केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली
सीनियर स्कूल सर्टिफिकेट परीक्षा (कक्षा बारहवीं)
परीक्षार्थी प्रवेश–पत्र के अनुसार भरे

XII

Subject : CHEMISTRY

Subject Code : 043

Day & Date of the Examination : WEDNESDAY / 9.3.2016

Medium of answering the paper : ENGLISH

| Write code No. as written on the top of the question paper : | Code Number: 56/2/N | Set Number: ① ● ③ ④ |
|---|---|---|
| No. of supplementary answer-book(s) used | NIL | |
| Person with Disabilities : (Yes / No) | NO | |

If physically challenged, tick the category

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

B = Blind, D = Hearing Impaired, H = Physically Challenged, S = Spastic, C = Dyslexic, A = Autistic

| Whether writer provided : (Yes / No) | NO |
|---|---|
| If Visually challenged, name of software used : | NIL |

*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।

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

Another factor which prevents the colloidal sols from coagulating is charge on the colloids. 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.

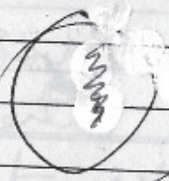
3. The gas is $NO_2$ (Nitrogen dioxide)

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

(brown gas)

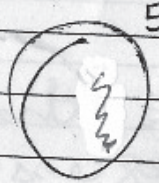
$$2NO_2 \underset{\text{cooling}}{\rightleftharpoons} N_2O_4$$

(colourless)

4. 

$CH_3-NH-CH_2-\overset{2}{C}H(CH_3)-\overset{3}{C}H_3$

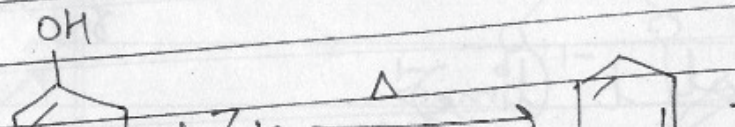
N-Methyl-2-Methylpropan-1-amine

5. 

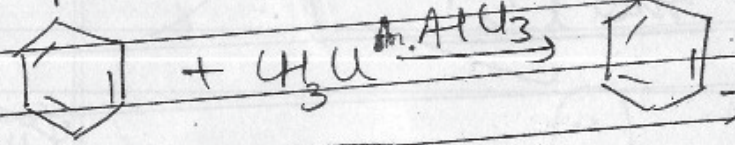
The reaction (i) is $S_N2$ reaction. This is because it leads to inversion of configuration.

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

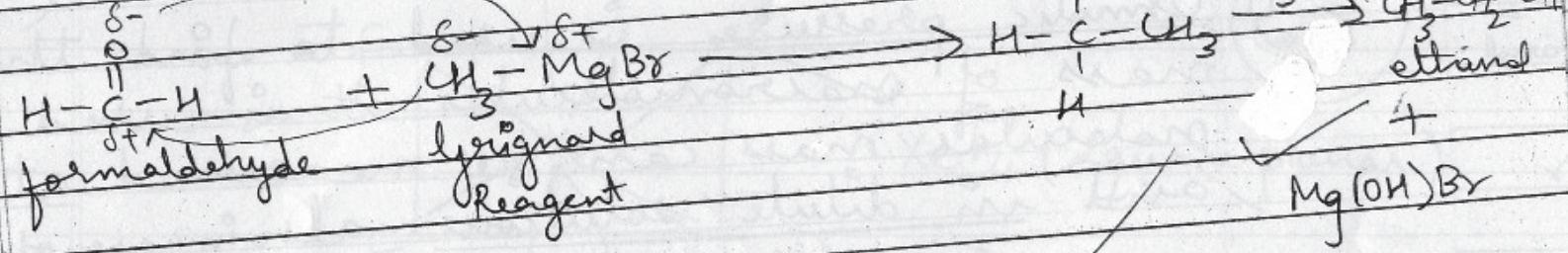
6.

i) 


phenol




toluene

ii) 


formaldehyde

Grignard Reagent

7.

i) It is a zero order reaction because

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

The molecularity of the reaction is two because 2 molecules of $NH_2$ are present as reactants.

