

उत्तराखण्ड विद्यालयी शिक्षा परिषद्, रामनगर (नैनीताल)

इण्टरमीडिएट परीक्षा "अ"  
(उत्तराखण्ड) 12 पन्ने

केन्द्र का नाम \_\_\_\_\_  
नोट-केंद्र के नाम की मुहर उत्तरपुस्तिका के किसी भी भाग पर न लगाएं।

नोट-परीक्षार्थी उत्तरपुस्तिका के किसी भी भाग में अपना नाम व केंद्र का नाम न लिखें।

'ब' उत्तर पुस्तिका की संख्या- 

ब <sub>1</sub>	ब <sub>2</sub>	ब <sub>3</sub>	ब <sub>4</sub>
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हस्ताक्षर कक्ष निरीक्षक-

परीक्षार्थी द्वारा भरा जायेगा-  
अनुक्रमांक (अंकों में)-  
अनुक्रमांक (शब्दों में)  
विषय-  
प्रश्नपत्र संकेतांक-  
परीक्षा का दिन-  
परीक्षा तिथि-

परीक्षक, निम्न तालिका में प्रत्येक प्रश्न तथा उसके खण्डों के प्राप्तांकों का विवरण यथास्थान भरे।

प्रश्न संख्या	क	ख	ग	घ	ङ	च	छ	ज	झ	ञ	योग
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कक्ष निरीक्षक द्वारा भरा जाय-  
केन्द्र संख्या-  
परीक्षा कक्ष संख्या-  
उपरोक्त सभी प्रविष्टियों की जाँच भरे द्वारा सावधानीपूर्वक कर ली गयी है।  
कक्ष निरीक्षक का नाम-  
दिनांक-  
हस्ताक्षर कक्ष निरीक्षक-

प्रमाणित किया जाता है कि मैंने इस उत्तर पुस्तिका का मूल्यांकन समुचित प्रश्न-पत्र संकेतांक तथा मूल्यांकन निर्देशों के अनुसार किया है। प्राप्तांकों का मुखपृष्ठ पर अग्रसारण कर प्राप्तांकों एवं प्राप्तांकों के योग का मिलान कर लिया गया है। एवार्ड ब्लैक में प्राप्तांकों की अंकना कर उनका पुनः मिलान भी कर लिया है। किसी भी प्रकार की त्रुटि के लिए मैं उत्तरदायी रहूँगा/रहूँगी।

परीक्षक के हस्ताक्षर एवं संख्या.....  
1. अंकेशक के हस्ताक्षर एवं संख्या  
2. अंकेशक के हस्ताक्षर एवं संख्या

सन्निरीक्षा प्रयोगार्थ  
सन्निरीक्षा पूर्व अंक-  
सन्निरीक्षा पश्चात् अंक-  
त्रुटि का प्रकार-  
दिनांक-  
हस्ताक्षर निरीक्षक-

योग (शब्दों में)..... योग (अंकों में) \_\_\_\_\_

A1)

(i) Aerosol

A2)

(ii) Formic Acid

A3)

(ii) Ethane

A4)

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

A5)

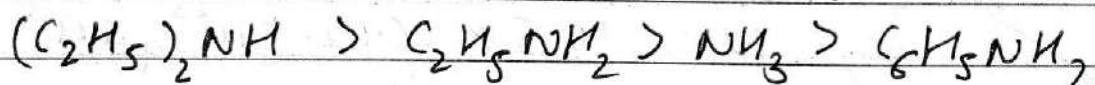
Monomer of PVC = vinyl chloride

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). Given, silver crystallises in fcc lattice. So,

$$Z = 4$$

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

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

$$M = ?$$

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

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

$$M = \frac{10.5 \times 3.011 \times 10^{23} + (4.077)^3 \times 10^{-24}}{42}$$

$$M = 10.5 \times 3.011 \times 10^{-1} \times \frac{33.88}{2}$$

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

$$M = 107.06 \approx 107$$

Atomic mass of silver = 107 g.

