

Calculating Percentage Mass of an Element in a Compound

Silver



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

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

For example: calculate the percentage of hydrogen in H₂O.

A_r of hydrogen = 1

A_r of oxygen = 16

First of all, find the M_r of the compound. For water, this would be (1 × 2) + 16 = 18.

The M_r of water is 18.

The question asks you to find the percentage of hydrogen in water: how many atoms of hydrogen are there? There are two atoms of hydrogen.

Multiply the A_r of the element by the number of atoms: 1 × 2 = 2

To calculate the % mass of the element, you now need to divide the answer above by the M_r of the compound. **2 ÷ 18 = 0.111**

Multiply by 100 to turn the answer into a percentage: **0.111 × 100 = 11.1%**

Have a go at calculating the percentage mass of an element in different chemical compounds. The first one has been done for you.

		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 oxygen in carbon dioxide.	CO ₂ 12 + (16 × 2) = 44	16 × 2 = 32 32 ÷ 44 = 0.727 0.727 × 100 72.7 Final answer to one decimal place.	



2	Calculate the percentage mass of chlorine in chlorine dioxide.	ClO_2		
3	Calculate the percentage mass of oxygen in chromium trioxide.	CrO_3		
4	Calculate the percentage mass of sulfur in cobalt sulfate.	CoSO_4		
5	Calculate the percentage mass of nitrogen in copper azide.	$\text{Cu}(\text{N}_3)_2$		
6	Calculate the percentage mass of germanium in germanium dioxide.	GeO_2		
7	Calculate the percentage mass of gold in gold chloride.	AuCl_3		



8	Calculate the percentage mass of hydrogen in hydrochloric acid.	HCl		
9	Calculate the percentage mass of bromine in hydrogen bromide.	HBr		
10	Calculate the percentage mass of phosphorus in hypophosphorous acid.	H ₃ PO ₂		
11	Calculate the percentage mass of iron in Iron(III) nitrate nonahydrate.	Fe(NO ₃) ₃ (H ₂ O) ₉		
12	Calculate the percentage mass of sulfur in iron thiocyanate.	Fe(SCN) ₃		
13	Calculate the percentage mass of lead in lead phosphate.	Pb ₃ (PO ₄) ₂		



14	Calculate the percentage mass of manganese in manganese sulfate monohydrate.	$\text{MnSO}_4 \cdot \text{H}_2\text{O}$		
15	Calculate the percentage mass of oxygen in sulfuric acid.	H_2SO_4		
16	Calculate the mass of hydrogen in ammonium chloride.	NH_4Cl		
17	Calculate the percentage mass of potassium in potassium sulfate.	K_2SO_4		
18	Calculate the percentage mass of titanium in titanium tetrafluoride.	TiF_4		
19	Calculate the percentage mass of chlorine in titanium tetrachloride.	TiCl_4		
20	Calculate the percentage mass of zinc in zinc cyanide.	$\text{Zn}(\text{CN})_2$		



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 oxygen in carbon dioxide.	CO_2 $12 + (16 \times 2) = 44$	$16 \times 2 = 32$ $32 \div 44 = 0.727$ 0.727×100 72.7 Final answer to one decimal place.	72.7%
2	Calculate the percentage mass of chlorine in chlorine dioxide.	ClO_2 $35.5 + (16 \times 2) = 67.5$	$35.5 \times 1 = 35.5$ $35.5 \div 67.5 = 0.525$ 0.525×100 52.6	52.6%
3	Calculate the percentage mass of oxygen in chromium trioxide.	CrO_3 $52 + (16 \times 3) = 100$	$16 \times 3 = 48$ $48 \div 100 = 0.48$ 0.48×100 48.0	48.0%
4	Calculate the percentage mass of sulfur in cobalt sulfate.	CoSO_4 $59 + 32 + (16 \times 4) = 155$	$32 \times 1 = 32$ $32 \div 155 = 0.206$ 0.206×100 20.6	20.6%
5	Calculate the percentage mass of nitrogen in copper azide.	$\text{Cu}(\text{N}_3)_2$ $14 \times 3 = 42$ $42 \times 2 = 84$ $63.5 + 84 = 147.5$	$14 \times 6 = 84$ $84 \div 147.5 = 0.569$ 0.569×100 56.9	56.9%



