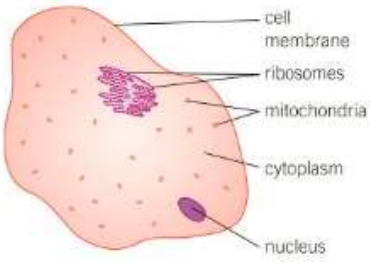
B1 Cell structure and transport SLOP

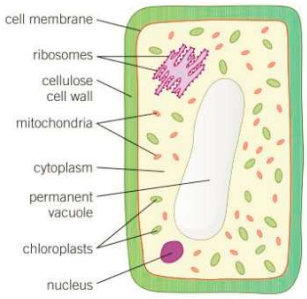
Lesson 1- Animal and plant cells

Reading

All living things are comprised (made up of) cells. Cells can be broadly categorised into two main areas: eukaryotic and prokaryotic cell. All eukaryotic cells have a nucleus and no prokaryotic cells do. Animal cells and plant cells are examples of eukaryotic cells.

Cell structure	Function
Found in both plant and animal cells	
Nucleus	Controls the activity of the cell. Contains the genes that carry the instructions needed for making protein and new cells
Cytoplasm	A liquid gel in which other organelles are found. Where most chemical reactions take place
Mitochondria	Site of aerobic respiration and where energy is released
Ribosomes	Site of protein synthesis
Cell membrane	Controls what goes in and out of the cell
Only found in plant cells	
Permanent vacuole	Filled with cell sap. Helps keep the cell rigid
Cell wall	Made of cellulose. Strengthens the cell and helps give it support.
Chloroplast	Contain chlorophyll which absorbs light. Site of photosynthesis





Task 1: copy above table into books.

Task 2: Comprehension questions

1. List the structures found in a human cell.
2. What is the function of the nucleus and mitochondria?
3. The Krebs cycle is an important part of aerobic respiration. Where does the Krebs cycle take place?
4. What three cell structures are found only in plant cells and not in animal cells?
5. What cell structure is responsible for making proteins?
6. Salivary cells produce amylase which is a type of protein, what type of cell structure will they have a lot of?
7. Muscle cells are likely to have large amount of what cell structure and why?

<u>Sophisticated sentences (Complete graphic organiser on next page first)</u>

Using your graphic knowledge organiser and the key words below create a set of sophisticated sentences about plant and animal cells.

Key words to use: While, whereas, similarly, contrastingly, in much the same way as, because

Example – Needs to be completed by student

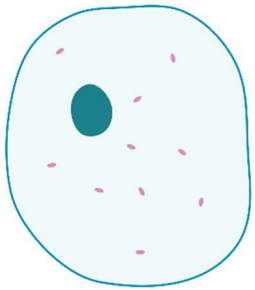
Both animal and plant cells are examples of…. Because…

<u>Now create your own</u> ☺

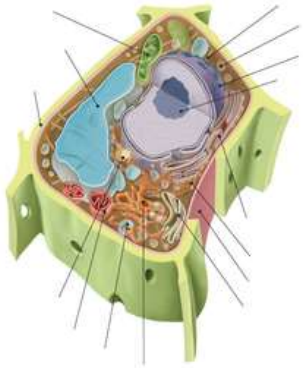
Differences

Similarities

Differences



Animal cell



Plant cell

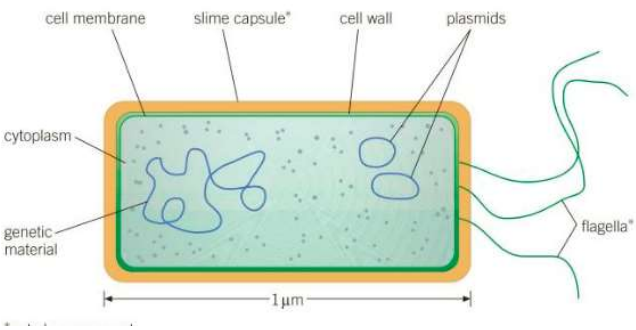
Extended response questions

1. Suggest why the nucleus and mitochondria are so important in all cells (4)
2. Suggest why root hair cells which are found underground do not have chloroplast (2)
3. The pancreas cell makes enzymes. Enzymes are proteins. Describe how the ribosomes and mitochondria help the cell to make enzymes. (3)
4. Compare a plant and animal cell (6)

Lesson 2 – Eukaryotic cells and prokaryotic cells

Reading

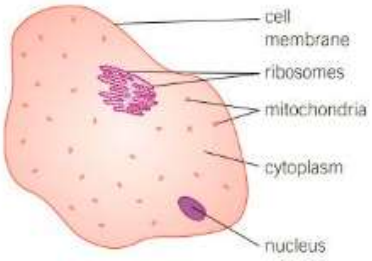
As previously mentioned animal and plant cells are eukaryotic cells because they have a nucleus. However, they are not the only cells to be eukaryotic both fungi and Protista are also eukaryotic. In a eukaryotic cell DNA is found in large linear structures called chromosomes in the nucleus. Bacteria are examples of prokaryotic cells they are smaller than eukaryotic cells being only 0.2 **µm**-2 **µm long. They do not have a nucleus.**



The cell wall of a bacterial cell is not made of cellulose. The bacterial chromosome is a single loop of DNA found free in the cytoplasm. A bacterial cell also has plasmids. These are small rings of DNA that carry genes for antibiotic resistance. Some bacteria have a flagellum which is a strand of protein that acts like a propeller to move them forwards. Some bacteria also have a slime capsule which protects them.

Comprehension

1. What is the difference between eukaryotic and prokaryotic cells?
2. Give examples of eukaryotic cells
3. Give an example of a prokaryotic cell
4. Why can't you see prokaryotic cells with a light microscope?
5. List all the structures that could be found in a bacterial cell
6. What is a plasmid?
7. What are two differences between an animal cell (right) and a bacterial cell (above)
8. Where is the DNA found in a bacterial cell



<u>Sophisticated sentences (Complete graphic organiser on next page first)</u>

Using your graphic knowledge organiser and the key words below create a set of sophisticated sentences about eukaryotic and prokaryotic cells.

Key words to use: While, whereas, similarly, contrastingly, in much the same way as, because

Example – Needs to be completed by student

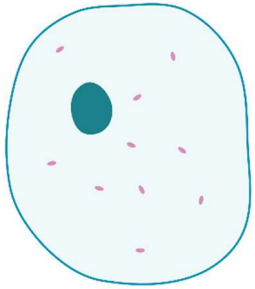
Both eukaryotic and prokaryotic cells…
In a plant cell …. Contrastingly…

<u>Now create your own</u> ☺

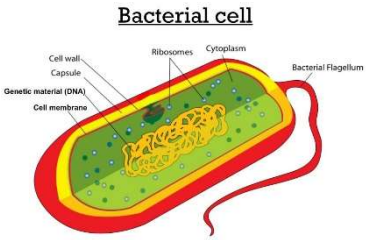
Differences

Similarities

Differences



Animal cell

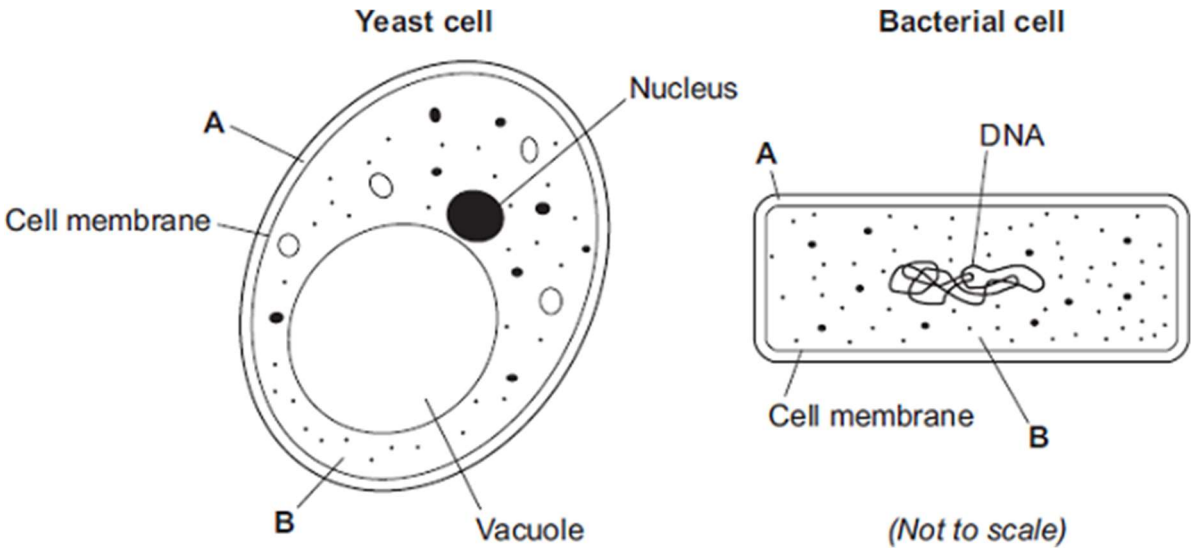


Bacterial cell

Extended response questions

1. Contrast plant cells and bacterial cells (5) (contrast means tell me differences)
2. Compare animal cells and bacterial cells (5) (compare means both similarities and differences)

(a) The diagrams show the structures of a yeast cell and a bacterial cell.



