

Moles of gold: Johnstone's triangle

Learning objectives

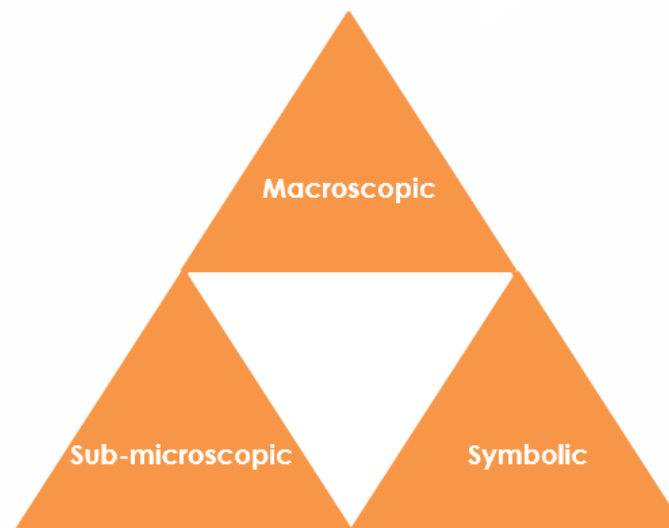
- 1 Recognise element symbols based on Latin names.
- 2 Calculate the number of moles of gold from the mass and relative atomic mass.
- 3 Calculate the number of atoms of gold in a ring.

Introduction

Avogadro's number (6.02×10^{23}) gives the number of atoms of gold in one mole of the element. The relative atomic mass of gold can be used to calculate the number of moles of gold in a given mass of this precious metal.

Johnstone's triangle

In chemistry we make sense of the things that we can see by representing what we can't see using formulas, equations, diagrams and models.



Johnstone's triangle is a way of thinking about these different concepts as different corners of a triangle:

- Macroscopic – what we can see. Think about the properties we can observe, measure and record.
- Sub-microscopic – smaller than we can see. Think about the particle or atomic level.
- Symbolic – representations. Think about how we represent chemical ideas, including symbols and diagrams.

Being able to connect and move between these three different levels is important for scientific understanding.

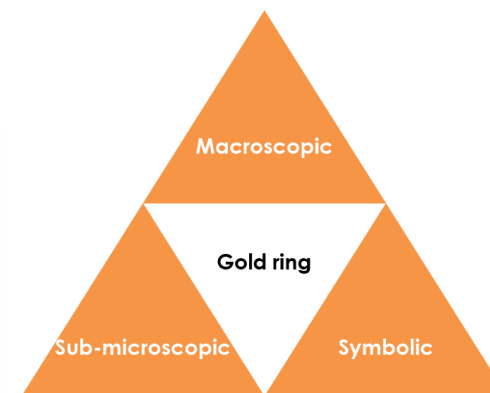
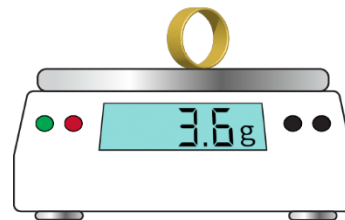
Macroscopic – what we can see

Name the equipment you would use to find the mass of a gold ring.

The ring in the picture is made of a mixture of 75% gold with silver and copper.

Calculate the mass of gold in the ring.

mass of gold = mass of ring \times 0.75 = _____ g

**Sub-microscopic – smaller than we can see**

One mole of gold is made of 6.02×10^{23} atoms.

Calculate the number of moles of gold in the ring.

$$\text{No. of moles} = \frac{\text{mass of gold (macroscopic box)}}{\text{relative atomic mass of gold (symbolic box)}}$$

=

= _____ moles

Calculate the number of gold atoms that form the ring.

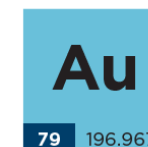
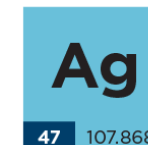
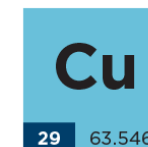
Suggest whether the number of atoms of silver in a silver ring of the same mass would be greater or less than this number of gold atom. Give reasons for your answer.

Symbolic – representations

The periodic table shows the symbol and relative atomic mass of different elements.

Use a periodic table to complete the table.

Symbol	Element name	Relative atomic mass
Cu		
Ag		
Au		



Determine whether an atom of silver has more or less mass than an atom of gold.
