Version No.	ROLL NUMBER

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

CHEMISTRY HSSC–II

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. Each part carries one mark.

1. The first ionization energy is higher for the:
   A. Alkali metals ◯ B. Alkaline earth metals ◯
   C. Halogens ◯ D. Noble gases ◯

2. Crimson red is characteristic flame color of:
   A. Li ◯ B. Na ◯
   C. Ca ◯ D. Ba ◯

3. The catalyst used for synthesis of ammonia by Haber process is:
   A. Fe ◯ B. $TiCl_4$ ◯
   C. Cr_2O_3 ◯ D. ZnO ◯

4. Aerosols and lotions are used as:
   A. Fungicides ◯ B. Repellents ◯
   C. Herbicides ◯ D. Miticides ◯

5. Due to inert pair effect _____ oxidation state is more stable than _____ for Pb.
   A. 2+,4+ ◯ B. 1+,4+ ◯
   C. 4+,2+ ◯ D. 2+,3+ ◯

6. Ozone is destroyed by:
   A. SO_2 ◯ B. CO_2 ◯
   C. CFCs ◯ D. HCl ◯

7. Which one of the following is used as reference in NMR spectroscopy?
   A. Tetra chloromethane ◯ B. Tetra methylsilane ◯
   C. Tetra silanemethane ◯ D. Tri iodomethane ◯

8. Which one of the following technique does not involve interaction of electromagnetic radiations with matter?

A. IR spectroscopy ◯ B. NMR spectroscopy ◯
C. Mass spectroscopy ◯ D. UV spectroscopy ◯

9. Benzoic acid is obtained by oxidation of:

A. m-Xylene ◯ B. p-Xylene ◯
C. Toluene ◯ D. Phenol ◯

10. The structural formula for carboxylic anhydride is:

A. RCOOCOR ◯ B. RCOR ◯
C. RCOOR ◯ D. RCOOH ◯

11. Which one of the following is not a nucleophile?

A. H_2O ◯ B. H_2S ◯
C. BF_3 ◯ D. NH_3 ◯

12. Oxonium ion is formed when:

A. Ethanol react with Na metal ◯
B. Phenol react with NaOH ◯
C. Ether is treated with HI ◯
D. Ethanol treated with $NaOH/I_2$ ◯

13. Which one of the following reagents reacts with both aldehyde and ketone?

A. Grignard reagent ◯ B. Tollen's reagent ◯
C. Fehling's reagent ◯ D. Benedict's reagent ◯

14. Which one of the following reagents is used for reduction of carboxylic acid?

A. H_2/Ni ◯ B. H_2/Pt ◯
C. $NaBH_4$ ◯ D. $LiAlH_4$ ◯

15. Which one of the following is used as major component of soap?

A. Fatty acid ◯ B. Palm oil ◯
C. Proteins ◯ D. Saccharides ◯

16. IUPAC name of Glutaric acid is:

A. Butane dioic acid ◯ B. Pentane dioic acid ◯
C. Propane dioic acid ◯ D. Hexane dioic acid ◯

17. Which one of the following nuclei is NMR active?

A. C^{12} ◯ B. C^{13} ◯
C. O^{16} ◯ D. Ne^{10} ◯

Federal Board HSSC-II Examination
Chemistry Model Question Paper
(Curriculum 2006)

MCQ'S KEY

1. D	2. A	3. A	4. B	5. A	6. C	7. B	8. C	9. C
10. A	11. C	12. C	13. A	14. D	15. A	16. B	17. B	

SECTION-B

Q. No. 2 (i) The thermal stability of carbonates of alkaline earth metals increases down the group. Justify this behavior.

Ans. Effect of heat on group 2 carbonates:

All carbonates decomposes on heating at appropriate temperature evolving CO_2.

The stability of carbonates increases down the group.

$$MCO_3 \xrightarrow{\Delta} CO_2 + MO$$

Reason: Cations of group 2 have smaller sizes and greater charge densities than the cations of group 1 elements. The cations of small size and high charge densities have greater ability to distort or polarize the carbonate ion and hence facilitate its decomposition.

