ATM

XII

Subject : CHEMISTRY
Subject Code : 043

Date of the Examination : WEDNESDAY | 9·3·2016

Paper : ENGLISH

Code Number : 5612N

Set Number : ① ② ③ ④

No. of supplementary answer-book(s) used : NIL

Person with Disabilities : हाँ / नहीं   Yes / No   NO

if physically challenged, tick the category :

| B | D | H | S | C | A |

B = अस्थि विकलांग, D = दृष्टि विकलांग, H = श्रवण बाधित, S = स्पास्टिक
Bl = Blind, A = दृष्टिहीन
VI = Visually Impaired, D = Hearing Impaired, H = Physically Challenged
S = Spastic, C = Dyslexic, A = Autistic

Teacher writer provided : हाँ / नहीं   Yes / No   NO

if visually challenged, name of software used : NIL
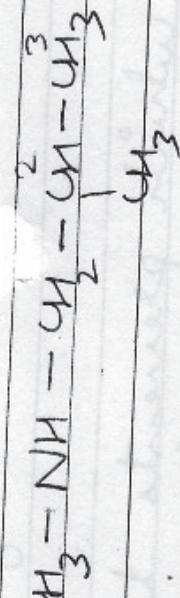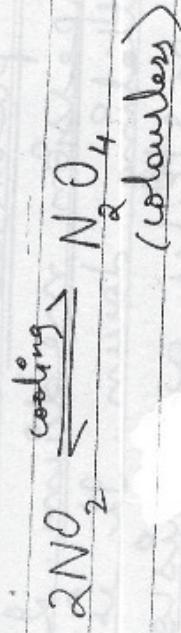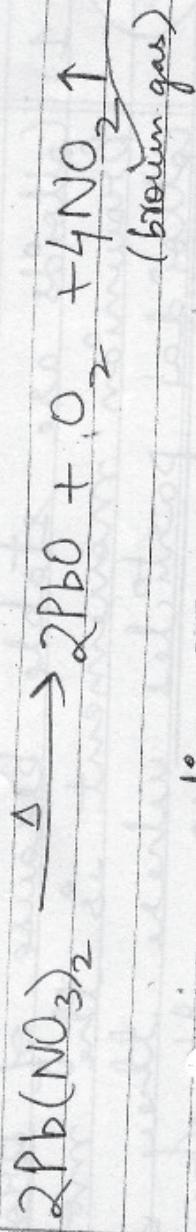
Each letter be written in one box and one box be left blank between each part of the
name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

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Space for office use

2

1. Colloids are stable because of Brownian motion. Brownian movement is the movement of colloidal particles where they strike against colloidal particles where they strike against the dispersion medium. It prevents them from settling down. It is generated by the size of particles and viscosity of dispersion medium.

Another factor which prevents the colloidal sols from coagulating is charge on the colloidal particles. The charge on colloidal particles makes them repel each other.

2. ZnO turns yellow on heating due to the non-stoichiometric defect called metal excess defect. This defect is caused by extra cations in the lattice site. On heating, oxygen escapes the lattice leaving behind the electron which give ZnO yellow colour.

$$ZnO \longrightarrow Zn^{2+} + \frac{1}{2}O_2 + 2e^-$$
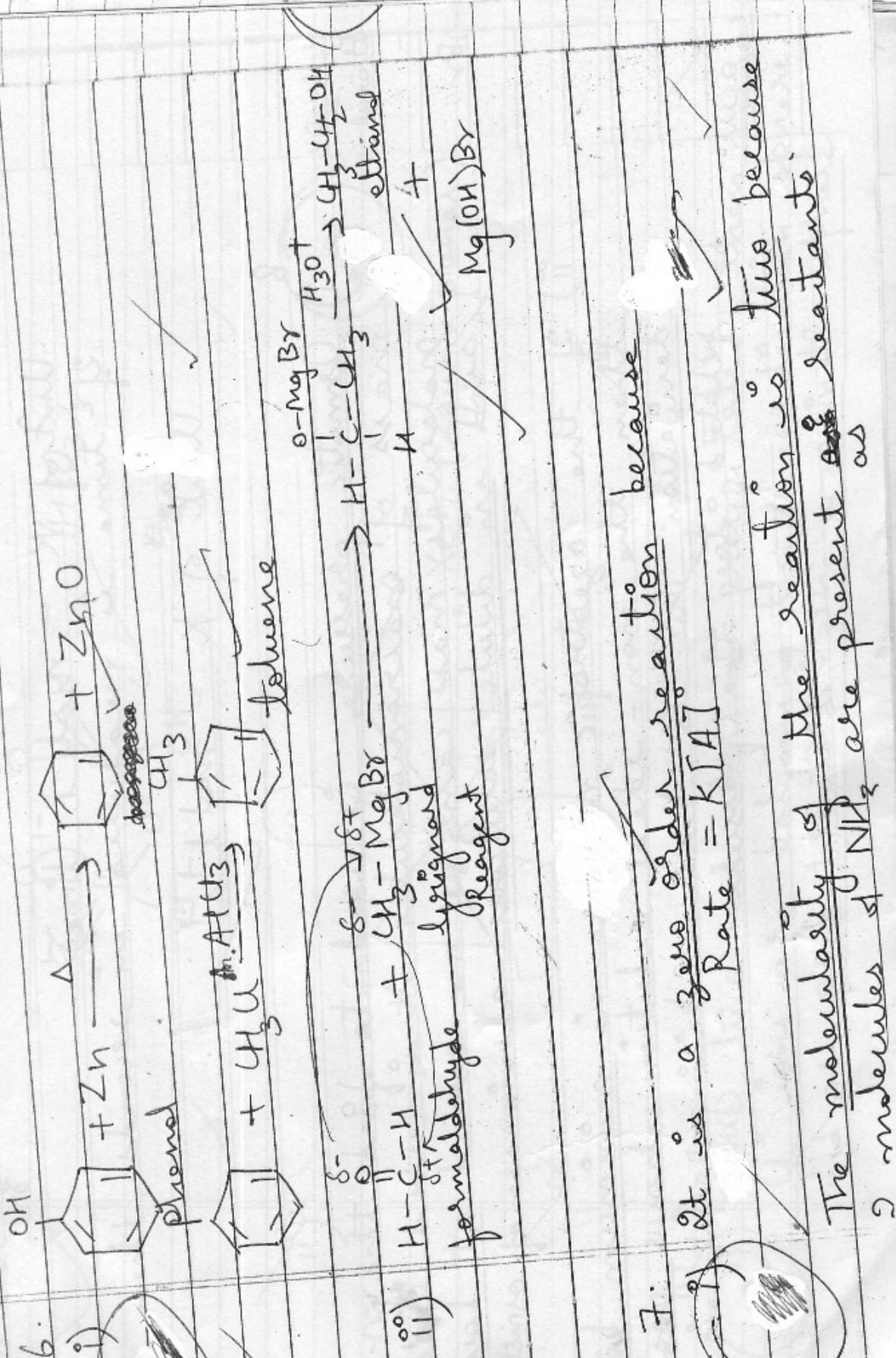
3. The gas is NO_2 (Nitrogen dioxide)

