

This Question Paper contains 8 Printed Pages]

052(E)
(MARCH, 2003)

Time : 3.00 Hours]

[Maximum Marks : 100

Instructions :

1. There are **FIVE** questions in this question paper. **All** are compulsory.
2. Give equations and diagrams wherever necessary.
3. You may ask for log-table, if required.
4. Atomic Weight (gm.mole⁻¹) :
H = 1, C = 12, O = 16, S = 32, Mg = 24.3.
5. (i) $E^0_{Ag/Ag^+} = -0.80$ Volt
(ii) $E^0_{\frac{1}{2}H_2/H^+} = 0.00$ Volt
6. (i) Planck's Constant $h = 6.626 \times 10^{-27}$ erg. sec.
(ii) Velocity of light $c = 3.0 \times 10^{10}$ cm . sec⁻¹.

Q.1. (A) Answer the following questions in short.

5

- (1) What are Alumino-silicates?
- (2) State the conductivity of Metals and Insulators.
- (3) A particular reaction will occur spontaneously or not and also, to determine the equilibrium constant of spontaneous reaction, which law of Thermodynamics is used? State this law.
- (4) What is Temperature?
- (5) CH_3NH_2 is a stronger base than NH_3 . Why?

[2]

(B) Solve **ANY TWO** of the following numericals.

6

- (1) pH of an aqueous solution containing 1.5 gram acetic acid is 2.88 at 25°C temperature. Find the volume of this solution.

K_a of Acetic acid is 1.75×10^{-5} at 25°C temperature.

- (2) For the reaction $\text{NO}_{(g)} + \text{O}_{3(g)} = \text{NO}_{2(g)} + \text{O}_{2(g)}$ equilibrium constant is 5.648×10^{34} at 25°C temperature. The standard free energy of formation of $\text{NO}_{(g)}$ and $\text{O}_{3(g)}$ are 20.72 and 39.06 K.cal.mole⁻¹ respectively at 25°C temperature. Calculate Standard Free Energy of formation of $\text{NO}_{2(g)}$.

- (3) The concentration of $\text{Mg}(\text{OH})_2$ in its saturated solution is $5.83 \times 10^{-4}\%$ (w/v). Calculate K_{sp} of $\text{Mg}(\text{OH})_2$.

(C) Answer **ANY THREE** of the following questions.

9

- (1) Give the classification of solids on the basis of electrical conductivity and discuss their properties.
- (2) Explain :
- (i) Acid-base Titration and pH.
 - (ii) Microscopic dividing line between Dissociation and Ionisation.
- (3) Explain :
- (i) Classification of Silicate compounds.
 - (ii) Paramagnetic substances.
- (4) A piece of ice kept in atmosphere at 25°C melts spontaneously but liquid water does not get converted into ice spontaneously at this temperature. By which law of Thermodynamics, we can explain this observation? Explain it.

Q.2. (A) Answer the following questions in short.

5

- (1) Which information is provided by an integrated rate law of reaction?

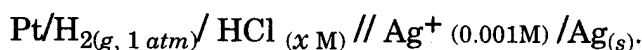
[3]

- (2) What is Oxidation potential and Reduction potential?
- (3) What is utilized in the construction of Electron Microscope?
- (4) What is essential to study the chemical and physical properties of molecules?
- (5) How many coulombs of electricity should be passed through 1 mole of aqueous Copper sulphate to obtain 1 mole of Copper metal during electrolysis?

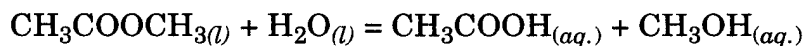
(B) Solve **ANY TWO** of the following numericals.

6

- (1) The potential of the following cell is 0.92 volt at 25°C. Calculate pH of HCl solution.



- (2) Methyl acetate added to 0.05 M HCl solution at 25°C undergoes the following hydrolysis reaction.



25 ml of the reaction mixture was withdrawn each time periodically and transferred to a flask containing ice to stop the reaction. Then it was titrated against 0.05 M NaOH. The following readings were recorded during the experiment. Prove that this reaction is of First order.

(i) Time (t)	t_0 0	t_1 20	t_2 75	t_3 120	t_∞ ∞
(ii) Volume of 0.05M NaOH used for titration (V ml)	V_0 24.40 ml	V_1 25.82 ml	V_2 29.35 ml	V_3 31.75 ml	V_∞ 47.50 ml

- (3) (i) Calculate energy of photon of radiation having wave-length 6000 Å.

[4]

- (ii) Calculate the mass of an electron having $7.0 \text{ \AA}$ wave-length and velocity $3.0 \times 10^{10} \text{ cm. sec}^{-1}$.

(C) Answer **ANY THREE** of the following.

9

- (1) What is Cell Potential? Draw the figure of Daniell cell and represent it by symbolic method and write the work of Salt bridge.
- (2) Discuss the factors affecting the rates of reaction with proper illustration.
- (3) Answer the following questions.
 - (i) Why do we believe that s-orbital is spherical?
 - (ii) Give electronic configuration of O_2 molecule. Determine its bond order and explain its magnetic property.
- (4) Explain :
 - (i) Angular momentum quantum number (l)
 - (ii) Nernst's equation.

Q.3. (A) Answer the following questions in short.

5

- (1) Fluorine can not form a positive ion, but it forms a negative ion. Why?
- (2) What is Cohesive Energy? On which it depends?
- (3) Give IUPAC names of
 - (i) Phenetol
 - (ii) Acetanilide
- (4) Give structural formulae of
 - (i) Benzamide
 - (ii) Catechol

[5]

- (5) Which reaction takes place when Phenol is heated with Acetic anhydride? Give chemical equation and structural formulae of main organic compounds and name of the product.

- (B) Write chemical equations for **ANY THREE** of the following conversions. Also give the conditions of the reactions, names and structural formulae of the main organic compounds.

6

(There should be only two steps of each conversion)

- (1) Benzene diazonium chloride from Chlorobenzene.
- (2) Benzene from Toluene.
- (3) Ethyl Iodide from Ethyl chloride.
- (4) Butane from Diethyl ether.

- (C) Answer **ANY THREE** of the following.

9

- (1) Discuss the physical properties of Halogen elements.
- (2) Explain :
 - (i) Electro-negativity and bond type in Alkali metals.
 - (ii) Reduction reaction in Alkali metals.
- (3) Various methods for the preparation of Hydrocarbon from Alkyl halides.
- (4) Explain reasons
 - (i) Nucleophilic substitution reaction of aryl halides is difficult as compared to that of alkyl halide.
 - (ii) π electrons in Benzene are indicated by a circle instead of double bonds.

- Q.4. (A)** Answer the following questions in short.

5

- (1) What are Optical brightners? Write uses of it.
- (2) Why Penicillin can not be taken by mouth? Write its effect on bacteria.

[6]

- (3) What is called Hofmann's reaction?
- (4) Carboxylic acids have higher boiling points as compared to those of alcohols. Why?
- (5) Reaction of Acetophenone in presence of LiAlH_4 . Give chemical equation, structural formulae and IUPAC name of the main product.

(B) Write the chemical equation for **ANY THREE** of the following conversions. Also give the conditions of the reactions, names, and structural formulae of main organic compounds. There should be only two steps of each conversion. 6

- (i) Acetophenone from Diazonium salt.
- (ii) Acetanilide from Benzamide.
- (iii) Ethene from Ethyl Acetate.
- (iv) Methane from Acetic Anhydride

(C) Answer **ANY THREE** of the following questions. 9

Explain :

- (1) (i) Industrial production of Alkyl benzene-sulphonates and its uses.
(ii) Hypoglycaemia and Hyperglycaemia.
- (2) (i) Hormones and their classification.
(ii) Preparation of Paracetamol and its uses.
- (3) *Explain :*
 - (i) Tollen's Test
 - (ii) Carbylamine Test.
- (4) (i) Classification of Amines.

[7]

- (ii) Reaction of Ethane nitrile with Ethanol in presence of concentrated H_2SO_4 . Give chemical equation, name of products and structural formulae of it.

Q.5. (A) Answer the following questions in short.

5

- (1) How is Black Phosphorous prepared? Give its characteristics.
- (2) Give the IUPAC name of the complex.
 $\text{K}[\text{Co}(\text{NH}_3)_2(\text{ox})_2]$
- (3) What are called the Transition elements? Give the electronic configuration of Chromium.
- (4) Write the balanced chemical equation reaction of Antimony with Nitric acid.
- (5) Give the molecular formula of the substance obtained by the reduction of aqueous Copper sulphate with Sodium hypo-phosphite. Also indicate its colour.

(B) Answer the following questions.

6

- (1) What is a Ligand? Give structure of Hexadentate Ligand.
- (2) Give balanced chemical equation for the following reactions.
 - (i) Reaction of Ferrous sulphate with HNO_3 in presence of Sulphuric acid.
 - (ii) Reduction of Potassium Nitrate by Sodium - Mercury amalgam.
- (3) Cu^{2+} ion like other transition element ions is coloured, while Cu^{1+} ion is colourless.

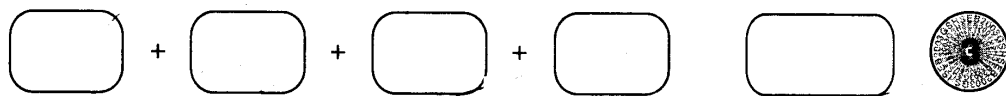
(C) Answer **ANY THREE** of the following questions.

