

उत्तराखण्ड विद्यालयी शिक्षा परिषद, रामनगर (नैनीताल) | इण्टरमीडिएट परीक्षा "अ"  
(उत्तराखण्ड) 12 पन्ने

केन्द्र संकाय की छवि	केन्द्र संकाय के संसाधन	नोट—परीक्षार्थी उत्तरपुस्तिका के किसी भी भग्न में अपना नाम व केन्द्र का नाम न लिखें। 'ब' उत्तर पुस्तिका की संख्या— <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>b<sub>1</sub></td><td>b<sub>2</sub></td><td>b<sub>3</sub></td><td>b<sub>4</sub></td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table>	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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**A1).**

(ii). Aerosol

**A2).**

(iv). Formic Acid

**A3).**

(ii). Ethane

**A4)**

(i). Vitamin - B<sub>1</sub>

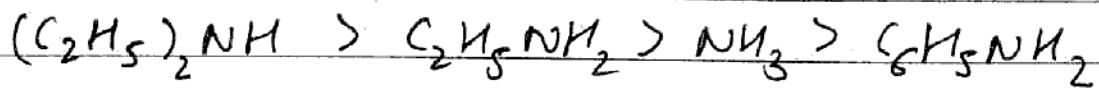
**A5).**

Monomer of PVC = vinyl chloride

**A6).**

$[\text{NiCl}_4]^{2-}$  is paramagnetic because Cl is a weak ligand and hence it does not pair the electrons, due to which unpaired electrons are left in it, while  $[\text{Ni}(\text{CO})_4]$  is diamagnetic due to the presence of no unpaired electron as carbonyl is a strong ligand.

**A7). Decreasing Order :-**



A8). Dettol is an example of antiseptics.

### A9). Uses of Freon-12

- (i) It is used in refrigerants and aerosols.
- (ii) It is used in making cups and plates.

### Uses of Chloroform

- (i) It is used in refrigerants and in aerosols as well.
- (ii) It is used as an anaesthetic.
- (iii) It is used as an organic solvent.

A10). Silver crystallises in fcc lattice. So,

$$Z = 4$$

$$a = 4.077 \times 10^{-8} \text{ cm}$$

$$\rho = 10.5 \text{ g/cm}^3$$

$$M = ?$$

$$\text{We know, } S = \frac{Z \times M}{N_A \times a^3}$$

$$\text{So, } M = \frac{10.5 \times (6.022 \times 10^{23}) \times a^3}{4}$$

$$M = 10.5 \times \frac{3.011}{6.022 \times 10^{23}} \times (4.077)^3 \times 10^{-24}$$

$$M = 10.5 \times 3.011 \times 10^{-1} \times \frac{67.76}{2}$$

$$M = 10.5 \times 3.011 \times 3.388$$

$$M = 107.06 \approx 107$$

Atomic mass of silver = 107 g.

## A II). Crystal lattice

Crystal lattice could be stated as the three dimensional arrangement of the points in space, where each point represents the constituent particle of any solid.

## Unit cell

Unit cell could be stated as the smallest part of any crystal lattice which when arranged together in a three dimensional arrangement leads to the formation of a whole crystal lattice.

**Difference :-** Thus, it could be seen

that unit cell and crystal lattice are different. As, crystal lattice is the three dimensional arrangement of the particles, but the unit cell is the smallest part of that crystal lattice.

A12). Zn, Cd and Hg may not be regarded as the transition elements.

### Reason

A transition element is the one in which incompletely filled d-orbitals are present.

But, in Zn, Cd and Hg, the electronic configuration is

$d^{10}$ , i.e., these contains completely filled d-orbitals in ground state as well as other oxidation states and hence, may not be regarded as transition elements.

A13) Given,

$$w = 8 \text{ gm}$$

$M = 40 \text{ g/mol}$  { $M'$  = Molar Mass}

$$\text{Volume} = 800 \text{ cm}^3 = \frac{800}{1000} \text{ L}$$

$$\{ V_L = 1000 \text{ cm}^3 \text{ g}$$

Molarity of solution,

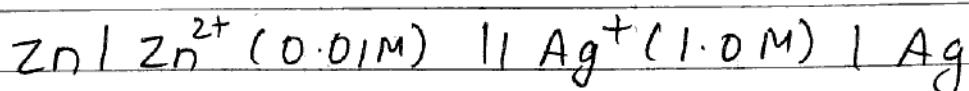
$$M = \frac{w}{M' V}$$

$$M = \frac{8}{40 \times 800} \times 1000$$

$$M = \frac{10}{40} = 0.25 \text{ mol/L}$$

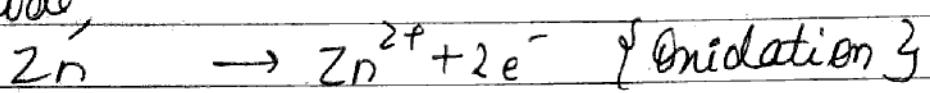
$$M = 0.25 \text{ mol/L Ans}$$

A14)

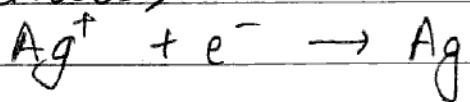


$$E_{\text{cell}}^\circ = 1.56 \text{ V}$$

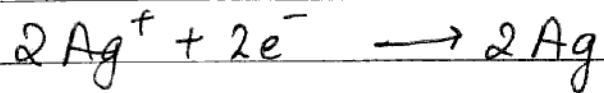
at anode,



At cathode,



Multiplying by 2,



Thus, no. of electrons,  
 $n = 2$ .

