Prior Knowledge Review: Concentration

Answer the questions below.

1. State how many particles there are in 1 mole of a substance.
   6.02×10^{23}
2. Calculate the M_r of calcium carbonate ($CaCO_3$). Ca=40, C=12, O=16
   100
3. Calculate the number of moles in 200 g of calcium carbonate.
   Number of moles $= \dfrac{mass}{M_r}$
   Number of moles $= \dfrac{200}{100}$
   $= 2$ mol
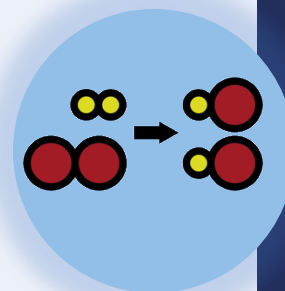
4. Calculate the mass of 0.75 moles of calcium carbonate.
   Number of moles $= \dfrac{mass}{M_r}$
   $0.75 = \dfrac{m}{100}$
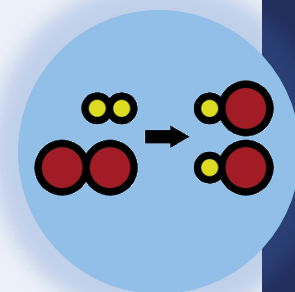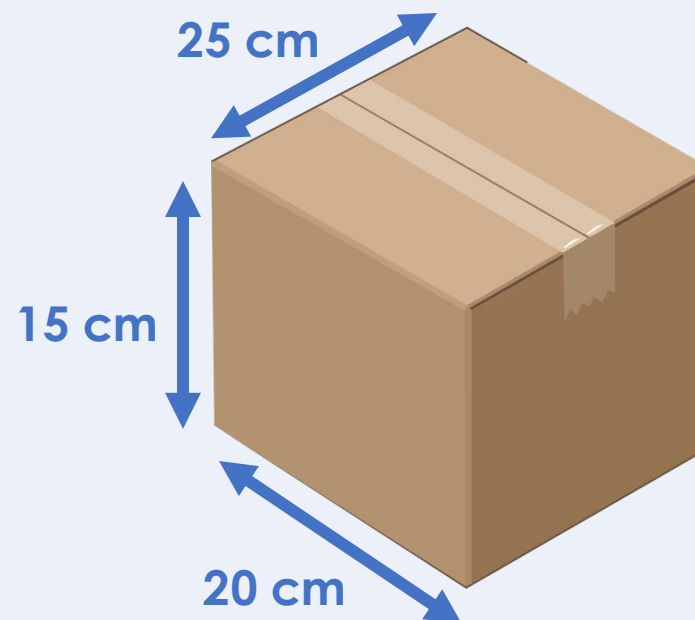   **$= 75$ g**

Do Now

Prior Knowledge Review: Concentration

Do Now:

1. State how many particles there are in 1 mole of a substance.
2. Calculate the M_r of calcium carbonate ($CaCO_3$). Ca=40, C=12, O=16
3. Calculate the number of moles in 200 g of calcium carbonate.
4. Calculate the mass of 0.75 moles of calcium carbonate.

Drill:

1. State the unit of mass (in chemistry).
2. Calculate the volume of this box.
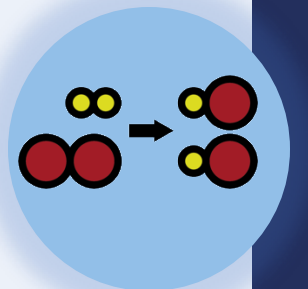3. Convert this to dm^3.

25 cm

15 cm

20 cm

Prior Knowledge Review: Concentration

Read Now:

Concentration is the mass of a solute per unit volume of a solution. When sugar is dissolved in water, sugar is the solute, water is the solvent and the sugary water is the solution. The mass of sugar in the given volume of solution is its concentration, so the greater the mass of sugar that is dissolved in the solution, the more concentrated it is. We can calculate concentration in terms of mass per unit volume using the equation: concentration = mass/volume.

