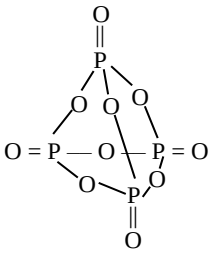
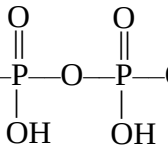
1. According to M.O.T. bond order of N_2 is
(a) 1 (b) 2 (c) 3 (d) 4

2. The number of σ and π bonds in vinyl acetate are
(a) 11σ& 2π (b) 9σ& 4 π
(c) 2σ& 11π (d) 10σ& 3π

3. Which of the following cannot exist on the basis of MO theory ?
(a) H_2^+ (b) He_2^+ (c) He_2 (d) O_2

4. He structure of P_4O_{10} (x) is as follows



(X) (x) + n $H_2O \longrightarrow$ 2  (pyrophosphoric acid)

What is the value of "n" ?
(a) n = 6 (b) n = 4 (c) n = 3 (d) n = 5

5. For NaCl ,lattice energy = – 186 kcal/mol, the solvation energy of Na^+ and Cl^- are –97 and – 85 kcal/mole respectively. Therefore for NaCl (s)
(a) Enthalpy of solution is exothermic and magnitude equal 4 kcal/mol.
(b) Enthalpy of solution is exothermic and magnitude equal to 368 kcal/mol
(c) Enthalpy of solution is endothermic and magnitude equal to 4 kcal/mol
(d) Enthalpy of solution is endothermic and magnitude equal to 368 kcal/mol

6. Which of the following , statements is correct for carbon monoxide ?
(a) A double bond between carbon and oxygen
(b) 1 σ , 1 π and 1 coordinate bond between carbon and oxygen
(c) One lone pair of electrons only on oxygen atom
(d) 1 σ and 2 π bonds between carbon and oxygen.

7. Which of the following ions does not involve pπ– dπbonding ?
(a) SO_3^{2-} (b) PO_4^{3-} (c) NO_3^- (d) Xe OF_4

8. Energy required to dissociate 4 grams of gaseous hydrogen into free gaseous atoms is 208 *kcal* at 25^0C the bond energy of *H–H* bond will be
(a) 104 *Kcal* (b) 10.4 *Kcal*
(c) 20.8 *Kcal* (d) 41.6 *Kcal*

9. The number and type of bonds between two carbon atoms in CaO_2
(a) One σ and one π bond (b) one σ and two π bonds
(c) one σ and a half π bonds (d) one σ bond

10. The compound which contains both ionic and covalent bond is
(a) KCN (b) KCl (c) H_2 (d) CH_4

11. Strength of H-bond is intermediate between
(a) Ionic & covalent bond
(b) Ionic& metallic bond
(c) Metallic and covalent bond

(d) Vanderwaals forces & covalent bond

12. The bonds are N_2O_5 in
(a) Only ionic (b) Only covalent
(c) Covalent and ionic (d) Covalent & Coordinates

13. Given the species N_2, CO, NO^+ and CN^- which of the following statements are true for them –
(I) All the species are diamagnetic
(II) All the species are isostructural
(III) All the species have identical bond order
(IV) More than one species have zero dipole Moment
(a) I, II and III (b) I, II, III and IV
(c) III and IV (d) I and II

14. The bonds present in N_2O_5 (g) are
(a) Only ionic (b) Covalent and coordinate
(c) Only covalent (d) Covalent and ionic

15. Which of the following bond orders is indication of existence of a molecule?
(a) Zero bond order (b) Negative bond order
(c) Positive bond order (d) All of these.

