

**CAT ENTRANCE EXAMINATION 2023 - M. Sc. CHEMISTRY
(SPECIALIZATION IN ENERGY SCIENCE)**

MULTIPLE CHOICE QUESTIONS (MCQs)

1. XeF_6 on reaction with quartz gives :

- (A) XeO_4
- (B) XeO_3
- (C) XeF_4
- (D) XeOF_4

2. The correct order of electron affinity among the following is :

- (A) $\text{F} > \text{Cl} > \text{Br}$
- (B) $\text{Cl} > \text{F} > \text{Br}$
- (C) $\text{Br} > \text{Cl} > \text{F}$
- (D) $\text{F} > \text{Br} > \text{Cl}$

3. A unit cell consists of a cube in which there are anions (B) at each corner and one at the centre of the unit cell and cations (A) at the centre of each face. What is the simplest formula for this compound ?

- (A) AB
- (B) AB_2
- (C) A_3B_2
- (D) A_2B_3

4. How many diastereomers are shown by the following molecule ?



- (A) 1
- (B) 2
- (C) 3
- (D) 4

5. The order of stability of following carbocations is ,

- (i) Tropylium cation
- (ii) Allyl carbocation
- (iii) Benzyl carbocation
- (iv) Triphenylmethyl carbocation

(A) $i > ii > iii > iv$

(B) $i > iv > iii > ii$

(C) $iv > iii > ii > i$

(D) $ii > iii > iv > i$

6. What are the component values (in terms of $h/2\pi$) of the orbital angular momentum along the z-direction for a 2p electron ?

(A) +2, +1, 0, -1, -2

(B) +1, 0, -1

(C) +1/2, -1/2

(D) +3/2, +1/2, -3/2, -1/2

7. The correct order of first ionization potential is

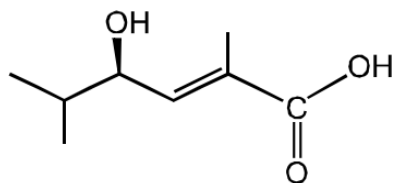
(A) $He > F > O > N > Mg$

(B) $N > F > He > O > Mg$

(C) $He > F > N > O > Mg$

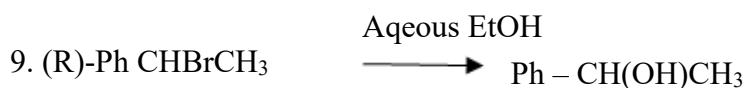
(D) $F > He > N > Mg > O$

8. For the compound



The stereochemical notations are

- (A) 2Z, 4R
- (B) 2Z, 4S
- (C) 2E, 4R
- (D) 2E, 4S



Which statement is the most likely to be correct concerning the given SN1 reaction.

- (A) The reaction proceeds with partial racemization.
- (B) The stereochemistry of the Halide is not inverted.
- (C) The carbonium ion Ph - CH₂ - CH₂⁺ is involved.
- (D) The carbonium ion is attacked in each side to same degree.

10. The wave number of the limiting line in Lyman series of hydrogen is 109678 cm⁻¹.

The wave number of the limiting line in Balmer series of He⁺ would be (in cm⁻¹).

- (A) 107879 cm⁻¹
- (B) 1096.78 cm⁻¹
- (C) 109678 cm⁻¹
- (D) 119658 cm⁻¹

11. The correct relations among the following is/are

(a) $\left(\frac{\partial U}{\partial V}\right)_T = \left(\frac{\partial H}{\partial V}\right)_T$ for an ideal gas

(b) $\oint dq = 0$ in a carnot cycle

(c) $\frac{dq_{\text{rev}}}{T}$ is a state function

(d) On adiabatic expansion, there is decrease in temperature of the system

12. The total number of oxygen atoms shared per unit of SiO_4^{4-} in Beryl $[\text{Be}_2\text{Al}_2\text{Si}_6\text{O}_{18}]$ is
(a) 4 (b) 3 (c) 2 (d) 1

13. 3 moles of ideal gas is expanded from 3 atm to 1 atm isothermally. The change in entropy is

- (a) $27.4 \text{ JK}^{-1} \text{ mol}^{-1}$ (b) $9.1 \text{ JK}^{-1} \text{ mol}^{-1}$
(c) $36.3 \text{ JK}^{-1} \text{ mol}^{-1}$ (d) $12.5 \text{ JK}^{-1} \text{ mol}^{-1}$

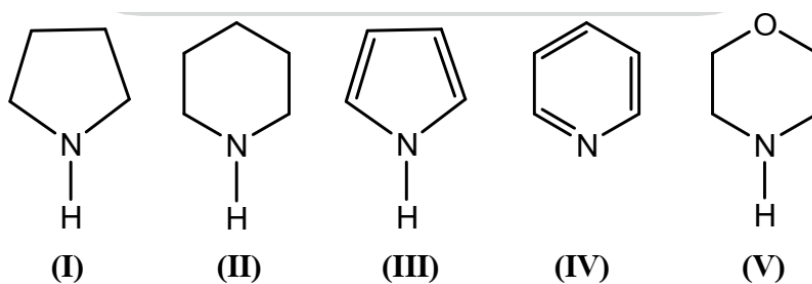
14. The shape of $[\text{HXeO}_4]$ and $[\text{ClF}_2]$ ions respectively, are

- (a) see-saw and linear (b) see-saw and bent
(c) tetrahedral and linear (d) square pyramidal and bent

15. Among the following statements, the correct is/are

- (a) Tyr is a neutral amino acid (b) Trp has an aromatic side chain
(c) Asp is an acidic amino acid (d) All the amino acids except cys has s-configuration

16. The reactivity of following compounds with proton will be in the order of



- (a) $\text{I} > \text{II} > \text{V} > \text{IV} > \text{III}$ (b) $\text{II} > \text{I} > \text{V} > \text{IV} > \text{III}$
(c) $\text{I} > \text{II} > \text{IV} > \text{V} > \text{III}$ (d) $\text{III} > \text{IV} > \text{V} > \text{II} > \text{I}$

17. The correct statement among the following is/are

- (a) For electrolytic cells, $\Delta G = nFE_{cell}$
(b) Transport number is directly proportional to the velocity of ion
(c) The value of activity coefficient decrease with increase in ionic strength for dilute solution

(d) Ecell is an extensive property.

18. The Hermitian operator(s) is/are

(a) $\frac{\partial}{\partial x}$

(b) $i\frac{\partial}{\partial x}$

(c) $i\hbar\frac{\partial}{\partial x}$

(d) $-i\hbar\frac{\partial}{\partial x}$

19. The co-ordination number in a DCC unit cell is

(a) 2 (b) 4 (c) 6 (d) 8

20. Which of the following orbital(s) have two angular node(s)

(a) 3d (b) 4d (c) 5d (d) 3p