$$2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + O_2 + 4NO_2 \uparrow$$
(brown gas)

$$2NO_2 \xrightleftharpoons{\text{cooling}} N_2O_4$$
(colourless)

4.

$$CH_3 - NH - CH_2 - CH - CH_3$$
$$\overset{2}{} \quad \overset{3}{}$$
$$|$$
$$CH_3$$

N-Methyl-2-methylpropan-1-amine

5. The reaction (1) is S_N^2 reaction. This is because it leads to inversion of configuration.

In the reaction (1) the configuration of a chiral carbon has been inverted. Inversion of configuration is a character of S_N2 reaction

6.

(i)

$$\underset{\text{Phenol}}{\text{OH}} + Zn \xrightarrow{\Delta} \underset{}{\bigcirc} + ZnO$$

$$\bigcirc + CH_3Cl \xrightarrow{\text{anh. } AlCl_3} \underset{\text{toluene}}{\overset{CH_3}{\bigcirc}}$$

(ii)

$$\overset{\delta-}{\underset{O}{\overset{\parallel}{H-C-H}}} + \underset{\text{Grignard reagent}}{\overset{\delta+}{CH_3}-MgBr} \longrightarrow \underset{\overset{|}{H}}{H-C-CH_3} \xrightarrow{H_3O^+} CH_3-CH_2-OH$$
$$\underset{\text{formaldehyde}}{} \qquad\qquad\qquad \underset{+}{} \qquad\qquad\qquad \text{ethanol}$$

$$Mg(OH)Br$$

7.

(i) It is a zero order reaction because

$$\text{Rate} = K[A]^0$$

(ii) The molecularity of the reaction is two because 2 molecules of NH_3 are present as reactants.

8)
11) Unit of K is same as the unit of Rate of reaction.

Unit of $K = mol \, l^{-1} (time)^{-1}$
2) if time is measured in seconds, then

Unit of $K = mol \, l^{-1} s^{-1}$

9)
i) Osmotic pressure is used to find the molecular mass of macromolecules. It is used because molecular mass can be measured at low temperature and in dilute solutions also in case of osmotic pressure.

2) By
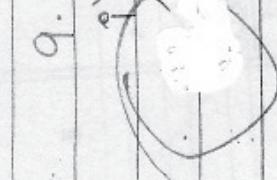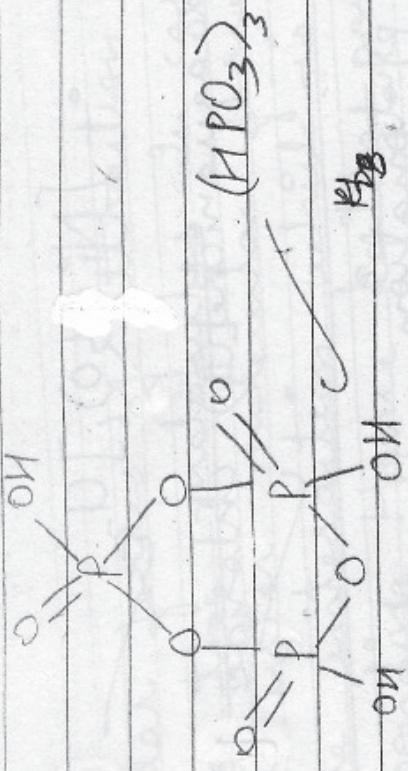
8) 2) the azeotropic mixture is minimum boiling
11) then the non-ideal solution shows positive deviation. This is because boiling point is inversely related to the pressure.

cause

9.

$(HPO_3)_3$

8.
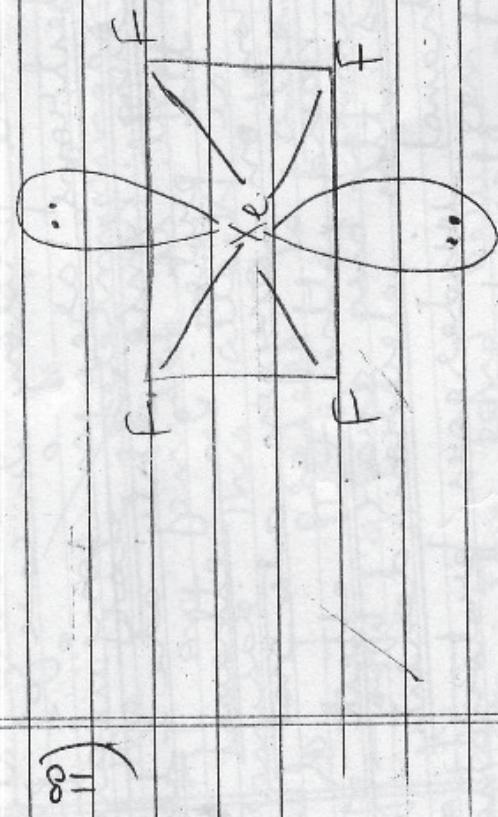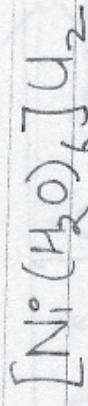
XeF_4 (square planar)

10.
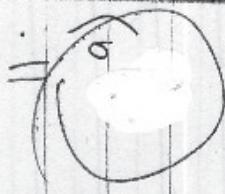
i) Since two mole $AgCl$ is precipitated, then two Cl^- ions are balancing the co-ordination sphere, and are present outside the co-ordination sphere.

