

Chapter 6: Chemical composition

Chemical composition questions involve amounts of substances...

How many grams Na are in 10 g NaCl? (It's not 5 g Na!)

The mole: convenient way of counting very large numbers of atoms or molecules

1 pair = 2 objects

1 dozen = 12 objects

1 mole = 6.022×10^{23} objects

How many dozen candy bars are 173 candy bars?

How many moles of Al are in 1.24×10^{15} Al atoms?

How many H₂O molecules are in 4.8 mol H₂O?

Mass and moles

Counting by mass is a way to count a large number of objects by measuring their mass.

If there are 80 nails per pound, how many nails are in 4.5 lb nails?

Relationship of mass and moles:

By definition, 1 mol of carbon-12 atoms has a mass of exactly 12 g

1 carbon-12 atom has a mass of 12 amu
1 mol carbon-12 atoms has a mass of 12 g

12
Mg
24.31

Atomic number =

Atomic mass =

Molar mass =

What is the mass of 17.0 mol Al?

How many moles Si are in 248.36 g Si?

Mole calculations

number
of particles \longleftrightarrow moles \longleftrightarrow mass (g)

How many S atoms are in 8.32 g S?

What is the average mass (in g) of 1 iron atom?

Molar mass of compounds

What is the mass in g of 12.0 mol H₂O?

You must first calculate the molar mass of H₂O:

$$2 \text{ H} = 2 (1.008 \text{ g/mol})$$

$$1 \text{ O} = 1 (\underline{16.00 \text{ g/mol}})$$

How many mol O₂ are in 82.3 g oxygen?

Converting to elements in a formula

4.28 mol Na₂SO₄ = ? mol Na
= ? mol S
= ? mol O

First, make a conversion factor from the chemical formula itself (called a mole ratio):

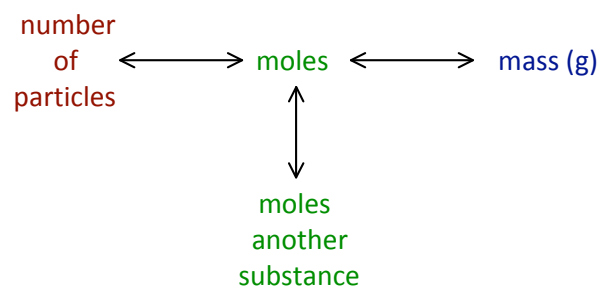
(when making a mole ratio from a formula, always consider 1 mole of the complete formula, and use the subscripts to find moles of each element)

1 mol Na₂SO₄ contains... ___ mol Na
___ mol S
___ mol O

On your own:

4.28 mol Na₂SO₄ contains: ? mol S
? mol O
? Na atoms
? g Na

Calculations with mole ratio



10.0 g NaCl contains how many grams Na?

g NaCl →

4.9 g K₂CO₃ contains how many grams K?

g K₂CO₃ →

More calculations

How many oxygen atoms are in 2.85 g Fe₂O₃?

How many grams of Cu₂O can be formed from 12.0 g of copper?

Mass percent composition

Mass percent composition: what percent of a compound's total mass comes from each element?

What is the mass % P in $\text{Ca}_3(\text{PO}_4)_2$?

Write out the compound's molar mass calculation:

What is the mass of 1 mol $\text{Ca}_3(\text{PO}_4)_2$?

What's the mass of P in 1 mol of $\text{Ca}_3(\text{PO}_4)_2$?

$$\text{Mass \%} = \frac{\text{element mass}}{\text{total compound mass}} \times 100\%$$

What's the mass % Na in NaCl, NaBr, and Na_2S ?