By Nernst Eq<sup>h</sup>,  
emf,

$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.0591}{n} \log_{10} \frac{[\text{Zn}^{2+}]}{[\text{Ag}^+]^2}$$

So,

$$E_{\text{cell}} = 1.56 - \frac{0.0591}{2} \log_{10} \frac{[1 \times 10^{-2}]}{[1]^2}$$

$$= 1.56 - \frac{0.0591}{2} \log_{10} (10^{-2})$$

$$= 1.56 - \frac{0.0591}{2} \times (-2) \times 1$$

$$\left. \begin{aligned} \log_{10} x^{-a} &= -a \log_{10} x \\ \log_{10} 10 &= 1 \end{aligned} \right\}$$

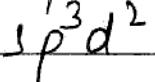
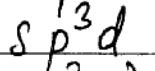
$$E_{\text{cell}} = 1.56 + 0.0591$$

$$E_{\text{cell}} = 1.6191 \text{ V}$$

## A15). Valence Bond Theory (VBT)

The main postulates of Valence Bond Theory are as follows:

- i). The central metal atom has empty or vacant s, p and d-orbitals available for accepting the lone pair of electrons donated by the ligands.
- ii). The no. of orbitals into which the lone pairs of electrons are donated equals the coordination number of the central metal atom.
- iii). If unpaired electrons are left, then the compound is paramagnetic and if not, then diamagnetic.
- iv). If inner d-orbitals are involved in hybridisation then, the complex is called inner orbital complex and if outer d-orbitals are involved, then outer orbital complex.
- v). The geometry of the compounds depend upon the hybridisation.  
If  $dsp^2$  hybridisation is there, then geometry is square planar.  
Similarly



tetrahedral

trigonal bipyramidal

Octahedral

$d^3sp^3$

Octahedral

### A16) Artificial Sweeteners

(a) Artificial sweeteners are the chemical substances that impart sweet taste to food materials. They are good for the diabetic patients as they do not increase calories.

Example, Saccharin

### (b) Food Preservatives

Food preservatives are the chemical substances that are added to food materials to increase their life time by saving them from the action of fungi, bacteria, etc.

Example, Table salt.

### A17)

(a) Allyl Chloride (3)  $CH_2=CHCH_2Cl$   $\frac{1}{12}$

(b) Benzyl Chloride (4)  $C_6H_5CH_2Cl$   $\frac{1}{12}$

(c) Vinyl chloride      (1)  $\text{CH}_2 = \text{CHCl}_{1/2}$

(d) Freon      (2)  $\text{CCl}_2\text{F}_2 \cdot 1/2$

### A 18). Natural polymers

Natural polymers could be stated as the polymers that are obtained naturally from plants and animals.

Examples starch and cellulose.

### Synthetic polymers

Synthetic polymers could be stated as the polymers that are designed synthetically by the human beings in the laboratory.

Examples, terylene and nylon.

### A 19). Electrochemical Series

Electrochemical series could be stated as the arrangement of the half-cells according to their values of standard reduction potential.

Fluorine is in the top of the electrochemical series as the  $E^\circ_{\text{cell}}$  value for it is the highest. All the elements that have positive values of standard reduction potential are good oxidising agents and these are kept above hydrogen in the electrochemical series. The value of standard reduction potential of hydrogen is 0.00 V. Further, the elements that have negative values of standard reduction potential are good reducing agents. Li (lithium) is the best reducing agent.

## **Applications of Electro-chemical Series**

The main applications of the electrochemical series are:

- (i). In determining the chemical reactivity of metals  
In the electrochemical series, the metals that have high value of standard reduction potential can replace the metals

having lower value of it. Thus, the metals present in the above part are much more reactive than the metals present below it. Hence, it could be seen that the electrochemical series help in determining the chemical reactivity of metals.

(ii) In determining the electropositive character of metals

The electrochemical series is also helpful in finding the electropositive character of metals. Higher the value of standard reduction potential, lesser is the electropositive character.

A 20)

(a) Isotonic solution: The solutions that have the same osmotic pressure at any given temperature are called isotonic solutions.

Hypotonic solution: The solution that has lesser osmotic pressure than the other solution at

any given temperature is called hypotonic solution.

Hypertonic solution: The solution that has greater osmotic pressure than the other solution is called hypertonic solution, at any given temperature.

