$ elec. configuration and suggest -2, +2, +4 and +6 oxidation state.

(B) Characteristics of nitrides of alkali and alkaline earth metals, nitrides are binary compounds of nitrogen with an element which is more electropositive or less electronegative than nitrogen itself. eg Li_3N, Na_3N (gp I)
Mg_3N_2, Ca_3N_2 (gp II)

Classification of nitrides

(i) Ionic or s-like nitrides
(ii) covalent nitrides
(iii) Interstitial nitrides

Comparative chemistry of nitrides of gp I and gp II

Preps :- ① $3Li + N \rightarrow Li_3N$

② $3Ca + N_2 \xrightarrow{713K} Ca_3N_2$

Prop :- ① $Li_3N + 3H_2O \rightarrow 3LiOH + NH_3\uparrow$

② $Be_3N_2 + 6H_2O \rightarrow 3Be(OH)_2 + 2NH_3\uparrow$

(c) Emission of sulphur di oxide.

Sources :- (i) Thermal power stations (ii) sulphuric acid industry (iii) smelting of non ferrous ores (iv) petroleum refineries (v) External combustion systems (vi) Internal combustion

Control Techniques :-

(i) Catalytic Process (ii) Sodium sulphate Process (iii) limestone Injection Process (iv) limestone Process for removal of SO_2 and particulates.

) Anomalous Behaviour of lithium

(a) Small size of lithium & high charge density

(b) Lattice energy of lithium is highest.

(c) high hydration ionization energy

(d) Potassium, rubidium and cesium in molten state are miscible with sodium but lithium is immiscible.

(e) salt of lithium are less soluble than corresponding salts of sodium and potassium.

(f) lithium directly combines with nitrogen & nitrides are formed.

D Preparation of $CaCO_3$ any one method

E Properties of $CaCO_3$ any two

) Uses of $CaCO_3$ any two

Q. No. Q3 F

Marks

(05)

Photo chemical smog : is extreme form of the atmospheric pollution due to internal combustion engines. It causes decrease in visibility & increase in acid smell, irritation to the eyes and has harmful effect on the lungs.

Photo chemical smog is caused by a high concentration of the primary pollutant (hydrocarbons and oxides of nitrogen) strong sunlight and stable air mass. O_2 molecules reacts with 'O' to form O_3. O_3 reacts with nitric oxide to form nitrogen dioxide and O_2 again enters in photolytic cycle.

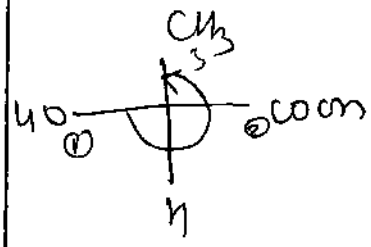
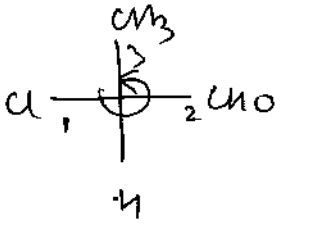
$NO_2 \rightarrow NO + (O)$

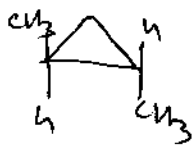
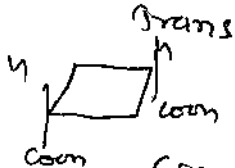
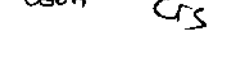
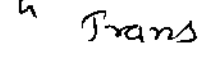
$O_2 + (O) \rightarrow O_3$

$NO + O_3 \rightarrow NO_2 + O_2$

(O) atom from O_3 attacks hydrocarbons and form PAN (Peroxy acetyl nitrate)

