

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

Chemistry
[Paper: MIC-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) Bohr's atomic model can explain

- (i) The spectrum of hydrogen atom only
- (ii) The spectrum of atom or ion containing one electron only
- (iii) The spectrum of hydrogen molecule
- (iv) The solar spectrum

(b) The principal quantum number of an atom represents

- (i) Size of the orbital
- (ii) Spin angular momentum
- (iii) Orbital angular momentum
- (iv) Space orientation of the orbital

(c) In which of the following pairs, total number of nodal planes are same

- (i) 3s, 4d
- (ii) 4s, 3p
- (iii) 5s, 4d
- (iv) 4s, 4p

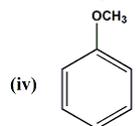
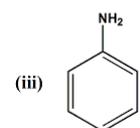
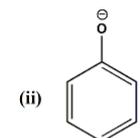
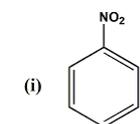
(d) Which of the following has the highest dipole moment?

- (i) CO₂
- (ii) H₂O
- (iii) BF₃
- (iv) NH₃

(e) XeF_4 has a shape of

- (i) Spherical
- (ii) Trigonal bipyramidal
- (iii) Square planar
- (iv) Tetrahedral

(f) In which of the following molecules π -electron density in the ring is maximum?



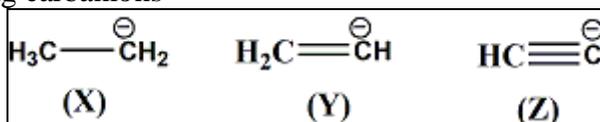
(g) Which of the following is not an electrophile?

- (i) NH_3
- (ii) BF_3
- (iii) AlCl_3
- (iv) Hg^{2+}

(h) The hybridization of carbon atoms in C-C single bond of $\text{HC}\equiv\text{C}-\text{CH}=\text{CH}_2$ is:

- (i) sp^3-sp^3
- (ii) sp^2-sp^3
- (iii) $sp-sp^2$
- (iv) sp^3-sp

(i) Consider the following carbanions



Correct order of stability of these carbanions in decreasing order is:

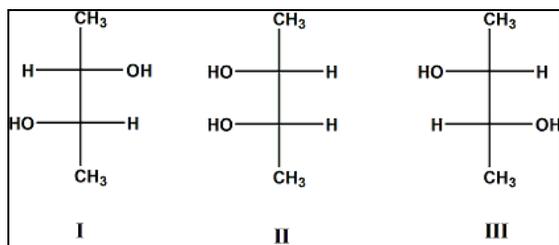
- (i) $\text{X} > \text{Y} > \text{Z}$
- (ii) $\text{Y} > \text{X} > \text{Z}$
- (iii) $\text{Z} > \text{Y} > \text{X}$
- (iv) $\text{Z} > \text{X} > \text{Y}$

- (j) Chiral molecules are those which are
 (i) not superimposable on their mirror image
 (ii) are superimposable on their mirror image
 (iii) show geometrical isomerism
 (iv) unstable molecule

Group-B

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

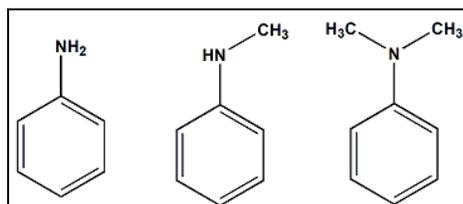
2. State and explain Pauli's exclusion principle.
3. Calculate the minimum uncertainty in velocity of a particle of mass 1.1×10^{-27} Kg if uncertainty in its position is 3×10^{-10} cm. [$h = 6.62 \times 10^{-34}$ Kg.m²S⁻¹]
4. Discuss the salient features of valence bond theory and its limitations.
5. Explain why CO₂ and CCl₄ molecules are non-polar while CHCl₃ molecule is polar.
6. Differentiate the following: [2+2]
 - (i) Fischer projections and relative configuration
 - (ii) Homolytic bond fission and heterolytic bond fission
7. What is hyperconjugation? How is it used to determine stability of carbocations and alkenes.
8. Identify the pairs of enantiomers and diastereomers from the following compounds I, II and III



7. (a) Arrange the following organic acids in decreasing order of their acidity:



- (b) Arrange the following organic bases in decreasing order of their basicity:



Group-C

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

9 (a) Draw the shapes of *s*, *p* and *d* orbitals indicating the sign of wave functions and axis. [6+4]

(b) Why half filled and completely filled orbital's have extra stability. Explain with the help of suitable examples

10. Define lattice energy. Discuss in details the Born-Haber cycle for calculating the lattice energy

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

- (a) Aufbau's principle
- (b) Quantum numbers
- (c) Fajan;s rule
- (d) Hückel's rule
- (e) E/Z Nomenclature

12 (a) Which of the following species behaves as (a) nucleophile, (b) an electrophile [4+6]



(b) Discuss all important conformations of butane by Newmann projection. Which one should be more stable.

13 What do you mean by optical isomerism? Discuss the optical isomerism of lactic acid and tartaric acid,