(b) Given,

$$\pi = 3.2$$

$$w = 45 \text{ gm}$$

Molar mass of sucrose,

$$M' = 342 \text{ g/mol}$$

$$V = 4 \text{ L}$$

$$T = 20^\circ \text{C} = 20 + 273 \\ = 293 \text{ K}$$

We know,  $\pi = CRT$   
{ $C$  = Molarity}

$$\pi = \frac{w}{M' V} \times RT$$

$$R = \frac{\pi M' V}{w T}$$

$$R = \frac{312 \times 342 \times 1}{450 \times 293} = \frac{10944}{13185} = 1094.4 \text{ J mol}^{-1}$$

$$R = 0.083 \text{ Latm K}^{-1}\text{mol}^{-1} \text{ (Ans)}$$

## A 2). Main Ores of Iron

Haematite :  $\text{Fe}_2\text{O}_3$

Magnetite :  $\text{Fe}_3\text{O}_4$

## Extraction of Iron

The steps involved in the extraction of iron are as follows:

- (1) Crushing and grinding of Ore  
The ore of iron, haematite is crushed into small pieces by the help of jaw crushers. Further, it is converted into powdered form by ball mill or stamp mill.

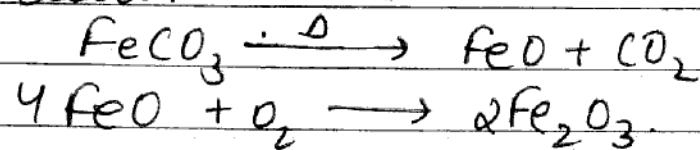
- (2) Concentration of Ore

The powdered ore is then concentrated, i.e., the impurities are removed by the method of hydraulic washing.

(3)

### Calcination

The conc. ore is then subjected to calcination. In the process of calcination the carbonate ore, siderite ( $\text{FeCO}_3$ ) of iron is used.



(4)

### Smelting

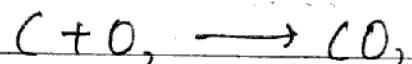
Smelting is carried out in the blast furnace.

Charge (8 parts of ore, 4 parts of coke and 1 part of limestone) is fed into the blast furnace. The reactions taking place at different zones are:

(i).

#### Combustion Zone (at 2170 K)

Coke is burned.

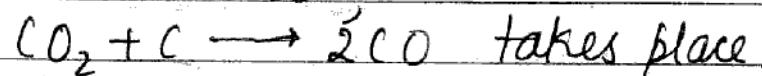


The reaction is exothermic and thus the temperature of blast furnace increases.

(ii).

#### Fusion Zone (at 1570 K)

Here, the reaction



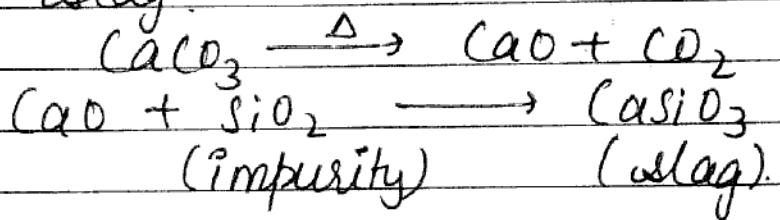
takes place. Thus, the temperature is reduced.

cts 1570 K.

iii) allag formation zone (at 1270K)

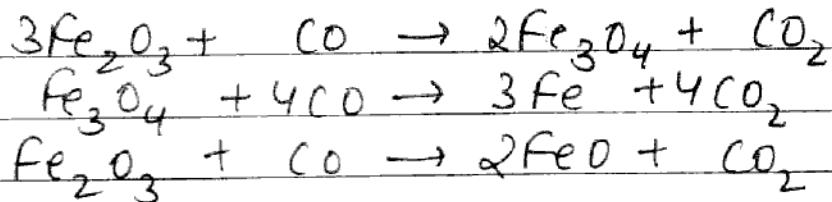
Here, slag is formed.

The limestone first decomposes to  $\text{CaO}$  (quick lime) which acts as flux and converts the acidic impurity to slag.



(iv). Reducting Zone

Here, the temperature is around 500-800 $^{\circ}$ C.  
The reactions are:



Spongy iron obtained, then melts in the fusion zone and then pig iron is obtained.

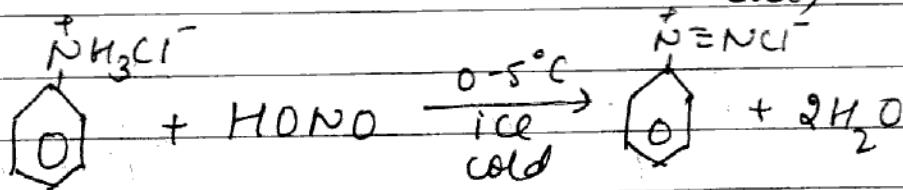
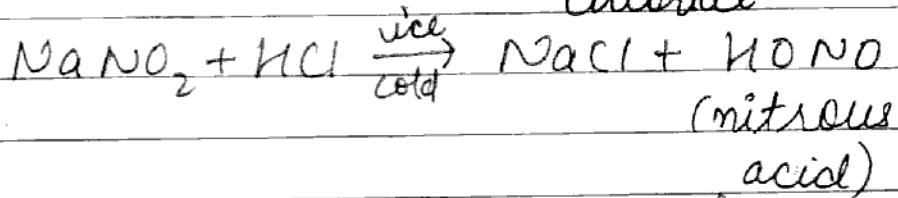
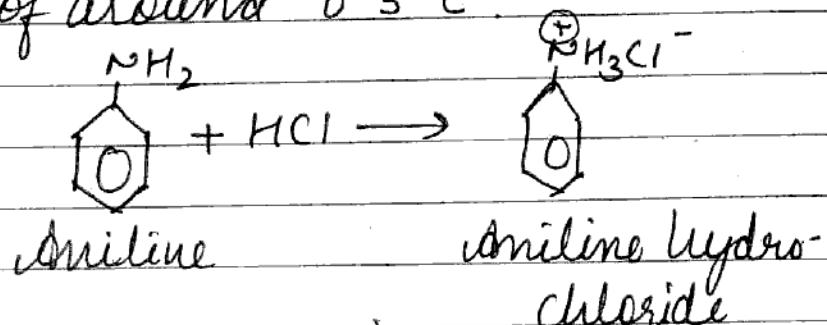
pig iron when reacted with scrap iron and coke with hot air blast leads to the formation of cast iron.

