A-LEVEL CHEMISTRY • EXERCISE SHEET

3.1 Electronegativity and bonding

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS electronegativity 电负性 • electron 电子 • ion 离子 • shielding 屏蔽 • atomic radius 原子半径

Objective

Build the skills to answer exam questions on **electronegativity and bonding** — defining **electronegativity** 电负性, its trends, and using **Pauling** 鲍林 values to predict bond type.

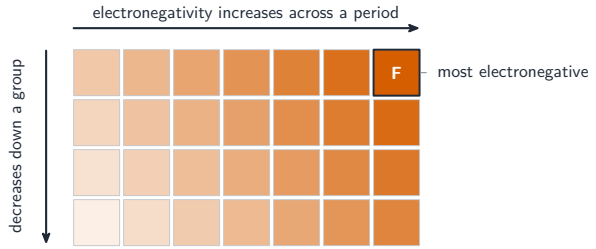
You must be able to:

- 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

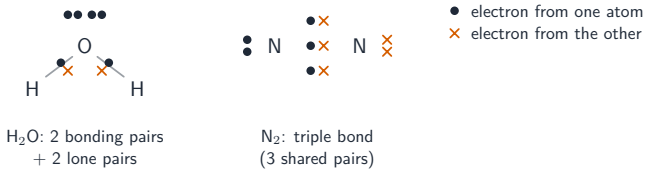
1 Worked examples

■ 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 → higher), **atomic radius** (smaller → higher) and **shielding** (more → lower).



Electronegativity rises across a period and falls down a group — fluorine is the most electronegative



H_2O: 2 bonding pairs + 2 lone pairs

N_2: triple bond (3 shared pairs)

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

■ Predicting bond type

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

2 Practice

2.1 Define **electronegativity**. [1]

2.2 State the most electronegative element. [1]

3 Exam-style questions

3.1 Electronegativity increases across Period 3 because: [1]

- **A** the atomic radius increases
- **B** the nuclear charge increases while shielding stays similar
- **C** more shells are added
- **D** the atoms gain electrons

3.2 Two elements have a **large** difference in electronegativity. The bond between them is likely to be: [1]

- **A** metallic
- **B** ionic
- **C** pure covalent
- **D** a hydrogen bond

3.3 Explain why electronegativity decreases down Group 17. [3]

3.4 Using electronegativity, explain why the bond in HCl is polar. [2]

Solutions

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

2.2 fluorine.

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

3.2 B. A large electronegativity difference gives an ionic bond.

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

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