# Past-paper walk-through

## Osmosis ▪ 3.2

eXercise

# Questions in this set

- 0610/21 N25 Q5 ▪ 1 mark
- 0610/23 N25 Q6 ▪ 1 mark
- 0610/22 J25 Q7 ▪ 1 mark
- 0610/23 J25 Q3 ▪ 1 mark
- 0610/23 J25 Q7 ▪ 1 mark
- 0610/42 J25 Q5 ▪ 11 marks
- 0610/62 J25 Q1 ▪ 20 marks
- 0610/22 M25 Q5 ▪ 1 mark

# Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

# Question 5

0610/21 N25 ▪ Q5 ▪ 1 mark

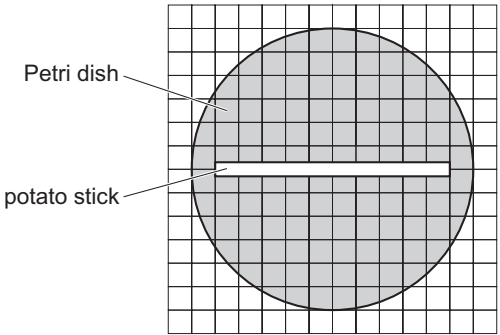
**5** A potato was used as a source of plant tissue. Four potato sticks of identical size were cut from the same potato. At the start of the investigation, each potato stick was 10 squares long. The potato sticks were put into four separate Petri dishes. Each Petri dish contained a different concentration of sugar solution.

The diagram shows the four Petri dishes after 24 hours.

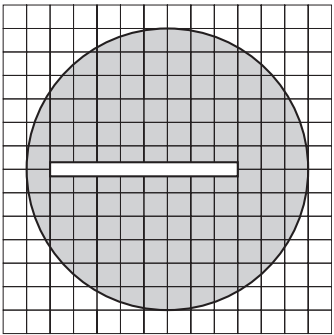
Which dish contains a sugar solution that has a higher water potential than the potato tissue?

**A** **B**

# Question 5

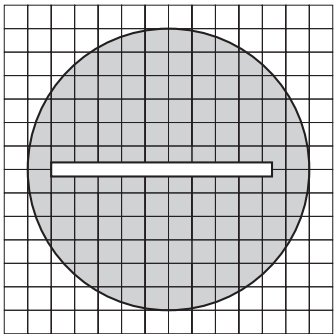


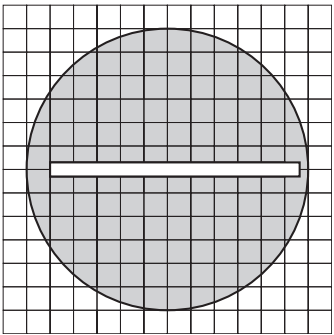

C



D

# Question 5





# Solution 5

Answer: **D**

**Why**

- A potato stick gains length in a solution of higher water potential and loses length in a lower one.
- Pure water gives the greatest gain; the most concentrated solution gives the greatest loss.
- So rank the four by concentration to predict which changed by how much.

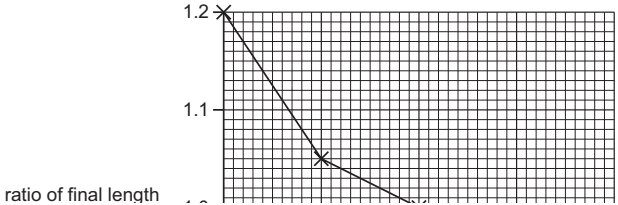
# Question 6

0610/23 N25 ▪ Q6 ▪ 1 mark

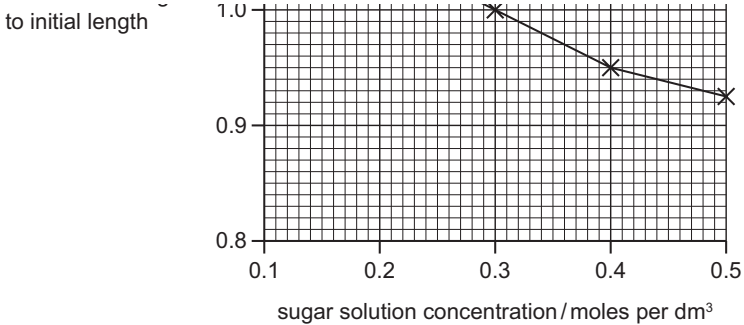
**6** Cylinders of potato tissue were placed in sugar solutions of different concentrations and left overnight.