16. What is the order of stability of N_2 and its ions?
(a) $N_2 > N_2^+ = N_2^- > N_2^{2-}$ (b) $N_2^+ > N_2^- > N_2 > N_2^{2-}$
(c) $N_2^- > N_2^+ = N_2^- > N_2^{2-}$ (d) $N_2^{2-} > N_2^- = N_2^+ > N_2$

17. Which of the following relationships is true?
(a) Bond dissociations energy of O_2 and O_2^- are same.
(b) Bond dissociations energy of O_2^+ is higher than O_2
(c) Bond dissociation energy of O_2^- and O_2^{2-} are same.
(d) Bond dissociation energy of O_2^{2-} is higher than O_2^-

18. Which of the following is a **wrong** order with respect to the property mentioned against each ?
(a) $O_2^{2-} > O_2 > O_2^+$ [Paramagnetic moment] (b) $(NO)^- > (NO) > (NO)^+$ [bond length]
(c) $H_2 > H_2^+ > He_2^+$ [bond energy] (d) $NO_2^+ > NO_2 > NO_2^-$ [bond angle]

19. The nature of intermolecular forces among benzene (C_6H_6) molecules is :
(a) dipole dipole attraction (b) london dispersion forces
(c) ion dipole attraction (d) hydrogen bonding

20. The percentage of p-character in the orbitals forming P – P bonds in P_4 is :
(a) 25 (b) 33
(c) 50 (d) 75

21. Which compound among the following has least ionic character?
(a) $AlCl_3$ (b) AlI_3
(c) MgI_2 (d) CsI

22. The number and type of bonds between two carbon atoms in calcium carbide are

(a) one sigma, one pi (b) one sigma, two pi
(c) two sigma, one pi (d) two sigma, two pi

23. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of :

(a) $Li_2 < Li_2^+ < Li_2^-$ (b) $Li_2^- < Li_2^+ < Li_2$
(c) $Li_2 < Li_2^- < Li_2^+$ (d) $Li_2^- < Li_2 < Li_2^+$

24. The correct statement for the molecule, CsI_3, is :

(a) it is a covalent molecule. (b) it contains Cs^+ and I_3^-
(c) it contains Cs^{3+} and I^- ions. (d) it contains Cs^+, I^- and lattice I_2 molecule.

25. The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is:

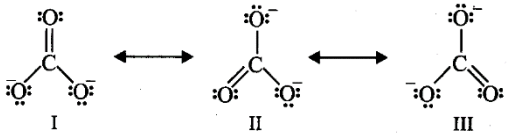
(a) ion-ion interaction (b) ion-dipole interaction
(c) London force (d) dipole-dipole attraction

26. Oxygen molecule is paramagnetic because
(a) No. of bonding electrons > no. of antibonding electrons
(b) No. of bonding electrons > no. of antibonding electrons
(c) No. of bonding electrons = no. of antibonding electrons
(d) Presence of unpaired electrons in molecular orbitals.

27. Which molecule/ion out of the following does not contain unpaired electrons?
(a) N_2^+ (b) O_2 (c) O_2^{2-} (d) B_2

28. The electronic configuration of four atoms are given in brackets:
L $(1s^2\ 2s^2\ 2p^1)$ M $(1s^2\ 2s^2\ 2p^5)$
Q $(1s^2\ 2p^2\ 2p^6 3s^1)$; R $(1s^2\ 2s^2 2p^2)$
The element that would most readily form a diatomic molecule is.
(a) Q (b) M (c) R (d) L

29. The given structures I, II and III of carbonate ion represent



(a) Hybrid structures
(b) Isomeric structures
(c) Canonical structures
(d) Dipole structures.

30. The ground state electronic configuration of S is $3s^2\ 3p^4$. How does if form the compound SF_6?
(a) Due to octahedral shape of S atoms
(b) Due to presence of vacant 3d-orbitals which provide 6 unpaired electrons in excited state
(c) Due to sp^3 hybridisation of S atom which provides 6 electrons to 6 F atoms
(d) Due to presence of 3 sigma and 3 pi bonds between S and F

1. (c)

Molecular orbital configuration of N_2 is $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 2p_y^2 \pi p^2{}_y \pi 2p_y^2 \sigma 2p_x^2$

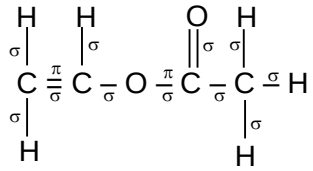
$\therefore$ Bond order

$$= \frac{\text{No. of electrons in bonding orbital} - \text{No. of electrons in antibonding orbital}}{2}$$

$$= \frac{8-2}{2} = 3$$

2. (a)