Q. No. 2 (ii) The order as reducing agent of Halide ions is $F^- < Cl^- < Br^- < I^-$. Interpret it.

Ans. The reducing ability of halide ions increases down the group. $F^- < Cl^- < Br^- < I^-$

When a halide ion acts as reducing agent, it has to lose electrons itself. The bigger the halide ion, farther the outer electrons are from the nucleus, and the more they are screened from it by the inner electrons. It, therefore gets easier for the halide ions to lose electrons as we go down the group because there are less attraction of outer electrons and nucleus.

Q. No. 2 (iii) Ammonia act as both ligand and base. Justify this statement by the reaction with copperion

Ans.Ammonia as base:

When few drops of aq. Ammonia is added to Cu (II) ion hydrogen of water ligand is removed by ammonia and blue ppt. of hydroxide of copper is formed.

$$[Cu(H_2O)_6]^{+6} + 2NH_3 \rightarrow [Cu(OH)_2(H_2O)_4] + 2NH_4^+$$

Blue ppt

Ammonia as ligand:

When excess drops of aq. Ammonia is added to Cu (II) ion hydrogen of water ligand is removed by ammonia and blue sol. of hydroxide of copper is formed. In this reaction ammonia acts as ligand.

$$[Cu(H_2O)_6]^{+2} + 4NH_3 \rightarrow [Cu(NH_3)_4]^{2+} + 6H_2O$$

Deep blue sol.

Q. No. 2 (iv)What are ligands? Give example of tridentate and hexa dentate ligand.
Ans. Ligand: A substance usually negatively charged, neutral molecule or sometimes positively charged surrounding the central metal atom or ion by donating e pair is called ligand.

Tridentate Ligand: Ligands which have three donatable electron pairs.

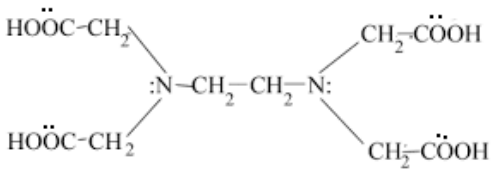
Example: Diethylene triamine

$$H_2NCH_2 - CH_2 - NH - CH_2 - CH_2 - NH_2$$

Hexadentate

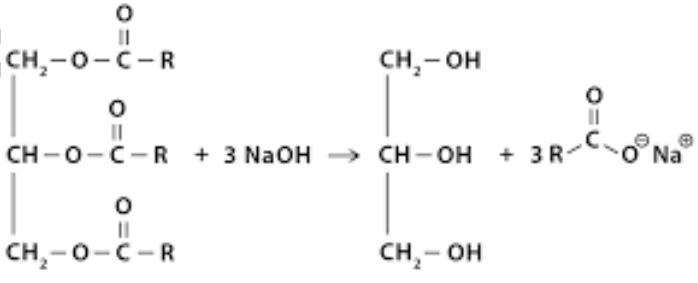
Ligand: Ligands which have six donatable electron pairs.

Example: Ethylene diamine tetra acetate (EDTA)



structure of EDTA

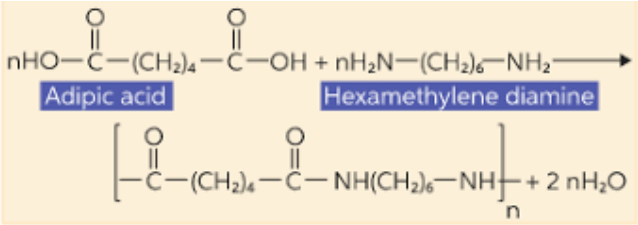
Q. No. 2 (v) How will you prepare glycerol from hydrolysis and saponification of fats andoils?
Ans. Saponification: It is the hydrolysis of triglycerides (oil and fats) by alkalies. Glycerol is produced along with Na and K salt of fatty acids. These Na and K salts are called soaps.



Q. No. 2 (vi)How can nylon-6,6 be prepared from Adipic acid? Give complete chemical reaction.

Ans. <u>Synthesis of Nylon-6,6</u>

Nylon-6,6 is the example of condensation polymerization which is the most important polyamide.



It is obtained by heating adipic acid with hexamethylenediamine under nitrogen at 200°C. It is derived its name from its starting material both of which have 6 carbons. It is used for production of stocking and other wearing apparels.

