1 Four cylinders of potato tissue were weighed and each was placed into a salt solution of a different concentration.

The cylinders were reweighed after one hour and the results are shown below.

Salt Solution	Initial mass of potato cylinder (g)	Final mass of potato cylinder (g)
А	10.0	7.0
В	10.0	9.4
С	10.0	11.2
D	10.0	12.6

In which salt solution would most potato cells be plasmolysed?

In an investigation into the effects of different solutions on plant cells, a beetroot cylinder was dried with a paper towel, weighed, and placed in a concentrated salt solution.

After 30 minutes, the beetroot cylinder was removed from the salt solution, dried and reweighed. It was then placed in water for 30 minutes, removed, dried and reweighed.

Which row in the table shows the most likely results?

2

	Initial mass (g)	Mass after 30 minutes in salt solution (g)	Mass after 30 minutes in water (g)
Α	2.5	3.0	3.5
В	3.0	3.5	2.5
С	3.0	2.5	3.5
D	3.5	3.0	2.5

3 Which row in the table describes the effects on red blood cells if they were left in the liquids shown for 20 minutes?

	Liquid		
	Pure water 10% salt soluti		
Α	swell and burst	plasmolyse	
В	swell and burst	shrink	
С	become turgid	plasmolyse	
D	become turgid	shrink	

4 The diagram shows a plant cell after being placed in a liquid for 30 minutes.



This cell has become:

- A plasmolysed due to water loss
- B plasmolysed due to water gain
- C turgid due to water loss
- D turgid due to water gain.

5 Animal cells left in a solution with a lower water concentration than their contents

- A shrink
- B burst
- C become turgid
- D become plasmolysed.

6. Four equal sized cubes of potato were weighed and each placed into a different concentration of sugar solution. They were dried and weighed again after one hour.

The results are shown in the table.

Which solution had the highest sugar concentration?

Solution	Mass of potato at start (g)	Mass of potato after one hour (g)
Α	4.5	3.9
В	4.5	4.3
С	4.5	4.5
D	4.5	5.5

- 7 An animal cell placed in a liquid swells up and bursts. What will happen to a plant cell placed in the same liquid?
  - A It will become turgid.
  - B It will become flaccid.
  - C It will become plasmolysed.
  - D It will not change.
- 8 Which line in the table below shows what happens to cells when placed in a high salt solution?

	Animal Cell	Plant Cell
А	swells and bursts	becomes turgid
В	becomes turgid	swells and bursts
С	shrinks	becomes plasmolysed
D	becomes plasmolysed	becomes plasmolysed

9 Four potato cylinders of equal mass were placed in four separate test tubes as shown below.



After two hours, the percentage change in mass of each cylinder was calculated and the results plotted on the graph below.



In which concentration of salt would the potato cylinders be most plasmolysed?

А	8%
В	5%
С	2%
2 <sup>D</sup>	0%

10. The diagram shows the initial diameter of a potato disc. The potato disc was placed in a distilled water solution for one hour.

12.



Which of the following diagrams shows correctly the change in the diameter of the potato disc.





11. A plant cell, which was placed in a liquid, gained water by osmosis.

When compared to the liquid, the cell contents are described as being

- A plasmolysed
- B burst
- C shrink

Four cylinders of potato tissue were weighed and each was placed into a salt solution of different concentration.

The cylinders were reweighed after one hour. The results are shown in the following table.

	Mass of potato cylinder (g)	
Salt solution	Initial mass	Final mass
A	10.0	12.6
В	10.0	11.2
C	10.0	9.4
D	10.0	7.0

In which salt solution would most potato cells be turgid?

13. A piece of potato was cut from a potato tuber and weighed. It was placed in pure water for an hour then removed, dried and weighed again. Finally, it was placed in a concentrated sugar solution for an hour, removed, dried and weighed again.

Which line in the table records the results most likely obtained by this treatment?