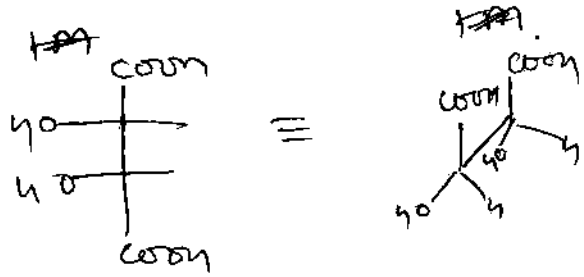
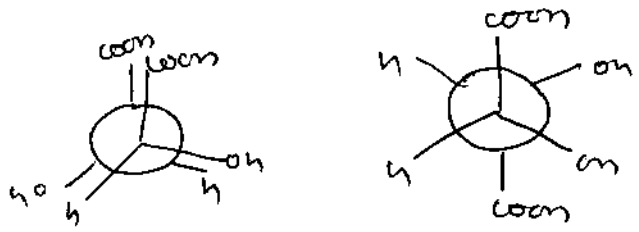
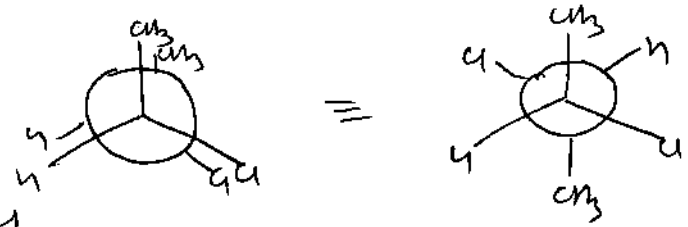
It causes severe health issues, mental tension, eye irritation, destroys hair etc.

Q. No.	4 A	Marks
I 9)	$-OH$ $-COOH$ $-CH_3$ $-H$ 8 6(8,8,8) 6(1,1,1) 1	1M
	 S configuration	1M
b)	$-Cl$ $-CHO$ $-CH_3$ $-H$ 17 6(8,8,1) 6(1,1,1) 1	1M
	 S configuration	1M
II	Chirality of molecule is the dissymmetry of molecule. When all the three elements of symmetry (plane, centre & axis) are absent a molecule is chiral.	(1)
4 B i	a) chiral b) Achiral c) Achiral	1M each
ii	a) D b) L	
4 C	Racemic Mixture 1 A mixture containing d & l forms of an optically active compound in equal amounts 2) A racemic mixture is optically inactive due to external compensation	2 pts 2M.

Q. No.		Marks
	3) A racemic mixture is represented as dl or (±)	
	eg → any example	
	Seperation of racemic mixture into its component enantiomers is called resolution of racemates	(1)
	ii) Enantiomers – i) They are optical isomers which are non superimposable mirror images of each other.	2 pts 2M
	ii) They rotate the plane of plane polarised light by the same amount but in opposite direction	
	iii) They show same physical properties	
	iv) they cannot be seperated by fractional distillation or fractional crystallisation	
D	1) Cycloalkanes have a rigid ring. Substituted cycloalkanes exhibit Geometrical isomerism due to rigidity of the ring. Due to rigidity of the ring the groups have definite positions above & below the ring	1M
	examples  1,2 dimethyl cyclopropane 	1M each example 2 examples expected.
	 cis  1,3 cyclobutane dicarboxylic acid	
	trans  cis  Trans	

Questions should be —
WRITTEN IN LEGIBLE HANDWRITING IN BLACK INK.
SIGNS, SKETCHES OR FIGURES IF ANY BE DRAWN IN NEAT BLACK INK,
so as to avoid mistakes in the printed question papers.

uration ..... Hours. Total Marks assigned to the paper .....

Q. No.		Marks
	N.B. :	
11)	a) E-isomer b) E isomer	1m each
E 1)	pair of diastereoisomers a & b — 1½m b & c — 1½m	
11		1m
		1m
F I a)		1½m
b)		
II	a) Threo b) Erythro	1m each

(13)

Set II

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.5. A)

alf life time of reaction: Half life time is the time it takes for the concentration of a reactant to fall to half its original value. **1 mark**

alf life time method for the determination: **4 marks**

The time at which one-half of the substance has disappeared is determined and the experiment is repeated with different initial concentrations of the reactants. The order (n) is then determined where 'a' is the initial concentration

$(t_{1/2})_1 \propto 1/\ a^{n-1}$

$\therefore\ t_{1/2} \propto\ a^{1-n} \qquad \therefore\ t_{1/2} = k\ a^{1-n} \qquad \therefore \log t_{1/2} = \log k + (1-n)\ a$

A plot of graph of *log* $t_{1/2}$ *vs log a* gives a straight line with a *slope* $(1-n)$.

From the slope the order (n) of the reaction can be determined.