Structure of vinyl acetate

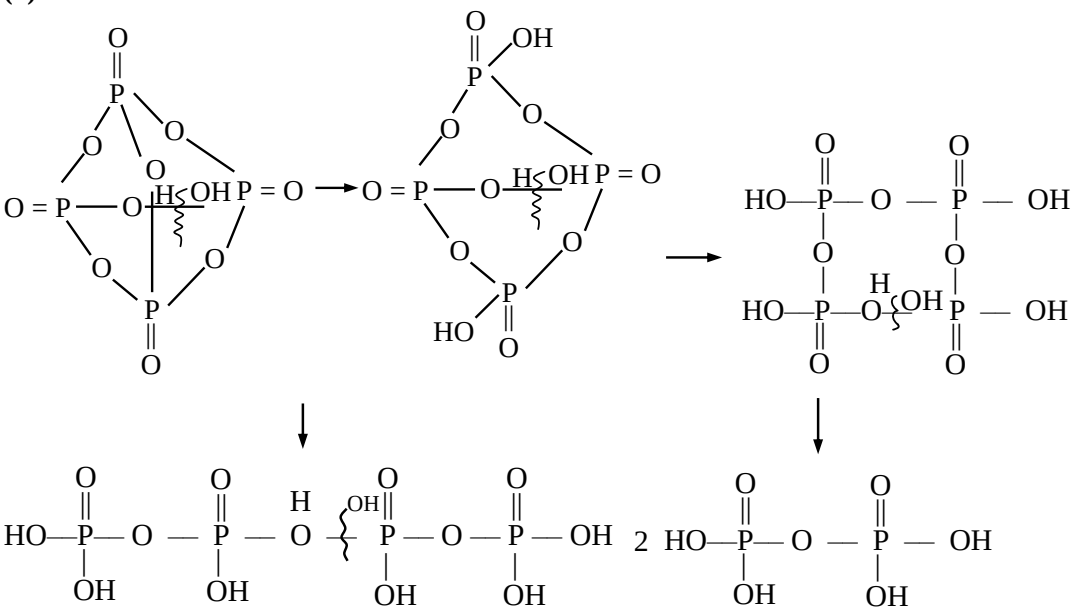


So it has 11σ & 2π bonds

3. (c)

Bond order of He_2 is zero, hence cannot exist.

4. (b)



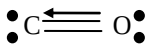
5. (c)

$\Delta H_{solv} = -97 - 85 = -182$ kcal/mol

$-LE = +186$ kcal/mol

ΔH (solution) $= +186 - 182 = 4$ kcal/mol & endothermic

6. (b)



7. (c)

N does not have d orbitals.

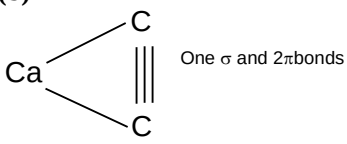
8. (a)

4 gram gaseous hydrogen has bond energy 208 *kcal*

So, 2 gram gaseous hydrogen has bond energy $= \frac{208}{2} kcal$

= 104 *kcal*.

9. (b)



The triple bond between C ≡ C bond is a combination of 1 σ 2 π bonds

10. (a)

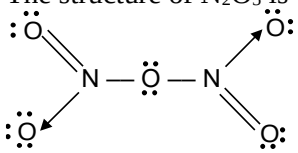
Structure of KCN: $K^+\left[C\equiv N\right]^-$

11. (d)

H-bonds are stronger them vanderwaals forces but weaker than covalent bonds

12. (d)

The structure of N_2O_5 is



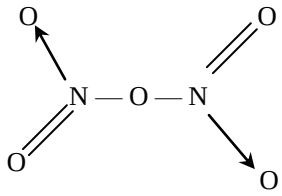
∴ If has covalent and coordinate bond

13. (a)

All species are iso-electronic.