The lengths of the potato cylinders were measured before and after they were placed in the sugar solutions.

The graph shows the results of the investigation.



# Question 6




In which sugar solution concentrations did the potato cells gain water?

**A** 0.1 moles per $dm^3$ and 0.2 moles per $dm^3$

**B** 0.1 moles per $dm^3$ only

# Question 6

**C** 0.2 moles per $dm^3$ and 0.3 moles per $dm^3$

**D** 0.4 moles per $dm^3$ and 0.5 moles per $dm^3$

# Solution 6

Answer: **A**

**Why**

- A cylinder gains length in a solution of higher water potential and loses length in a lower one.
- The concentration where the length does not change is where the two water potentials match.
- So plot the change against concentration and read off where the line crosses zero.

# Question 7

0610/22 J25 ▪ Q7 ▪ 1 mark

**7** Uncooked potato cylinders of identical size were placed in four different liquids for two hours.

The different liquids are listed.

1 pure water

2 a sugar solution that was less concentrated than the contents of the potato cells

3 a sugar solution that was more concentrated than the contents of the potato cells

4 a sugar solution that was the same concentration as the contents of the potato cells

In which liquids will the potato cylinders increase in length?

**A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

# Solution 7

Answer: **A**

**Why**

- A potato cylinder gains mass in a solution of higher water potential than its own, and loses mass in a lower one.
- Pure water has the highest water potential, so the cylinder in it gains the most.
- The more concentrated the sugar solution, the more mass the cylinder loses.

# Question 3

0610/23 J25 ▪ Q3 ▪ 1 mark

**3** What happens when plant cells are placed in a sugar solution that has a lower water potential than the cytoplasm of the cells?

**A** The cells gain water and become flaccid.

**B** The cells gain water and become turgid.

**C** The cells lose water and become flaccid.

**D** The cells lose water and become turgid.

# Solution 3

Answer: **C**

**Why**

- A lower water potential outside means water leaves the cell by osmosis.
- The vacuole shrinks and the cytoplasm pulls away from the cell wall – plasmolysis.
- So the cells lose water and become flaccid, then plasmolysed.

# Question 7

0610/23 J25 ▪ Q7 ▪ 1 mark

**7** A potato was removed from a potato plant. A 5 g cube of potato was cut and put into a beaker of distilled water.

What is the most likely mass of the cube of potato after two hours?

**A** 2 g **B** 4 g **C** 5 g **D** 7 g

# Solution 7

Answer: **D**

**Why**

- Distilled water has a higher water potential than the potato cells' contents.
- So water moves *into* the cells by osmosis.
- The cube therefore gains mass, ending up slightly heavier than $5$ g.

# Question 5

0610/42 J25 ▪ Q5 ▪ 11 marks

**5** Fig. 5.1 is a diagram of a plant root hair cell.

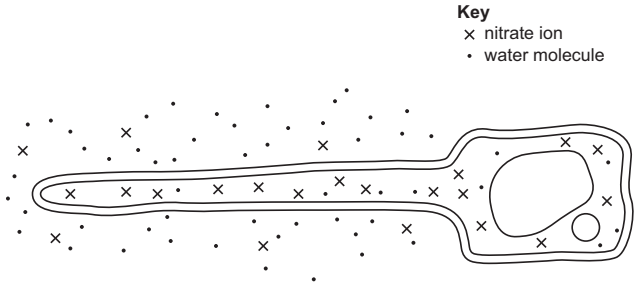



**Fig. 5.1**

# Question 5

**(a)** **(i)** Using the information in Fig. 5.1, explain how nitrate ions are transported into the root hair cell.

# Question 5

**(ii)** State **two** ways that nitrogen fixation occurs.

# Question 5

# Question 5

[1]

**(b)** State the name of the process that moves water molecules into root hair cells.

# Question 5

**(c)** Describe differences **and** similarities between the structure of a plant root hair cell and a bacterial cell.

# Question 5

[Total: 11]

