

- Instructions:**
1. All questions are compulsory.
 2. Scientific calculators are allowed.
 3. Section A and B to be written on separate answer books.
 4. Constants

$$\text{Rydberg's constant } R_H = 1.0976 \times 10^5 \text{ cm}^{-1}$$

$$R_H = 13.6 \text{ eV}$$

$$R_H = 2.18 \times 10^{-18} \text{ J}$$

$$\text{Mass of electron } m = 9.1 \times 10^{-31} \text{ kg}$$

$$\text{Planck's constant } h = 6.6 \times 10^{-34} \text{ kg.m}^2.\text{s}^{-1}$$

SECTION A: INORGANIC CHEMISTRY

Q.1. Answer any five from the following

(2x5 = 10)

- i) Give the most stable electronic configuration of Neon and Iron atoms.
- ii) Give the expression for energy of an electron in a hydrogen atom. Calculate the minimum energy possible for an electron in a hydrogen atom.
- iii) What is the shape of p orbital? Give a trace of p_x and d_{xy} orbital.
- iv) List the properties of ionic compounds.
- v) Define polarization and polarizing power.
- vi) Hydrogen molecule exist but helium molecule does not. Explain.
- vii) Which of the following molecules are planar and why: BF_3 , NH_3 and PCl_5 .

Q.2.A. Answer the following

- i) Deduce the structure of PF_3 molecule on the basis of VSEPR theory. (4)
- ii) Calculate the wavelength associated with an electron moving with a velocity of $4 \times 10^4 \text{ m.s}^{-1}$. (3)

OR

- iii) Deduce the structure of XeF_2 molecule on the basis of VSEPR theory. (4)
- iv) Calculate the frequency of spectral line in the Balmer series of a H atom for an electron in the fourth orbit. Which region of the electromagnetic spectrum does the spectral line belong to? (3)

- Q.2. B. i)** Give the expression for energy of an electron in hydrogen atom. Calculate the energy of an electron in the fourth orbital ($n=4$). Will this energy be higher than the energy of an electron in the third orbit? (4)

- ii)** Describe the different type of hybrid orbitals that can be formed by an atom with s and p orbital in its valence shell. What shapes do each of these hybrid orbitals have?

Q.3.A. Answer the following

- i) Draw the molecular orbital diagram for N_2 molecule. Determine bond order and comment on this. Comment on its magnetic properties. (4)
- ii) Draw the radial probability diagram for a 2p orbital. How many radial nodes and angular nodes will this orbital have? (3)

OR

- iii) Write the electronic configuration for O_2 molecule. Determine its bond order. How many unpaired electrons are present in this molecule? (4)
- iv) Give the correct notations for the orbitals with the following set of quantum numbers (3)
- a) $n=3, l=2, m_l=2$ b) $n=2, l=1, m_l=-1$
c) $n=3, l=1, m_l=1$ d) $n=4, l=0, m_l=0$

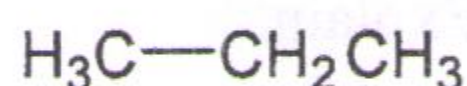
- Q.3.B. i) What are quantum numbers? List the different quantum numbers. What information does principal quantum number give? (4)
- ii) On the basis of hybridization discuss the geometry of methane molecule. (4)

Section B: Organic Chemistry-1

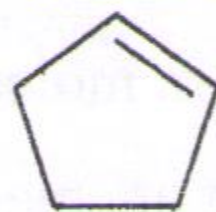
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Q4.A. Answer any five questions of the following. (2 x 5=10)

- i. Indicate the number of sigma and pi-bonds in the following compounds

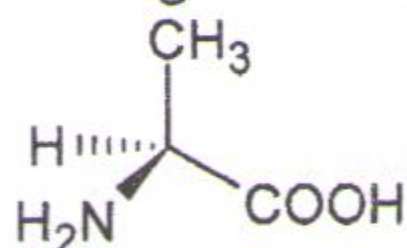


A

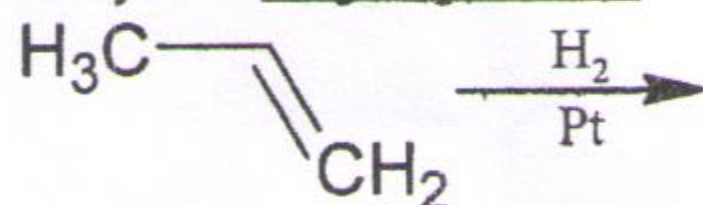


B

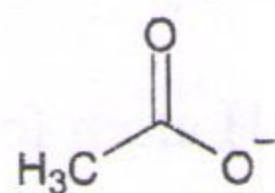
- ii. Assign R/S configuration for the following compound:



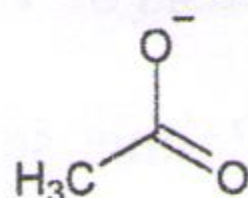
- iii. Predict only the major product for the following reaction.



