

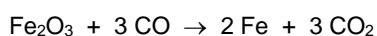
# GENERAL CALCULATIONS 2



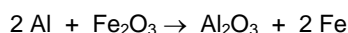
Name ..... Form .....

- 1) A compound contains 59.4% carbon, 10.9% hydrogen, 13.9% nitrogen and 15.8% oxygen, by mass. Find the empirical formula of the compound.
- 2) A compound containing carbon, hydrogen and oxygen only contains 74.2% carbon and 7.9% hydrogen. Its  $M_r$  is found to be 178 by mass spectroscopy. Find its empirical and molecular formulae.

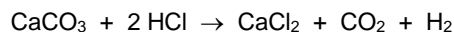
- 3) What mass of carbon monoxide is needed to react with 1.00 kg of iron oxide?



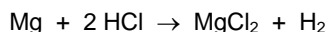
- 4) The reaction below is known as the Thermit reaction, which is used to form molten iron to mould train tracks together. What mass of aluminium powder is needed to react with 8.00 g of iron (III) oxide?



- 5) What volume of  $0.100 \text{ mol dm}^{-3}$  hydrochloric acid would react with 25.0 g of calcium carbonate?



- 6)  $25.0 \text{ cm}^3$  of  $0.0400 \text{ mol dm}^{-3}$  sodium hydroxide solution reacted with  $20.75 \text{ cm}^3$  of sulphuric acid in a titration. Find the concentration of the sulphuric acid.
- 7) 13.8 g of a solid monoprotic acid was dissolved in water and made up to  $250 \text{ cm}^3$ .  $25.0 \text{ cm}^3$  portions of this were titrated against  $0.250 \text{ mol dm}^{-3}$  sodium hydroxide, requiring  $23.5 \text{ cm}^3$ . Calculate the  $M_r$  of the acid.
- 8) 10.0 g of a mixture of copper powder and magnesium powder was mixed with  $100 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3}$  hydrochloric acid. The copper does not react, but the magnesium does as shown:



The resulting solution was filtered to remove unreacted copper and then made up to  $250 \text{ cm}^3$  with water.  $25.0 \text{ cm}^3$  of this solution was found to neutralise  $36.8 \text{ cm}^3$  of  $0.200 \text{ mol dm}^{-3}$  NaOH. Find the % by mass of the magnesium in the metal powder mixture.

- 9) 12.0 g of a mixture of calcium carbonate and sodium chloride was treated with  $100 \text{ cm}^3$  of  $2.00 \text{ mol dm}^{-3}$  hydrochloric acid (only the calcium carbonate reacts). The resulting solution was made up to  $250 \text{ cm}^3$  with water and a  $25.0 \text{ cm}^3$  portion of this needed  $34.1 \text{ cm}^3$  of  $0.200 \text{ mol dm}^{-3}$  sodium hydroxide for neutralisation. Find the % by mass of the calcium carbonate in the mixture.
- 10) The solid booster rockets of the space shuttle are fuelled by a mixture of aluminium and ammonium chlorate (VII) ( $\text{NH}_4\text{ClO}_4$ ).
  - a) If no other reagents are involved, and the products are nitrogen, water, hydrogen chloride and aluminium oxide, devise an equation for this reaction.
  - b) Each launch consumes about 160 tonnes of aluminium. What mass of hydrogen chloride gas is produced in the atmosphere above the Cape Canaveral launch pad?