

0 4

A student carried out an investigation using chicken eggs.

This is the method used.

1. Place 5 eggs in acid for 24 hours to dissolve the egg shell.
2. Measure and record the mass of each egg.
3. Place each egg into a separate beaker containing 200 cm<sup>3</sup> of distilled water.
4. After 20 minutes, remove the eggs from the beakers and dry them gently with a paper towel.
5. Measure and record the mass of each egg.

**Table 4** shows the results.

**Table 4**

<b>Egg</b>	<b>Mass of egg without shell in grams</b>	<b>Mass of egg after 20 minutes in grams</b>
1	73.5	77.0
2	70.3	73.9
3	72.4	75.7
4	71.6	73.1
5	70.5	73.8

0 4 . 1

Another student suggested that the result for egg **4** was anomalous.

Do you agree with the student?

Give a reason for your answer.

**[1 mark]**

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0 4 . 2

Calculate the percentage change in mass of egg 3.

[2 marks]

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Percentage change in mass = \_\_\_\_\_

0 4 . 3

Explain why the masses of the eggs increased.

[3 marks]

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0 4 . 4

Explain how the student could modify the investigation to determine the concentration of the solution inside each egg.

[3 marks]

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Turn over ►

Chicken egg shells contain calcium. Calcium ions are moved from the shell into the cytoplasm of the egg.

Do not write  
outside the  
box

**Table 5** shows information about the concentration of calcium ions.

**Table 5**

Location	Concentration of calcium ions in arbitrary units
Egg shell	0.6
Egg cytoplasm	2.1

0 4 . 5

Explain how calcium ions are moved from the shell into the cytoplasm of the egg.

**[3 marks]**

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12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(yes, because) the mass change (of egg 4) is much lower than the others	allow because it / egg 4 has gained (over) 50% less mass than the others allow it / egg 4 has gained 1.5 g and the others have all gained more than 3 g (unit required)	1	AO3 4.1.3.2
04.2	$\frac{75.7 - 72.4}{72.4} \times 100$  4.6 (%)	an answer of 4.6 / 4.56 / 4.558 scores <b>2</b> marks  or equivalent  allow 4.558 / 4.56 (%) allow any correct rounding of 4.558011049723757	1  1	AO2 4.1.3.2
04.3	(mass increased because) water entered by osmosis  from a dilute solution in the beaker to a more concentrated solution in the egg (cell)  through a partially permeable membrane	allow from an area of high water concentration in the beaker to an area of low water concentration in the egg (cell) allow ref to water potential allow ref to 'strong' and 'weak' solutions  ignore along / across concentration gradient  do <b>not</b> accept 'amount' in place of concentration  allow semi-permeable / selectively permeable membrane	1  1  1	AO2 4.1.3.2  AO2 4.1.3.2  AO1 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.	
<b>04.4</b>	use five (or more) different concentrations of salt / sugar solution (in beakers)	allow any number of concentrations provided it is more than four	1	AO3 4.1.3.2	
	(by) plotting percentage change (in mass / volume) on / using a graph		1		
	determine the concentration where the curve / line crosses the zero percentage change (in mass / volume)		1		
<b>04.5</b>	(ions are moved) from an area of low concentration to high concentration	allow against the concentration gradient allow in terms of solution do <b>not</b> accept molecules	1	AO2 4.1.3.3	
	(by) active transport		1		AO1 4.1.3.3
	(which) requires using energy		1		AO1 4.1.3.3
<b>Total</b>			<b>12</b>		