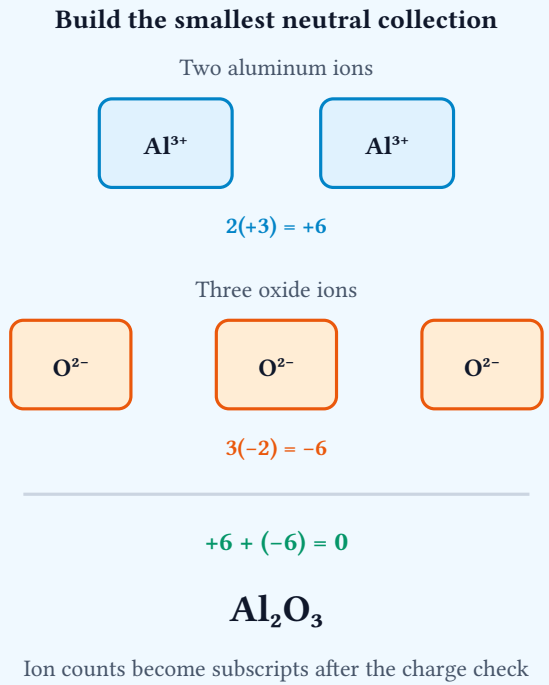
Science 10

Unit A: Energy and matter in chemical change

Periodic table patterns and combining ratios

The fixed formula of sodium chloride

- Sodium chloride is NaCl. $NaCl_2$ and Na_2Cl_5 are wrong.
- That repeating formula has to come from how the atoms are built.



Three decisions in this chapter

- Use main-group periodic position to predict common outer-electron behaviour and ion charge.
- Build the smallest whole-number ion ratio that makes total charge zero.
- Distinguish an ionic formula-unit ratio from the atom counts in a molecular formula.

Key terms

group

A vertical column of the periodic table whose elements often have similar chemical properties.

period

A horizontal row of the periodic table.

valence

The combining capacity associated with an atom’s outer electrons in the Grade 10 model.

ion

An atom or group of atoms with a net electric charge after gaining or losing electrons.

Key terms

ionic bond

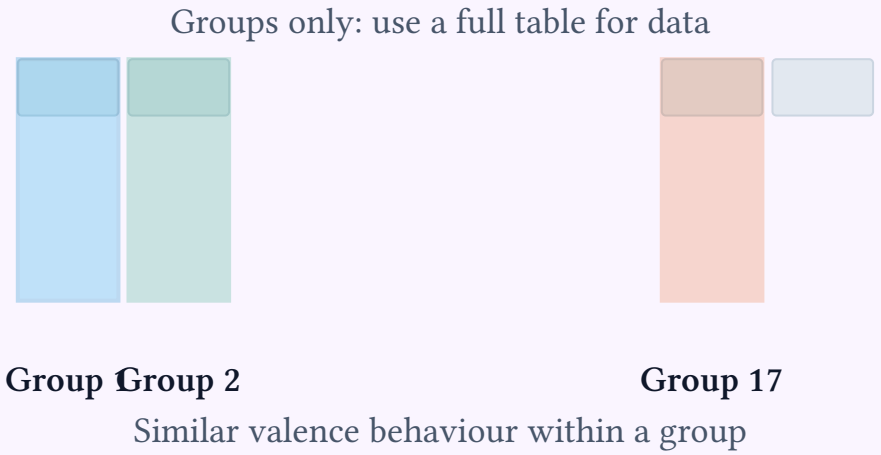
Attraction between oppositely charged ions after electron transfer.

covalent bond

Electrons shared between atoms in a molecule.