9

- (1) Preparation of Arsenic acid and give the molecular formula and name of its Sodium salts.
 - (2) Explain d^2sp^3 hybridization with examples of Potassium Ferrocyanide and discuss its geometrical structure and magnetic property.
 - (3) Give electronic configuration of Vanadium and Manganese elements. Discuss their different oxidation states.
 - (4) Explain :
 - (i) Complexes in nature.
 - (ii) Physical properties of the Inert Gas elements.
-



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Q I A

1) Alumino Silicates

When one or more atoms of silicate tetrahedron is replaced by aluminium, alumino silicates are obtained.

eg. Feldspar

2)

The conductivity of metals is $10^8 \text{ ohm}^{-1} \text{ cm}^{-1}$

Conductivity of insulators $10^{-12} \text{ ohm}^{-1} \text{ cm}^{-1}$



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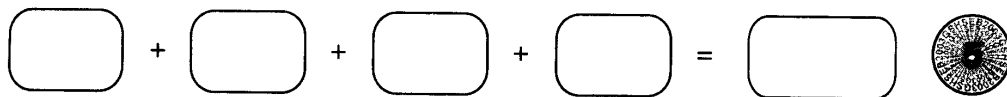
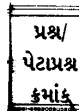
3)

Second law of Thermodynamics
is used to determine whether particular reaction will occur spontaneously or not & also to determine equilibrium constant of spontaneous reaction

Statement

This law is stated in different ways as

- 1) The entropy of universe increases in all spontaneous processes
- 2) The free energy of systems decreases in all spontaneous processes
- 4) Temperature is a measure of level of heat energy possessed by a substance.
However, it doesn't indicate the amount of heat energy possessed by substance.
- 5) CH_3NH_2 is stronger base than NH_3 as K_b value of



CH_3NH_2 is greater than that of NH_3

Q 1 B

1)

Acetic acid is weak acid

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

$$-\log [\text{H}_3\text{O}^+] = -2.88$$

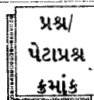
$$\log [\text{H}_3\text{O}^+] = -2.88$$

$$\log [\text{H}_3\text{O}^+] = -3.12$$

$$[\text{H}_3\text{O}^+] = 1.318 \times 10^{-3}$$

$$[\text{H}_3\text{O}^+] = \sqrt{K_a \cdot C_0}$$

$$\begin{array}{r} -1 \quad 1.0000 \\ -2 \quad 0.88 \\ \hline 3 \quad 0.12 \end{array}$$



$$[\text{H}_3\text{O}^+]^2 = K_a \cdot C_0$$

$$C_0 = \frac{(1.318)^2 \times 10^{-6}}{1.75 \times 10^{-5}}$$

$$C_0 = 0.9926 \text{ M}$$

Molecular weight of acetic acid
 CH_3COOH
 $= 24 + 4 + 32$
 $= 60 \text{ gm}$

$$\therefore \text{Moles} = \frac{1.5}{60} = \frac{1}{40} = 2.5 \times 10^{-2} \text{ moles}$$

~~10 liter~~ $\rightarrow$ ~~10~~

0.9926 moles are present in 1 liter
 $\therefore 2.5 \times 10^{-2}$ are present in

$$\frac{2.5 \times 10^{-2}}{0.9926} = 2.519 \times 10^{-2} \text{ l}$$

Volume 25.19 ml.

$$\begin{array}{r} 1173 \\ 26 \\ \hline 1199 \end{array}$$

$$0.1199$$

$$0.1199$$

$$0.2398$$

$$0.2430$$

$$79968$$

$$9968$$

$$18$$

$$9926$$

$$0.3979$$

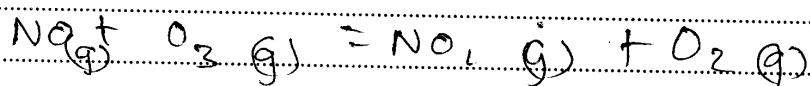
$$0.9968$$

$$1$$

$$0.4011$$



2)



$$\Delta G = -2.303 RT \log K$$

$$= -2.303 \times 1.987 \times 298 \times \log 5.648 \times 10^{34}$$

$$= -2.303 \times 1.987 \times 298 [\log 5.648 + 34]$$

$$= -2.303 \times 1.987 \times 298 \times 34.7519$$

$$= -47400 \text{ cal}$$

Now $\Delta G = \sum \Delta G_f^\circ \text{ Products} - \sum \Delta G_f^\circ \text{ Reactants}$

$$-47400 = (\Delta G_f^\circ \text{NO}_2(g) + \Delta G_f^\circ \text{O}_2(g)) - (\Delta G_f^\circ \text{NO} + \Delta G_f^\circ \text{O}_3(g))$$

$$-47400 = \Delta G_f^\circ \text{NO}_2(g) - (20720 + 39060)$$

$$= \Delta G_f^\circ \text{NO}_2(g) - 59780$$

0.7519

0.3623

0.2983

2.4242

1.5409

4.6757

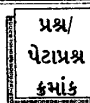
20720

39060

59780

47400

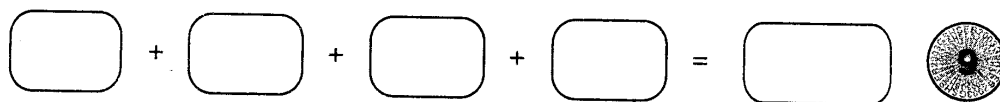
12380



$$\Delta G_f^\circ \text{ NO}_2(g) = 12380 \text{ Cal mole}^{-1}$$

Standard free energy
of formation of NO_2

$$= 12.38 \text{ KCal mole}^{-1}$$



Q | C .

4) By Second law of thermodynamics, this observation can be explained

To know whether any reaction will occur spontaneously or not, the changes in entropy of system & surrounding are calculated assuming that reaction is spontaneous

Suppose one mole of ice is kept in atmosphere at 25°C .

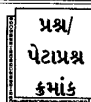
Now one mole of ice at 0°C absorbs 1440 Calorie heat to convert to water at 0°C

If $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} > 0$, reaction is spontaneous

If $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} < 0$, reaction is non spontaneous

$$\therefore \Delta S_{\text{system}} = \frac{q_{\text{rev}}}{T}$$

$$= \frac{1440}{273}$$



$$\Delta S_{\text{system}} = +5.28 \text{ cal } ^\circ\text{K}^{-1}$$

Now atmosphere loses 1440 cal heat, but this loss cannot change its temperature

$$\therefore \Delta S_{\text{surrounding}} = \frac{-1440}{2.73 \times 25}$$

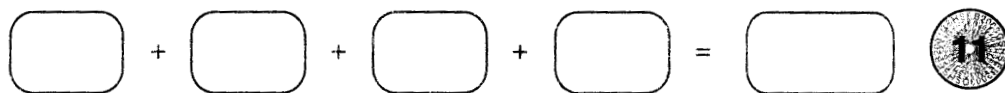
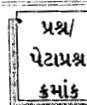
$$\Delta S_{\text{surrounding}} = -4.83 \text{ cal } ^\circ\text{K}^{-1}$$

$$\begin{aligned} \therefore \Delta S_{\text{system}} + \Delta S_{\text{surrounding}} &= 5.28 - 4.83 \\ &= 0.45 \text{ cal } ^\circ\text{K}^{-1} \end{aligned}$$

$$\Delta S_{\text{sys}} + \Delta S_{\text{sur}} > 0$$

$\therefore$ The reaction is spontaneous,

But for reverse reaction, the $\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} < 0$, so the reaction wouldn't be spontaneous.



1) Solids are classified into 3 groups depending on their electrical conductivity.

- 1) Good conductors
- 2) Semiconductors
- 3) Insulators.

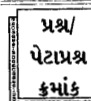
Good conductors have conductivity $10^8 \text{ ohm}^{-1} \text{ cm}^{-1}$

Insulators have conductivity $10^{-12} \text{ ohm}^{-1} \text{ cm}^{-1}$.

The electric conductivity of metals i.e. good conductors is due to easy mobility of electrons & holes. This kind is called electronic conductivity.

The conduction in ionic solids is due to the motion of ions and hence it is ionic conductivity.

At absolute zero temperature, semiconductors like silicon are insulators.



But at higher temperatures, the electrons are excited to higher energy levels and so they become holes & elements become semiconductors.

Addition of impurities also increases conductivity

Transition metal oxides show wide variation in conductivity

~~Good conductors~~

Insulators : TiO

Semiconductors : Ti_2O_3

Good conductor : TiO_2 , Fe, Co

Appearance & conductivity of ReO_3 is like metallic copper



2)

i) Acid Base Titration and pH

Titration is an experimental method used in laboratory to determine concentration of solutions.

A definite amount of acid or base is taken by pipette & solution of base or acid is added till neutralisation is complete.

Indicators are used to detect end point of neutralisation.

Indicators are substances that change their colour during certain pH range.

The pH of solution in titration undergoes large change at endpoint.

In titration of 0.1 M HCl & 0.1 M NaOH, ~~pH~~ from 99.9% to 100.1% pH changes from 4.3 to 10.7.