2) $[Ni(H_2O)_6]4_2$

Hexaaquanickel(II) chloride

a) In protonation, the lone pair on the oxygen atom is given to the proton. In case of phenol, the lone pair of electrons are in conjugation with the benzene ring. Hence they are less available for giving to the proton. In ethanol, the lone pair of electron on oxygen are not in conjugation. On the other hand, the +I effect of ethyl group increases the electron density on oxygen. That's why ethanol undergoes protonation easily as compared to phenol.

b) The boiling point of a substance is governed by the strength of intermolecular force of attraction. In case of ethanol, the molecules have strong

intermolecular forces of attraction i.e. Hydrogen bonds among the molecules. In case of di-methyl ether, the inter molecular forces are only dipole-dipole interaction which is weaker than H-bonding. Hence boiling point of alcohol is greater than ether. More +

c) The rate determining step in the reaction of HI on anisole is the attack of I^- ion on anisole. This attack is through S_N2 mechanism. So, I^- prefers to attack the less hindered $-CH_3$ group and forms CH_3-I.

Also the bond between O and C in $\underline{\hspace{1cm}}$ is more difficult to break because of its double bond character due to resonance. The bond between $O-CH_3$ is easy to break; hence CH_3-I is formed. Phenol resists further substitution by I^- ion because it does not undergo nucleophilic
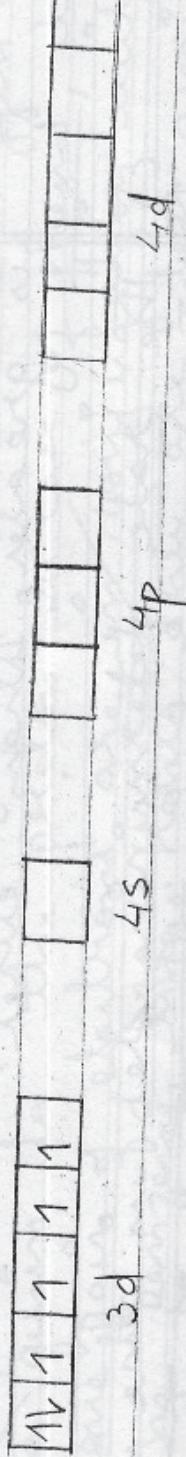
substitution reaction easily.
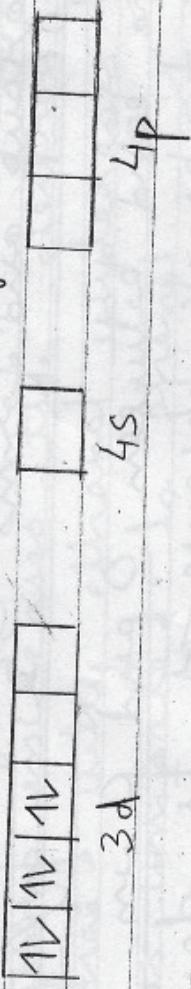
12(a) Oxidation number of Fe is +2 in $[Fe(CN)_6]^{4-}$

$Fe^{2+} \rightarrow 3d^6$

3d	4s	4p	4d
↑↓ ↑ ↑ ↑ ↑	▢	▢ ▢ ▢	▢

CN^- is a strong ligand i.e. 2t pairs up the electron in the 3d orbital of Fe^{2+}.

3d	4s	4p
↑↓ ↑↓ ↑↓	▢	▢ ▢ ▢

The six CN^- ions give their 6 pairs of electron to the empty orbitals. The orbitals utilised for hybridisation are d^2sp^3 i.e. two 3d orbitals, one 4s orbital and give 3 4p orbitals