# Solution 5

## (a)(i) Mark scheme

- any four from:
- 1
- active transport ;
- 2
- (movement of particles / nitrate ions) from a low concentration to a
- high concentration / against OR up the concentration gradient OR
- there are more (nitrate) ions in the cell / root hair than the soil ;
- 3

# Solution 5

- pass, through / across, cell / partially permeable, membrane ;
- 4
- using protein, carriers / molecules ;
- 5
- using energy (from respiration) ;
- 4
- MP3 A root hair has a large surface area

# Solution 5

**(a)(ii)**

**Mark scheme**

- lightning and (nitrogen fixing) bacteria ;
- 1

# Solution 5

**(b)**

**Mark scheme**

- osmosis ;
- 1
- 0610/42
- May/June 2025
- Guidance

# Solution 5

## (c) Mark scheme

- total of five from:
- differences to max 3:
- root hair cells have:
- 1
- nucleus / nuclear membrane ;
- 2
- mitochondria ;
- 3

# Solution 5

- (large permanent) vacuole ;
- 4
- cellulose cell wall / cell wall made of a different substance ;
- 5
- linear DNA ;
- 6
- no plasmids ;
- 7
- AVP ;
- similarities to max 3:

## Solution 5

- 8
- cell wall ;
- 9
- cell membrane ;
- 10 cytoplasm ;
- 11 DNA / genetic material ;
- 12 ribosomes ;
- 13 AVP ;
- 5
- ora for the differences relating in context of

# Solution 5

- bacteria
- MP2 A (correct named) membrane-bound
- organelles
- MP5 A circular / loop of, DNA
- 0610/42
- May/June 2025
- Guidance

# Question 1

0610/62 J25 ▪ Q1 ▪ 20 marks

**1** A student investigated the effect of the concentration of salt solutions on osmosis in potato tissue.

The student used three different concentrations of salt solution and potato tissue that had been cut into cylinders.

**(a) (i)** Using the information in Table 1.1, decide the volumes of **S** and **W** needed to make 50 $cm^3$ of a 0.5 mol per $dm^3$ salt solution.

Complete Table 1.1 by writing in the volumes of **S** and **W** needed to make the 0.5 mol per $dm^3$ salt solution.

**Table 1.1**

# Question 1

| beaker | volume of 1.0 mol per $dm^3$ salt solution **S** / $cm^3$ | volume of distilled water **W** / $cm^3$ | final concentration of salt solution / mol per $dm^3$ |
|---|---|---|---|
| **S1** | 50 | 0 | 1.0 |
| **S2** | ..... | ..... | 0.5 |
| **S3** | 0 | 50 | 0.0 |

[1]

The student used this method:

Step 1 Label three beakers **S1**, **S2** and **S3**.

# Question 1

Step 2 Use the volumes of 1.0 mol per $dm^3$ salt solution **S** and distilled water **W** shown in Table 1.1 to make the salt solutions in beakers **S1**, **S2** and **S3**.

Step 3 Put the potato cylinders onto a white tile and cut each potato cylinder into 3 mm discs, as shown in Fig. 1.1. You will need 30 potato discs.

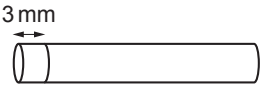



**Fig. 1.1**

Step 4 Place 10 potato discs in a line next to a ruler, as shown in Fig. 1.2.

# Question 1

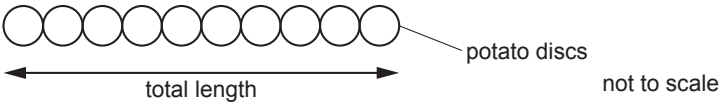



**Fig. 1.2**

Step 5 Measure the total length of the 10 potato discs.

Step 6 Put the 10 potato discs into beaker **S1**.

Step 7 Repeat step 4 to step 6 with the other potato discs and the salt solutions in beakers **S2** and **S3**.

Step 8 Start the stop-clock and leave the potato discs in the beakers of salt solution for 20 minutes.

# Question 1

Step 9 Remove the 10 potato discs from beaker **S1** and put them onto the white tile, line them up along the ruler, as shown in Fig. 1.2.

Step 10 Measure the final total length of the 10 potato discs.

Step 11 Repeat step 9 and step 10 with the potato discs in beaker **S2** and beaker **S3**.

Fig. 1.3 shows the notes the student recorded about the results.

