

## sigma ( $\sigma$ ) and pi ( $\pi$ ) bonds

1) Describe the formation of a sigma ( $\sigma$ ) bond.

2) Describe the formation of a pi ( $\pi$ ) bond.

3) Complete the following table:

Type of overlap	Type of bond formed
s and s head on	
s and p head on	
p and p head on	
p and p sideways	

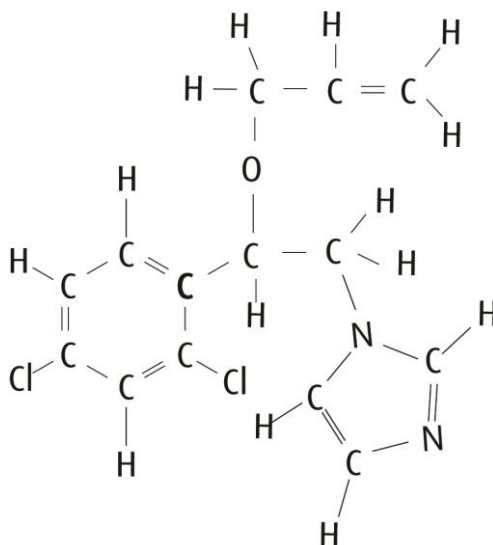
4) Determine the number of sigma ( $\sigma$ ) and pi ( $\pi$ ) bonds in the following molecules:

a)  $\text{Cl}_2$

b)  $\text{O}_2$

c)  $\text{N}_2$

5) Determine the number of sigma ( $\sigma$ ) and pi ( $\pi$ ) bond in a molecule of imazalil (pictured below).



**Answers:**

- 1) A sigma ( $\sigma$ ) bond is formed by head on overlap of atomic orbitals. The electron density is concentrated between the nuclei of the bonding atoms.
- 2) A pi ( $\pi$ ) bond is formed by sideways overlap of atomic orbitals. The electron density is concentrated above and below the plane of the nuclei of the bonding atoms.

3)

Type of overlap	Type of bond formed
s and s head on	sigma ( $\sigma$ )
s and p head on	sigma ( $\sigma$ )
p and p head on	sigma ( $\sigma$ )
p and p sideways	pi ( $\pi$ )

4)

- a) Cl<sub>2</sub> single bond between atoms– one sigma ( $\sigma$ ) bond
- b) O<sub>2</sub> double bond between atoms– one sigma ( $\sigma$ ), one pi ( $\pi$ ) bond
- c) N<sub>2</sub> triple bond between atoms – one sigma ( $\sigma$ ), two pi ( $\pi$ ) bonds

5) 34 sigma ( $\sigma$ ) bonds, 6 pi ( $\pi$ ) bonds