~~The~~ The pH change in solution having concentration less



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than 0.1 is small. So
dilute solutions cannot be
titrated successfully

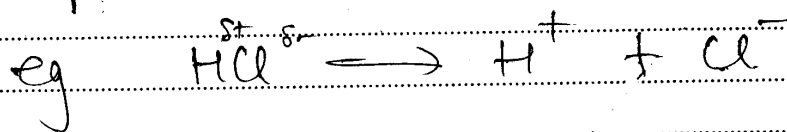
pH

pH scale was devised by
Sorenson to express H_3O^+
concentration in aqueous
solution

It is negative logarithm
to base 10 of molarity
of H_3O^+ aqueous

The dividing line between
ionisation & dissociation

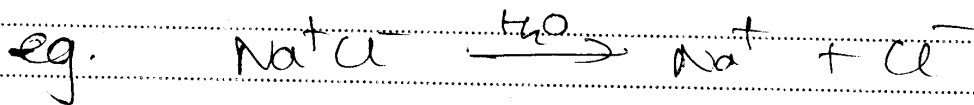
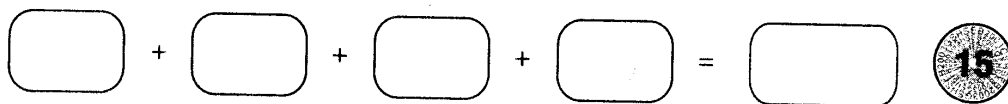
Ionisation is process of
forming ions from molecular
compounds



Dissociation is term used
to denote the release
of ions held firmly
in crystal lattice
structure of salts



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In aqueous solution of electrolytes, there is

- 1) formation of ions capable of conducting current
- 2) formation of ion pairs (NaCl) incapable of conducting current

Fonisation means forming ions capable of current

Dissociation denotes both

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Q 2 A

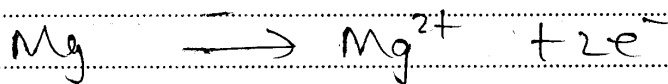
1) The integrated rate law provides following information

1) Concentration of reactants at all times

2) Rate constant k of reaction

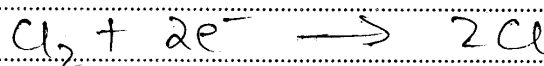
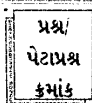
2) Oxidation Potential

measure of
The $\uparrow$ tendency of an atom, ion or molecule to release electrons & get ~~reduced~~ oxidised is called oxidation potential



Reduction potential

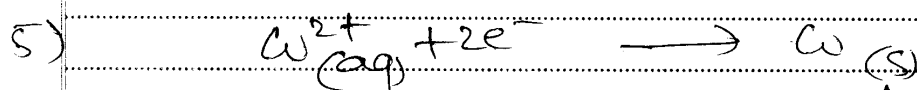
measure of
The $\uparrow$ tendency of atom, ion, molecule to gain electrons & get reduced is reduction potential



3) Wave nature of electron is used in construction of electron microscope

4) It is essential to study chemical & physical properties of molecules to understand the reactivity of molecules & reactions they undergo

4) 1) Bond angle 2) Bond length
3) Type of chemical bond are necessary to study physical & chemical properties of molecules



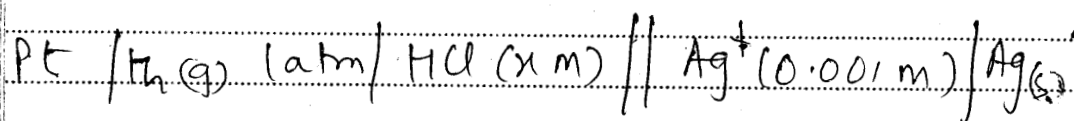
2 x 96500 Coulomb i.e. 193000
Coulombs electricity should
be passed through aqueous
 CuSO_4 to get 1 mole
copper metal

$$\begin{array}{r} 96500 \\ \times 2 \\ \hline 193000 \end{array}$$



Q 2 B

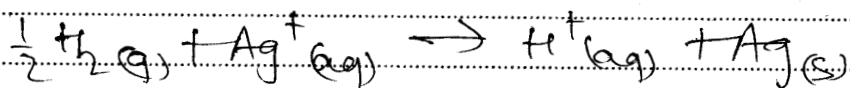
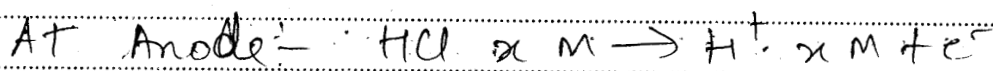
1) $\Delta E = 0.92 \text{ V}$



$$\Delta E^\circ = E^\circ_{\frac{1}{2}\text{H}_2/\text{H}^+} - E^\circ_{\text{Ag}/\text{Ag}^+}$$

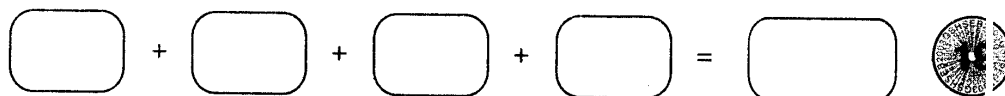
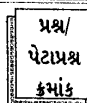
$$= 0.00 - (-0.80)$$

$$= 0.80 \text{ V}$$



$$n = 1$$

$$\Delta E = \Delta E^\circ - \frac{0.0592}{1} \log \frac{[\text{H}^+]}{[\text{Ag}^+]}$$



$$0.92 = 0.80 - 0.0592 \log [H^+] \quad \frac{0.001}{0.001}$$

$$\frac{0.12}{0.0592} = -[\log [H^+] - \log 10^{-3}]$$

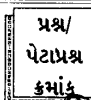
$$\frac{12}{5.92} = -[\log [H^+] + 3]$$

$$2.027 = -\log [H^+] - 3$$

$$-\log [H^+] = 5.027$$

$$\boxed{\therefore pH = 5.027}$$

$$\begin{array}{r} 1.0792 \\ 0.7725 \\ \hline 0.3067 \end{array}$$



$$\lambda = 6000 \text{ \AA} = 6000 \times 10^{-8} \text{ cm}$$

$$\lambda = 6 \times 10^{-5} \text{ cm}$$

$$h = 6.626 \times 10^{-27} \text{ erg-sec}, \quad c = 3 \times 10^{10} \text{ cm/s}$$

$$E = \frac{hc}{\lambda}$$

$$= \frac{6.626 \times 10^{-27} \times 3 \times 10^{10}}{6 \times 10^{-5}}$$

$$= 3.313 \times 10^{-12} \text{ erg photon}^{-1}$$

$$E = 3.313 \times 10^{-12} \text{ erg photon}^{-1}$$

$$\lambda = 7 \text{ \AA} = 7 \times 10^{-8} \text{ cm.}$$

$$v = 3 \times 10^{10} \text{ cm sec}^{-1}$$

$$\lambda = \frac{h}{mv}$$

$$m = \frac{h}{\lambda v}$$



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$$\boxed{} + \boxed{} + \boxed{} + \boxed{} = \boxed{}$$

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$$m = \frac{6.626 \times 10^{-27}}{7 \times 10^{-8} \times 3 \times 10^{10}}$$

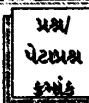
$$m = 0.3156 \times 10^{-9} \text{ gm.}$$

$$m = 3.156 \times 10^{-10} \text{ gm}$$

$$\begin{array}{r} 0.8213 \\ 1.3222 \\ \hline 7.4991 \end{array}$$

$$\begin{array}{r} 0.8451 \\ 0.4771 \\ \hline 1.3222 \end{array}$$

$$\begin{array}{r} 22 \\ 13 \\ \hline 9 \end{array}$$



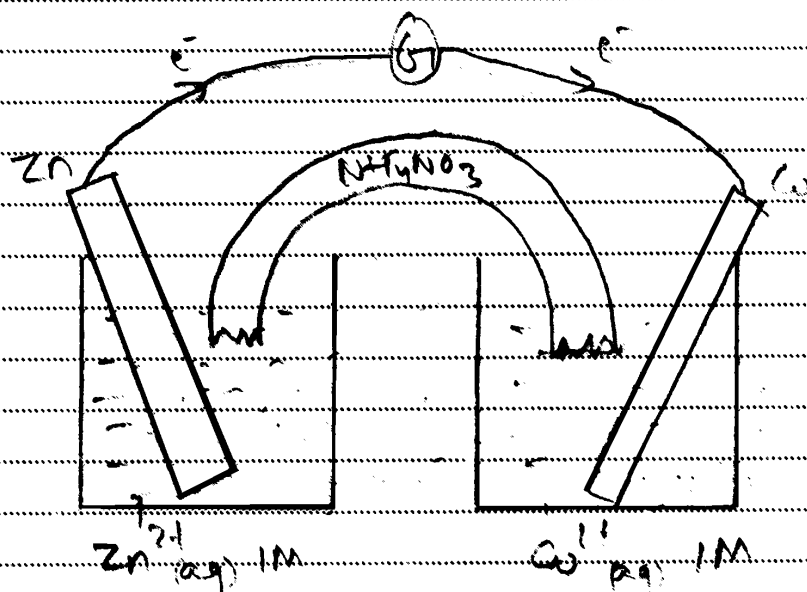
Q 2 C.

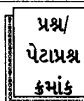
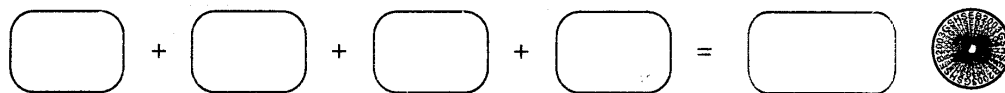
1) Cell Potential

The cell potential is the difference in the oxidation potentials of anode & cathode.

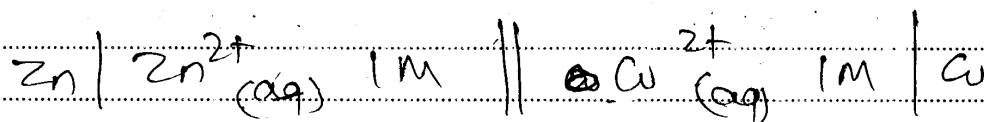
In electrochemical cell, electrons move from anode to cathode due to electrical pressure due to chemical reaction. This electrical pressure is cell potential.

Daniel cell





Symbolic representation



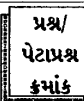
Function of salt Bridge

- 1) The salt bridge contains concentrated NH_4NO_3 solution. It connects anodic & cathodic solution and completes electrical circuit.
- 2) It maintains electrical neutrality of anodic & cathodic solutions.

