Masses and Moles

Topic Summary

- Make sure that you are confident with calculating the formula mass of a substance before attempting this worksheet.
- A mole is a very large number of particles (6.022×10^{23}), chosen because one mole of any substance will have the same mass (in grams) as the formula mass of that compound. For example, one mole of carbon dioxide is 44 g and one mole of water is 18 g.
- Use the equation moles = mass ÷ Mr to calculate the number of moles if you already know the mass of the sample.
- Use the equation mass = Mr × moles to calculate the mass of a substance given it's formula and the number of moles present.
- Recognise that masses **must always be converted into grams** before carrying out mole calculations.
- Round answers correctly, usually to three decimal places unless instructed otherwise.
- By applying mass–mole conversions you will be able to solve reacting mass calculations, and this will be covered in detail in later videos/worksheets.

Skills Pre-check

Check that you can find the formula masses of these compounds before moving on...

a) $CaCO_3$ b) $LiOH$ c) H_2SO_4 d) $Ca(OH)_2$ e) Al_2O_3

ANS: a) 100, b) 24, c) 98, d) 74, e) 102

Simple moles to masses (using mass = M_r x moles)

Find the correct number of moles for each of these masses

a) 2 moles of NaCl (Mr = 58.5) .....

..... (1 mark)

b) 10 moles of CO_2 (Mr = 44) .....

..... (1 mark)

c) 0.5 moles of H_2O (Mr = 18) .....

..... (1 mark)

d) 0.05 moles of H_2SO_4 (Mr = 98) .....

..... (1 mark)

Simple masses to moles (using moles = Mass ÷ M_r)

Find the correct mass for each of these amounts (give non-exact answers to 3 d.p.)

a) 200 g $CaCO_3$ (Mr = 100) .....

..... (1 mark)

b) 5.6 g of CaO (Mr = 56) .....

..... (1 mark)

c) 5 g of H_2O (Mr = 18) .....

..... (1 mark)

d) 23 g of H_2SO_4 (Mr = 98) .....

..... (1 mark)

More complex conversions

Find the correct mass or numbers of moles for each of these amounts, convert mass units where required (give non-exact answers to 3 d.p.)

a) 25 g HCl (Mr = 36.5) .....

..... (1 mark)

b) 40g of CaO (Mr = 56) .....

..... (1 mark)

c) 5 moles of H_2O (Mr = 18) .....

..... (1 mark)

d) 2.3 moles of HNO_3 .....

..... (1 mark)

e) 14 kg of MgO (Mr = 40) .....

..... (1 mark)

Exam Style Questions

1. A student uses 36.0 g of magnesium oxide (Mr = 40.0) in an experiment.

Calculate the number of moles of magnesium oxide used. Give your answer to 3 decimal places.

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..... (2 mark)

2. A sample contains 17.1 g of aluminium oxide (Al_2O_3).

Calculate the number of moles of aluminium oxide in the sample.
Give your answer to 3 decimal places. (Relative atomic masses: Al = 27, O = 16)

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..... (3 mark)

3. An industrial process requires 2.50 kg of sodium carbonate (Na_2CO_3).

Calculate the number of moles of sodium carbonate required.
Give your answer to 3 decimal places. (Relative atomic masses: Na = 23, C = 12, O = 16)

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..... (4 mark)

Exam Style Questions

4. A chemical manufacturer requires 1.80 kg of calcium nitrate ($Ca(NO_3)_2$) to prepare a fertiliser.

Calculate the number of moles of calcium nitrate used.

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..... (5 mark)

Do this later...

Give your brain a break and come back to these questions later. Cover the rest of the sheet while you have a go. By doing this 24-48 hours after watching the video you will boost your chances of remembering the key points in an exam. If you struggle with these questions, re-watch the video and then try again.

a) Find the formula mass of $CuSO_4$ .....

..... (1 mark)

b) How many moles is 10g of $MgSO_4$ .....

..... (2 mark)

c) What mass is 0.3 moles of Cl_2 (Mr = 71) .....

..... (1 mark)

d) How many moles is 10 kg of HNO_3 .....

..... (3 mark)

e) A large scale chemical reaction requires 140 kg of LiCl.
How many moles of the substances are required?

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..... (3 mark)