Q1.

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

This is the method used.

1.   Cut four pieces of a potato to the same size.

2.   Record the mass of each piece of potato.

3.   Put one of the pieces of potato into a beaker containing 100 cm^3 of 0.1 mol/dm^3 salt solution.

4.   Repeat step 3 using the other pieces of potato, each in a different concentration of salt solution.

5.   After 20 minutes, remove the pieces of potato from the solutions.

6.   Record the mass of each piece of potato.

(a)   Give **two** control variables the student used in the investigation.

1   _____

_____

2   _____

_____

(2)

(b)   The student needed to be sure the measurements were as accurate as possible.

What should be done to each piece of potato after removing from the solution and before measuring the mass?

_____

_____

(1)

(c)   Name the piece of apparatus the student could use to measure the mass of the pieces of potato.

_____

(1)

The table below shows the results.

Piece of potato	Concentration of salt solution in mol/dm³	Mass of piece of potato in grams			Percentage (%) change in mass of piece of potato
		At start	After 20 minutes	Change	
A	0.1	6.2	6.5	+ 0.3	+ 4.8
B	0.3	6.8	6.5	− 0.3	− 4.4
C	0.5	6.5	5.8	− 0.7	− 10.8
D	0.7	6.0	4.9	− 1.1	**X**

(d)   What was the resolution of the apparatus used for measuring mass?

Use the table above.

Tick (✓) **one** box.

0.01 g ☐   0.1 g ☐   1.0 g ☐   1.1 g ☐

(1)

(e)   Which piece of potato had the greatest change in mass in the investigation?

Tick (✓) **one** box.

A ☐   B ☐   C ☐   D ☐

(1)

(f)   Calculate value **X** in the table above.

Use the equation:

$$\text{percentage change in mass} = \frac{\text{change in mass in grams}}{\text{mass at start in grams}} \times 100$$

Give your answer to 1 decimal place.

_____

_____

_____

_____

_____

X (1 decimal place) = _____ %

(3)

(g)   What is the best way to present the data in the table above?

Tick (✓) **one** box.

Bar chart   ☐

Line graph   ☐

Pie chart   ☐

(1)

(h)   Complete the sentences.

Some of the pieces of potato decreased in mass because the potato cells

lost   _____ .

The decrease in mass was due to a process
called   _____ .

The structure surrounding each cell in a piece of potato is

partially   _____ .

(3)

(i)   The table above is repeated below.

Piece of potato	Concentration of salt solution in mol/dm³	Mass of piece of potato in grams			Percentage (%) change in mass of piece of potato
		At start	After 20 minutes	Change	
A	0.1	6.2	6.5	+ 0.3	+ 4.8
B	0.3	6.8	6.5	− 0.3	− 4.4
C	0.5	6.5	5.8	− 0.7	− 10.8
D	0.7	6.0	4.9	− 1.1	X

Estimate the concentration of salt solution that would **not** cause a change in mass of these pieces of potato.

_____

Concentration = _____ mol/dm³

(1)
(Total 14 marks)

Q2.

Plants are made of cells, tissues and organs.

(a)   Which part of a plant is the largest?

Tick (✓) **one** box.

A guard cell   ☐

A leaf   ☐

A root hair   ☐

(1)

Students investigated the effect of concentration of salt solution on the mass of pieces of potato.

This is the method used.

1.   Cut two pieces of potato to the same size.
2.   Record the mass of each piece of potato.
3.   Place one piece of potato into a beaker containing a dilute salt solution.
4.   Place the other piece of potato into a beaker containing a concentrated salt solution.
5.   After 20 minutes, remove each piece of potato from its solution.
6.   Record the change in mass of each piece of potato.
7.   Repeat steps 1 to 6 two more times.

The table below shows the results.

Solution	Change in mass of piece of potato in grams			
	Test 1	Test 2	Test 3	Mean
Dilute salt solution	1.1	1.1	1.4	**X**
Concentrated salt solution	−7.2	−6.8	−32.4	−7.0

(b)   Calculate mean value **X** in the table above.

_____

_____

_____

_____

                                            X = _____ grams

(2)

There is an anomalous result for the concentrated salt solution in the table.

(c)   Draw a ring around the anomalous result in the table above.

(1)

(d)   What did the students do with the anomalous result when calculating the
        mean in the table above?

_____

(1)

(e)   What name is given to a variable that is kept the same during an
        investigation?

        Tick ✓ **one** box.

        Control variable   [ ]

        Dependent variable   [ ]

        Independent variable   [ ]

(1)

(f)   One variable the students kept the same during the investigation was the size of the pieces of potato.