Thus, in this way, cast iron is obtained from haematite.

A22)

## (a) Diazotisation

Diazotisation could be stated as the process of formation of benzene diazonium chloride from aniline at a temperature of around  $0-5^{\circ}\text{C}$ .

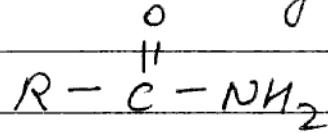


(Benzene diazonium chloride)

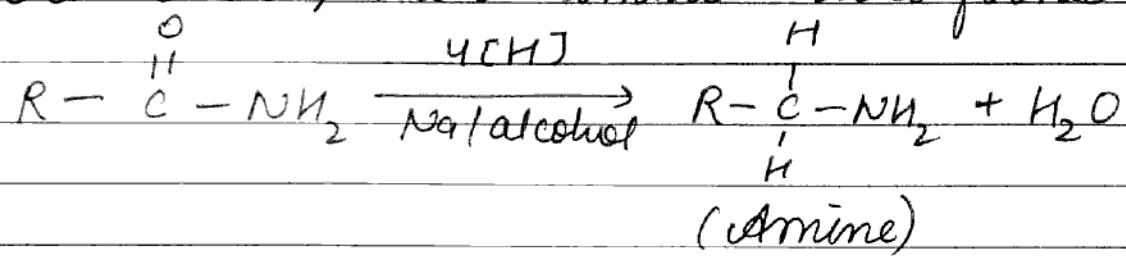
Nitrous acid is prepared by reacting  $\text{NaNO}_2$  and  $\text{HCl}$  in ice cold conditions, which when further reacted with the aniline hydrochloride forms benzene diazonium chloride. This is the process of diazotisation.

## (b) Reduction of Amides

Whenever the  $-OH$  group in the carboxylic acids is replaced by  $-NH_2$  group. Then, it is called amide. It may be represented as:-

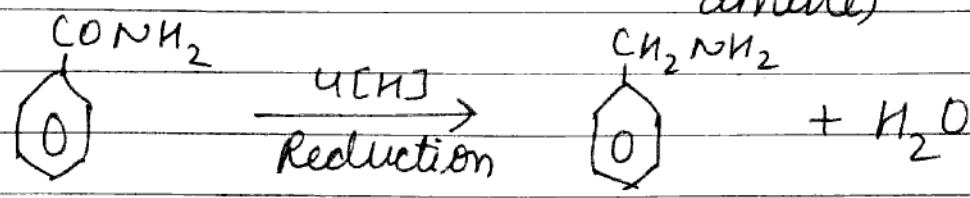
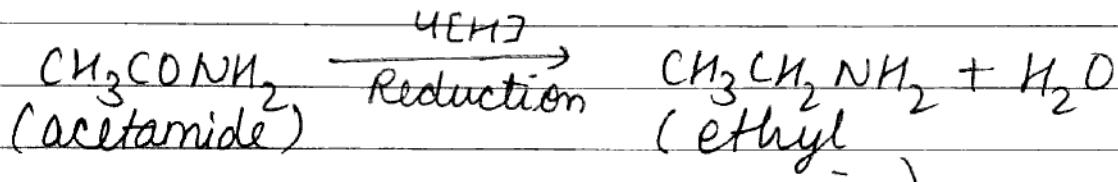


When the amides are subjected to reduction, then amines are formed



Different reducing agents may be used for the reduction of amides like  $\text{Sn/HCl}$  or  $\text{Na}/\text{alcohol}$  or  $\text{LiAlH}_4$ . But, the product formed after the reduction remains same, which is the amine. The loss of  $\text{an } H_2O$  molecule takes place.

For example,



(benzamide)

(benzyl amine)

A 23).