	First weighing	Second weighing	Third weighing
А	5 g	6 g	4 g
В	5 g	4 g	6 g
С	6 g	5 g	4 g
D	5 g	4 g	3 g

 A piece of potato was cut from a potato tuber, blotted dry and weighed.

> It was then placed in concentrated sugar solution for an hour, removed, dried and re-weighed.

It was placed in pure water for an hour and then removed, dried and re-weighed.



pure concentrated water sugar solution

Which line in the table shows the results most likely to be obtained?

	First weight (g)	Second weight (g)	Third weight (g)
A	5	6	4
В	5	4	6
С	5	7	9
D	5	4	3

- 1. Three discs were cut from the same potato and were placed in three salt solutions of 2. different concentrations. After 30 minutes the discs were removed from the solutions and the cells examined under a light microscope. A cell from each disc is shown below.
  - A B C
  - (a) (i) Identify the cell which was placed in

Distilled water

Concentrated salt solution

- (ii) Name the process which causes the difference in appearance of the cells.
- (iii) What name is used to describe the condition of cell C?
- (b) Name the cell structure which prevents plant cells from bursting.

The diagram below shows the appearance of a cell from an onion.



Pieces of onion were placed in three different solutions:

a 10% salt solution; a 2% salt solution and pure water.

The following diagrams show the appearance of the cells after 10 minutes.











1

solution Z

cells swell

cells are unchanged cell contents shrink

(i) Use the letters from the diagrams to identify the solutions.

One has been identified already.



2% salt solution Y

pure water

(ii) Name the process by which water diffuses through a selectively permeable membrane.

(c) Describe the appearance of red blood cells when placed in sucrose solution.

3. The diagrams below represent red blood cells in different solutions as they would appear under a microscope.



1

What has happened to the cells in diagram B? Explain the change in terms of water concentrations.

Description \_\_\_\_\_

Explanation \_\_\_\_\_

**4.** Cells from the same plant tissue were placed in three different liquids, left for 20 minutes and then examined using a microscope.

The following diagrams represent cells from each liquid.



Which cell is most likely to have been placed in pure water? Give a reason for your answer.

Cell \_\_\_\_\_

Reason \_\_\_\_\_

- 1
- An investigation into the effects of solutions of different salt concentrations on red blood cells was carried out. Three microscope slides were set up as shown below.



Each blood sample was observed under a microscope after 10 minutes.

(i) Describe what would have happened to the red blood cells on slides A and C.

Slide A	 	 	-
Slide C			_ 1

(ii) Name the process responsible for these changes.

5

2

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Paramecium is a single-celled organism which lives in fresh water.
 The following diagram shows some of its structures.



(a) The water concentration outside the paramecium is higher than the water concentration of the cytoplasm. This causes the diffusion of water into the cell.

Name this movement of water.

- (b) Name the structure present in a plant cell which prevents it from bursting when full of water.
- 7 a) An animal cell is placed in distilled water.

Describe the appearance of the animal cell after one hour.

b) An isotonic solution is one in which the concentration of the solution externally is the same as the concentration inside the cell.

Explain why animal cells placed in an isotonic solution would stay the same size.

8. A student examined plant and animal cells using a microscope.



The animal and plant cells were placed in solutions of different salt concentrations. After several minutes a sample of cells was taken from each solution and examined. One cell from each solution is shown.



- (a) Changes in the cells were due to osmosis.
   Explain why osmosis is described as a passive process.
- (b) Identify the animal cell shown which had been placed in a solution of higher salt concentration than its cell contents.

Cell number \_\_\_\_\_

- (c) State the term used to describe the condition of cell 6.
- (d) Cells 3 and 4 had been placed in solutions which were both of the same concentration.

Explain why the results observed were different.

2

1

1

11.

9. Pieces of beetroot and rhubarb tissue were placed in different concentrations of sugar solution. After 30 minutes, the number of plasmolysed cells in a sample of 50 cells was counted under a microscope.

