



HOMework BOOKLET

C3&C5 Foundation



Balancing Equations

Chemical equations are a simple way to describe how different substances are made in a reaction. The equation tells us which substances have **reacted** in the reaction. These are called the **reactants** and are found on the **left-hand** side of the equation.

The equation tells us which substances are **produced** in the reaction. These are called the **products** and are found on the **right-hand** side of the equation.

Word equations use words to describe the reaction.

1. Write word equations for the reactions below.

a. Lithium and fluorine react together to produce lithium fluoride.

_____ → _____

b. Magnesium and oxygen react together to produce magnesium oxide.

_____ → _____

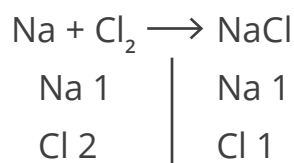
c. Sodium and chlorine react together to produce sodium chloride.

_____ → _____

Symbol equations give us more detail as they show the elements present in the reaction and also the number of each element.

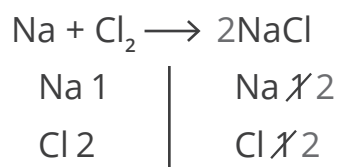
To balance a symbol equation:

Step 1 - Write the symbol equation.



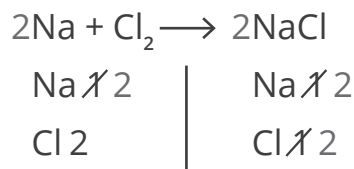
Step 2 - List the elements that are present on each side of the arrow.

Step 3 - Write down the number of each element present on each side.

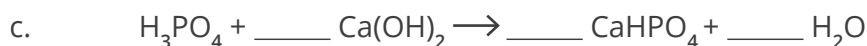
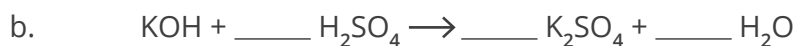
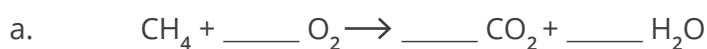


Step 4 - Identify which elements have different amounts on each side.

Step 5 - Through trial and error, place numbers in front of the chemical formulae to balance the equation.



2. Balance the symbol equations below.





Relative Formula Mass

The relative formula mass (M_r) is the sum of the relative atomic masses (A_r) of all the atoms present in a compound.

To calculate relative formula mass:

Step 1 – Work out how many atoms of each element are in the chemical formula.

Step 2 – Find the relative atomic mass of each element on the periodic table.

Step 3 – Add together the relative atomic masses for all the atoms of each element in the formula.

e.g. The chemical formula for water is H_2O .

There are two atoms of hydrogen and one atom of oxygen.

Relative atomic masses (A_r): H = 1, O = 16

Relative formula mass (M_r) = $(1 \times 2) + 16 = 18$

1. How many atoms of each element are present in the compounds below?

a. CO_2

b. H_2SO_4

c. $Mg(NO_3)_2$

2. Calculate the relative formula mass of the compounds below.

a. NH_3

$M_r =$ _____

b. HNO_3

$M_r =$ _____

c. C_2H_5OH

$M_r =$ _____



Calculating Percentage by Mass

Percentage by mass of an element tells us the percentage of a chemical compound made up of that element.

$$\text{percentage mass of Y} = \frac{A_r \text{ of element Y} \times \text{number of atoms of Y}}{M_r \text{ of compound}} \times 100$$

To calculate percentage by mass of an element:

Step 1 - Calculate the relative formula mass (M_r) of the compound.

Step 2 - Find the relative atomic mass (A_r) of the element.

Step 3 - Multiply the A_r of the element by the number of atoms of that element present in the compound.

Step 4 - Divide the mass of the element by the M_r of the compound and multiply by 100.

Worked example:

Calculate the percentage by mass of oxygen in copper sulfate (CuSO_4).

Relative atomic masses (A_r): Cu = 63.5, S = 32, O = 16

M_r of $\text{CuSO}_4 = 63.5 + 32 + (16 \times 4) = 159.5$

$$\text{percentage by mass of oxygen} = \frac{(16 \times 4)}{159.5} \times 100 = 40\%$$

1. Calculate the percentage by mass of carbon in carbon dioxide (CO_2).

Give your answer to 2 significant figures.

Relative atomic masses (A_r): C = 12, O = 16

percentage by mass = _____ %

2. Calculate the percentage by mass of sodium in sodium hydroxide (NaOH).

Give your answer to 2 significant figures.

Relative atomic masses (A_r): Na = 23, O = 16, H = 1

percentage by mass = _____ %



3. Calculate the percentage by mass of aluminium in aluminium sulfate ($\text{Al}_2(\text{SO}_4)_3$).
Give your answer to 2 significant figures.

Relative atomic masses (A_r): Al = 27, S = 32, O = 16

percentage by mass = _____ %





Concentrations of Solutions in g/dm^3

Concentration is a measure of the amount of a substance in a volume of liquid. The more particles of a substance present in a solution, the higher the concentration.

In chemistry, there are two ways to measure the concentration of a solution. This can be done by calculating the mass of the substance in grams or by calculating the number of moles.

To calculate concentration, you must be working in dm^3 .

$$\text{concentration (g/dm}^3\text{)} = \frac{\text{mass (g)}}{\text{volume (dm}^3\text{)}}$$

The equation can be rearranged to calculate mass and volume.

