

# Year 12 Preparation: Mark Scheme

Year 12 Chemistry Students: This is the mark scheme for the question booklet

**This must be brought to your first Chemistry lesson in September**

## **Structure:**

Information



Questions



Example



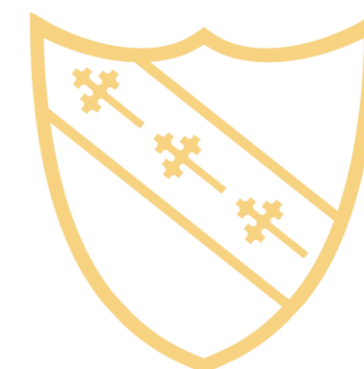
Answers



# Within the **first two weeks back** you will have a test on the below Topics;

The three types of bonding and the properties arising from them	Calculating percentage by mass
<b>Electronic structure and configuration (s, p, d, etc.)</b>	No. of protons, neutrons and electrons
Calculating Relative Atomic Mass (Shown as $M_r$ at A level)	Yields
Balancing Equations	Manipulating equations regarding number of moles and Avogadro's Number
<b>Calculating Empirical Formula</b>	Calculating moles

Topics highlighted in **red** are A Level Chemistry and new content. Those in blue are covered in GCSE.



11/06/2026

# Structure and bonding

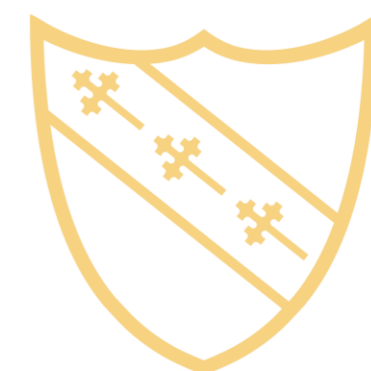


# Video links

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Bonding, structure and  
the properties of  
matter walkthrough

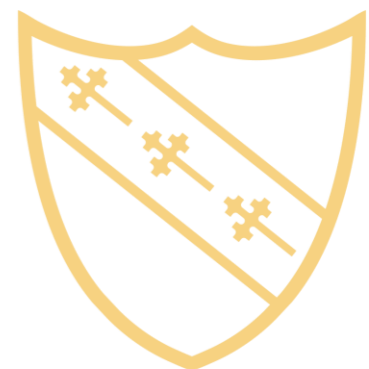




# Which structure type?

Determine the structures for the following:

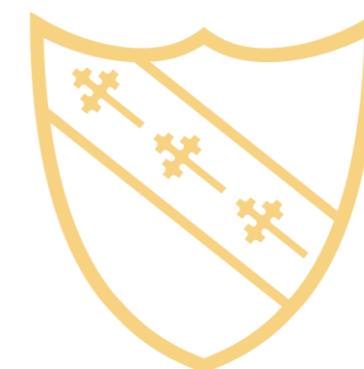
- a) Na
- b) NaCl
- c) Bromine
- d) Graphite
- e)  $\text{Na}_2\text{O}$
- f)  $\text{H}_2\text{O}$
- g) Mg
- h) Ar
- i) Neon
- j) Diamond
- k)  $\text{SiO}_2$



# Which structure type?

Determine the structures for the following:

- a) Na = Simple Molecule
- b) NaCl = Giant ionic
- c) Bromine = Simple Molecule
- d) Graphite = Giant Covalent
- e) Na<sub>2</sub>O = Giant ionic
- f) H<sub>2</sub>O = Simple Molecule
- g) Mg = Giant Metallic
- h) Ar = Monatomic
- i) Neon = Monatomic
- j) Diamond = Giant Covalent
- k) SiO<sub>2</sub> = Giant Covalent



# Explain the following statements:



a) Magnesium chloride has a high melting point. ....

.....  
.....  
.....  
.....

(3)

b) Copper conducts electricity. ....

.....  
.....  
.....  
.....

(3)

c) Methane has a low boiling point. ....

.....  
.....  
.....  
.....

(3)



# Explain the following statements:



d) Aluminium oxide conducts electricity when molten but not as a solid. ....

.....

.....

.....

.....

(3)

e) Helium has a very low boiling point. ....

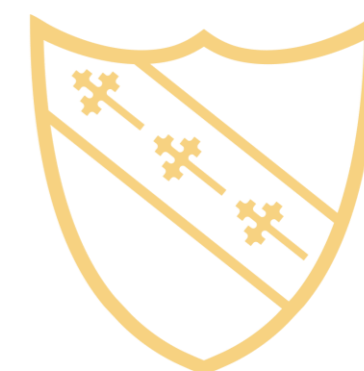
.....

.....

.....

.....

(3)



# Explain the following statements:



a) Magnesium chloride has a high melting point.

- ✓ ionic structure
- ✓ strong attraction between positive and negative ions
- ✓ takes a lot of energy to overcome attraction

b) Copper conducts electricity.

- ✓ outer shell
- ✓ electrons are delocalised
- ✓ and carry charge through structure / metal

c) Methane has a low boiling point.

- ✓ simple molecular
- ✓ weak forces between molecules
- ✓ does not need much energy to overcome attraction



# Explain the following statements:



d) Aluminium oxide conducts electricity when molten but not as a solid.

