Molecular orbital theory

21. Which one is paramagnetic and has the bond order 1/2

(a) O_2 (b) N_2

(c) F_2 (d) H_2^+

22. When two atoms of chlorine combine to form one molecule of chlorine gas, the energy of the molecule

(a) Greater than that of separate atoms

(b) Equal to that of separate atoms

(c) Lower than that of separate atoms

(d) None of the above statement is correct

23. An atom of an element *A* has three electrons in its outermost shell and that of *B* has six electrons in the outermost shell. The formula of the compound between these two will be

(a) A_3B_4 (b) A_2B_3

(c) A_3B_2 (d) A_2B_3

24. The bond order of individual carbon-carbon bonds in benzene is

(a) One

(b) Two

(c) Between 1 and 2

(d) One and two alternately

25. PCl_5 exists but NCl_5does not because

(a) Nitrogen has no vacant d-orbitals

(b) $NCl_5$is unstable

(c) Nitrogen atom is much smaller

(d) Nitrogen is highly inert

26. Paramagnetism is exhibited by molecules

(a) Not attracted into a magnetic field

(b) Containing only paired electrons

(c) Carrying a positive charge

(d) Containing unpaired electrons

27. Which one of the following is paramagnetic

(a) H_2O (b) NO_2

(c) SO_2 (d) CO_2

28. The energy of a $2p$ orbital except hydrogen atom is

(a) Less than that of sp^2 orbital

(b) More than that of $2s$orbital

(c) Equal to that of $2s$ orbital

(d) Double that of $2s$ orbital

29. In the electronic structure of acetic acid, there are

(a) 16 shared and 8 unshared electrons

(b) 8 shared and 16 unshared electrons

(c) 12 shared and 12 unshared electrons

(d) 18 shared and 6 unshared electrons

30. Which of the following does not exist on the basis of molecular orbital theory

(a) H_2^+ (b) He_2^+

(c) He_2 (d) Li_2

31. In P_4O_{10}, the number of oxygen atoms attached to each phosphorus atom is

(a) 2 (b) 3

(c) 4 (d) 2.5

32. Of the following statements which one is correct

(a) Oxygen and nitric oxide molecules are both paramagnetic because both contain unpaired electrons

(b) Oxygen and nitric oxide molecules are both diamagnetic because both contain no unpaired electrons

(c) Oxygen is paramagnetic because it contains unpaired electrons, while nitric oxide is diamagnetic because it contains no unpaired electrons

(d) Oxygen is diamagnetic because it contains no unpaired electrons, while nitric oxide is paramagnetic because it contains an unpaired electron

33. According to the molecular orbital theory, the bond order in C_2 molecule is

(a) 0 (b) 1

(c) 2 (d) 3

34. The molecular orbital configuration of a diatomic molecule is

$$\sigma\,1s^2\ \sigma^*\,1s^2\ \sigma\,2s^2\ \sigma^*\,2s^2\ \sigma\,2p_x^2 \begin{cases} \pi\,2p_y^2 \\ \pi\,2p_z^2 \end{cases}$$

Its bond order is

(a) 3 (b) 2.5

(c) 2 (d) 1

35. The difference in energy between the molecular orbital formed and the combining atomic orbitals is called

(a) Bond energy

(b) Activation energy

(c) Stabilization energy

(d) Destabilization energy

36. According to molecular orbital theory, the paramagnetism of O_2 molecule is due to presence of

(a) Unpaired electrons in the bonding σ molecular orbital

(b) Unpaired electrons in the antibonding σmolecular orbital

(c) Unpaired electron in the bonding π molecular orbital

(d) Unpaired electrons in the antibonding πmolecular orbital

37. The bond order in O_2^+ is

(a) 2 (b) 2.5

(c) 1.5 (d) 3

38. Which of the following is paramagnetic

(a) O_2 (b) CN^-

(c) CO (d) NO^+

39. If $N_x$is the number of bonding orbitals of an atom and N_y is the number of antibonding orbitals, then the molecule/atom will be stable if

(a) $N_x > N_y$ (b) $N_x = N_y$

(c) $N_x < N_y$ (d) $N_x \leq N_y$

40. Which of the following molecular orbitals has two nodal planes

(a) $\sigma 2s$ (b) $\pi 2p_y$

(c) $\pi^* 2p_y$ (d) $\sigma^* 2p_x$