

Concentration Calculations

Answer the questions below.

1. How is a solution formed?
A solute is dissolved in a solvent.

2. Convert 3000 cm³ to dm³

$$3000 \div 1000 = 3 \text{ dm}^3$$

3. Calculate the relative formula mass of H₂SO₄.

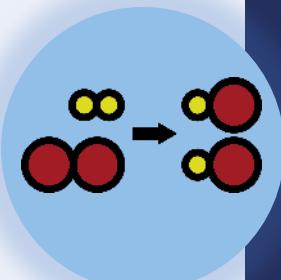
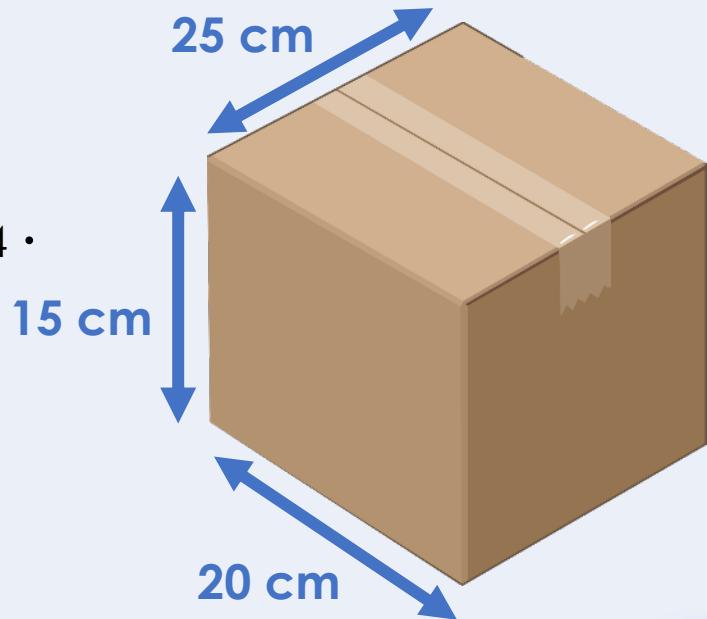
$$(1 \times 2) + 32 + (16 \times 4) = 98$$

4. State the unit of concentration.

$$\text{g/dm}^3$$

5. Calculate the volume of the box shown.

$$7875 \text{ cm}^3 (7.9 \text{ dm}^3)$$



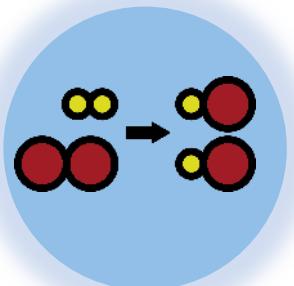
Concentration Calculations

C3.2.8

Science
Mastery

- C3.2.1 Prior Knowledge Review
- C3.2.2 Relative Formula Mass
- C3.2.3 Percentage by Mass
- C3.2.4 Conservation of Mass
- C3.2.5 Balancing Equations
- C3.2.6 Uncertainty
- C3.2.7 Introducing Concentration

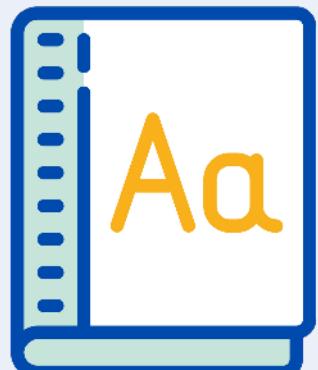
- **C3.2.8 Concentration Calculations**
- C3.2.9 Soluble Salts
- C3.2.10 Making Soluble Salts
- C3.2.11 Making Soluble Salts 2



Following this lesson, students will be able to:

- Calculate the concentration of a solution, given the mass of solute and volume of solvent
- Rearrange equations

Key Words:



volume mass solute
concentration solution

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
 - **reteach, explanation, demonstration or modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
 - **practise** answering specific questions or of key skills.
 - **redrafting** or **improving** previous work.

Choose the correct option for the following questions.

1. Salt dissolves in water. Which word describes salt best?
 A. soluble
 B. insoluble
 C. solvent
2. 5 g of solute is dissolved in 200cm³ of solution. Which of these quantities has the same **volume** as this solution?
 A. 0.2 dm³
 B. 200000 cm³
 C. 0.005 kg
3. Select the answer below which is equal to 0.05 dm³.
 A. 500 cm³
 B. 50 cm³
 C. 0.00005 cm³

How do we calculate concentration?