- ✓ **ions cannot move as solid**
- ✓ **ions can move as liquid**
- ✓ **and carry charge through structure**

e) Helium has a very low boiling point.

- ✓ **monatomic**
- ✓ **weak forces between atoms**
- ✓ **does not need much energy to overcome attraction**



# Proton, neutron and electron number

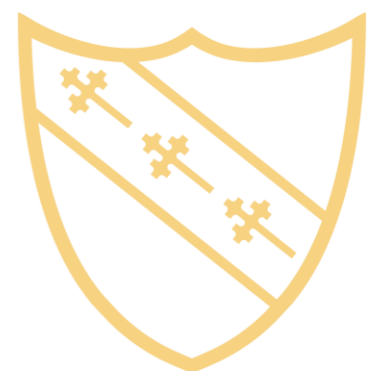


# Video links

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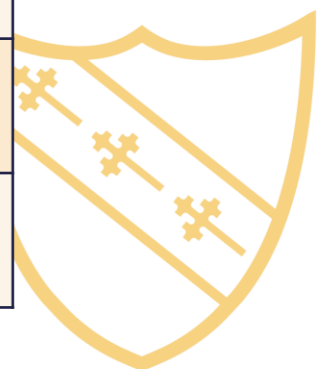
Proton, neutron and  
electron number  
walkthrough





## 1. Complete the table

Element	Protons	Neutrons	electrons	Atom or ion
Li		4	3	
	28		26	Ion
Mg				
Sc			21	
	7		10	
	10			
Br <sup>-1</sup>	35			
	15	16		
Cr(V) <sup>+5</sup>	24			Ion
Ti				
	26			Atom
Be <sup>+2</sup>				



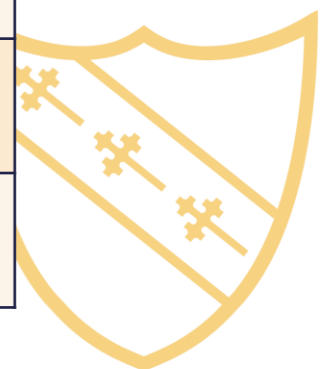
# Practice - **Answers**

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## 1. Complete the table

Element	Protons	Neutrons	electrons	Atom or ion
Li	3	4	3	Atom
Ni <sup>+2</sup>	28	31	26	Ion
Mg	12	12	12	Atom
Sc	21	24	21	Atom
N <sup>-3</sup>	7	7	10	Ion
Ne	10	10	10	Atom
Br <sup>-1</sup>	35	45	36	Ion
P	15	16	15	Atom
Cr(V) <sup>+5</sup>	24	28	19	Ion
Ti	22	26	22	Atom
Fe	26	30	26	Atom
Be <sup>+2</sup>	4	5	2	Ion





2. A student has a K atom. Calculate the number of neutrons it contains
3. A student has a  $\text{Mg}^{+2}$  ion. Calculate the number of neutrons it contains
4. A student has an element with 6 protons and 7 neutrons. Identify the element and state if it is an isotope of that element
5. A student has a sample with two isotopes in it. 60% of the sample is  $\text{N}^{14}$  and the rest is  $\text{N}^{16}$ . Calculate the relative atomic mass of nitrogen in the sample.
6. A student has a sample with three isotopes in it. 22% of the sample is  $\text{Cu}^{60}$ , 18% of the sample is  $\text{Cu}^{61}$  and the rest is  $\text{Cu}^{62}$ . Calculate the relative atomic mass of copper in the sample to 1d.p.



# Practice - Answers

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2. A student has a K atom. Calculate the number of neutrons it contains  $39 - 19 = 20$
3. A student has a  $\text{Mg}^{+2}$  ion. Calculate the number of neutrons it contains  $24 - 12 = 12$  *The fact it is an ion has no effect on neutron number*
4. A student has an element with 6 protons and 7 neutrons. Identify the element and state if it is an isotope of that element **Carbon as it has 6 protons and it is an isotope as it has more neutrons than normal**
5. A student has a sample with two isotopes in it. 60% of the sample is  $\text{N}^{14}$  and the rest is  $\text{N}^{16}$ . Calculate the relative atomic mass of nitrogen in the sample.  
 $[(60 \times 14) + (40 \times 16)] \div 100 = 14.8$
6. A student has a sample with three isotopes in it. 22% of the sample is  $\text{Cu}^{60}$ , 18% of the sample is  $\text{Cu}^{61}$  and the rest is  $\text{Cu}^{62}$ . Calculate the relative atomic mass of copper in the sample to 1d.p.  
 $[(22 \times 60) + (18 \times 61) + (60 \times 62)] \div 100 = 61.38 \rightarrow 61.4 (1.d.p)$

