Important long answer questions for EC exam (Dr. G. Mallesham)

Chapter-1: Molecular structure and spectroscopy

1) Molecular orbital energy level diagrams of N_2, O_2 and F_2.

2) Pi-molecular orbitals of butadiene and benzene.

3) Write the possible electronic transitions in UV-Visible spectroscopy

4) Write the types of molecular vibrations in IR spectroscopy

Chapter-2: Water technology

1) Numerical problems based on hardness of water

2) Desalination of brackish water through **Reverse Osmosis**

3) Boiler Troubles

4) Ion exchange

5) Lime soda

Chapter-3: Electrochemistry, Batteries and Corrosion

1) Standard Calomel Electrode (SCE) & Standard Hydrogen Electrode (SHE)

2) Lead-Acid storage Battery

3) Lithium-Ion cell

4) Fuel Cells

5) Electrochemical corrosion or Wet corrosion

6) Factor effecting the rate of corrosion

7) Electroplating and electroless plating

Chapter IV: Stereochemistry, Reaction Mechanism and Synthesis of Drug Molecules

1) Enantiomers and Diastereomers

2) Conformational analysis of n-Butane

3) SN1 and SN2 reactions

4) Markovnikovs and anti-Markovnikovs rules

5) Synthesis, advantages and disadvantages of Aspirin and Paracetamol

Unit-v: Engineering materials

1) Preparation, properties and applications of five biodegradable polymers (PGA, PLA, PHB, PHBV and PCL)

2) Flash point and Fire point of lubricants

3) Cloud point and pour point of lubricants

4) Classifications and properties of Refractories.

Note 1: Important means more probability to come in the exam

Note 2: Below average students should study the important questions but the above average students must study all the topics in every chapter and more focus on the imp questions.

Note 3: Blue colour is the first half and red colour is the second half of the chapter.

Note 4: Mid-I: Up to Fuel cell & Mid-II For Wet Corrosion.

Along with long answers focus the following short answers for MID-II.

1) Pilling Bedworth rule**

"The extent of protection given by the metal oxide layer to the parent metal" is Pilling Bedworth rule.

It is expressed in terms of Specific Volume Ratio.

$$\text{Specific Volume Ratio} = \frac{\text{Volume of Metal Oxide Layer}}{\text{Volume of Parent Metal}}$$

2) The relation between rate of corrosion and temperature

Temperature: The rate of corrosion is directly proportional to the temperature. Means, the rate of corrosion increases with increase in temperature and vice versa.

Rate of corrosion ∝ Temperature

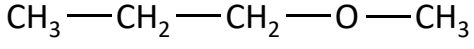
3) What is Critical Humidity: The humidity above which the rate of corrosion increases rapidly is called as critical humidity.

4) The relation between rate of corrosion and **pH**: Rate of corrosion is inversely proportional to pH. Means, in acidic medium metals undergo rapid corrosion compared to neutral/basic medium.

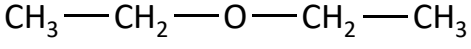
$$\textbf{Rate of corrosion} \propto \frac{1}{\text{pH}}$$

5) What is **Metamers?** Compounds having the same molecular formula but **differ in the alkyl groups attached to the same functional group** are called metamers.

Ex 1. Ethers:

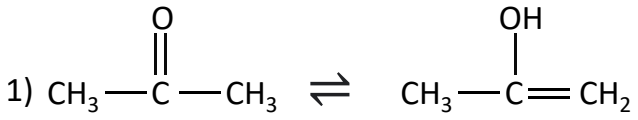


Methyl propyl ether



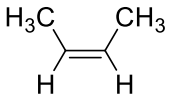
Diethyl ether

6) What is **Tautomers:** Compounds having the same molecular formula, **that are readily interconvertible and exist in dynamic equilibrium**, are called tautomers, and this phenomenon is called tautomerism. (or) Compounds having the same molecular formula, and **involving 1,3-proton transfer,** are called tautomers, and this phenomenon is called tautomerism.



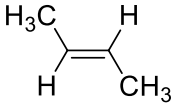
Keto form (Propanone) ⇌ Enol form (Isopropenol)

7) What is Cis Isomers? Compounds having the same molecular formula and **both identical/similar groups are present on the same side of the double bond,** are called Cis isomers.



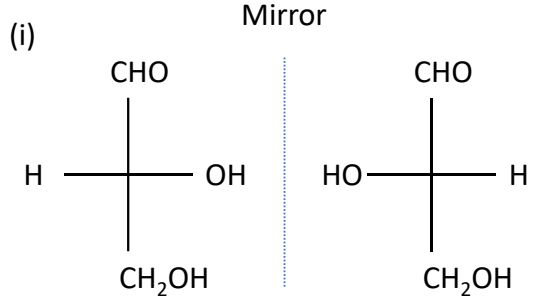
Cis 2-butene

8) What is Trans Isomers? Compounds having the same molecular formula and **both identical/similar groups are present on the opposite side of the double bond,** are called Trans isomers.