The **mass of solute** found in a solution can be expressed as **g/dm³**. This is the **mass of solute per dm³ of solution**.

The units, g/dm³, give a clue to how to **calculate** concentration of a solution.

$$\text{Mass} \xrightarrow{\div} \text{g/dm}^3 \xleftarrow{\text{volume}}$$

The volume needs to be in dm³.

$$\text{cm}^3 \div 1000 = \text{dm}^3$$

If 6 g of citric acid is dissolved in water to make up **2 000 cm³** of solution, what would the concentration be?

$$\begin{aligned}\text{Concentration} &= \text{mass} \div \text{volume} \\ &= 6 \text{ g} \div 2 \text{ dm}^3 \\ &= \underline{\underline{3 \text{ g/dm}^3}}\end{aligned}$$

$$2\ 000\text{cm}^3 \div 1\ 000 = 2\ \text{dm}^3$$

How do we calculate concentration?

**Sea water contains about 8.75 g of salt in every 0.25 dm³ of water.
Calculate the salt concentration of the water.**

The volume needs
to be in dm³.



concentration

$$\begin{aligned} &= \text{mass} \div \text{volume} \\ &= 8.75 \text{ g} \div 0.25 \text{ dm}^3 \\ &= \underline{\underline{35 \text{ g/dm}^3}} \end{aligned}$$

160 g of sodium hydroxide is used to make 300 cm³ of solution.

What is the concentration?

160 g is the mass of solute

300 cm³ is the volume of the solution

=0.3 dm³

concentration

$$\begin{aligned} &= \text{mass} \div \text{volume} \\ &= 160 \text{ g} \div 0.3 \text{ dm}^3 \\ &= \underline{\underline{533 \text{ g/dm}^3}} \end{aligned}$$

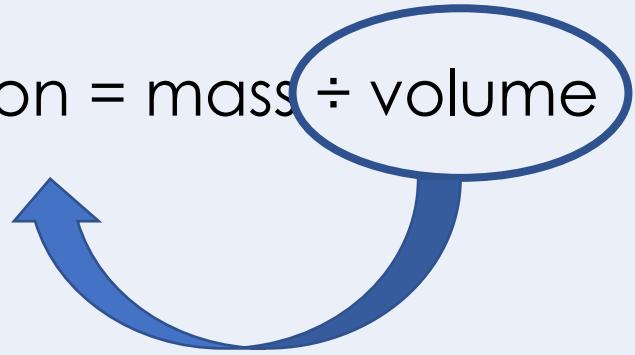
Steps:

1. What is the question asking?
2. What information does the question give you?
3. Write down the correct equation.
4. Substitute the numbers.
5. Rearrange the equation if necessary.
6. Complete the calculation.
7. Add units.

Try this one:

Rearranging equations

Concentration = mass ÷ volume



Concentration x volume = mass

Mass = concentration x volume

If I want to get mass by itself, I need to move volume from the right-hand side of the equation to the left.

Because it's '÷ volume' on the right, it will be 'x volume' on the left.

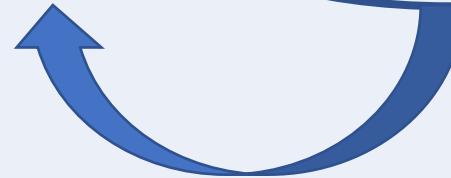
Now we have two equations we can use:

Concentration = mass ÷ volume

Mass = concentration x volume

Rearranging equations

$$\text{Mass} = \text{concentration} \times \text{volume}$$



$$\text{Mass} \div \text{concentration} = \text{volume}$$

$$\text{Volume} = \text{mass} \div \text{concentration}$$

If I want to get volume by itself, I need to move concentration from the right-hand side of the equation to the left.

Because it's 'x concentration' on the right, it will be '÷ concentration' on the left.

Now we have three equations we can use:

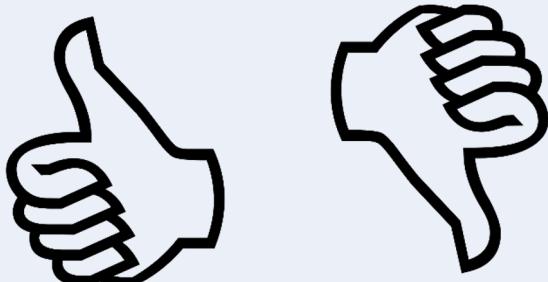
$$\text{Concentration} = \text{mass} \div \text{volume}$$

$$\text{Mass} = \text{concentration} \times \text{volume}$$

$$\text{Volume} = \text{mass} \div \text{concentration}$$

True or False?