## A11). 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,

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

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

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

$$\{ 1 \text{ L} = 1000 \text{ cm}^3 \}$$

Molarity of solution,

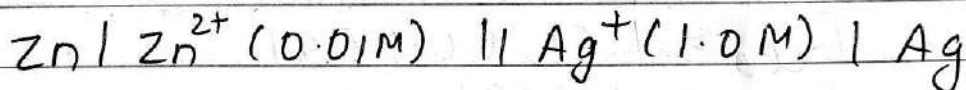
$$M = \frac{W}{M'V}$$

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

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

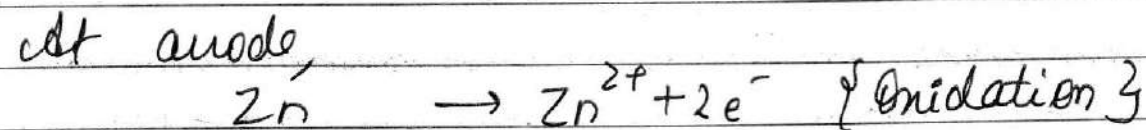
$$M = 0.25 \text{ mol/L Ans}$$

A14)

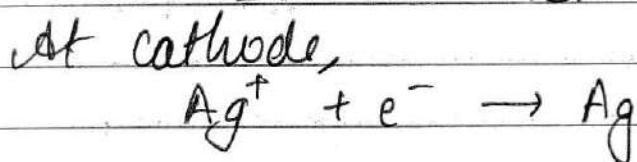


$$E^\circ_{\text{cell}} = 1.56 \text{ V}$$

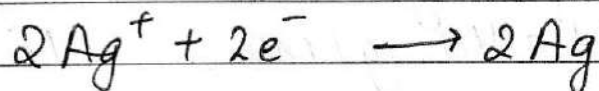
at anode,



at cathode,



Multiplying by 2,



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

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

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

do,

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

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

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

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

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

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

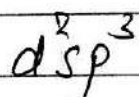
# A15) Valence Bond Theory (VBT)

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  

$sp^3$	tetrahedral
$sp^3d$	trigonal bipyramidal
$sp^3d^2$	octahedral





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)  $\text{CH}_2=\text{CHCH}_2\text{Cl}$   $\frac{1}{2}$

(b)

Benzyl chloride (4)  $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$   $\frac{1}{2}$

(c). Vinyl Chloride  $(1) CH_2=CHCl \cdot \frac{1}{2}$

(d). Freon  $(2) CCl_2F_2 \cdot \frac{1}{2}$

### 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, Acrylene 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.

c 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}

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

$$R = \frac{\pi M'V}{wT}$$

$$R = \frac{312 \times 342 \times 1}{450 \times 293}$$

$$= \frac{10944}{131850} = \frac{1094.4}{13185}$$

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

## A 21) Main Ores of Iron

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

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

## Extraction of Iron

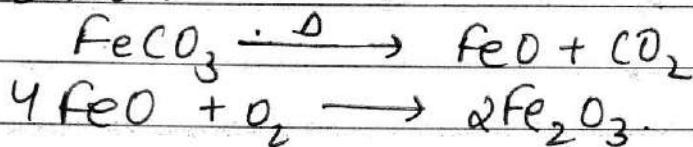
The steps involved in the extraction of iron are as follows:

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.

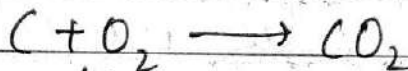


### ④. Smelting

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:

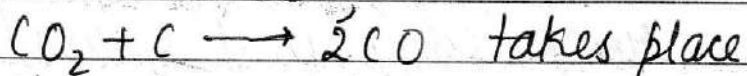
(i). Combustion Zone (At 2170 K)  
Coke is burned



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

(ii). Fusion Zone (At 1570 K)

Here, the reaction



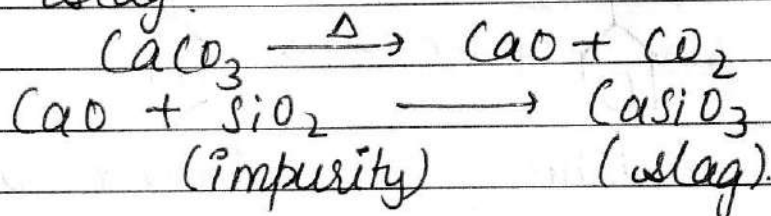
Thus, the temperature is reduced

to 1570 K.

ciii) Slag Formation Zone (at 1270 K)

Here, slag is formed.