| ⇅ | ⇅ | ⇅ | | | ⇅ | ⇅ | ⇅ | ⇅ | ⇅ |

3d d^2sp^3

hybrid orbitals
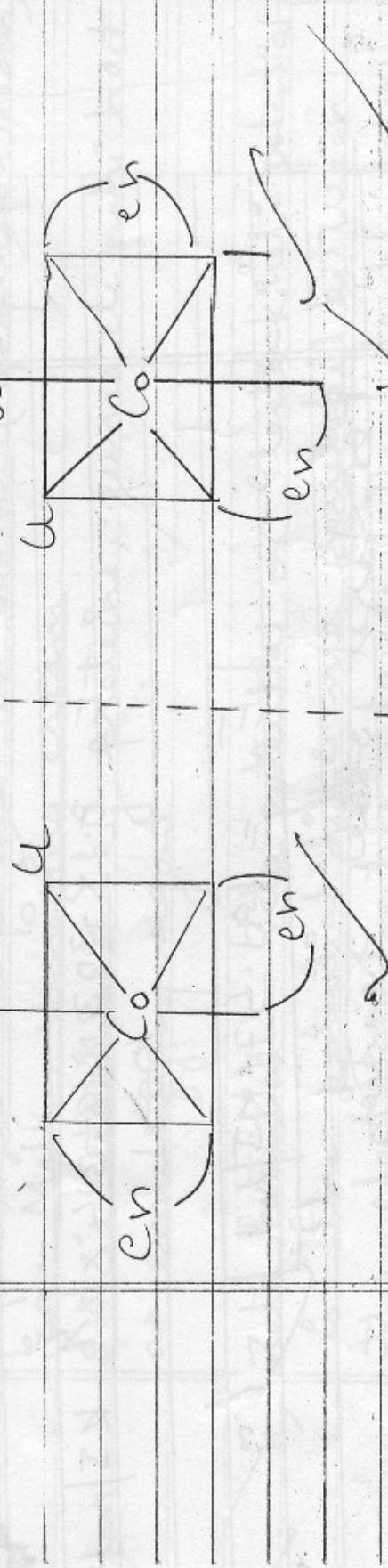
Hybridisation — d^2sp^3

Magnetic character — diamagnetic

Magnetic moment = 0

spin type — low spin complex

b) Cis — form of $[Co(en)_2 Cl_2]^+$ is optically active

optical isomers of cis $- [Co(en)_2 Cl_2]^+$

13

$$\log K = \frac{-E_a}{2.303R} \times \frac{1}{T} + \log A \quad\text{——①}$$

$$\log K = -1\times10^4 \, K \times \frac{1}{T} + 14.2 \quad\text{——②}$$

Comparing eq ① and ② we find that

$$\frac{E_a}{2.303R} = 1\times10^4$$

$$E_a = 2.303R \times 10^4 \, J/mol$$
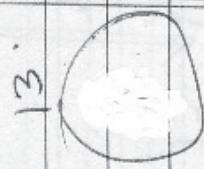
$$E_a = \frac{2.303 \times 8.314 \times 10^4}{1000} \, kJ/mol$$

$$\boxed{E_a = 191.471 \, kJ/mol}$$

For first order reaction,

$$k = \frac{0.693}{t_{\frac{1}{2}}}$$
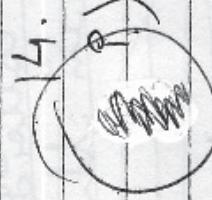
$$K = \dfrac{0.693}{200} \ min^{-1}$$

$$K = 0.3465 \times 10^{-2} \ min^{-1}$$

$$\boxed{K = 3.465 \times 10^{-3} \ min^{-1}}$$

4.
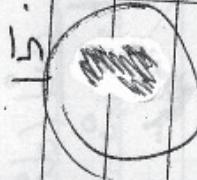
i) O/W Emulsion - It is oil in water emulsion. It is the type of emulsion in which oil (dispersed phase) is dispersed in water (dispersion medium) eg- Milk, Vanishing cream.

It is stabilised big proteins, gums etc which at as emulsifying agent.

ii) Zeta Potential - Zeta potential or electrokinetic potential is the potential difference developed between the electric double layer. The double layer is formed when the colloid absorbs an ion

which is common to the sol. The counter ions form
another loose layer of opposite charges around it.

(iii) Multimolecular colloids – Multimolecular colloids are
the colloids which are formed when many particles
of small size (size smaller than the colloidal range)
aggregate to form a particle which is in the colloidal
range. eg – gold.

15.

density $= \dfrac{Z \times Mol.\ mass}{N_A \times a^3}$

In FCC, $Z = 4$

$a = 400 \times 10^{-10}$ cm

$a = 4 \times 10^{-8}$ cm

$Z = 4 \times Mol.\ mass$

Mol. mass $= \dfrac{Z \times N \times N_A \times (4 \times 10^{-8})^3}{N_A \times 64 \times 10^{-24}}$

No. of moles of substance $= \dfrac{\text{given mass}}{\text{molar mass}}$

No. of atoms $= N_A \times$ no. of moles

$= N_A \times \dfrac{\text{given mass}}{\text{molar mass}}$

$= N_A \times \dfrac{2 \cdot 80}{\text{Molar mass}}$

No. of atoms $= N_A \times \dfrac{2 \cdot 80 \times 4}{16 \cdot 4}$

$= \dfrac{7 \times N_A \times 67 \times 10^{-24}}{16 \cdot 4}$
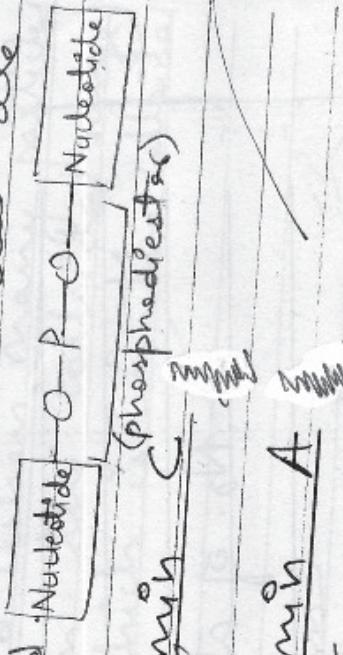
$= 0.25 \times 10^{25}$

$\boxed{\text{No. of atoms} = 2.5 \times 10^{24}}$

16. D-glucose does not react with $NaHSO_3$. This is because its aldehyde group has reacted with the alcoholic group at the 5th carbon to form cyclic hemiacetal.
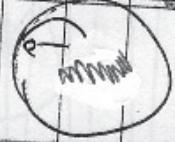
D-glucose + $NaHSO_3$ $\longrightarrow$ no addition

∴ glucose had an open chain structure → $NaHSO_3$ would have given addition product.
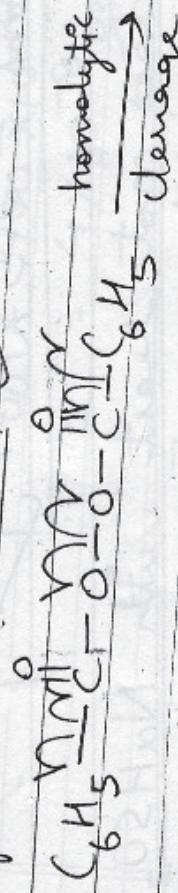
ii) Nucleic acids have phosphodiester linkage between the various nucleotides. Two nucleotides are joined by phosphodiester bond.

