

**B.SC. CHEMISTRY
FIRST SEMESTER
CHEMISTRY C I
BSC-MAJ-111**

[USE OMR FOR OBJECTIVE PART]

**SET
A**

Duration: 2 hrs.

Full Marks: 50

Time: 20 min.

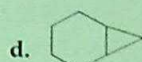
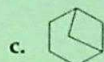
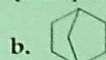
(Objective)

Marks: 15

1×15=15

Choose the correct answer from the following:

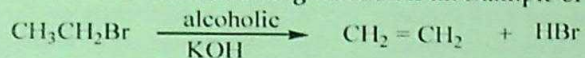
1. Which of the following compound is bicyclo [2.2.1] heptane



2. Chloro acetic acid is more acidic than acetic acid due to

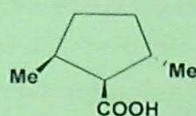
- a. Inductive effect b. Mesomeric effect
c. Resonance effect d. Hyperconjugation

3. The following reaction is an example of

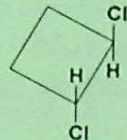


- a. substitution reaction b. elimination reaction
c. addition reaction d. rearrangement reaction

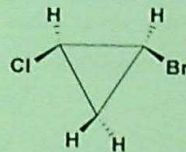
4. For of the following molecules, which will be the correct statement for their optical activity?



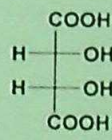
A



B



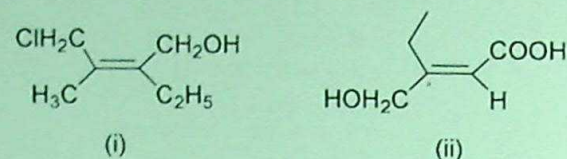
C



D

- a. A, B and C are active and D inactive b. A and B are active, C and D inactive.
c. A and D inactive, B and C active. d. A, B and C are inactive and D active.
5. Which of the following is true of any (R)-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 (S)-enantiomer

6. The configuration of the following geometrical isomers are



- | | |
|---|---|
| <p>a. i→E, ii→Z</p> <p>c. i→E, ii→E</p> | <p>b. i→Z, ii→Z</p> <p>d. i→Z, ii→E</p> |
|---|---|
7. For the generalized structure, HOCH₂CHClCH₂CHClCH₂OH there exists what number of stereoisomers?
- | | |
|------|------|
| a. 2 | b. 3 |
| c. 4 | d. 6 |
8. From the kinetic theory of gases, the ratio of most probable velocity (c_{mp}) to root mean square velocity (c_{rms}) is
- | | |
|--------------------------------|--------------------------------|
| a. $\sqrt{3}$ | b. $\frac{\sqrt{2}}{\sqrt{3}}$ |
| c. $\frac{\sqrt{3}}{\sqrt{2}}$ | d. $\frac{3}{\sqrt{2}}$ |
9. A real gas behaves most like an ideal gas under conditions of:
- | | |
|--------------------------------------|---------------------------------------|
| a. Low temperature and high pressure | b. High temperature and low pressure |
| c. Low temperature and low pressure | d. High temperature and high pressure |
10. Which one of the following statements is wrong for gases?
- Gases do not have a definite shape and volume
 - Volume of the gas is equal to volume of container confining the gas
 - Confined gas exerts uniform pressure on the walls of its container in all directions
 - Mass of gas cannot be determined by weighing a container in which it is enclosed
11. The unit in which surface tension is measured is
- | | |
|--------------------------|--|
| a. dyne cm | b. dyne cm ⁻¹ |
| c. dyne ⁻¹ cm | d. dyne ⁻¹ cm ⁻¹ |
12. The element with configuration [Ar] 4s² 3d⁵ is:
- | | |
|-------|-------|
| a. Mn | b. Fe |
| c. Cr | d. Co |
13. Which rule explains stability of half-filled and fully filled subshells?
- | | |
|---------------------|----------------------|
| a. Hund's Rule | b. Pauli's Principle |
| c. Aufbau Principle | d. Bohr's Principle |
14. What does $|\psi|^2$ represent?
- | | |
|-----------------------------|---|
| a. Velocity of the electron | b. Probability density of finding an electron |
| c. Charge density | d. Momentum of electron |