3) 1

Shape of an orbital depends on acceptable solutions of ψ for it

Hydrogen atom has only one electron in $n=1, l=0$ level



When schrodinger's equation is solved for $n=1, l=0$, acceptable ψ solutions are

$$\psi_{n=1, l=0} = \frac{1}{\sqrt{\pi}} \left(\frac{1}{a_0} \right)^{3/2} e^{-r/a_0}$$

r = distance of electron from nucleus

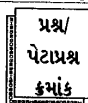
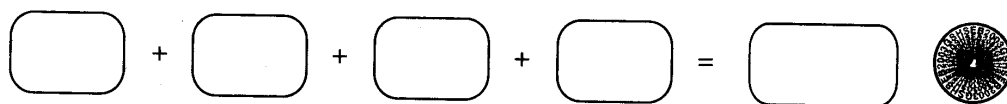
$$a_0 = \frac{h^2}{4\pi m e^2} = \text{constant}$$

Hence for $n=1, l=0$ shape of orbital depends only on r variable & not θ or ϕ .

Hence value of ψ & ψ^2 at all equidistant points from nucleus is same

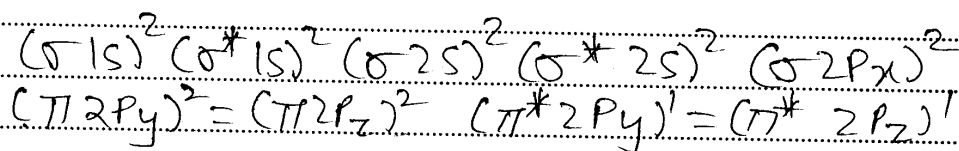
If we consider a plane passing, we get spherical shape

Hence s -orbital is spherical.
In every energy level



there is one orbital of spherical symmetry

3(ii) Electronic Configuration of O_2 molecule



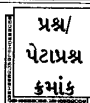
Bond Order

Relative stability controlling number is bond order

In O_2 molecule, there are 16 electrons, 10 enter BMO, 6 enter ABMO

$$\begin{aligned} \text{Bond Order} &= \frac{1}{2} (e^- \text{ in BMO} - e^- \text{ in ABMO}) \\ &= \frac{1}{2} (10 - 6) \\ &= \underline{\underline{2}} \end{aligned}$$

So there is double bond between two oxygen atoms. $\rightarrow$



Magnetic property

As there are two unpaired electrons, oxygen is paramagnetic.

Angular Momentum quantum number

Integer l appears in acceptable solutions of Schrodinger equation as mathematical requirement

It is angular momentum quantum number

Its value depends on 'n'.

For n values, there are $(n-1)$ value of l

e.g. for $n=2$, $l=0, 1$.

l indicates angular momentum of the electron



48/
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5415

It also determines shape of orbital,

for s, p, d, f, l values are 0, 1, 2, 3.

4(ii)

Nernst Equation

The cell potential depends on concentration of solution & electrode, ~~concentration~~ & temperature of cell

Nernst derived relation between cell potential & concentration of solution at 25°C

These laws are derived on basis of thermodynamics

Non Standard Half Cell

eg Zn/Zn^{2+}

$$\Delta E_{\text{Zn}/\text{Zn}^{2+}} = \Delta E^{\circ}_{\text{Zn}/\text{Zn}^{2+}} - \frac{0.0592}{2} \log [\text{Zn}^{2+}]$$

28

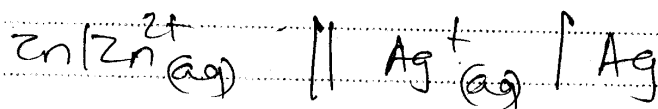


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 ~~$\Delta E \Rightarrow \Delta E$~~

$$\Delta E_{Zn^{2+}/Zn} = \Delta E^{\circ}_{Zn^{2+}/Zn} - \frac{0.0592}{2} \log \frac{1}{[Zn^{2+}]}$$

B) Non standard complete cell

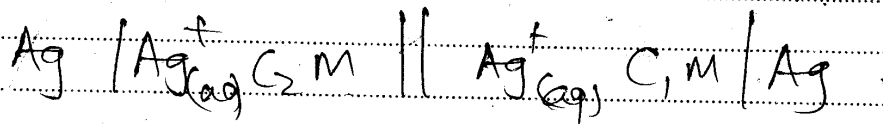


$$\Delta E = \Delta E^{\circ} - \frac{0.0592}{n} \log \frac{[Zn^{2+}]}{[Ag^{+}]^2}$$

n = change in oxidation number

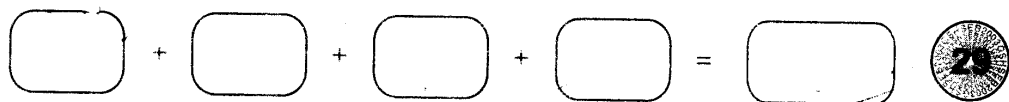
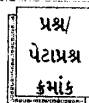
$$0.0592 = \frac{RT}{F} \text{ at } 25^{\circ}C$$

C) Concentration cell



$$C_1 > C_2$$

$$\Delta E = - \frac{0.0592}{1} \log \frac{C_2}{C_1}$$



Q3A

Halogens have valency shell configuration ns^2np^5 . So they gain 1 electron & form negative ion.

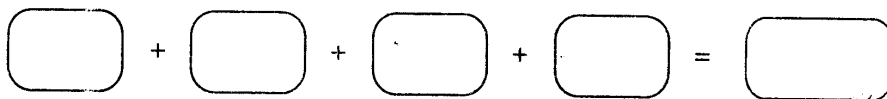
Hence, as ionisation energy of fluorine is very high, it doesn't form positive ion, but forms negative ion.

Cohesive Energy

The attractive force holding atoms together in solid state is called cohesive energy.

It depends on bonding electrons & their binding energies.

30



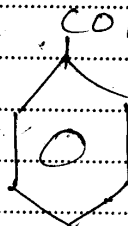
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(i) Phenetole — Ethoxy Benzene

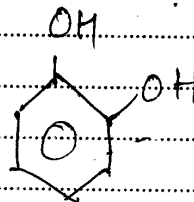
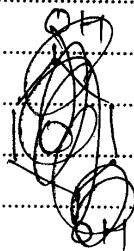
(ii) Acetanilide — ~~Acetyl Benzene~~
N acetyl aniline

4)

(i) Benzamide — 

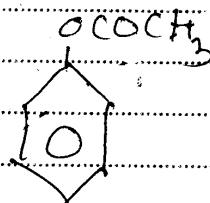
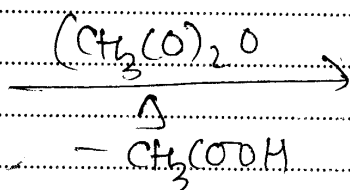
(ii)

Catechol



5)

Acetylation reaction occurs :
when phenol is heated
with acetic anhydride



Phenyl acetate



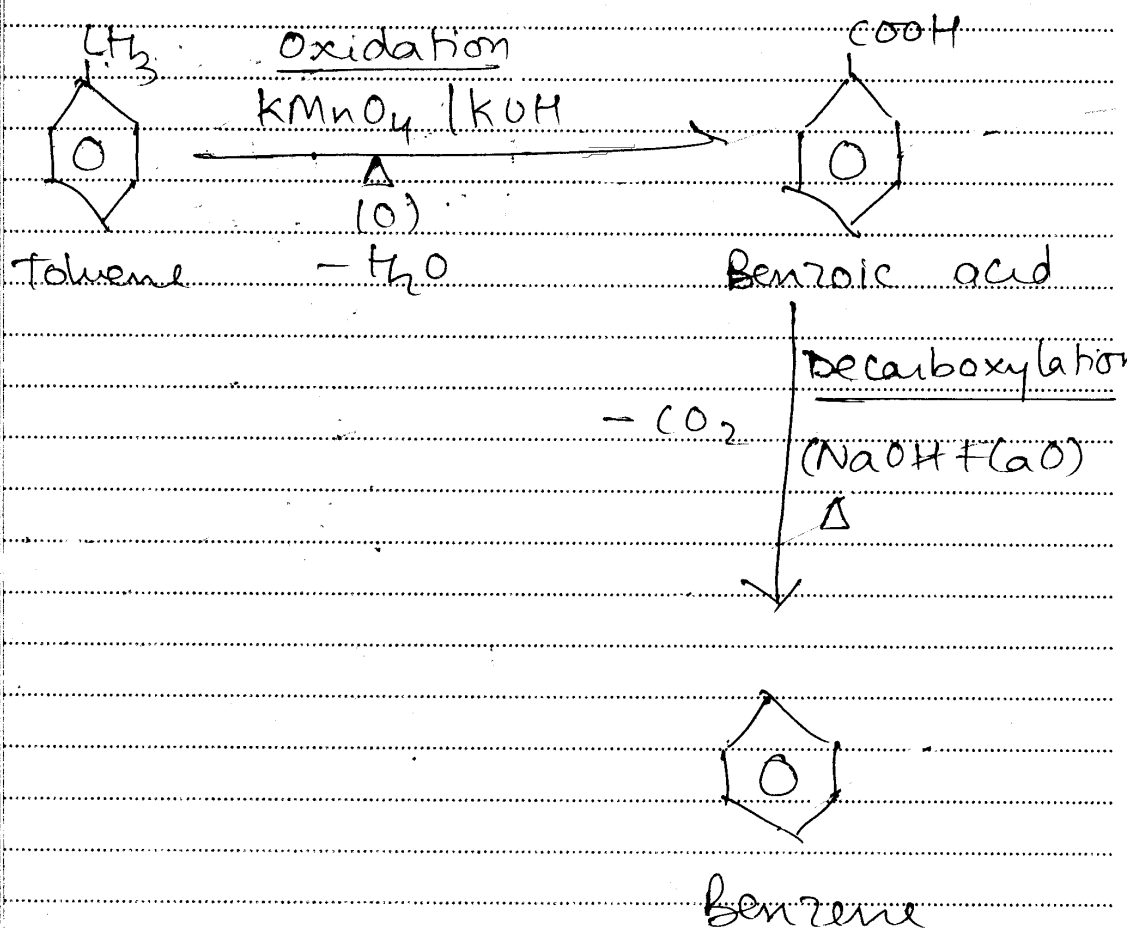
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31

