

# Calculating Percentage Mass of an Element in a Compound

Gold



To calculate the percentage mass of an element in a compound you will need to follow the general formula.

$$\% \text{ mass of an element in a compound} = \frac{\text{relative atomic mass of the element (A}_r\text{)} \times \text{number of atoms of the element in the formula.}}{\text{relative formula mass (M}_r\text{)}} \times 100$$

Have a go at calculating the percentage mass of an element in different chemical compounds.

		Calculate the M <sub>r</sub> of the compound.	Use this space to show your working out.	Write your answer in the box below.
1	Calculate the percentage mass of strontium in strontium hydroxide.	Sr(OH) <sub>2</sub>		
2	Calculate the percentage mass of oxygen in strontium carbonate.	SrCO <sub>3</sub>		
3	Calculate the percentage mass of calcium in calcium carbonate.			



4	Calculate the percentage mass of manganese in sodium manganate.	$\text{Na}_2\text{MnO}_4$		
5	Calculate the percentage mass of nitrogen in copper azide.	$\text{Cu}(\text{N}_3)_2$		
6	Calculate the percentage mass of sodium in sodium bicarbonate.	$\text{NaHCO}_3$		
7	Calculate the percentage mass of iron in sodium ferrocyanide.	$\text{Na}_4\text{Fe}(\text{CN})_6$		
8	Calculate the percentage mass of silver in silver sulfate.	$\text{Ag}_2\text{SO}_4$		
9	Calculate the percentage mass of oxygen in scandium nitrate.	$\text{Sc}(\text{NO}_3)_3$		



10	Calculate the percentage of potassium in potassium sulfide.			
11	Calculate the percentage mass of nitrogen in iron nitrate.	$\text{Fe}(\text{NO}_3)_3(\text{H}_2\text{O})_9$		
12	Calculate the percentage mass of carbon in iron thiocyanate.	$\text{Fe}(\text{SCN})_3$		
13	Calculate the percentage mass of phosphorus in lead phosphate.	$\text{Pb}_3(\text{PO}_4)_2$		
14	Calculate the percentage mass of manganese in manganese sulfate monohydrate.	$\text{MnSO}_4\text{H}_2\text{O}$		
15	Calculate the percentage mass of sulfur in sulfuric acid.			



Answer the following challenge questions:

1. A scientist analysed a compound and found it had a mass of 289.9g/mol. The compound contained 49.67% of carbon, 48.92% of chlorine and 1.39% of hydrogen.

Calculate the molecular formula of the compound. Tip: round your answers to the nearest whole number.

A scientist found that a sample of fuel with a molecular mass of 32.05g/mol was found to contain 87.4% of nitrogen and 12.6% of hydrogen.

2. Calculate the molecular formula of the fuel. Tip: round your answers to the nearest whole number.



Vanillin is a compound that is present in vanilla extract. The molecular mass of the compound is 152.08g/mol. Vanillin contains 5.26% of hydrogen, 63.18% of carbon and 31.56% of oxygen.

3. Calculate the molecular formula of vanillin. Tip: round your answers to the nearest whole number.



# Calculating Percentage Mass of an Element in a Compound Answers

		Calculate the $M_r$ of the compound.	Use this space to show your working out.	Write your answer in the box below.
1	Calculate the percentage mass of strontium in strontium hydroxide.	$\text{Sr}(\text{OH})_2$ $(16 + 1) \times 2 = 34$ $88 + 34 = 122$	$88 \times 1 = 88$ $88 \div 122 = 0.721$ $0.721 \times 100$ $72.1$	72.1%
2	Calculate the percentage mass of oxygen in strontium carbonate.	$\text{SrCO}_3$ $88 + 12 + (16 \times 3) = 148$	$16 \times 3 = 48$ $48 \div 148 = 0.324$ $0.324 \times 100$ $32.4\%$	32.4%
3	Calculate the percentage mass of calcium in calcium carbonate.	$\text{CaCO}_3$ $40 + 12 + (16 \times 3) = 100$	$40 \times 1 = 40$ $40 \div 100 = 0.4$ $0.4 \times 100$ $40$	40%
4	Calculate the percentage mass of manganese in sodium manganate.	$\text{Na}_2\text{MnO}_4$ $(23 \times 2) + 55 + (16 \times 4) = 165$	$55 \times 1 = 55$ $55 \div 165 = 0.333$ $0.333 \times 100$ $33.3\%$	33.3%
5	Calculate the percentage mass of nitrogen in copper azide.	$\text{Cu}(\text{N}_3)_2$ $14 \times 3 = 42$ $42 \times 2 = 84$ $63.5 + 84 = 147.5$	$14 \times 6 = 84$ $84 \div 147.5 = 0.569$ $0.569 \times 100$ $56.9$	56.9%
6	Calculate the percentage mass of sodium in sodium bicarbonate.	$\text{NaHCO}_3$ $23 + 1 + 12 + (16 \times 3) = 84$	$23 \times 1 = 23$ $23 \div 84 = 0.274$ $0.274 \times 100$ $27.4$	27.4%
7	Calculate the percentage mass of iron in sodium ferrocyanide.	$\text{Na}_4\text{Fe}(\text{CN})_6$ $12 + 14 = 26$ $26 \times 6 = 156$ $(23 \times 4) + 56 + 156 = 304$	$56 \times 1 = 56$ $56 \div 304 = 0.184$ $0.184 \times 100$ $18.4\%$	18.4%