(i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A _____

B _____

3. (2)

(ii) The yeast cell and the bacterial cell have different shapes and sizes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

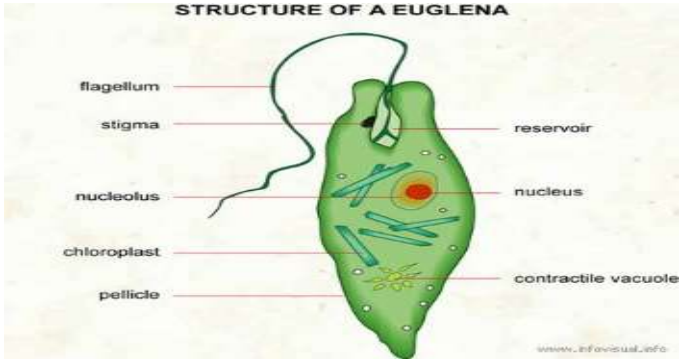
_____

_____

4. (1)

(iii) Suggest whether a yeast cell is a prokaryotic cell or a eukaryotic cell and why? (2)

<u>Interleaved extension questions</u>

1. What is the function of the nucleus, ribosomes and mitochondria?
2. State what type of cell the one below is and **justify** why?
3. 

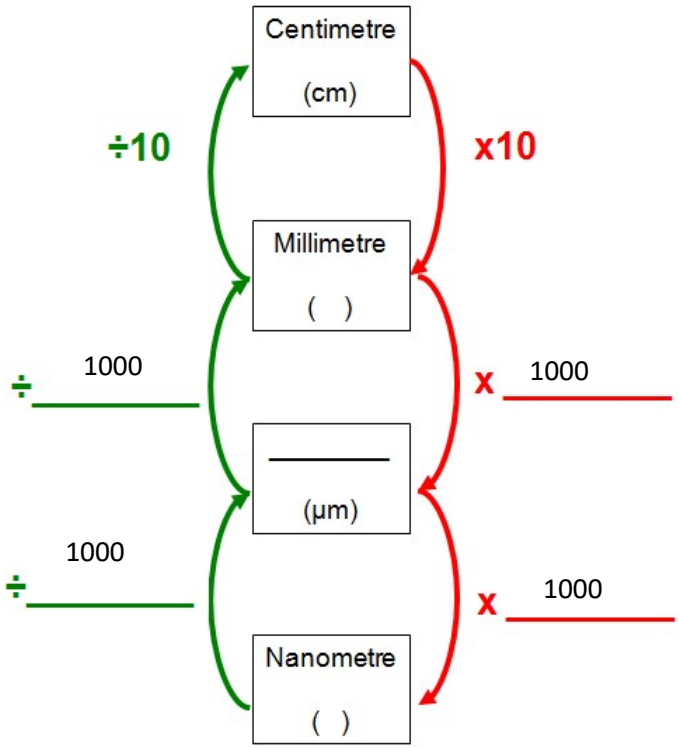
Lesson 3 Microscopes and magnification

Reading

Cells are too small to be seen with the naked eye. Instead microscopes have to be used. The first light microscopes were made in the 17th century. They use a beam of light to form an image of an object and can only reach magnifications of x2000. They are relatively cheap, easy to use and can magnify live specimens. The invention of electron microscopes in the 1930's allowed scientists to see cells in more detail and discover new sub cellular structures. Electron microscopes have a higher magnification and resolution. They use a beam of electrons and can magnify up to 2 000 000. Electron microscopes are large, very expensive, have to be kept in special conditions and cannot use live specimens. Resolution is the ability to distinguish between two objects as separate points.

Magnification of a light microscope can be calculated very easily.

Total magnification = eyepiece lens magnification x objective lens magnification



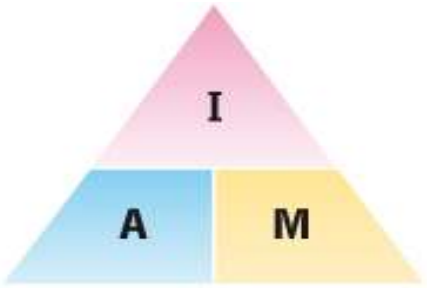
1) Complete the table below to show the corresponding value nanometres, micrometres and millimetres for the measurements given in each row. The first row has been completed for you. Ensure that your answers use the correct unit symbols.

Nanometre	**Micrometre**	**Millimetre**
5	0.005	0.000005
1		
	1	
		1
	3	
7		
		0.5

Calculating total Magnification of a compound light microscope

Eyepiece Magnification	Objective Magnification	Overall Magnification
X10	X4	
X10	X10	
X10	X40	
X10	X100	

Calculating Cell Magnification from images

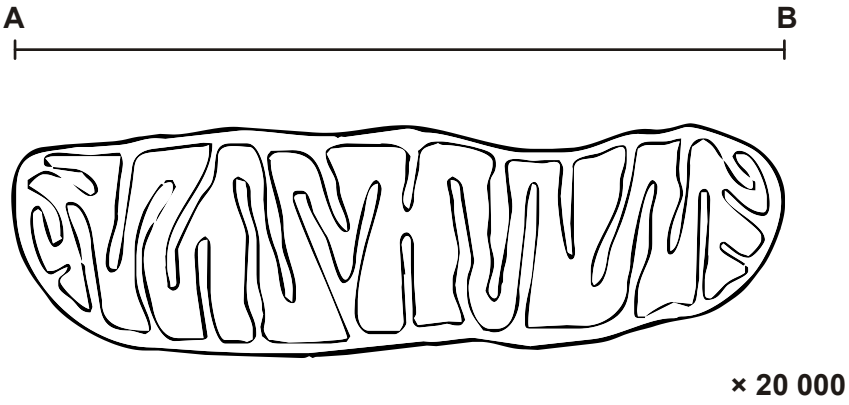


$$\text{Actual size} = \frac{\text{Image size}}{\text{Magnification}}$$

$$\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}$$

IMPORTANT: When calculating the size of an image or object, always convert units so that they are both the same. For example all in micrometres

The diagram below is a drawing of an organelle from a ciliated cell as seen with an electron microscope.

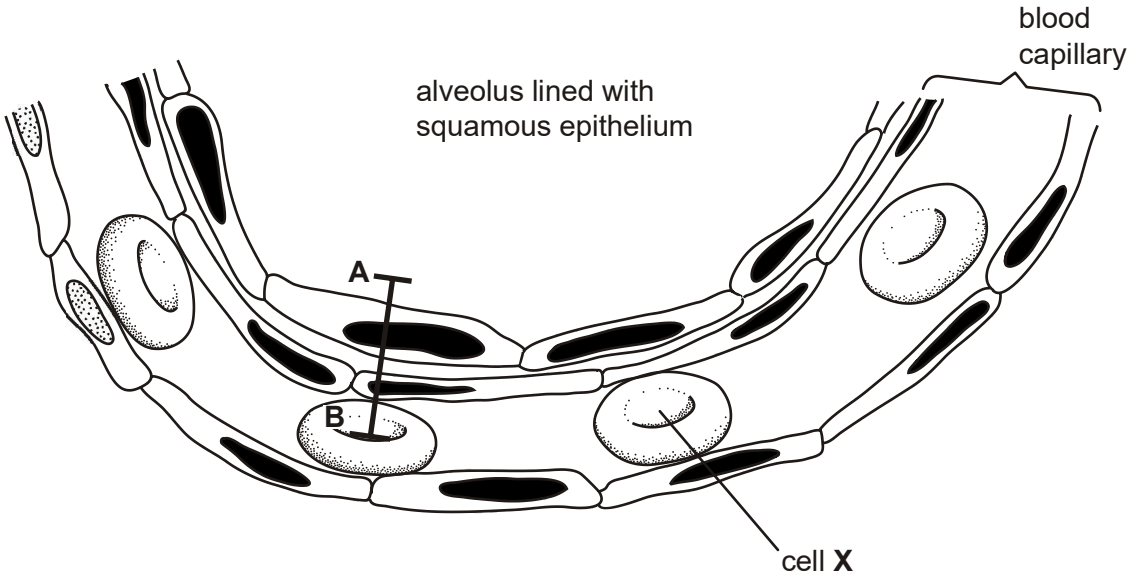


Calculate the actual length of the organelle as shown by the line AB in the diagram. Express your answer to the nearest micrometer (μm).