- iv. Determine whether the following pairs of structures are different compounds or simply resonance forms of the same compounds.

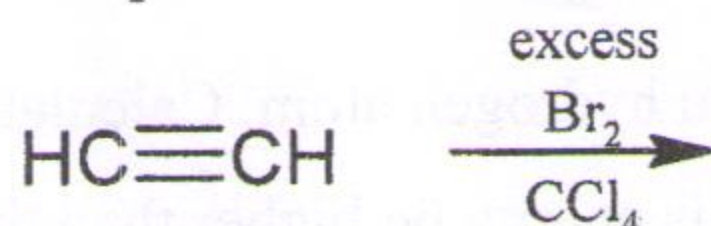


A



B

- v. Predict the product for the following reaction

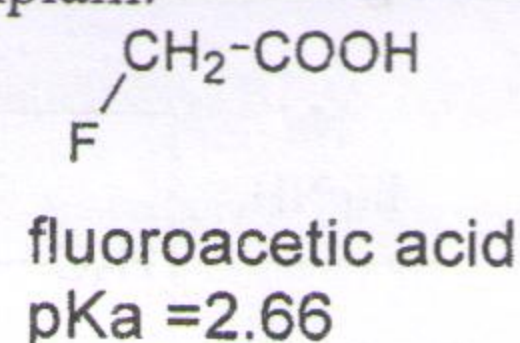
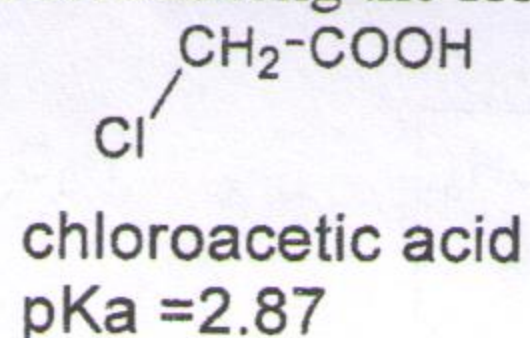


- vi. Which of the following compounds may show optical activity? Explain.

a) 1-chloropentane b) 2-chloropentane

- vii. Give any one method of preparation of alkenes.

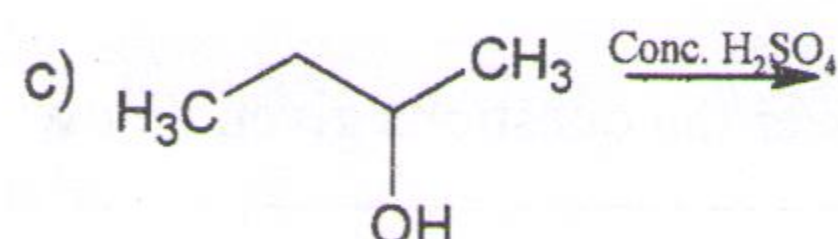
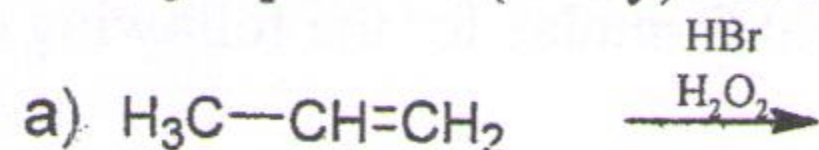
Q.5.A. i. a) Identify the weak acid among the following? Explain. (2)



b) In the examples given below, show the cleavage of bonds using curved arrow notations. (2)

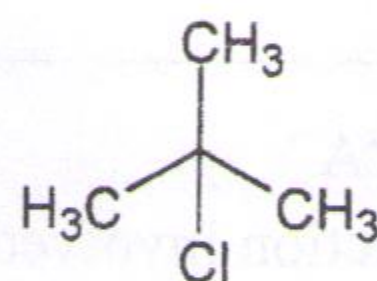
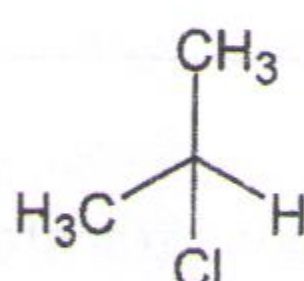
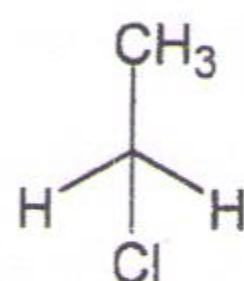
- 1) $\text{CH}_3\text{-CH}_2\text{-Br}$
- 2) Cl_2

ii) Predict the major product (if any) for the following reactions: (3)