1. Define concentration.
2. Explain the difference between a solute and a solvent.
3. Describe the relationship between the mass of a solute that is dissolved in a solution and its concentration.
4. State the equation that links concentration, mass and volume.

Prior Knowledge Review: Concentration

C4.3.4

Science
Mastery

Following this lesson, students will be able to:

- Define concentration

- Convert between cm^3 and dm^3

- Calculate concentration from a given mass and volume

Key Words:

mass   volume   concentration

solute   solution

This is the fix-it portion of the lesson

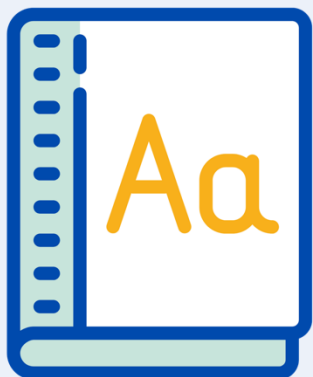The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the **pre-unit quiz**.

- 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.
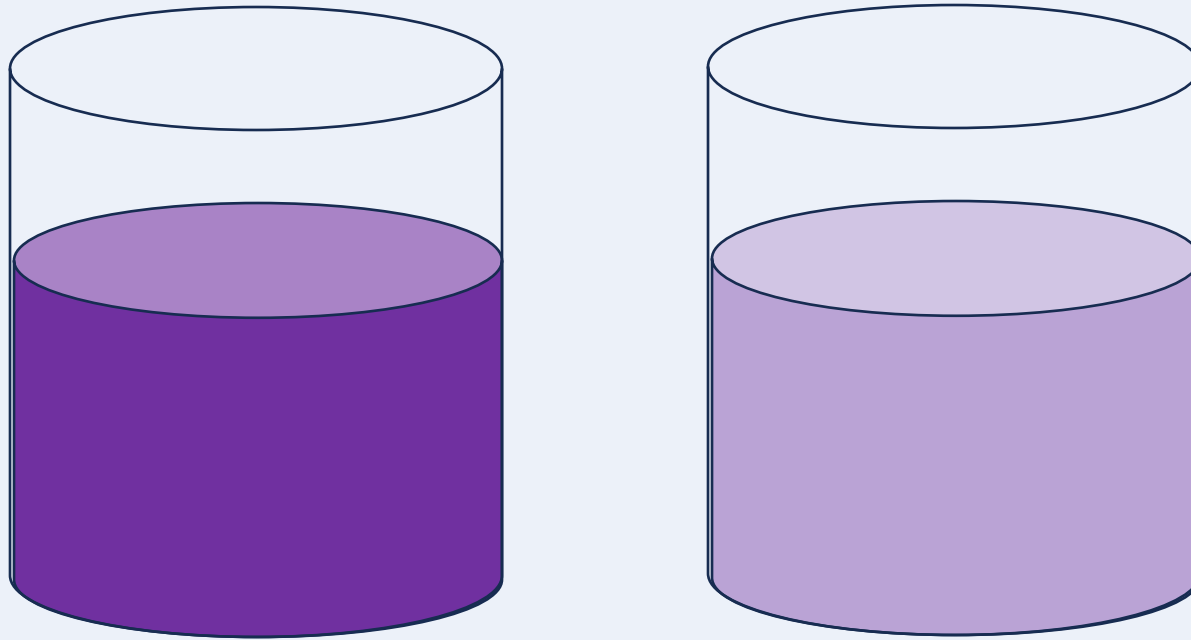
Answer the questions below.

1. What is the relative formula mass of NO_2? (A_r: N = 14; O = 16)
   - ☐ A. 30
   - ☐ B. 44
   - ☑ C. 46

2. What is the mass of 0.02 mol of Na_2CO_3? (M_r: 106)
   - ☑ A. 2.12 g
   - ☐ B. 21.2 g
   - ☐ C. 5 300 g

3. What is the amount of substance in 26.5 g of Na_2CO_3? (M_r: 106)
   - ☐ A. 4 mol
   - ☑ B. 0.25 mol
   - ☐ C. 2 809 mol

Which is more concentrated?

