

# GCSE Combined Science: Trilogy

## Worksheet: Concentration of solutions

|                       |                          |                              |                                   |
|-----------------------|--------------------------|------------------------------|-----------------------------------|
| TIME<br><b>35 min</b> | TOTAL<br><b>32 marks</b> | CALCULATOR<br><b>Allowed</b> | DIFFICULTY<br><b>Easy, Medium</b> |
|-----------------------|--------------------------|------------------------------|-----------------------------------|

**Topics:** Concentration of solutions

|                   |                    |                   |
|-------------------|--------------------|-------------------|
| <b>NAME</b> _____ | <b>CLASS</b> _____ | <b>DATE</b> _____ |
|-------------------|--------------------|-------------------|

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The concentration of a solution can be calculated using the equation:

concentration in  $\text{g/dm}^3$  = mass of solute in g  $\div$  volume of solution in  $\text{dm}^3$

0 1 . 1

A student dissolved 12 g of sodium chloride in water to make  $0.50 \text{ dm}^3$  of solution.

Calculate the concentration of the solution.

.....

.....

.....

.....

Concentration = .....  $\text{g/dm}^3$

**[2 marks]**

0 1 . 2

How many  $\text{cm}^3$  are there in  $1 \text{ dm}^3$ ?

.....

.....

.....

.....  
**[1 mark]**

0 1 . 3

Calculate the mass of solute in  $2.0 \text{ dm}^3$  of a solution with a concentration of  $15 \text{ g/dm}^3$ .

.....

.....

.....

.....

Mass = ..... g

[2 marks]

0 2

concentration in  $\text{g/dm}^3$  = mass of solute in g  $\div$  volume of solution in  $\text{dm}^3$

0 2 . 1

Which of these is a correct unit for concentration?

Tick (✓) **one** box.

g

☐

$\text{cm}^3$

☐

$\text{g/dm}^3$

☐

$\text{dm}^3$

☐

[1 mark]

0 2 . 2

How many  $\text{cm}^3$  are there in  $0.250 \text{ dm}^3$ ?

.....

.....

.....

.....

[1 mark]

0 2 . 3

A solution has a volume of 1500 cm<sup>3</sup>.  
Give this volume in dm<sup>3</sup>.

.....

.....

.....

.....  
[1 mark]

0 3

A student found the concentration of a salt solution by evaporating the water.  
The student:

- weighed an empty evaporating basin
- added 25.0 cm<sup>3</sup> of the salt solution to the basin
- heated the basin gently until all the water had evaporated
- weighed the basin and dry salt.

Table 1 shows the results.

Table 1

| Measurement                    | Mass in g |
|--------------------------------|-----------|
| Empty evaporating basin        | 45.12     |
| Evaporating basin and dry salt | 46.02     |

0 3 . 1

Calculate the mass of salt in 25.0 cm<sup>3</sup> of the solution.

.....

.....

.....

Mass = ..... g  
[1 mark]

0 3 . 2

Calculate the concentration of the salt solution in g/dm<sup>3</sup>.

.....

.....

.....

.....

Concentration = ..... g/dm<sup>3</sup>

[2 marks]

0 3 . 3

The student heated and reweighed the basin until the mass stopped changing. Explain why.

.....

.....

[1 mark]

0 3 . 4

Calculate the mass of salt in 1.5 dm<sup>3</sup> of this solution.

.....

.....

.....

Mass = ..... g

[1 mark]

0 4

An oral rehydration sachet contains 2.6 g of sodium chloride. A nurse dissolves one sachet in water to make 1 dm<sup>3</sup> of solution for a patient to drink.

0 4 . 1

Calculate the concentration of sodium chloride in the rehydration solution.

.....

.....

.....

Concentration = ..... g/dm<sup>3</sup>

[1 mark]

0 4 . 2

The nurse only has a  $500\text{ cm}^3$  bottle available.

Calculate the mass of sodium chloride needed to make  $500\text{ cm}^3$  of solution with the same concentration.

.....

.....

.....

.....

Mass = ..... g

[2 marks]

0 4 . 3

Suggest why it is important that the concentration of a rehydration solution is accurate.

.....

.....

[1 mark]

0 5

Many chemical reactions take place in solutions. The concentration of a solution can be measured in  $\text{g/dm}^3$ .

0 5 . 1

A student dissolved  $5.0\text{ g}$  of copper sulfate in water to make  $250\text{ cm}^3$  of solution. Calculate the concentration of the solution in  $\text{g/dm}^3$ .

.....

.....

.....

.....

Concentration = .....  $\text{g/dm}^3$

[2 marks]

0 5 . 2

Calculate the mass of sodium hydroxide in  $25.0 \text{ cm}^3$  of a solution with a concentration of  $40 \text{ g/dm}^3$ .

.....

.....

.....

.....

Mass = ..... g

[2 marks]

0 5 . 3

A student needs  $3.0 \text{ g}$  of potassium nitrate. The student has a solution of potassium nitrate with a concentration of  $60 \text{ g/dm}^3$ .

Calculate the volume of solution, in  $\text{cm}^3$ , that contains  $3.0 \text{ g}$  of potassium nitrate.

.....

.....

.....

.....

Volume = .....  $\text{cm}^3$

[2 marks]

0 6

A student is making  $250 \text{ cm}^3$  of a solution of known, accurate concentration from a solid solute.

0 6 . 1

Name the piece of apparatus used to weigh the solid solute accurately.

.....

.....

.....

.....

[1 mark]

0 6 . 2

After the solute is dissolved in a small volume of water in a beaker, the solution is transferred to a 250 cm<sup>3</sup> volumetric flask and made up to the mark.  
Name the piece of apparatus that should be used to add the final few cm<sup>3</sup> of water accurately.

