

**Bonding – AS Chemistry P1**

1. No.3

0 3

This question is about structure and bonding.

0 3 . 1

Define electronegativity.

[1 mark]

It is the relative ability of an atom to attract electron density in a covalent bond.

0 3 . 2

Explain why the C–Cl bond is polar.

[2 marks]

Chlorine has a higher electronegativity than carbon. This means the shared electron pair is pulled closer to chlorine creating uneven distribution of electron density. Chlorine becomes  $\delta^-$  and carbon  $\delta^+$  making the bond polar.

0 3 . 3

Although the C–Cl bond is polar,  $\text{CCl}_4$  is a non-polar molecule.

Explain why.

[2 marks]

$\text{CCl}_4$  is a tetrahedral and symmetrical because the polar C–Cl bonds are arranged so that their dipole moments act in equal and opposite directions. As a result, the bond dipoles cancel out giving the molecule no overall dipole moment.

0 3 . 4 There are van der Waals forces between non-polar molecules.

Explain what causes these forces.

[3 marks]

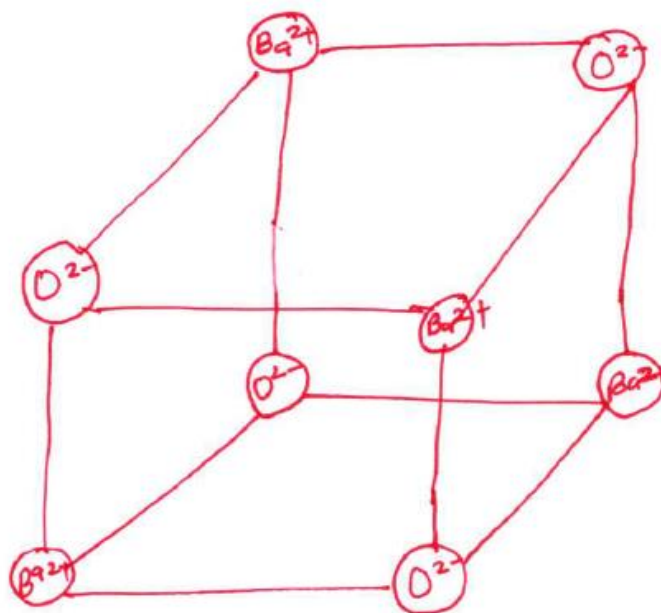
In non polar molecule, the electrons are in constant random motion so at any instant the electron distribution may be uneven. This uneven distribution creates a temporary dipole in one molecule. This temporary dipole induces an opposite dipole in a neighbouring molecule. Electrostatic attraction occurs between the  $\delta^+$  of one molecule and the  $\delta^-$  of another.

Barium reacts with oxygen to form barium oxide.

Barium oxide has a high melting point and an ionic lattice structure similar to that of sodium chloride.

0 3 . 5 Draw a 3D diagram to show how the particles are arranged in a barium oxide lattice. You should draw eight particles.

[2 marks]



2. No.5

0 5

$\text{SF}_6$  and  $\text{SF}_3^+$  have different shapes and different bond angles.

Deduce the shape of  $\text{SF}_6$  and the shape of  $\text{SF}_3^+$

State the bond angle in  $\text{SF}_6$  and the bond angle in  $\text{SF}_3^+$

Justify the bond angles by referring to electron pairs.

[6 marks]

$\text{SF}_6$

Shape - Octahedral.

Bond angle -  $90^\circ$ .

Sulfur in  $\text{SF}_6$  has six bonding pairs and no lone pairs. These six bond. pairs repel equally, arranging themselves to be as far apart as possible, in 3D space forming an octahedral shape.

$\text{SF}_3^+$

Shape is Trigonal pyramidal.

Bond angle is  $103-107^\circ$

$\text{SF}_3^+$  has three bonding pairs and one lone pair around sulfur.

The lone pair-bond pair repulsion is stronger than bond-pair-bond pair repulsion, so the bond angles are slightly less than the ideal  $109.5^\circ$  of a tetrahedral structure leading to a trigonal pyramidal shape.

3. No.11

Which involves the formation of a dative covalent bond?

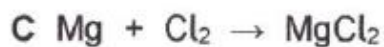
[1 mark]



Normal covalent bond.



Ionic bond.



Ionic bond.

dative covalent bond  
Donates lone pair of electron to electron deficient  $\text{BH}_3$