

**UG (Sem.-I) Examination 2023**  
**Model Question Paper (CBCS)**

**Chemistry**  
**[Paper: MJC-1(T)]**  
**Session 2023-27**

[Time: 3 Hours]

[Full Marks:70]

*Candidates are required to give their answers in their own words as far as practicable. Figure in the margin indicate full marks. Answer from all Groups as directed.*

*Question No.-1 is compulsory.*

**Group-A**

1. Select the correct answer from the given options:

[2x10=20]

(a) The quantum number which determines the shape of the orbital is:

- (i) Magnetic quantum number
- (ii) Azimuthal quantum number
- (iii) Spin quantum number
- (iv) Principal quantum number

(b) What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition  $n=4$  to  $n=2$  of  $\text{He}^+$  spectrum.

- (i)  $n=4$  to  $n=2$
- (ii)  $n=4$  to  $n=1$
- (iii)  $n=2$  to  $n=1$
- (iv)  $n=3$  to  $n=2$

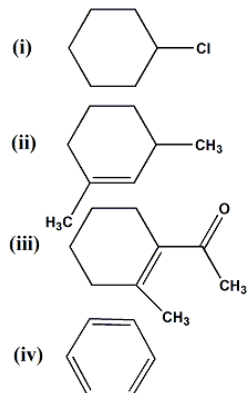
(c) The correct order of strength of Hydrogen bonding in the following compounds:

- (i)  $\text{H}_2\text{O} > \text{H}_2\text{O}_2 > \text{HF} > \text{H}_2\text{S}$
- (ii)  $\text{HF} > \text{H}_2\text{O}_2 > \text{H}_2\text{O} > \text{H}_2\text{S}$
- (iii)  $\text{HF} > \text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{O}_2$
- (iv)  $\text{HF} > \text{H}_2\text{O} > \text{H}_2\text{O}_2 > \text{H}_2\text{S}$

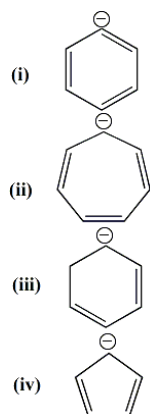
(d) In which of the following pairs, both the species have the same bond order?

- (i)  $[\text{N}_2, \text{N}_2^+]$
- (ii)  $[\text{O}_2, \text{F}_2]$
- (iii)  $[\text{C}_2, \text{O}_2]$
- (iv)  $[\text{C}_2, \text{N}_2]$

(e) In which of the following molecules all the effects namely inductive, mesomeric and hyperconjugation operates?



(f) The most stable anion is:-



(g) The smallest alkane which can show optical isomerism possess:

- (i) Five carbon atoms
- (ii) Six carbon atoms
- (iii) Seven carbon atoms
- (iv) Eight Six carbon atoms

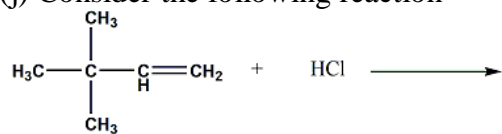
(h) Which of the following will have least hindered rotation about Carbon-Carbon bond.?

- (i) Ethylene
- (ii) Ethane
- (iii) Hexachloroethane
- (iv) Acetylene

(i) Which of the following methods of alkane synthesis involves the electrochemical oxidation of alkanoate ion?

- (i) Kolbe's method
- (ii) Wurtz method
- (iii) Frankland method
- (iv) Corey-House method

(j) Consider the following reaction



The major product obtained in the reaction is:

- (i) 
$$\begin{array}{c}
 \text{Cl} \quad \text{CH}_3 \\
 | \quad | \\
 \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_3 \\
 | \quad | \\
 \text{CH}_3 \quad \text{H}
 \end{array}$$
- (ii) 
$$\begin{array}{c}
 \text{Cl} \quad \text{CH}_3 \\
 | \quad | \\
 \text{H}_3\text{C}-\text{C}-\text{C}-\text{CH}_3 \\
 | \quad | \\
 \text{CH}_3 \quad \text{H}
 \end{array}$$
- (iii) 
$$\begin{array}{c}
 \text{CH}_3 \\
 | \\
 \text{H}_3\text{C}-\text{C}-\text{C}-\text{C}-\text{Cl} \\
 | \quad | \quad | \\
 \text{CH}_3 \quad \text{H}_2 \quad \text{H}_2
 \end{array}$$
- (iv) None of the above