.....

.....

.....

.....  
[1 mark]

0 6 . 3

Explain why a volumetric flask, rather than a beaker, is used to make the solution up to its final volume.

.....

.....

[1 mark]

0 7

Table 2 shows information about three soft drinks.

Table 2

| Drink | Volume of drink in cm <sup>3</sup> | Mass of sugar in g |
|-------|------------------------------------|--------------------|
| P     | 330                                | 35.0               |
| Q     | 500                                | 32.0               |
| R     | 250                                | 22.5               |

0 7 . 1

Calculate the concentration of sugar in drink P in g/dm<sup>3</sup>.  
Give your answer to 3 significant figures.

.....

.....

.....

.....

Concentration = ..... g/dm<sup>3</sup>  
[2 marks]

0 7 . 2

Which drink has the highest concentration of sugar?

Show how you worked out your answer.

.....

.....

.....

.....

[2 marks]

0 7 . 3

A person drinks  $200 \text{ cm}^3$  of drink R.

Calculate the mass of sugar the person drinks.

.....

.....

.....

.....

Mass = ..... g

[2 marks]

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**END OF QUESTIONS**

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# Mark scheme

## GCSE Combined Science: Trilogy · Worksheet: Concentration of solutions · 32 marks

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### Question 1 (5 marks)

#### 01.1 [2 marks]

**Answer:**  $24 \text{ g/dm}^3$

- $12 \div 0.50$  (1)
  - $24 \text{ (g/dm}^3\text{)}$  (1)
- 

#### 01.2 [1 mark]

**Answer:** 1000

- 1000 (1)
- 

#### 01.3 [2 marks]

**Answer:** 30 g

- $15 \times 2.0$  (1)
  - 30 (g) (1)
- 

### Question 2 (3 marks)

#### 02.1 [1 mark]

**Correct:**  $\text{g/dm}^3$

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#### 02.2 [1 mark]

**Answer:**  $250 \text{ cm}^3$

- $250 \text{ (cm}^3\text{)}$  (1)
- 

#### 02.3 [1 mark]

**Answer:**  $1.5 \text{ dm}^3$

- $1.5 \text{ (dm}^3\text{)}$  (1)
-

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### Question 3 (5 marks)

03.1 [1 mark]

**Answer:** 0.90 g

- 0.90 (g) (1)

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03.2 [2 marks]

**Answer:** 36 g/dm<sup>3</sup>

- $25.0 \text{ cm}^3 = 0.0250 \text{ dm}^3$  (1)
- $0.90 \div 0.0250 = 36 \text{ (g/dm}^3\text{)}$  (1)

**Notes:** Allow ECF from part 1.

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03.3 [1 mark]

- to make sure that all of the water had evaporated (so only salt was weighed) (1)

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03.4 [1 mark]

**Answer:** 54 g

- 54 (g) (1)

**Notes:** Allow ECF from part 2.

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### Question 4 (4 marks)

04.1 [1 mark]

**Answer:** 2.6 g/dm<sup>3</sup>

- 2.6 (g/dm<sup>3</sup>) (1)

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04.2 [2 marks]

**Answer:** 1.3 g

- $2.6 \times (500 \div 1000)$  (1)
- 1.3 (g) (1)

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04.3 [1 mark]

- allow: too concentrated could make dehydration worse (draws water out of the body) / too dilute would be less effective at replacing lost salts (1)

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## Question 5 (6 marks)

### 05.1 [2 marks]

**Answer:**  $20 \text{ g/dm}^3$

- $250 \text{ cm}^3 = 0.25 \text{ dm}^3$  (1)
- $5.0 \div 0.25 = 20 \text{ (g/dm}^3\text{)}$  (1)

**Notes:** An answer of 0.02 scores 1 mark.

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### 05.2 [2 marks]

**Answer:** 1.0 g

- $40 \times 0.0250$  (1)
  - 1.0 (g) (1)
- 

### 05.3 [2 marks]

**Answer:**  $50 \text{ cm}^3$

- $3.0 \div 60 = 0.05 \text{ (dm}^3\text{)}$  (1)
  - $50 \text{ (cm}^3\text{)}$  (1)
- 

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## Question 6 (3 marks)

### 06.1 [1 mark]

**Answer:** (electronic) balance

- (electronic) balance (1)
- 

### 06.2 [1 mark]

**Answer:** (dropping) pipette

- (dropping) pipette (1)
- 

### 06.3 [1 mark]

- a volumetric flask measures one precise, accurate volume (marked with a single calibration line), whereas a beaker's scale is only approximate (1)
-

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### Question 7 (6 marks)

#### 07.1 [2 marks]

**Answer:**  $106 \text{ g/dm}^3$

- $35.0 \div 0.330$  (1)
  - $106 \text{ (g/dm}^3\text{)}$  (1)
- 

#### 07.2 [2 marks]

**Answer:** P ( $Q = 64 \text{ g/dm}^3$ ,  $R = 90 \text{ g/dm}^3$ )

- $Q = 64 \text{ (g/dm}^3\text{)}$  and  $R = 90 \text{ (g/dm}^3\text{)}$  (1)
- P has the highest concentration (1)

**Notes:** Allow comparison of the mass of sugar per  $100 \text{ cm}^3$ : P 10.6 g, Q 6.4 g, R 9.0 g.

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#### 07.3 [2 marks]

**Answer:** 18 g

- concentration of R =  $22.5 \div 0.250 = 90 \text{ (g/dm}^3\text{)}$  (1)
  - $90 \times 0.200 = 18 \text{ (g)}$  (1)
-