15. Rydberg formula is associated with
- Atomic radius
 - Line spectra
 - Heat capacity
 - Nuclear charge

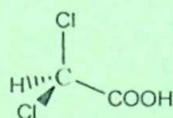
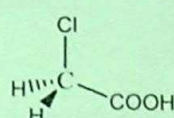
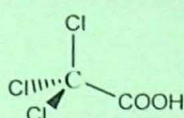
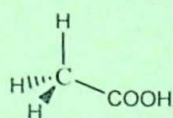
(Descriptive)

Time : 1 hr. 40 mins.

Marks : 35

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

- Derive Avogadro's Law from the kinetic gas equation. 2+3=5
 - Derive de Broglie's equation.
- Define inductive effect. Arrange the following acids in order of their increasing acidic strength and justify your answer. 3+2+3
+2=10



- What is heterolytic fission? What are the products formed when $\text{CH}_3\text{-Cl}$ undergoes heterolytic fission?
- What are carbanions? How are they generated? Arrange the following in increasing order of stability. $\text{CH}_3^\cdot$, $\text{CH}_3\text{CH}_2^\cdot$, $(\text{CH}_3)_3\text{C}^\cdot$, $(\text{CH}_3)_2\text{CH}^\cdot$
- Give reason why net dipole moment of CCl_4 is zero despite the presence of four C-Cl polar bonds.

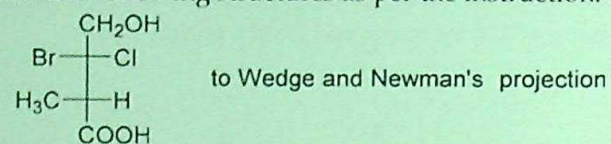
3. a. Explain the terms:
(i) Enantiomers and (ii) Diastereomers

2+2+2
+2+2=
10

b. Match the list I with II.

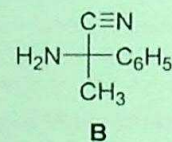
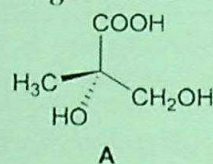
List I	List II
A. Meso compound	1. Non superimposable mirror images
B. Racemates	2. Stereo isomers that are not mirror images
C. Diastereomers	3. Molecule with plane or centre of symmetry
D. Enantiomers	4. An equimolecular mixture of enantiomers

c. Convert the following structures as per the instruction:



d. A given pair of enantiomers is found to have d-isomer in 70% enantiomeric excess. Find the percentage of each isomer.

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



4. a. Write the postulates of kinetic theory of gases?
 b. What is Degrees of freedom for a gaseous molecule?
 c. What are real gases? Why the real gases show deviations from the ideal behaviour?
 d. Write the Van der wall's equation for real gases? Explain the meaning of the terms?
 e. For hydrogen gas, calculate the root mean square velocity and most probable velocity at 0 °C.
 f. What is compressibility factor, Z?

2+1+2
+2+2+
1=10

5. a. Define the terms surface tension and viscosity of a liquid? Write their units. 2+3+3
+2=10
- b. Write in brief about the five elements of symmetry?
- c. Calculate the uncertainty of position of an electron if the uncertainty of its velocity is $5.0 \times 10^5 \text{ m s}^{-1}$. ($h = 6.6 \times 10^{-34} \text{ J s}$, $m = 9.1 \times 10^{-31} \text{ kg}$)
- d. Explain Heisenberg's uncertainty principle.
6. a. Draw radial distribution curve of 3s and 3d orbital. 2+2+3
+3=10
- b. State the Aufbau principle and write the order in which orbitals are filled with electrons. Write electronic configuration of Cr.
- c. Define all four quantum numbers and state their significance.
- d. Write down main postulates of Bohr's Theory.

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