

## Structured Questions

# Water Potential

Osmosis / Osmosis in Cells / Osmosis: Skills / Water Potential (HL) / Water Movement in Plant Tissue (HL)

Medium (3 questions)	/32
Hard (3 questions)	/19
<b>Total Marks</b>	<b>/51</b>

Scan here to return to the course  
or visit [savemyexams.com](https://www.savemyexams.com)



# Medium Questions

1 (a) Define the term water potential.

---

---

---

(3 marks)

(b) The table below compares some environmental conditions between water at the surface of the ocean and water in the depths of the ocean.

Water body	Salinity (g/L)	Pressure (kPa)	Water potential (kPa)
Ocean surface	34-36	101	-2500
Deep ocean	35.5	110 000	+107 500

Explain the difference in water potential between the two locations.

---

---

(2 marks)

(c) The temperature of the water at the surface of the ocean is approximately 20 °C, whilst at the bottom of the ocean, temperatures are around 0 °C.

Describe and explain the effect of decreasing temperature on water potential.

---

---

(2 marks)

2 (a) The cell walls of three plant cells are in contact with each other. The water potentials inside each cell are shown in the table.

Cell	Water potential (kPa)
1	-900
2	-300
3	-600

Describe how water will move between the three cells.

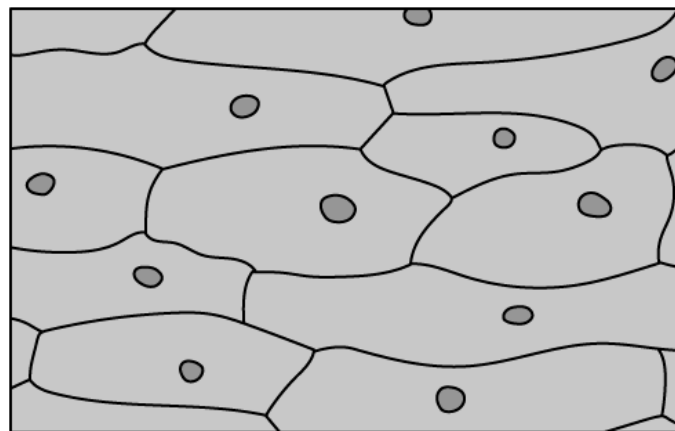
.....

.....

.....

**(3 marks)**

(b) Some onion cells were placed in distilled water for several hours, a light micrograph image of the cells can be seen below:



Describe and explain the changes to water potential in these cells.

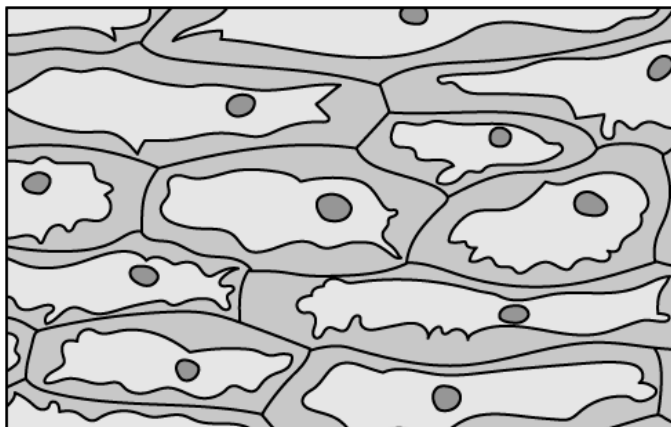
.....

.....

.....

(4 marks)

(c) Another group of cells appears as follows under the microscope:



Explain why these cells differ in appearance from the cells shown in part (b).

(2 marks)

(d) Emphysematous pyelonephritis (EPN) is a very rare complication that can develop as a result of an untreated kidney infection. It is a severe infection during which bacteria destroy kidney tissue, eventually leading to kidney failure. If kidney failure is left untreated the kidneys are unable to regulate the amount of water in the body and the blood plasma becomes more dilute than normal.

Describe the effect that this would have on red blood cells.

(3 marks)

(e) Explain why changes in cell volume affect animal cells more severely than plant cells.