Given,

$$P_A^{\circ} = 17.535 \text{ mm Hg}$$

{ A = solvent    B = solute }

$$w_B = 25 \text{ g}$$

$$w_A = 450 \text{ g. } P_A = ?$$

Molar mass of glucose,

$$M_B = 180 \text{ g/mol}$$

Molar mass of water,

$$M_A = 18 \text{ g/mol.}$$

We know,

$$\frac{P_A^{\circ} - P_A}{P_A^{\circ}} = \frac{w_B}{M_B} \times \frac{M_A}{w_A}$$

Putting values,

$$\frac{17.535 - P_A}{17.535} = \frac{25}{180} \times \frac{18}{450}$$

$$\frac{1 - P_A}{17.535} = \frac{1}{180}$$

$$1 - \frac{1}{180} = \frac{P_A}{17.535}$$

$$P_A = 17.535 \left( \frac{179}{180} \right)$$

$$P_A = 17.437 \text{ mm Hg}$$

Thus, the vapour pressure of water when glucose is dissolved in it is 17.437 mm Hg. (Ans)

## A 24) Trends in property in n-16

a) Ionization Enthalpy

As, we know that the general electronic configuration of elements of group 16 is  $nS^2np^4$ . Thus, their ionization enthalpy is lesser than the group 15 elements.

Though, in actual, the ionization enthalpy increases from left to right. But, the electronic configuration of group 15 elements is  $nS^2np^3$ . As, the p-orbital is half filled it is more stable and thus, more energy is required to remove electron.

Down the group, the ionization enthalpy decreases.

A 24)  
(b)

## Oxidation State

The general oxidation states of the elements of this group are  $-2$ ,  $+2$ ,  $+4$  and  $+6$ .

But, it is seen that down the group, the stability of  $+4$  oxidation state increases and of the other oxidation states decreases due to inert pair effect.

Oxygen generally exhibits  $-2$  oxidation state, but when it is bonded to fluorine, its oxidation state changes and thus, it exhibits other oxidation states also.

(c)

## Electron Negativity.

Electron Negativity (or electronegativity) of these elements is more than the group 15 elements, but lesser than group -17 elements.

Oxygen is the second highest electronegative element in the periodic table.

Down the group, electron negativity decreases.

Ans).

### (a) Reducing Sugar

Reducing sugars could be stated as the carbohydrates which reduces Tollen's reagent to silver and Fehling's solution to  $Cu_2O$  (cuprous oxide).

For example, glucose & fructose.

### (b) Oligosaccharide

Oligosaccharides are the disaccharides only. Thus, the oligosaccharides could be stated as the carbohydrates which leads to the formation of 2-10 molecules of monosaccharides on hydrolysis.

For example, sucrose & maltose.

### (c) Protein

Proteins could be stated as the biomolecules which are important for growth and maintenance of the cells in living organisms. There are two types of proteins :-

(i) Globular proteins

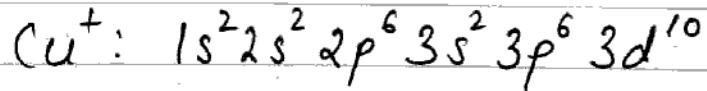
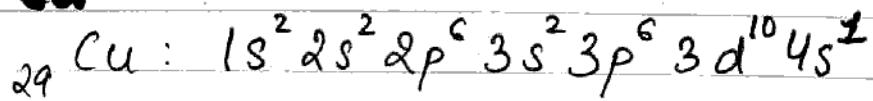
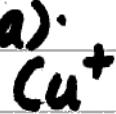
(ii) Fibrous proteins.

Proteins are important for growth of the body. Deficiency of proteins causes

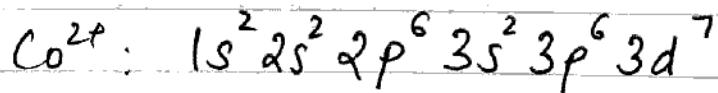
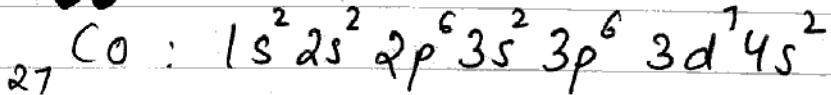
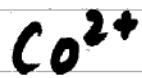
diseases like Krasilnikov's.

A 26)

(i)



(ii)



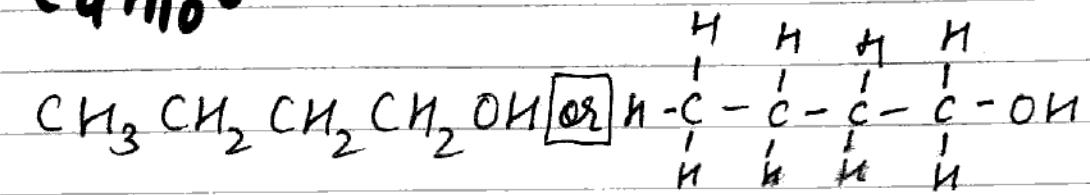
(b).

Transition elements form complex compounds due to the availability of vacant d-orbitals in them which are available for accepting the lone pair of electrons donated by the ligands.

Thus, they bond with the ligands, which are Lewis Base and themselves, act as Lewis Acid.