OR

Q 5A iii) Which of the following will generate the most stable carbocation and why? (4)

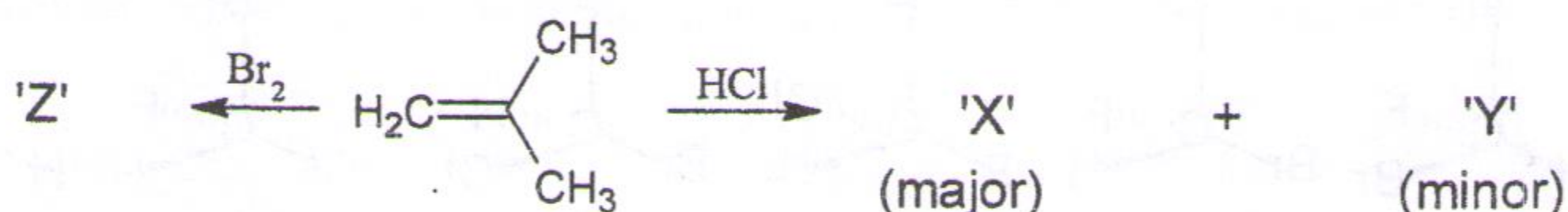


a

b

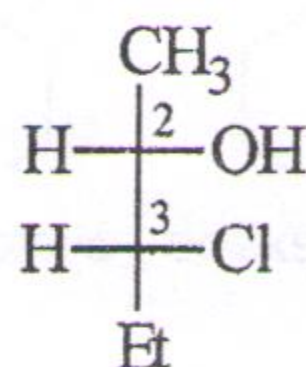
c

iv) Identify the products X, Y & Z: (3)

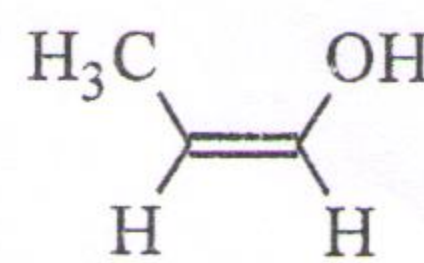
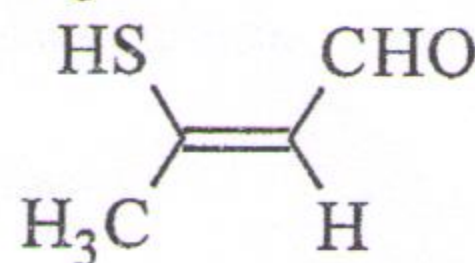
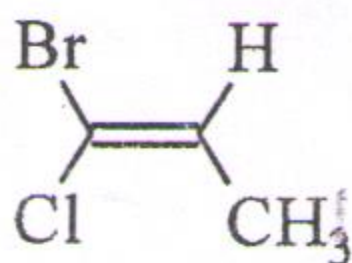
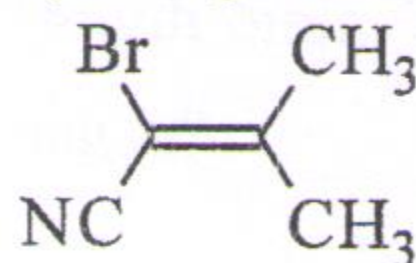


2-methylprop-1-ene

Q 5 B i) a) Assign R/S configuration at the two chiral centers in the following compound. Indicate if the compound is threo or erythro with justification. (2)



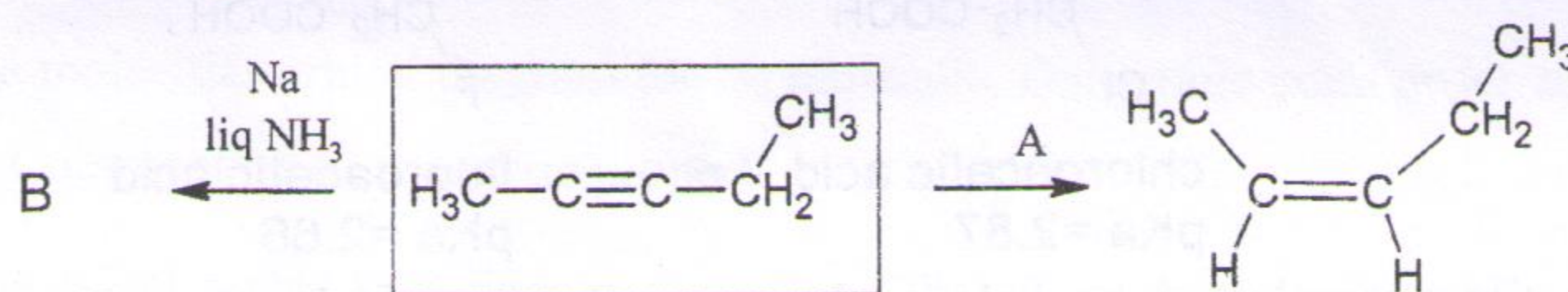
b) Assign E/Z configuration to the following. (2)



ii) Give any one method of preparation for the following (4)