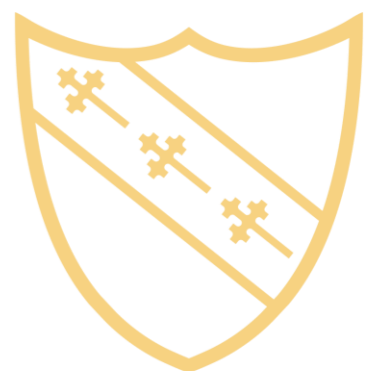


# Calculating empirical formula





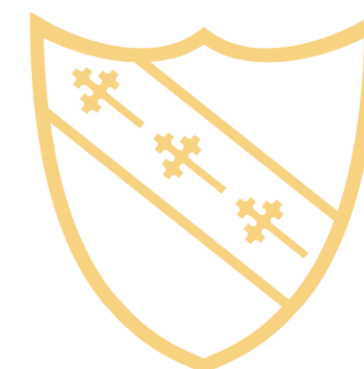
Empirical formula  
walkthrough



# Empirical formulae calculation:



1. A substance contains 43.7 g of phosphorus and 56.3 g of oxygen, its  $M_r$  is 284. Calculate the empirical and molecular formula of the substance.
2. Find the empirical formula for the compound with a composition by mass of C 86.0% and H 14.0%.
3. 3.21 g of sulfur reacts completely with oxygen to produce 6.41 g of an oxide of sulfur. Calculate the empirical formula of the oxide of sulfur.  
(Relative atomic masses: S = 32.1, O = 16.0).
4. In an experiment, 1.27 g of hot copper reacts with iodine vapour to form 3.81 g of copper iodide. Calculate the empirical formula of copper iodide.  
(Relative atomic masses: Cu = 63.5, I = 126.9).
5. Find the empirical formula for the compound with a composition by mass of C 52.2%, H 13.0% and O 34.8%.
6. 3.36 g of iron join with 1.44 g of oxygen in an oxide of iron. What is the empirical formula of the oxide?

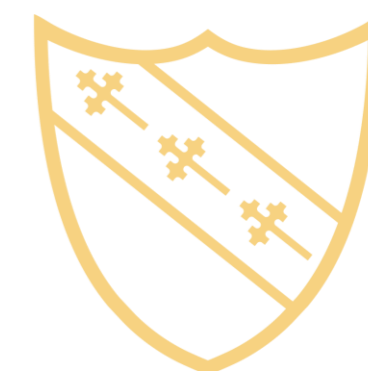


# Empirical formulae calculation:



1. A substance contains 43.7 g of phosphorus and 56.3 g of oxygen, its  $M_r$  is 284. Calculate the empirical and molecular formula of the substance.

	<b>P</b>	<b>O</b>
Mass	43.7	56.3
Mr	31	16
Moles	$43.7 \div 31 = 1.4097$	$56.3 \div 16 = 3.5188$
Molar ratio	$1.4097 \div 1.4097 = 1$	$3.5188 \div 1.4097 = 2.5$
Whole number ratio	2	5

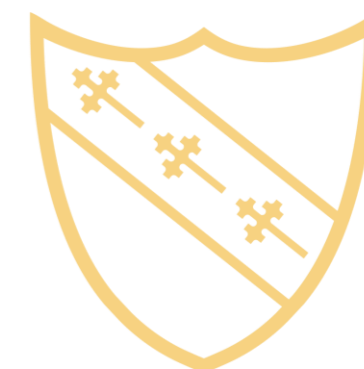


# Empirical formulae calculation:



2. Find the empirical formula for the compound with a composition by mass of C 86.0% and H 14.0%.

	<b>C</b>	<b>H</b>
Mass	86.0	14.0
Mr	12	1
Moles	$86 \div 12 = 7.16\dots$	$14 \div 1 = 14$
Molar ratio	$7.16\dots \div 7.16\dots = 1$	$14 \div 7.16\dots = 1.95$
Whole number ratio	1	2

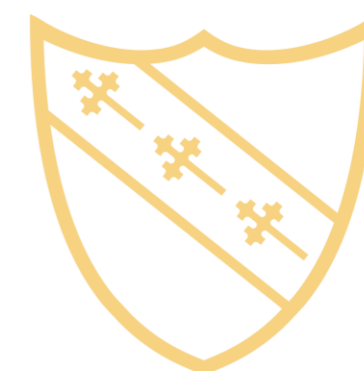


# Empirical formulae calculation:



3. 3.21 g of sulfur reacts completely with oxygen to produce 6.41 g of an oxide of sulfur. Calculate the empirical formula of the oxide of sulfur. (Relative atomic masses: S = 32.1, O = 16.0).

	<b>S</b>	<b>O</b>
Mass	3.21	6.41
Mr	32.1	16
Moles	$3.21 \div 32.1 = 0.1$	$6.41 \div 16 = 0.2$
Molar ratio	$0.1 \div 0.1 = 1$	$0.2 \div 0.1 = 2$
Whole number ratio	1	2



# Empirical formulae calculation:



4. In an experiment, 1.27 g of hot copper reacts with iodine vapour to form 3.81 g of copper iodide. Calculate the empirical formula of copper iodide. (Relative atomic masses: Cu = 63.5, I = 126.9).

