

Semester I of B.Sc.

Total Marks: 80

Date: /01/2021

Duration: 2 Hours

No. of Pages: 05

2. Scientific calculators are allowed.

3. Section A and B to be written on separate answer books.

4. Constants

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

 $R_H = 13.6 \text{ eV}$
$$R_H = 2.18 \times 10^{-18} \text{ J}$$

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

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

Q.1. Answer any five from the following

 $(2 \times 5 = 10)$

- i) Give the stable electronic configuration of the following atom /ion.
a) Na^+
b) Cr
- ii) Among 4s and 3d which orbital will be filled first and why?
- iii) Write all quantum numbers representing 4d orbital
- iv) Define Lattice Energy and state the effect of ionic size and ionic charge on lattice energy.
- v) The bond angle in NH_3 is larger than the bond angle in PH_3 . Explain.
- vi) Arrange the following elements in the increasing order of its polarising power
a) Li b) Na c) K d) Rb
- vii) Represent the formation of pi bond and sigma bond in p orbitals.

Q.2 A. Answer the following

- i) Deduce the structure of PF_5 molecule on the basis of VSEPR theory (4)
- ii) The Kinetic energy of an electron has been found to be 4.86×10^{-15} joules. Calculate the wavelength associated with the electron. (3)

OR

- iii) Deduce the structure of SF_6 molecule on the basis of VSEPR theory. (4)

- iv) Calculate the frequency of spectral line for H atom when electron jumps from third orbit to ground state. The emission belongs to which series of hydrogen spectrum? ($R_H = 1.0976 \times 10^5 \text{ cm}^{-1}$) (3)

- Q.2. B. i) Draw the shapes of the following atomic orbitals d_{xy} , d_{z^2} , p_y and $2s$ (4)
ii) On the basis of hybridization discuss the geometry of BH_3 molecule. (4)

Q.3. A. Answer the following

- i) Write the electronic configuration for N_2 molecule. Draw the molecular orbital diagram for N_2 molecule. Determine bond order and comment on its magnetic property (4)
ii) Draw the radial probability diagram for a $2p$ orbital. How radial nodes and angular nodes are there for this orbital. (3)

OR

- iii) Write the electronic configuration for CO molecule. Draw the Molecular orbital diagram. Determine its bond order and magnetic property. (4)
iv) For the given quantum numbers identify the orbital in which electron is present.
 $n=3, \ell=1, m_\ell=0, m_s=+1/2$ (3)

- Q.3.B (i) Explain the concept of Exchange energy with example. (4)
(ii) Draw Born Haber cycle for the formation of NaCl and represent the different energies involved. (4)

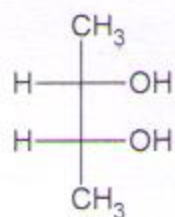
Section B: Organic Chemistry-1

Marks: 40

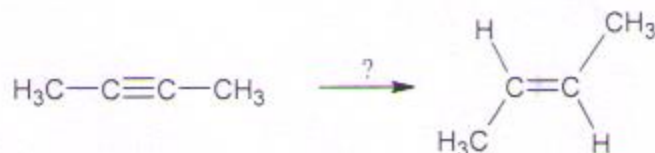
Q.4. Answer any five questions of the following.

(2 x 5=10 marks)

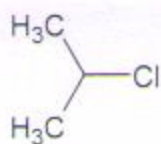
- i. What do you understand by the term nucleophile?
ii. Convert the following into sawhorse eclipsed projection.