### Group-B

Answer **any four** questions of the following: [4×5=20]

2. Write down the main postulates of Bohr's atomic theory.
3. Calculate the uncertainty in the position of a particle when the uncertainty in the momentum is  $1 \times 10^{-2} \text{ gm cm Sec}^{-1}$ .
4. What do you understand by polar and non-polar molecules? Is it possible for the non-polar molecule to have polar bonds? Justify your answer with suitable examples.
5. Discuss different type of defects that are commonly observed in the crystals.
6. Distinguish between inductive and resonance effects with suitable examples.
7. Write the structure of *meso*-tartaric acid in Newman projection and translate it into Fischer projection.
8. How can you synthesize the following compounds from 1-butene? Draw the complete mechanisms for all steps involved.

- (i) 
$$\begin{array}{c}
 \text{Br} \\
 | \\
 \text{CH}_3\text{CH}_2\text{CHCH}_3
 \end{array}$$
- (ii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
- (iii) 
$$\begin{array}{c}
 \text{O} \\
 \diagup \quad \diagdown \\
 \text{CH}_3\text{CH}_2\text{CH}-\text{CH}_2
 \end{array}$$
- (iv)  $\text{CH}_3\text{CH}_2\text{CHO} + \text{HCHO}$

### Group-C

Answer **any three** questions of the following: [3×10=30]

9 (a) Write down the Schrodinger's wave equation for H-atom and explain different terms involved in it. [6+4]

(b) Calculate the wavelength associated with, electron moving in the 1st orbit (Bohr) of H-atom with approximate velocity of  $2 \times 10^6 \text{ mS}^{-1}$ .

10 (a) Draw the M.O. diagram of CO and O<sub>2</sub> molecules and find bond order in them. [6+4]

(b) Discuss various theories of Metallic bonds.

11 Write notes on any two of the following: [5+5]

(a) Pauli's Exclusion Principle

(b) VSEPR Theory

(c) Hückel's rule

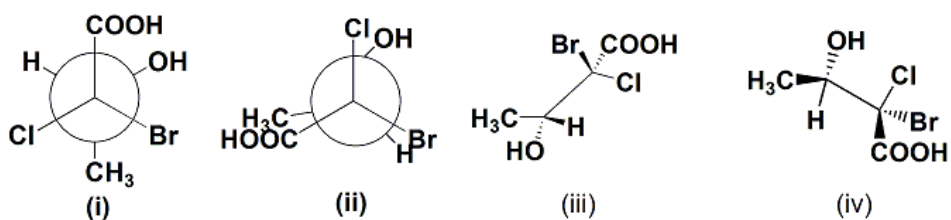
(d) Born-Landé equation

(e) Kolbe's Synthesis

(f) Saytzeff's rule

12 (a) What is Cahn Ingold Prelog (CIP) rule? Explain it with an example. [5+5]

(b) Draw the Fischer projections of the following projection formulas and then find out their stereo chemical relationships.



13 A hydrocarbon "A" (C<sub>6</sub>H<sub>10</sub>) on reduction first gives "B" (C<sub>6</sub>H<sub>12</sub>) and finally "C" C<sub>6</sub>H<sub>14</sub>. "A" on ozonolysis followed by Zn-H<sub>2</sub>O treatment gives two molecule of aldehyde "D" (C<sub>2</sub>H<sub>4</sub>O) and one molecule of aldehyde "E" (C<sub>2</sub>H<sub>2</sub>O). Oxidation of B with acidified KMnO<sub>4</sub> gives an acid "F" (C<sub>4</sub>H<sub>8</sub>O<sub>2</sub>). Determine structure of A to F with proper reasoning.

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