	<b>Cu</b>	<b>I</b>
Mass	1.27	2.54
Mr	63.5	126.9
Moles	$1.27 \div 63.5 = 0.02$	$2.54 \div 126.9 = 0.02$
Molar ratio	$0.02 \div 0.02 = 1$	$0.02 \div 0.02 = 1$
Whole number ratio	1	1

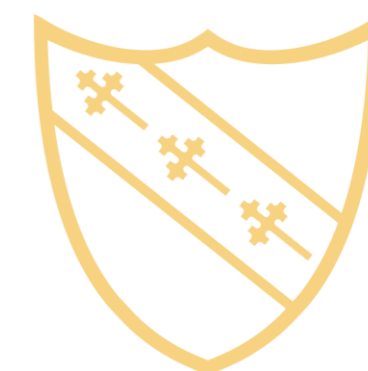
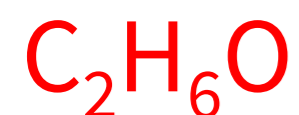


# Empirical formulae calculation:



5. Find the empirical formula for the compound with a composition by mass of C 52.2%, H 13.0% and O 34.8%.

	<b>C</b>	<b>H</b>	<b>O</b>
Mass	52.2	13.0	34.8
Mr	12	1	16
Moles	$52.2 \div 12 = 4.35$	$13 \div 1 = 13$	$34.8 \div 16 = 2.18$
Molar ratio	$4.35 \div 2.18 = 1.99$	$13 \div 2.18 = 5.97$	$2.18 \div 2.18 = 1$
Whole number ratio	2	6	1

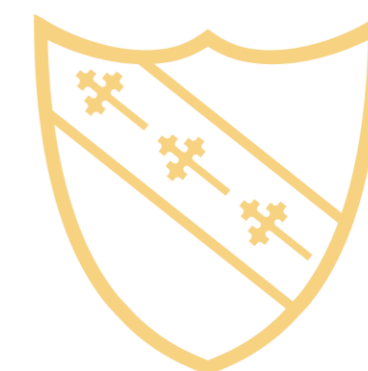


# Empirical formulae calculation:



6. 3.36 g of iron join with 1.44 g of oxygen in an oxide of iron.  
What is the empirical formula of the oxide?

	<b>Fe</b>	<b>O</b>
Mass	3.36	1.44
Mr	55.8	16
Moles	$3.36 \div 55.8 = 0.0602$	$1.44 \div 16 = 0.09$
Molar ratio	$0.0602 \div 0.0602 = 1$	$0.09 \div 0.0602 = 1.5$
Whole number ratio	2	3







**Q1.**

Scientists found that a compound contained per 100g:

22.8% sodium; 21.8% boron; and 55.4% oxygen.

Use the percentages to calculate the simplest ratio of atoms of each element in the compound and therefore the formula (known as the empirical formula of the compound)

Relative atomic masses ( $A_r$ ): B = 11; O = 16; Na = 23

To gain full marks you **must** show all your working.

	<b>Na</b>	<b>B</b>	<b>O</b>
Mass	22.8	21.8	55.4
Mr	23	11	16
Moles	$22.8 \div 23 = 0.991$	$21.8 \div 11 = 1.98$	$55.4 \div 16 = 3.46$
Molar ratio	$0.991 \div 0.991 = 1$	$1.98 \div 0.991 = 2$	$3.46 \div 0.991 = 3.5$
Whole number ratio	2	4	7

Empirical formula =  **$\text{Na}_2\text{B}_4\text{O}_7$**

(Total 5 marks)



# Using Avogadro's number

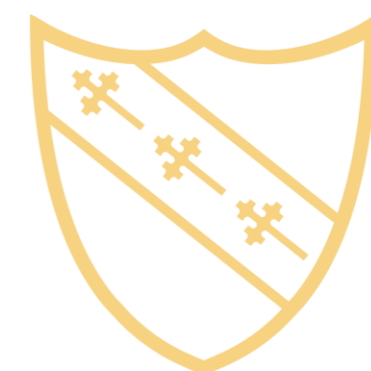


# Video links

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Moles and Avogadro's  
number

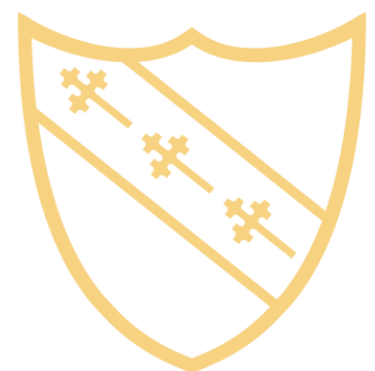




# Using Avogadro's constant

## More complex Avogadro's constant calculations

1. How many atoms are there in 10 moles of oxygen molecules ( $\text{O}_2$ )?
2. How many atoms are there in 2 moles of nitrogen molecules ( $\text{N}_2$ )?
3. How many atoms are there in 2.6 moles of chlorine molecules ( $\text{Cl}_2$ )?
4. How many atoms are there in 4.2 moles of hydrogen molecules ( $\text{H}_2$ )?
5. How many atoms are there in 5.5 moles of methane molecules ( $\text{CH}_4$ )?