The results are shown in the table.

Concentration of sugar	Number of plasmolysed cells		
solution (mol/l)	Beetroot	Rhubarb	
0.30	0	8	
0.35	3	15	
0.40	9	30	
0.45	23	38	
0.50	33	44	
0.55	50	50	

identify the concentration of sugar solution in the beetroot cells.

\_\_\_\_\_mol/l

1

10 A group of students measured the mass of pieces of turnip tissue before placing them in different concentrations of salt solution. After one hour, the change in mass of the turnip tissue was recorded.

The results are shown in the table.

Concentration of salt solution (g/100 cm <sup>3</sup> )	Percentage change in mass (%)
1	+17
3	+11
6	-2
8	-9
10	-16

Identify the salt solution where most of the turnip cells would be turgid.

 $_{\rm g}/100 \ {\rm cm}^{\rm 3}$ 

A student cut five similar cylinders from the same potato, dried them with a paper towel and weighed them.

Each cylinder was placed in a different concentration of sugar solution

The graph below shows the percentage change in mass at each concentration.



(i) The movement of what substance is responsible for the change in mass?

1

1

(ii) At what concentration was there no change in mass of the potato?

\_\_\_\_\_ Molar

 Three similar cylinders were cut from the same potato, dried and weighed. Each cylinder was placed in a different solution as shown in the diagrams below.



After one hour, the cylinders were removed from the solutions, dried and reweighed.

(i) Use the information in the diagrams to complete the table below.

Solution	Initial weight (g)	Final weight (g)		
	10	8		
	10	10		
	10	12		

(ii) Which process has caused these changes in weight?

1

1

(iii) The diagram below shows a cell from one of the potato cylinders.



What term would be used to describe the condition of this cell?

1

13. A student cut five similar cylinders from the same potato, dried them with a paper towel and weighed them.

Each cylinder was placed in a different concentration of sugar solution as shown in the diagram below:



After three hours, the student removed the cylinders from the solutions, dried and weighed them as before.

The results are shown in the table below.

Test tube	Concentration of sugar solution (M)	Initial mass of potato cylinder (g)	Final mass of potato cylinder (g)	Change in mass of potato cylinder (g)	Percentage change in mass of potato
А	0.1	2.0	2.2	+0.2	+10
В	0.5	2.0	2.1	+0.1	+5
С	0.3	2.0	1.8	-0.2	-10
D	0.4	2.0	1.7	-0.3	
E	0.5	2.0	1.5	-0.2	-25

- (i) State the letter of the test tube with the highest water concentration.
- (ii) Predict the appearance of the potato cylinder in test tube E after three hours.

14. Several pieces of potato were blotted dry and weighed. Each was then placed in a different concentration of salt solution.

After 2 hours the pieces of potato were removed, blotted dry and reweighed. The percentage change in mass was calculated and the results plotted on a graph.



(a) At which salt concentration did the mass of the potato remain the same?

#### \_\_\_\_\_ g/100 cm<sup>3</sup>

(b) Cells from the potato in the 8 g/100 cm<sup>3</sup> solution were examined with a microscope.

Which of the following diagrams best represents one cell from the potato?

Tick the correct box.



15. An investigation was carried out to find the effect of salt solutions of different concentrations on the mass of potato tissue. Five test tubes were set up as shown below, each containing a different concentration of salt solution.



Each potato cylinder was weighed, placed in the solution and left for an hour. Each cylinder was then reweighed and the percentage (%) change in mass was calculated.

The table below shows the results of the investigation.

Salt concentration $(g/100 \mathrm{cm}^3)$	Change in mass (%)
1	+15
3	+10
6	-5
8	-15
10	-20

State the salt concentration (s) that would result in the most turgid potato cells.

\_\_\_\_\_ g/100cm<sup>3</sup>

16. Shells can be removed from eggs by dissolving them in vinegar for 2-3 days. The egg contents remain inside a thin membrane.