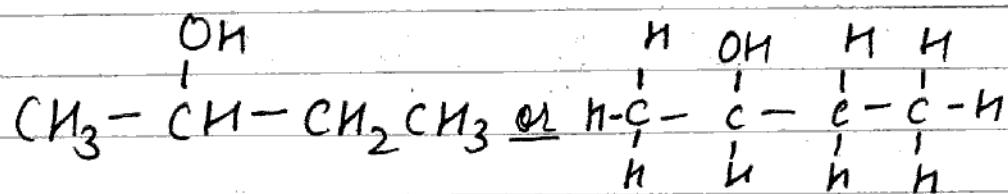
**A 27) 3 isomers of Molecular formula,  
 $C_4H_{10}O$**

(i).



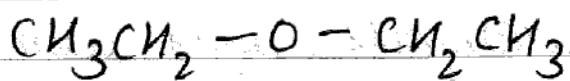
IUPAC name  $\rightarrow$  butan-1-ol  
 (or butanol)

(ii).



IUPAC name  $\rightarrow$  butan-2-ol  
 (or 2-butanol)

(iii).



IUPAC name  $\rightarrow$  ethoxyethane

**A 28).**

(a).

Integrated Rate Equation of First Order Reaction

A first order reaction may be regarded as the one in which the rate of its reaction is directly proportional to the concentration of only one reactant.

For any reaction,



{ R = reactant  
P = product }

Rate of reaction  $\propto [R]^1$

$$-\frac{d[R]}{dt} \propto [R]$$

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

{ k = Rate Constant }

$$\frac{d[R]}{[R]} = -k dt \quad \left\{ \text{separating the variables} \right.$$

Integrating both sides,

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

$$du[R] = -kt + I \quad \text{--- (1)}$$

{ I = constant of integration }

When  $t = 0$

$$[R] = [R]_0 \quad \left\{ [R]_0 = \text{initial conc.} \right\}$$

$$\text{Thus, } du[R]_0 = -k \times 0 + I$$

$$\ln[R]_0 = I$$

Putting the value of  $I$  in eq<sup>n</sup> ①,

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

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

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

$$kt = 2.303 \cancel{R} \log_{10} \frac{[R]_0}{[R]}$$

{Converting to base 10 value}  
Thus, rate constant,

$$k = \frac{2.303}{t} \log_{10} \frac{a}{a-x}$$

where,  $a$  = initial conc.

$a-x$  = conc. at time  $t'$

Thus, this is the integrated rate equation of 1st order.

(b) Given,  $k = 2.31 \times 10^{-3} \text{ sec}^{-1}$

We know,  
half life of reaction,

$$t_{V_2} = \frac{0.693}{k}$$

$$\text{So, } t_{V_2} = \frac{0.693}{2.31 \times 10^{-3}}$$

$$t_{V_2} = \frac{693.00}{2.31} \times 10^3$$

Thus,  $t_{V_2} = 300 \text{ sec.}$

half life period of reaction = 300 sec.

A 29).

(a) ·

### Ostwald Process

Nitric acid ( $\text{HNO}_3$ ) is prepared by Ostwald process by the oxidation of ammonia. The oxidation of ammonia is the principle reaction and further, the reaction is proceeded to obtain nitric acid.

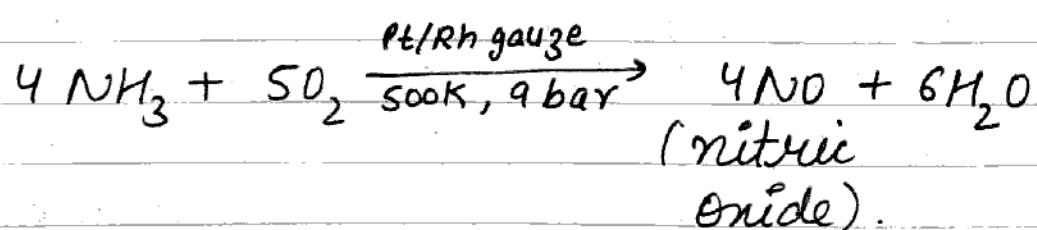
The steps involved in the preparation of nitric acid by Ostwald process are as follows:

ci) -

#### Catalytic Oxidation of Ammonia

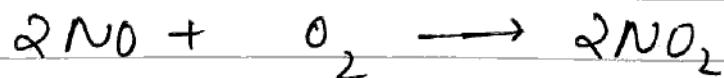
The oxidation of ammonia is done in the converter which contains platinum gauze acting as catalyst.

A 29)(a) Ammonia and oxygen in the ratio 1:10 is used to the converter where the following reaction takes place :-



In the converter, nitric oxide (NO) is formed, which is further passed to the oxidising chamber.

(ii) Oxidising chamber (Oxidation of NO):  
Further, before passing nitric oxide to oxidising chamber, it is passed through cooler as the earlier reaction is exothermic. Further NO reacts with oxygen to form  $\text{NO}_2$ .



$\text{NO}_2$  formed is then passed to absorption tower.