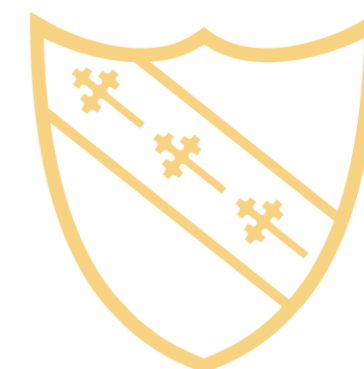


# Using Avogadro's constant - **Answers**



## More complex Avogadro's constant calculations

1. How many atoms are there in 10 moles of oxygen molecules ( $O_2$ )?  $10 \times 6.02 \times 10^{23} = 6.02 \times 10^{24} \times 2 = 1.204 \times 10^{25}$
2. How many atoms are there in 2 moles of nitrogen molecules ( $N_2$ )?  $2 \times 6.02 \times 10^{23} = 1.204 \times 10^{24} \times 2 = 2.408 \times 10^{24}$
3. How many atoms are there in 2.6 moles of chlorine molecules ( $Cl_2$ )?  
 $2.6 \times 6.02 \times 10^{23} = 1.5652 \times 10^{24} \times 2 = 3.1304 \times 10^{24}$
4. How many atoms are there in 4.2 moles of hydrogen molecules ( $H_2$ )?  
 $4.2 \times 6.02 \times 10^{23} = 2.5284 \times 10^{24} \times 2 = 5.0568 \times 10^{24}$
5. How many atoms are there in 5.5 moles of methane molecules ( $CH_4$ )?  
 $5.5 \times 6.02 \times 10^{23} = 3.311 \times 10^{24} \times 5 = 1.6555 \times 10^{25}$



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# Balancing equations



# Video links

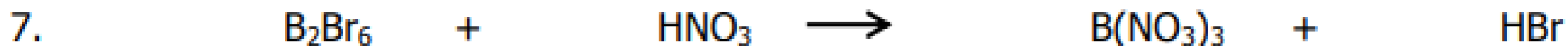
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Balancing chemical  
equation walkthrough



# Balancing equations



## Remember

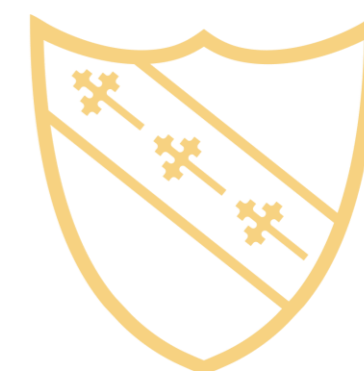
Carbonates -  $\text{CO}_3^{2-}$

Nitrates -  $\text{NO}_3^-$

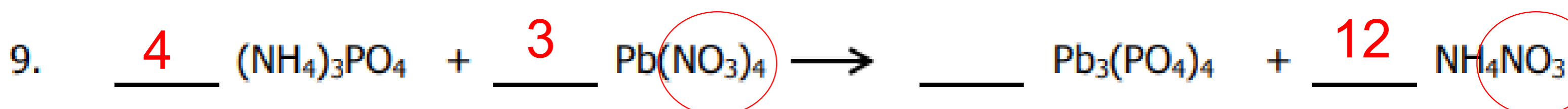
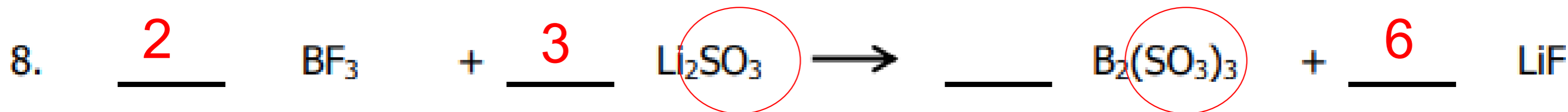
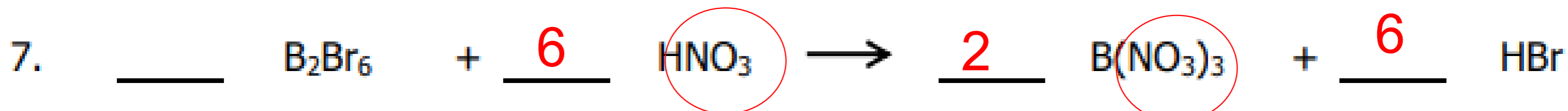
Sulphates -  $\text{SO}_4^{2-}$

Phosphates -  $\text{PO}_4^{3-}$

Ammonium ions  $\text{NH}_4^+$



# Balancing equations



**Remember**  
Carbonates -  $\text{CO}_3^{2-}$   
Nitrates -  $\text{NO}_3^-$   
Sulphates -  $\text{SO}_4^{2-}$   
Phosphates -  $\text{PO}_4^{3-}$   
Ammonium ions  $\text{NH}_4^+$