Which other variable did the students keep the same?

Tick ✓ **one** box.

Change in mass of pieces of potato ☐

Concentration of salt solution ☐

Time in the salt solution ☐

(1)

(g)   The pieces of potato in the concentrated salt solution decreased in mass.

Complete the sentence.

Choose the answer from the box.

excretion	osmosis	respiration

Water moved out of the potato by the process of _____.

(1)

(h)   The potato cells have a partially permeable membrane.

Which particles can pass through a partially permeable membrane?

Tick ✓ **one** box.

No particles ☐

Some particles ☐

All particles ☐

(1)

(i)   How could the students improve their investigation?

Tick ✓ **one** box.

Boil the pieces of potato at the start.   ☐

Leave the skin on some pieces of potato.   ☐

Use more concentrations of salt solution.   ☐

(1)
(Total 10 marks)

Q3.

The table below shows information about four jellyfish.

The jellyfish are listed in order of increasing size.

Jellyfish	Size of jellyfish	Surface area in mm²	Volume in mm³	Surface area to volume ratio
A	Smallest	3 600	1 200	**X**:1
B		50 000	25 000	2:1
C		1 800 000	6 000 000	0.3:1
D	Largest	7 500 000	125 000 000	0.06:1

(a) Calculate value **X** in the table above.

_____

_____

_____

X = _____

(2)

(b) Describe the relationship between the size of a jellyfish and its surface area to volume ratio.

Use the table above.

_____

_____

(1)

The jellyfish in the table above take oxygen into their cells by diffusion.

(c) Name **one** other substance that enters cells by diffusion.

Do **not** refer to oxygen in your answer.

_____

(1)

(d)   Suggest **two** factors that affect the rate of diffusion of oxygen into a
      jellyfish.

      1   _____

      _____

      2   _____

      _____

                                                                    (2)
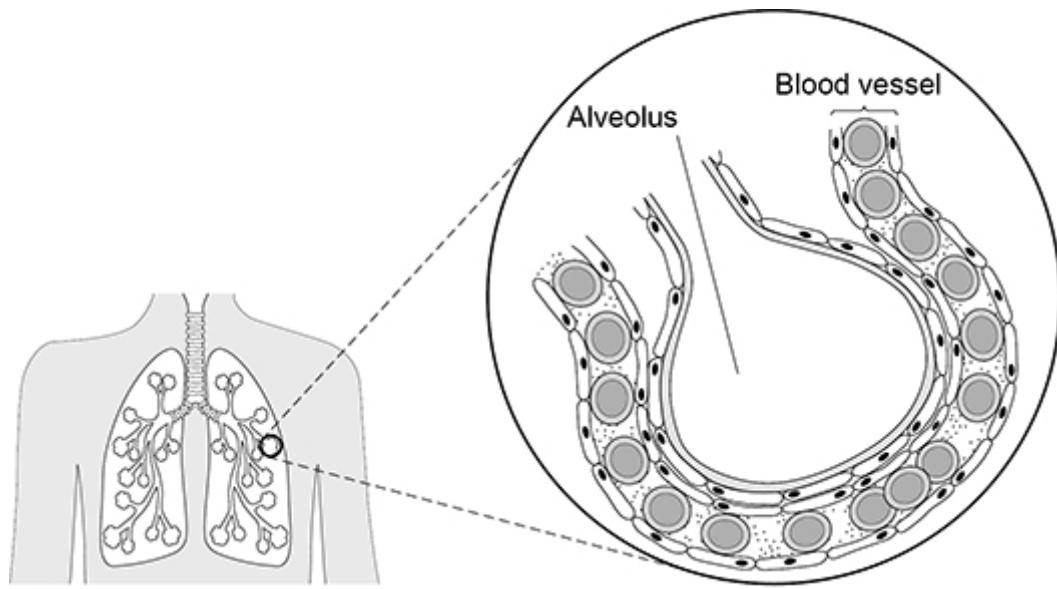
(e)   Some organisms take in oxygen using a respiratory system.

      In humans, gas exchange takes place in the lungs.

      Name the organs where gas exchange takes place in **fish**.

      _____

                                                                    (1)

(f)   The figure below shows parts of the human breathing system.

Explain how the human breathing system is adapted to maximise the rate of gas exchange.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)
(Total 13 marks)

Q4.

This question is about cells and transport.

(a)   Complete **Table 1**.

Table 1

	Contains genetic information
Mitochondria	
	Controls the movement of substances into and out of the cell

(3)

Cells in potatoes are plant cells.