In an investigation the shells from two eggs were removed. The eggs were then weighed and placed in beakers as shown below.



a) After 2 hours the eggs were removed from the beakers, blotted dry and reweighed. The results are shown in the following table.

Suggest why the eggs were blotted dry before being reweighed.

b) Choose either beaker A or B and explain how osmosis caused the change in mass of the eggs in that beaker.

Beaker \_\_\_\_\_

Explanation \_\_\_\_\_

c) Water enters a plant by osmosis, which is an example of passive transport.

State what this means in terms of the energy required for osmosis.

17. Osmosis is a process which can occur across the cell membrane.

Choose either the leaf cell or red blood cell by ticking (  $\checkmark$  ) one of the boxes below.

Describe the effect of osmosis on this type of cell if it was placed in pure water.

Leaf cell Red blood cell		
--------------------------	--	--

Effect on the cell \_\_\_\_\_

18. When water enters a plant cell the vacuole fills and swells until no more water can enter.

State the term used to describe a plant cell in this state.

19. A flower petal was examined under the microscope and then placed in a concentrated salt solution for 30 minutes. It was then re-examined under the microscope.

The diagrams show a cell from the petal before and after being in the solution.





- (i) The movement of water caused the change in the appearance of the cell. What name is given to this movement of water?
- 1

1

1

1

(ii) In terms of water concentration, explain why this movement of water took place.

1

2

20. (i) Tissue from an onion root was placed in water. The diagram 21. below represents a cell from the tissue.



- The tissue was then transferred into a very concentrated salt solution for one hour.
- Complete the diagram below to show the appearance of the onion cell contents after this time.
- (An additional diagram is available, if required, on page 27.)



(ii) <u>Underline</u> **one** alternative in each group to make the following sentence correct.

In concentrated salt solution, water passes 
$$\begin{cases} into \\ out of \end{cases}$$
 an onion  
cell from a region of  $\begin{cases} high \\ low \end{cases}$  water concentration, to a region  
of  $\begin{cases} high \\ low \end{cases}$  water concentration with the cell membrane acting  
as a  $\begin{cases} selectively \\ fully \end{cases}$  permeable membrane.

Five cylinders of potato tissue were weighed and each was placed into a salt solution of a different concentration.

The cylinders were reweighed after one hour and the results are shown in the following table.

Salt solution	A	В	С	D	Е
Initial mass of potato cylinder (g)	10	10	10	10	10
Final mass of potato cylinder (g)	12.6	11.2	10.1	9.4	7.0

(i) The potato cylinders were blotted dry before each weighing. Suggest a reason for this.

1

1

(ii) Which salt solution had the highest water concentration?

Salt solution \_\_\_\_\_

 In an investigation, three 25 g samples of sultanas were put into separate 23. beakers of distilled water, as shown below.



After 24 hours, the sultanas were removed from the water, blotted on filter paper and reweighed. The results are shown in the table.

Sample	Mass after 24 hours (g)	Percentage change in mass
1	32.5	30.0
2	32.2	28.8

- (a) The change in mass of the sultanas was caused by the movement of water.
  - (i) Name this process.
  - (ii) Explain the results in terms of water concentrations.

Plant cells and animal cells were left in water or 10% sucrose solution for 10 minutes. The cells were then examined under the microscope. The appearance of three individual cells is shown below.



(a) Which two of the cells had been placed in 10% sucrose solution?

Cell \_\_\_\_\_ and Cell \_\_\_\_\_

(b) The change in the cells was caused by the movement of water into or out of the cells.

What is the name of this process?

(c) With reference to the cells placed in water, what is meant by the term "concentration gradient"?

1

1

1

(b) Which of the following is the best reason for blotting the sultanas before reweighing?

Tick the correct box.

