Concentration of solutions

Worked solutions

GCSE science calculations

This topic online

1 Bilal dissolves 12 g of sodium chloride in water to make 0.50 dm^3 of solution.

Calculate the concentration of the solution in g/dm^3. (2 marks)

Concentration = mass ÷ volume

concentration = 12 ÷ 0.50

24 g/dm^3

2 A technician at a school in Leeds makes 1.5 dm^3 of copper sulfate solution using 7.5 g of copper sulfate.

Calculate the concentration of the solution in g/dm^3. (2 marks)

Concentration = mass ÷ volume

concentration = 7.5 ÷ 1.5

5 g/dm^3

3 A sports drink is made by dissolving 0.80 g of salt in water. The final volume of the drink is 0.25 dm^3.

Calculate the concentration of salt in the drink in g/dm^3. (2 marks)

Concentration = mass ÷ volume

concentration = 0.80 ÷ 0.25

3.2 g/dm^3

4 Grace dissolves 4.0 g of citric acid in water and makes the solution up to 250 cm^3 in a volumetric flask.

Calculate the concentration of the solution in g/dm^3. (3 marks)

Change cm^3 to dm^3: divide by 1000

250 cm^3 = 250 ÷ 1000 = 0.25 dm^3

Concentration = mass ÷ volume

concentration = 4.0 ÷ 0.25

16 g/dm^3

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5 A gardener in Swansea makes a concentrated plant feed by dissolving 1.75 g of potassium nitrate in water. The volume of the concentrated feed is 50 cm^3. She will dilute it before watering her plants.

Calculate the concentration of the concentrated plant feed in g/dm^3. (3 marks)

Change cm^3 to dm^3: divide by 1000

$50\ cm^3 = 50 \div 1000 = 0.050\ dm^3$

Concentration = mass ÷ volume

concentration = 1.75 ÷ 0.050

35 g/dm^3

6 Amara weighs some sodium carbonate into a beaker on a balance.

- Mass of the empty beaker = 48.20 g
- Mass of the beaker and sodium carbonate = 51.20 g

She dissolves all of the sodium carbonate and makes the solution up to 200 cm^3.

Calculate the concentration of the solution in g/dm^3. (3 marks)

Use only the mass of the solid, not the beaker

mass = 51.20 - 48.20 = 3.00 g

Change cm^3 to dm^3: divide by 1000

$200\ cm^3 = 200 \div 1000 = 0.200\ dm^3$

Concentration = mass ÷ volume

concentration = 3.00 ÷ 0.200

15 g/dm^3

7 Mr Novak needs 500 cm^3 of sodium hydroxide solution with a concentration of 40 g/dm^3 for a class practical.

Calculate the mass of sodium hydroxide he must dissolve. (3 marks)

Change cm^3 to dm^3: divide by 1000

$500\ cm^3 = 500 \div 1000 = 0.500\ dm^3$

Concentration = mass ÷ volume

40 = mass ÷ 0.500

Multiply both sides by 0.500

mass = 40 × 0.500

20 g

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8 Hamza has 9.0 g of magnesium sulfate. He wants to make a solution with a concentration of 30 g/dm^3.

Calculate the volume of solution he should make, in cm^3. (3 marks)

Concentration = mass ÷ volume

30 = 9.0 ÷ volume

Rearrange: volume = mass ÷ concentration

volume = 9.0 ÷ 30

volume = 0.30 dm^3

Change dm^3 to cm^3: multiply by 1000

volume = 0.30 × 1000

300 cm^3

9 A nurse at a hospital in Glasgow has a glucose solution with a concentration of 18 g/dm^3.

Calculate the volume of this solution that contains 2.5 g of glucose. Give your answer in cm^3 to 2 significant figures. (3 marks)

Concentration = mass ÷ volume, so volume = mass ÷ concentration

volume = 2.5 ÷ 18

volume = 0.13888... dm^3

Keep the full value in the calculator

Change dm^3 to cm^3: multiply by 1000

volume = 0.13888... × 1000 = 138.88... cm^3

140 cm^3

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10 Elif has 100 cm^3 of a food dye solution with a concentration of 60 g/dm^3. She adds 200 cm^3 of water and stirs.

Calculate the concentration of the diluted solution in g/dm^3. Show your working. (4 marks)

Change cm^3 to dm^3: divide by 1000

$100\ cm^3 = 0.100\ dm^3$

Mass of dye = concentration × volume

mass = $60 \times 0.100 = 6.0\ g$

Use the total volume after mixing, not just the 200 cm^3 of water

total volume = $100 + 200 = 300\ cm^3$

Change cm^3 to dm^3: divide by 1000

$300\ cm^3 = 300 \div 1000 = 0.300\ dm^3$

Concentration = mass ÷ volume

concentration = $6.0 \div 0.300$

$20\ g/dm^3$

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11 Two bottles of salt solution are on a shelf in a school lab.

- Bottle A: 5.0 g of salt in 125 cm^3 of solution
- Bottle B: 18 g of salt in 0.40 dm^3 of solution

a. Calculate the concentration of the solution in bottle A in g/dm^3.

b. Calculate the concentration of the solution in bottle B in g/dm^3.

c. Which bottle holds the more concentrated solution? Show your working.

(4 marks)

a)

Change cm^3 to dm^3: divide by 1000

$125\ cm^3 = 125 \div 1000 = 0.125\ dm^3$

Concentration = mass ÷ volume

concentration = 5.0 ÷ 0.125

$40\ g/dm^3$

b)

Volume is already in dm^3

concentration = 18 ÷ 0.40

$45\ g/dm^3$

c)

$45\ g/dm^3 > 40\ g/dm^3$

B

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12 Oliver mixes two sugar solutions in a jug.

- 150 cm^3 of a solution with a concentration of 24 g/dm^3
- 80 cm^3 of a solution with a concentration of 50 g/dm^3

Calculate the concentration of sugar in the mixture in g/dm^3.
Give your answer to 2 significant figures. Show your working.

(5 marks)

Change cm^3 to dm^3: divide by 1000

$150\ cm^3 = 0.150\ dm^3$

$80\ cm^3 = 0.080\ dm^3$

Mass of sugar = concentration × volume

mass 1 = $24 \times 0.150 = 3.6$ g

mass 2 = $50 \times 0.080 = 4.0$ g

total mass = $3.6 + 4.0 = 7.6$ g

total volume = $0.150 + 0.080 = 0.230\ dm^3$

Concentration = mass ÷ volume

concentration = $7.6 \div 0.230$

concentration = $33.04...\ g/dm^3$

$33\ g/dm^3$

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