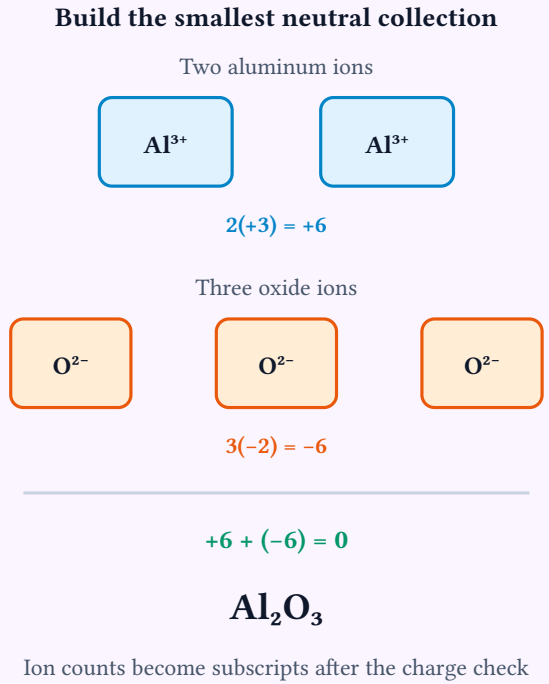
Periodic position and outer electrons

- A period shows the occupied energy levels in the Grade 10 model; a main-group column shows a recurring outer-electron pattern.
- Group 1 and 2 metals commonly form 1+ and 2+ ions by losing outer electrons; Group 17 and 16 non-metals commonly form 1− and 2− ions by gaining electrons.
- Two non-metals often share electrons, forming a covalent bond.



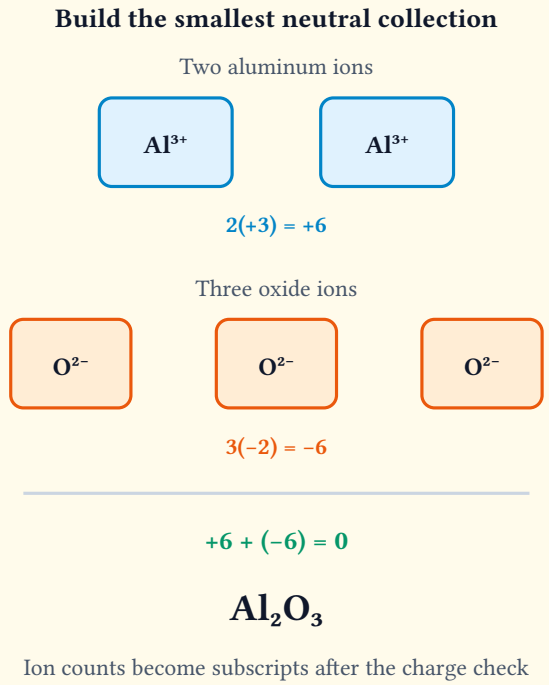
Smallest neutral ion ratio

- Write each ion with its charge, then combine ions until total positive charge equals total negative charge.
- Use the smallest whole-number ratio: two Al^{3+} ions give +6 and three O^{2-} ions give −6, so the formula is Al_2O_3.
- Check neutrality and reduce the ratio before removing charge symbols; keep each ion's internal subscripts exactly as they are.



From periodic position to formula

- Aluminum is in Group 13 and commonly forms Al^{3+}; oxygen is in Group 16 and commonly forms O^{2-} in this course model.
- The smallest neutral collection is two Al^{3+} ions and three O^{2-} ions.
- Write Al_2O_3, then verify $2(+3) + 3(-2) = 0$.



Formula practice

- Write formulas for magnesium oxide, sodium sulfide, and aluminum fluoride.
- For each compound, show ion charges, the smallest neutral ratio, and a total-charge check.
- Attempt all three before opening the solution; correct the first reasoning step that differs.

Communicating formulas

- A formula states which atoms are present and in what ratio.
- $CaCl_2$ and CaCl are separate formulas. The subscript changes the substance in this model.
- Laboratories and emergency crews rely on that ratio.
- A wrong ratio can waste a reaction or create a hazard.



Periodic pattern and formula retrieval check

- Predict the common ion charges for magnesium and chlorine from their periodic-table groups.
- Use charge balance to write magnesium chloride.
- Explain why MgCl and $MgCl_3$ both fail as neutral ionic compounds.

Image credits

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