# DEPARTMENT OF CHEMISTRY

## SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

## B.TECH (2018-2019)

**Subject/Code: Chemistry/** 18CYB101J **Semester-I**

## MCQ

### Module I

1. If the sign of the wave function is unchanged when the orbital is reflected about its centre, the orbital is

   a) **Gerade**

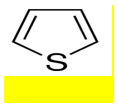
   b) Ungerade

   c) Gerade as well as Ungerade

   d) Anti-Symmetric

   [Explanation: If the sign of the wave function is unchanged when the orbital is reflected about its center (i.e., x, y and z are replaced by –x, -y and –z), the orbital is **gerade**.]

2. Which of the following molecules are aromatic?

   **a)**  b.  c.  d. 

3. The filling up of Molecular orbital takes place according to

   a) Huckel's rule **b) Hund's rule** c) Fajan's rule d) Cahn Ingold Prelog rule

4. Bond Order of $O_2$, $F_2$, $N_2$ respectively are

   a) +1, +2, +3

   b) +2, +3, +1

   c) **+2, +1, +3**

   d) +3, +2, +1

5. Arrange the following molecules in decreasing bond length.

   a) $O_2 > O_2^- > O_2^+ > O_2^{2-}$

   b) **$O_2^{2-} > O_2^- > O_2 > O_2^+$**

   c) $O_2^{2-} > O_2^- > O_2^+ > O_2$

   d) $O_2^- > O_2^+ > O_2^{2-} > O_2$ [Explanation: The bond length is inversely proportional to the bond order. Therefore, the correct is: $O_2^{2-} > O_2^- > O_2 > O_2^+$.]

6. Arrange the following molecules in the order of increasing stability.

   a) $N_2^+ < N_2 < N_2^- < N_2^{2-}$

   b) $N_2^{2-} < N_2^- < N_2 < N_2^+$

   c) **$N_2^{2-} < N_2^- = N_2^+ < N_2$**

   d) $N_2 < N_2^+ = N_2^- < N_2^{2-}$ [Explanation: The order of stability is directly proportional to the bond order. Therefore, the correct order of stability is $N_2^{2-} < N_2^- = N_2^+ < N_2$.]

7. On the basis of molecular orbital theory, select the most appropriate option.

   a) The bond order of $O_2$ is 2.5 and it is paramagnetic

   b) The bond order of $O_2$ is 1.5 and it is paramagnetic

   c) The bond order of $O_2$ is 2 and it is diamagnetic

   d) **The bond order of $O_2$ is 2 and it is paramagnetic**

8. Which of the following molecule does not exist due to its zero bond order?

   a) $H_2^+$

   b) $He_2^+$

   **c) $He_2$**

   d) $H_2^-$ [Explanation: Molecular orbital electronic configuration of $He_2$ molecule = $(\sigma_{1s})^2 (\sigma^*_{1s})^2$.. Bond order = 0, so $He_2$ molecule does not exist.]

9. The relative energies of molecular orbitals in increasing order have been found to be as follows:

$(\sigma_{1s}) < (\sigma^*_{1s}) < (\sigma_{2s}) < (\sigma^*_{2s}) < [(\pi_{2py})(\pi_{2pz})] < (\sigma_{2px}) < [(\pi^*_{2py})(\pi^*_{2pz})] < (\sigma^*_{2px})$

a) For $O_2$ to $Ne_2$

b) **For $H_2$ to $N_2$**

c) For $H_2$ to $Ne_2$

d) For $N_2$ to $Ne_2$

10. Choose the incorrect statement from the following options.

a) **In bonding molecular orbital, electron density is low in the region between the nuclei of bonded atoms**

b) The energy of antibonding molecular orbital is higher than that of atomic orbitals from which it is formed

c) Every electron in bonding molecular orbital contributes toward stability of the molecule

d) Antibonding takes place when lobes of atomic orbitals have different signs.