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# Calculating moles





Calculating moles  
walkthrough





# Calculating Moles

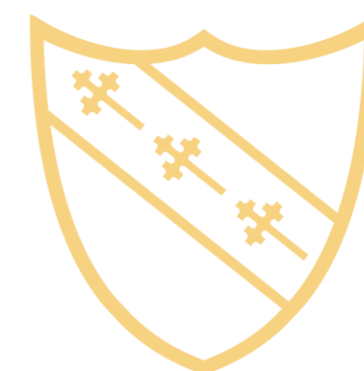
1. How many moles of methane ( $\text{CH}_4$ ) are there in 160g?
2. How many moles of  $\text{CaCO}_3$  are there in 25g?
3. How many moles of  $\text{NH}_3$  are there in 3.4g?
4. There are 7 moles of carbon dioxide ( $\text{CO}_2$ ) what is the mass?
5. A solution of  $\text{NaOH}$  has a volume of  $75\text{cm}^3$  and a concentration of  $0.5\text{mol/dm}^3$ . Calculate the number of moles
6. A solution of  $\text{HCl}$  has a volume of  $50\text{cm}^3$  and a concentration of  $0.75\text{mol/dm}^3$ . Calculate the number of moles
7. Carbon dioxide gas contains 5 moles. Calculate the volume of gas present in  $\text{dm}^3$
8. In a reaction  $5\text{ dm}^3$  of  $\text{N}_2$  reacts with  $6\text{ dm}^3$  of  $\text{O}_2$ . Calculate the volume of  $\text{NH}_3$ . The equation is:  $\text{N}_{2(\text{g})} + 2\text{O}_{2(\text{g})} \rightarrow 2\text{NO}_{2(\text{g})}$
9. In a reaction  $4\text{ dm}^3$  of  $\text{H}_2$  reacts with  $2\text{ dm}^3$  of  $\text{N}_2$ . Calculate the volume of  $\text{NH}_3$ . The equation is:  $3\text{H}_{2(\text{g})} + \text{N}_{2(\text{g})} \rightarrow 2\text{NH}_{3(\text{g})}$



# Calculating Moles - **Answers**



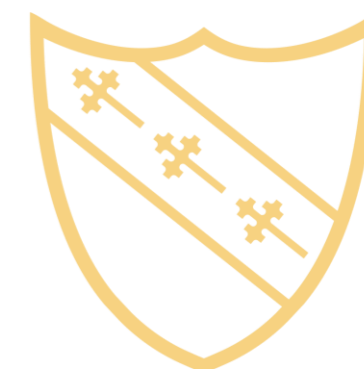
1. How many moles of methane ( $\text{CH}_4$ ) are there in 160g?  
 $160/(12+4) = 10$  moles
2. How many moles of  $\text{CaCO}_3$  are there in 25g?  
 $25/(40+12+(3 \times 16)) = 0.25$  moles
3. How many moles of  $\text{NH}_3$  are there in 3.4g?  
 $3.4\text{g}/(14+3) = 0.2$  moles
4. There are 7 moles of carbon dioxide ( $\text{CO}_2$ ) what is the mass?  
 $7 \times (12 + (2 \times 16)) = 308$  g



# Calculating Moles - **Answers**



5. A solution of NaOH has a volume of  $75\text{cm}^3$  and a concentration of  $0.5\text{mol/dm}^3$ . Calculate the number of moles  
 $75/1000 \times 0.5 = 0.0375 \text{ mol}$
6. A solution of HCl has a volume of  $50\text{cm}^3$  and a concentration of  $0.75 \text{mol dm}^{-3}$ . Calculate the number of moles  
 $50/1000 \times 0.75 = 0.0375 \text{ mol}$
7. Carbon dioxide gas contains 5 moles. Calculate the volume of gas present in  $\text{dm}^3$   
 $5 \times 24 = 120 \text{ dm}^3$



# Calculating Moles - **Answers**



8. In a reaction 5 dm<sup>3</sup> of N<sub>2</sub> reacts with 6 dm<sup>3</sup> of O<sub>2</sub>. Calculate the volume of NH<sub>3</sub>. The equation is:  $\text{N}_{2(g)} + 2\text{O}_{2(g)} \rightarrow 2\text{NO}_{2(g)}$

	Nitrogen	Oxygen	Nitrogen Oxide
Volume (dm <sup>3</sup> )	5.0	6.0	6 ÷ 2 = 3.0
Ratio	1	2	1
Comparison volume (dm <sup>3</sup> )	5 ÷ 1 = 5.0	6 ÷ 2 = 3.0	-----

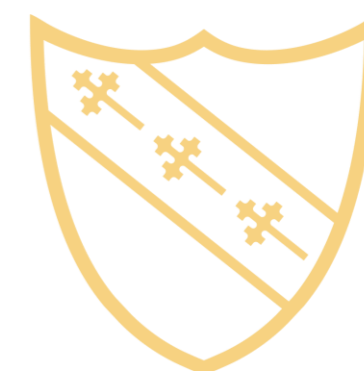
In excess as the comparison volume is the bigger number

Limiting reactant

More N<sub>2</sub> than needed so in excess. Have to use the volume of O<sub>2</sub> to work out volume of NO

Volume of O<sub>2</sub> ÷ 2 due to molar ratio

6 x 2 = 3 dm<sup>3</sup>



# Calculating Moles - **Answers**



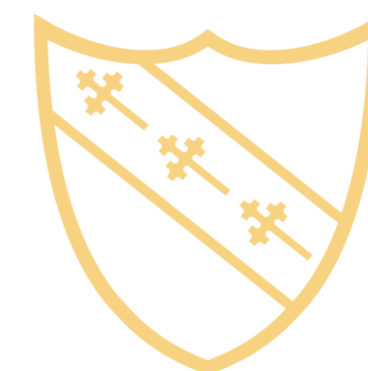
9. In a reaction 4 dm<sup>3</sup> of H<sub>2</sub> reacts with 1 dm<sup>3</sup> of N<sub>2</sub>. Calculate the volume of NH<sub>3</sub>. The equation is:  $3\text{H}_2 + \text{N}_2 \rightarrow 2\text{NH}_3$