If half life at different concentration is given i.e $(t_{1/2})_1$ and $(t_{1/2})_2$ then

$(t_{1/2})_1 \propto 1/\ a_1^{n-1}$ and $(t_{1/2})_2 \propto 1/\ a_2^{n-1}$ then

$$\frac{(t_{1/2})_1}{(t_{1/2})_2} = \frac{a_2^{n-1}}{a_1^{n-1}}$$

$\therefore$ Order of Reaction (n) is

$$n = 1 + \frac{(\log t_{1/2})_1 - (\log t_{1/2})_2}{\log a_2 - \log a_1}$$

Q. No.		Marks
B).	i) Coefficient of Viscosity - It may be defined as the force per unit area required to maintain a unit difference of velocity between two consecutive parallel layers of the liquid 1cm apart.	1 mark
	ii) Specific viscosity (η_{sp}) - It is the relative increase in viscosity and mathematically, may be represented as, $\eta_{sp} = \frac{\eta - \eta_0}{\eta_0} = \frac{\eta}{\eta_0} - 1 = \eta_r - 1$	2 marks
	iii) Reduced viscosity - The ratio of η_{sp}/c i.e, increase in specific viscosity per unit concentration of the solution is known as reduced viscosity	1 mark
	iv) Relative viscosity - The term η/η_0 is known as relative viscosity (η_r).	1 mark

Set II

Marks

I. No.

(05)

Properties which explains metallic and non metallic nature of the elements

a) Highly electropositive metals reacts with highly electronegative non metals

$Na + Cl \rightarrow NaCl$.

b) The elements reacts with oxy acids to give stable salt and releases $H_2 \uparrow$

$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2 \uparrow$

c) Metallic oxides & hydroxides are basic in nature.

$CaO + H_2O \rightarrow Ca^{2+} + 2OH^-$

d) Electro positive behaviour of metals is also given by the degree of hydrolysis of the ions $M \rightarrow M^+$, they are not readily hydrated where as less electropositive metal has lesser ability to loss the electrons and stronger is the hydration.

Moving across the period there is variation in metallic character. Ionization potential of elements increases from left to right. Hence, the metallic character decreases from left to right across the period. Thus as we move from alkali metals to halogens in a given period,

No. | Marks

the non-metallic character of elements goes on increasing. The main group of elements are divided as (i) metals (ii) metalloids (iii) non metals.

5 D. (05)

Carbides in general are binary compounds of carbon with an element which is more electropositive or less electronegative than carbon itself

any two types of ionic carbides

(i) Methanides containing discrete C^{4-} groups

(ii) Acetylides containing diatomic C_2^{2-} groups

(iii) Allylides containing C_3^{4-} groups

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Set II

Marks

Q. No. S-E

a) i) Diastereoisomers are optical isomers which are non superimposable but they are not mirror images of each other — any 3 pts 3 marks

ii) Molecule must have at least two chiral carbon atoms to show diastereoisomerism

iii) They may rotate the plane of plane polarised light by different amounts and in different directions

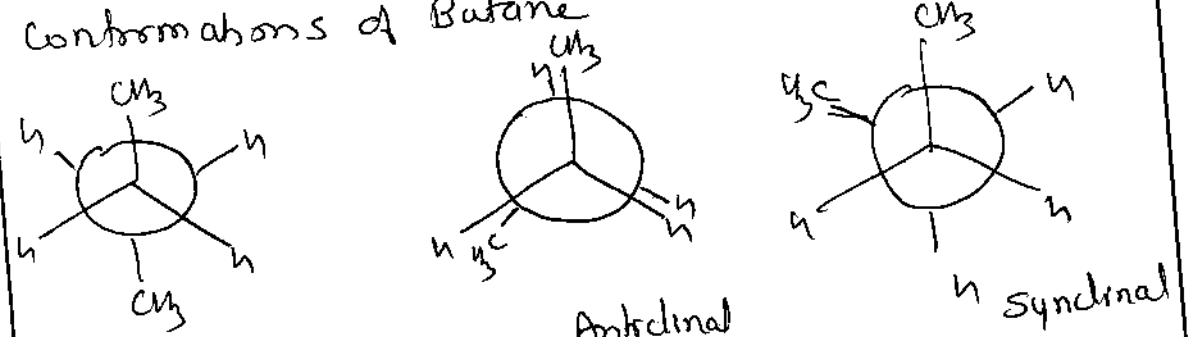
iv) They can be seperated by fractional distillation or fractional crystallisation — 1 m each

b) i) a) Trans b) Cis

5 F

ii) Conformation — the arrangements of atoms of the molecule in space obtained by rotation about single bond are called conformation — 1 m

Conformations of Butane



2 M

2 M