Q 3 B

2) Benzene from toluene

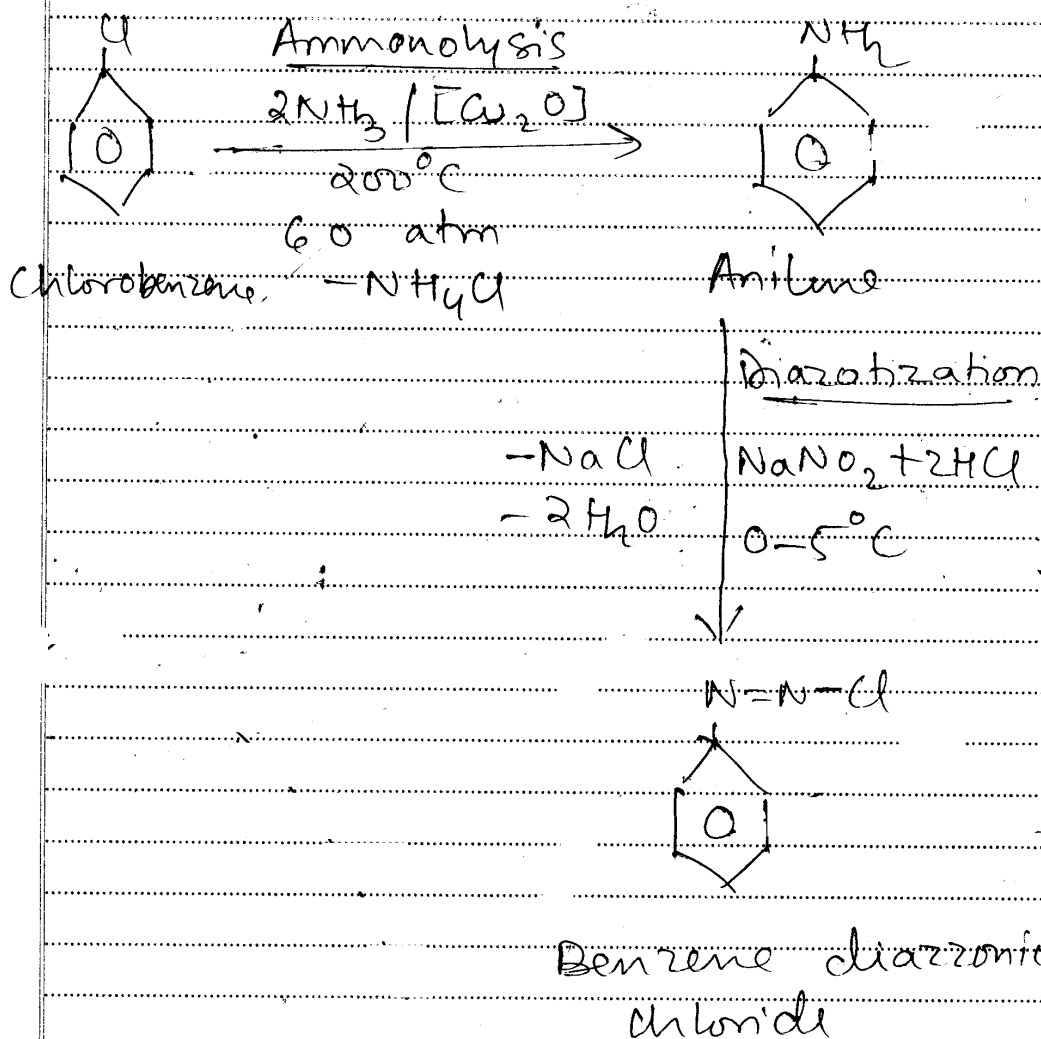




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1)

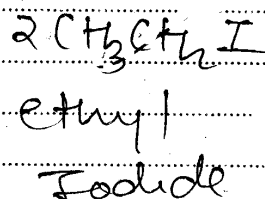
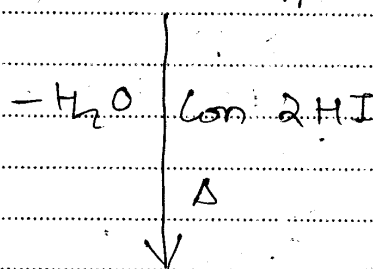
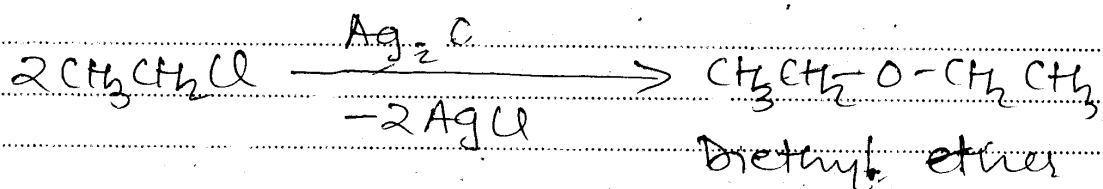
Benzene diazonium chloride
from chlorobenzene





3)

Ethyl iodide from ethyl chloride



Q 3 C

1) Physical Properties of halogens

1) Ionic radius, melting & boiling points increase with increasing atomic number

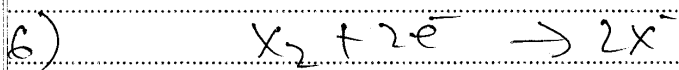
2) Electronegativity decreases as atomic number increases



3) They have valence $ns^2 np^5$ configuration. So they gain electron & form negative ions.

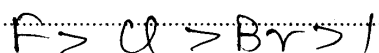
4) Fluorine & Chlorine are gases;
Bromine is dark red liquid
Iodine is purple solid

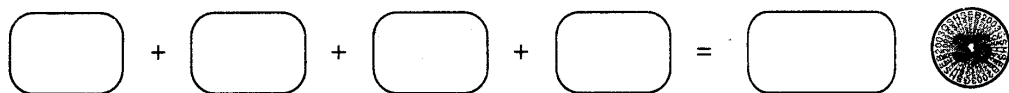
5) They have high ionisation energy, so they do not form positive ions.
Fluorine is most electronegative. They form negative.



Halogens have tendency to accept electrons. Their reducing potential decreases & also oxidising property decreases as atomic number increases.

Order is:





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7) They form interhalogen compounds by combining with each other

eg ICl , ICl_3 , IF_3 ,

Electronegativity ~~also~~ difference of combining element determines stability of these compounds

8) Two or more halogens of same or different type combine with a metal ion giving polyhalogen compounds

eg CsICl_2 , CsCl_3 , CsIBr_2

These have anions like Cl_3^- , ICl_2^- , IBr_2^-

2 (1) Electronegativity & Bond Type

Electronegativity of alkali elements is extremely low

They form ionic compounds with elements of high electronegativity.



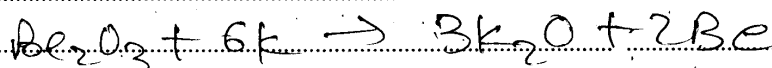
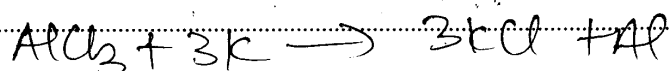
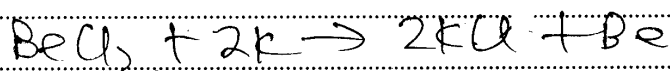
eg Na^+ (electronegativity 0.9) &
 Cl^- (electronegativity 3.0) combine
 to produce ionic NaCl

Similarly LiF , KBr are ionic

If electronegativity difference
 of combining elements is
 between 1.7 to 1.8,
 bond formed is 50% ionic

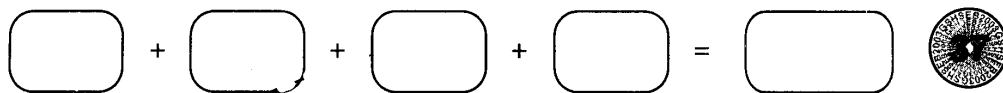
Reduction

Alkali metals have strong
 attraction towards oxygen &
 halogen. Oxides & halides of
 other metals give free metals
 on reaction with alkali



Alkali metals have
 tendency to release
 electrons.