1. To convert cm^3 into dm^3 you need to multiply by 1000. **False**
2. $250 \text{ cm}^3 = 0.25 \text{ dm}^3$ **True**
3. 250 cm^3 of a 4 g/dm^3 solution contains 1 g of solute. **True**
4. $0.5 \text{ dm}^3 = 5000 \text{ cm}^3$ **False**
5. 5.5 g of copper sulfate is dissolved in 500 cm^3 to form a 11 g/dm^3 solution. **True**



Discuss with your partner how you should solve this question.

Work together to find the answer.

Some glucose was dissolved in 500 cm^3 of water.
The concentration of the solution was $5\text{g}/\text{dm}^3$.

What mass of glucose was dissolved in the solution?

Equation: mass = concentration x volume

Numbers: mass = 5×0.5

Answer and unit: 2.5 g

V
E
S
C
U

I: Worked example

5g of sodium hydroxide, NaOH is dissolved in 250 cm³ of water

Calculate the concentration of NaOH.

concentration= ? mass = 5g Volume = 250cm³

$$\text{Volume} = \frac{250}{1000} = 0.250\text{dm}^3$$

$$\text{concentration} = \frac{\text{Mass}}{\text{volume}}$$

$$\text{concentration} = \frac{5}{0.250}$$

$$\text{concentration} = 20 \text{ g/dm}^3$$

V
E
S
C
U

We: Worked example

8g of calcium hydroxide, Ca(OH)_2 is dissolved in 100 cm³ of water

Calculate the concentration of Ca(OH)_2 .

concentration= ? mass = 8g Volume = 100cm³

$$\text{Volume} = \frac{100}{1000} = 0.100\text{dm}^3$$

$$\text{concentration} = \frac{\text{Mass}}{\text{volume}}$$

$$\text{concentration} = \frac{8}{0.100}$$

$$\text{concentration} = 80 \text{ g/dm}^3$$

Apply

V
E
S
C
U

You: Worked example

1g of calcium hydroxide, Ca(OH)_2 is dissolved in 100 cm³ of water

Calculate the concentration of Ca(OH)_2 .

concentration= ? mass = 1g Volume = 25cm³

$$\text{Volume} = \frac{25}{1000} = 0.025\text{dm}^3$$

$$\text{concentration} = \frac{\text{Mass}}{\text{volume}}$$

$$\text{concentration} = \frac{1}{0.025}$$

$$\text{concentration} = 40 \text{ g/dm}^3$$

Drill

1. What are the units for concentration?
2. What are the units for volume?
3. What are the units for mass?
4. 50 g of sugar is dissolved in 1dm³ of water. What is the concentration?
Give units
5. 50 g of sugar is dissolved in 1litre of water. What is the concentration?
Give units
6. Link concentration, mass and volume in an equation where
concentration is the subject.
7. Link concentration, mass and volume in an equation where mass is the
subject.
8. Link concentration, mass and volume in an equation where volume is the
subject.

Drill answers

1. g/dm^3
 2. dm^3
 3. g
 4. 50 g/dm^3
 5. 50 g/dm^3
 6. Concentration = $\frac{\text{mass}}{\text{volume}}$
-
7. Mass = concentration \times volume
 8. Volume = $\frac{\text{concentration}}{\text{volume}}$

Check for understanding

Answer the questions below.

1. 10 g of a solute was used to make a solution with a volume of 25 dm³. What was the concentration of the solution?
 A. 250 g/dm³
 B. 0.4 g/dm³
 C. 2.5 g/dm³

2. 5 g of solute is dissolved in 200 cm³ of solution. The concentration of the solution is:
 A. 25 g/dm³
 B. 0.025 g/dm³
 C. 1 g/dm³

3. Select the correct formula to calculate the mass of a solute.
 A. mass = concentration x volume
 B. mass = concentration ÷ volume
 C. concentration = mass ÷ volume

Lesson C3.2.6

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)
or by emailing sciencemastery@arkonline.org
Thank you!