Show your working.

Answer = ... μm

The diagram below is a drawing of an alveolus together with an associated blood capillary.

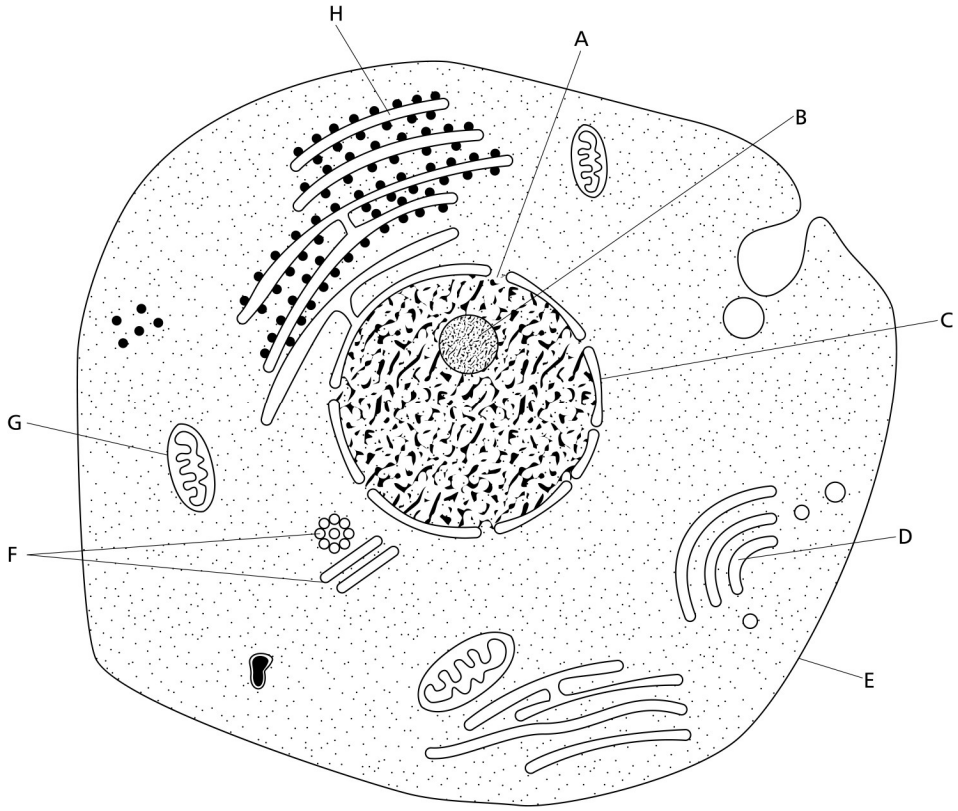


The line **AB** in the diagram represents an actual distance of 1.5 μm.

Calculate the magnification of the drawing. Show your working.

Answer = × .....

The diagram below shows the general structure of an animal cell as seen under an electron microscope.



5μm

1) Calculate the magnification factor of the diagram (use the scale bar above- number below it is actual size, use a ruler to work out image size)

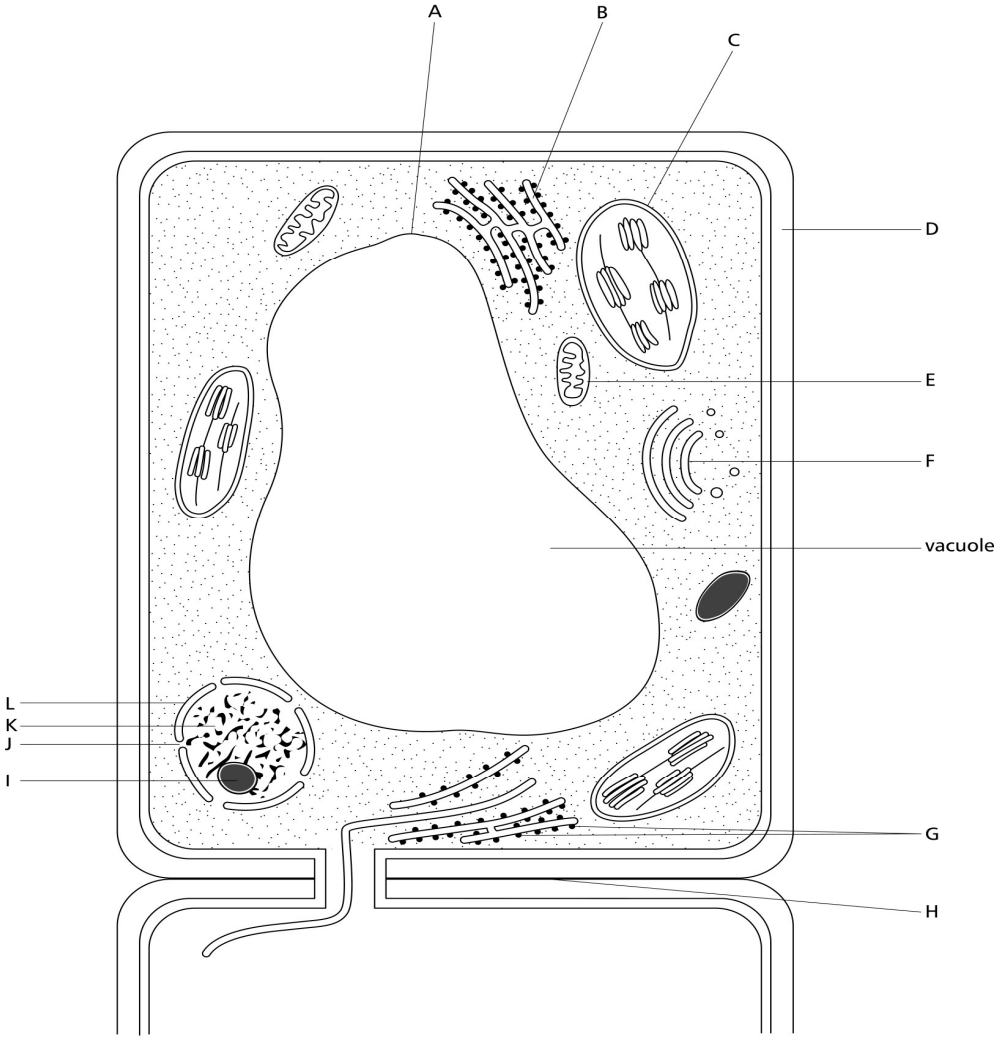
2) Calculate the actual length of structure G

3) Calculate the diameter of the nucleolus (structure B)

4) Calculate the diameter of the nucleus

5) Calculate the diameter of the cell at its widest point

The diagram below shows the general structure of a plant cell when viewed under and electron microscope.



Magnification is x5000

1) Calculate the thickness of the cellulose cell wall.

2) Calculate the length of the cell.

3) Calculate the length of structure C.

4) Calculate the length of the vacuole.

1 Fig. 1.1 is a diagram of an animal cell as seen using a transmission electron microscope.

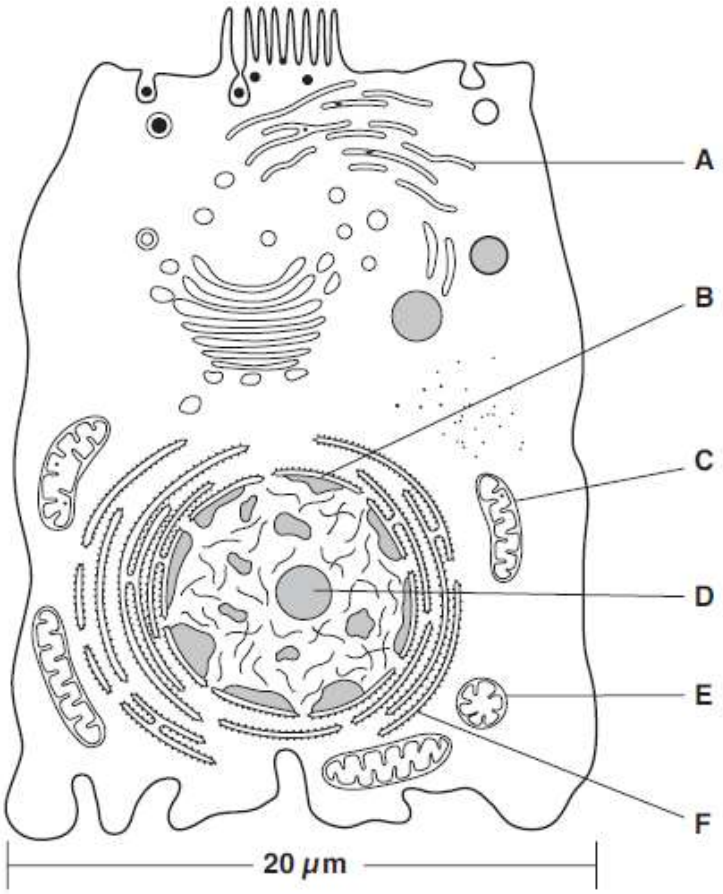


Fig. 1.1

Calculate the actual length of structure C.

