

Reacting Masses Limiting Reactants

GCSE Chemistry · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Calculate the mass of magnesium oxide formed when 6.0 g of magnesium burns completely. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (Mg = 24, O = 16) (3 marks)

Step 1 · Moles of Mg

$$6.0 \div 24 = 0.25 \text{ mol}$$

Step 2 · Ratio Mg : MgO = 2 : 2 = 1 : 1

$$0.25 \text{ mol MgO}$$

Step 3 · Mass of MgO ($M_r = 40$)

$$0.25 \times 40 = 10 \text{ g}$$

Answer: 10 g

Check: Mass gained = 4.0 g of oxygen; $0.125 \text{ mol O}_2 \times 32 = 4.0 \text{ g}$ ✓

2. Now try one with the steps

Calculate the mass of calcium oxide made by heating 25 g of calcium carbonate. $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ (Ca = 40, C = 12, O = 16) (3 marks)

Step 1 · Moles CaCO_3 ($M_r = 100$)

Step 2 · Ratio 1 : 1

Step 3 · Mass (M_r CaO = 56)

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. In $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$, state the mole ratio of Mg to O_2 . [1]

2. Calculate the mass, in g, of magnesium oxide formed from 12 g of magnesium. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (Mg = 24, O = 16) [3]

3. Calculate the mass, in g, of carbon dioxide formed when 3.0 g of carbon burns. $C + O_2 \rightarrow CO_2$ (C = 12, O = 16) [3]

4. Calculate the mass, in g, of water formed from 4.0 g of hydrogen. $2H_2 + O_2 \rightarrow 2H_2O$ (H = 1, O = 16) [3]

5. Calculate the mass, in g, of iron produced from 80 g of iron(III) oxide. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ (Fe = 56, O = 16) [3]

6. Calculate the mass, in g, of calcium carbonate needed to make 28 g of calcium oxide. $CaCO_3 \rightarrow CaO + CO_2$ (Ca = 40, C = 12, O = 16) [3]

7. Define the term limiting reactant. [1]

8. Explain why one reactant is often used in excess. [1]

9. 2.3 g of sodium reacts with 3.55 g of chlorine, Cl_2 , to form 5.85 g of sodium chloride. Use these masses to balance $Na + Cl_2 \rightarrow NaCl$. (Na = 23, Cl = 35.5) [3]

10. 1.2 g of magnesium is added to 2.19 g of hydrogen chloride. $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$. Identify the limiting reactant. ($\text{Mg} = 24$, $\text{H} = 1$, $\text{Cl} = 35.5$) [2]

11. For question 10, calculate the mass, in g, of hydrogen formed. [2]

12. Calculate the mass, in g, of sodium chloride formed from 4.6 g of sodium and excess chlorine. $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ [3]

13. Calculate the mass, in g, of oxygen needed to burn 8.0 g of methane completely. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ ($\text{C} = 12$, $\text{H} = 1$, $\text{O} = 16$) [3]

14. 5.6 g of iron reacts with 10.65 g of chlorine to form 16.25 g of iron chloride. Use these masses to balance $\text{Fe} + \text{Cl}_2 \rightarrow \text{FeCl}_3$. ($\text{Fe} = 56$, $\text{Cl} = 35.5$) [3]

4. Before you hand it in

Going straight from mass to mass with a ratio

Mass $\rightarrow$ moles ($\div M_r$) $\rightarrow$ use the ratio $\rightarrow$ moles $\rightarrow$ mass ($\times M_r$).

Calculating the product from the reactant in excess

Find the limiting reactant first and work from it.

Ignoring the balancing numbers when using M_r

Use M_r of one unit, then apply the mole ratio separately.