As they have high



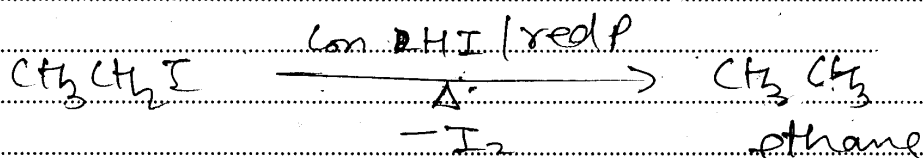
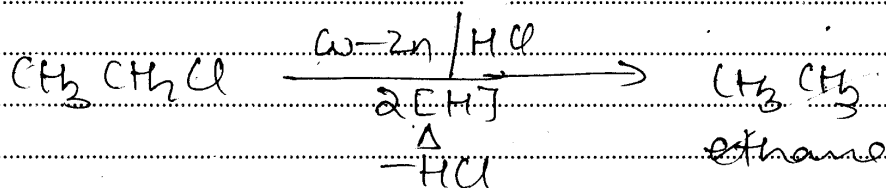
oxidation potentials, they are good reducing agents

3)

When halogen of halides is replaced by hydrogen, alkyl halides give hydrocarbons

1) Alkyl halides on reaction with W-Zn in ^{presence} concentrated HCl give alkane

Ethyl iodide reacts with con. HI in presence of red phosphorus to give ethane



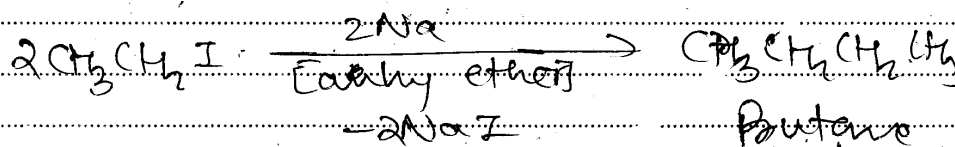
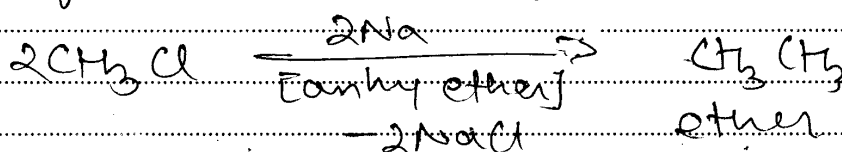
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2) Wurtz reaction

when alkyl halides react with sodium in presence of anhydrous ether, alkane with double number of carbons is formed



3) Grignard reaction

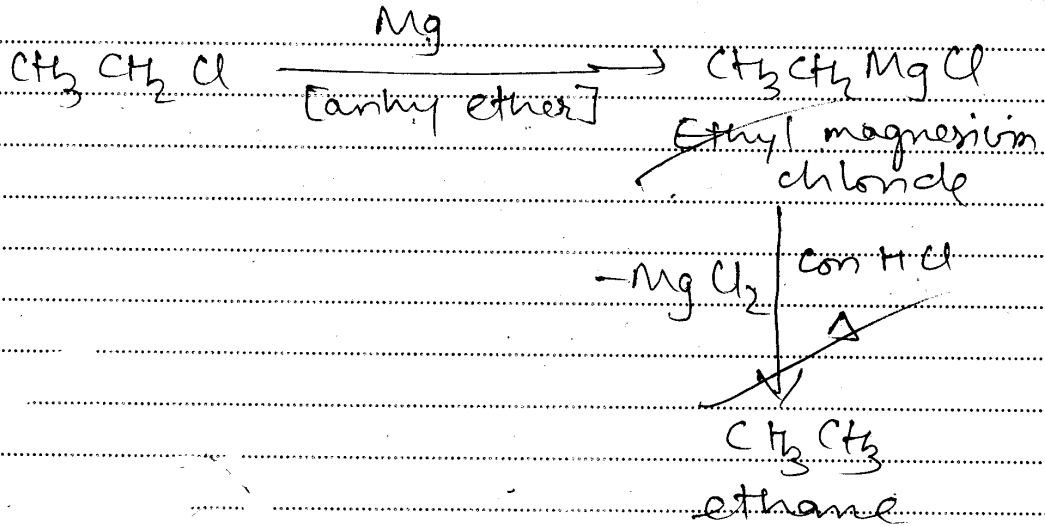
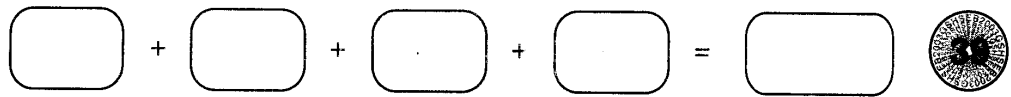
when magnesium turnings are added to ether solution of alkyl or aryl halide grignard reagent is obtained

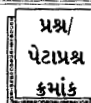
[Alkyl magnesium halide or aryl magnesium halide]

Grignard reagent on hydrolysis ~~gives~~ with concentrated HCl gives alkane with same number of carbons.



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કાપી





Q 4 A

- 1) Substances like Blankophor have fluorescent property in sunlight & some affinity towards fibres.

They are optical brighteners

Whiteness can be applied to clothes. This method is fluorescent bleaching

- 2) Penicillin cannot be taken by mouth as it is hydrolysed by acid in stomach.

Penicillin is effective against gram positive bacteria

- 3) When acetamide is heated with Bromine and aqueous NaOH, ethyl amine is obtained. Benzamide similarly gives aniline

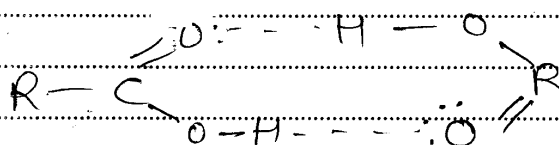
This reaction is Hofmann's



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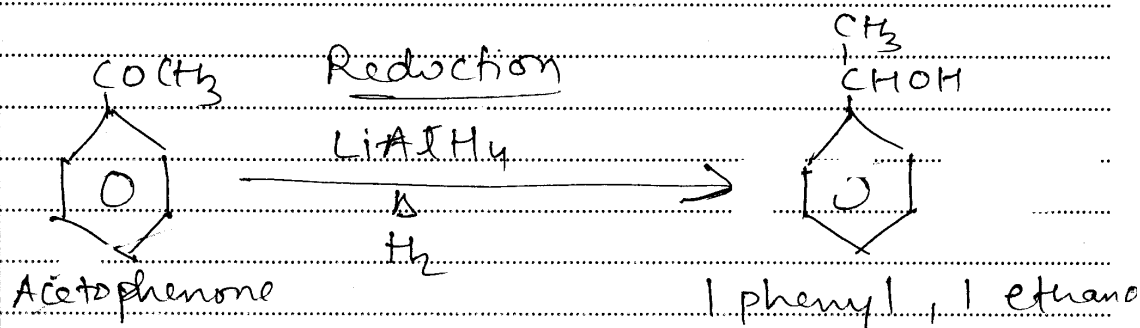
reaction. The primary amine formed has one carbon less than the original amide.

4) In solid state, two molecules of acids combine ~~to~~ through intermolecular H bond & form dimer.



So carboxylic acids have higher boiling points than alcohols.

5)

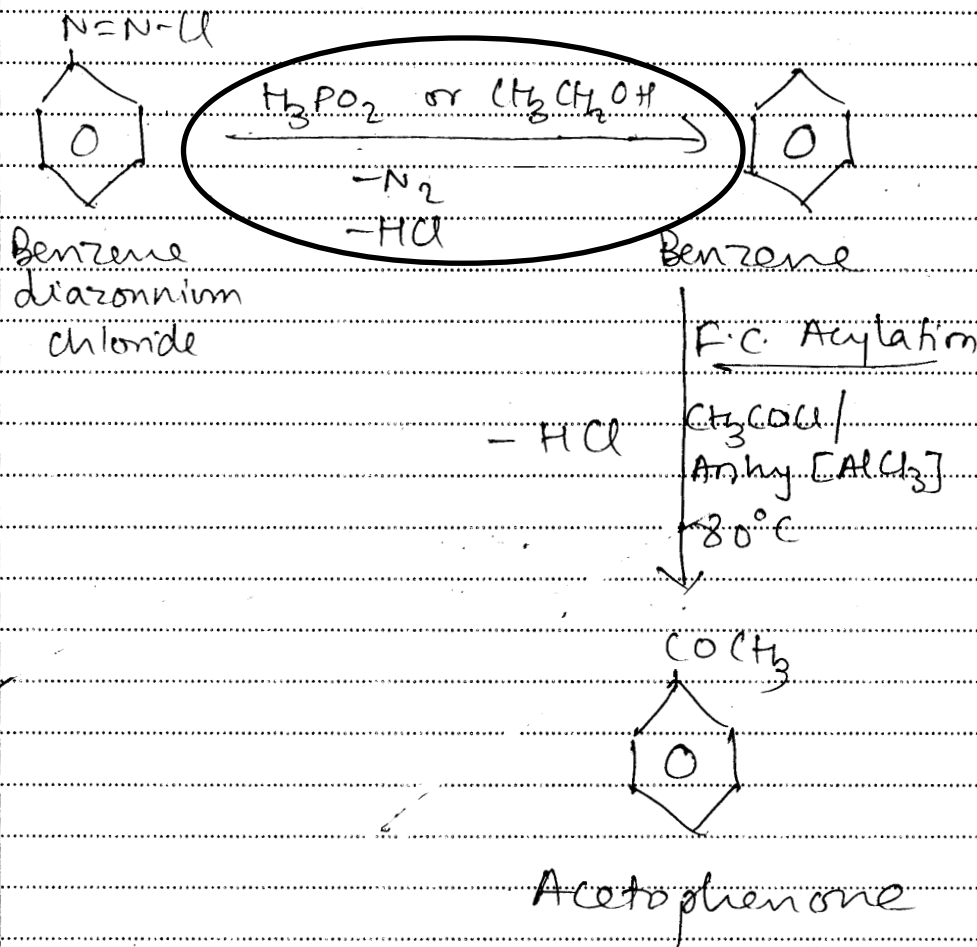




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Q 4 B.

