

GCSE Combined Science: Trilogy

Worksheet: Osmosis

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Osmosis

NAME _____

CLASS _____

DATE _____

- 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

A student put a cylinder of carrot into a 1.0 mol/dm^3 sugar solution for 30 minutes. The mass of the cylinder at the start was 2.23 g. The mass at the end was 1.94 g.

0 1 . 1

Calculate the percentage change in mass of the cylinder.
Give your answer to 1 decimal place.

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Percentage change = %

[2 marks]

0 1 . 2

Give the reason why the student blotted the cylinder dry before measuring its mass.

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[1 mark]

0 2

A student investigated the effect of the concentration of sucrose solution on potato tissue. The student cut potato cylinders with a cork borer, blotted each one dry, weighed it, placed it in sucrose solution for 24 hours, then blotted and reweighed it. Table 1 shows the mean percentage change in mass at each concentration. At 0.4 mol/dm^3 , the percentage changes in mass for the three repeats were -1.5% , -2.5% and -2.0% .

Table 1

Concentration of sucrose solution in mol/dm^3	Mean percentage change in mass
0.0	+12.0
0.2	+5.0
0.4	-2.0
0.6	-9.0
0.8	-15.5

0 2 . 1

The balance used has a resolution of 0.01 g . Explain what is meant by the resolution of a balance, and suggest one reason why using this balance might still not make the percentage change measurement fully accurate.

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[2 marks]

0 2 . 2

Calculate the uncertainty in the mean percentage change in mass at 0.4 mol/dm^3 .

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Uncertainty = %

[2 marks]

0 2 . 3

A different group of students, using the same balance and following the same method exactly, obtained a mean percentage change of -2.3% at 0.4 mol/dm^3 . Is this result **repeatable**, **reproducible**, or neither? Explain your answer.

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[2 marks]

0 3

A student put discs of beetroot into salt solutions of different concentrations. After 2 hours the student calculated the percentage change in mass of the discs.

Table 2 shows the results.

Table 2

Concentration of salt solution in mol/dm ³	0.00	0.10	0.20	0.30	0.40	0.50
Percentage change in mass	+9.0	+4.5	+0.5	-3.5	-6.5	-8.5

0 3 . 1

Figure 1

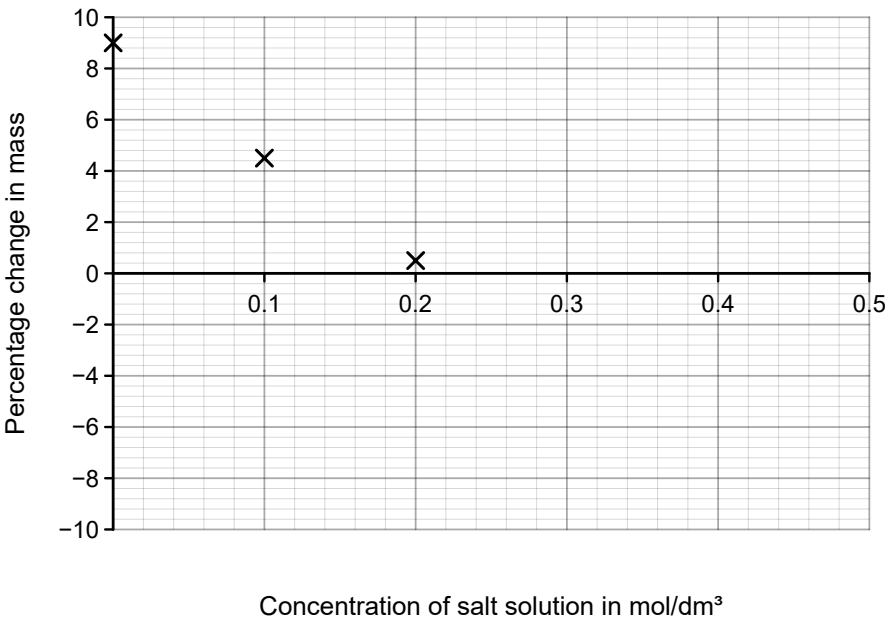


Figure 1 shows some of the results.

Complete Figure 1:

- plot the results for 0.30, 0.40 and 0.50 mol/dm³
- draw a line of best fit.

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[2 marks]

0 3 . 2

Use your graph to estimate the concentration of the solution inside the beetroot cells.

Give a reason for your answer.

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Concentration = mol/dm³

[2 marks]

0 3 . 3

Explain why the discs in 0.00 mol/dm³ salt solution gained mass.

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[2 marks]

0 3 . 4

Describe how the student could make sure that all the discs had the same surface area.

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[1 mark]

0 3 . 5

After 2 hours, the water in the 0.00 mol/dm³ tube had turned slightly red. Suggest why.