Show your working and give your answer in micrometres (μm). Note: need to use scale bar first to find out magnification.

Answer = …….. μm

Lesson 4 Specialised animal cells

Reading

Humans and other animals are multicellular organisms meaning they are made up of multiple cells, millions in fact. The animal cell you have learnt about in the past is the general animal cell but animal cells can be specialised meaning they are adapted to their function. The sub-cellular structures (organelles) like nucleus, mitochondria etc and shape of a cell can change.

Type of specialised cell	Function	Adaptations
Nerve cell	Carry electrical impulses around the body	• Lots of dendrites to make connections to other cells • A very long axon that carries the impulse from one place to another • Synapses to pass the electrical impulse between nerve cells • Synapses contain lots of mitochondria to provide the energy needed to make special transmitter molecules
Muscle cells	Contract and relax to allow movement	• Contain special fibres that can slide over one another to allow the fibres to contract • Contain lots of mitochondria to provide energy for contraction • Store glycogen which can be converted into glucose for respiration
Sperm cells	Fertilise an egg cell	• A tail for movement • Middle section full of mitochondria to provide energy for tail to move • Digestive enzymes in acrosome to break through egg • A large nucleus containing genetic information

Comprehension –Task 1

1. Why does the sperm cell have a tail?
2. What is a specialised cell?
3. What do muscle cells contain a store of?
4. Why do muscle cells contain a store of the above item?
5. What other adaptation of a muscle cell links to the store of glycogen?
6. What is the function of a nerve cell
7. Give two adaptations of a nerve cell
8. Why do nerve cells contain lots of mitochondria?
9. If you are in your exam and are unsure of an adaptation of an animal cell, what one do they all share?

Extended response questions

1. Cone cells are specialised nerve cells found in the eye. They make a pigment that allows them to detect light and see colour. Once the pigment detects light another nerve signal is sent along another nerve cell to the brain. Cone cells contain lots of mitochondria. Suggest why this is an important adaptation. (4)
2. What does the number of mitochondria and the presence of flagella tell you about a cell? (2)
3. Describe and explain how the adaptations of a sperm cell assist it with its function (5)

Graphic organiser – fill in the gaps from memory – Task 2

Type of specialised cell	Function	Adaptations
Nerve cell	Carry around the body	• Lots of to make connections to other cells • A that carries the impulse from one place to another Synapses to • Synapses contain to provide the energy needed to make special
Muscle cells	Contract and relax	• Contain special fibres that can to allow the fibres to • Contain to provide energy for contraction • Store which can be converted into glucose for
Sperm cells		• A tail for movement Middle section full of mitochondria to • Digestive enzymes in to break through egg • A large nucleus containing genetic information

Answers

1. Transmitter chemicals are required to pass impulse from cone cell to another nerve cell and then on to brain (1). The many mitochondria supply energy from cellular respiration needed to make transmitter chemicals (1). By respiration (1) Energy released is used to make pigments (1)
2. Number of mitochondria tell how much energy a cell uses (1) prescence of flagella tell you that a cell has to be able to move (1)

Specialised plant cells

Reading

Plants like animals are multicellular organism and as such contains many specialised cells. Just like animal specialised cells these plant cells contain certain features and adaptations that make them successful at their function.

Specialised cell	Function	Adaptations
Root hair cell	• Absorb water and minerals	• Large surface area available for water to move into cell by osmosis • Large permanent vacuole that speeds up osmosis • Lots of mitochondria that carry out respiration to provide the energy needed for active transport
Photosynthetic cells (For example a palisade cell)	• Carry out photosynthesis	• Contain lots of chloroplasts containing chlorophyll that trap light • Usually found in outer layers of leaf and stem to absorb as much light as possible
Xylem cells	• Transports water and mineral ions from the roots to the highest leaves and shoots	• When first formed xylem cells are alive but due to build-up of lignin the cells dies and form long hollow tubes that allow water and mineral ions to travel up the plants • The lignin makes the xylem cells very strong and help them withstand the pressure of water moving up the plant
Phloem cells	• Transports glucose around the plant	• Cell walls between cells break down to form sieve plates that allow water carrying dissolved glucose to move up and down the phloem • Supported by companion cells that keep them alive. Phloem cells don't have cell structures like mitochondria instead they rely on companion cells for their energy needs

Comprehension

1. What is the function of root hair cells, xylem cells and phloem cells
2. The build up of what chemical causes xylem cells to die?
3. Why do root hair cells have lots of mitochondria?
4. What cell structure do photosynthetic cells have lots of?
5. Why must xylem cells be strong?
6. What is the purpose of sieve plates?
7. What is the name given to the type of cells that keep phloem cells alive?

Extended response questions

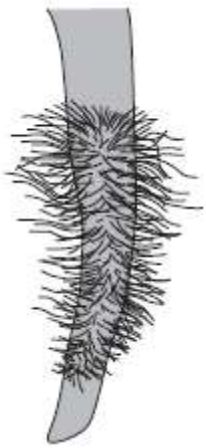
1. Suggest why a cell within the trunk of a tree cannot carry out photosynthesis (Hint: what can't it get)
2. Suggest why root hair cells don't contain chloroplasts (Hint: think about their location)

Graphic organiser – fill in the gaps

Specialised cell	Function	Adaptations
	• Absorb water and minerals	• Large available for water to move into cell • Large that speeds up osmosis • Lots of that carry out to provide the energy needed
Photosynthetic cells (For example a palisade cell)	• Carry out photosynthesis	• Contain lots of containing that trap light • Usually found in outer layers of leaf and stem to absorb as much light as possible
Xylem cells	• Transports water and mineral ions from the roots to the highest leaves and shoots	• When first formed xylem cells are but due to build-up of the cells dies and form long hollow tubes that allow and to travel up the plants • The lignin makes the xylem cells and help them withstand the moving up the plant
Phloem cells	• Transports around the plant	• Cell walls between cells break down to form that allow water carrying to move up and down the phloem • Supported by that keep them alive. Phloem cells don't have cell structures like instead they rely on companion cells for their energy needs

Extended response questions continued

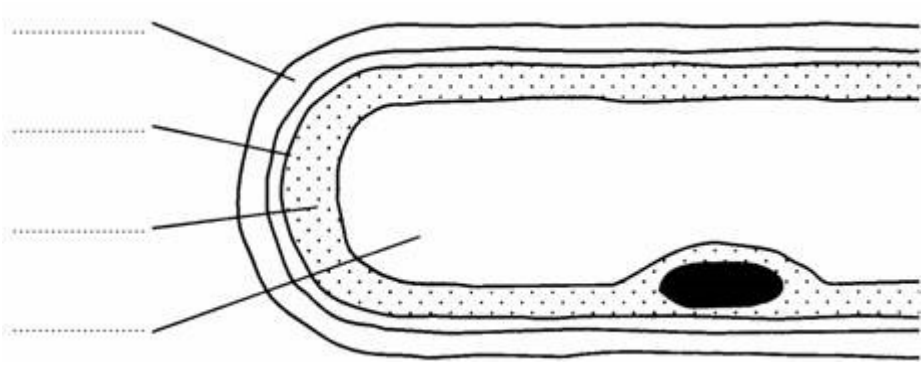
3. The image below shows part of a plant root.



The plant root is adapted for absorbing water from the soil.

Use information from the diagram to explain how this plant root is adapted for absorbing water.

4. The drawing shows part of a root hair cell.

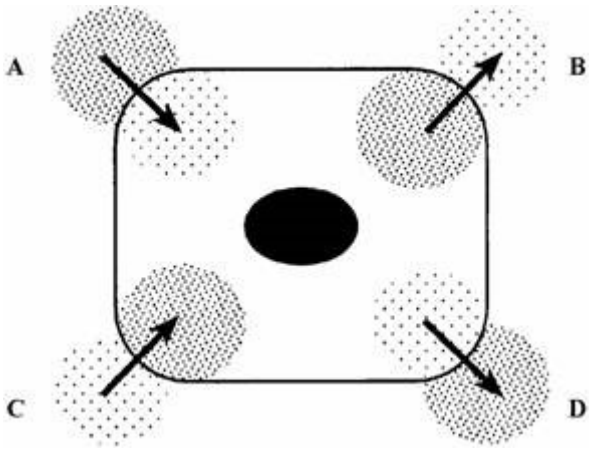


(a) Use words from the list to label the parts of the root hair cell.

cell membrane **cell wall** **cytoplasm** **nucleus** **vacuole**

(4)

(b) The diagram shows four ways in which molecules may move into and out of a cell. The dots show the concentration of molecules.