1) Acetophenone from diazonium salt

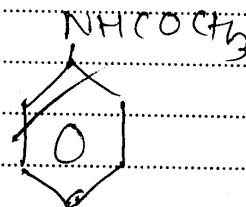
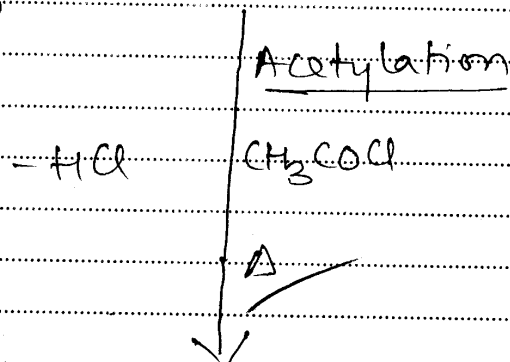
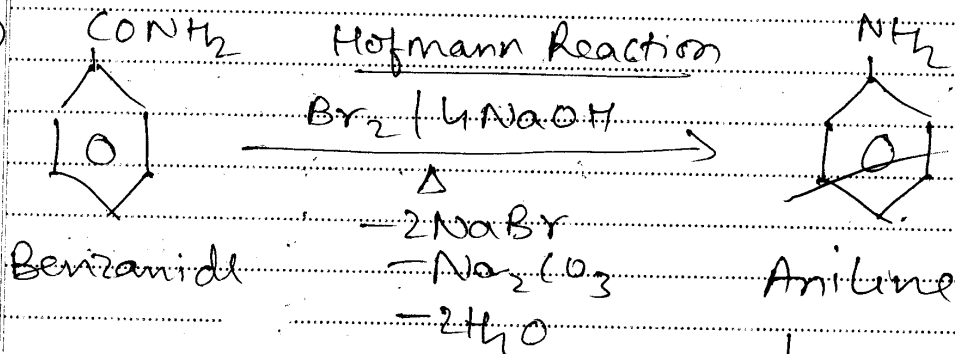




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Acetanilide from Benzanide

2)

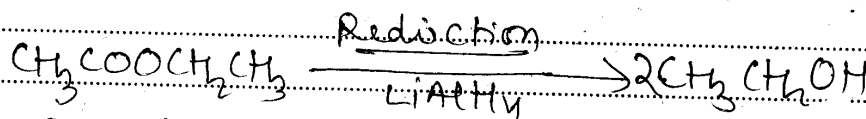


Acetanilide



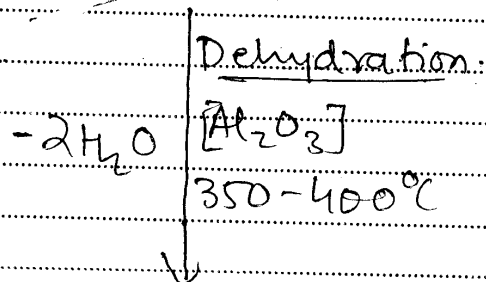
3)

Ethene from ethyl acetate

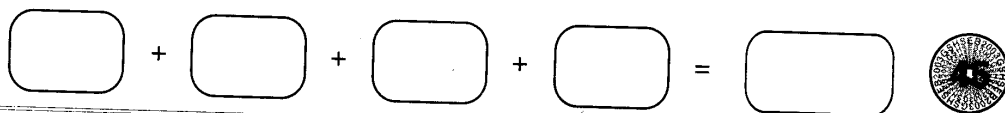
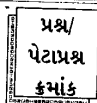


Ethyl
acetate

Ethanol



Ethene



Q 4 C

2) i) Hormones

Hormones are chemical messengers secreted by endocrine or ductless glands.

They are secreted in ~~extremely~~ small quantities & are extremely efficient.

They have stimulatory or inhibitory effect on tissues via blood circulation.

Hormones Classification

Hormones are classified into 3 groups:

1) Steroid Hormones

eg. Oestrone, Oestradiol, Testosterone, Progesterone

2) Protein Hormones

Oxytocin, Vasopressin, Insulin



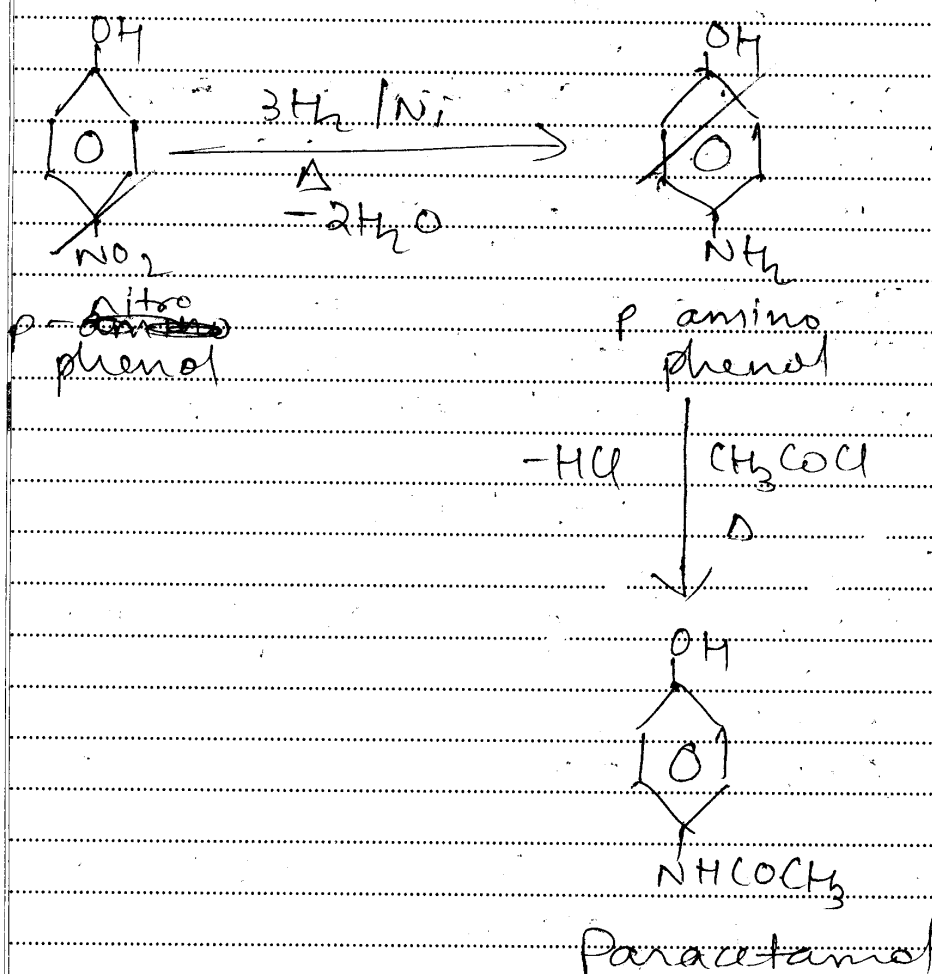
પ્રશ્ન
વર્ણન
ક્રમ

3) Amine Hormones

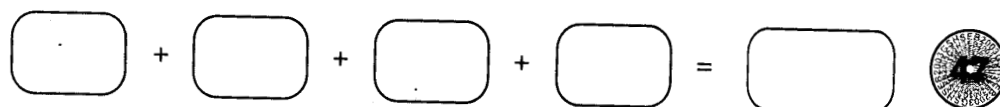
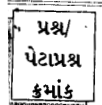
Adrenalin, Thyroxine

2 (ii)

Paracetamol



p-nitro phenol on
 reduction with H_2/Ni gives
 p-amino phenol
 On ~~acc~~ reaction with



CH_3COCl , paracetamol is obtained

Use - It is antipyretic & analgesic drug

It is used to treat fever due to cold (flu)

3① Tollens Test

Tollens test is used for detection of aldehydes

Tollens Reagent

When slight excess of NH_4OH is added to aqueous $AgNO_3$ solution, ammoniacal silver nitrate is formed: $[Ag(NH_3)_2OH]$

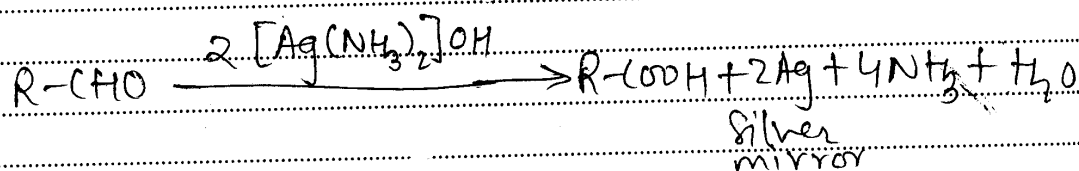
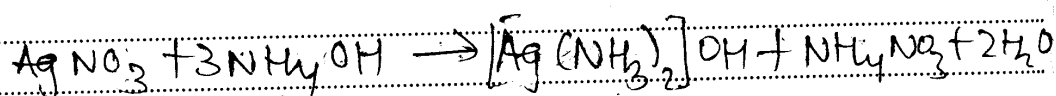
This is tollens reagent

Test

Given organic substance containing aldehyde group is warmed with tollens reagent



Aldehyde is oxidised to corresponding acid & liberated silver deposits on wall of test tube giving silver mirror



Ketones do not give this test

3 (ii) Carbylamine Test

This test is used for detection of primary amine

when primary amines are heated with alcoholic KOH & chloroform, foul smelling & toxic isocyanide is formed

Secondary & tertiary amines do not give this test

Supplimentary / પુરવણી - 1

★ અહીંથી જ લખવાનું શરૂ કરવું. ★



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પેટાપ્રશ્ન
ક્રમાંક

40

□ + □ + □ + □ = □ 1

Complexes in nature

~~Magnesium~~ Chlorophyll

Chlorophyll is magnesium complex.

It is found in plant leaves

One magnesium is coordinated with four nitrogen atoms in the complex.

The plants synthesize their own food with help of chlorophyll.

Animals get magnesium from plants.

2



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The body of grown up person has 25 mg of Magnesium

It is required for nervous system and for muscles in body

Haemoglobin

Haemoglobin is Iron complex. Red colour of blood is due to haemoglobin.

