Concentration calculations

Student activity • calculation workshop

YEAR 10 / LESSON 45 / CHEMISTRY ONLY

The question

How do mass, amount and solution volume connect?

Work between mass concentration and amount concentration with explicit units. Convert the final solution volume into dm^3 before using $c = n/V$. These are paper calculations, not preparation instructions.

Equipment

- Booklet, calculator and periodic table

Desk activity only; no chemicals or heating.

Course coverage: Chemistry only: 1.34C calculations involving amount, solution volume and concentration in mol dm^{-3}; mass concentration supports the school objectives.

Plan, model or apparatus sketch

Draw the calculation route: mass → amount → concentration.

Method and reasoning

Read the whole sequence before starting

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1. Write the given quantities with units. Convert each volume in cm^3 into dm^3 by dividing by 1000.

2. For a known mass use n = m/M, then c = n/V. For mass concentration use mass in g divided by solution volume in dm^3.

3. Complete the four cases in the table; show a rearranged equation before substituting numbers.

4. For a reacting-volume problem, write the balanced equation, calculate the known amount, apply the mole ratio, then find the unknown volume or concentration.

5. Solve the acid/base practice in the questions. Keep intermediate calculator values and give a final unit with an appropriate precision.

6. Check by reversing your calculation. Explain why solution volume means the final volume, not just the water initially used.

Cleanup

- Keep your workings and corrections; return shared materials.

Record your evidence

Blank spaces are for your own work

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Reference and task data

n = m/M; c = n/V with V in dm^3; V = n/c. 1000 cm^3 = 1 dm^3. M(NaCl) = 58.5 g mol^{-1}; M(NaOH) = 40 g mol^{-1}. Mass concentration has unit g dm^{-3}; amount concentration has unit mol dm^{-3}. In the case table, M after a number means mol dm^{-3}.

Given case	Working with units	Requested result
5.85 g NaCl; 250 cm^3		c / mol dm^{-3}
0.0750 mol; 150 cm^3		c / mol dm^{-3}
n = 0.0300 mol; c = 1.20 M		V / cm^3
c = 0.200 M; V = 500 cm^3		n / mol

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Complete all four table calculations, showing volume conversions.

2. Calculate the mass concentration of the NaCl solution in the first row.

3. A 0.250 mol dm^{-3} NaOH solution has what mass concentration in g dm^{-3}?

4. 20.0 cm^3 of 0.200 mol dm^{-3} H_2SO_4 reacts with NaOH. Use $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ to calculate the volume of 0.400 mol dm^{-3} NaOH needed.

5. Correct this claim: “0.100 mol in 250 cm^3 is 0.000400 mol dm^{-3}.”

6. Explain why adding solute to 250 cm^3 water does not necessarily give 250 cm^3 solution.