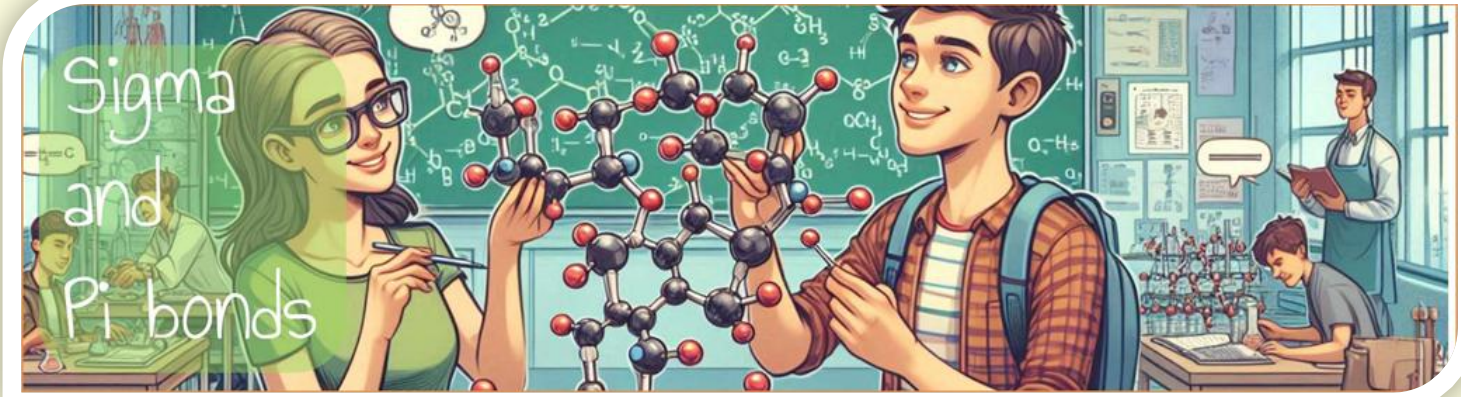



Answer all the questions below as fully as you can then check your answers

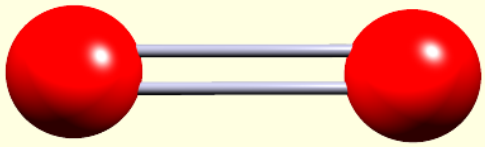
1. Explain in terms of how they are formed the difference between pi and sigma bonds.

2. Which type of bond, sigma or pi is the strongest? Give a reason for your answer.

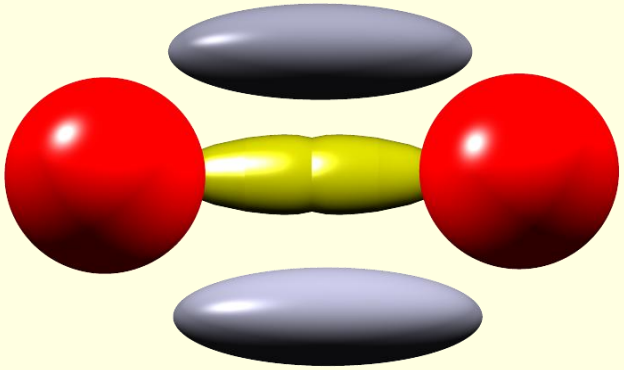
3. Draw a diagram to show how 2 p-orbitals can overlap to form a sigma bond and then draw a similar diagram to show how a pi bond is formed.

4. Oxygen has an atomic number of 8. What is its electronic configuration?

a. Oxygen is a diatomic gas with the form $O_2$, shown opposite. In terms of sigma and pi bonds describe the nature of the double covalent bond between the oxygen atoms.



b. The bonding in the oxygen molecule has been redrawn, as shown opposite.



i. Explain what the yellow and grey shapes are representing in the diagram.

ii. How many electrons are in the pi and sigma bonds?

iii. What is an orbital?

iv. Where in the pi bond are the 2 electrons it contains likely to be found?

v. Explain how the electrons are able to move from the top part of the pi bond to the bottom lobe of the pi bond???????

