

AS TRANSITION – Problems

How many moles?

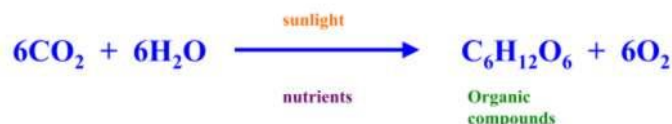
- 1) Mr Atkin weighs a sample of CaCO_3 and records a mass of 5.0 g.
How many moles of calcium carbonate are present?

- 2) Mrs Mason measures out 50 cm^3 of 0.1 mol dm^{-3} hydrochloric acid.
How many moles of hydrochloric acid are present?

- 3) Mr Clarke collects 48 cm^3 of carbon dioxide in a gas syringe at 298 K and 100 kPa. How many moles of carbon dioxide are present?

Using Chemical Equations

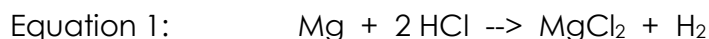
Chemical Equations show the ratio in which different species react in a chemical equation.



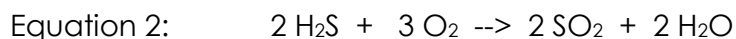
This equation shows that **6** moles carbon dioxide of react with **6** mole of water to make **1** mole of glucose and **6** moles of oxygen.

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- a) How many moles of water are needed to react with 0.03 moles of carbon dioxide?
- b) How many moles of glucose can you make from 0.03 moles of carbon dioxide?
- c) How many moles of oxygen can you make from 0.03 moles of carbon dioxide?



- a) How many moles of magnesium would be needed to react with 0.01 moles of hydrochloric acid?
- b) How many moles of hydrogen could be produced from 0.01 moles of hydrochloric acid?



- a) How many moles of oxygen are needed to react with 0.5 moles of hydrogen sulphide?
- b) How many moles of sulphur dioxide can be made from 0.5 moles of hydrogen sulphide?



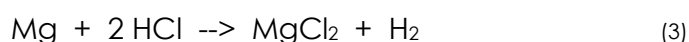
- a) How many moles of oxygen are needed to react with 0.05 moles of potassium?
- b) How many moles of potassium oxide can be made from 0.05 moles of potassium?

Calculating Reacting Quantities from Chemical Equations

You perform these calculations in three steps:

- **calculate the number of moles of one of the substances (you will either be given the mass, or the aqueous volume and the concentration, or the gaseous volume)**
- **use the equation to work out the number of moles of the other substance**
- **use one of the mole relationships to work out the quantity you need**

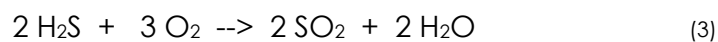
- 1) What volume (in dm³) of hydrogen is produced at 298 K and 100 kPa when 194 g of magnesium is reacted with hydrochloric acid?



- 2) What volume (in cm³) of 0.5 mol dm⁻³ hydrochloric acid is required to react completely with 1.94 g of magnesium?



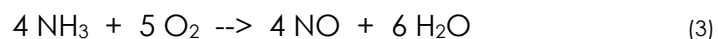
- 3) What volume (in dm³) of oxygen at 298 K and 100 kPa is needed to react with 8.5 g of hydrogen sulphide (H₂S)?



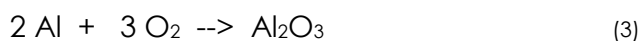
- 4) What mass of potassium oxide is formed when 7.8 g of potassium is burned in excess oxygen?



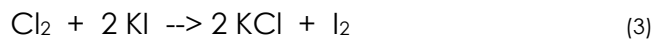
- 5) What volume of oxygen (in dm³) at 298 K and 100 kPa is required to oxidise 10 g of ammonia to NO?



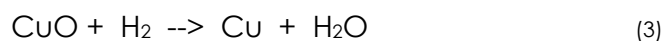
- 6) What mass of aluminium oxide is produced when 135 g of aluminium is burned in oxygen?



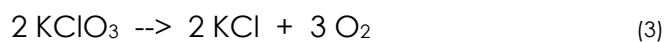
- 7) What mass of iodine is produced when 2.4 dm³ of chlorine gas reacts with excess potassium iodide at 298 K and 100 kPa?



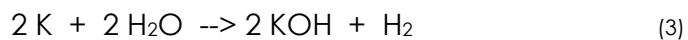
- 8) What volume (in dm³) of hydrogen is needed to react with 32 g of copper oxide at 200 °C and 100 kPa?



- 9) What volume of oxygen is formed at 398 K and 100 kPa when 735 g of potassium chlorate decomposes?



- 10) What volume of hydrogen is produced when 195 g of potassium is added to water at 298 K and 100 kPa?



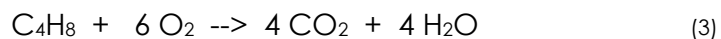
- 11) What mass of calcium carbonate is required to produce 1.2 dm³ of carbon dioxide at 398 K and 100 kPa?



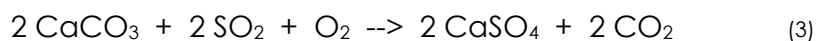
- 12) What mass of magnesium oxide is formed when magnesium reacts with 6 dm³ of oxygen at 298 K and 100 kPa?



- 13) What volume of carbon dioxide (in dm³) is produced when 5.6 g of butene (C₄H₈) is burnt at 298 K and 100 kPa?



- 14) The pollutant sulphur dioxide can be removed from the air by reaction with calcium carbonate in the presence of oxygen. What mass of calcium carbonate is needed to remove 480 dm³ of sulphur dioxide at 298 K and 100 kPa?



- 15) 25 cm³ of a solution of sodium hydroxide reacts with 15 cm³ of 0.1 mol/dm³ HCl. What is the molar concentration of the sodium hydroxide solution?

