

DEPARTMENT OF CHEMISTRY
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
QUESTION BANKS FOR CYCLE TEST -I

1) For a homonuclear diatomic molecule the bonding orbital is

- a) **σ_g of lowest energy**
- b) σ_u of second lowest energy
- c) π_g of lowest energy
- d) π_u of lowest energy

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

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

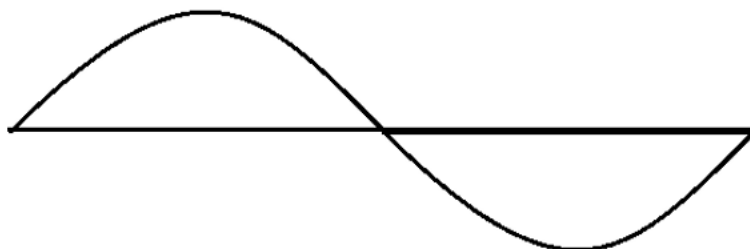
a) For O_2 to Ne_2

b) For H_2 to N_2

c) For H_2 to Ne_2

d) For N_2 to Ne_2

3) The wave function for which quantum state is shown in the figure?



- a) 1
- b) 2**
- c) 3
- d) 4

4. In $K_4[Fe(CN)_6]$ the number of unpaired electrons in iron are ?

- (a) 0**
- (b) 2
- (c) 3
- (d) 5.

5. The tetrahedral complexes have coordination number

- (a) 3
- (b) 6
- (c) 4**
- (d) 8

6. The spin only magnetic moment value (in Bohr magneton units) of $Cr(CO)_6$ is

- (a) 0**
- (b) 2.84
- (c) 4.90

(d) 5.92

7. The spin only formula (μ_s) for octahedral complexes is

- A) **$(4S(S+1))^{1/2}$**
- B) $(4S(S+1))^{1/2} + (L(L+1))^{1/2}$
- c) $(L(L+1))^{1/2}$
- d) $L(L+1)$

8. The number of unpaired electrons in d6 low spin octahedral complex is

- a) 0**
- b) 1
- c) 2
- d) 3

9. According to Heisenberg the product of uncertainty in the position & momentum of the body is

- a. Equal to h/p
- b. Equal to $E-V$
- c. $\geq h/4\pi$**
- d. $\geq E-V$

10. 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

11. 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) $\Delta_o \approx 4/9 \Delta_t$

12. Calculate the Zero-point energy for a particle in an infinite potential well for an electron confined to a 1 nm atom.

- a. $3.9 \times 10^{-29} \text{ J}$
- b. $4.9 \times 10^{-29} \text{ J}$
- c. $5.9 \times 10^{-29} \text{ J}$**
- d. $6.9 \times 10^{-29} \text{ J}$

13. The magnetic moment of $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$

is

- (a) 1.73
- (b) 2.83

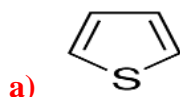
- (c) 6.6
(d) Zero

14. 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

15. Which of the following molecule is aromatic?



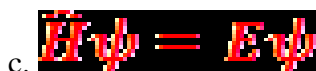
16. On the basis of molecular orbital theory, select the most appropriate option.

- a. The bond order of O₂ is 2.5 and it is paramagnetic
- b. The bond order of O₂ is 1.5 and it is paramagnetic
- c. The bond order of O₂ is 2 and it is diamagnetic

d. The bond order of O₂ is 2 and it is paramagnetic

17. Which of the following is known as the Schrödinger equation?

- a. $E = mc^2$
- b. $\lambda = h/p$



- d. $-\hbar^2 / 2m$

18. The CFSE for a high spin d₄ octahedral complex is

a) -0.6 Δ_{oct}

b) -1.8 Δ_{oct}

c) -1.6 Δ_{oct} + P

d) -1.2 Δ_{oct}

19. Which of the following species will be diamagnetic?

- a) $[\text{Fe}(\text{CN})_6]^{4-}$
- b) $[\text{FeF}_6]^{3+}$
- c) $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
- d) $[\text{CoF}_6]^{3-}$