The cell is respiring aerobically.
Which arrow, **A**, **B**, **C** or **D** represents:

(i) movement of oxygen molecules; _____

(ii) movement of carbon dioxide molecules? _____

(2)

(c) Name the process by which these gases move into and out of the cell.

_____

(1

Answers

3.(b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

ignore absorption

1

5. (a) (cell) wall
(cell) membrane
cytoplasm
vacuole

for 1 mark each

4

(b) (i) A

(ii) B

for 1 mark each

2

(c) diffusion (*reject* osmosis)

for 1 mark

Lesson 6 Diffusion

Reading

Your cells need to take in substances like glucose and oxygen to survive and remove substances like urea and carbon dioxide. Dissolved substances and gases can move in and out of cells by diffusion. Diffusion is the movement of particles from a high concentration to a low concentration. Diffusion occurs down a concentration gradient. Different conditions can affect how fast diffusion occurs. At higher temperature diffusion happens faster because the particles move faster as they have more kinetic energy.

The bigger the difference in concentration between two areas the faster diffusion will occur. The oxygen you need for respiration passes from the air into your lungs. From here it diffuses into red blood cells to be transported round the body to where it is needed for example muscle cells. Carbon dioxide will diffuse from red blood cells into the lungs.

The single most common adaptation to improve diffusion is to increase the surface area of a cell. This is commonly done by folding the cell membrane.

Comprehension

1. What substances commonly enter cells?
2. What substances are commonly removed by cells?
3. Define diffusion
4. State two factors that can affect diffusion
5. Draw a diagram to represent diffusion
6. Why does increased temperature increase diffusion?
7. What diffuses from your lungs into red blood cells?
8. What diffuses from your red blood cells to your muscle cells?

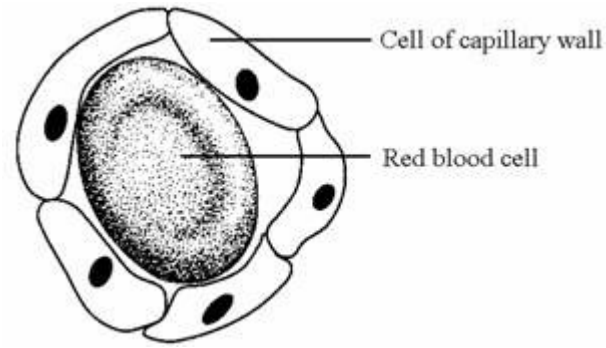
Extended response questions

1. Explain why so many cells have folded membranes along at least one surface. (2)
2. Describe the process of diffusion including any adaptations for the following statements:
    a. Carbon dioxide moves from the blood in the capillaries of your lungs to the air in the lungs (3)
    b. Male moths can track down a mate from up to 3 miles away because of the special chemicals produced by the female (3)
3. Diffusion is an important process in animals and plants.
   The movement of many substances into and out of cells occurs by diffusion.

   Describe why diffusion is important to animals and plants.

   In your answer you should refer to:
   - animals
   - plants
   - examples of the diffusion of named substances (6).

4. Capillaries are blood vessels in the body which join the arteries to the veins. They have walls which are one cell thick and so are able to exchange substances with the body cells.



(i) Name **two** substances that travel from the muscle cells to the blood in the capillaries.

1. _____

2. _____

(2)

(ii) Glucose is one substance that travels from the blood in the capillaries to the body cells. Explain how this happens.

_____

_____

_____

(2)

(Total 4 marks)

Answers

1. Folded membranes provide increased surface area.
   The greater the surface area, the more diffusion of dissolved substances can take place across it.

2a. Carbon dioxide moves from blood (high concentration) into air in the alveoli of the lungs (low concentration) down a concentration gradient.

Large surface area of alveoli increases rate of diffusion.

Rich blood supply maintains concentration gradient.

2b Chemicals produced by female moth spread out into air around her down concentration gradient.

Chemicals more concentrated close to female moth (high concentration) than further away (low concentration).

Male moth flies up concentration gradient, following chemical to reach female moth.

3. **0 marks**
No relevant content.
Level 1 (1 – 2 marks)
An example is given of a named substance
or
a process
or
there is an idea of why diffusion is important eg definition.
Level 2 (3 – 4 marks)

At least one example of a substance is given
and
correctly linked to a process in either animals or plants.
Level 3 (5 – 6 marks)
There is a description of a process occurring in either animals or plants that is correctly linked to a substance
and
a process occurring in the other type of organism that is correctly linked to a substance.
examples of points made in the response
Importance of diffusion:
- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:
- for gas exchange / respiration: O_2 in / CO_2 out
- for gas exchange / photosynthesis: CO_2 in / O_2 out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine
- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information
Description of processes might include:
- *movement of particles / molecules / ions*
- *through a partially permeable membrane*
- *(movement of substance) down a concentration gradient*
- *osmosis: turgor / support / stomatal movements*

2. [6]

4. (i) any **two** from:

urea

carbon dioxide

water

lactic acid

2

(ii) higher concentration of glucose **or** more glucose in blood than cells

1

<u>diffuses</u> across

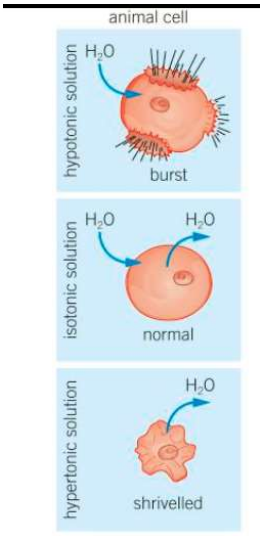
1

Lesson 7 – Osmosis

Reading

Osmosis is the movement of water from a dilute solution to a more concentrated solution across a partially permeable membrane. A partially permeable membrane is one that only lets certain substances pass through and not others. A dilute solution is one which contains lots of water and less solute and a more concentrated solution is one with less water and more solute. Another way of describing osmosis is the movement of water from a high water concentration to a low water concentration across a partially permeable membrane. Like diffusion it also occurs down a concentration gradient and is a passive process meaning it doesn't require energy. The water concentration gradient outside our cells can cause water to move in and out of cells.

If the water concentration outside the cell is equal to the water concentration inside the cell the solution is termed isotonic. A hypotonic solution has a higher water concentration that the cell this means water moves from the solution into the cell. Finally, a hypertonic solution is one in which the water concentration in the solution is lower than the cell causing water to move from the cell into the solution.



If an animal cell absorbs too much water it can burst conversely it can shrivel if it loses too much water. Plant cells do not do either of these as they have a cell wall that keeps them rigid and supports them.

Comprehension

1. What is a partially permeable membrane?
2. What is osmosis?
3. What is one similarity between diffusion and osmosis?
4. What is a passive process?
5. Define isotonic, hypotonic and hypertonic
6. What happen to a red blood cell placed in a hypotonic solution?
7. What happens to a root hair cell placed in a hypotonic solution?
8. Why do the two cells respond differently?

<u>Sophisticated sentences (Complete graphic organiser on next page first)</u>

Using your graphic knowledge organiser and the key words below create a set of sophisticated sentences about eukaryotic and prokaryotic cells.

Key words to use: While, whereas, similarly, contrastingly, in much the same way as, because

Example – Needs to be completed by student

Both diffusion and osmosis…
Osmosis is the movement of…. Contrastingly diffusion…

<u>Now create your own</u> ☺

Differences

Similarities

Differences

Diffusion

Osmosis

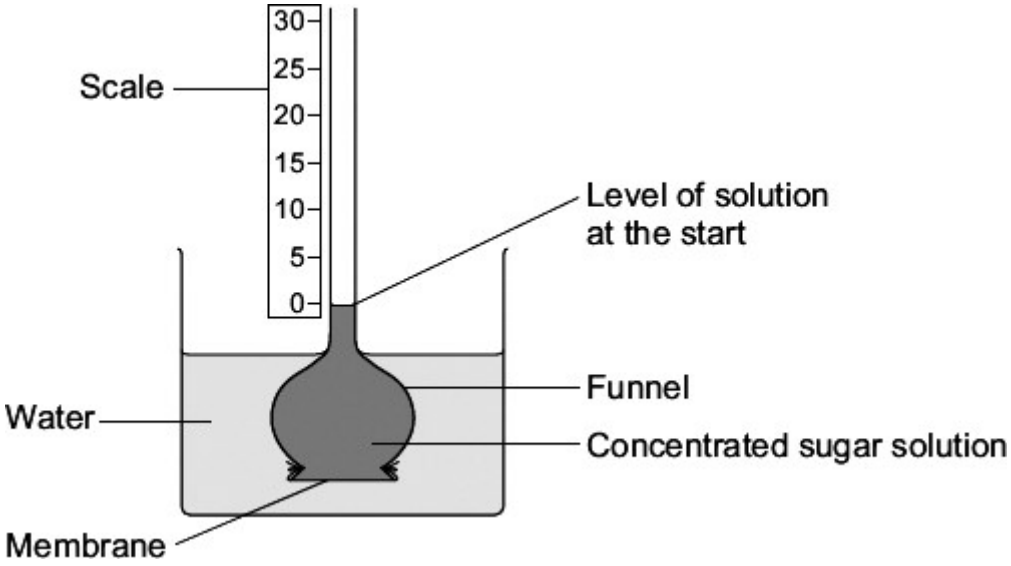
Extended response questions

1. Compare osmosis and diffusion (4)
2. Animals that live in fresh water have a constant problem with their water balance. The single celled organism amoeba has a special vacuole that fills with water and then moves to the outside of a cell to burst. A new vacuole starts forming straight away. Explain in terms of osmosis why amoeba need vacuole (4)
3. Explain why it is so important for the cells of the human body that the solute/water concentration of the fluid surrounding the cell to be kept as constant as possible (4)
4. Some substances move through membranes. A student set up an investigation.