8	Calculate the percentage mass of silver in silver sulfate.	$\text{Ag}_2\text{SO}_4$ $(108 \times 2) + 32 + (16 \times 4) = 312$	$108 \times 2 = 216$ $216 \div 312 = 0.692$ $0.692 \times 100$ $69.2$	69.2%
9	Calculate the percentage mass of oxygen in scandium nitrate.	$\text{Sc}(\text{NO}_3)_3$ $(16 \times 3) + 14 = 62$ $62 \times 3 = 186$ $45 + 186 = 231$	$16 \times 9 = 144$ $144 \div 231 = 0.623$ $0.623 \times 100$ $62.3$	62.3%
10	Calculate the percentage of potassium in potassium sulfide.	$\text{K}_2\text{S}$ $(39 \times 2) + 32 = 110$	$39 \times 2 = 78$ $78 \div 110 = 0.709$ $0.709 \times 100$ $70.9$	70.9%
11	Calculate the percentage mass of nitrogen in iron nitrate.	$\text{Fe}(\text{NO}_3)_3 (\text{H}_2\text{O})_9$ $(16 \times 3) + 14 = 62$ $62 \times 3 = 186$ $(1 \times 2) + 16 = 18$ $18 \times 9 = 162$ $56 + 186 + 162 = 404$	$14 \times 3 = 42$ $42 \div 404 = 0.104$ $0.104 \times 100$ $10.4$	10.4%
12	Calculate the percentage mass of carbon in iron thiocyanate.	$\text{Fe}(\text{SCN})_3$ $32 + 12 + 14 = 58$ $58 \times 3 = 174$ $56 + 174 = 230$	$12 \times 3 = 36$ $36 \div 230 = 0.157$ $0.157 \times 100$	15.7%
13	Calculate the percentage mass of phosphorus in lead phosphate.	$\text{Pb}_3(\text{PO}_4)_2$ $16 \times 4 = 64$ $31 + 64 = 95$ $95 \times 2 = 190$ $(207 \times 3) + 190 = 811$	$31 \times 2 = 62$ $62 \div 811 = 0.076$ $0.076 \times 100$ $7.6$	7.6%
14	Calculate the percentage mass of manganese in manganese sulfate monohydrate.	$\text{MnSO}_4 \cdot \text{H}_2\text{O}$ $55 + 32 + (16 \times 4) + (1 \times 2) + 16 = 169$	$55 \times 1 = 55$ $55 \div 169 = 0.325$ $0.325 \times 100$ $32.54$	32.5%
15	Calculate the percentage mass of sulfur in sulfuric acid.	$\text{H}_2\text{SO}_4$ $(1 \times 2) + 32 + (16 \times 4) = 98$	$32 \times 1 = 32$ $32 \div 98 = 0.327$ $0.327 \times 100$ $32.7$	32.7%



Answer the following challenge questions:

1. A scientist analysed a compound and found it had a mass of 289.9g/mol. The compound contained 49.67% of carbon, 48.92% of chlorine and 1.39% of hydrogen.

Calculate the molecular formula of the compound. Tip: round your answers to the nearest whole number.

**Carbon ( $A_r = 12$ )**

$$49.67 \div 100 = 0.4967$$

$$0.4967 \times 289.9 = 143.9$$

$$143.9 \div 12 = 11.99$$

**Round the answer to the nearest whole number = 12**

**Chlorine ( $A_r = 35.5$ )**

$$48.92 \div 100 = 0.4892$$

$$0.4892 \times 289.9 = 141.8$$

$$141.8 \div 35.5 = 3.99$$

**Round the answer to the nearest whole number = 4**

**Hydrogen ( $A_r = 1$ )**

$$1.39 \div 100 = 0.0139$$

$$0.0139 \times 289.9 = 4.03$$

$$4.03 \div 1 = 4.03$$

**Round the answer to the nearest whole number = 4**

**The molecular formula for the unknown compound is  $C_{12}H_4Cl_4$ .**

A scientist found that a sample of fuel with a molecular mass of 32.05g/mol was found to contain 87.4% of nitrogen and 12.6% of hydrogen.

2. Calculate the molecular formula of the fuel. Tip: round your answers to the nearest whole number.

**Nitrogen ( $A_r = 14$ )**

$$87.4 \div 100 = 0.874$$

$$0.874 \times 32.05 = 28.01$$

$$28.01 \div 14 = 2.00$$

**Hydrogen ( $A_r = 1$ )**

$$12.6 \div 100 = 0.126$$

$$0.126 \times 32.05 = 4.04$$

$$4.04 \div 1 = 4.04$$

**Round the answer to the nearest whole number = 4**

**The molecular formula for the fuel is  $N_2H_4$ .**





Vanillin is a compound that is present in vanilla extract. The molecular mass of the compound is 152.08g/mol. Vanillin contains 5.26% of hydrogen, 63.18% of carbon and 31.56% of oxygen.

3. Calculate the molecular formula of vanillin. Tip: round your answers to the nearest whole number.

**Carbon ( $A_r = 12$ )**

$$63.18 \div 100 = 0.6318$$

$$0.6318 \times 152.08 = 96.08$$

$$96.08 \div 12 = 8.01$$

Round the answer to the nearest whole number = 8

**Hydrogen ( $A_r = 1$ )**

$$5.26 \div 100 = 0.0526$$

$$0.0526 \times 152.08 = 7.99$$

$$7.99 \div 1 = 7.99$$

Round the answer to the nearest whole number = 8

**Oxygen ( $A_r = 16$ )**

$$31.56 \div 100 = 0.3156$$

$$0.3156 \times 152.08 = 47.99$$

$$47.99 \div 16 = 2.99$$

Round the answer to the nearest whole number = 3

The molecular formula of vanillin is  $C_8H_8O_3$ .