- a. 2-butanol from a suitable alkene
- b. 3-pentene from a suitable alkyl halide

ii) Consider the following reaction answer the questions given below: (3)



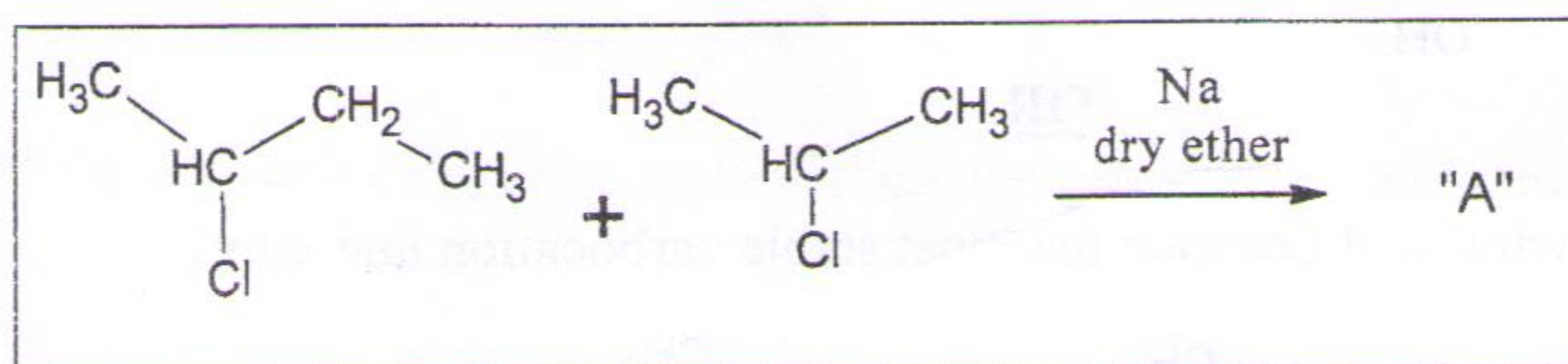
1. Identify the missing reagent 'A'.
2. Identify the product 'B'.

OR

Q 6 A iii) Draw Fischer projection and 3D structural formulae for the following compounds: (4)

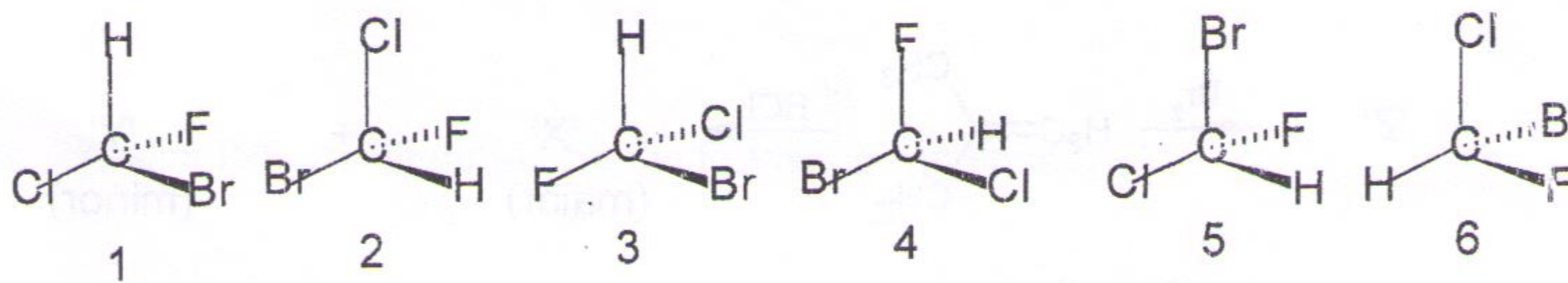
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|-------------------------------|----------------------------|
| a) (R)-1-bromo-1-chloroethane | b) (S)-1-chloro-2-propanol |
| c) (S)-2,3-dimethylpentane | d) (R)-2-butanol |

iv) Consider the following reaction and answer the questions given below: (3)



- a. Identify the product "A"
- b. Identify the name reaction involved in the above transformation
- c. Give the IUPAC nomenclature for the product "A"

Q 6 B i) Arrange the following into sets of identical and enantiomeric structures: (4)



ii) Indicate the type of hybridization of each carbon atom in the following structures:

