



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 $\text{moles} = \text{mass} \div M_r$ to calculate the number of moles if you already know the mass of the sample.
- Use the equation $\text{mass} = M_r \times \text{moles}$ to calculate the mass of a substance given its 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 $\text{mass} = M_r \times \text{moles}$)

Find the correct number of moles for each of these masses

- a) 2 moles of NaCl ($M_r = 58.5$) 117 g.....
..... (1 mark)
- b) 10 moles of CO_2 ($M_r = 44$) 440 g.....
..... (1 mark)
- c) 0.5 moles of H_2O ($M_r = 18$) 9 g.....
..... (1 mark)
- d) 0.05 moles of H_2SO_4 ($M_r = 98$) 4.9 g.....
..... (1 mark)



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Simple masses to moles (using $\text{moles} = \text{Mass} \div M_r$)

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

- a) 200 g CaCO_3 ($M_r = 100$)2 moles.....
..... (1 mark)
- b) 5.6 g of CaO ($M_r = 56$)0.1 moles.....
..... (1 mark)
- c) 5 g of H_2O ($M_r = 18$)0.278 moles.....
..... (1 mark)
- d) 23 g of H_2SO_4 ($M_r = 98$)0.235 moles.....
..... (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 ($M_r = 36.5$)0.685 moles.....
..... (1 mark)
- b) 40g of CaO ($M_r = 56$)0.714 moles.....
..... (1 mark)
- c) 5 moles of H_2O ($M_r = 18$)90 g.....
..... (1 mark)
- d) 2.3 moles of HNO_3 ($M_r = 63$)...144.9 g.....
..... (1 mark)
- e) 14 kg of MgO ($M_r = 40$)350
..... (2 mark)



Exam Style Questions

1. A student uses 36.0 g of magnesium oxide ($\text{Mr} = 40.0$) in an experiment.

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

.....Moles = Mass $\div$ Mr.....(1).....

.....36.0 $\div$ 40.0 = 0.900 mol.....(1).....

..... (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)

..... $\text{Mr}(\text{Al}_2\text{O}_3) = (2 \times 27) + (3 \times 16) = 102$ (1).....

.....Moles = Mass $\div$ Mr (1).....

.....= 0.168 mol... (1).....

.....

..... (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)

.....2.50 kg = 2500 g (1).....

..... $\text{Mr}(\text{Na}_2\text{CO}_3) = (2 \times 23) + 12 + (3 \times 16) = 106$ (1).....

.....Moles = Mass $\div$ Mr (1).....

.....2500 $\div$ 106 = 23.6 mol (3 s.f.).....(1).....

..... (4 mark)



Exam Style Questions

4. A chemical manufacturer requires 1.80 kg of calcium nitrate ($\text{Ca}(\text{NO}_3)_2$) to prepare a fertiliser.

Calculate the number of moles of calcium nitrate used.

..... 1.80 kg = 1800 g (1).....

..... $\text{Mr}(\text{Ca}(\text{NO}_3)_2) = 40 + (2 \times 14) + (6 \times 16) = 164$ (2).....

..... $\text{Moles} = \text{Mass} \div \text{Mr}$ (1).....

..... = 10.976 (1).....

..... allow other reasonable (correct) rounding or 11.0 to 3s.f.

.....

..... (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

..... 159.5..... (1 mark)

b) How many moles is 10g of MgSO_4

..... [Mr 120 (1)]..... 0.083..... (2 mark)

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

..... 21.3 g (unit required)..... (1 mark)

d) How many moles is 10 kg of HNO_3

..... [Mr 63 (1)]..... [10 000 g (1)] 158.730..... (3 mark)

e) A large scale chemical reaction requires 140 kg of LiCl .

How many moles of the substances are required?

..... [Mr = 42.5 (1)]..... [140 000 g (1)].....

..... 3294.118 (or other reasonable correct rounding).....

..... (3 mark)