Purple juice is added to two glasses of water.

The concentration of a solution tells you how much **solute** is dissolved **in a given volume** of a **solution**.

Volume

Volume is the **amount of space** that a substance or object takes up.

How many **units of volume** can you think of?

m^3 (cubic metres)
cm^3 (cubic centimetres)
L (Litres)
mL (millilitres)

Scientists use a different unit of volume: **dm^3** (cubic decimetres)

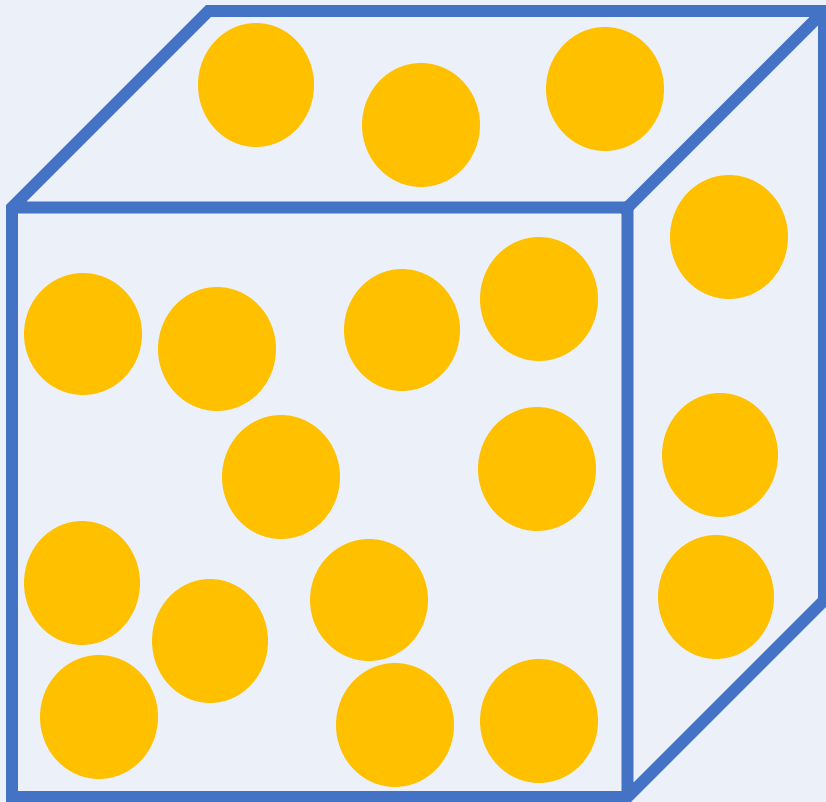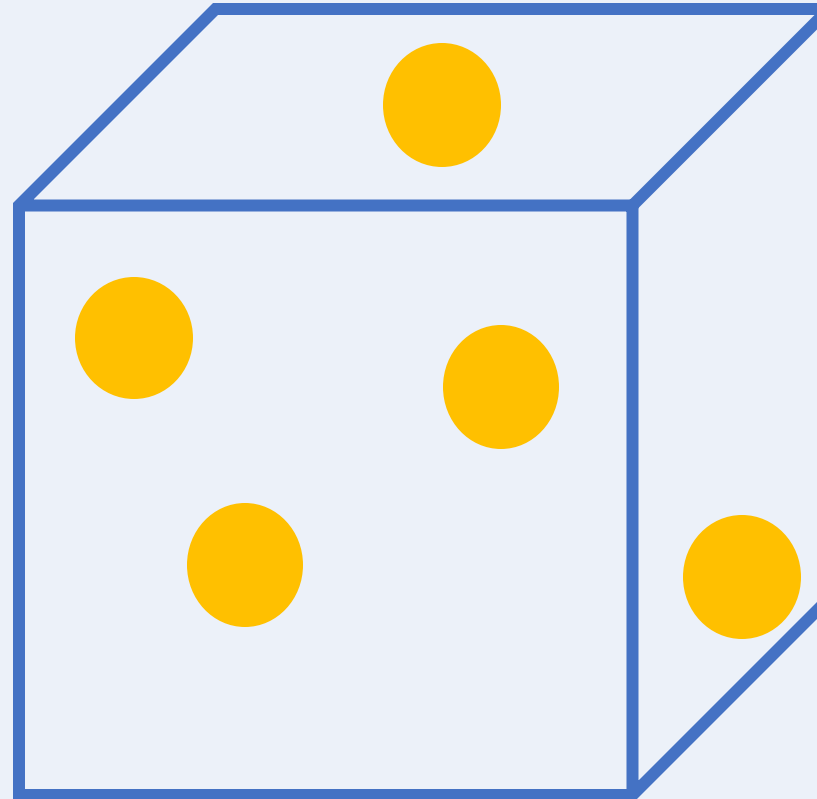**1 dm^3 = 1 L = 1000 cm^3**

