Module 2: Metals

Teaching matters

1. Energy considerations in extracting metals

It is sometimes argued that because energy must be supplied to break a metallic compound into its constituent elements, energy is required to extract a metal from its ore. This is not a valid argument, because often the chemical reaction used to extract the metal from its ore is not a simple decomposition reaction (for example Cu from $Cu_2S + O_2 \rightarrow 2Cu + SO_2$ or Fe from $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$) and so it may require the input of energy or may release energy. However it is true that energy is required to extract metals from their ores because of the reasons set out at the bottom of page 113. For some metals, for example aluminium and magnesium, a large input of energy is required to make the extraction reaction occur (electrolysis in both of these examples) and this adds significantly to the energy costs of such metals (see Table 4.7 on page 114).

2. Correct use of terms

Several terms are used for roughly similar concepts:

relative atomic mass
atomic weight
atomic mass
molar mass

(and analogous terms with *molecular* replacing *atomic*)

Relative atomic mass is the 'correct' term for what has historically for over 150 years been called ***atomic weight*** – a relative mass, a dimensionless quantity. The atomic weight of sodium is 23 (not 23 u or μ or grams)

Atomic mass is the mass of an atom: it is a mass: 3.8×10^{-23} g for sodium or 23 u or 23 amu where u or amu is 1.66×10^{-24} g.

Molar mass is the mass of one mole, 23 g/mol for sodium. It is the term that is really needed in stoichiometric calculations.

For compounds similar terms exist; for example for carbon dioxide,
the relative molecular mass or molecular weight is 44
the molar mass is 44 g/mol
the molecular mass is 44 u or 44 amu (or 7.3×10^{-23} g)

6.02×10^{23} particles per mole (or just mol^{-1}) is the **Avogadro *constant*** - it's not a *number,* because it has units.

While there is probably no need to be pedantic about this with students, perhaps as teachers we should be precise in the words and terms we use.

3. Limiting reagent and mass-volume calculations?

These are not required here. Mass-volume calculations are in Module 2 of the HSC course. However it's a bit hard to know just what is required for 'process information from secondary sources to investigate the relationship between the volumes of gases involved in reactions involving a metal and relate this to an understanding of a mole' (2002 syllabus document page 31). I have taken this to mean the type of volume–volume calculation done on pages 151–2 and in the exercises that follow. Two such reactions involving metals are used there (Example 12 and Exercise 44(b)); others are Fe_2O_3 + CO forming CO_2 and CuO + H_2 forming steam.