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

Unit of K = $mol\ l^{-1}(time)^{-1}$

If time is measured in seconds, then

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

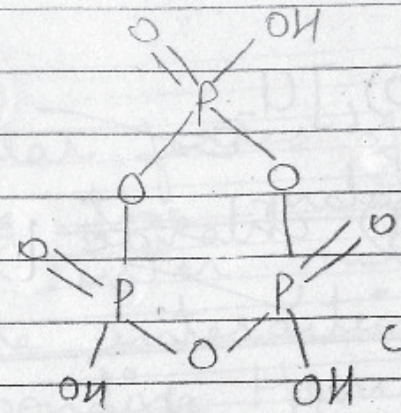
8.

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

ii) If the azeotropic mixture is minimum boiling then the non-ideal solution shows positive deviation. This is because boiling point is inversely related to the pressure.

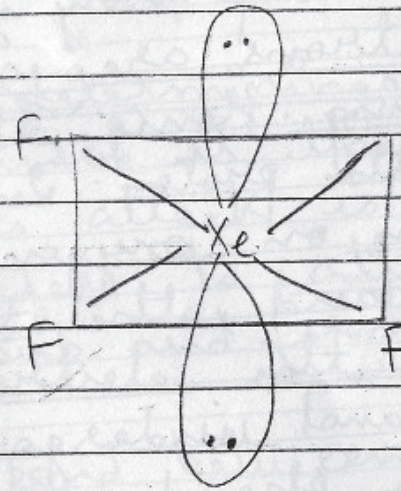
9.

i)



$(HPO_3)_3$

ii)



$XeF_4$ (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

$[Ni(H_2O)_6]Cl_2$

ii) Hexaaquanickel(II) chloride

11.

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 is why ethanol undergoes protonation easily as compared to phenol.

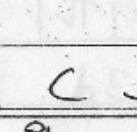
b) The boiling point of a substance is governed by the intermolecular force of attraction. In case of ethanol, the molecules have strong

two

here.

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

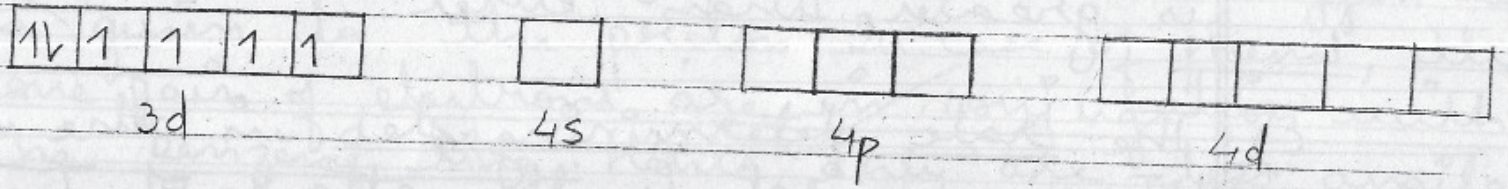
c) The rate determining step in the reaction of HI on anisole is the attack of $I^-$ ion on anisole. This attack is through $S_N2$ mechanism. So, $I^-$ prefers to attack the less hindered $-CH_3$ group and forms $CH_3-I$.

Also the bond between O and C in  is more difficult to break because of its double bond character due to resonance. The bond between $O-CH_3$ is easier to break, hence $CH_3-I$ is formed. Phenol resists further substitution by $I^-$ ion because it does not undergo nucleophilic

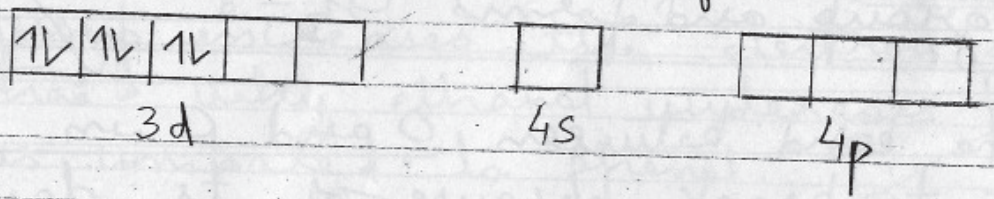
substitution easily.