	Hydrogen	Nitrogen	Ammonia
Volume (dm <sup>3</sup> )	4.0	1.0	1.0 x 2 = 2.0
Ratio	3	1	2
Comparison volume (dm <sup>3</sup> )	4 ÷ 3 = 1.3333...	1 ÷ 1 = 1.0	-----

In excess as the comparison volume is the bigger number

Limiting reactant

More H<sub>2</sub> than needed so in excess. Have to use the volume of N<sub>2</sub> to work out volume of NH<sub>3</sub>  
Volume of N<sub>2</sub> x 2 due to molar ratio  
1 x 2 = 2 dm<sup>3</sup>



11/06/2026

# Percentage yield

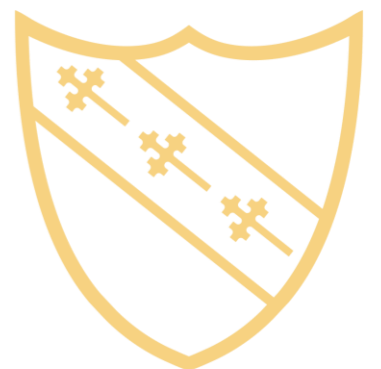


# Video links

11/06/2026



Percentage yield

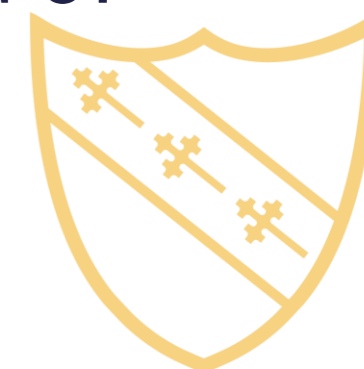


# Percentage yield practice

11/06/2026



1. A student obtained 6g of an element but expected 10.1g  
Calculate the percentage yield of the reaction to 2.d.p
2. A student obtained 5.7g of an element but expected 6.8g  
Calculate the percentage yield of the reaction to 2.d.p
3. The student starts with 6g of calcium (Ca). They obtained 10.6g of calcium sulfate ( $\text{CaSO}_4$ ). Calculate the percentage yield of the reaction  
 $\text{Ca} + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2$
4. A student starts with 15g of methane ( $\text{CH}_4$ ). They obtain 20g of water ( $\text{H}_2\text{O}$ ). Calculate the percentage yield  
 $\text{CH}_4 + 2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{CO}_2$
5. A student starts with 10g of ethane ( $\text{C}_2\text{H}_6$ ). They obtain 25g of carbon dioxide ( $\text{CO}_2$ ). Calculate the percentage yield  
 $2\text{C}_2\text{H}_6 + 6\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{CO}_2$
6. Calculate the mass of magnesium (Mg) needed to obtain 27g of magnesium sulfate ( $\text{MgSO}_4$ ) assuming there is an 80% yield of magnesium sulfate ( $\text{MgSO}_4$ ) to 1.d.p  
 $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$

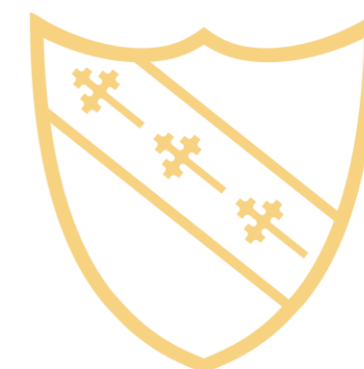


# Percentage yield practice - **Answers**

11/06/2026



1. A student obtained 6g of an element but expected 10.1g  
Calculate the percentage yield of the reaction to 2.d.p  
 $(6 \div 10.1) \times 100 = 59.41\%$
2. A student obtained 5.7g of an element but expected 6.8g  
Calculate the percentage yield of the reaction to 2.d.p  
 $(5.7 \div 6.8) \times 100 = 83.32\%$

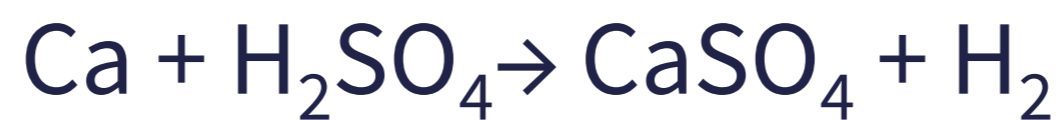


# Percentage yield practice - **Answers**

11/06/2026

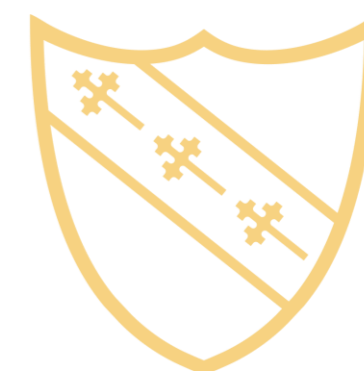


3. The student starts with 6g of calcium (Ca). They obtained 10.6g of calcium sulfate ( $\text{CaSO}_4$ ). Calculate the percentage yield of the reaction to 2.d.p