1. Calculate the **concentration** of the solution produced when a 3.2g of sodium chloride is dissolved in 8dm^3 of water.

$$\text{concentration} = \underline{\hspace{2cm}} \text{ g/dm}^3$$

2. Calculate the **mass** of magnesium chloride you would need to dissolve in 4dm^3 of water to make a 0.9g/dm^3 solution.

$$\text{mass} = \underline{\hspace{2cm}} \text{ g}$$

3. Calculate the **concentration** of the solution produced when 5.2g of potassium chloride is dissolved in 200cm^3 of water.

Give your answer in g/dm^3 .

$$\text{concentration} = \underline{\hspace{2cm}} \text{ g/dm}^3$$

4. Calculate the **volume** of water required to add to 4.5g of sodium carbonate to make a 15g/dm^3 solution.

Give your answer in cm^3 .

$$\text{volume} = \underline{\hspace{2cm}} \text{ cm}^3$$



Reaction Profiles

1. What is activation energy?

Tick **one** box.

The amount of energy that is transferred in a reaction.

The maximum amount of energy that can be released in a reaction.

The minimum amount of energy that particles need to react.

2. What is an endothermic reaction?

Tick **one** box.

A reaction that has no overall energy change.

A reaction that releases energy to the surroundings.

A reaction that takes in energy from the surroundings.

3. What happens to the temperature of the surroundings when an endothermic reaction takes place?

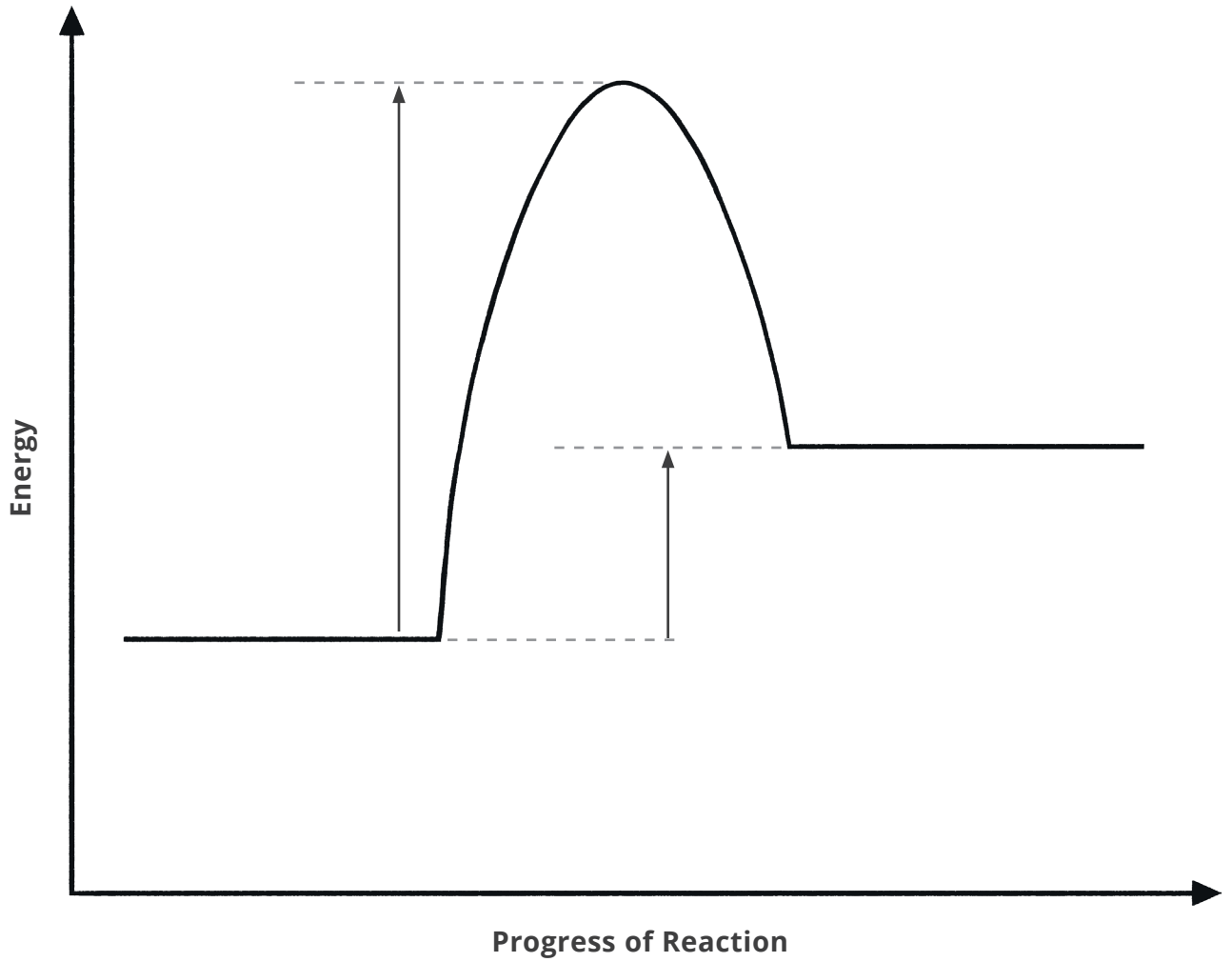
4. Four types of reaction are listed in Table 1. Tick **one** box in each row to decide whether they are examples of endothermic or exothermic reactions.

Table 1

Reaction	Endothermic	Exothermic
combustion		
neutralisation		
thermal decomposition		
the reaction within a sports injury pack		

Figure 1 shows an unlabelled reaction profile.

Figure 1



a. Use the words from the box below to label the reaction profile.

activation energy	overall energy change	products	reactants
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b. Name the type of reaction shown in **Figure 1**.

c. A catalyst is added to the reaction shown in **Figure 1**. Describe the effect the catalyst would have on the activation energy of the reaction.