Q. No. 2 (vii) How does tetraethyl lead cause air pollution?
Ans. <u>Drawbacks of tetraethyl lead:</u>

Tetraethyl lead is added to petrol to improve its quality and hence enables it to burn more completely. Due to this air pollution is minimized.

Use of tetraethyl lead has few drawbacks.

1. Lead vapors pollute the air.
2. Lead oxide deposits in the valves of the engine.

Q. No. 2 (viii)What are the oxidation number and coordination number of the metals in the following complex compounds?

(a) $[Cr(H_2O)_4(OH)_2]NO_3$ (b) $K_4[Fe(CN)_6]$

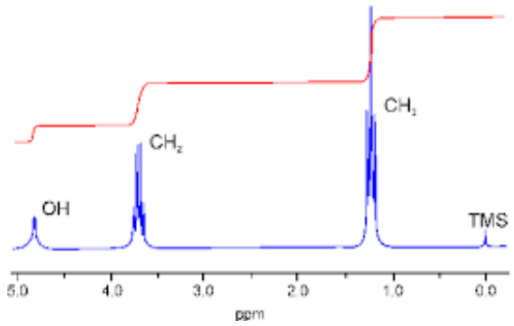
Ans.

a) Coordination No: 6 Oxidation No: III

b) Coordination No: 6 Oxidation No: II

Q. No. 2 (ix) What information are obtained from number of peaks and area under the peaks in NMR spectrum?
Ans. <u>No of peaks:</u> Protons in different chemical environment require slightly different magnetic field to come to resonance. Therefore different types of protons form peak position in NMR spectrum.

Area under the Peak: It is proportional to number of protons involved.

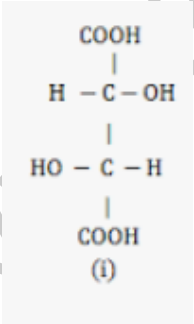


Q. No. 2 (x) What are adhesives? How does hot Gluework?
Ans. Adhesives: They are meant to stick together. An adhesive is a compound that adhere or bound two items together. It may come from either natural or synthetic sources.

Hot Glue: It is also known as hot melt adhesives. These are thermoplastics they are applied hot and simply allowed as they cool. The glue gun melts the solid adhesive and then allowed the liquid to pass through barrel of the gun onto material where it solidifies.

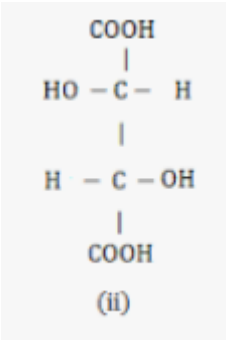
Q. No. 2 (xi)Summarize the concept of optical Isomerism by drawing different isomeric structures of tartaric acid showing their optical behavior.
Ans. Tartaric acid contains two asymmetric carbon atoms.

(i) (+) rotates plane polarized light to right.



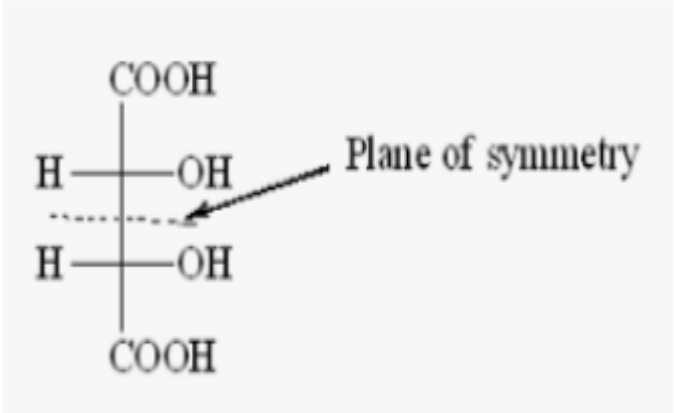
(i)

(ii) (-) rotates plane polarized light to left.



(ii)

(iii) Meso: It possess plane of symmetry, optically inactive.