To stop them sticking together

To remove external sugar solution

To remove external water

To make sure the sultanas were dried **1** 

111

24. The following diagrams show an investigation into osmosis using four model cells. The model cells were weighed before placing them in the test tubes.

After one hour the model cells were taken out of the test tubes and reweighed.



- (a) State the letters of the model cells which would have increased in mass after one hour.
- (b) What should be done to the model cells before each weighing to obtain valid results?
- <mark>1</mark>26

1

1

1

(c) Predict which model cell would have the greatest change in mass after one hour.

Give a reason for your choice.

Model cell

Reason \_

<sup>A</sup> model cell was made using a visking tubing bag filled with a starch and 25. nino acid solution. It was placed into a beaker of water and left for two hours.



What would happen to the mass of the model cell during the two hour period? Explain your answer.

Mass of model cell

Explanation\_

Osmosis occurs in plant cells.

- (i) Name the substance that enters or leaves cells by osmosis.
- (ii) What term describes the condition of plant cells after being placed in distilled water?

2

1

27. Potato cylinders of equal mass were placed in separate test tubes, as shown in the diagram.



The tubes contained salt solutions of 0.5%, 1.0%, 1.5%, 2.0% and 3.0% concentrations.

After two hours the change in mass of each cylinder was measured. The results are shown in the table.

Tube	Change in mass (g)	Salt solution (%)
А	-0.6	
В	-0.5	
С	-0.2	1.5
D	+0.1	
Е	+0.2	

a) Which tube contained a solution with a water concentration closest to that of the potato cell sap?

Tube \_\_\_\_\_

1

- b) Why would it be good experimental technique to blot the potato cylinders dry before each weighing?
- 1

28 An investigation was carried out into the effect of water concentration on the rate of osmosis.

Details of the apparatus, method used and results are given below.





Method

- 1 A thistle funnel containing  $50 \text{ cm}^3$  of 0.5% sugar solution was covered with selectively permeable membrane.
- 2 The funnel was placed in a beaker of pure water.
- 3 The scale was positioned with the sugar solution at zero on the scale.
- 4 The position of the sugar solution was recorded after 30 minutes.
- 5 The procedure was repeated using 1.0%, 2.0% and 3.0% sugar solutions.

Concentration of sugar solution (%)	Distance moved by sugar solution in 30 minutes (mm)
0.5	4.5
1.0	9.0
2.0	18.0
3.0	27.0

Explain the movement of the sugar solution in terms of water concentrations.

29 The apparatus shown below was used to investigate the movement of water into and out of a model cell. The model cell had a selectively permeable membrane.



The liquid level in the glass tubing was measured every 10 minutes for 60 minutes.

The results are shown in the table below.

Time (minutes)	Liquid level (mm)
0	10
10	22
20	32
30	40
40	48
50	56
60	64

(a) Name the process which caused the liquid level to rise.

(b) Explain how this process caused the liquid level to rise.

(c) When the investigation was repeated, the average rate of movement of liquid was slower.

Suggest **one** difference in the way that the investigation was set up that could have caused this change in results.

2

1

30. Explain how water moves when a potato cylinder is placed into a strong sucrose



#### Ma

32

The apparatus below was used to demonstrate diffusion. 31.



The height of the sugar solution in the capillary tube was measured at regular intervals. The results are shown in the graph.



What caused the change in height of the sugar solution in the capillary tube?

Tick the correct box.



The statements in the table describe the movement of substances into or out of cells.

Number	Statement
1	glucose moves from the small intestine into the blood
2	water enters root cells from the soil
3	carbon dioxide passes from the blood into the lungs

Which statement is an example of osmosis?

Statement number \_

33 in water.

# cytoplasm cell membrane nucleus vacuole emptying

- vacuole filling
- The water concentration outside the cell is higher than the water (a)concentration of the cytoplasm. This causes water to enter the cell constantly.
  - (i) What is the name for this movement of water?
  - (ii) From the information given, state whether Paramecium is likely to live in fresh water or salt water.
- Paramecium must get rid of excess water. Pure water is collected in the b) vacuoles by removing it from the cytoplasm. The vacuoles are emptied to the surrounding water as soon as they are full.

