Percentage change and osmosis

Worked solutions

GCSE science calculations

This topic online

1 A potato cylinder has a mass of 2.50 g. It is left in distilled water for 40 minutes. Its mass is then 2.80 g.

Calculate the percentage change in mass of the potato cylinder. (2 marks)

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(2.80 - 2.50)}{2.50} \times 100$$

$$\text{percentage change} = \frac{0.30}{2.50} \times 100$$

12%

2 A carrot cylinder has a mass of 3.20 g. After an hour in a strong salt solution its mass is 2.72 g.

Calculate the percentage change in mass of the carrot cylinder. (2 marks)

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(2.72 - 3.20)}{3.20} \times 100$$

$$\text{percentage change} = \frac{-0.48}{3.20} \times 100$$

Mass lost, so the answer is negative

−15%

3 Grace measures a beetroot cylinder before and after leaving it in a weak sugar solution.

	Before	After
Length in mm	30	31
Mass in g	1.60	1.84

Calculate the percentage change in mass of the beetroot cylinder. (2 marks)

Use the masses, not the lengths

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(1.84 - 1.60)}{1.60} \times 100$$

$$\text{percentage change} = \frac{0.24}{1.60} \times 100$$

15%

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4 A slice of apple has a mass of 2.4 g. After 30 minutes in a concentrated sugar solution, its mass is 2150 mg.

Calculate the percentage change in mass of the apple slice. Give your answer to 3 significant figures. (3 marks)

Same units first: 1 g = 1000 mg

2150 mg = 2150 ÷ 1000 = 2.15 g

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(2.15 - 2.4)}{2.4} \times 100$$

$$\text{percentage change} = \frac{-0.25}{2.4} \times 100$$

percentage change = −10.416...%

−10.4%

5 A small disc of cucumber has a mass of 850 mg. It is placed in distilled water. Later its mass is 1.02 g.

Calculate the percentage change in mass of the cucumber disc. (3 marks)

Same units first: 1 g = 1000 mg

850 mg = 850 ÷ 1000 = 0.85 g

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(1.02 - 0.85)}{0.85} \times 100$$

$$\text{percentage change} = \frac{0.17}{0.85} \times 100$$

20%

6 Kwame repeats his osmosis experiment four times with potato cylinders in the same salt solution.

Repeat	1	2	3	4
Percentage change in mass	−6.4	−6.8	−2.1	−6.6

Repeat 3 is anomalous.

Calculate the mean percentage change in mass. Do not include the anomalous result. (2 marks)

Leave out the anomalous −2.1

Mean = sum of values ÷ number of values

$$\text{mean} = \frac{-6.4 - 6.8 - 6.6}{3}$$

$$\text{mean} = \frac{-19.8}{3}$$

−6.6%

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7 A radish slice has a mass of 3.50 g. In distilled water its mass increases by 8%.
Calculate the mass of the radish slice after it has been in the water. (2 marks)

Percentage change = (final − initial) ÷ initial × 100

$$8 = \frac{(final - 3.50)}{3.50} \times 100$$

Divide both sides by 100

$$0.08 = \frac{(final - 3.50)}{3.50}$$

Multiply both sides by 3.50

$$final - 3.50 = 0.08 \times 3.50$$

$$final - 3.50 = 0.28$$

$$final = 3.50 + 0.28$$

3.78 g

8 A piece of sweet potato loses 20% of its mass in a salt solution. Its final mass is 2.24 g.
Calculate the mass of the sweet potato before it was put in the solution. (3 marks)

Percentage change = (final − initial) ÷ initial × 100
A 20% loss leaves 80% of the initial mass

$$0.80 \times initial = 2.24$$

$$initial = 2.24 \div 0.80$$

2.8 g

9 Five potato cylinders are weighed together. Their total mass is 6.20 g. After a day in a strong sugar solution, the percentage change in their total mass is −15%.

a. Calculate the mass the cylinders lost.

b. Calculate their total mass at the end. (3 marks)

a)

Change in mass = percentage change ÷ 100 × initial mass

$$change = 0.15 \times 6.20$$

0.93 g

b)

$$final\ mass = 6.20 - 0.93$$

5.27 g

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10 Aisha puts cubes of swede into sucrose solutions of different concentrations. Each cube has a different starting mass. Her results are in the table.

Concentration in mol/dm^3	Mass before in g	Mass after in g	Percentage change in mass
0.0	2.40	2.76	+15.0
0.2	2.20	2.31	+5.0
0.4	2.60	2.47	
0.6	2.50	2.25	−10.0

a. Calculate the missing percentage change in mass for 0.4 mol/dm^3.

b. The percentage change goes down evenly between 0.2 mol/dm^3 and 0.4 mol/dm^3. Estimate the concentration of sucrose solution that would give no change in mass.

Show your working.

(4 marks)

a)

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(2.47 - 2.60)}{2.60} \times 100$$

$$\text{percentage change} = \frac{-0.13}{2.60} \times 100$$

−5%

b)

No change in mass means 0%

+5% at 0.2 and −5% at 0.4, so 0% is halfway

$$\text{concentration} = \frac{(0.2 + 0.4)}{2}$$

0.3 mol/dm^3

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11 Amara writes her results like this.

Mass after 45 minutes in g	Mass at the start in g
3.06	3.40

a. Calculate the change in mass.

b. Calculate the percentage change in mass.

Show your working.

(3 marks)

a)

Initial = mass at the start = 3.40 g; final = 3.06 g

change = 3.06 - 3.40

-0.34 g

b)

Divide by the initial mass, not the final mass

$$\text{percentage change} = \frac{-0.34}{3.40} \times 100$$

-10%

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12 Ravi compares potato and sweet potato in distilled water.

Tissue	Mass at the start in g	Mass at the end in g
potato	1.85	2.03
sweet potato	2.60	2.79

Ravi says: "The sweet potato gained more mass, so it took in water faster."

a. Calculate the percentage change in mass of the potato. Give your answer to 2 significant figures.

b. Calculate the percentage change in mass of the sweet potato. Give your answer to 2 significant figures.

c. Which tissue had the larger percentage change in mass?

Show your working.

(5 marks)

a)

Percentage change = (final − initial) ÷ initial × 100

$$\text{percentage change} = \frac{(2.03 - 1.85)}{1.85} \times 100$$

$$\text{percentage change} = \frac{0.18}{1.85} \times 100$$

$$\text{percentage change} = 9.729...\%$$

9.7%

b)

$$\text{percentage change} = \frac{(2.79 - 2.60)}{2.60} \times 100$$

$$\text{percentage change} = \frac{0.19}{2.60} \times 100$$

$$\text{percentage change} = 7.307...\%$$

7.3%

c)

Compare percentages, not grams: the starting masses are different

9.7% is bigger than 7.3%

potato

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