12(a) Oxidation number of Fe is +2 in $[Fe(CN)_6]^{4-}$

$Fe^{2+} = 3d^6$




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




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 three 4p orbitals

| ↑↓ | ↑↓ | ↑ |
|---|---|---|

3d

| ↑↓ | ↑↓ | ↑ | ↑ | ↑ | ↑ |
|---|---|---|---|---|---|

$d^2sp^3$

hybrid orbitals

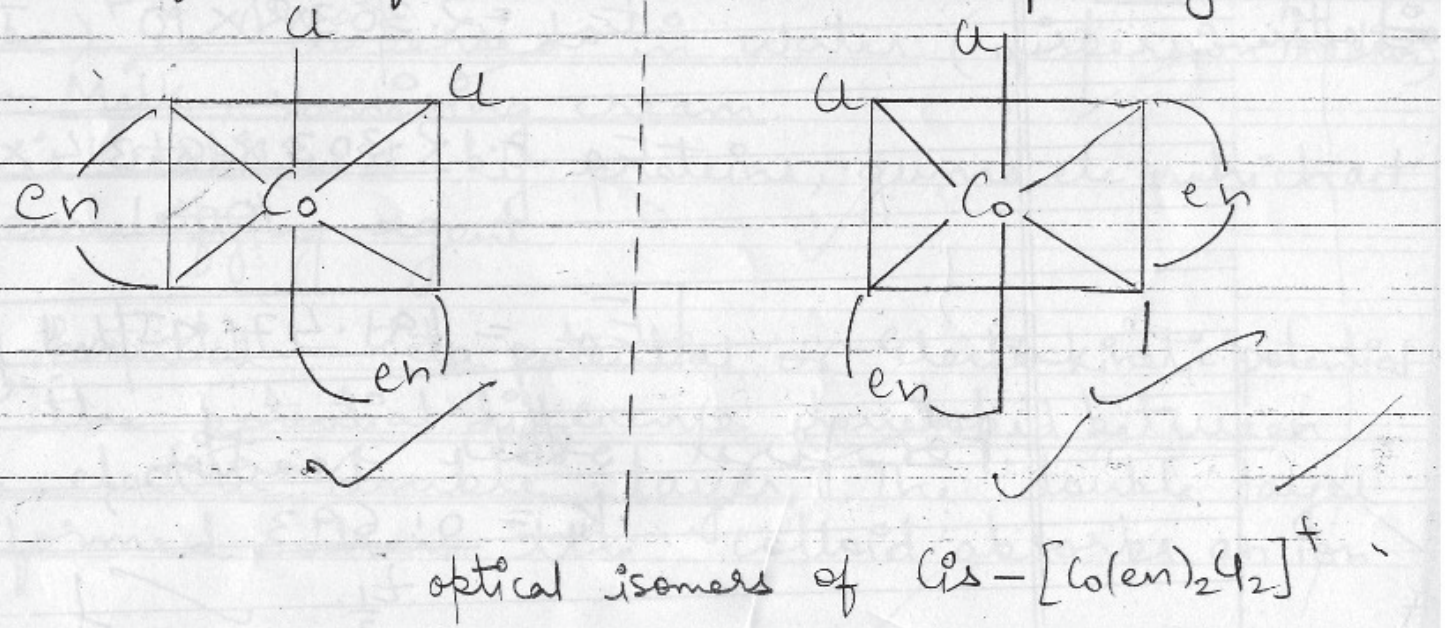
Hybridisation – $d^2sp^3$

Magnetic character – diamagnetic

Magnetic moment = 0

Spin type – low spin complex.

b) Cis – form of $[Co(en)_2Cl_2]^+$ is optically ~~odd~~ acti




optical isomers of Cis – $[Co(en)_2Cl_2]^+$

13.

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

$$\log K = -\frac{1 \times 10^4 K}{T} + 14.2 \quad \text{——} (2)$$

Compairing eq (1) and (2) we find that

$$\frac{E_a}{2.303R} = 1 \times 10^4$$

$$E_a = 2.303 R \times 10^4 \text{ J/mol}$$

$$E_a = \frac{2.303 \times 8.314 \times 10^4}{1000} \text{ KJ/mol}$$

$$\boxed{E_a = 191.471 \text{ KJ/mol}}$$

For first order reaction,

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

$$K = \frac{0.693}{200} \text{ min}^{-1}$$

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

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

14.

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 by proteins, gums etc which act as emulsifying agent.

ii) Zeta Potential – Zeta potential or Electro-kinetic 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.