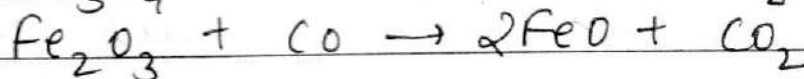
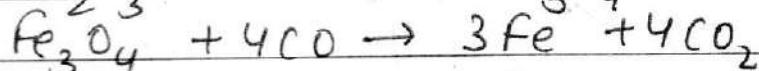
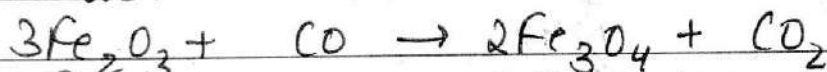
The limestone first decomposes to CaO (quick lime) which acts as flux and converts the acidic impurity to slag.



civ). Reducing <sup>on</sup> Zone

Here, the temperature is around 500-800.

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.

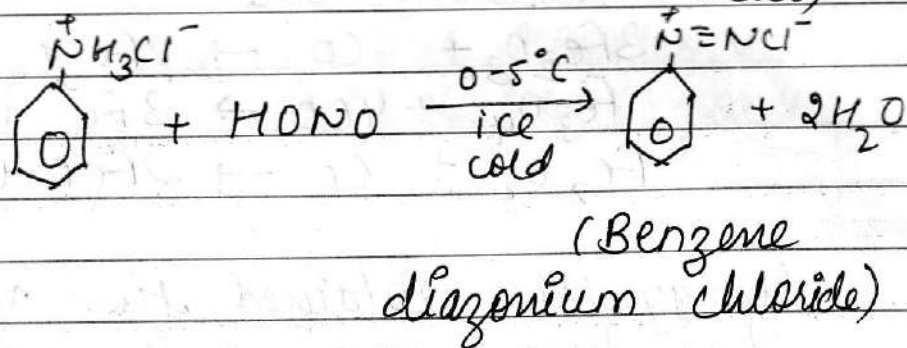
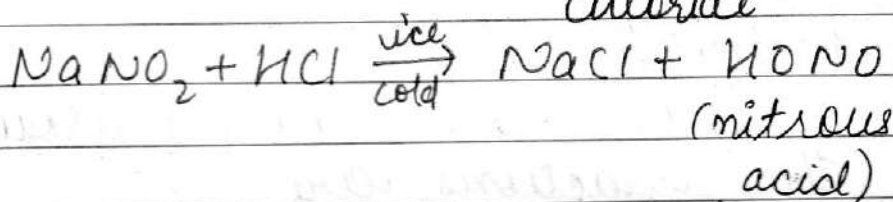
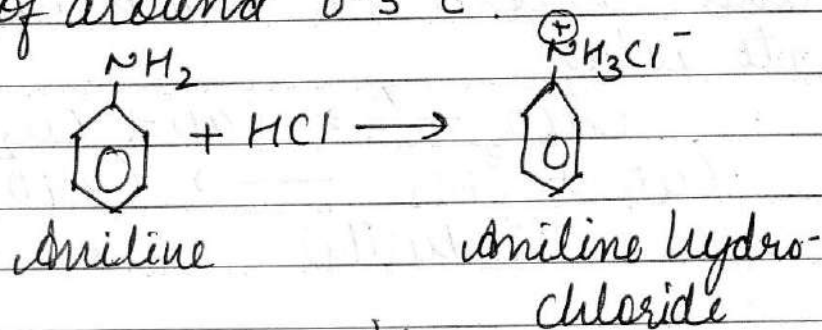
Thus, in this way, cast iron is obtained from haematite.



A22)  
(a)

## Diazotisation

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



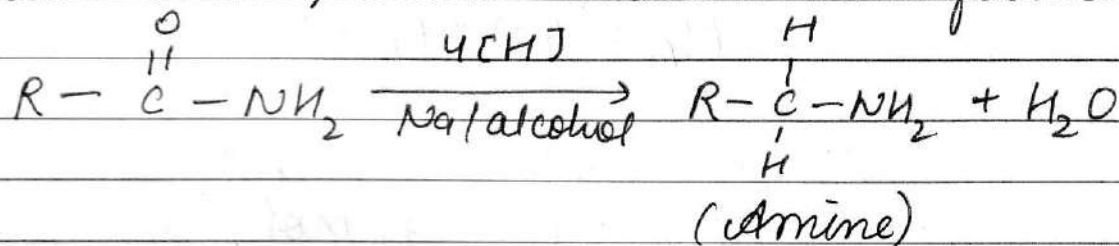
Nitrous acid is prepared by reacting  $\text{NaNO}_2$  and  $\text{HCl}$  in ice cold conditions, which when further reacted with the aniline hydrochloride forms benzene diazonium chloride. This is the process of diazotisation.

