

## Unit Conversions

\*You can multiply anything by 1 without changing the physical meaning\*

### How Do We Multiply By 1

If the same thing is on the top and the bottom of a fraction,

$$\frac{\square}{\square} = 1$$

Then they cancel out... and become 1.

#### All Equalities = 1

Any time you put two things that are equal to each other

$$1000\text{g} = 1\text{kg}$$

On top and on bottom

$$\frac{1000\text{ g}}{1000\text{ g}} = 1$$

Then they cancel out... and become 1.

It doesn't matter which is on top and which is on bottom.

$$\frac{1000\text{ g}}{1000\text{ g}} = 1 \quad \text{or} \quad \frac{1\text{ kg}}{1\text{ kg}} = 1$$

Both cancel out... and become 1.

**The Rules : Picket Fence Method**

- Write down “given” + unit
- Draw a horizontal & vertical line “picket fence”
- Write “wanted” / “given” on the fence
- Enter proper #s for “wanted units & “given” units
- Cancel units & do the math

**For example: Convert 25 km to meters (m)**

Use the conversion factor equals one and that allows units to cancel.

$$\frac{1,000 \text{ m}}{1 \text{ km}} \text{ or } \frac{1 \text{ km}}{1,000 \text{ m}}$$

(given) 25 km | 1000 m | = 25,000 m (wanted)

| 1 km |

or: 25 km X  $\frac{1,000 \text{ m}}{1 \text{ km}}$  = 25,000 m

**Examples:**

**How old are you in days?**

Multiply by conversion factors that equal one and allow units to cancel

(given ) 15 years	365 days	= 5,475 days (units wanted)
	year	

**How much does a 120 lb person weigh in kilograms. There are 0.454 kg in one pound**

Multiply by conversion factors that equal one and allow units to cancel

(given ) 120 lbs	0.454 kg	= 54.58 kgs (units wanted)
	lb	

**How many inches are in 5 yards?** (a yard is 3 feet and there are 12 inches in a foot)

Multiply by conversion factors that equal one and allow units to cancel

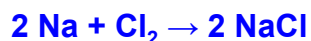
(given ) 5 yards	3 feet	12 inches	= 180 inches (units wanted)
	yard	foot	

### How many seconds are in 7 days?

Multiply by conversion factors that equal one and allow units to cancel

(given ) 7 days	24 hours	60 minutes	60 seconds	= 604,800 seconds (units wanted)
	day	hour	minute	

**A chemist performs the synthesis of sodium chloride from its elements. The chemist begins with 46 grams of sodium. How many moles of chlorine (Cl<sub>2</sub>) are needed?**



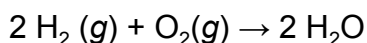
*This balanced equation tells us that one mol of Cl<sub>2</sub> is needed to react with every 2 moles of sodium (Na).*

Multiply by conversion factors that equal one and allow units to cancel

(given ) 46 grams Na	1 mol Na	1 mol Cl <sub>2</sub>	= 1 mol Cl <sub>2</sub> (units wanted)
	23 grams Na	2 mol Na	

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**How many grams of water can be prepared from 5 moles of hydrogen at standard conditions?**



*This balanced equation tells us that two moles of H<sub>2</sub>O can be prepared from 2 moles of hydrogen (H<sub>2</sub>) and 1 mole of oxygen (O<sub>2</sub>).*

Multiply by conversion factors that equal one and allow units to cancel

(given ) 5 mol H <sub>2</sub>	2 mol H <sub>2</sub> ⇌	18.02 g H <sub>2</sub> O	= 90.1 g H <sub>2</sub> O (units wanted)
	2 mol H <sub>2</sub>	1 mol H <sub>2</sub> ⇌	