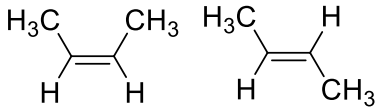
Trans 2-butene

9) What is Enantiomers? Compounds having the same molecular formula that are "**Non-Superimposable Mirror images**" are called enantiomers.



D-Glyceraldehyde L-Glyceraldehyde

10) What is Diastereomers: Compounds having same molecular formula, that are **Non-Superimposable and Non-Mirror images** called Diastereomers.



Cis 2-butene Trans 2-butene

10) What is Chirality: A molecule which is **nonsuperimposable on its mirror image** by any translations or rotations called as chirality.

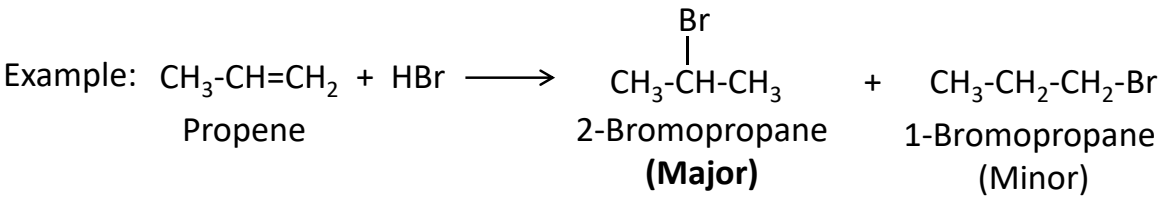
11) What is Optical activity? The ability of a substance to rotate plane polarized light that is passed through it called optical activity.

12) What is dextro (d) rotation? If a compound rotates plane polarized light in **clockwise** direction (or right-hand side) called as **dextrorotatory (d).**

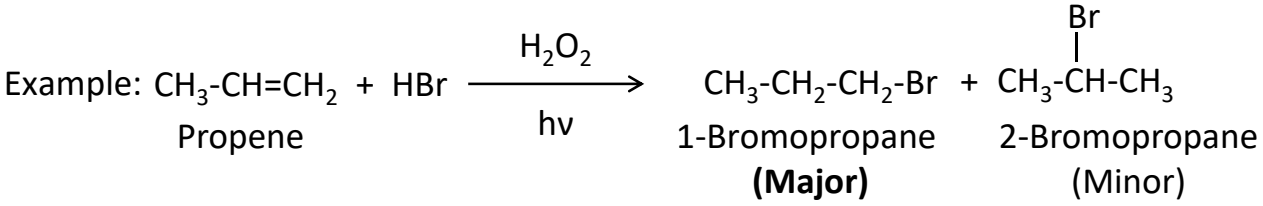
13) What is levo (l) rotation? If a compound rotates plane polarized light in **anti-clockwise** direction (or left-hand side) called as **levorotatory (*l*).**

14) From DL and RS configuration one question possible

15) What is Markovnicov's Rule? When an asymmetrical reagent is added to unsymmetrical alkene, then the **negative half of the reagent** will attach to the carbon atom containing **lesser number of hydrogen atoms"** is Markovnicov's Rule.

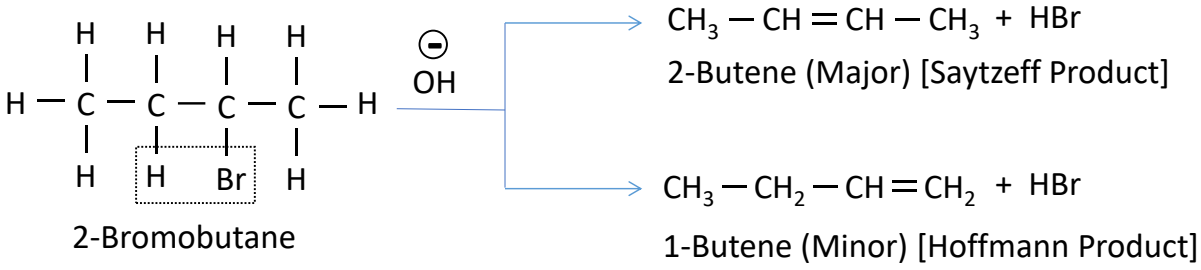


15) What is AntiMarkovnicov's Rule? When an asymmetrical reagent is added to unsymmetrical alkene, then the **negative half of the reagent** will attach to the carbon atom containing **more number of hydrogen atoms** is Anti Markovnicov's Rule. This will occur in presence of peroxide; therefore, this is also called as **Peroxide effect** or **Kharasch effect**.