Nucleotide — O—P—O — Nucleotide (phosphodiester)

iii) Water soluble vitamin — Vitamin — C

Fat soluble vitamin — Vitamin — A

17. Benzoyl peroxide is the reagent which generates free radical.

$$C_6H_5-\overset{O}{C}-O-O-\overset{O}{C}-C_6H_5 \xrightarrow{\text{homolytic cleavage}} 2 \cdot C_6H_5 + 2CO_2$$

The phenyl free radical generated reacts on ethene molecule to generate bigger free radical. This is
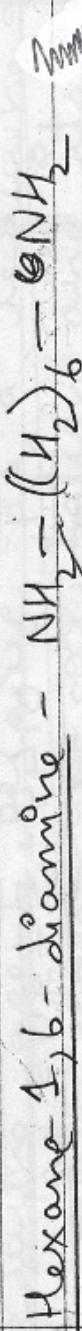
called chain initiation

$$C_6H_5^{\bullet} + CH_2=CH_2 \longrightarrow C_6H_5-CH_2-CH_2^{\bullet}$$

$C_6H_5-CH_2-CH_2^{\bullet}$ reacts on other ethene molecule to leading to chain propagation.

ii) The polymer is Nylon-6,6

Monomers are —

adipic acid = $COOH-(CH_2)_4-COOH$

Hexane 1,6-diamine — $NH_2-(CH_2)_6-NH_2$ Nylon=6,6

iii) Buna S < Polythene < Nylon-6,6

Buna S — Elastomer

Polythene — Thermoplastic

Nylon-6,6 — Fibre

18. Na_2SO_4 on ionizing produces 3 ions.

∴ i = 3 (Vant Hoff factor)

$$\Delta T_b = i \times K_b \times m$$

$$\Delta T_b = \frac{3 \times 0.52 \times 2 \times 1000}{142 \times 50}$$

$$\Delta T_b = 0.4394 \ K$$
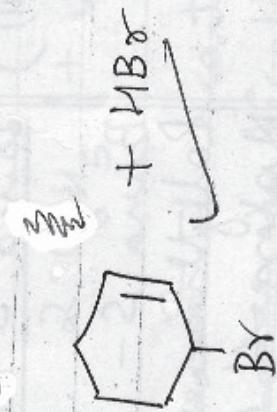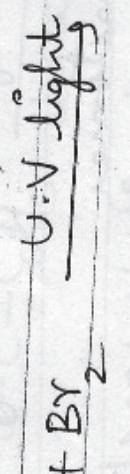
$$\Delta T_b \approx 0.44 \ K$$

$$\Delta T_b = T_b - T_b^{\circ}$$
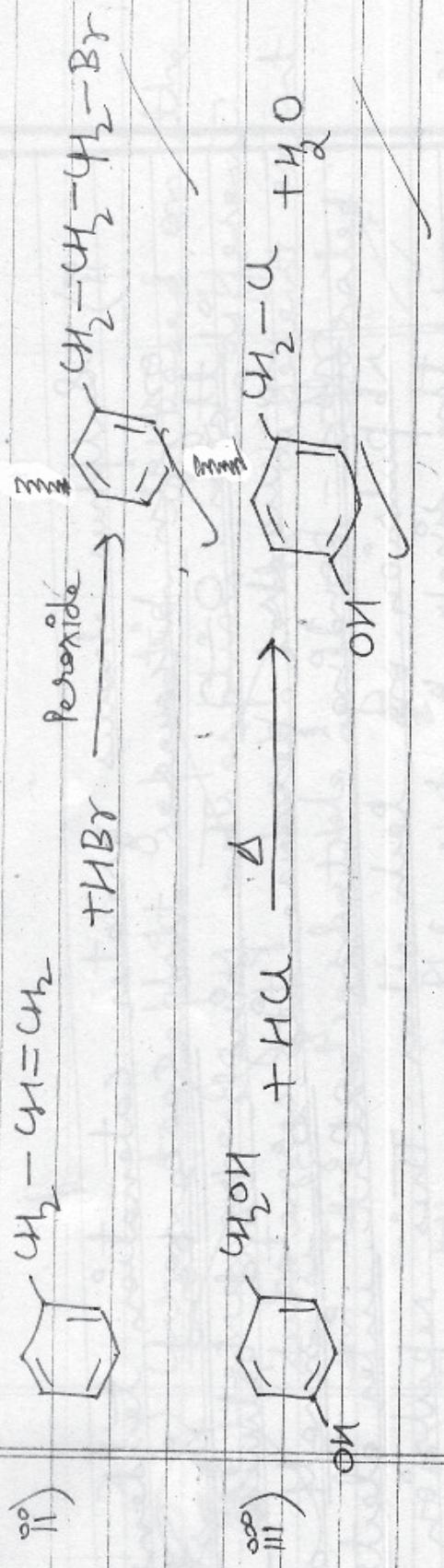
T_b° – Boiling pt. of pure water

$$T_b = 0.44 + 373.15$$

$$\boxed{T_b = 373.59 \ K}$$

or

$$\boxed{T_b = 100.44 \ ^{\circ}C}$$

19.

(i)

⬡ $+ Br_2$ $\xrightarrow{\text{U.V light}}$ ⬡—I $+ HBr$

(with Br substituent)

18

ii)

$\bigcirc$—CH_2—$CH=CH_2$ $\xrightarrow{\text{peroxide}}$ $\bigcirc$—CH_2—CH_2—CH_2—Br
  + HBr

iii)

$\bigcirc$—CH_2OH + HCl $\xrightarrow{\Delta}$ $\bigcirc$—CH_2—Cl + H_2O
  (OH)   (OH)
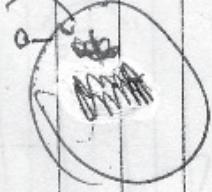
20.

i) The oxidation number of phosphorous in H_3PO_2 is +1 and in H_3PO_3 is +3. H_3PO_2 and H_3PO_3 act as a reducing agent because as a reducing agent, H_3PO_2 is a strong reducing agent because it will undergo oxidation and its oxidation number will increase. But H_3PO_4 cannot act as a reducing agent because its oxidation number is already maximum i.e. at +5. H_3PO_4 cannot get oxidised further. Therefore H_3PO_4 acts as a good oxidising agent and a poor reducing agent.

