

Exercise walk-through

3.7

Dot-and-cross diagrams

A-Level Chemistry

Electronegativity

Electronegativity is the power of an atom to attract bonding electrons towards itself. The difference in **Pauling electronegativity** values predicts the bond type.

nuclear charge

more protons pull the pair more strongly

atomic radius

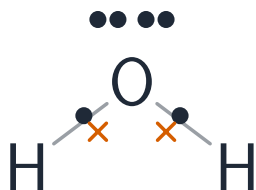
closer to the nucleus
⇒ stronger pull

shielding

inner shells
weaken the pull

It **rises** across a period and **falls** down a group. Fluorine is the most electronegative element. A large difference ⇒ ionic; a small difference ⇒ covalent.

Dot-and-cross diagrams



H₂O: 2 bonding pairs
+ 2 lone pairs

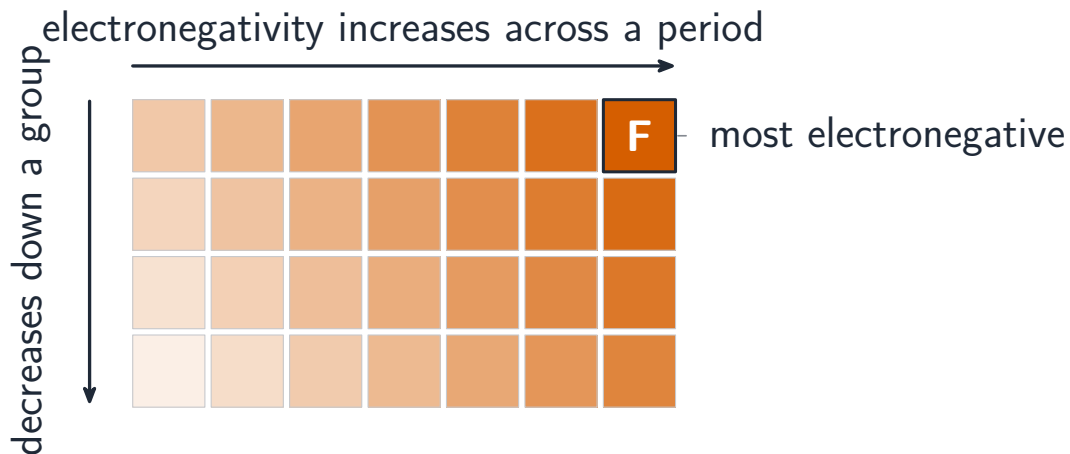


N₂: triple bond
(3 shared pairs)

- electron from one atom
- × electron from the other

Covalent dot-and-cross: each shared pair is one electron from each atom. Water has two bonding pairs and two lone pairs; nitrogen shares three pairs (a triple bond)

Electronegativity, continued



Electronegativity rises across a period and falls down a group, so fluorine is the most electronegative element

Exercises 2.1-2.2

2.1 State what dots and crosses represent in a dot-and-cross diagram. [1]

2.2 State how many lone pairs are on the oxygen atom in a water molecule. [1]

Exercises 2.1·2.2

2.1 State what dots and crosses represent in a dot-and-cross diagram. [1]

2.1

- the outer (valence) electrons of each of the two atoms

2.2 State how many lone pairs are on the oxygen atom in a water molecule. [1]

2.2

- 2 lone pairs

Exercises 3.1·3.2

3.1 In a dot-and-cross diagram of methane, CH_4 , how many shared (bonding) pairs are shown around the carbon? [1]

- ☐ A 1
☐ B 2
☐ C 4
☐ D 8

3.2 Draw a dot-and-cross diagram for a molecule of ammonia, NH_3 (show the bonding pairs and the lone pair on nitrogen). [2]

Exercises 3.1·3.2

3.1 In a dot-and-cross diagram of methane, CH_4 , how many shared (bonding) pairs are shown around the carbon? [1]

- ☐ A 1
☐ B 2
☐ C 4
☐ D 8

3.1 C

- Methane has four shared pairs (four C–H bonds)

3.2 Draw a dot-and-cross diagram for a molecule of ammonia, NH_3 (show the bonding pairs and the lone pair on nitrogen). [2]

3.2

- three N–H bonding pairs, each one dot + one cross; one lone pair shown on the nitrogen

Exercises 3.3-3.4

3.3 Draw a dot-and-cross diagram for carbon dioxide, CO_2 (show the two double bonds).[2]

3.4 Draw a dot-and-cross diagram for the ammonium ion, NH_4^+ , showing the coordinate bond. [2]

Exercises 3.3-3.4

3.3 Draw a dot-and-cross diagram for carbon dioxide, CO_2 (show the two double bonds).[2]

3.3

- carbon in the centre with two double bonds to the oxygens (two shared pairs each); two lone pairs shown on each oxygen

3.4 Draw a dot-and-cross diagram for the ammonium ion, NH_4^+ , showing the coordinate bond. [2]

3.4

- four N–H bonds around nitrogen; one shown as a coordinate bond (both electrons from N), with the whole ion in brackets and a + charge