

Model Questions
MJC-1 (T) Chemistry
ESE-2023

Answer All Questions

Time: 3 Hours.

(Full Marks: 70)

PART – A

(Compulsory Questions)

All ten objective/multiple choice questions (MCQ) to be answered carrying two marks each.

10x2 = 20 Marks

1. Give the correct answer (s)

(i) Match the following species with their corresponding ground state electronic configuration.

Atom/Ions	Electronic configuration			
A. Cu	1.	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$		
B. Cu^{2+}	2.	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$		
C. Zn^{2+}	3.	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$		
D. Cr^{3+}	4.	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$		
	5.	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$		
	A	B	C	D
(a)	4	2	5	1
(b)	3	4	1	5
(c)	3	2	1	4
(d)	4	2	1	3

(ii) The general formula of saturated Hydrocarbons (HCs) is

- (a) C_nH_{2n+2} (b) C_nH_{2n+1} (c) C_nH_{2n} (d) C_nH_{2n-2}

(iii) What is the Pauli Exclusion Principle?

- (a) The principle that states that all particles in an atom must have the same energy.
(b) The principle that states that no two electrons in an atom can have the same set of quantum numbers.
(c) The principle that states that all electrons in an atom must have the same spin.
(d) The principle that states that no two electrons in an atom can have the same energy.

(iv) Alkenes show geometrical Isomerism due to

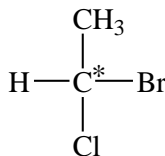
- (a) Asymmetry (b) Resonance
(c) Rotation around a single bond (d) Restricted rotation around a double bond

(v) Which of the following isomeric compound show optical isomerism

- (a) 1-Aminopentane (b) 2-Aminopentane
(c) 3-Aminopentane (d) Isopropyl amine

- (vi) Which of the following represent a racemic mixture
- 75% (*R*)-2-butanol, 25% (*S*)-2-butanol
 - 25% (*R*)-2-butanol, 75% (*S*)-2-butanol
 - 50% (*R*)-2-butanol, 50% (*S*)-2-butanol
 - 100% (*R*)-2-butanol, 0% (*S*)-2-butanol
- (vii) A *meso* compound
- is an achiral molecule which contain chiral carbons
 - contains a *plane of symmetry* or *centre of Symmetry*
 - is optically inactive
 - is characterised by all the above
- (viii) Which of the following compound will show dipole moment?
- cis*-1,2-dichloroethylene
 - o*-dichlorobenzene
 - trans*-1,2-dichloroethylene
 - p*-dichlorobenzene
- (ix) Which one of the following is correct order for the stability of conformers of ethane?
- Eclipsed > Skew > Staggered
 - Staggered > Eclipsed > Skew
 - Skew > Staggered > Eclipsed
 - Staggered > Skew > Eclipsed
- (x) Correct configuration of the chiral carbon present in given structure is -

- R*
- S*
- Both *R* and *S*
- None



PART – B

(Short Answer Type)

Any four questions to be answered out of six questions carrying five Marks each.

4x5 = 20 Marks

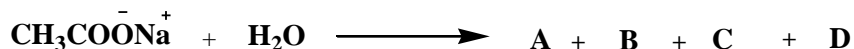
- What is mesomeric effect? Give one example where this effect is operative.
 - What is carbonium ion? explain the relative stability of primary, secondary and tertiary carbonium ion.
 - Draw the Molecular orbital diagram of O₂. Write the value of bond order.
 - Discuss about Hund's rule and Pauli's Exclusion Principle.
 - What is de Broglie equation? Calculate wavelength of an α particle having mass 6.6×10^{-27} Kg moving with a speed of 10^5 cm sec⁻¹ (**Planck constant, $h = 6.6 \times 10^{-34}$ Kg m² sec**).
- Ans: 1×10^{-10} m
- Discuss about Born- Haber Cycle and its applications.

PART – C
(Long Answer Type)

Any three questions to be answered out of five questions carrying ten marks each.

3x10 = 30 Marks

8. Derive the Schrodinger's wave equation for a single electron system. What is the Significance of the wave function ψ and ψ^2 in this equation?
9. (i) Discuss Bohr's model how it successfully explain the spectrum of hydrogen atom.
(ii) Derive de Broglie equation. Calculate the de Broglie wavelength associated with a ball weighing 150 g thrown with a velocity of $3 \times 10^3 \text{ cm sec}^{-1}$
(Planck constant, $h = 6.625 \times 10^{-27} \text{ erg sec}$).
10. (i) Write the structural formula and give the IUPAC names for all isomeric alkanes of the molecular formula C_5H_{12} .
(ii) What are conformational isomers of ethane?
(iii) Write the name of following Products A, B, C and D in the given chemical reaction



11. (i) Write a note on Markovnikov rule.
(ii) How will you Synthesize ethylene in laboratory?
(iii) What happens when ethylene is treated with:
(a) Br_2/CCl_4
(b) Conc. H_2SO_4
(c) Dil. Cold KMnO_4
(d) O_3 and then $\text{Zn}/\text{H}_2\text{O}$
12. Explain basic ideas of the VSEPR theory? By using this theory predict the hybridization and shape and of the molecules- PCl_5 , BCl_3 , SF_6 , H_2O , OF_2 and NH_3 .

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