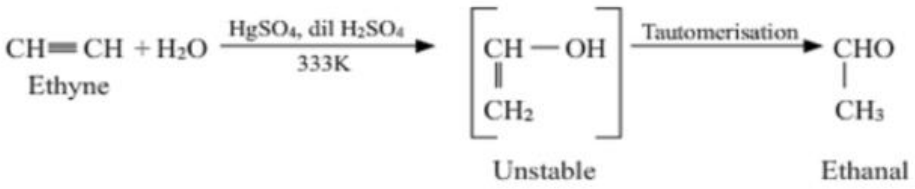
(iv) Racemic mixture: (+/-) Equimolar mixture of (+) and (-) forms. Does not rotates plane polarized light in any direction.

Q. No. 2 (xii)How will you prepare following compounds starting fromacetylene?

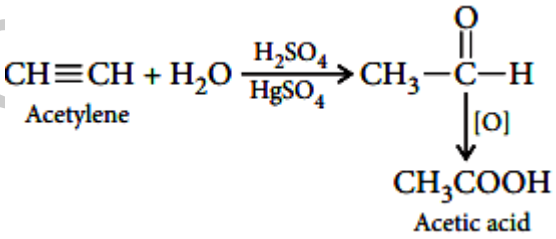
a. Acetaldehyde b. Aceticacid

Ans.

a) <u>Acetylene to acetaldehyde</u>

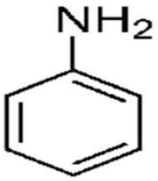


b) <u>Acetylene to acetic acid</u>

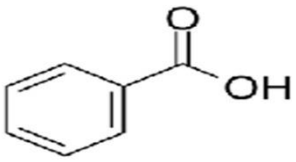


Q. No. 2 (xiii)The following mono substituted benzene are subjected to nitration reaction. Prioritize the positions of different products formed.

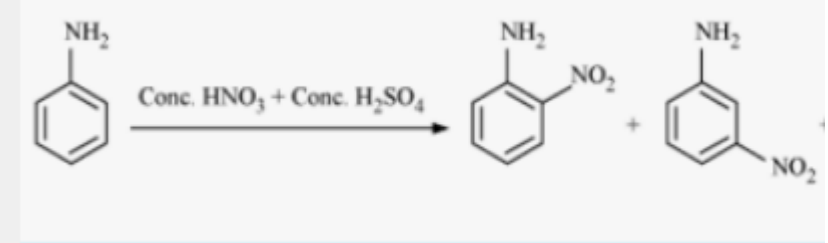
a)



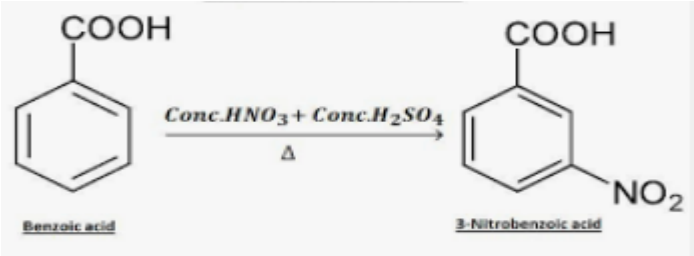
b)



Ans. In aniline, NH_2 is o/p directing group it increases e density on these positions making electrophilic attack on these positions more feasible.



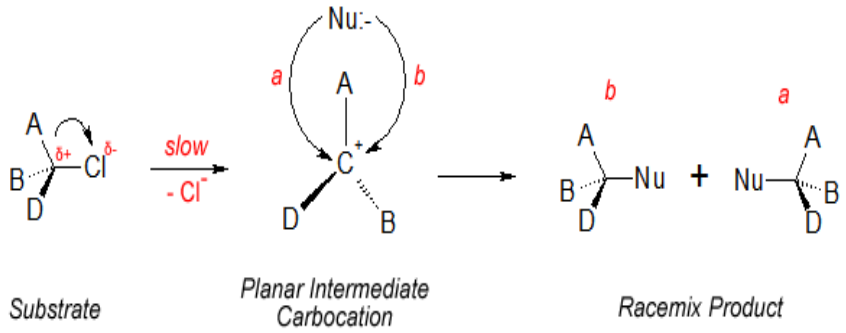
In benzoic acid, COOH is meta directing group, it directs the incoming electrophile to meta position. It deactivatesthe o/p positions while meta position remain electron rich.



