2025/12

SET A

B.Sc. CHEMISTRY
FIRST SEMESTER
FUNDAMENTAL CHEMISTRY-I
BSC-MIN-911

[USE OMR FOR OBJECTIVE PART]

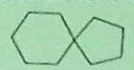
Duration: 2 hrs. **Full Marks: 50**

Objective

Time: 20 min. **Marks: 15**

Choose the correct answer from the following: ***1×15=15***

1. The name of the following compound is

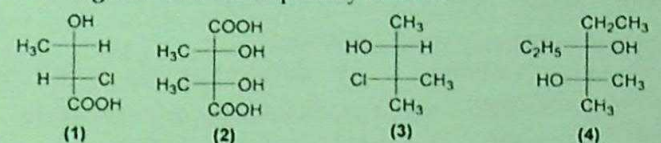


   a. Spiro[4.5]decane
   b. Spiro[3.4]nonane
   c. Spiro[4.5]nonane
   d. Spiro[3.4]decane

2. An example of an electrophile is
   a. Cl^-
   b. H_2O
   c. NO_2^+
   d. OH^-

3. If HBr is added to propene then 2-bromopropane is formed. This reaction is an example of
   a. substitution reaction
   b. elimination reaction
   c. addition reaction
   d. rearrangement reaction

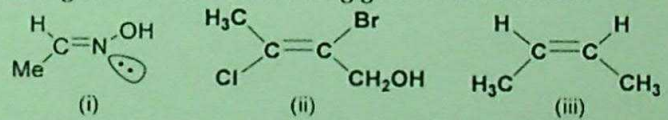
4. Which of the following molecules are optically inactive



   a. 1 &3
   b. 2 & 3
   c 2 & 4
   d. 3 & 4

5. Which of the following is true of any (*S*)-enantiomer?
   a. It rotates plane-polarized light to the right
   b. It rotates plane-polarized light to the left
   c. It is a racemic form
   d. It is the mirror image of the corresponding (R)-enantiomer

6. Assign E-, Z- configurations for the following geometrical isomers:



a. i→E, ii→Z iii→E
b. i→E, ii→Z iii→Z
c. i→E, ii→E iii→Z
d. i→Z, ii→Z iii→E

7. Which of the following statements are correct?
   A. Configurational isomers are not readily interconvertible.
   B. Conformational isomers are formed by rotation around single bond.
   C. energy differences among conformational isomers are very high.
   a. A & B
   b. B and C
   c. A and C
   d. All 3 statements are correct

8. The kinetic theory assumes that gas molecules undergo
   a. Elastic collisions only
   b. Inelastic collisions only
   c. No collisions
   d. Partially elastic collisions

9. What happens to pressure when RMS velocity is doubled according to kinetic gas equation?
   a. Pressure becomes half
   b. Pressure becomes double
   c. Pressure becomes four times
   d. No change

10. Which velocity is given by the expression $\sqrt{\frac{2RT}{M}}$?
   a. Most probable velocity
   b. RMS velocity
   c. Average velocity
   d. None of these

11. For a diatomic ideal gas, the molar internal energy at temperature *T* is:
   a. ½ RT
   b. 3/2 RT
   c. 5/2 RT
   d. 3 RT

12. Principal quantum number gives
   a. relative size of distribution
   b. general shape of distribution
   c. orientation of distribution
   d. orientations of the shapes.

13. Electrons that are in different energy levels have
   a. same probability distribution
   b. different probability distribution
   c. same radial probability distribution
   d. same angular distribution

14. An electron traveling in an elliptical orbit would have in addition to angular momentum a component momentum along
   a. radial direction
   b. tangential
   c. X-axis
   d. Y- axis

15. The Secondary Quantum number is related to general
   a. shape of distribution
   b. size of distribution.
   c. direction of distribution
   d. position of distribution

-- --- -

Descriptive

Time : 1 hr. 40 mins. **Marks : 35**

[Answer question no.1 & any three (3) from the rest]

1. a. What is Zeeman Effect ? How this led to the concept of Magnetic Quantum number. **3+2=5**
   b. Write down the expression of kinetic gas equation and limitation of the same.

2. a. Give an account of the Dual nature of electon. **4+3+3 =10**
   b. What is Line Spectra? How is it produced ?
   c. State and explain what do you understand by Heisenberg's Uncertaintiy Principle.

3. a. Write down the Energy Expression for hydrogen atom in terms of mass of electron, atomic number, charge of electron, Plank's Constant and Principal quantum number. **3+2+3+ 2=10**
   b. What are the drawbacks of Schrodinger Wave Equation?
   c. Derive ideal gas equation from Charles's Law, Boyle's law and Avogadro's law.
   d. State maxwell- Boltzmann distribution law and law of equipartition of energy.

4. a. Write the postulates of kinetic theory of gases? **3+3+2+ 2=10**
   b. Find out translational, rotational and vibrational degrees of freedom of ammonia. Calculate the molar internal energy of a ammonia gas at 298 K. ($R=8.314\ J\ mol^{-1}K^{-1}$)
   c. Draw maxwell speed distribution curve and indicate most probable speed, average speed and root mean square speed in the curve.
   d. Write down the expression for these three kinds of molecular speeds at an temperature T.

5. a. Define sp^2 hybridization. Draw the orbital structure of C_2H_4 molecule and discuss its shape. **3+3+2+ 2=10**
   b. What is hyperconjugation? Draw the different possible hyperconjugation structures of $(CH_3)_2CH^+$ and $CH_3CH_2^+$ and explain their stability.
   c. Define heterolytic fission. Name the different fragments formed when CH_3-Cl undergoes heterolytic fission.

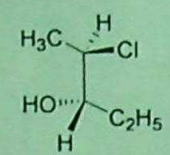
d. What are the different products formed when CH_4 reacts with Cl_2 in presence of sunlight? Give their IUPAC names.

6. a. Explain the terms with examples: **2×5=10**
   i. enantiomers and
   ii. Diastereomers

b. Match the list I with II

List I	List II
A. Diastereomers	1. Molecule with plane or centre of symmetry
B. Racemates	2. Stereo isomers that are not mirror images
C. Meso compound	3. An equimolecular mixture of enantiomers

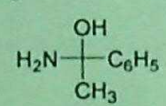
c. Convert the following structures as per the instruction:



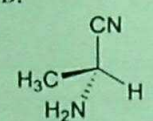
to Fisher projection and then to saw horse projection

d. A given pair of enantiomers is found to have l-isomer in 80% enantiomeric excess. Find the percentage of each isomers.

e. Write down the configuration (R/S) of each of the chiral carbon in the following molecules A and B.



A



B

= = *** = =