# Answers

Answer all the questions below as fully as you can then check your answers

1. Explain in terms of how they are formed the difference between pi and sigma bonds.

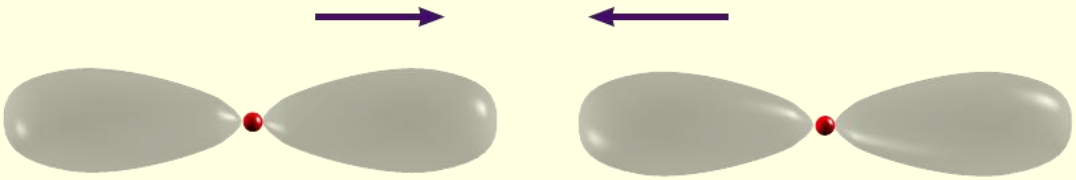
   A sigma bond involves the head-on overlap of atomic orbitals.

   A pi bond is formed by the sideways or partial overlap of atomic orbitals.

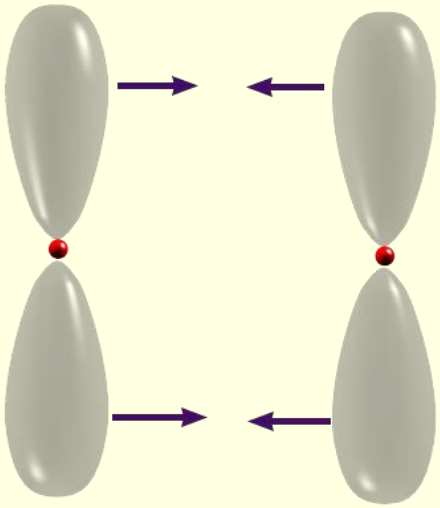
2. Which type of bond, sigma or pi is the strongest? Give a reason for your answer.

   Sigma bonds are stronger than pi bonds, due to the fact that there is more overlap of the atomic orbitals when the sigma bond forms.

3. Draw a diagram to show how 2 p-orbitals can overlap to form a sigma bond and then draw a similar diagram to show how a pi bond is formed.



sigma bond is formed by head-on overlap of orbitals, in this case

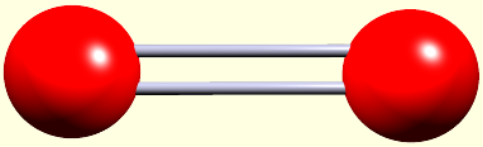


pi bond is formed by the sideways or partial overlap of orbitals.

4. Oxygen has an atomic number of 8. What is its electronic configuration?

$1s^2 2s^2 p^4$ Or $1s^2 2^s 2p_x^2 2p_y^1 2pz^1$

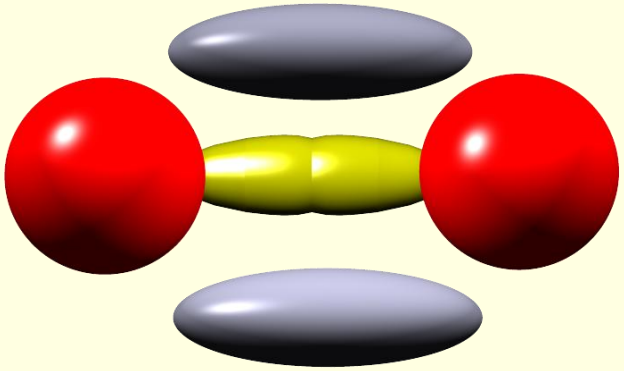
a. Oxygen is a diatomic gas with the form $O_2$, shown opposite. In terms of sigma and pi bonds describe the nature of the double covalent bond between the oxygen atoms.



There is one sigma and 1 pi bond

b. The bonding in the oxygen molecule has been redrawn, as shown below.

i. Explain what the yellow and grey shapes are representing in the diagram.



Yellow - represents the sigma bond

Grey- represents the two lobes of the pi bond

ii. How many electrons are in the pi and sigma bonds?

2 electrons in sigma bond and 2 electrons in the pi bond. It's a double bond and a covalent bond has 2 electrons, so since we have 2 covalent bonds we have a total of 4e electrons.

iii. What is an orbital?

A volume where there is a high probability of finding the electron.

iv. Where in the pi bond are the 2 electrons it contains likely to be found?

The 2 electrons will be in the lobes, above and below the sigma bond in the diagram above (in the grey lobes)

v. Explain how the electrons are able to move from the top part of the pi bond to the bottom lobe of the pi bond???????

Obviously this is a very silly question. The bonding theory we have used uses orbitals, orbitals are produced by quantum theory and in the quantum theory the electrons are described as waves and not as particles. So the question is moot!

Aside – if the electron moves as a wave and not a particles, wave equations have areas of zero amplitude, this could be used to explain areas of zero electron density.