6	Calculate the percentage mass of germanium in germanium dioxide.	GeO_2 $73 + (16 \times 2) = 105$	$73 \times 1 = 73$ $73 \div 105 = 0.695$ 0.695×100 69.5	69.5%
7	Calculate the percentage mass of gold in gold chloride.	AuCl_3 $197 + (35.5 \times 3) = 303.5$	$197 \times 1 = 197$ $197 \div 303.5 = 0.649$ 0.649×100 64.9	64.9%
8	Calculate the percentage mass of hydrogen in hydrochloric acid.	HCl $1 + 35.5 = 36.5$	$1 \times 1 = 1$ $1 \div 36.5 = 0.027$ 0.027×100 2.7	2.7%
9	Calculate the percentage mass of bromine in hydrogen bromide.	HBr $1 + 80 = 81$	$80 \times 1 = 80$ $80 \div 81 = 0.987$ 0.987×100 98.8	98.8%
10	Calculate the percentage mass of phosphorus in hypophosphorous acid.	H_3PO_2 $(1 \times 3) + 31 + (16 \times 2) = 66$	$31 \times 1 = 31$ $31 \div 66 = 0.469$ 0.469×100 47.0	47.0%
11	Calculate the percentage mass of iron in Iron(III) nitrate nonahydrate.	$\text{Fe}(\text{NO}_3)_3 (\text{H}_2\text{O})_9$ $(16 \times 3) + 14 = 62$ $62 \times 3 = 186$ $(1 \times 2) + 16 = 18$ $18 \times 9 = 162$ $56 + 186 + 162 = 404$	$56 \times 1 = 56$ $56 \div 404 = 0.138$ 0.138×100 13.9	13.9%



12	Calculate the percentage mass of sulfur in iron thiocyanate.	$\text{Fe}(\text{SCN})_3$ $32 + 12 + 14 = 58$ $58 \times 3 = 174$ $56 + 174 = 230$	$32 \times 3 = 96$ $96 \div 230 = 0.417$ 0.417×100 41.7	41.7%
13	Calculate the percentage mass of lead in lead phosphate.	$\text{Pb}_3(\text{PO}_4)_2$ $16 \times 4 = 64$ $31 + 64 = 95$ $95 \times 2 = 190$ $(207 \times 3) + 190 = 811$	$207 \times 3 = 621$ $621 \div 811 = 0.765$ 0.765×100 76.6	76.6%
14	Calculate the percentage mass of manganese in manganese sulfate monohydrate.	$\text{MnSO}_4 \cdot \text{H}_2\text{O}$ $55 + 32 + (16 \times 4) + (1 \times 2) + 16 = 169$	$55 \times 1 = 55$ $55 \div 169 = 0.325$ 0.325×100 32.5	32.5%
15	Calculate the percentage mass of oxygen in sulfuric acid.	H_2SO_4 $(1 \times 2) + 32 + (16 \times 4) = 98$	$16 \times 4 = 64$ $64 \div 98 = 0.653$ 0.653×100 65.3	65.3%
16	Calculate the mass of hydrogen in ammonium chloride.	NH_4Cl $14 + (1 \times 4) + 35.5 = 53.5$	$1 \times 4 = 4$ $4 \div 53.5 = 0.074$ 0.074×100 7.5	7.5%
17	Calculate the percentage mass of potassium in potassium sulfate.	K_2SO_4 $(39 \times 2) + 32 + (16 \times 4) = 174$	$39 \times 2 = 78$ $78 \div 174 = 0.448$ 0.448×100 44.8	44.8%



18	Calculate the percentage mass of titanium in titanium tetrafluoride.	TiF_4 $48 + (19 \times 4) = 124$	$48 \times 1 = 48$ $48 \div 124 = 0.387$ 0.387×100	38.7%
19	Calculate the percentage mass of chlorine in titanium tetrachloride.	TiCl_4 $48 + (35.5 \times 4) = 190$	$35.5 \times 4 = 142$ $142 \div 190 = 0.747$ 0.747×100 74.7	74.7%
20	Calculate the percentage mass of zinc in zinc cyanide.	$\text{Zn}(\text{CN})_2$ $12 + 14 = 26$ $26 \times 2 = 52$ $65 + 52 = 117$	$65 \times 1 = 65$ $65 \div 117 = 0.555$ 0.555×100 55.6	55.6%