14. (b)

The structure of N_2O_5 is



It contains covalent and coordinate bond. In solid phase it exist as $[NO_2]^+ [NO_3]^-$

15. (c) : A molecule exists only if the bond order is positive. If bond order is zero or negative, the molecule does not exist.

16. (a) : Bond order of $N_2 = 3, N_2^+ = 2.5, n_2^- = 2.5$ and N_2^{2-} is 2. Higher the bond order, more is the stability.

17. (b) : M.O. configuration of O_2^+

$(\sigma 1s^2)(\sigma^* 1s^2)(\sigma 2s^2)(\sigma^* 2s^2)(\sigma 2p_x^2 = \pi 2p_y^2)(\pi^* 2p_x^1)$ B.O.$= \frac{10-5}{2} = 2.5$

B.O. of $O_2 = 2$

$$\begin{bmatrix} O_2^+ > & O_2 & > O_2^- > & O_2^{2-} \\ 2.5 & 2 & 1.5 & 1 \end{bmatrix}$$

18. (a) Bond order 2.0 2.5 3

$H_2 > H_2^+ > He_2^+$ (bond energy)

Bond order 1 0.5 0.5

(In He_2^+ more electron in antibonding MO's)

	NO_2^+ >		NO_2	> NO_2^- (bond angle)
Bond angle	180°	133°	115°	
	O_2^{2-} <	O_2^+ <	O_2	(paramagnetic moment)
No. of unpaired e^-	0	1	2	

19. (b) Benzene (C_6H_6) being non-polar has only london dispersion forces on account of unsymmetrical distribution of electron at any instant of time producing dipoles.

20. (d) Steric number = 4 ; thus sp^3 hybridisation in P_4 . As each phosphorus is sp^3, so

% p character will be = $\frac{3}{4} \times 100 = 75$.

21. (b) According to Fajan's rule bigger the anion more will be the polarisability of anion. As a result, there will be more polarisation leading to increased covalent character i.e. lesser ionic character in the compound, AlI_3.

22. (b) Calcium carbide is ionic carbide having $[: C \equiv C :]^{2-}$ $Ca^{2+}\left[: C \overset{1\sigma}{\underset{2\pi}{\equiv}} C :\right]^{2-}$

23. (b) Li_2 $\sigma 1s^2$ $\sigma^* 1s^2$ $\sigma 2s^2$ Bond order = 1

Li_2^+ $\sigma 1s^2$ $\sigma^* 1s^2$ $\sigma 2s^1$ Bond order = 0.5

Li_2^- $\sigma 1s^2$ $\sigma^* 1s^2$ $\sigma 2s^2$ $\sigma^* 2s^1$ Bond order = 0.5

Stability order $Li_2 > Li_2^+ > Li_2^-$

24. (b) It is a simple & popular fact.

25. (c)

26. (d) : M.O. configuration of O_2 :

$(\sigma 1s^2)(\sigma^* 1s^2)(\sigma 2s^2)(\sigma^* 2s^2)(\sigma 2p_z^2)$

$(\pi 2p_x^2 = \pi 2p_y^2)(\pi^* 2p_x^1 = \pi^* 2p_y^1)$

27. (c) : $N_2^+(13) = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \pi 2p_x^2 = \pi 2P_y^2 \sigma 2P_z^1$

$O_2(16) = \sigma 15s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2$

$\pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^1 = \pi^* 2P_y^1$

$O_2^{2-}(18) = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2, \pi 2p_x^2$

$= \pi 2p_y^2, \pi^* 2p_x^2 = \pi^* 2P_y^2$

$B_2(10) = \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^1 = \pi 2p_y^1$

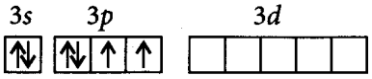
Thus, O_2^{2-} does not contain unpaired electrons.

28. (b) : By sharing of 1 electron each both the atoms of M will get a completed octet.

29. (c) : The structures represent canonical or resonating structures of carbonate ion.

30. (b) : S can go into excited state with 6 unpaired electrons due to presence of vacant 3d-orbitals which are overlapped by six F electrons.

Ground state



Excited state