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

In FCC, $Z = 4$

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

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

$$7 = \frac{4 \times \text{Mol. mass}}{N_A \times (4 \times 10^{-8})^3}$$

$$\text{Mol. mass} = \frac{7 \times N_A \times 64 \times 10^{-24}}{}$$

No. of moles of substance = $\frac{\text{given mass}}{\text{Molar Mass}}$

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

$= N_A \times \frac{280}{\text{Molar mass}}$

$= N_A \times \frac{280}{64} \times 4$

No. of atoms $= \frac{N_A \times 280 \times 4}{7 \times N_A \times 64 \times 10^{-24}}$

$= 0.25 \times 10^{25}$

$= 2.5 \times 10^{24}$

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.

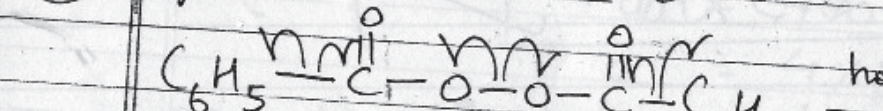
D- glucose + $NaHSO_3$ ⟶ no addition.
If glucose had an open chain structure, $NaHSO_3$ would have given addition product.

ii) Nucleic acids have phosphodiester linkage between the various nucleotides. Two nucleotides are joined by phospho-diester bond. Nucleotide — O — P — O — Nucleotide (phosphodiester)

iii) Water soluble vitamin — Vitamin C
Fat soluble vitamin — Vitamin A

17.

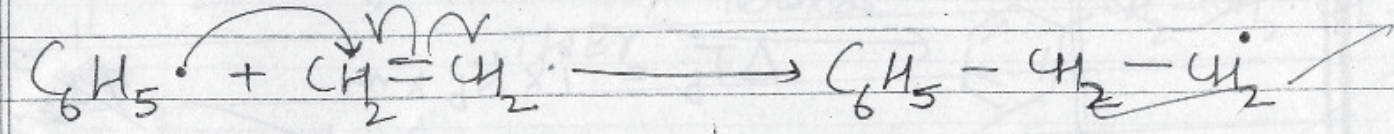
i) Benzoyl peroxide is the reagent which generates free radical.




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

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

called chain initiation.



$C_6H_5-CH_2-CH_2^{\cdot}$ reacts on other ethene molecules leading to chain propogation.

ii) The polymer is Nylon-6,6

Monomers are —

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

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

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.

$\therefore i = 3$ (Vant Hoff factor)

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

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

$$\Delta T_b = 0.4394\ K$$

$$\Delta T_b \approx 0.44K$$

$$\Delta T_b = T_b - T_b^\circ$$

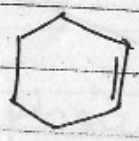
$T_b^\circ$ – Boiling pt. of pure water

$$T_b = 0.44 + 373.15$$

$$\boxed{T_b = 373.59\ K} \text{ or } \boxed{T_b = 100.44\ ^\circ C}$$

19.

i)