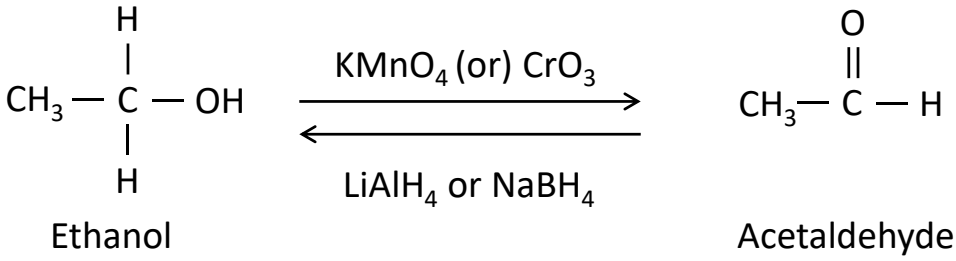


15) What is **Saytzeff rule?**

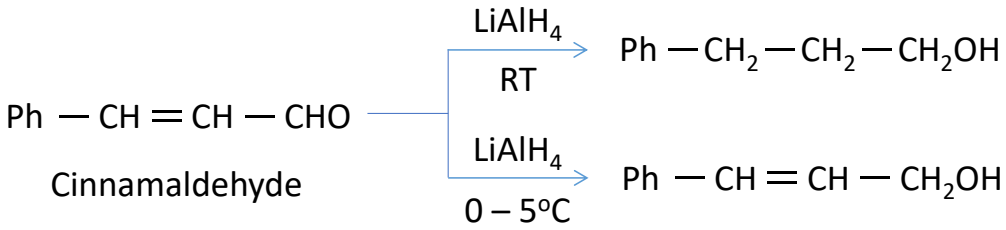
Saytzeff's rule says that in an elimination reaction if two types of products are possible, then the **more substituted alkene** is the **major** product.



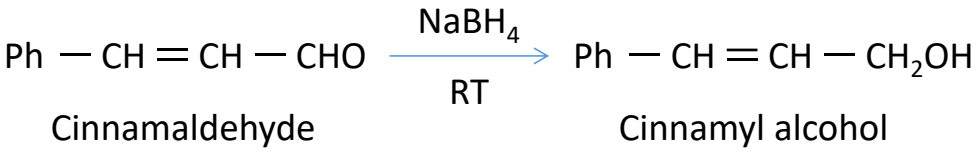
16) Reagents



17) Cinnamaldehyde on reduction with $LiALH_4$ forms following products.



18) In Cinnamaldehyde $NaBH_4$ reduces only aldehydes but not double bonds.



19) Natural biodegradable polymers are **four types**.

(a) Polysaccharides: Ex. Starch and Cellulose

(b) Proteins: Ex. Gelatin, Fibrin, Silk and Wool

(c) Polyesters: Ex: Polyhydroxyalkanoates

(d) Others: Ex. natural Rubbers and Lignin.

20) What is Refractoriness? The ability of a material to resist at high temperatures without appreciable deformation or softening under given working conditions called refractoriness. A good refractory should possess high refractoriness.

21) What is Refractoriness under load (RUL)? RUL is a measure of the resistance behaviour of a refractory body to the **combined effects of rising temperature and load**.

Example: Fire clay refractories collapse at temperature below to their fusion temperature, when appreciable load is applied. On the other hand, Silica refractories withstand of heavy load even at high temperature. Hence, the RUL test is performed to know the safe upper temperature limit up to which the refractory can be used.

22) What is Thermal spalling: High temperature and its fluctuations induces uneven expansion and contraction of refractory material which ultimately leads to cracking and breaking of refractory bricks. This phenomenon is called as thermal spalling.

23) What is Absolute viscosity: It is the indirect force per unit area required to maintain a 'unit velocity gradient' between two parallel layers. Units in C.G.S. are 'Poise'.

24) What is Kinetic viscosity: It is the ratio of absolute viscosity to the density of the liquid. Units in C.G.S. are 'Stokes'.

25) What is Viscosity Index (VI): The variation of viscosity of a liquid with temperature is called viscosity index.

$$VI = \frac{L-U}{L-H} \times 100$$

Where, L = Viscosity of standard oil having the **viscosity index of zero** at 38 ^{o}C.

U = Viscosity of test oil at 38 ^{o}C, H = Viscosity of the standard oil having the **VI of 100** at 38 ^{o}C.

26) What is Flash point and fire point: Flash point is the lowest temperature at which the **lubricating oil gives enough vapors**, when a test flame brought near to it.

Fire point is the lowest temperature at which the **vapors of the lubricating oil burn continuously at least for 5 seconds**, when a test flame brought near to it. Generally, fire point is 5 to 40 times higher than the flash point.

27) What is cloud point and pour point? The temperature at which the lubricating oil becomes **cloudy or hazy upon cooling** is called cloud point.

The temperature at which the oil **ceases to flow or pour** is called as pour point.

28) Write the Classification of Ceramics?

1) Based on chemical composition

Oxides: Ex: SiO_2, Al_2O_3, **Carbides:** Ex: SiC, **Nitrides:** Ex: Si_3N_4, **Sulphides:** Ex: Ag_2S

2) Based on their applications

Clay products: Structural clay products (Tiles, Bricks etc), **White wares:** (Porcelain and China clay), **Refractories**: Fire clay, Dolomite. **Glass**: Insulated glass, Safety glass.

29) What are the Properties of Ceramics

Extreme hardness, Corrosion resistance, Heat resistance, Low electrical conductivity, Low thermal conductivity, Low thermal expansion and contraction

30) What are the Applications of Ceramics

Consumer uses: Glassware, windows,

Automotive: Catalytic converters,

Aerospace: fuel cells

Medical: Orthopaedic devices, dental restoration and bone implants.