## cb) Reduction of Amides

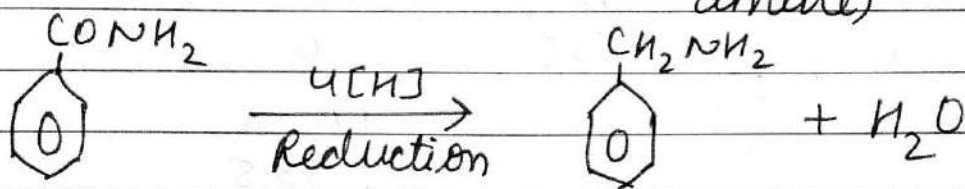
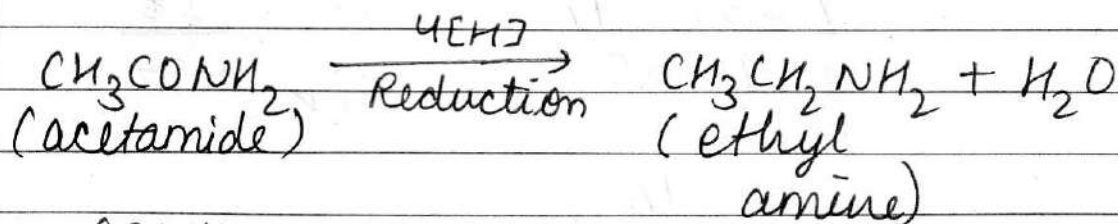
Whenever the  $-OH$  group in the carboxylic acids is replaced by  $-NH_2$  group. Then, it is called amide. It may be represented as:-

$$R-\overset{\overset{O}{\parallel}}{C}-NH_2$$

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



Different reducing agents may be used for the reduction of amides like  $Sn/HCl$  or  $Na/alcohol$  or  $LiAlH_4$ . But, the product formed after the reduction remains same, which is the amine. The loss of an  $H_2O$  molecule takes place. For example,



A 23)

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

{ A = solvent    B = solute }

$$W_B = 25 \text{ g}$$
$$W_A = 450 \text{ g} \quad P_A = ?$$

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,

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

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

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

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

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

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

## A 24) Trends in property in 6-16

ca).

Ionization Enthalpy

As, we know that the general electronic configuration of elements of group 16 is  $ns^2 np^4$ . 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  $ns^2 np^3$ . 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)  
cb)

## 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.

cc)

## 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  $\text{Cu}_2\text{O}$  (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

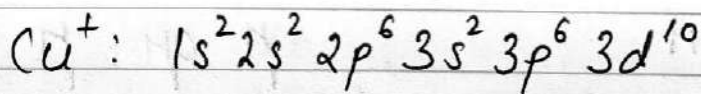
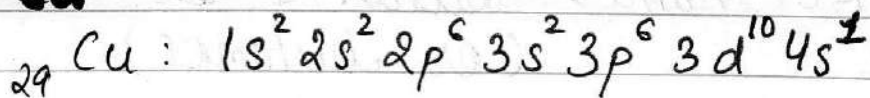
(ii). Fibrous proteins.

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

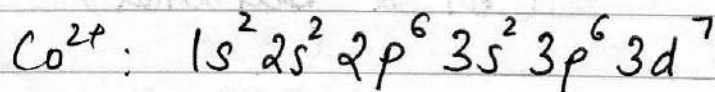
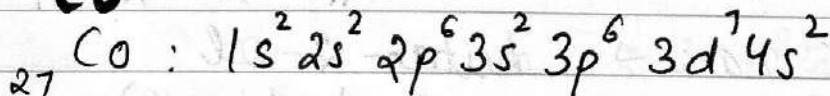
diseases like Kwashiorkor.

A 26) (a).

