

(Transport in cells: diffusion, osmosis, active transport)

Q1.a)(2018)

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 cm³ 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

Egg	Mass of egg without shell in grams	Mass of egg after 20 minutes in grams
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

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]

Q1.b)(2018)

Calculate the percentage change in mass of egg 3.

[2 marks]

Percentage change in mass = _____

Q1.c)(2018)

Explain why the masses of the eggs increased.

[3 marks]

Q1.d)(2018)

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

[3 marks]

Q1.e)(2018)

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

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

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

[3 marks]

Q2.(2020)

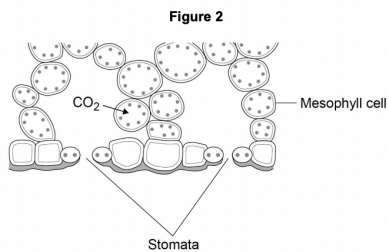
Diffusion is an important process in animals and plants.

What is meant by the term diffusion?

[2 marks]

Q3.(2020)

Figure 2 shows part of a leaf.



Molecules of carbon dioxide diffuse from the air into the mesophyll cells.

Which **two** changes will increase the rate at which carbon dioxide diffuses into the mesophyll cells?

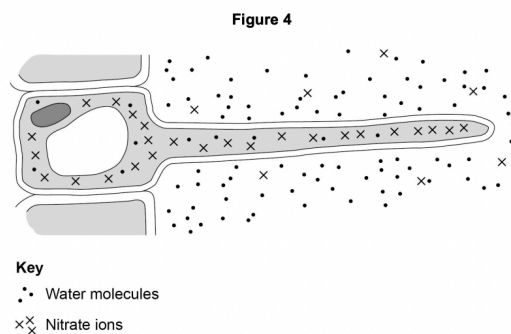
[2 marks]

Tick (✓) **two** boxes.

- | | |
|---|--------------------------|
| Decreased number of chloroplasts in the cells | ☐ |
| Decreased surface area of cells in contact with the air | ☐ |
| Increased carbon dioxide concentration in the air | ☐ |
| Increased number of stomata that are open | ☐ |
| Increased oxygen concentration in the air | ☐ |

Q4.a)(2020)

Figure 4 shows a root hair cell.



Name the process by which water molecules enter the root hair cell.

[1 mark]

Q4.b)(2020)

Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in **Figure 4** are transported into the root hair cell.

Use information from **Figure 4** in your answer.

[3 marks]

Name of process _____

Explanation _____

Q5.a)(2022)

A student investigated the effect of salt concentration on pieces of potato.

This is the method used.

1. Cut three pieces of potato of the same size.
2. Record the mass of each potato piece.
3. Add 150 cm³ of 0.4 mol/dm³ salt solution to a beaker.
4. Place each potato piece into the beaker.
5. After 30 minutes, remove each potato piece and dry the surface with a paper towel.
6. Record the mass of each potato piece.
7. Repeat steps 1 to 6 using different concentrations of salt solution.

What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Concentration of salt solution

☐

Mass of potato piece

☐

Time potato is left in salt solution

☐

Volume of salt solution

☐

Q5.b)(2022)

Why did the student dry the surface of each potato piece with a paper towel in step 5?

[1 mark]

Q5.c)(2022)

The student calculated the percentage change in mass of each potato piece.

For one potato piece:

- the starting mass was 2.5 g
- the end mass was 2.7 g.

Calculate the percentage increase in mass of the potato piece.

[2 marks]

Use the equation:

$$\text{percentage increase in mass} = \frac{\text{increase in mass}}{\text{starting mass}} \times 100$$

Percentage increase in mass = _____ %

Q5.d)(2022)

The student used the results from each potato piece to calculate the mean percentage change in mass at each concentration.

Table 2 shows the results.

Table 2

Concentration of salt solution in mol/dm ³	Mean percentage (%) change in mass
0.0	9.8
0.1	9.5
0.2	7.0
0.3	0.4
0.4	-1.4

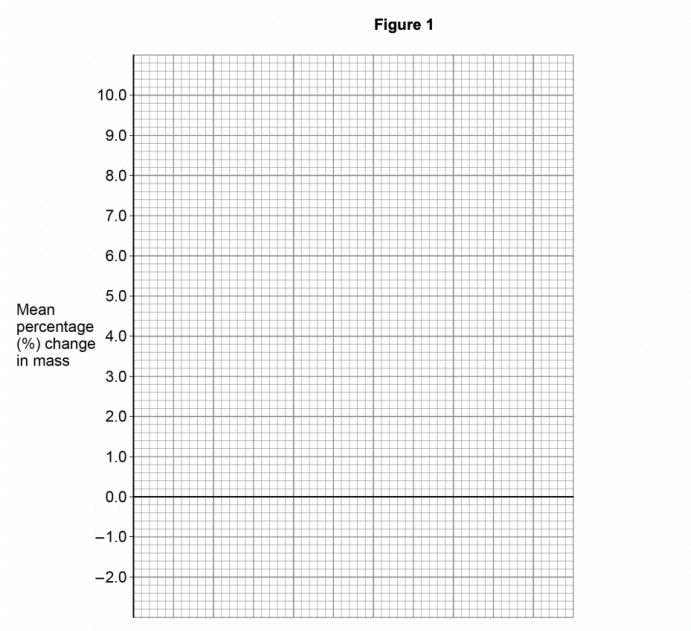
Complete Figure 1.

