Exercise walk-through

Electronegativity and bonding ▪ 3.1

eXercise

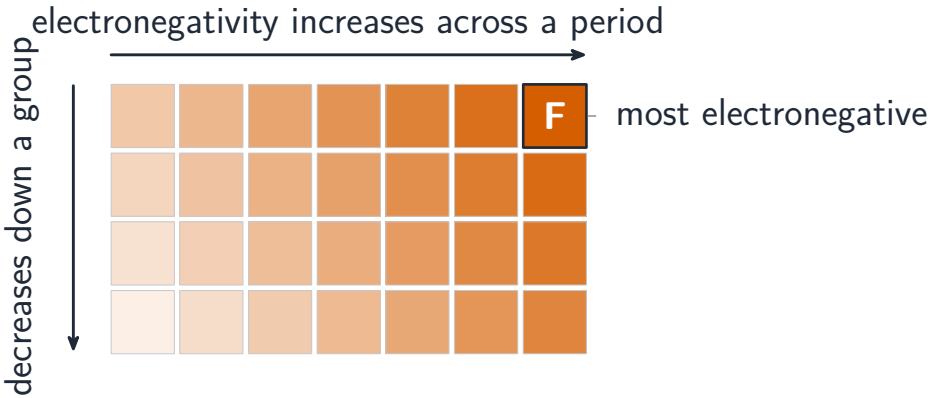
You must be able to

- define electronegativity and explain the factors that affect it
- state and explain the trends across a period and down a group
- use electronegativity differences to predict ionic or covalent bonding

Method — Electronegativity and its trends

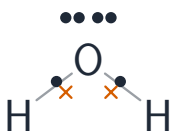
Electronegativity is the power of an atom to attract the **electrons** in a bond towards itself. It depends on **nuclear charge** (more $\rightarrow$ higher), **atomic radius** (smaller $\rightarrow$ higher) and **shielding** (more $\rightarrow$ lower).

Method — Electronegativity and its trends



A grid shaded pale at bottom-left to deep at top-right, with fluorine at the top-right

Method — Electronegativity and its trends



H_2O: 2 bonding pairs + 2 lone pairs

N_2: triple bond (3 shared pairs)

• electron from one atom
× electron from the other

Electronegativity sets where a bond sits on the ionic-covalent scale

Method — Predicting bond type

A **large** difference in Pauling values → **ionic**; a **small** difference → **covalent**.

Practice 2.1 ▪ 1 mark

Define **electronegativity**.

Solution 2.1

Worked steps

the power of an atom to attract the electrons in a bond towards itself B1.

Practice 2.2 ▪ 1 mark

State the most electronegative element.

Solution 2.2

Method: Electronegativity and its trends

Worked steps

fluorine B1.

Exam-style 3.1 ▪ 1 mark

Electronegativity increases across Period 3 because:

A the atomic radius increases

B the nuclear charge increases while shielding stays similar

C more shells are added

D the atoms gain electrons

Solution 3.1

Method: Electronegativity and its trends

A the atomic radius increases

B the nuclear charge increases while shielding stays similar ✓

C more shells are added

D the atoms gain electrons

Worked steps

B. Rising nuclear charge with similar shielding pulls bonding electrons more strongly.

Exam-style 3.2 ▪ 1 mark

Two elements have a **large** difference in electronegativity. The bond between them is likely to be:

A metallic

B ionic

C pure covalent

D a hydrogen bond

Solution 3.2

Method: Predicting bond type

A metallic

B ionic ✓

C pure covalent

D a hydrogen bond

Worked steps

B. A large electronegativity difference gives an ionic bond.

Exam-style 3.3 ▪ 3 marks

Explain why electronegativity decreases down Group 17.

Solution 3.3

Method: Electronegativity and its trends

Worked steps

down the group each element has more shells, so a larger atomic radius **M1** and more shielding **M1**; the nucleus attracts the bonding electrons less strongly, so electronegativity falls **A1**.

Exam-style 3.4 ▪ 2 marks

Using electronegativity, explain why the bond in HCl is polar.

Solution 3.4

Method: Electronegativity and its trends

Worked steps

chlorine is more electronegative than hydrogen **M1**, so it pulls the bonding electrons closer, giving Cl a $\delta-$ and H a $\delta+$ — a polar bond **A1**.