What would happen to the Paramecium cell if the vacuoles stopped working properly?

1

1

The diagram below shows *Paramecium*, a single-celled organism which lives 34. Describe the differences in the processes of osmosis and active transport.

1.	A						
2.	C						
3.	В						
4.	A						
5.	A						
6.	A						
7.	A						
8.	с						
9.	A						
10.	A						
11.	D						
12.	A						
13.	A						
14.	В						
1 a (I)	Distilled water = C	Concentrated Salt = A	(ii) osmosis	(iii) turgid	b) cell wall	c) shrunk/shrivelled	
2. (I)	10% salt solution Z	(ii) osmosis					
	2% salt solution Y						
	pure water X.						

3a) 0.90% Cells in this solution do not burst or shrink/gain or lose water b) shrunk/shrivelled (1) High water concentration inside cell to low water concentration outside cell (1)

#### 4. cell A

Vacuole has got bigger OR cell membrane is pushing up against the cell wall.

- 5. (i) A—burst C–shrunk (ii) osmosis
- 6. a) osmosis b) cell wall
- 7. a) burst b) water cannot move from HWC to LWC OR no water concentration gradient to cause water to move.
- 8. a) No ATP/energy needed b) 2 c) plasmolysed d picture 3 bursts as animal cell has no cell wall OR picture 4 does not burst due to cell wall
- 9. 0.30
- 10. 1
- 11. (i) Water (ii) 0.25

 Solution
 Initial weight (g)
 Final weight (g)

 Strong sugar
 10
 8

 Weak sugar
 10
 10

 water
 10
 12

(i)	А
	(i)

```
(ii) plasmolysed
```

b)

14 a)5



15 1

a) To remove excess surface water c) No ATP/energy required 16 b) Beaker A HWC outside to LWC inside OR Beaker B HWC inside to LWC outside 17. Leaf cell goes turgid Red blood cell bursts Turgid 18. In concentrated salt solution, water passes an onion out o (i) osmosis high 19. (ii) HWC inside to LWC outside cell from a region of water concentration, to a region (ii) 20. high water concentration with the cell membrane acting of low (selectively permeable membrane. as a

- 21 (i) To remove external surface water (ii) A
- 22 a) (i) osmosis (ii) HWC outside to LWC inside (25g at start to 32.5g at end) b) to remove external water
- 23 a) S and T b) osmosis c) difference between the high and low water concentration inside/outside the cell.
- 24 A) C or D b) blot dry c) B largest concentration gradient/difference in concentration (100% water and 80% water)
- 25 Increase in mass HWC outside to LWC inside
- 26 (i) water (ii) turgid
- 27 A) D b) to remove external surface water
- 28 HWC outside to LWC inside in the sugar solution. This moves liquid along tube/up the scale
- 29 a) osmosis b) HWC outside to LWC inside c) wider tube/lower temperature



**31.** What caused the change in height of the sugar solution in the capillary tube?

Tick the correct box.



30.

21

33 a (i) osmosis (ii) fresh water (HWC outside) b) it would burst as its not a plant cell

1.	osmosis is the movement of wa molecules	ter
	AND	
	active transport is the moveme of molecules/ions	ent (1)
2.	in osmosis movement is from a high(er) to a low(er) water concentration/down a concentration gradient	
	AND	
	in active transport movement i from a low(er) to a high(er) concentration/ against/up a concentration gradient	s (1)
3.	osmosis is a passive process, bu active transport is not.	ıt
	OR	
	No energy/ATP is required for osmosis but is needed for activ transport	e (1)
4.	active transport requires (membrane) proteins	
	AND	
	osmosis does not.	(1)
Any 3 from 4 points		