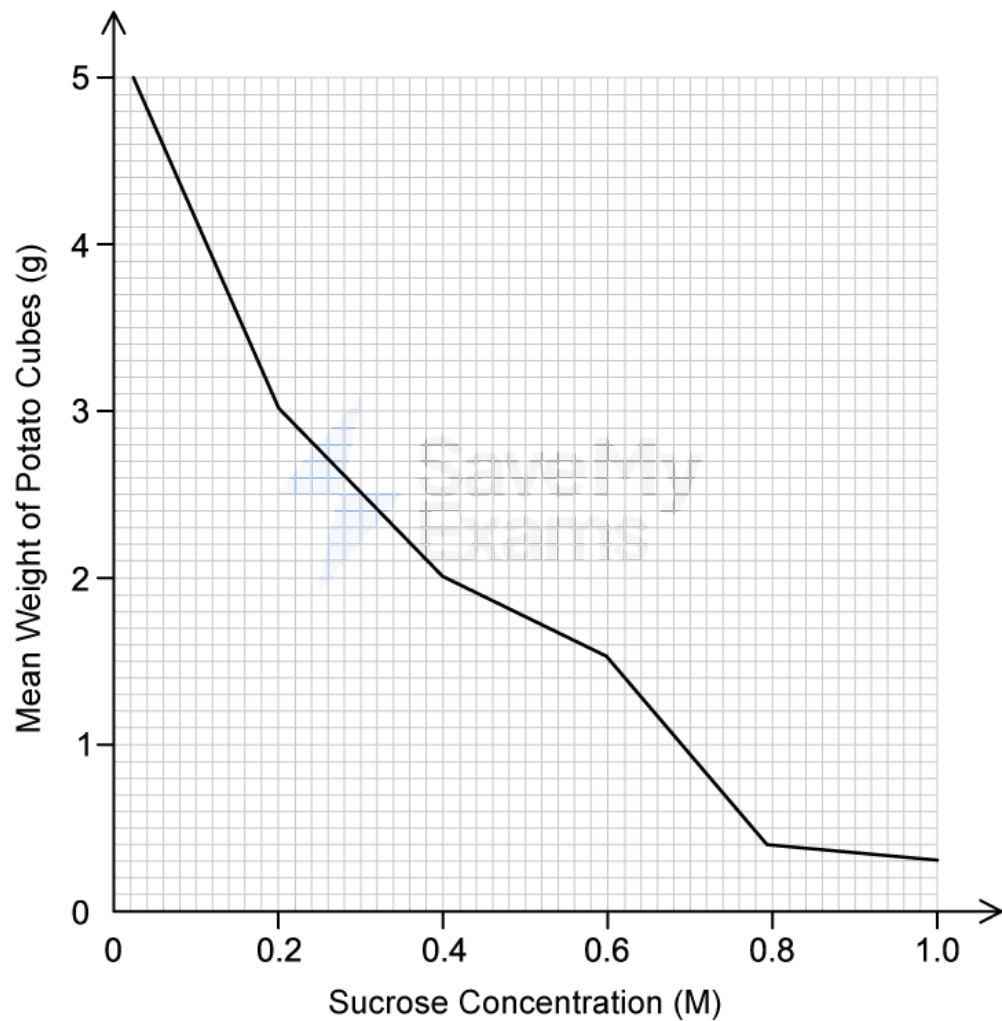
---

(2 marks)

**3 (a)** A group of students carried out an experiment to investigate water movement using the following method:

1. Dice potato into  $1\text{cm}^3$  cubes and weigh them
2. Add potato cubes to 6 test tubes, each containing a solution with a different sucrose concentration
3. Wait 12 hours
4. Weigh the cubes from each test tube and plot a graph

The mean weight of the potato cubes was 2.5g before being added to the solution and the graph shows the weights of potato cubes after the experiment.



- (i) Identify which sucrose concentration provides an isotonic solution.

[1]

(ii) Explain your answer to part (i)

[2]

---

---

---

**(3 marks)**

**(b)** With reference to the graph in part (a), describe and explain the changes in pressure potential observed in the potato cells between 0.3 M and 1 M sucrose solution.

---

---

---

**(3 marks)**

**(c)** Sketch one of the potato cells that was kept in the 1.00 M sucrose solution. Label the cell wall, cell membrane and cytoplasm in your diagram.

