

Worksheet 1.1: Reacting Masses Calculations

Specification: GCSE Chemistry (AQA 5.3.1.2 / Edexcel SC14 / OCR Gateway C4.1)

Key Formula: Moles (mol) = $\frac{\text{Mass (g)}}{M_r}$ Mass (g) = Moles $\times M_r$ $M_r = \frac{\text{Mass (g)}}{\text{Moles}}$

Units: Moles (mol), Mass (g), M_r (Relative formula mass, no units). **Also consider Mole Ratios from balanced equations.**

Core Concepts: This worksheet focuses on applying the mole concept to calculate quantities of reactants and products in chemical reactions. Remember the law of conservation of mass and how to use mole ratios from balanced equations.

Section A: Formula Recall & Rearrangement

1. Complete the table below with the correct SI unit and symbol for each variable in the formula.

Variable	Unit Name	Unit Symbol
Moles	_____	_____
Mass	_____	_____
Relative formula mass (M_r)	_____	_____

2. Rearrange the key formula (Moles = $\frac{\text{Mass}}{M_r}$) to make Mass and M_r the subject.

a) Mass (g) = _____

b) M_r = _____

3. Perform the following conversions or calculations. Use the following approximate relative atomic masses (A_r): H=1, C=12, O=16, Mg=24, Cl=35.5.

a) Calculate the mass of 2.5 mol of H₂O ($M_r = 18$). _____

b) Calculate the moles in 120 g of Mg ($M_r = 24$). _____

c) Calculate the mass of 0.05 mol of CO₂ ($M_r = 44$). _____

d) Calculate the moles in 177.5 g of Cl₂ ($M_r = 71$). _____

e) An unknown substance has a mass of 10 g and contains 0.25 mol. Calculate its M_r . _____

Section B: Practice Calculations

Show all your working clearly for each question. Use the following approximate relative atomic masses (A_r): Ca=40, C=12, O=16, Na=23, H=1.

- a) Calculate the number of moles in 100 g of calcium carbonate (CaCO₃).

- b) Calculate the number of moles in 22 g of carbon dioxide (CO₂).

- c) Calculate the mass of 0.2 mol of sodium hydroxide (NaOH).

- d) A sample of an unknown compound has a mass of 4.9 g and contains 0.05 mol. Calculate its relative formula mass (M_r).

Section C: Challenge Context

Show all your working clearly for each question. Use the following approximate relative atomic masses (A_r): Na=23, Cl=35.5, Cu=63.5, C=12, O=16.

- a) Sodium (Na) reacts with chlorine (Cl_2) to produce sodium chloride (NaCl) according to the balanced equation:
 $2\text{Na(s)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{NaCl(s)}$
If 4.6 g of sodium reacts completely, calculate the mass of sodium chloride (NaCl) produced.

- b) Copper carbonate (CuCO_3) decomposes when heated to form copper oxide (CuO) and carbon dioxide (CO_2).
The reaction is shown below: $\text{CuCO}_3\text{(s)} \xrightarrow{\text{heat}} \text{CuO(s)} + \text{CO}_2\text{(g)}$

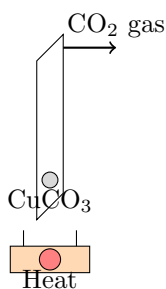


Figure 1: Thermal decomposition of copper carbonate.

In an experiment, 12.4 g of copper carbonate was heated, and 8.0 g of copper oxide was produced. Calculate the mass of carbon dioxide (CO_2) produced.