(iii) Absorption tower:

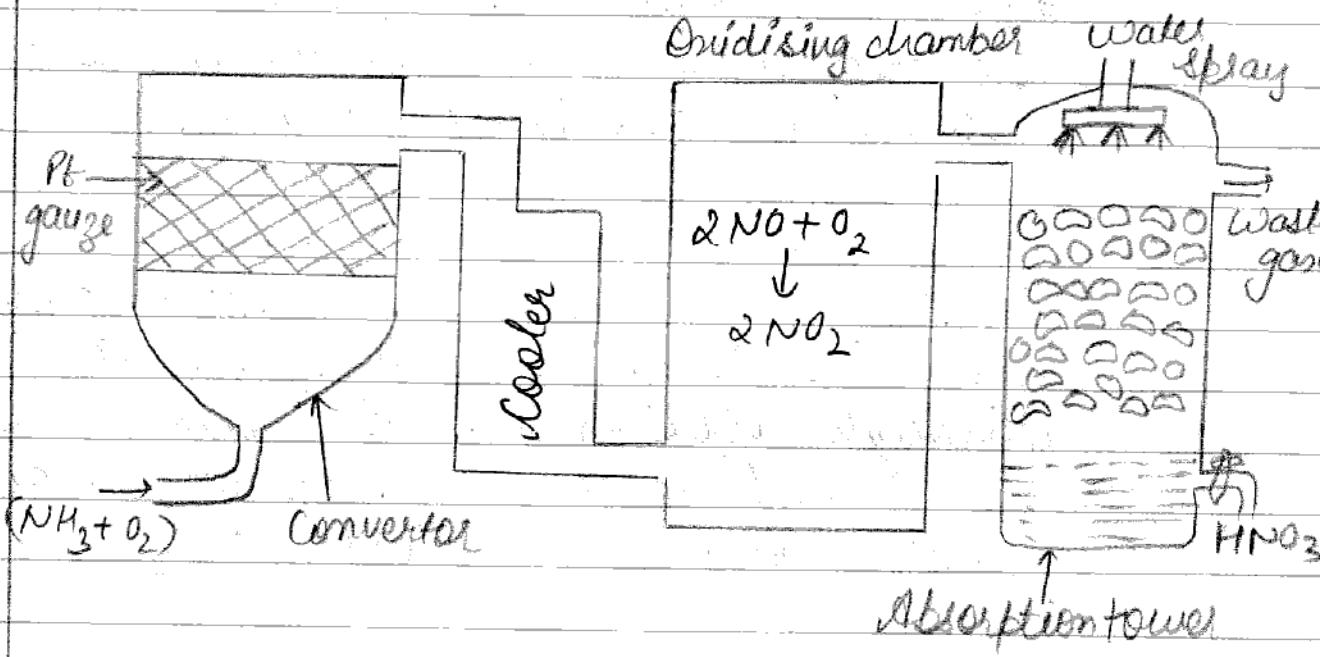
The absorption tower contains acid proof flint in it. Water is sprayed from above where  $\text{NO}_2$  reacts with it to form nitric acid.



Thus, NO is recycled.

Nitric Acid obtained contains 68% of it by mass or it could be said that it is 68% concentrated.

Further, by reacting it with conc.  $\text{H}_2\text{SO}_4$ , it is made 98% concentrated.



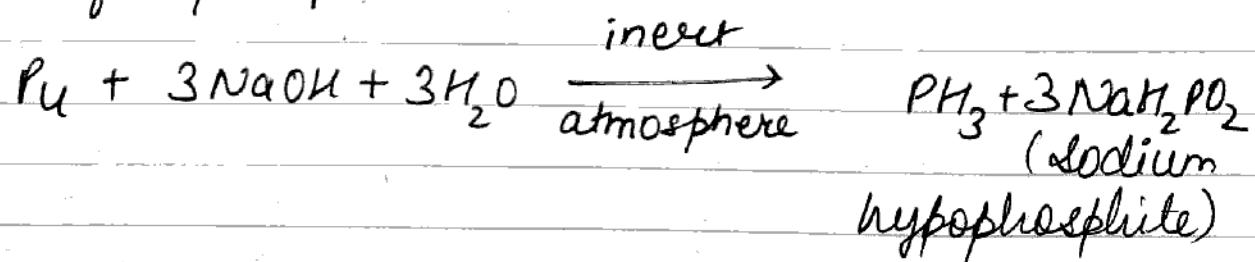
Flow Chart for formation of Nitric Acid.

**Aqua Regia:** When 3 parts of conc.  $\text{HCl}$  and 1 part of conc.  $\text{HNO}_3$  are added together, then it is called aqua regia.

The noble metals could be dissolved by aqua regia.

## (b) Preparation of Phosphine

When phosphorus (white phosphorus) is reacted with conc. NaOH and water in an inert atmosphere of  $\text{CO}_2$ , it leads to the formation of phosphine.



Inert atmosphere is important for the formation of phosphine so that it does not escape outside as it is a poisonous gas.

Phosphine is used in Holme's signal.

A 30).

Given, organic compound contains:

H E - 11.63 %.

C - 69.77 %.

Thus, % of oxygen (O) =  $100 - (11.63 + 69.77)$

also, O - 18.6 %.

### Determination of Empirical Formula

Element	%.	Atomic Mass	% / Atomic Mass	Simplest ratio
C	69.77	12	5.81	$5.81/1.16 = 5$
H	11.63	1	11.63	$11.63/1.16 = 10$
O	18.60	16	1.16	$1.16/1.16 = 1$

Thus, Empirical formula =  $C_5H_{10}O$ .