11. Which of the following molecule is not homonuclear?

a) $H_2$

b) $N_2$

c) **NO**

d) $O_2$

12. Bond order of $NO^+$ molecule is

a) 2

**b) 3**

c) 2.5

d) 4 [Explanation: Bond order = (10-4)/ 2 = 3]

13. The molecular orbital electronic configuration of HF molecule is

a) **$1s^2\ 2s^2\ \sigma_{spx}^2\ [2_{py}^2\ 2_{pz}^2]\ \sigma_{spx}^*$**

b) $1s^2\ 2s^2\ \sigma_{spx}^2\ [2_{px}^2\ 2_{py}^2]\ \sigma_{spx}^*$

c) $1s^2\ 2s^2\ \sigma_{spx}^2\ [2_{px}^2\ 2_{pz}^2]\ \sigma_{spx}^*$

d) $1s^2\ 2s^2\ \sigma_{spx}^2\ [2_{px}^4]\ \sigma_{spx}^*$ [Explanation: HF molecule has 10 electrons and its electronic configuration is $1s^2\ 2s^2\ \sigma_{spx}^2\ [2_{py}^2\ 2_{pz}^2]\ \sigma_{spx}^*$.]

14. From the following options, choose the heteronuclear diatomic molecules which are paramagnetic in nature?

a) HF and NO

b) HF and $O_2$

c) NO and $O_2$

d) **Only NO**

15. The combination of H ($1s^1$) and F ($2px^1$) gives

a) Bonding orbital

b) Anti-bonding orbital

c) **Both bonding and anti-bonding orbital**

d) Non-bonding orbital

[Explanation: The combination of H (1s1) and F (2px1) gives both bonding ($\sigma_{spx}$) and antibonding ($\sigma_{spx}^*$) orbitals.]

16. Choose the **incorrect option** from the following.

a) Valence bond theory does not explain the paramagnetic nature of $O_2$

b) Molecular orbital theory explains the extra stability of $O_2^+$cation over $O_2$

c) **Valence bond theory explains the ionization or gain of electrons, giving $O_2^+$ and $O_2^-$ ions, if $O_2$ has the stable octet**

d) Resonance has no role in Molecular orbital theory

17. The interaction will be attractive between the ----- orbital [Provided x is the principal axis]

a) $2p_y$-$2p_z$

b) 1s-2s

c) $2p_x$-$2p_y$

**d) 2s-$2p_x$**

18. Identify the incorrect statement regarding aromaticity

a) It is the extra stability possessed by a molecule

b) p-orbitals must be planar and overlap

c) Cyclic delocalization takes place

**d) It does not follow Huckel's rule**

19. According to Heisenberg the product of uncertainty in the position & moment run of the body is

a) Equal to h/p

b) Equal to E-V

**c) ≥ h/4 π**

d) ≥E-V

20. CO has 10 bonding electrons and 4 anti-bonding electrons and its bond order is

**a) 3** b)7 c)1 d) 5/2

21. Which of the following is known as the Schrödinger equation

a) $E = mc^2$ b) $\lambda = h/p$ **c)** $\hat{H}\psi = E\psi$ d) $-\frac{\hbar^2}{2m}\nabla^2$

22. The CFSE for a high spin $d^4$ octahedral complex is

a) $-0.6\ \Delta_{oct}$ **b) $-1.8\ \Delta_{oct}$** c) $-1.6\ \Delta_{oct} + P$ d) $-1.2\ \Delta_{oct}$

24. Two electrons occupying the same orbital are distinguished by

a) azimuthal quantum number b) **spin quantum number** c) Magnetic quantum number d) orbital quantum number

25. Organic compounds which contain more than one benzene rings are termed
**a) arenes** b) Aryls c) acyls d) benzenes

26. The de- broglie hypothesis is associated with
a) wave nature of electrons only
b) wave nature of protons only
c) wave nature of radiation
**d) wave nature of all material particles**

27. For a homonuclear diatomic molecule the bonding orbital is
**a) σg of lowest energy** b) σu of second lowest energy c) πg of lowest energy d) πu of lowest energy

28. The crystal field splitting energy for octahedral and tetrahedral complexes is related as
**a) $\Delta t \approx 4/9\ \Delta o$** b) $\Delta t \approx 1/2\ \Delta o$ c) $\Delta o \approx 2\ \Delta t$ d) $\Delta o \approx 4/9\ \Delta t$