You should:

- label the x-axis
- use a suitable scale for the x-axis
- plot the data from Table 2
- draw a line of best fit.

[4 marks]

Q5.e)(2022)



What concentration of salt solution was equal to the concentration of the solution inside the potato pieces?

Use **Figure 1**.

[1 mark]

Concentration = _____ mol/dm³

Q5.f)(2022)

Explain why the potato pieces in the 0.4 mol/dm³ salt solution decreased in mass.

[3 marks]

Q6.a)(2022)

Table 6 shows information about five different organisms.

Table 6

Organism	Surface area in m ²	Volume in m ³	Surface area to volume ratio
A	6.04×10^{-8}	1.65×10^{-12}	36606:1
B	3.21×10^{-3}	1.25×10^{-6}	2568:1
C	9.96×10^{-3}	1.35×10^{-4}	X:1
D	4.61×10^{-1}	1.57×10^{-2}	29:1
E	1.99×10^1	6.12×10^0	3:1

Calculate value X in Table 6.

Give your answer to the nearest whole number.

[3 marks]

X (nearest whole number) = _____

Q6.b)(2022)

What is the relationship between the size of an organism and its surface area to volume ratio?

Use Table 6.

[1 mark]

Q6.c)(2022)

Organism B exchanges gases with the environment directly through its skin.

Organism D exchanges gases with the environment using its respiratory system.

Explain why organism D requires a respiratory system, but organism B does **not** require a respiratory system.

[2 marks]

Q6.d)(2022)

Table 6 is repeated below.

Table 6

Organism	Surface area in m ²	Volume in m ³	Surface area to volume ratio
A	6.04×10^{-8}	1.65×10^{-12}	36606:1
B	3.21×10^{-3}	1.25×10^{-6}	2568:1
C	9.96×10^{-3}	1.35×10^{-4}	X:1
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E	1.99×10^1	6.12×10^0	3:1

Table 7 shows information about organism D and organism E.

Table 7

Organism	Metabolic rate in arbitrary units
D	890
E	75

Organisms D and E both keep a constant body temperature (warm-blooded).

Explain why the metabolic rate of organism D is greater than the metabolic rate of organism E.

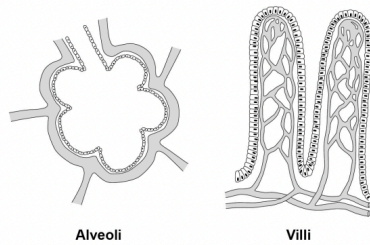
Use information from Table 6 and Table 7.

[4 marks]

Organism D and organism E both have alveoli in the lungs and villi in the small intestine.

Figure 8 shows some alveoli and some villi.

Figure 8



Describe how the alveoli and the villi are adapted to increase absorption.

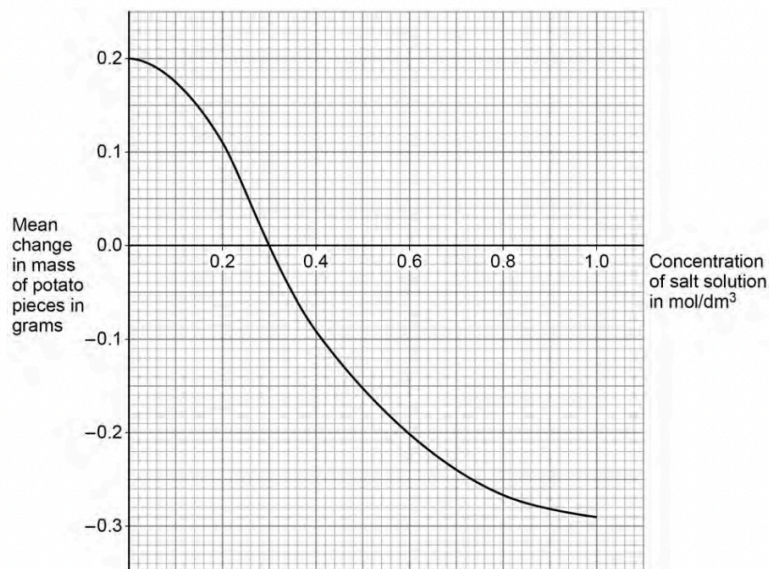
[4 marks]

Q7.a)(2024)

A student investigated the effect of concentration of salt solution on the mass of uncooked potato pieces.

Figure 4 shows the results.

Figure 4



Plan a method that could be used to obtain the results in **Figure 4**.

[6 marks]

Q7.b)(2024)

Explain the result for the potato pieces in the 0.6 mol/dm^3 salt concentration.

[3 marks]

Q7.c)(2024)

Explain why the result for the potato pieces at 1.0 mol/dm^3 was different from the result at 0.6 mol/dm^3 .

[2 marks]