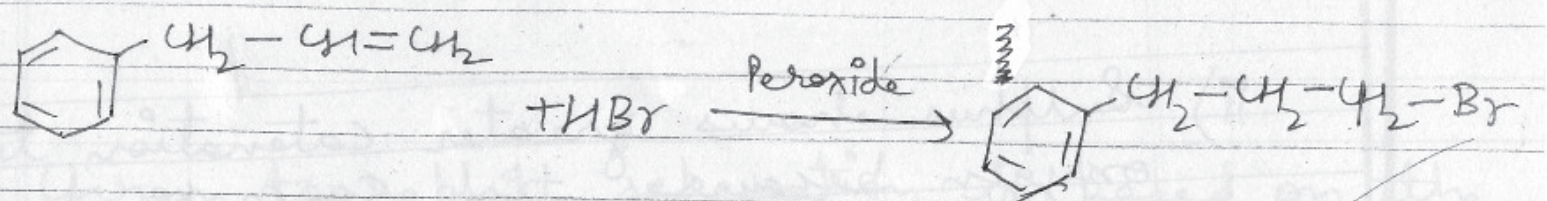


$+ Br_2$ — U.V light →

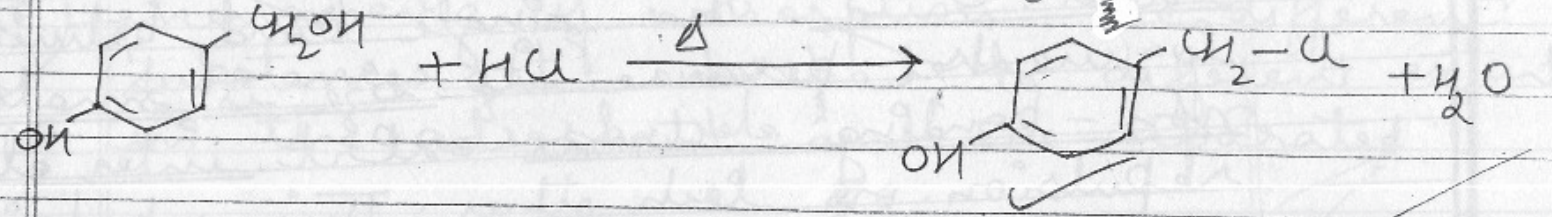
$+ HBr$

Br

ii)




iii)




20.

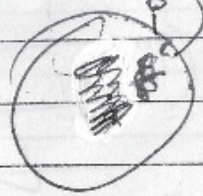
i) The oxidation number of phosphorous in $H_3PO_2$ is +1 and in $H_3PO_4$ is +5. $H_3PO_2$ is a stronger reducing agent because as a reducing agent, it will undergo oxidation and its oxidation number will increase. But $H_3PO_4$ cannot act as a reducing agent because its oxidation number is already maximum i.e. at +5. It 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 exert inter electronic repulsion on each other. This repulsion weakens 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 tendency to lose hydrogen increases. Hence down the group reducing charac...

21.

i) Chromatographic separation is based on the phenomena of adsorption. The different substances get adsorbed to different extent in the adsorbant and are separated.



ii) In metallurgy of PbS, NaCN is added as a depressant. It 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).

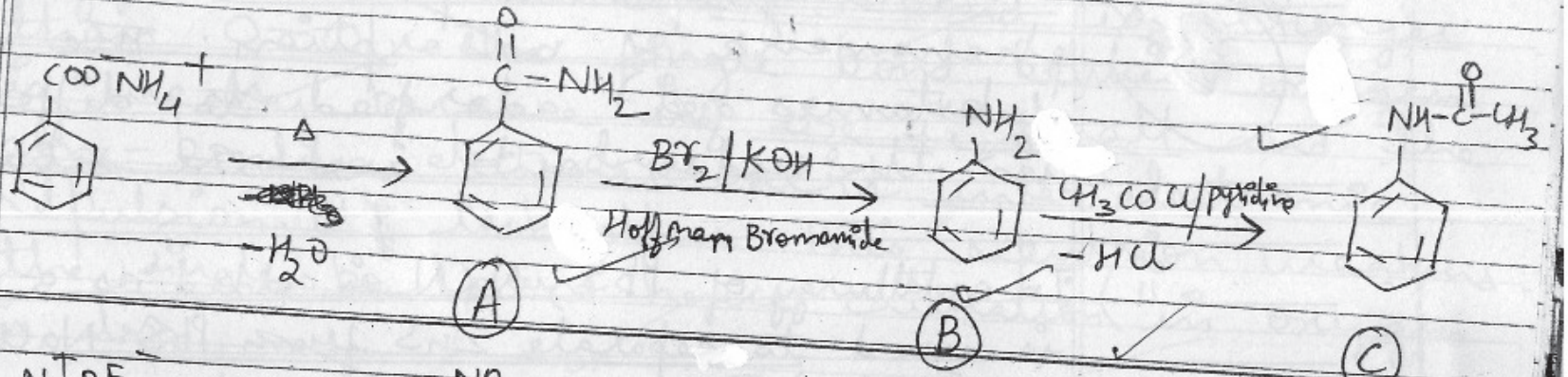
iii) Limestone ($CaCO_3$) acts as the basic flux. Iron ore has $SiO_2$ (silicon dioxide) as the gangue which is acidic. The basic flux reacts with acidic gangue to remove it as an infusible mass called slag ($CaSiO_3$)