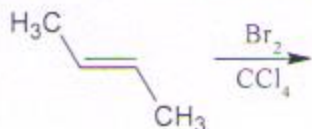
iii. Identify the missing reagent:



iv. How will you dissociate or cleave the bonds in the following molecule?



v. Complete the following reaction

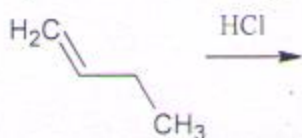


vi. Which of the following molecule is Chiral among the two? Kindly justify your answer:

a) 2-bromopropane

b) 2-chloropentane

vii. Complete the following reaction

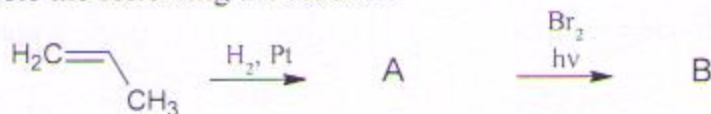


Q.5.A. i) Explain the concept of stability in substituted carbanions

4 marks

ii) Complete the following the reaction

3 marks



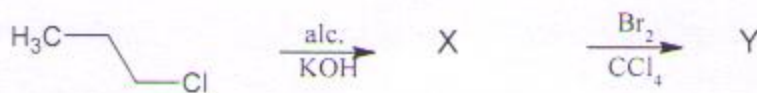
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iii) Explain any two theories that explain the behaviour of acids & bases.

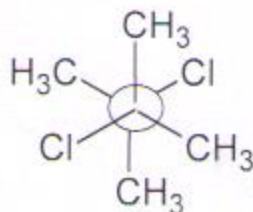
4 marks

iv) Complete the following the reaction

3 marks



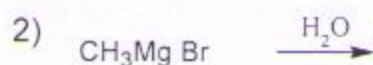
Q.5.B. i) Convert the following Newman projection into Fischer projection and answer the questions given below: (2+1+1=4 marks)



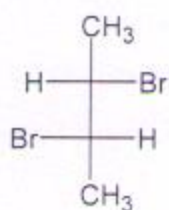
- Identify and label the chiral centres on the compound.
- Assign R/S configuration to the labelled chiral centres

ii) Predict the product for the following

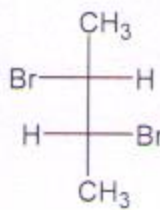
4 marks



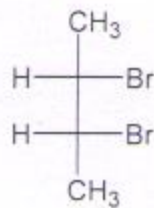
Q.6.A. i) Consider the following structures and answer the questions given below. (3+1=4 marks)



structure A



structure B

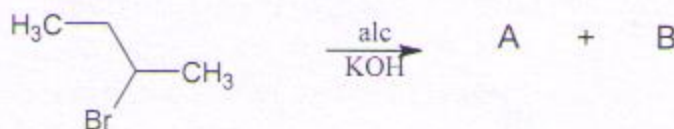


structure C

- Assign R/S configuration for the structure A, B & C
- What is the relationship between Structure A & B, B & C?

ii) Complete the following reaction

3 marks



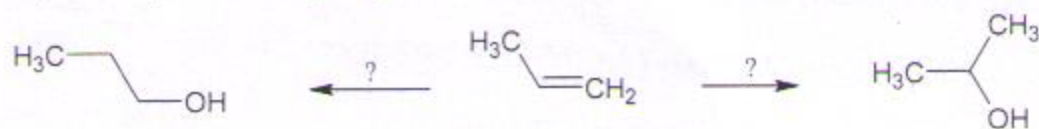
OR

- Write the totally eclipsed and anti-staggered conformation for butane molecule. Comment on their stability.

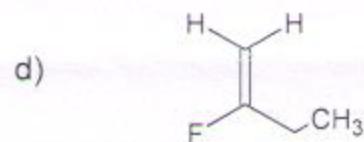
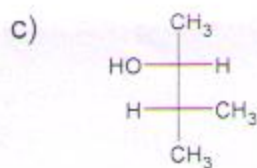
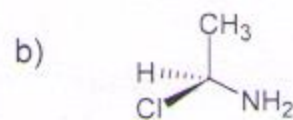
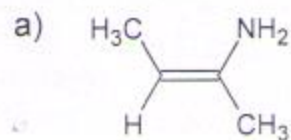
4 marks

iv) Identify the missing reagents

3 marks



Q.6.B. i) Assign E/Z or R/S configuration for the following compounds (wherever applicable) 4 marks



ii) Give any one method for the formation of carbocation and carbon free radical.

4 marks

ALL THE BEST