ii) Sulphur shows greater catenation tendency than oxygen because the S—S bond is stronger than O—O. The single bond between oxygen is weaker because its size is small and the non-bonding electrons exhibit inter electronic repulsion on each other. This repulsion weaken the single bond and hence catenation in oxygen is less.

iii) Reducing character is a measure of the ability of the molecule to get oxidised. More reducing character means that the molecule gets oxidised easily. In case of halogen acids, the tendency to get oxidised is measured by its ability to lose hydrogen. Down the group, as the size of halogen increases, the X—H bond becomes weak and the do tendency to lose hydrogen increase hence down the group reducing character...⑨

21
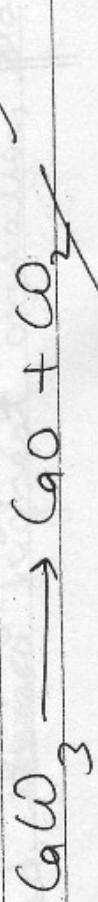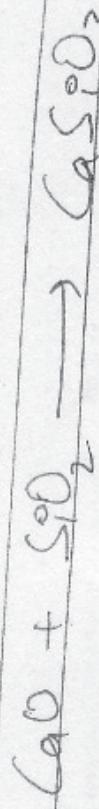
a) Chromatographic separation is based on the phenomenon of adsorption. The different substances get adsorbed to different extent on the adsorbant and are separated.

(ii) In metallurgy of PbS, NaCN is added as a depressant. NaCN is used to separate ZnS from PbS. NaCN forms a complex $Na_2[Zn(CN)_4]$ which separates out and pure PbS is left. Depressant removes the unwanted sulphide (ZnS).
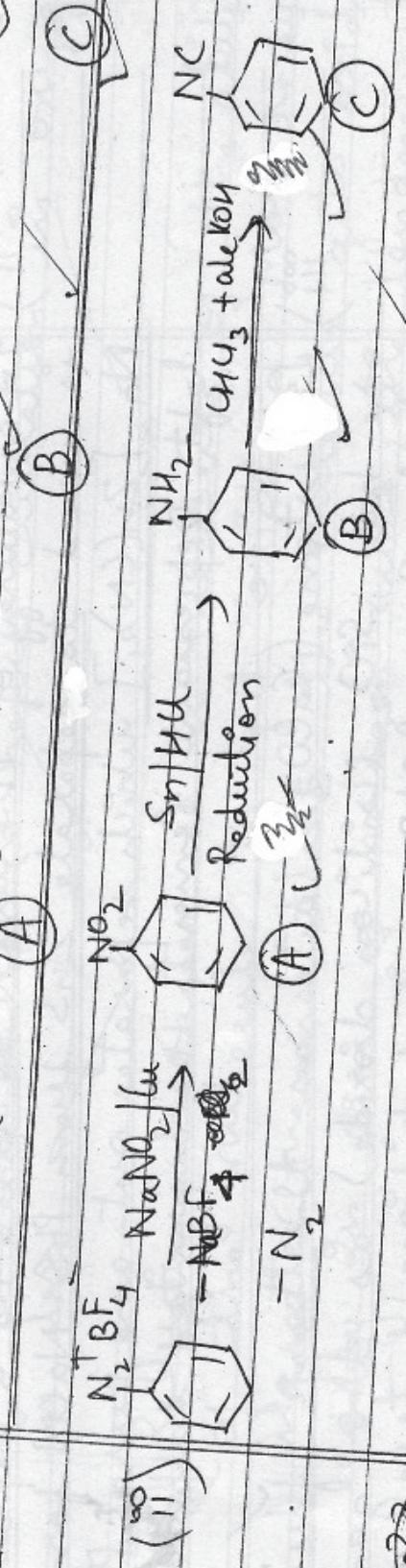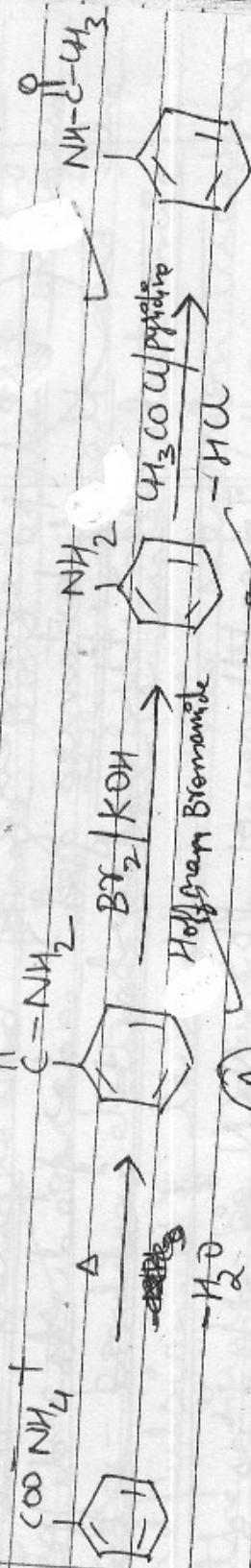
(iii) Limestone $(CaCO_3)$ acts as the basic flux. Iron ore has SiO_2 (silicon dioxide) as the gangue which is acidic. The basic flux reacts with the acidic gangue to remove it as an infusible mass called slag $(CaSiO_3)$

$$CaCO_3 \longrightarrow CaO + CO_2$$

$$CaO + SiO_2 \longrightarrow CaSiO_3$$
(Calcium silicate)

flux   gangue   slag

22)

3)
$C_6H_5-COONH_4 \xrightarrow{\Delta} -H_2O$

$C_6H_5-\overset{O}{\overset{||}{C}}-NH_2$ →(A) $\xrightarrow[\text{Hofmann Bromamide}]{Br_2/KOH} -H_2O$ $C_6H_5-NH_2$ →(B) $\xrightarrow[-HCl]{H_3COCl/pyridine}$ $C_6H_5-NH-\overset{O}{\overset{||}{C}}-CH_3$ (C)

23)

$C_6H_5-N_2^+BF_4^- \xrightarrow[-N_2]{NaNO_2/Cu \atop -NBF_4}$ (A)$C_6H_5-NO_2 \xrightarrow[\text{Reduction}]{Sn/HCl} (A)$ $C_6H_5-NH_2 \xrightarrow{NH_3 + aldehyde} (B)$ $C_6H_4(CN)$ (C)

1) Mr. Ray is a very good and concerned friend of Mr. Awasthi. He does him correct advise keeping

in mind his friend's health. Mr. Roy also has good knowledge of practical biology and chemistry

ii) Sleeping pills or hypnotic drugs are barbiturates. Without consulting the doctor if the sleeping pills are taken then they can harm the person. If overdose happens then it can lead to death also.

iii) Tranquilizers are the drugs that affect the nervous system. They lower depression and induce a sense of well-being in the person. They inhibit the enzymes that breakdown nor adrenalin.
eg- Equanil, prominozid

24.
Q.9) Mn shows its highest oxidation state in Mn_2O_7 and highest oxidation state with
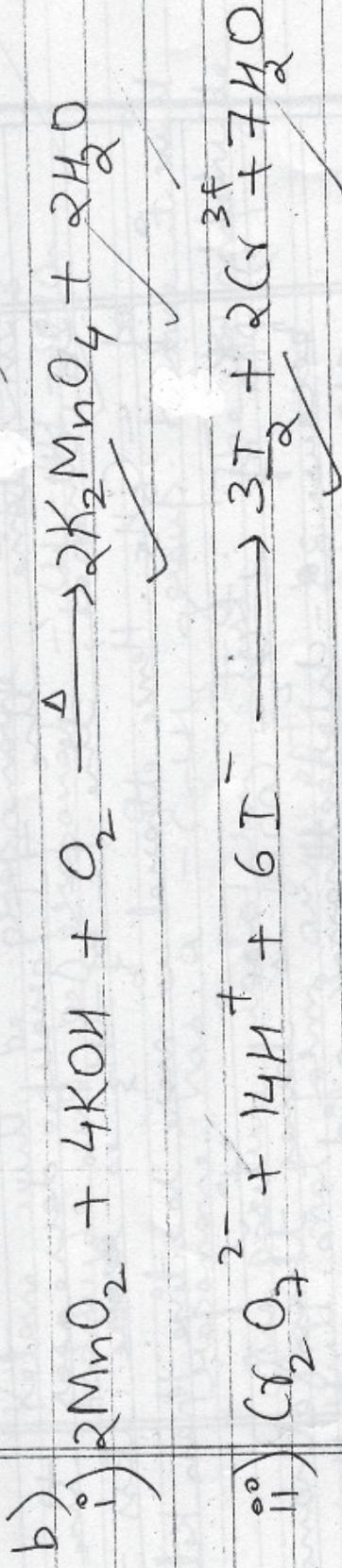
fluorine in MnF_4. Highest oxidation states are been with oxygen because oxygen has the ability to form multiple bonds with the metal atom while fluorine does not form multiple bonds.

20)
11) Zirconium and Hafnium have similar properties and similar radii because of lanthanoid contraction. Zr is an element of 4d series and Hf is an element of 5d series. Before 5d series, there is the 4f series. The screening due to 4f electrons is poor, hence the effective attraction on 5d electrons by the nucleus is more. The increase in size due to addition of new shell is compensated by the poor screening of 4f electrons when we move from 4d to 5d. Hence Zr and Hf have similar size and properties.
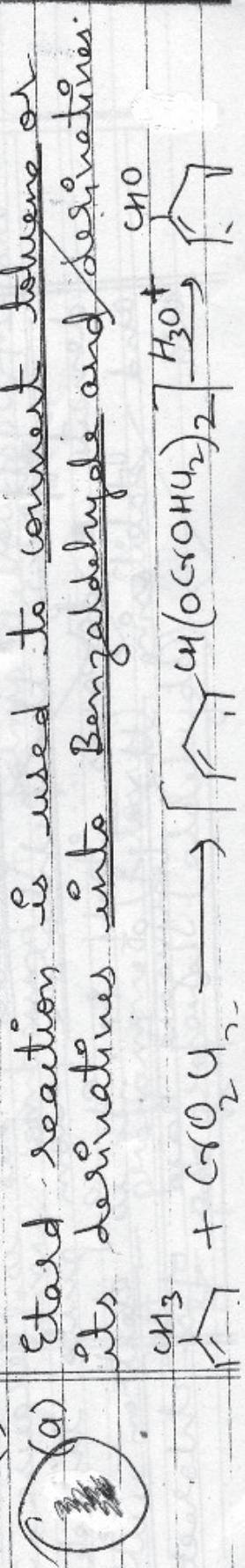
iii) Transition metals act as good catalyst because of their ability to adapt multiple oxidation states and form complexes.

They form complexes because of their small high charge (i.e. large surface charge density) and the d-orbitals.

b)

i) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta} 2K_2MnO_4 + 2H_2O$

ii) $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 3I_2 + 2Cr^{3+} + 7H_2O$

25.

a) Etard reaction is used to convert toluene or its derivatives into Benzaldehyde and derivatives.

$$\text{C}_6\text{H}_5\text{CH}_3 + CrO_2Cl_2 \longrightarrow \text{C}_6\text{H}_5\text{CH(OCrOHCl}_2)_2 \xrightarrow{H_3O^+} \text{C}_6\text{H}_5\text{CHO}$$
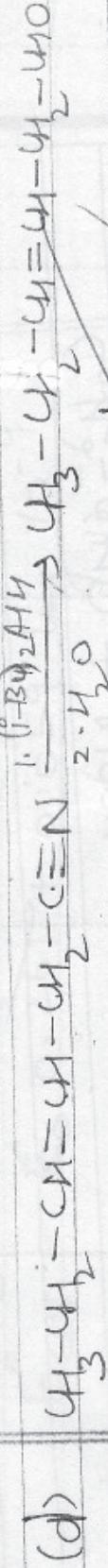
The reagent used is ° Chromyl chloride (CrO_2Cl_2)