Concentration

g   dm³

Concentration is the **mass** of a solute in a certain **volume** of solvent.
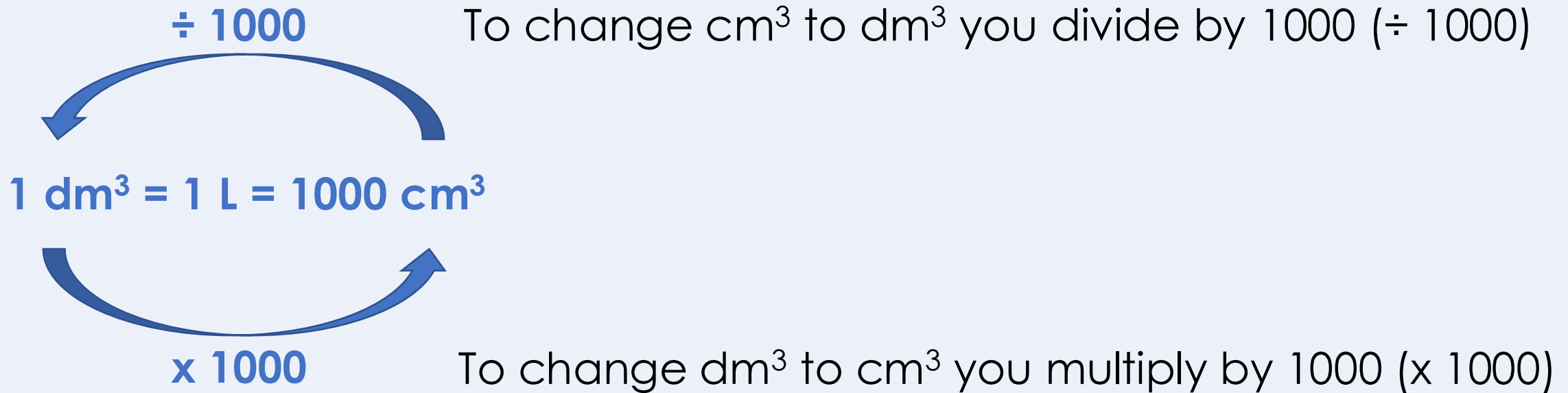
So, the unit of concentration is g/dm³

High concentration

Low concentration

Converting between units of volume

$\div$ **1000**

To change cm^3 to dm^3 you divide by 1000 ($\div$ 1000)

1 dm^3 = 1 L = 1000 cm^3

x 1000

To change dm^3 to cm^3 you multiply by 1000 (x 1000)

Let's practice converting these volumes to different units.