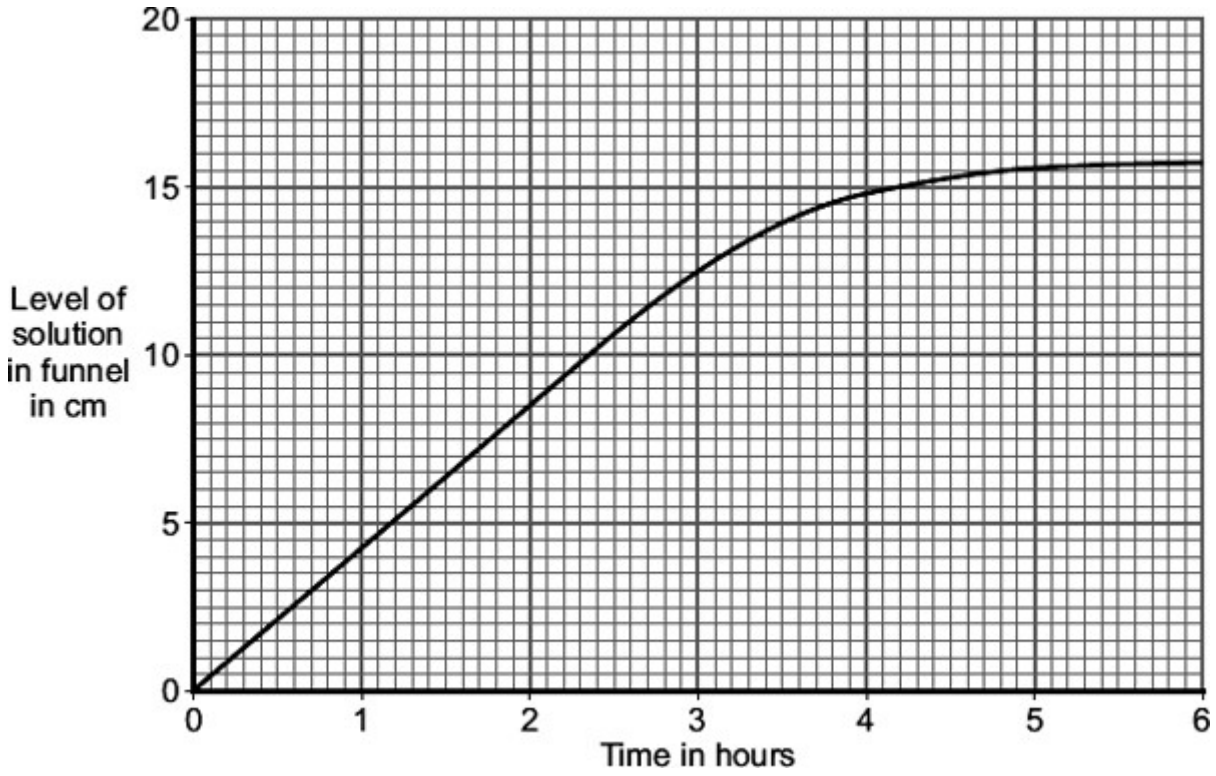
   The student:

   - tied a thin membrane across the end of a funnel
   - put concentrated sugar solution in the funnel
   - put the funnel in a beaker of water
   - measured the level of the solution in the funnel every 30 minutes.

   The diagram shows the apparatus.



   The graph shows the results.



(a) After 3 hours, the level of the solution in the funnel is different from the level at the start.

Explain why, as fully as you can.

(3)

(b) The student repeated the investigation using dilute sugar solution instead of concentrated sugar solution.

In what way would you expect the results using dilute sugar solution to be different from the results using concentrated sugar solution?

Give the reason for your answer.

(2)

(Total 5 marks)

Answers

3	If solute concentration outside body cells is more dilute than cell contents, water will move into cells by osmosis – cells will swell and may burst. If solute concentration outside body cells is higher than cell contents, water will leave cells by osmosis – cells will shrink and stop working properly. Solute concentration outside body cells must be as constant as possible to minimise changes in size and shape of cells, keeping them working normally.	1 1 1 1	
2	Cytoplasm of *Amoeba* is more concentrated than fresh water. Its cell membrane is partially permeable, so water constantly moves into *Amoeba* from its surroundings by osmosis. If this continued without stopping, the organism would burst. Water is moved into special vacuole by active transport, and vacuole then bursts to remove excess water	1 1 1 1	

4. (a) water enters (funnel / sugar solution) **or** water diffuses in (to the funnel)

*do **not** accept if diffusion of sugar*

1

membrane partially / selectively / semi permeable **or** by osmosis

allow description

1

because concentration (of sugar) greater
inside funnel than outside / water / in beaker

assume 'concentration' refers to sugar unless candidate indicates otherwise
the position of the solutions may be implied

1

(b) (level / it) rises more slowly **or** levels out earlier **or** does not rise as much

accept inference of less steep gradient (of graph)

allow less / slower osmosis / diffusion / less water passes through or less water enters funnel

allow water enters / passes through slower

1

less difference in concentration (between solution / funnel and water / beaker)

accept due to lower diffusion / concentration gradient / described

1

[5]

Lesson 8 – Osmosis in plants

Reading

Osmosis is the movement of water from a dilute solution to a more concentrated solution across a partially permeable membrane. As previously mentioned plant cells have a cell wall that prevents them from bursting or shrivelling when put in different solutions. Instead when in a hypotonic solution water moves into a plant cell and causes them to swell and appear turgid. When in a hypertonic solution the plant cell will lose water and appear plasmolysed. A plant cell is described as plasmolysed when a plant cell membrane pulls away from the cell wall.

Required practical

A piece of plant tissue is placed in solutions of different salt/sugar concentration. Prior to this the mass of the plant tissue is measured and after a set period of time the mass of the potato chip is measured and the % change in mass is recorded. The % change is recorded as although roughly the same size piece of plant tissue is used there can be differences. Prior to measuring the outside of the plant tissue is blotted to remove any excess water on outside. An example set of results can be seen below:

Concentration of sugar solution in mol dm^{-3}	Starting mass in g	Final mass in g	Change of mass in g	Percentage (%) change
0.0	1.30	1.51	0.21	16.2
0.2	1.35	1.50	0.15	**X**
0.4	1.30	1.35	0.05	3.8
0.6	1.34	1.28	−0.06	−4.5
0.8	1.22	1.11	−0.11	−9.0

Positive percentage changes in mass are caused by movement of water from the more dilute solution to a more concentrated solution inside the cell. The more water that moves in the greater the mass. Negative values are caused when water moves from a more dilute solution in cells to a more concentrated solution outside the cell by osmosis.

Comprehension

1. What is osmosis?
2. What do plant cells have that prevents them from bursting?
3. What happens to a plant cell placed in a hypotonic solution?
4. What does plasmolysed mean?
5. When does a plant cell become plasmolysed?
6. Why do we use percentage change in mass?
7. Why is the outside of the plant tissue dried?
8. What causes an increase in mas of plant tissue in the 0.0 solution?
9. Suggest why there is a greater percentage increase in mass in the 0.0 solution than the 0.2 solution

Extended response questions

The table below shows the results.

Concentration of sugar solution in mol dm^{-3}	Starting mass in g	Final mass in g	Change of mass in g	Percentage (%) change
0.0	1.30	1.51	0.21	16.2
0.2	1.35	1.50	0.15	**X**
0.4	1.30	1.35	0.05	3.8
0.6	1.34	1.28	−0.06	−4.5
0.8	1.22	1.11	−0.11	−9.0

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

.....

.....

Percentage change in mass = ... %

(2)

(b) Why did the student calculate the percentage change in mass as well as the change in grams?

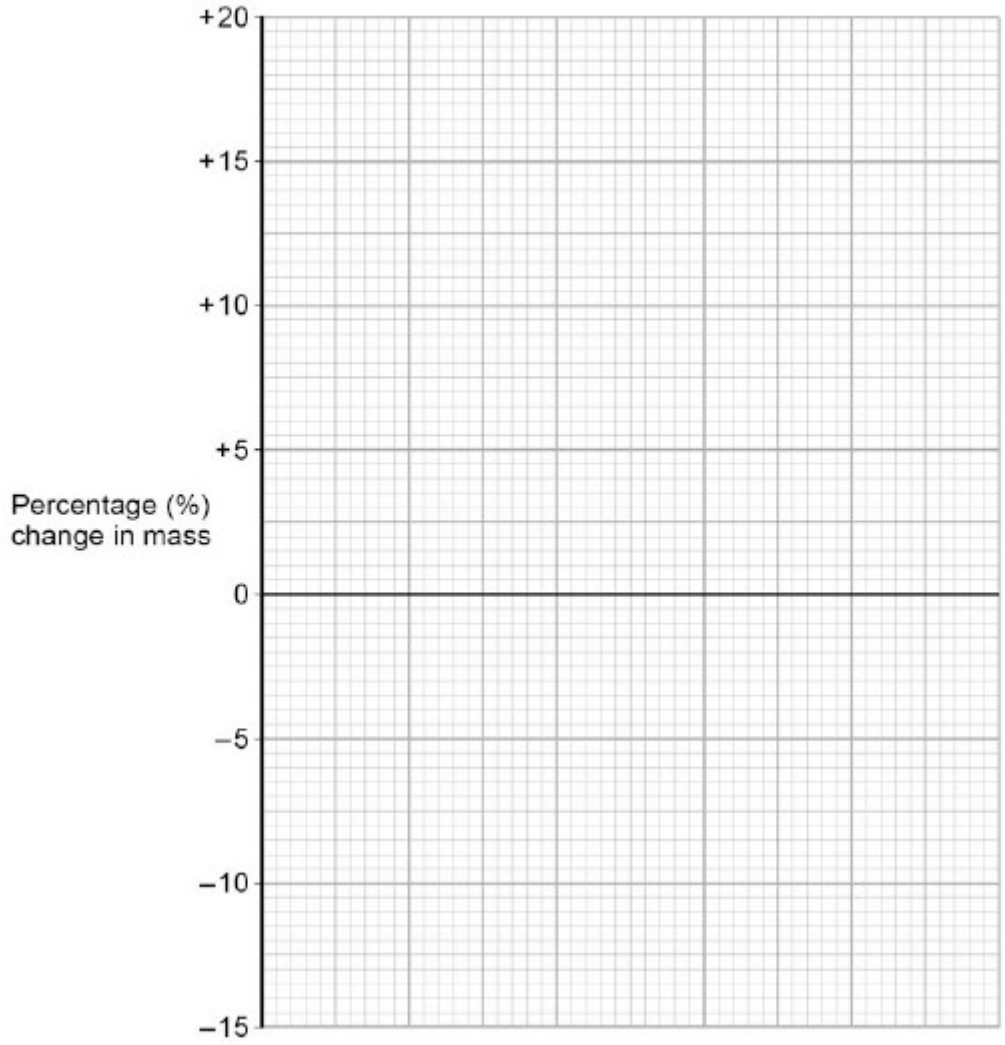
.....

.....

(1)

(c) Complete the graph using data from the table above.

- Choose a suitable scale and label for the x-axis.
- Plot the percentage (%) change in mass.
- Draw a line of best fit.



(4)

(d) Use your graph to estimate the concentration of the solution inside the potato cells.

Concentration = ... mol dm^{-3}

(1)

(e) The results in the table above show the percentage change in mass of the potato cylinders.

Explain why the percentage change results are positive **and** negative.

.....

.....

.....

.....

.....

.....

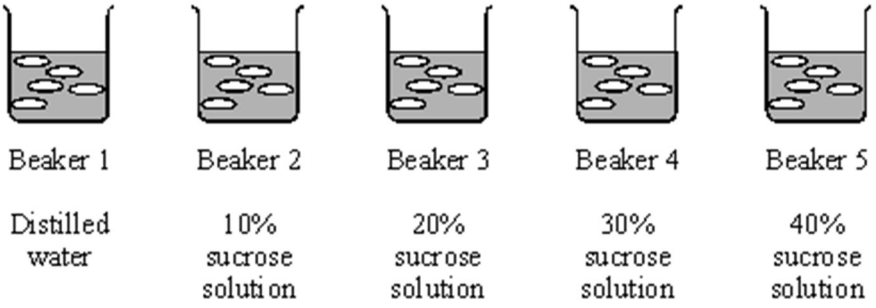
.....

.....

(3)

Q5. Some students set up an experiment using osmosis to find the concentration of

sucrose solution in potato cell sap. They used discs of potato cut to the same size and weighing approximately 10 gms. The discs were put into each of five beakers.



(a) (i) After two hours they reweighed the discs after carefully blotting them first. Why did the students blot the potato before weighing it?

.....

.....

(1)

(ii) Their results are shown in the table below.

	Beaker 1	**Beaker 2**	**Beaker 3**	**Beaker 4**	**Beaker 5**
Final mass in g	13.0	12.2	9.0	7.9	7.3
Initial mass in g	10.0	10.6	10.0	10.1	10.4

The students calculated the % gain or loss in mass of potato. Complete this table of results for Beakers 2, 4 and 5.

Beaker 1	**Beaker 2**	**Beaker 3**	**Beaker 4**	**Beaker 5**
13 – 10.0 = 3.0 $\frac{3.0}{10.0} \times 100\% = 30\%$		9.0 – 10.0 = –1.0 $\frac{-1.0}{10.0} \times 100\%$ = –10%		
Gain in mass = 30%		Loss in mass = 10%		

(3)

(Total 10 marks)

Lesson 9 -Active transport

Reading

Alongside diffusion and osmosis there is an additional method of transport in and out of cells. This is active transport. Active transport is the movement of particles from a low concentration to a high concentration across a partially permeable membrane. This occurs against a concentration gradient and requires energy. Active transport allows cells to absorb substances that are very low in concentration. Cell that carry out active transport require lots of energy. This energy comes from respiration. Therefore these cells need lots of mitochondria. They are also likely to have a large surface area.

Active transport is particularly important for root hair cells. They need to absorb minerals like nitrate ions. However these ions are typically lower in concentration outside the cell than inside the cell. It is also important in the kidneys where glucose in urine must be reabsorbed. In order for all glucose to be reabsorbed back into our blood active transport must be used. Glucose is important as it is used for respiration.

Comprehension

1. What is active transport?
2. What are two differences between active transport and diffusion?
3. What is a similarity between diffusion and active transport
4. What two adaptations do cells that carry out active transport have?
5. Why is active transport important for root hair cells?

