

Approaching exam calculations

Education in Chemistry

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Build up the complexity of the calculations you set students until they are ready to tackle exam-style problems.

1. Begin with relatively simple questions that don't involve any unit conversions or any rearrangement of the formula.

eg What concentration would result if you dissolved 20 g of sodium chloride in 10 dm³ water?

2. Introduce questions that ask for mass and so involve rearrangement of the formula.

eg What mass of sodium chloride would be present in 10 dm³ of a solution with a concentration of 2 g.dm⁻³?

3. Introduce questions that ask for the volume of the solution and so involve rearrangement of the formula.

eg What volume of a 2 g.dm⁻³ solution would contain 10 g?

4. Ask students to invent their own questions using the following mix-and-match templates.

What volume... have ___ g of _____ at a concentration of ___ g.dm⁻³

What mass of _____... in ___ dm³ of solution at a concentration of ___ g.dm⁻³

What concentration.... have ___ g of _____ in ___ dm³ of solution

5. Introduce questions that involve unit conversions but not rearrangement of the formula.

eg What would the concentration be in g.dm⁻³ if 50 g of sodium chloride was dissolved in 250 cm³?

6. Finally tackle a past exam question such as this:

Calculate the mass of sodium hydroxide that must be dissolved in water to make 200 cm³ of solution of concentration 60 g.dm⁻³.

- Ask 'What are we looking for?' and 'What will its units be?' Highlight or circle it.
- Ask 'What do we know?' (and think 'what do the units tell us?' In this case the units cm³ tell us that we have a volume of 200 cm³). Highlight or circle them.
- Ask 'Write down the formula that relates these quantities.' (Hint: 'what do the units tell us?')
- Ask 'Do the prefixes match?' In this case we have cm³ and dm³ so convert 200 cm³ to dm³.
- Substitute in the numbers with their units into the formula then rearrange as required. (Alternatively rearrange the formula first). Ensure that the units cancel out appropriately.

Model answer:

Calculate the mass of sodium hydroxide that must be dissolved in water to make 200 cm³ of solution of concentration 60 g.dm⁻³.

- a) We are trying to calculate the mass – units should be g.
- b) We know the volume is 200 cm³ (cm³ is a unit for volume).
We know the concentration is 60 g.dm⁻³
- c) $\text{concentration} \left(\frac{\text{g}}{\text{dm}^3} \right) = \frac{\text{mass (g)}}{\text{volume (dm}^3\text{)}}$
- d) 200 cm³ is 0.2 dm³
- e) $\text{mass} = \text{concentration} \times \text{volume} = 60 \frac{\text{g}}{\text{dm}^3} \times 0.2 \text{ dm}^3 = 12 \text{ g}$