1000 cm^3 = ___**1**___ dm^3

5000 cm^3 = ___**5**___ dm^3

2403 cm^3 = ___**2.403**___ dm^3

145 cm^3 = ___**0.145**___ dm^3

1 dm^3 = ___**1000**___ cm^3

10 dm^3 = ___**10000**___ cm^3

179 dm^3 = ___**179000**___ cm^3

0.2 dm^3 = ___**200**___ cm^3

Sugar is added to hot water and stirred. After a while it can't be seen anymore.

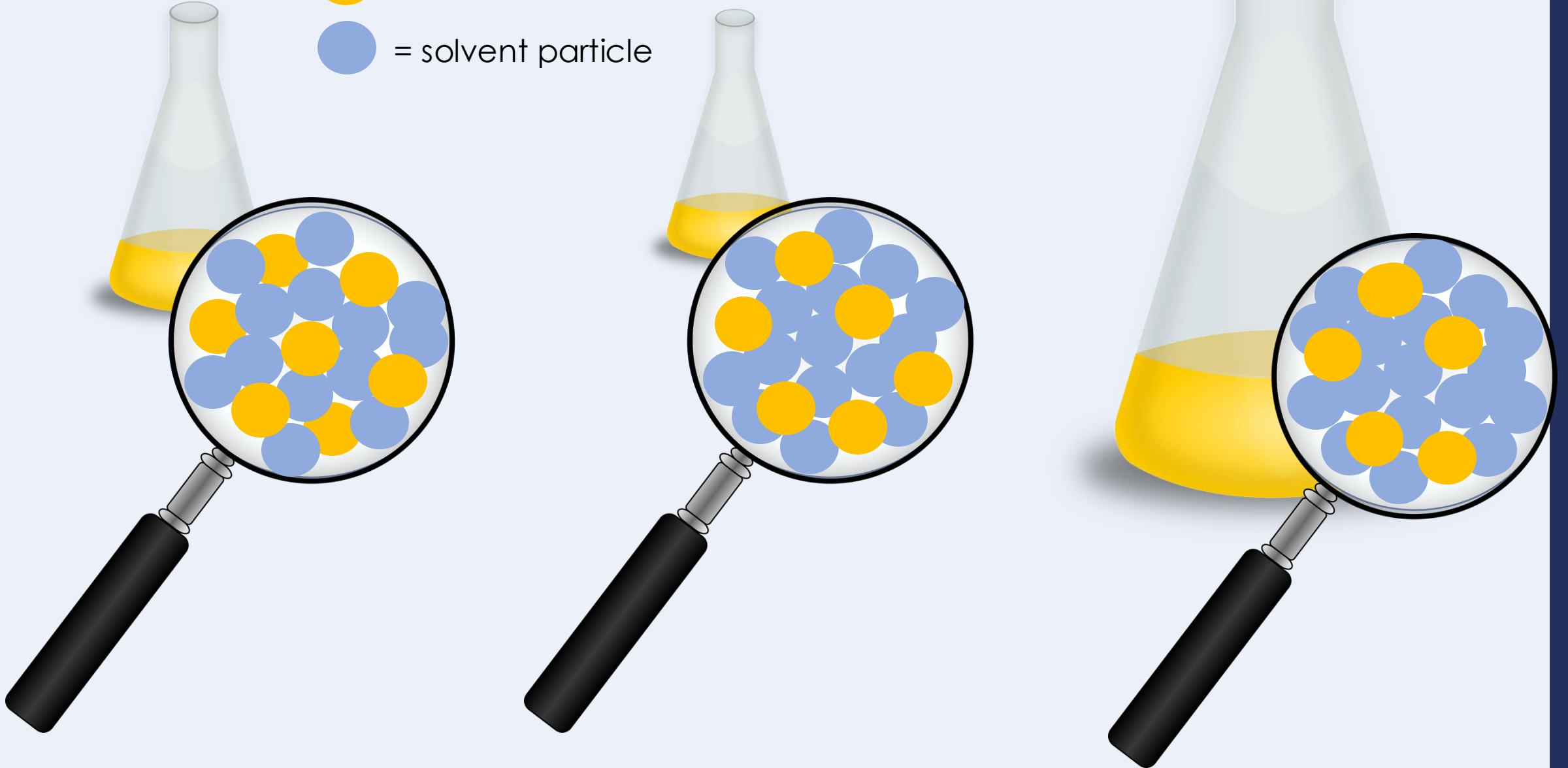**Choose the correct statements below.**

The sugar melts.