	<b>Ca</b>	<b>CaSO<sub>4</sub></b>
Mass	6	<b>20.4</b>
Mr	40	136
Mole	0.15	0.15
Molar ratio	1	1

$$(10.6 \div 20.4) \times 100 = 51.96 \text{ (2.d.p)}$$



# Percentage yield practice - **Answers**

11/06/2026

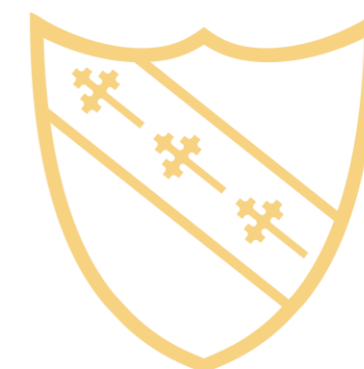


4. A student starts with 15g of methane (CH<sub>4</sub>). They obtain 20g of water (H<sub>2</sub>O). Calculate the percentage yield



	<b>CH<sub>4</sub></b>	<b>H<sub>2</sub>O</b>
Mass	15	<b>33.75</b>
Mr	16	18
Mole	0.9375	1.875
Molar ratio	1	2

$$(20 \div 33.75) \times 100 = 59.26 \text{ (2.d.p)}$$



# Percentage yield practice - **Answers**

11/06/2026

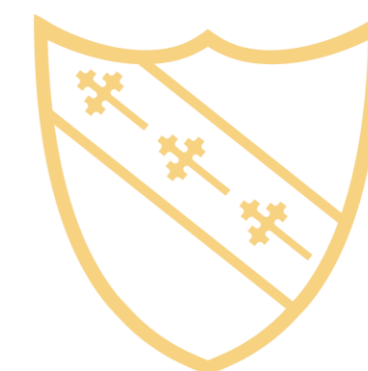


5. A student starts with 10g of ethane (C<sub>2</sub>H<sub>6</sub>). They obtain 25g of carbon dioxide (CO<sub>2</sub>). Calculate the percentage yield



	<b>C<sub>2</sub>H<sub>6</sub></b>	<b>CO<sub>2</sub></b>
Mass	10	29.3...
Mr	30	44
Mole	0.33333...	0.6666...
Molar ratio	2	4

$$(25 \div 29.3...) \times 100 = 85.23 \text{ (2.d.p)}$$



# Percentage yield practice - **Answers**

11/06/2026

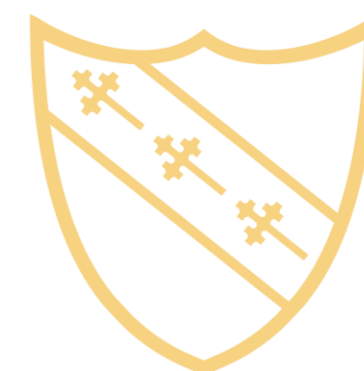


6. Calculate the mass of magnesium (Mg) needed to obtain 27g of magnesium sulfate ( $\text{MgSO}_4$ ) assuming there is an 80% yield of magnesium sulfate ( $\text{MgSO}_4$ ) to 1.d.p



$$27 \div 0.8 = 33.75\text{g (Theoretical mass)}$$

	<b>MgSO<sub>4</sub></b>	<b>Mg</b>
Mass	33.75	<b>6.8</b>
Mr	120.4	24.3
Mole	0.2803...	0.2803...
Molar ratio	1	1



# Electron configuration





Electronic configuration 1



Electronic configuration 2

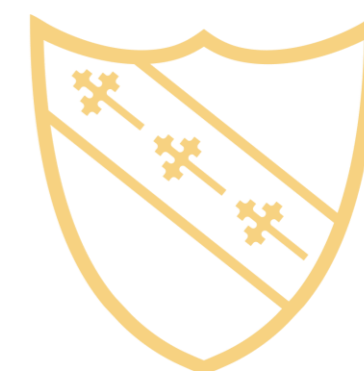


# Electron configuration practice

11/06/2026



1. Write the full electron configuration for the following elements
  - a) Sodium (Na)
  - b) Nitrogen (N)
  - c) Argon (Ar)
  - d) Helium (He)
  - e) Iron (Fe)
  - f) Potassium (K)
  - g) Manganese (Mn)
  - h) Oxygen (O)



# Electron configuration practice -

## Answers

11/06/2026



1. Write the full electron configuration for the following elements

a) Sodium (Na) –  $1s^2, 2s^2, 2p^6, 3s^1$

b) Nitrogen (N) –  $1s^2, 2s^2, 2p^3$

c) Argon (Ar) –  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

d) Helium (He) –  $1s^2$

e) Iron (Fe) –  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^6$

f) Potassium (K) –  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$

g) Manganese (Mn) –  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^5$

h) Oxygen (O) –  $1s^2, 2s^2, 2p^4$