(i)  $\text{Cu}^+$



(ii)  $\text{Co}^{2+}$



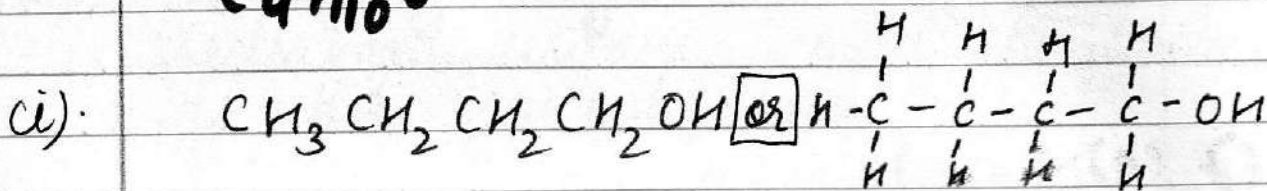
(b).

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.

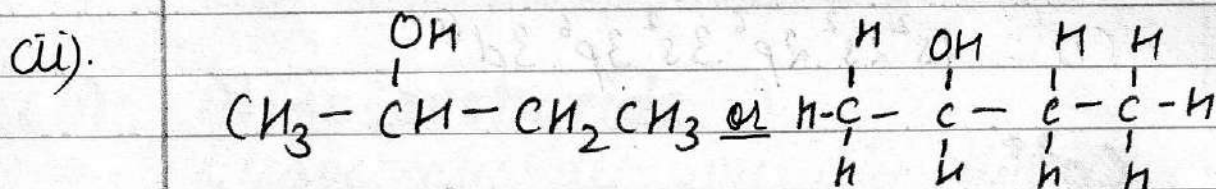
Thus, they bond with the ligands, which are Lewis Base and themselves, act as Lewis Acid.



A 27). 3 isomers of Molecular Formula,  
 $C_4H_{10}O$

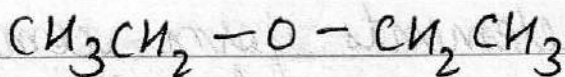


IUPAC name  $\rightarrow$  butan-1-ol  
(or butanol)



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

(iii).



IUPAC name  $\rightarrow$  ethoxy ethane

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,  
 $R \rightarrow P$

{ 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,

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

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

{ I = constant of integration }

When  $t = 0$

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

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

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

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

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

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

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

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

{Converting to base 10 value}

Thus, rate constant,

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

where,  $a$  = initial conc.

$a-x$  = conc. at time  $t$

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

c b) .

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

We know,

half life of reaction,

$$t_{1/2} = \frac{0.693}{k}$$

$$\text{So, } t_{1/2} = \frac{0.693}{2.31 \times 10^{-3}}$$

$$t_{1/2} = \frac{\cancel{69300} \ 300}{\cancel{2.31}}$$

Thus,  $t_{1/2} = 300$  sec.

Half life period of reaction = 300 sec.

A29).  
(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:

(i) -

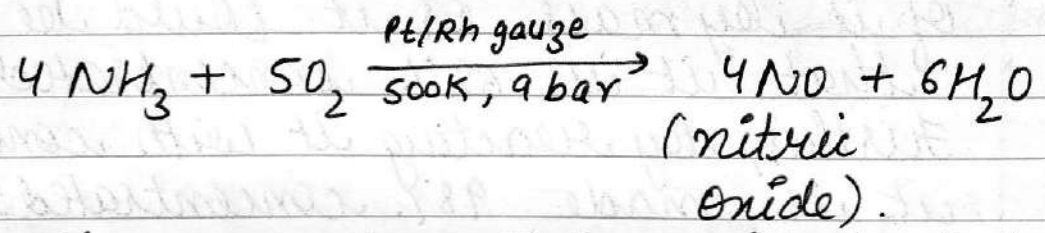
Catalytic Oxidation of Ammonia

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



A 29)(a)

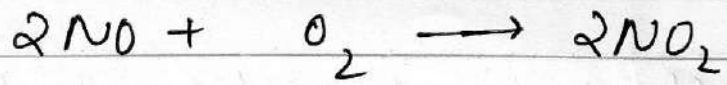
Ammonia and oxygen in the ratio 1:10 is used to the converter where the following reaction takes place:-



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

cii)

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  $\text{NO}_2$

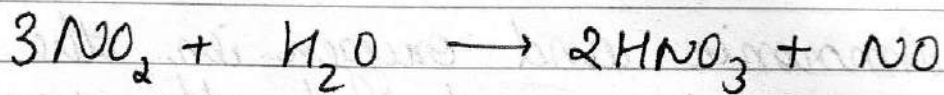


$\text{NO}_2$  formed is then passed to absorption tower.

ciii)

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.