(b)

$C_6H_5COCH_3 < CH_3CHO < HCHO$
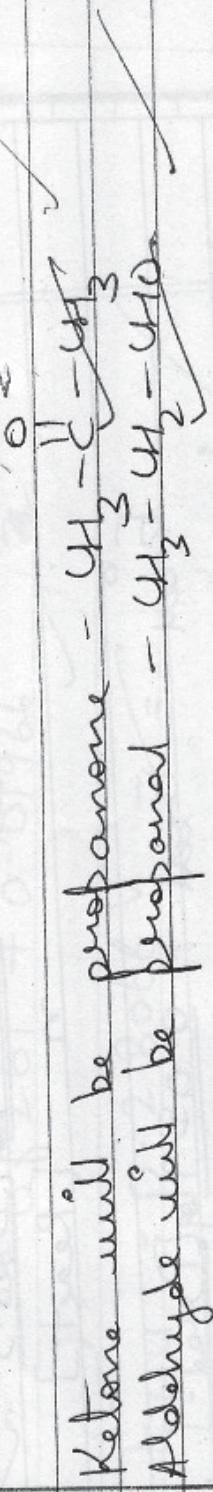
The more electrophilic the carbonyl carbon, the more reactive is the compound to nucleophilic addition. ... has ...

In ketone the + I group decreases the electrophilicity
In ethanol, the + I of $-CH_3$ is ... less than that of $-C_6H_5$. Hence ethanal is more reactive than ketone.

19) pKa of $4-CH_2-COOH$ is lower than ethanoic acid
because 2-chloroethanoic acid is a ... acidic than ethanoic acid. This is because, through chlorine atom pulls the electron density towards itself i.e. it is a $-I$ electron withdrawing effect, the chlorine atom pulls the electron and stabilizing the conjugate base of 2-chloroethanoic acid. (CH_2ClCOO)

(d)

$$CH_3-CH_2-CH=CH=CH-CH_2-C\equiv N \xrightarrow[2.\ H_2O]{1.(i-Bu)_2AlH} CH_3-CH-CH=CH-CH_2-CH_2-CHO$$
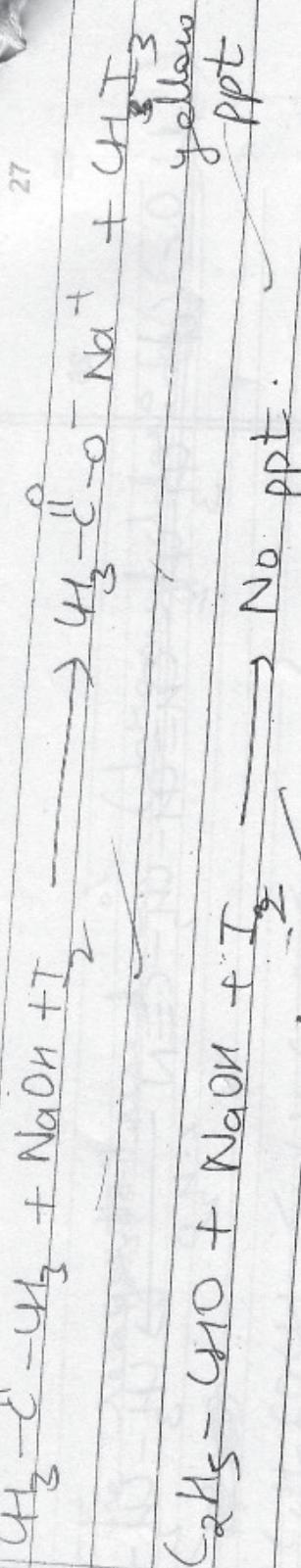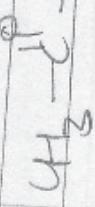
(e) From the structural formula, we can say that C_3H_6O is a compound with one ketone group. Hence the compounds are aldehyde and Ketone.

Ketone will be propanone - $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

Aldehyde will be propanal - CH_3-CH_2-CHO

Propanone has a $-C-CH_3$ group. Hence it will give positive iodoform test. The aldehyde will not form any ppt.

Since compound A forms yellow ppt, hence

A — propanone (Ketone)

B — propanal (aldehyde)

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + NaOH + I_2 \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-O-Na^+ + CHI_3$$
yellow ppt

$$C_2H_5-OH + NaOH + I_2 \longrightarrow \text{No ppt.}$$

26.

(a) According to Nernst equation

$$E_{cell} = E^0_{cell} - \frac{0.059}{n}\log\frac{[Prod.]}{[React]}$$

$$E^0_{cell} = E_{cell} + \frac{0.059}{n}\log\frac{[Prod.]}{[React]}$$

$$= 0.261 + \frac{0.059}{6}\log\frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$$

$$= 0.261 + \frac{0.059}{6}\log\frac{(10^{-2})^2}{(10^{-2})^3}$$

$$E^\circ_{cell} = E^\circ_{cell} - 0.261 + 0.059 \, \log \frac{10^{-4}}{10^{-6}}$$

$$= 0.261 + 0.059 \, \frac{\log 10^{2}}{6}$$

$$E^\circ_{cell} = 0.261 + \frac{0.059 \times 2}{6}$$

$$= 0.261 + 0.01966$$

$$E^\circ_{cell} = 0.28066 \, V$$

$$\boxed{E^\circ_{cell} = 0.281 \, V}$$

(b) From the reduction potential values, we can conclude that the more negative the reduction potential is, the better is the species a reducing agent i.e. it has higher tendency to get oxidised

Rusting of iron is due to its oxidation from

Fe to Fe^{2+}. If we coat the surface with a substance that has more tendency to get oxidised than iron, then iron will not get oxidised and corrosion will be prevented.

Thus we have to choose a metal whose reduction potential is more negative than that of iron. We can see that metal A has a more negative reduction potential. Thus metal A is better for coating iron. The metal A will work as a sacrificial metal and will get oxidised instead of iron.