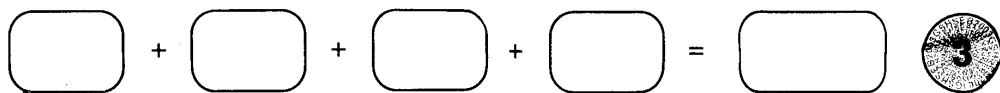
One ferrous ion is coordinated with four nitrogens in complex

Haemoglobin combines with oxygen & supplies ~~to~~ oxygen to tissue after forming intermediate compound

Vitamin B₁₂

Vitamin B₁₂ has ~~no~~ ~~req~~ Cobalt as an ~~also~~ component

A person requires 1.5 micro gram of vitamin B₁₂ everyday



Natural complexes are necessary for biochemical reactions in body.

4 (ii) Physical Properties of inert gas elements

1) Inert gas are monoatomic, ~~colorless~~ ^{odorless} gases sparingly soluble in water.

2) They are good conductors of electricity. When electricity is passed through them at low temperature, coloured light is seen.

3) ~~As~~ As they have high ionisation energy, they do not form ionic compounds.

4) As all electrons are paired & expansion of valency shell not being possible, they do not form covalent compounds.

3) Vanadium: $[\text{Ar}] 3d^3 4s^2$
Vanadium has highest oxidation

4



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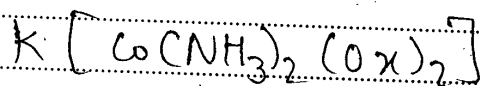
Q 5 A

1)

Black phosphorus is prepared by heating yellow phosphorus under pressure.

It is polymorphic solid & most stable form of phosphorus.

2)

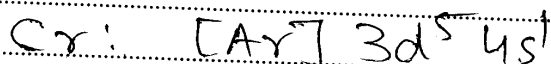


IUPAC

Potassium bis oxalato diammine cobaltate (III)

3)

The elements whose electron configuration have incompletely filled d orbitals (~~3d~~ $3d^{1-9}$) are called transition element.

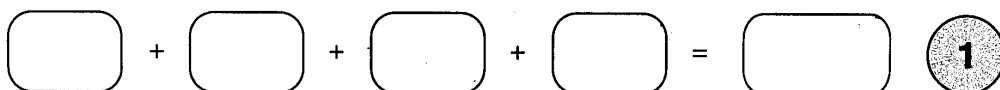


Supplimentary / પુરવણી - 2

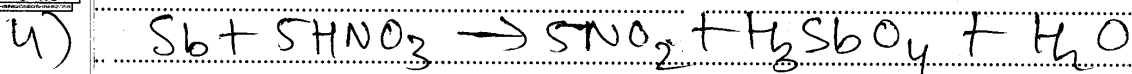
★ અહીંથી જ લખવાનું શરૂ કરવું. ★



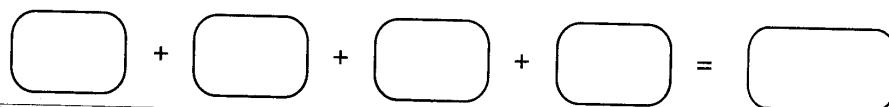
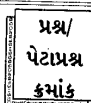
પ્રશ્ન/
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ક્રમાંક



Reaction of antimony & Nitric acid



5) $\text{CuH}_{0.96}$, the interstitial hydride of copper is obtained by reduction of aqueous copper sulphate with sodium hypophosphite. It is brownish in colour.



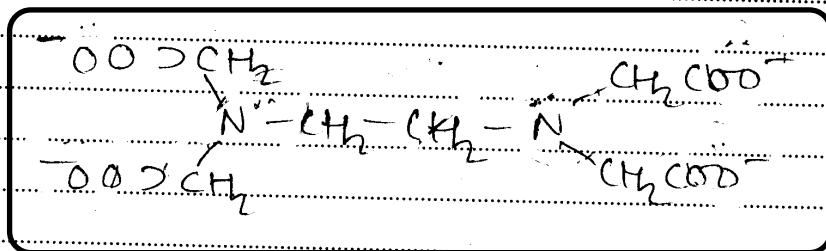
Q 5B

1) Ligands

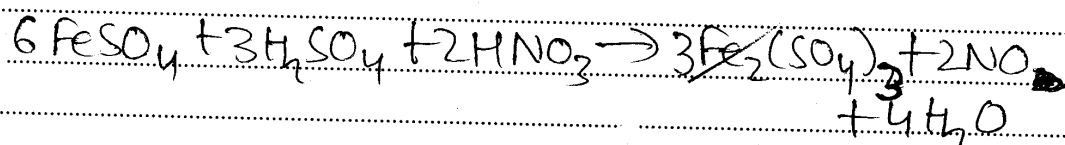
In complex salts, the neutral molecules or negative ions bound ~~joined~~ with transition metal ion by its secondary valency are called ligands.

hexadentate ligand

Ethylene diamine tetra acetate (edta)

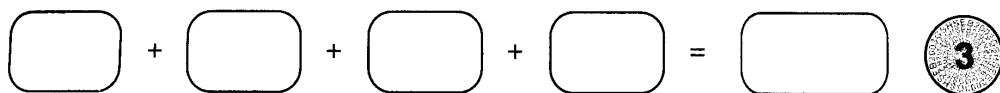


2) (i) Reaction of ferrous sulphate with HNO_3 in presence of sulphuric acid

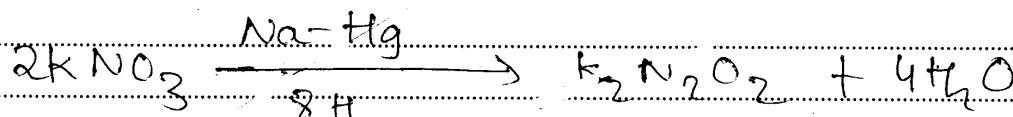




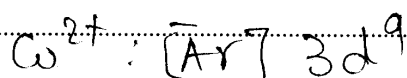
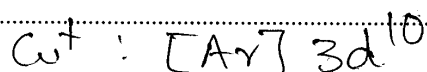
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(1) Reduction of potassium nitrate by sodium mercury amalgam



3)



In electron configuration of Cu^+ ion, d orbitals are completely filled. So d-d transition is not possible. So Cu^+ is colourless.

In electron configuration of Cu^{2+} , d orbitals are incompletely filled. So d-d transition is possible. Electrons in lower energy d orbital are excited to higher level by visible radiation.

While returning to ground state, they emit absorbed energy in form of visible radiation making Cu^{2+} appear blue coloured. So Cu^+ is colourless & Cu^{2+} is coloured.

4



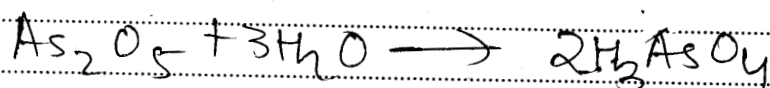
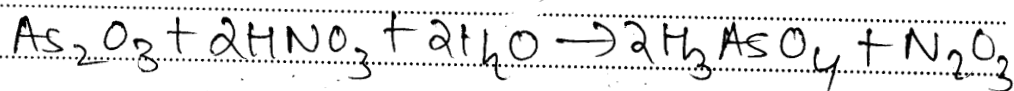
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Q 5 C

1) Preparation of arsenic Acid

Arsenic acid is prepared by reaction of between arsenic trioxide & nitric acid.

Also it is prepared by dissolving arsenic pentoxide in water



Sodium Salts

Name	Formula
Trisodium orthoarsenate	Na_3AsO_4
Disodium orthoarsenate	Na_2HAsO_4
Monosodium orthoarsenate	NaH_2AsO_4

Supplimentary / પુરવણી - 3

★ અહીંથી જ લખવાનું શરૂ કરવું. ★



પ્રશ્ન
પેટીમાં
ક્રમાંક

40

□ + □ + □ + □ = □ 1

Complexes in nature

~~Magnesium~~ Chlorophyll

Chlorophyll is magnesium complex.

It is found in plant leaves.

One magnesium is coordinated with four nitrogen atoms in the complex.

The plants synthesize their own food with help of chlorophyll.

Animals get magnesium from plants.

2



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The body of grown up person has 25 mg of Magnesium

It is required for nervous system and for muscles in body

Haemoglobin

Haemoglobin is iron complex. Red colour of blood is due to haemoglobin.

One ferrous ion is coordinated with four nitrogens in complex

Haemoglobin combines with oxygen & supplies ~~to~~ oxygen to tissue after forming intermediate compound.

Vitamin B₁₂

Vitamin B₁₂ ~~has~~ ~~is~~ Cobalt as an ~~also~~ component

A person requires 1.5 micro gram of vitamin B₁₂ everyday



Natural complexes are necessary for biochemical reactions in body.

4 (ii) Physical Properties of inert gas elements

1) Inert gas are monoatomic, ~~colorless~~ colorless gases sparingly soluble in water.

2) They are good conductors of electricity. When electricity is passed through them at low temperature, coloured light is seen.

3) ~~As~~ As they have high ionisation energy, they do not form ionic compounds.

4) As all electrons are paired & expansion of valency shell not being possible, they do not form covalent compounds.

3) Vanadium: $[\text{Ar}] 3d^3 4s^2$
Vanadium has highest oxidation



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State +5.

Compounds of Vanadium in +5 oxidation state are vanadates

The ~~+2~~ +2 & +3 oxidation states are not important & are unstable

Manganese: $[\text{Ar}] 3d^5 4s^2$

Manganese has highest oxidation state +7. however it is unstable

Most stable state is +2.

Other oxidation states ~~are~~ like ~~+5~~ +5, +6 also aren't stable

KMnO_4 is good ~~red~~ oxidising agent. It has Mn in +7 oxidation state. So it gains electrons to acquire +2 state.