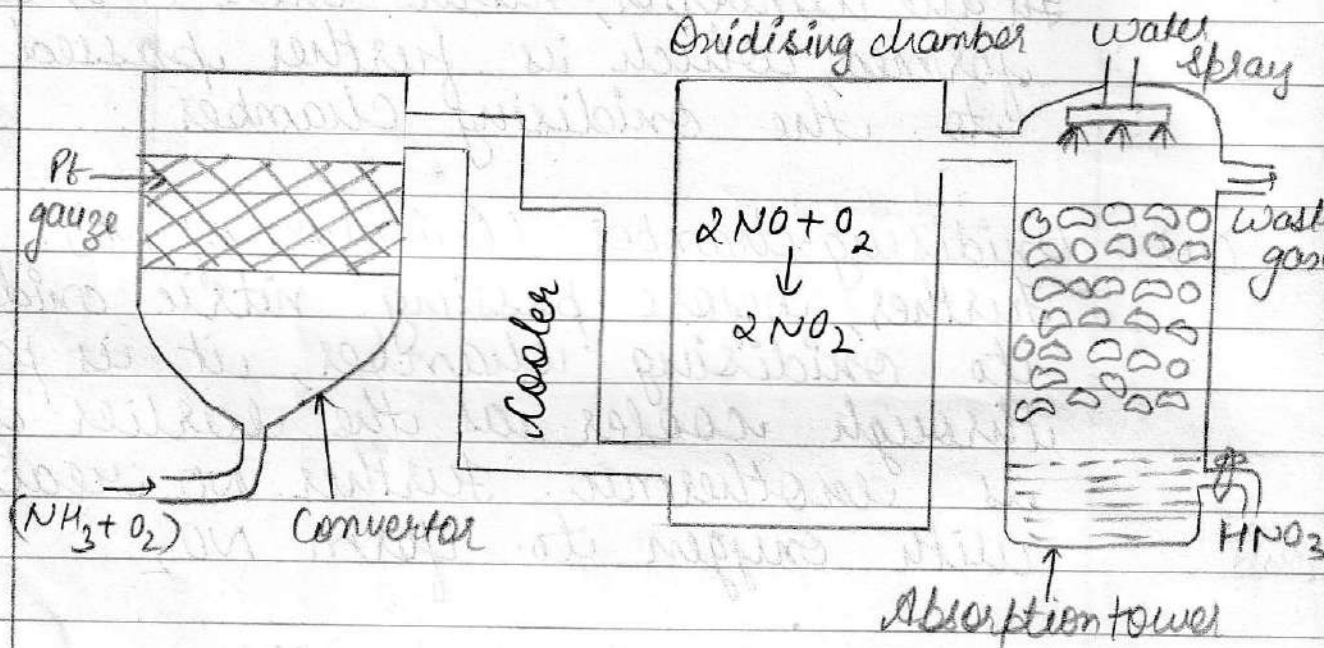




Thus, NO is recycled.

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.

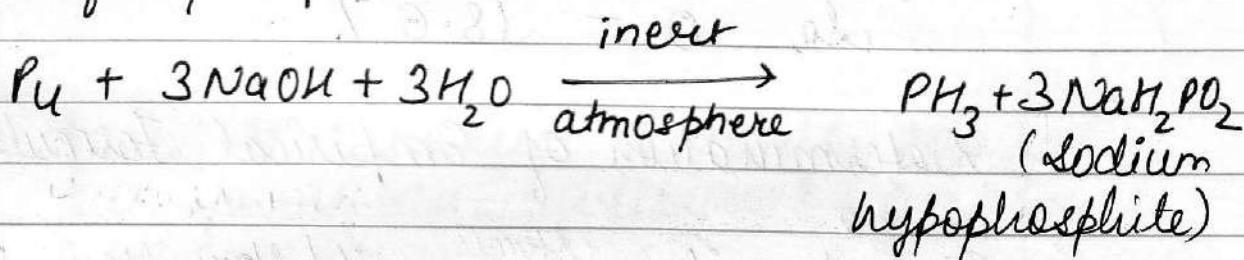
**Aqua Regia:** When 3 parts of conc. HCl and 1 part of conc.  $\text{HNO}_3$  are added together, then it is called aqua Regia.