Q. No. 2 (xiv)Give stereo chemical evidences of Nucleophilic Substitution reactions of alkyl halides.

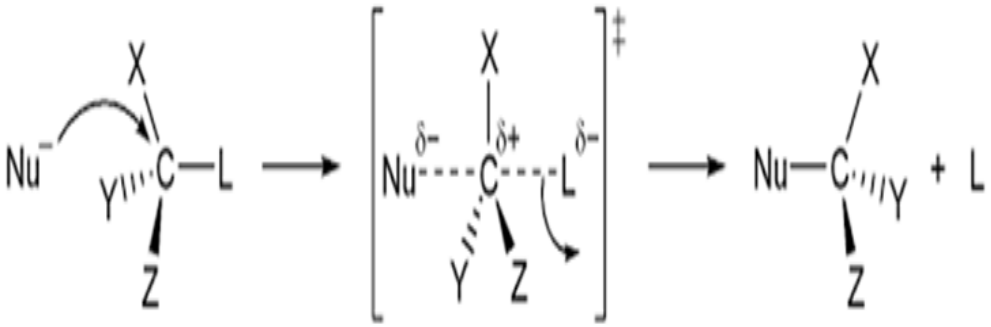
Ans. <u>SN1 mechanism (stereo chemical evidence):</u>

Since carbocation is formed in first step and nucleophile can attack it form either direction, formation of a racemic mixture (or partial racemization) is a proof of SN_1 mechanism.

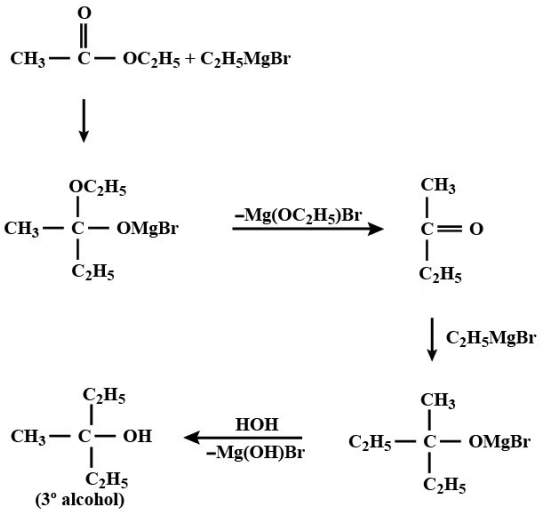


<u>SN2 mechanism (stereo chemical evidence):</u>

As SN_2 is a single step mechanism, nucleophile attacks from the side opposite to the leaving group. Therefore, inversion of configuration is a proof of this mechanism.



Q. No. 2 (xv)Identify the products when CH_3MgBr react with ethyl acetate? Give its mechanism.
Ans. Reaction of Grignard reagent with ester:

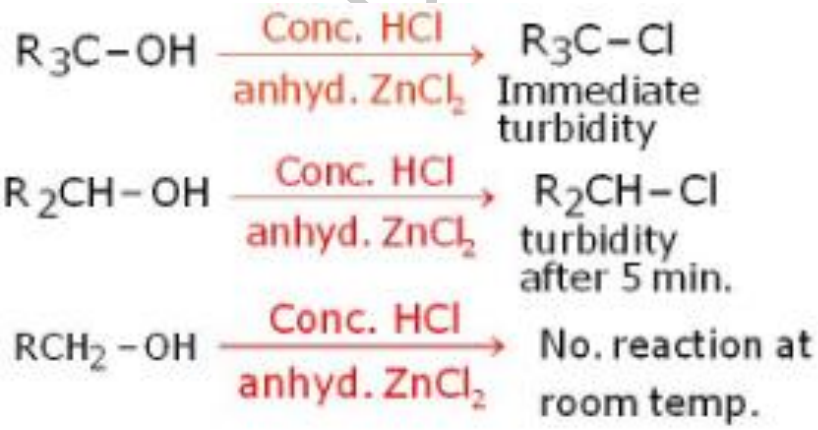


Q. No. 2 (xvi) How Lucas Test being employed to distinguish different types of alcohols?
Ans. Lucas test is used to distinguish Pri, sec and tertiary alcohols.