---

---

---

**(3 marks)**

**(d)** Using the data from (a), calculate the percentage change in mass for the potato cylinders in 0.2 M sucrose solution.

---

---

**(2 marks)**

# Hard Questions

1 (a) A biologist investigated how surface area affects osmosis in potato cubes.

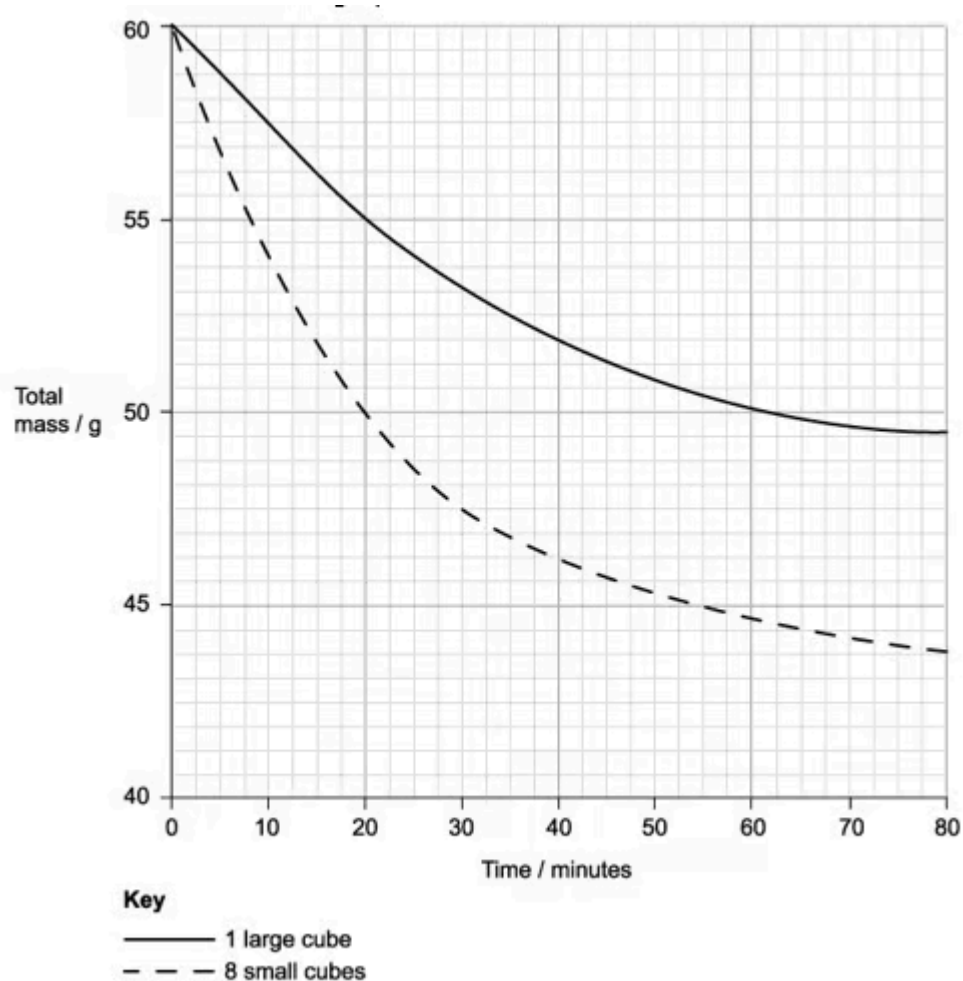
**Step 1:** Cut two cubes of potato, each with sides of 4 cm in length.

**Step 2:** Place one cube into concentrated (40%) sucrose solution.

**Step 3:** Cut the remaining cube into eight equal-sized smaller cubes and place into concentrated (40%) sucrose solution.

**Step 4:** Record the masses of the cubes at time intervals.

The results are shown in the graph.



Explain why the potato tissue changed in mass.

---



---

(2 marks)

- (b) The biologist recorded the masses of the cubes at intervals. Before weighing the cubes at each interval, the biologist blotted the outside of each cube with paper towel.

Explain why.