Cells in potatoes do **not** contain chloroplasts.

(b)   What is the function of chloroplasts?

_____

_____

(1)

(c)   Name **one** type of cell in a potato plant that does **not** contain chloroplasts.

_____

(1)

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 cm^3 of 0.4 mol/dm^3 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.

(d)   What is the independent variable in the investigation?

Tick (✓) **one** box.

Concentration of salt solution ☐

Mass of potato piece ☐

Time potato is left in salt solution ☐

Volume of salt solution ☐

(1)

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

_____

_____

(1)

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

(f)   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.

Use the equation:

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

_____

_____

_____

_____

Percentage increase in mass = _____%

(2)

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
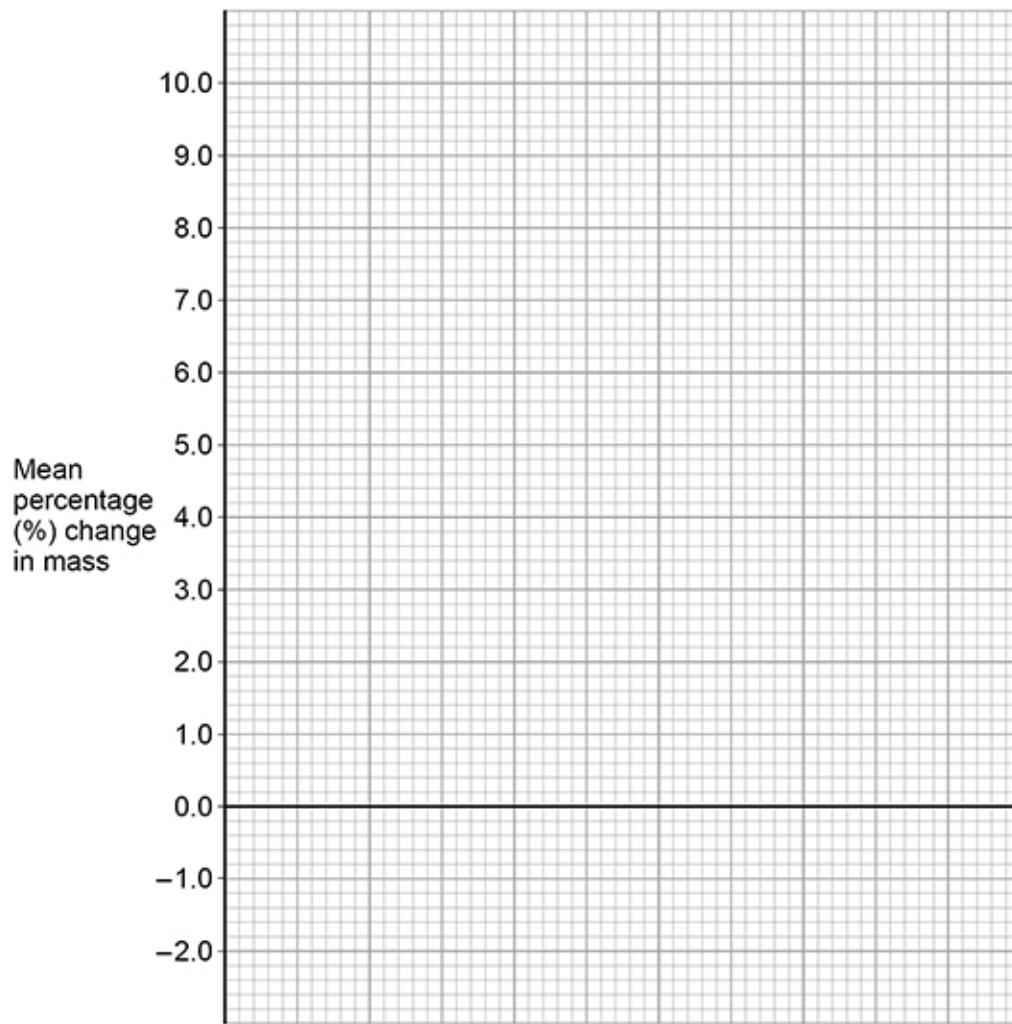
Concentration of salt solution in mol/dm³	Mean percentage (%) change in mass
0.0	9.8
0.1	9.5
0.2	7.0
0.3	0.4
0.4	−1.4

(g)   Complete the graph below.

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)

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

Use the graph above.

Concentration = _____ mol/dm^3

(1)

(i)   Explain why the potato pieces in the 0.4 mol/dm^3 salt solution decreased in mass.

_____

_____

_____

_____

_____

_____

(3)
(Total 17 marks)