Tertiary alcohol form oily layer immediately.

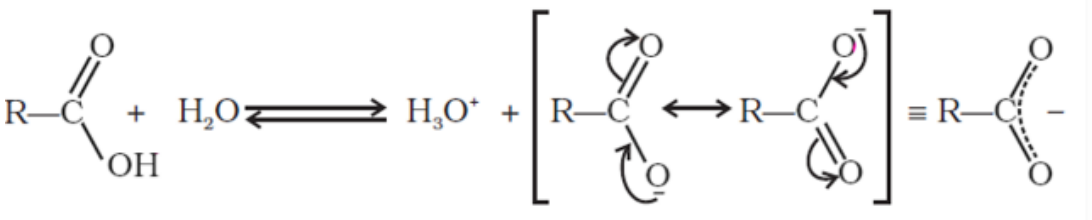
Secondary alcohol gives oily layer in 5-10 min.

Primary alcohol gives oily layer on heating.

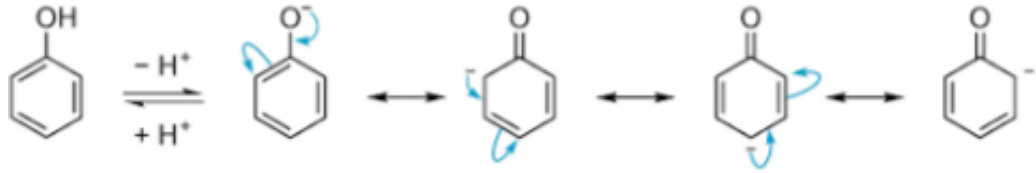


Q. No. 2 (xvii)Compare acidity of phenols and carboxylic acids. Support your answer by drawing resonance structures?
Ans. Acidity of carboxylic acid > phenol

Carboxylic acid is more acidic than phenol, because carboxylate ion is more stable conjugate base than phenolate ion because the negative charges spread from O to O atom.



Phenol is less acidic than carboxylate because there is only one electronegative O atom



Q. No. 2 (xviii)Discuss the reactivity order of following carbonyl compounds with reason.Formaldehyde > Acetaldehyde > Butanone

Ans. <u>Reactivity of aldehydes and ketones</u>

Formaldehyde> acetaldehyde > butanone

<u>Reason:</u>

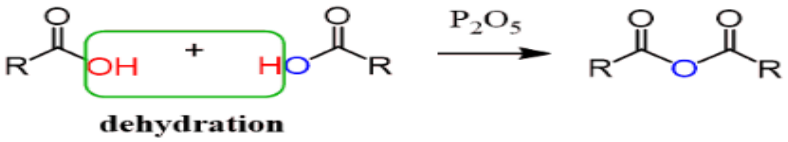
1. **Size of substituent attached to C=O**
   Larger group will tend to sterically hinder the approach of incoming nucleophile making it less reactive.
2. **Electronic effect of substituent:**
   R group are weakly e donating so they make the carbonyl carbon less electrophilic and less reactive towards nucleophile.

Q. No. 2 (xix) How can the following acid derivative be prepared from carboxylic acid?

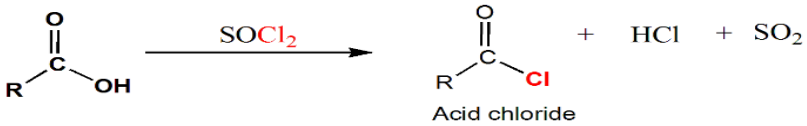
a.Acidanhydride b. Acylhalidc c. Acid amide

Ans. Preparation of acid derivatives from carboxylic acid:

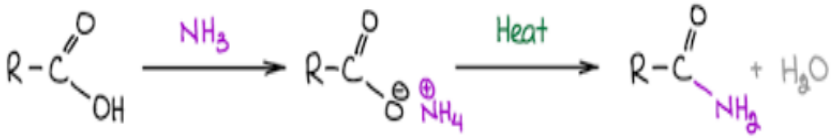
(i) Acid Anhydride:



(ii) Acid Halide:

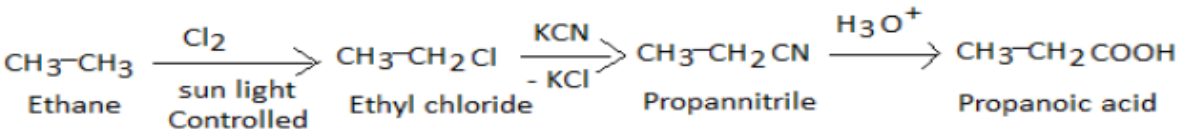


(iii) Acid Amide:



Q. No. 2 (xx)How can propanoic acid be prepared from methane?

Ans. <u>Ethane to propanoic acid:</u>



SECTION -C

Q 3: (a)Describe the peculiar behavior of 1st member of the alkaline earth metals.

Give seven main differences.

Ans. <u>Peculiar behavior of Beryllium:</u>

Beryllium is the first member of alkaline earth metals and it differs from other members in following ways:

i.Beryllium is as hard as iron while the other members of the alkaline earth metals are soft.

ii. Melting and boiling point of Beryllium is much higher than other members of its family

iii. Oxide and hydroxide of Beryllium are amphoteric while that of others is basic.

$$Be(OH)_2 + 2HCl \rightarrow BeCl_2 + 2H_2O$$

$$Be(OH)_2 + 2NaOH \rightarrow Na_2[Be(OH)_4]$$

iv. It does not react even with boiling water. Other members of this group react with water and liberate hydrogen gas.

$$Mg + H_2O \rightarrow MgO + H_2$$

vi. It is the only member of the family which in reaction with alkalis liberates hydrogen.

$$Be + 2NaOH \rightarrow Na_2BeO_2 + H_2$$

vii. Oxides, nitrides, sulphides, chlorides etc of group II-A are ionic but that of Be are covalent.

viii. Halides of Beryllium are soluble in organic solvents while others are soluble in water.

<u>Additional points:</u>Only seven differences were asked in question. Following differences may also be given in answer.

- Behavior of carbides
- Behavior of nitrides

(b)How does arrangement of electrons affect the magnetic properties of transition elements? How can it be calculated? Calculate magnetic moment of Fe =26.

Ans. Magnetic properties of transition elements:

Transition elements can be classified into following three types on the basis of their magnetic properties.

(1)Paramagnetic: The substances which are attracted into the magnetic field. It is due to the unpaired electrons present in the metals and their compounds

(2)Diamagnetic: The substances in which even number of electrons are present and are slightly repelled by magnetic field, are called diamagnetic.

(3)Ferromagnetic: The substances which can be magnetized are called ferromagnetic.e.g. Iron, Cobalt, Nickel

Magnetic moment of iron: Magnetic moment of iron can be calculated as:

Fe: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

Iron contains 4 unpaired electrons, therefore n = 4

$\mu = \sqrt{n(n+2)}$

$= \sqrt{4(4+2)}$

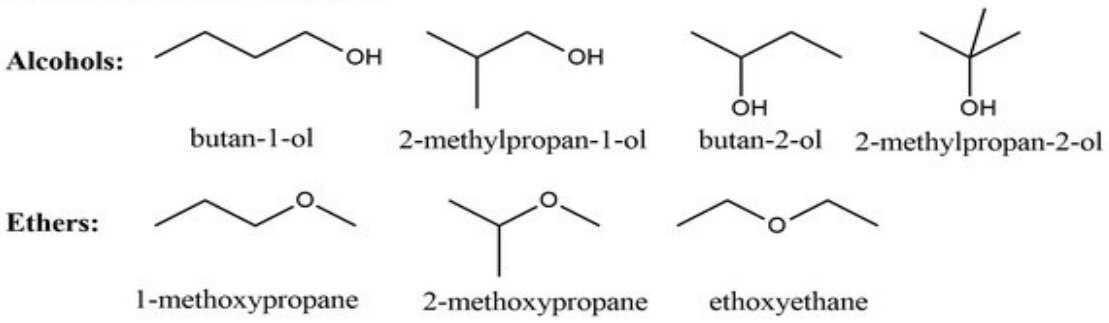
$= 4.89$ BM

Q 4: (a)Define isomerism. Make all possible structural isomers of $C_4H_{10}O$,classify each giving IUPAC names.

