

15 The mole – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	Write it 3 times (English)
moles	_____
amount of substance	_____
Avogadro constant	_____
atoms	_____
molecules	_____

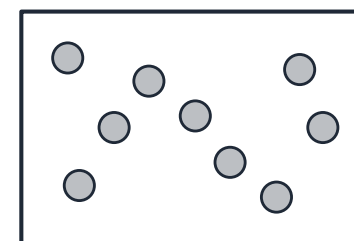
Recall

Counting atoms one by one is impossible – there are far too many. So we count them in **moles**, the same way we count eggs in dozens, but with a much bigger number.

New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

■ 1 The mole



1 mole

$$= 6.02 \times 10^{23} \text{ particles } (N_A)$$

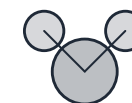
The **mole** is the SI unit of **amount of substance**. One mole has 6.02×10^{23} particles – the **Avogadro constant** N_A . The number of particles is $N = n N_A$, where n is the number of moles.

Worked example. How many molecules are in 0.50 mol of water? $N = n N_A = 0.50 \times 6.02 \times 10^{23} = 3.0 \times 10^{23}$.

■ 2 What is a particle?



He atom

O₂ moleculeH₂O molecule

always say what you are counting

A “particle” is whatever you are counting – **atoms** for helium, **molecules** for O₂ or H₂O. Always say what you count.

Worked example. One mole of oxygen gas has 6.02×10^{23} molecules, but each O₂ molecule holds 2 atoms, so there are 1.2×10^{24} oxygen atoms in it.

Watch out: a mole of O₂ *molecules* contains two moles of O *atoms*. Always state whether you are counting atoms or molecules.

Practice

Try these in order.

15.1 What does one *mole* contain? [1]

15.2 What is the value of the *Avogadro constant*? [1]

15.3 For oxygen gas O₂, are you counting atoms or molecules? [1]

15.4 How many particles are in 3.0 moles? [1]

15.5 A sample contains 3.01×10^{23} molecules. How many moles is this ($n = N/N_A$)? [2]

15.6 One mole of carbon dioxide CO₂ is a mole of molecules. How many atoms does it contain in total? Explain. [2]

15.7 Challenge. Which contains more atoms – one mole of helium gas (He) or one mole of oxygen gas (O₂)? Explain. [2]