20. How many unpaired electrons are there in a strong field complex $[\text{Co}(\text{NH}_3)\text{Cl}_2]$?

- a) **Zero**
- b) One
- c) Two
- d) three

21. Which one of the following nuclei has a magnetic moment?

- a) ^{12}C
- b) **^{14}N**
- c) ^{16}O
- d) ^{32}S

22. $[\text{Co}(\text{NH}_3)_6]^{3+}$ ion is:

- (a) Paramagnetic
- (b) **Diamagnetic**
- (c) Ferromagnetic
- (d) Ferri magnetic.

23. 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

24. For a homonuclear diatomic molecule the bonding orbital is

- a) **σ_g of lowest energy**
- b) σ_u of second lowest energy
- c) π_g of lowest energy
- d) π_u of lowest energy

25. s-p mixing that is seen in lighter second period elements are due to the

- a) **effective nuclear charge that increases to the right of the period, stabilizing the 2s orbital more drastically than the 2p orbital.**
- b) effective nuclear charge that decreases to the right of the period, stabilizing the 2s orbital more drastically than the 2p orbital.
- c) effective nuclear charge that increases to the right of the period, stabilizing the 2p orbital more drastically than the 2s orbital.
- d) Both b and c

26. What is the bond order of BC^{-1} ?

- a) 1
- b) **2**

- c) 1.5
- d) 2.5

27. Which of the following statement is incorrect?

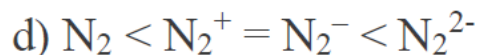
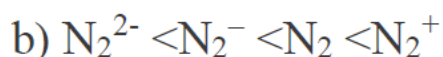
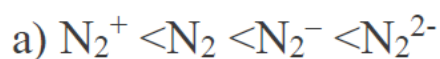
a) Benzene is less reactive than 1,3,5 - hexatriene

b) Highest occupied molecular orbitals (HOMO) of benzene are higher in energy than the highest occupied molecular orbital (HOMO) of hexatriene.

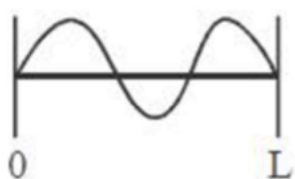
c) Highest occupied molecular orbitals (HOMO) of benzene are lower in energy than the highest occupied molecular orbital (HOMO) of hexatriene.

d) Highest occupied molecular orbitals (HOMO) of benzene and the highest occupied molecular orbital (HOMO) of hexatriene is at same energy level

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

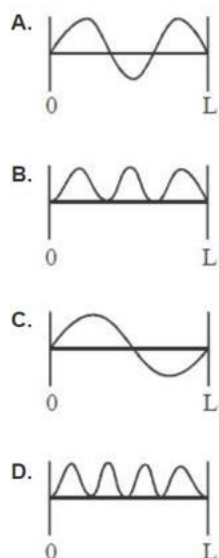


29. The wave function for which quantum state is shown in the figure?



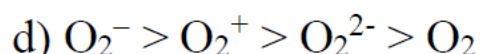
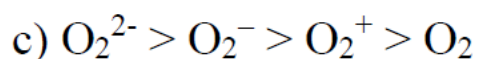
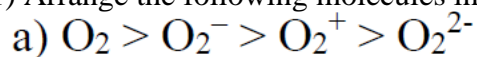
- a) 1
- b) 2
- c) 3**
- d) 4

30. For the energy level $n=3$, the probability density for a particle of mass m in a One dimensional box of width L is given by



Answer: B

31) Arrange the following molecules in decreasing bond length.



32) Which of the following statements is wrong?

a) When two orbitals overlap in-phase with each other, a bonding molecular orbital form.

b) When two orbitals overlap out-of-phase with each other, an antibonding molecular orbital form.

c) When one of two atoms connected by a σ bond rotates about the bond axis, orbital overlap is lost.