Solution

CHEMICAL BONDING

Class 11 - Chemistry

1.

(c) Both overlapping of atomic orbitals and hybridisation of atomic orbitals

Explanation:

Both overlapping of atomic orbitals and hybridisation of atomic orbitals

2.

(d) O_2^{2-}, B_2

Explanation:

O_2^{2-}, B_2

3. **(a)** $He_2^+ < O_2^- < NO < C_2^{2-}$

Explanation:

$He_2^+ < O_2^- < NO < C_2^{2-}$

4.

(d) sodium to chlorine

Explanation:

sodium to chlorine

5.

(b) H_2^+, He_2

Explanation:

H_2^+, He_2

6.

(d) PCI_5

Explanation:

PCI_5

7. **(a)** Only I

Explanation:

Only I

8.

(b) hydrogen bond

Explanation:

hydrogen bond

9.

(d) K

Explanation:

K

10.

(c) Li_2O

Explanation:

Li_2O

11.

	Atomic orbitals	Molecular orbitals
(i)	Atomic orbital is monocentric, i.e., the electron cloud is associated to the nucleus of the single atoms.	Molecular orbital is polycentric, i.e., the electron cloud is associated with the molecule as a whole and is spread over the whole nuclear system of combining atoms.
(ii)	They are pure orbitals.	They are obtained by combination of atomic orbitals of the combining atoms.
(iii)	They possess higher energy and are less stable.	They possess lesser energy and are highly stable.

12. i. $C_2 \longrightarrow C_2^+ + e^-$

As the bond order changes from 2 to 1.5, the bond length increases. Also, with the loss of e^-, C_2^+ becomes paramagnetic in nature.

ii. $O_2 \longrightarrow O_2^+ + e^-$

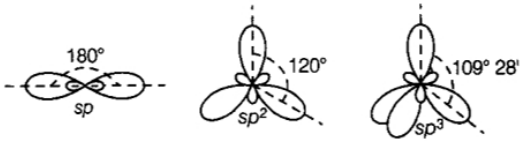
As the bond order changes from 2 to 2.5 , the bond length decreases. There is no change in magnetic character in this case.

13. Electronic configuration of carbon

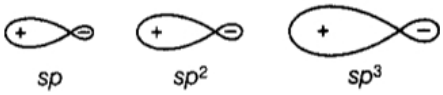
In ground state $_6C = 1s^2, 2s^2, 2p_x^1, 2p_y^1$

In excite state $1s^2, \underbrace{2s^1, 2p_x^1, 2p_y^1, 2p_z^1}_{sp^3\text{-hybridised}}$

In CH_4 molecule, carbon is sp^3 hybridised, so it is tetrahedral in shape. For square planar, dsp^2 hybridisation is required which is not possible in carbon due to the absence of d-orbitals. Furthermore according to VSEPR theory, the four bonded electron pairs around C - atom arranged themselves in a regular tetrahedral geometry. For tetahedral structure, the bond angle is 109^o, 28' while is square planar structure, the bond angle in 90^o. Therefore, in tetrahedral structure repulsions between bonded electron pairs is less than that of the square planar.

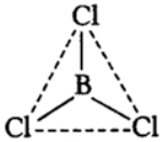
14. 

All the hybrid orbitals have same shape. However, their sizes are in the order : $sp < sp^2 < sp^3$.

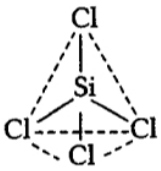


15. i. BeF_2; F-Be-F

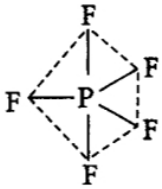
ii. BCl_3 :



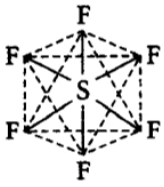
iii. $SiCl_4$:



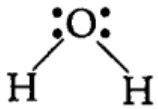
iv. PF_5 :



v. SF_6 :



vi. H_2O :



16. A. $\Delta_{\text{sub}}\ H^\circ = 108.5\ kJ\ mol^{-1}$

$\Delta_{\text{diss}}\ H^\circ = 243.0\ kJ\ mol^{-1}$

$IE = 495.8\ kJ\ mol^{-1}$

$\Delta_{eg}H^\circ = -348.8\ kJ\ mol^{-1}$

$U = -758.7\ kJ\ mol^{-1}$

According to Born cycle:

$\Delta H_f^\circ = +\Delta_{\text{sub}}\ H^\circ +$ IE $+\frac{1}{2}\Delta_{\text{diss}}\ H^\circ + \Delta_{eg}H^\circ + U$

Substituting:

$\Delta H_f^\circ = +108.5 + 495.8 + \frac{1}{2} \times 243.0\ + (-348.8) + (-758.7)$

$\Delta H_f^\circ = -381.7\ kJ\ mol^{-1}$

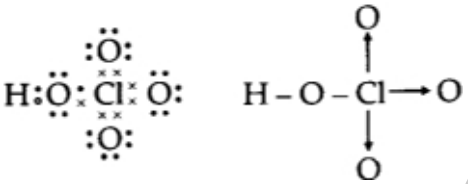
Hence, the heat of formation of NaCl is $-381.7\ kJ\ mol^{-1}$

B. a. ΔH solution $= \Delta H_{\text{hydration}}\ - \Delta H_{\text{lattice}}$

b. The salt will dissolve in water.

17. A. Chlorine forms four oxy acids: hypochlorous acid, chlorous acid, chloric acid and perchloric acid Hypochlorous acid (HClO)

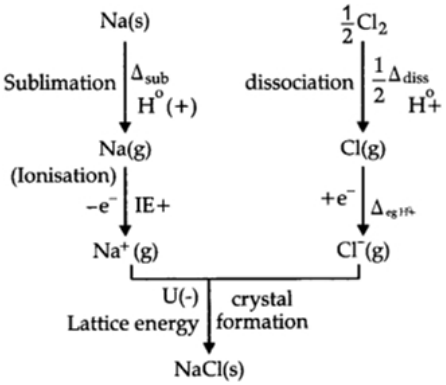
B. Perchloric acid ($HClO_4$)



C. Hypochlorous acid.

D. The coordinate bond is formed due to bonding between electrovalent and covalent bond.

18. A.



Reaction for amount of heat liberated:

$\Delta H_f^\circ = +\Delta_{\text{sub}}\ H^\circ + IE + \frac{1}{2}\Delta_{\text{diss}}\ H^\circ\ + \Delta_{\text{eg}}\ H^\circ + U$

B. Ionic solids will dissolve in water.

Water has high dielectric constant and it weakens the electrostatic force of attraction present between the ions. The ions thus get separated and get surrounded by water molecule.

But benzene has low dielectric constant and thus cannot weaken the electrostatic force of attraction.

19. A. Octet rule implies that elements of group 1, 2 and 13 have less than four electrons in their valence shell so they cannot form covalent bonding.

This proved to be wrong as BF_3 is a stable molecule where B has two electrons in valence shell.

B. Sidgwick

Sidgwick put forward concept of maximum covalency. The concept was based on position of an atom in periodic table, The maximum covalency can be less than four or more than four.

According to this concept, it is not necessary for an element to show its maximum covalency which is 4 in case of Boron (2^{nd} period).Thus justifies formation of BF_3.