---

---

(2 marks)

- (c) During the first 20 minutes the combined loss in mass of the eight small cubes is greater than in the single large cube (as shown in the graph in part a).

Calculate the *rate of loss* in mass, per  $\text{cm}^2$ , per minute for the single large cube **and** the eight small cubes during the first 20 minutes.

Give your answers in grams, per  $\text{cm}^2$ , per minute.

---

---

---

---

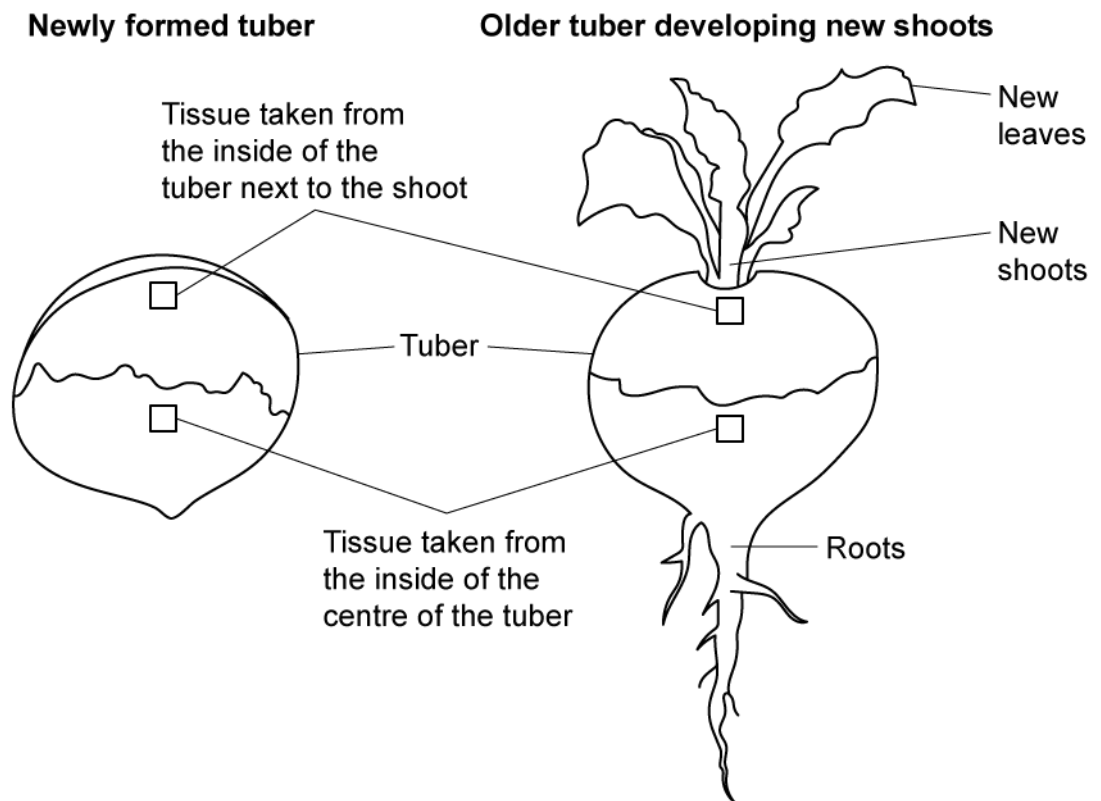
(4 marks)

**2 (a)** A biologist investigated the solute concentration of cells from different parts of turnip tubers of different ages (as shown in the diagram below).