# Question 1

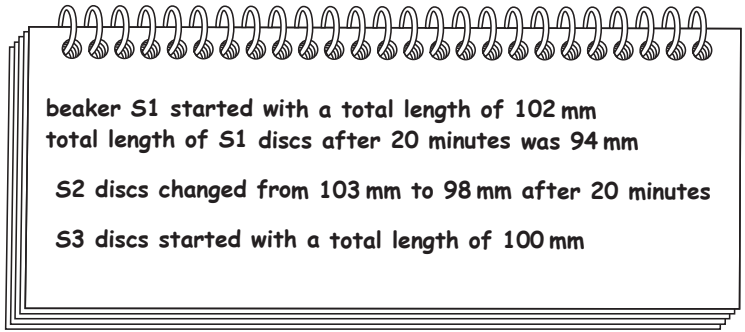



Fig. 1.3

# Question 1

Fig. 1.4 is a diagram showing the actual size of the 10 potato discs from beaker **S3** after 20 minutes.

**Fig. 1.4**

**(ii)** Measure the total length of the 10 potato discs **in Fig. 1.4**.

# Question 1

**(iii)** Prepare a table and record the results shown in Fig. 1.3 and your measurement in **1(a)(ii)**.

Include the final concentrations of the salt solutions in your table.

# Question 1

[3]

**(iv)** Calculate the **change** in total length of the 10 potato discs in each beaker.

# Question 1

[1]

**(v)** State a conclusion for the results of this investigation.

# Question 1

**(vi)** State the dependent variable in this investigation.

# Question 1

**(vii)** Suggest why the student used 10 potato discs instead of 1 potato disc in each salt solution.

# Question 1

**(viii)** Describe **one** safety precaution the student should take when preparing the potato discs.

# Question 1

**(b)** The student added a few drops of a yellow-brown solution to test one of the potato discs.

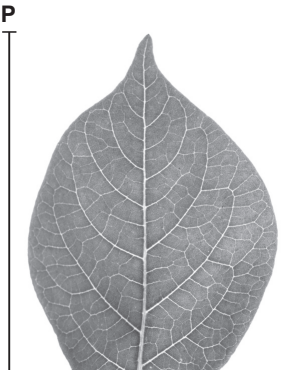
The solution changed to a blue-black colour.

Identify the solution added and state a conclusion for this test.

# Question 1

[1]

**(c)** Fig. 1.5 shows a leaf from a potato plant.



# Question 1

# Question 1


**Fig. 1.5**

**(i)** Draw a large diagram of the leaf shown in Fig. 1.5.

# Question 1

# Question 1

# Question 1

[4]

**(ii)** Line **PQ** represents the length of the leaf in Fig. 1.5.

Measure the length of line **PQ** in Fig. 1.5.

# Question 1

The actual length of the leaf is 39 mm.

Using your measurement and the formula, calculate the magnification of the leaf in Fig. 1.5.

$$\text{magnification} = \frac{\text{length of line } \mathbf{PQ} \text{ in Fig. 1.5}}{\text{actual length of the leaf}}$$

Give your answer to **two** significant figures.

Space for working.

# Question 1

[3]

**(iii)** Fig. 1.6 shows a leaf from a tomato plant. The tomato leaf is narrower than the potato leaf shown in Fig. 1.5.

# Question 1

**Fig. 1.6**

Compare the leaves shown in Fig. 1.5 and in Fig. 1.6.

Describe **one** visible difference, other than size, and **one** visible similarity.

# Question 1

[2]

[Total: 20]

# Solution 1

**(a)(i)**

**Mark scheme**

- 25 and 25 (cm3) ;
- 1

**(a)(ii)**

**Mark scheme**

- 102 $\pm 1$ (mm) ;
- 1

# Solution 1

## (a)(iii) Mark scheme

- table drawn with a minimum of three columns and a header line ;
- suitable headings with correct units for concentration and length ;
- five correct lengths recorded that match the salt solution concentration ;
- 3
- (salt solution)
- concentration
- / mol per dm3
- start/initial

# Solution 1

- length / mm
- final
- length
- / mm
- 1.0
- 0.5
- 0.0
- 102
- 103
- 100

# Solution 1

- 94
- 98
- (answer
- to 1(a)(ii))