The sugar joins with the water to make a new liquid.

The sugar breaks up into smaller pieces and mixes with the water.

The sugar disappears.

Which flask contains the most concentrated solution?

= solute particle

= solvent particle

Check for understanding

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.

÷

Mass   volume

g/dm³

The volume needs to be in dm³.

$cm^3 ÷ 1000 = dm^3$

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

$$Concentration = \frac{mass}{volume}$$

$$2\ 000 cm^3 ÷ 1\ 000 = 2\ dm^3$$

$$Concentration = \frac{6}{2}$$

$$= \underline{\textbf{3 g/ dm}^3}$$

How do we calculate concentration?

The volume needs to be in dm^3.

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

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

$$\text{Concentration} = \frac{8.75}{0.25}$$

$$= \underline{\textbf{35 g/dm}^3}$$

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

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

$$\text{Concentration} = \frac{160}{0.3}$$

$$= \textbf{533 g/dm}^3$$

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.

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 g/dm^3.

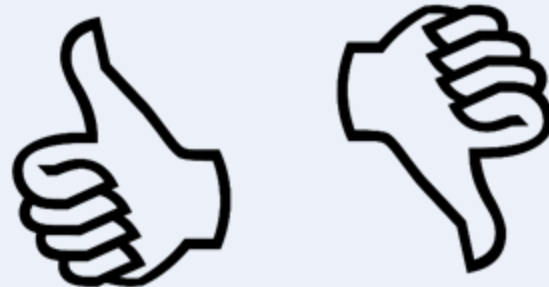What mass of glucose was dissolved in the solution?

500 cm^3 = 0.5 dm^3

$$\textbf{Concentration} = \frac{\textbf{mass}}{\textbf{volume}}$$

$$\textbf{5 g/dm3} = \frac{\textbf{mass}}{\mathbf{0.5}}$$

Mass = 2.5 g

True or false?

1. To convert cm^3 into dm^3 you need to multiply by 1000.

   False

2. 250 cm^3 = 0.25 dm^3 **True**

3. 250 cm^3 of a 4 g/dm^3 solution contains 1 g of solute. **True**

4. 0.5 dm^3 = 5000 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**

Drill

1. Define concentration.
2. State the equation that links concentration, mass and volume.
3. State the unit for mass.
4. State the unit for volume
5. State the unit for concentration.
6. Convert 5000 cm^3 into dm^3.
7. Define solute.
8. Define solvent.
9. Define solution.

Drill answers

1. The mass of a solute per unit volume (of solution).
2. $\text{Concentration} = \dfrac{\text{mass}}{\text{volume}}$
3. g
4. dm^3
5. g/dm^3
6. $5\ dm^3$
7. The (solid) substance that is dissolved in the solvent.
8. The liquid into which the solute is dissolved.
9. The mixture formed when a solute dissolves in a solvent.

Answer the questions below.

1. Select the answer below which is equal to 0.05 dm^3.
   - ❑ A. 500 cm^3
   - ☑ B. 50 cm^3
   - ❑ C. 0.00005 cm^3

2. 10 g of a solute was used to make a solution with a volume of 25 dm^3. What was the concentration of the solution?
   - ❑ A. 250 g/dm^3
   - ☑ B. 0.4 g/dm^3
   - ❑ C. 2.5 g/dm^3

3. 200 cm^3 of a solution has a concentration of 25 g/cm3. What mass of solute was dissolved in it?
   - ❑ A. 5000 g
   - ❑ B. 125 g
   - ☑ C. 5 g

Lesson C4.3.4	
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!