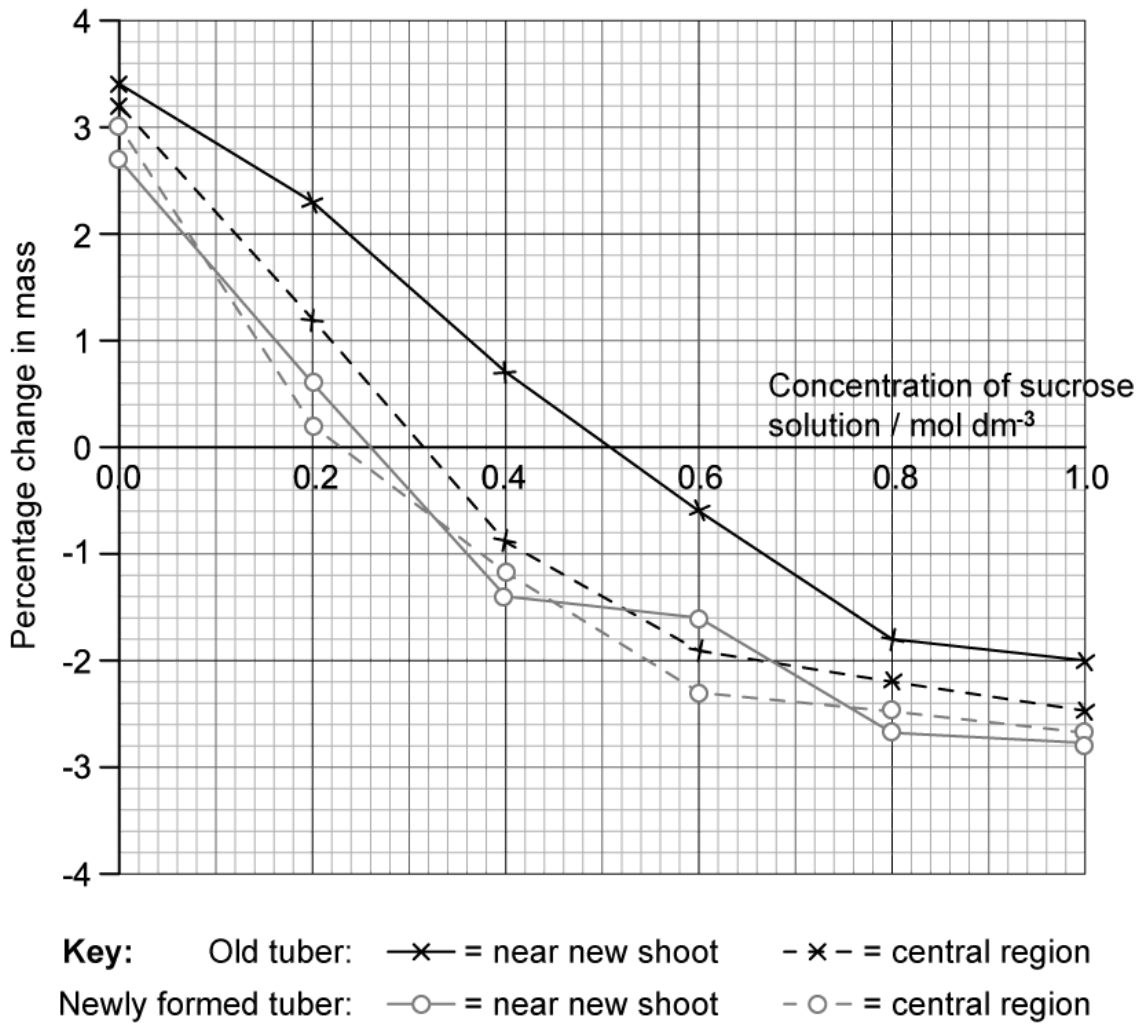
The solute concentration was estimated using discs of turnip tissue and sucrose solutions of different concentrations.

The diagram below shows:

- The appearance of the tubers
- The locations from which the tissue samples were obtained



The results are shown in the graph below



Estimate the sucrose concentration of the near new shoot sample from the old tuber.

(1 mark)

(b) Explain why the biologist used percentage change in mass rather than the change in mass.

(1 mark)

(c) After analysing the data the biologist came to the following conclusions:

1. The tissue in the old tuber, close to the new shoots has the highest solute concentration
2. In the old tuber, close to new shoots, starch reserves were being converted to sugar
3. In the old tuber, central region, starch was being converted to sugar
4. In the newly formed tuber, all the sugar had been converted to starch.

Evaluate the conclusions made by the biologist based on the evidence collected.

.....

.....

.....

**(3 marks)**

(d) Suggest **two** possible sources of error that the biologist may have encountered when collecting the data in this investigation.

.....

.....

**(2 marks)**

3 Outline the effects on human heart tissue of being placed into a hypotonic solution.

.....

.....

.....

.....

**(4 marks)**