Empirical formula mass =

$$(2 \times 5) + (10 \times 1) + 16 \\ = 86$$

Thus,  $n = \frac{\text{Molecular formula mass}}{\text{Empirical formula mass}}$

$$n = \frac{86}{86}$$

{ Given, Molecular mass = 86 }

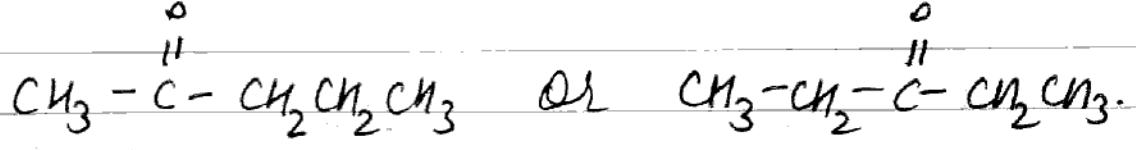
$$\text{also, } n = 1$$

$$\text{Thus, molecular formula} = (\text{C}_5\text{H}_{10}\text{O})_n \\ = \text{C}_5\text{H}_{10}\text{O}$$

This organic compound could be either a ketone or aldehyde.

But, it is given that the compound does not reduce Tollen's reagent, but forms an additional compound with  $\text{NaHSO}_3$  & gives '+'ve Fehling test. So, it is a ketone.

Now, 2 possible structures of ketone are possible

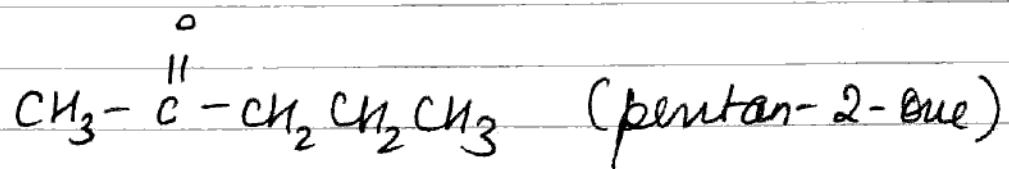


pentan-2-one

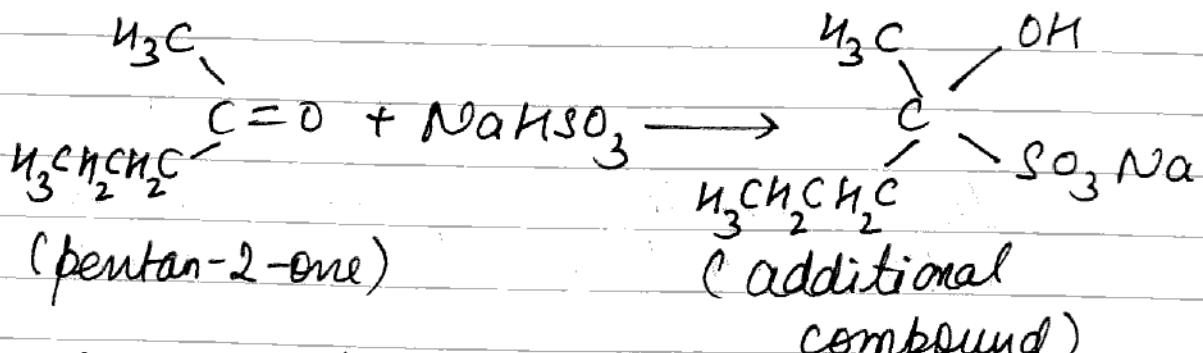
pentan-3-one

But, it is given that on vigorous oxidation, it gives ethanoic acid and propenoic acid, so it is pentan-2-one.

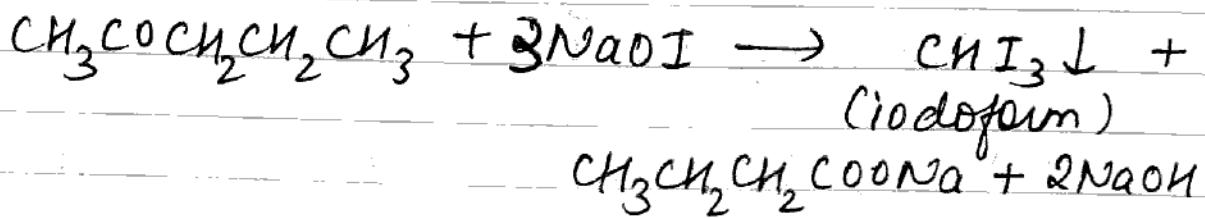
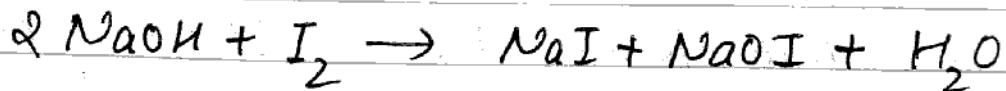
Possible structure of compound A



## Chemical Reactions Involved



Godofrom test



Oxidation