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[1 mark]

0 4

A scientist placed samples of red blood cells into three different solutions:

- solution **A** – pure water
- solution **B** – a salt solution with the same concentration as blood plasma
- solution **C** – a concentrated salt solution.

0 4 . 1

Describe and explain what happens to the red blood cells in solution **A**.

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[3 marks]

0 4 . 2

Predict what happens to the red blood cells in solution **C**.

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[1 mark]

0 4 . 3

Explain why a plant cell placed in pure water does not burst.

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[2 marks]

0 4 . 4

Fluids given to patients through a drip into a vein must have the same concentration as blood plasma.
Explain why.

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[2 marks]

0 5

A student put cylinders of parsnip into salt solutions of different concentrations for 30 minutes.
Table 3 shows the results.

Table 3

Concentration of salt solution in mol/dm ³	Mass at start in g	Mass at end in g	Percentage change in mass
0.0	2.12	2.23	+5.2
0.1	2.31	2.36	X
0.2	2.78	2.73	-1.8
0.3	2.01	1.91	-5.0
0.4	2.24	2.08	-7.1
0.5	2.51	2.26	-10.0

0 5 . 1

Calculate value X.
Give your answer to 1 decimal place.

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X = %

[2 marks]

0 5 . 2

Between which two concentrations is the concentration of the solution inside the parsnip cells?
Give a reason for your answer.

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[2 marks]

0 5 . 3

Explain why the cylinder in the 0.5 mol/dm^3 solution lost mass.

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[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Osmosis · 31 marks

Question 1 (3 marks)

01.1 [2 marks]

Answer: -13.0%

- $(1.94 - 2.23) \div 2.23 \times 100$ (1)
- -13.0 (%) (1)

Notes: The answer must show a decrease: 13.0 without the negative sign scores 1 mark only.

01.2 [1 mark]

- to remove solution from the surface, which would add to the mass (1)
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Question 2 (6 marks)

02.1 [2 marks]

- resolution is the smallest change in a reading that an instrument can detect / display (1)
 - e.g. even though the balance can detect small mass changes precisely, water left on (or removed from) the surface of the cylinder by blotting can add or remove more mass than the balance's resolution, so the result may not accurately measure osmosis alone (1)
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02.2 [2 marks]

Answer: $\pm 0.5\%$

- range = $-1.5 - (-2.5) = 1.0$ (%) (1)
 - uncertainty = $\pm$ half the range = ± 0.5 (%) (1)
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02.3 [2 marks]

- reproducible, not just repeatable — a different group of people carried out the investigation, which is what distinguishes reproducibility from repeatability, even though the same balance and method were used (1)
 - -2.3% lies within the uncertainty range of the original mean ($-2.0\% \pm 0.5\%$, i.e. -2.5% to -1.5%), which supports the result being reproducible (1)
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Question 3 (8 marks)

03.1 [2 marks]

- all three points plotted correctly ($\pm\frac{1}{2}$ small square) (1)
- a smooth curve of best fit through or close to all the points (1)

03.2 [2 marks]

Answer: about 0.21 mol/dm^3 (allow $0.20\text{--}0.23$)

- $0.20\text{--}0.23 \text{ (mol/dm}^3\text{)}$ (1)
- there is no change in mass at this concentration, so there is no net movement of water (the concentrations inside and outside the cells are equal) (1)

03.3 [2 marks]

- the water was more dilute than the solution inside the beetroot cells (1)
- so water moved into the cells by osmosis (through the partially permeable membrane) (1)

03.4 [1 mark]

- cut the discs with the same cork borer and cut each to the same thickness using a scalpel and ruler (1)

03.5 [1 mark]

- red pigment leaked out of cells that were cut / damaged when the discs were prepared (1)
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Question 4 (8 marks)

04.1 [3 marks]

- water moves into the cells by osmosis (1)
- because the water is more dilute than the solution inside the cells (1)
- the cells swell and burst (because they have no cell wall) (1)

04.2 [1 mark]

- they shrink / shrivel (as they lose water) (1)

04.3 [2 marks]

- a plant cell has a (strong) cell wall (1)
- which stops the cell expanding any further (the cell becomes turgid) (1)

04.4 [2 marks]

- there is no net movement of water into or out of the blood cells by osmosis (1)
 - so the cells do not burst or shrink (1)
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Question 5 (6 marks)

05.1 [2 marks]

Answer: +2.2%

- $(2.36 - 2.31) \div 2.31 \times 100$ (1)
- +2.2 (%) (1)

Notes: Allow the answer without a + sign.

05.2 [2 marks]

Answer: 0.1 and 0.2 mol/dm³

- 0.1 and 0.2 (mol/dm³) (1)
 - the cylinder gained mass at 0.1 and lost mass at 0.2, so there would be no net movement of water somewhere in between (1)
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05.3 [2 marks]

- the solution was more concentrated than the solution inside the parsnip cells (1)
 - so water moved out of the cells by osmosis (1)
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