# Solution 1

**(a)(iv)**

**Mark scheme**

- S1: 8 (mm) and S2: 5 (mm) (S3 matches candidate's measurement) ;
- 1

# Solution 1

## (a)(v) Mark scheme

- any one from:
- the higher the concentration (of salt), the, more / faster, osmosis occurs ;
- the higher the concentration (of salt) the more water, is lost / moves out ;
- water move out of the, potato / disc(s), in salt solution(s) ;
- water moves into the, potato / disc(s), when there is no salt / in pure
- water / in 0 mol dm3 ;
- the solute concentration of the potato (cell(s)) is between 0.5 mol dm3 and
- 0 mol dm3 ;

# Solution 1

- 1
- A potatoes have a higher water potential than
- the salt solution but a lower water potential
- than (pure/distilled) water

# Solution 1

**(a)(vi)**

**Mark scheme**

- length (of discs) ;
- 1

# Solution 1

**(a)(vii)**

**Mark scheme**

- any one from:
- change / difference, (in one disc) too small (to, measure / see) / ora ;
- one disc may not be, representative / typical ;
- decreases / reduces, percentage error / AW ;
- reduces the effect of anomalous results ;
- 1

# Solution 1

**(a)(viii)**

**Mark scheme**

- cut, on a tile / on a flat surface / away from hand or body / AW ;
- 1
- 0610/62
- May/June 2025
- Guidance

# Solution 1

**(b)**

**Mark scheme**

- solution: iodine (solution)
- and
- conclusion: starch present ;
- 1

# Solution 1

**(c)(i)**

**Mark scheme**

- Outline is a single clear line with no shading ;
- Size –at least half the available space used ;
- Detail 1: midrib as a double line for at least half its length ;
- Detail 2: four bumps across the base of the leaf (two on either side of the
- petiole and two bulges at the edges) ;
- 4

# Solution 1

## (c)(ii) Mark scheme

- PQ $= 63 \pm 1$ (mm) ;
- ($\times$) 1.6 ;;
- 3 MP1 correct measurement of line PQ
- MP2 correct calculation of the actual size to
- any number of significant figures
- MP3 correct rounding to three significant
- figures
- ecf from previous step

# Solution 1

- 0610/62
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# Solution 1

## (c)(iii) Mark scheme

- one difference from: ;
- (potato / Fig. 1.5)
- (tomato / Fig. 1.6)
- more veins
- OR
- fewer veins
- veins more
- branched

# Solution 1

- OR
- veins less branched
- (outline / side / edge
- is)
- smooth / even / not
- lobed
- AND (outline / side / edge
- is)
- uneven / lobed / wavy
- / jagged / bumpy

## Solution 1

- single / undivided /
- not lobed ,leaf
- AND divided
- leaf / leaflet / lobed (at
- bottom)
- symmetrical
- AND not
- symmetrical / irregular
- shape
- one similarity from: ;

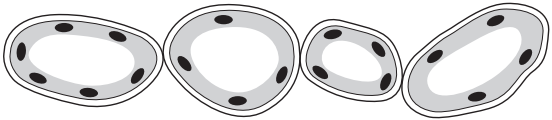
# Solution 1

- ▪
- (both have) veins / midrib
- ▪
- (both have) a (leaf) stalk / stem / petiole
- ▪
- (both have) a pointed tip
- 2
- 0610/62
- May/June 2025
- Guidance

# Question 5

0610/22 M25 ▪ Q5 ▪ 1 mark

**5** The diagram shows four mesophyll cells, W, X, Y and Z. Water moves through these cells.




Which arrow shows the direction of movement of water through these cells?

| | direction of water movement | water potential / kPa | | | |
|---|---|---|---|---|---|
| | | W | X | Y | Z |

# Question 5

| | | | | | |
|---|---|---|---|---|---|
| **A** | → | –600 | –450 | –350 | –250 |
| **B** | → | –350 | –400 | –450 | –600 |
| **C** | ← | –400 | –450 | –500 | –550 |
| **D** | ← | –200 | –300 | –350 | –450 |

# Solution 5

Answer: **B**

**Why**

- Water always moves from a higher water potential to a lower one, by osmosis.
- In a transpiring leaf water is being pulled towards the air spaces and out of the stomata.
- So follow the direction of increasing solute concentration through the four cells.