Ans. Isomerism:

Isomerism is the phenomenon in which more than one compounds have the same chemical formula but different chemical structures.

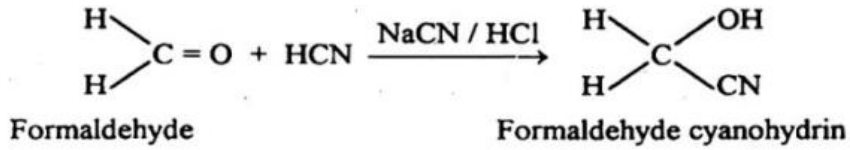
Isomers by formula $C_4H_{10}O$:



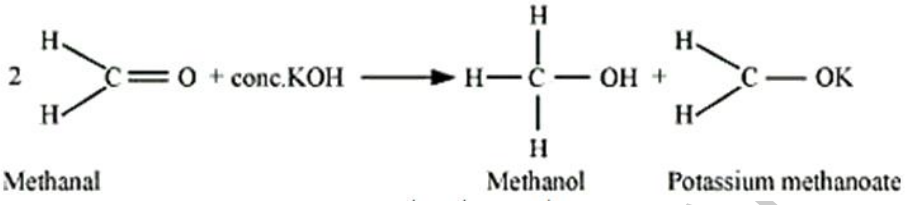
(b)What are the possible products formed when formaldehyde reacts with the following reagents?

i. HCN ii. NaOH iii. $AgNO_3/NH_4OH$

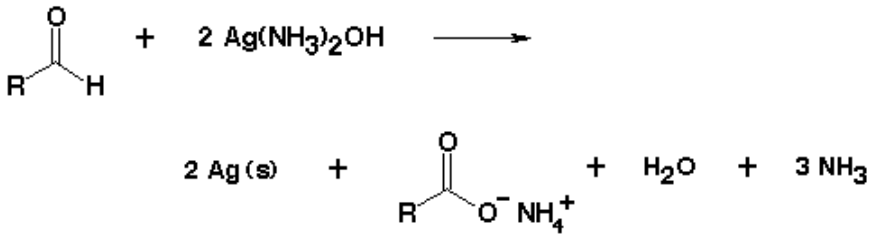
Ans. i. With HCN:



ii. With NaOH:



iii. With $AgNO_3/NH_4OH$:



Q 5: (a) What is beta-elimination reaction? Explain reaction mechanism for the Unimolecular and Bimolecular elimination reactions of R–X.

Ans. Beta-elimination reactions:

An elimination reaction is a type of organic reaction in which two substituents are removed from a molecule in either a one or two step mechanism. Since beta hydrogen is necessary for eliminations, it is also called beta-elimination (β-elimination).

E-2 Mechanism:

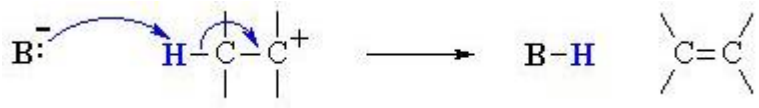
E2 stands for bimolecular elimination. The reaction involves a one-step mechanism in which C-H and carbon-halogen bonds break to form a double bond (C=C Pi bond).

E-1 Mechanism:

E1 stands for unimolecular elimination. E1 is a model to explain a particular type of chemical elimination reaction.

Loss of the leaving group to generate a carbocation intermediate:

Loss of a proton, H^+, from the carbocation



(b) Explain the following:

i. The different routes for the loss of zinc from human body.

ii. Is carbon dioxide responsible for greenhouse effect? If yes then how?

Ans.i. Different routes for the loss of zinc from the human body are as under:

1) About half of the zinc is eliminated from the body through gastrointestinal tract.

2) It is also secreted through biliary and intestinal secretions.

3) It is also eliminated through urine and surface loses (hair, sweat)

ii. Yes, carbon dioxide is responsible for greenhouse effect. It is because carbon dioxide is a greenhouse gas i.e. it is capable of absorbing infrared radiation (net heat energy) emitted from Earth's surface and reradiates it back to Earth's surface.