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 = 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 }

also,  $n = 1$

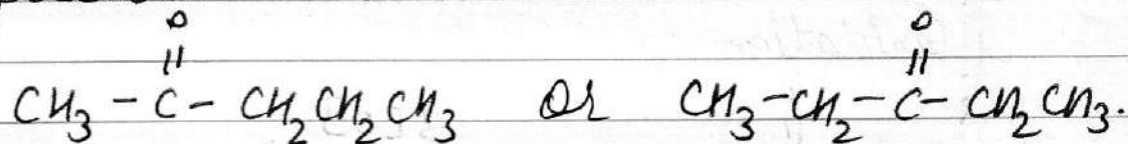


Thus, molecular formula =  $(C_5H_{10}O)_n$   
=  $C_5H_{10}O$

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  $NaHSO_3$  & gives '+ve' Iodoform test. So, it is a ketone.

Now, 2 possible structures of ketone are possible

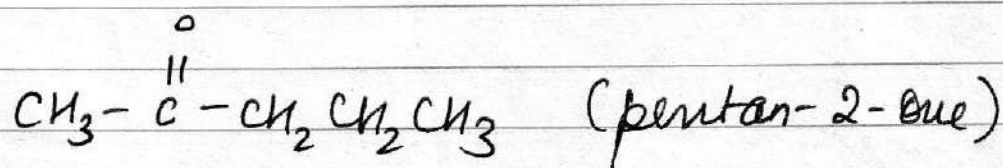


pentan-2-one

pentan-3-one

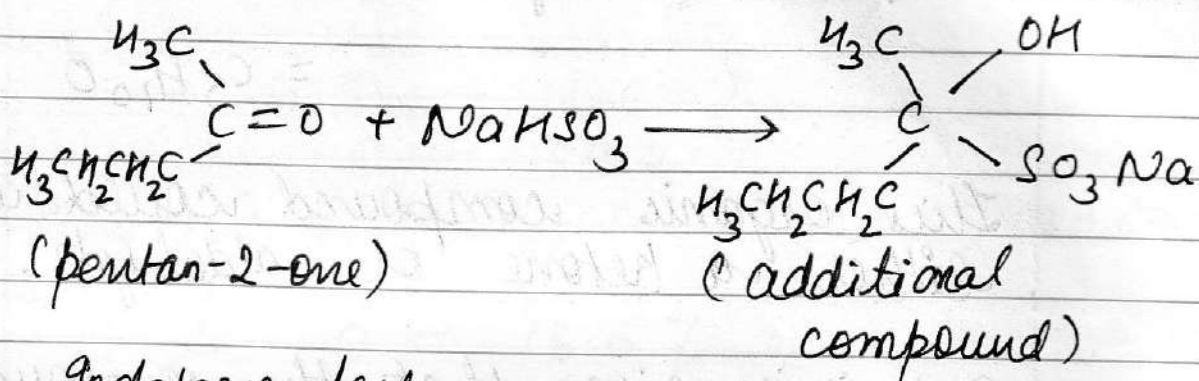
But, it is given that on vigorous oxidation, it gives ethanoic acid and propenoic (acid), so it is pentan-2-one.

Possible structure of compound A

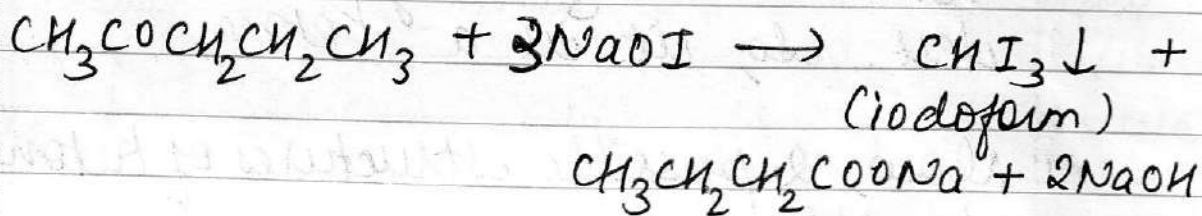
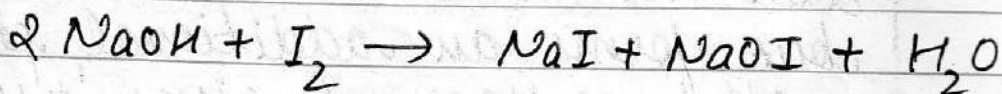




## Chemical Reactions Involved



## Iodoform test



## Oxidation

