

Combined Science - Chemistry - Key Stage 4

Quantitative Chemistry

Concentration

Mrs. Begum



Periodic Table of Elements

Key:

relative atomic mass →

Name →

Atomic symbol

Atomic (proton number)

1 H hydrogen 1																	4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[97] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 87	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og oganesson 118

* The lanthanides (atomic numbers 58 - 71) and the Actinides (atomic numbers 90 - 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.



Warm up

1. Calculate the RFM of CaCl_2 .
2. Balance this equation:
$$\text{CaO} + \text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2\text{O}$$
3. Convert 30 mg into g.
4. 12.2 g Mg was burned in 8.1 g oxygen. Calculate the mass of magnesium oxide formed.
5. Write the formula for magnesium oxide.



Independent practice 1

Convert the volumes below to dm^3 :

1. 10 cm^3
2. 100 cm^3
3. 200 cm^3
4. 0.03 cm^3
5. 730 cm^3

Convert the volumes below to cm^3 :

6. 1 dm^3
7. 10 dm^3
8. 70 dm^3
9. 0.8 dm^3
10. 2.3 dm^3



Independent practice 2

Calculate the concentration of:

1. 40 g solute in 800 cm³
2. 0.08 g solute in 20 cm³
3. 90 g solute in 780 cm³
4. 2.5 g of solute dissolved in a 500 cm³ solution
5. 2.3 g of solute in a 250 cm³ solution
6. 10 mg of solute in a 25 cm³ solution
7. 15 mg of solute in a 750 cm³ solution



Independent practice 3

Calculate the mass of the solute dissolved in the given volumes :

1. 200 cm^3 of a 3.0 g/dm^3 solution (remember to convert to dm^3)
2. 0.5 dm^3 of a 250 g/dm^3 solution
3. 10 cm^3 of a 40 g/dm^3 solution
4. 40 cm^3 of a 60 g/dm^3 solution
5. 0.05 dm^3 of a 300 g/dm^3 solution
6. 25 cm^3 of a 2.3 g/dm^3 solution



Independent practice 4

Using 75 g of solute, calculate how much water is needed to:

1. Make a 34 g/dm^3 solution
2. Make a 0.1 g/dm^3 solution
3. Make a 83 g/dm^3 solution
4. Make a 10 g/dm^3 solution
5. Make a 1660 g/dm^3 solution. Give your answer in cm^3



Independent practice - Triple only

Describe how you would make up:

- A 0.2 M solution of HCl
- 500 cm³ of 0.1 M solution of CaCl₂



Independent practice - Triple only

1. What mass of HCl is dissolved in 100 cm^3 of a 3 M solution?
2. What mass of NaOH is in 24 cm^3 of a 2 M solution?



Warm up answers

1. Calculate the RFM of CaCl_2 . **111**
2. Balance this equation:
$$\text{CaO} + \mathbf{2}\text{HCl} \longrightarrow \text{CaCl}_2 + \text{H}_2\text{O}$$
3. Convert 30 mg into g. **$30/1000 = 0.03 \text{ g}$**
4. 12.2 g Mg was burned in 8.1 g oxygen. Calculate the mass of magnesium oxide formed.
 $12.2 + 8.1 = 20.3 \text{ g}$
5. Write the formula for magnesium oxide. **MgO**



Independent practice 1 answers

Convert the volumes below to dm^3 :

- | | | |
|----|---------------------|--|
| 1. | 10 cm^3 | 0.01 dm^3 |
| 2. | 100 cm^3 | 0.1 dm^3 |
| 3. | 200 cm^3 | 0.2 dm^3 |
| 4. | 0.03 cm^3 | 0.00003 dm^3 |
| 5. | 730 cm^3 | 0.73 dm^3 |

Convert the volumes below to cm^3 :

- | | | |
|-----|--------------------|--|
| 6. | 1 dm^3 | 1000 cm^3 |
| 7. | 10 dm^3 | 10000 cm^3 |
| 8. | 70 dm^3 | 70000 cm^3 |
| 9. | 0.8 dm^3 | 800 cm^3 |
| 10. | 2.3 dm^3 | 2300 cm^3 |



Independent practice 2 answers

Calculate the concentration of:

1. 40 g solute in 800 cm³ **50 g/dm³**
2. 0.08 g solute in 20 cm³ **4 g/dm³**
3. 90 g solute in 780 cm³ **115 g/dm³**
4. 2.5 g of solute dissolved in a 500 cm³ solution **5 g/dm³**
5. 2.3 g of solute in a 250 cm³ solution **9.2 g/dm³**
6. 10 mg of solute in a 25 cm³ solution **0.4 g/dm³**
7. 15 mg of solute in a 750 cm³ solution **0.02 g/dm³**



Independent practice 3 answers

Calculate the mass of the solute dissolved in the given volumes :

- | | |
|---|-----------------|
| 1. 200 cm ³ of a 3.0 g/dm ³ solution | 0.6 g |
| 2. 0.5 dm ³ of a 250 g/dm ³ solution | 125 g |
| 3. 10 cm ³ of a 40 g/dm ³ solution | 0.4 g |
| 4. 40 cm ³ of a 60 g/dm ³ solution | 2.4 g |
| 5. 0.05 dm ³ of a 300 g/dm ³ solution | 15 g |
| 6. 25 cm ³ of a 2.3 g/dm ³ solution | 0.0575 g |



Independent practice 4 answers

Using 75 g of solute, how much water is needed to:

- | | |
|--|----------------------------|
| 1. Make a 34 g/dm ³ solution | 2.2 dm³ |
| 2. Make a 0.1 g/dm ³ solution | 750 dm³ |
| 3. Make a 83 g/dm ³ solution | 0.9 dm³ |
| 4. Make a 10 g/dm ³ solution | 7.5 dm³ |
| 5. Make a 1660 g/dm ³ solution. Give your answer in cm ³ | 45.2 cm³ |



Independent task - Triple answers

Describe how you would make up:

- A 0.2 M solution of HCl

Weigh out 7.3 g of HCl and dissolve it in 1000 cm³ of water.

- 500 cm³ of 0.1 M solution of CaCl₂

Weigh out 55.5 g of CaCl₂ and dissolve it in 500 cm³ of water.



Independent practice answers

1. What mass of HCl is dissolved in 100 cm³ of a 3 M solution?

A 3 M solution contains $3 \times 36.5 = 109.5$ g.

That equals 109.5g in 1000 cm³.

From the question, we are looking for the mass in 100 cm³,

Divide answer by 10 to get 10.95 g (in 100 cm³)

2. What mass of NaOH is in 24 cm³ of a 2 M solution?

A 2 M solution of NaOH = $2 \times 40 = 80$ g

80 g in 1000 cm³

$\div 1000 = 0.08$ g in 1 cm³

$\times 24 = 1.92$ g (in 24 cm³)