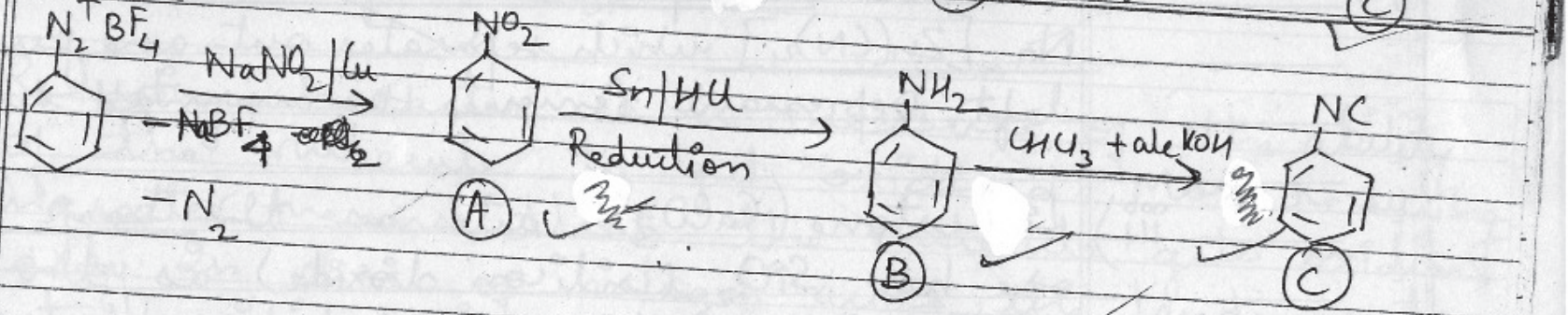
$$CaCO_3 \longrightarrow CaO + CO_2$$

$CaO + SiO_2 \longrightarrow CaSiO_3$

flux gangue (Calcium silicate) slag

22.

i) 


ii) 


23.

i) Mr. Roy is a very good and concerned friend of Mr. Amarthi. He gave him correct advice 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, Iproniazid.

24.

(a) i) Mn shows its highest oxidation state in $Mn_2O_7$ and its highest oxidation state with

fluorine in $MnF_4$. Highest oxidation states are seen with oxygen because oxygen has the ability to form multiple bonds with the metal atom while fluorine does not form multiple bonds.

ii) 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 adopt multiple oxidation states and form complexes.

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

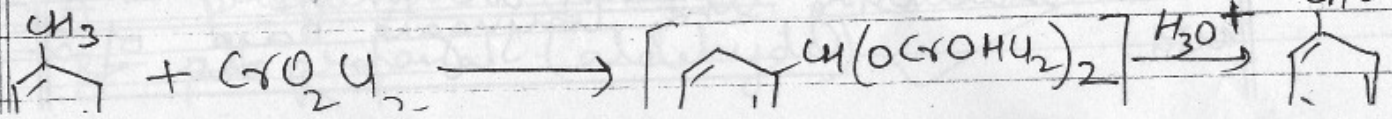
b)

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 derivatines into Benzaldehyde and derivatines.



The reagent used is Chromyl chloride ($CrO_2Cl_2$)

(b) ~~RCHO~~

$C_6H_5COCH_3 < CH_3CHO < HCHO$

The more electrophilic the carbonyl carbon, the more reactive is the compound to ~~electrophilic~~ nucleophilic addition.

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

(c) pKa of $Cl-CH_2-COOH$ is lower than ethanoic acid because 2-chloroethanoic acid is ~~a better~~ a more acidic than ethanoic acid. This is because, through -I effect, the chlorine atom pulls the electron density towards itself i.e. it is electron withdrawing and stabilising the conjugate base of 2-chloroethanoic acid.

(d) $CH_3-CH_2-CH=CH-CH_2-C\equiv N \xrightarrow[2.H_2O]{1.(i\text{-}Bu)_2AlH} CH_3-CH_2-CH=CH-CH_2-CHO$

(e) From the ~~comp~~ structural formula, we can say that $C_3H_6O$ is a compound with one carbonyl group. Hence the compounds are aldehyde ~~or~~ and Ketone.

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

Aldehyde will be propanal - $CH_3-CH_2-CHO$

Propanone has a $-\overset{\overset{O}{\|}}{C}-CH_3$ group. Hence it will give positive iodoform test. The ~~b~~ aldehyde will not form any ppt.

Since compound A forms yellow ppt, hence

A - propanone (Ketone)

B - ~~pro~~ 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)

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

26.

a) According to Nernst equation

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

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

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

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

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

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

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

$$= 0.261 + 0.01966$$

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

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

(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

ATM

29

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 oxidise and corrosion will be prevented.

Thus we have to choose a metal whose reduction potential is more negative than that of iron. From the data 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.

Lutfi