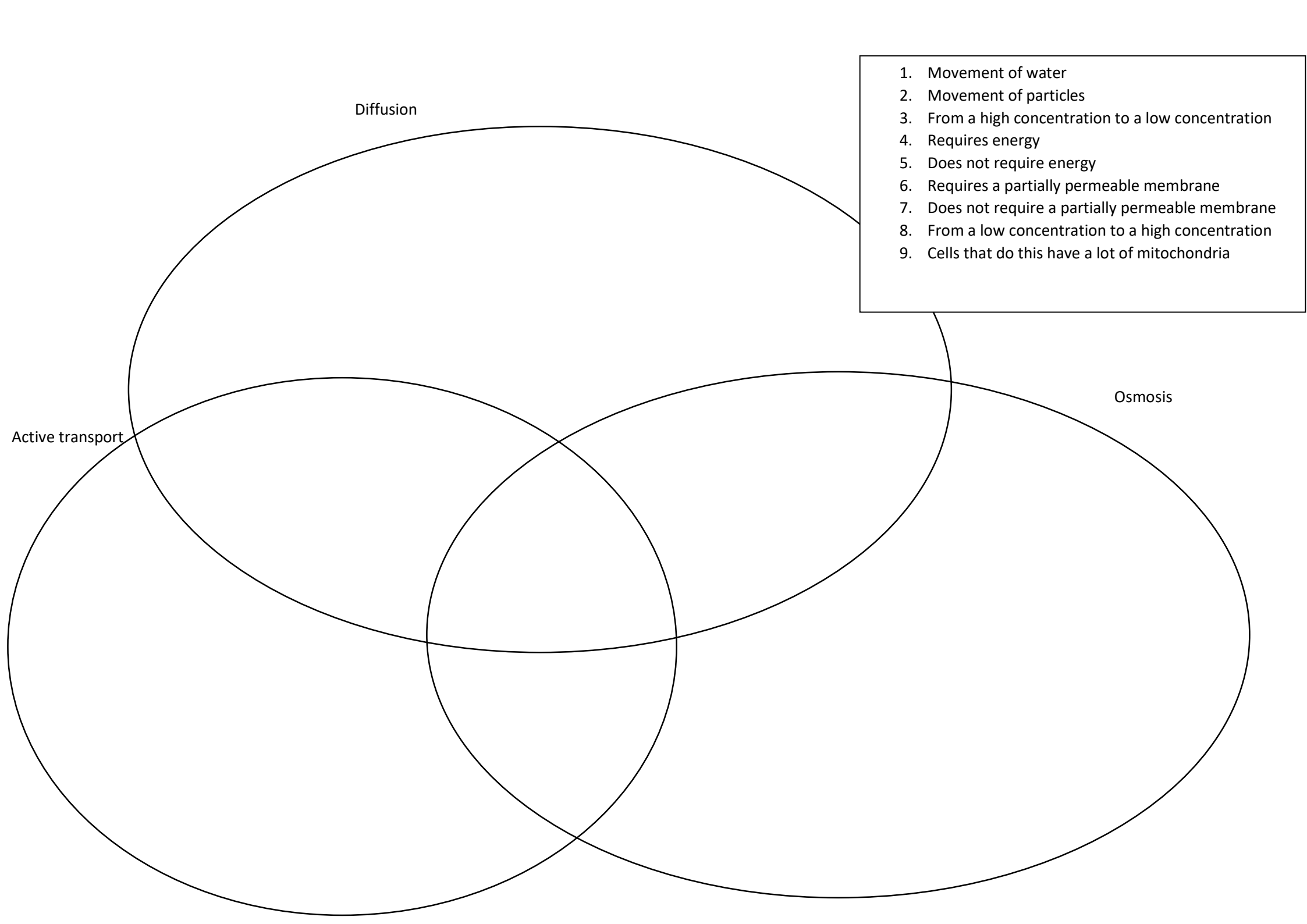
<u>Sophisticated sentences (Complete graphic organiser on next page first)</u>

Using your graphic knowledge organiser and the key words below create a set of sophisticated sentences about active transport
Key words to use: While, whereas, similarly, contrastingly, in much the same way as, because

Example – Needs to be completed by student

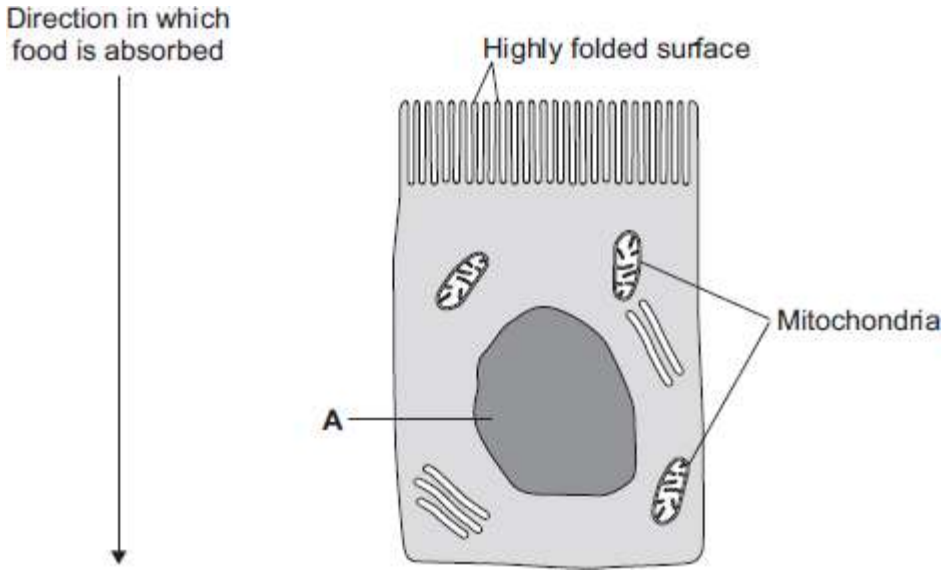
Both active transport and osmosis…
Active transport requires…. Contrastingly…

<u>Now create your own ☺</u>


1. Movement of water
2. Movement of particles
3. From a high concentration to a low concentration
4. Requires energy
5. Does not require energy
6. Requires a partially permeable membrane
7. Does not require a partially permeable membrane
8. From a low concentration to a high concentration
9. Cells that do this have a lot of mitochondria
Diffusion
Osmosis
Active transport

Extended response questions

1. The image below shows an epithelial cell from the lining of the small intestine.



(a) (i) In the image above, the part of the cell labelled **A** contains chromosomes.

What is the name of part **A**?

(1)

(ii) How are most soluble food molecules absorbed into the epithelial cells of the small intestine?

Draw a ring around the correct answer.

diffusion	**osmosis**	**respiration**

(1)

(b) Suggest how the highly folded cell surface helps the epithelial cell to absorb soluble food.

(1)

(c) Epithelial cells also carry out active transport.

(i) Name **one** food molecule absorbed into epithelial cells by active transport.

(1)

(ii) Why is it necessary to absorb some food molecules by active transport?

(1)

(ii) Suggest why epithelial cells have many mitochondria.

_____

(2)

(d) Some plants also carry out active transport.

Give **one** substance that plants absorb by active transport.

2. Describe the process of active transport in the root hair cells of plants (3)
3. Compare active transport and diffusion (6)

Lesson 10 – exchange surfaces

The bigger the surface area to volume ratio the better an organism it at exchanging material. As animals become larger their surface area to volume ratio becomes smaller. This means that simple diffusion cannot be used to supply all cells with gases and food molecules and poisonous substances can build up in cells. To prevent this larger organisms have evolved complex exchange systems.

These exchange systems share certain common adaptations: large surface area over which exchange can take place, thin membrane to provide a short diffusion distance, efficient blood supply to maintain a steep concentration gradient.

Examples of adapted exchange surfaces include the alveoli which are numerous to provide a large surface area, and a very rich blood supply. The small intestine has many villi and microvilli to increase surface area, a rich blood supply to maintain a steep concentration gradient. The villi are thin to provide a short diffusion distance. This increases the rate at which nutrients like glucose can be absorbed.

Fish gills contain many filaments to increase surface area, there is also a constant supply of water running over the gills to maintain a steep concentration gradient, and the gills also have a rich blood supply for the same reason.

Comprehension

1. What affect does becoming larger have on surface area to volume ratio?
2. What affect does becoming smaller have on surface area to volume ratio?
3. What are three common adaptations of exchange surfaces?
4. Why is a thin membrane useful?
5. Why do alveoli have a rich blood supply?
6. What do fish gills contain to increase their surface area?
7. What is absorbed in the villi?

<u>Sophisticated sentences (Complete graphic organiser on next page first)</u>

Using your graphic knowledge organiser and the key words below create a set of sophisticated sentences about plant and animal cells.

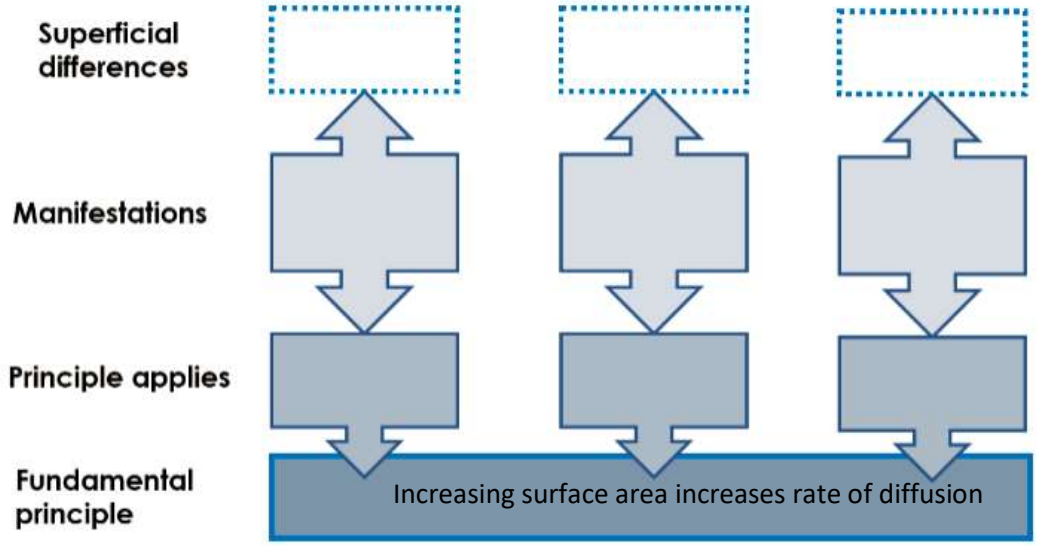
example:
Increasing the surface area can increase the rate of diffusion

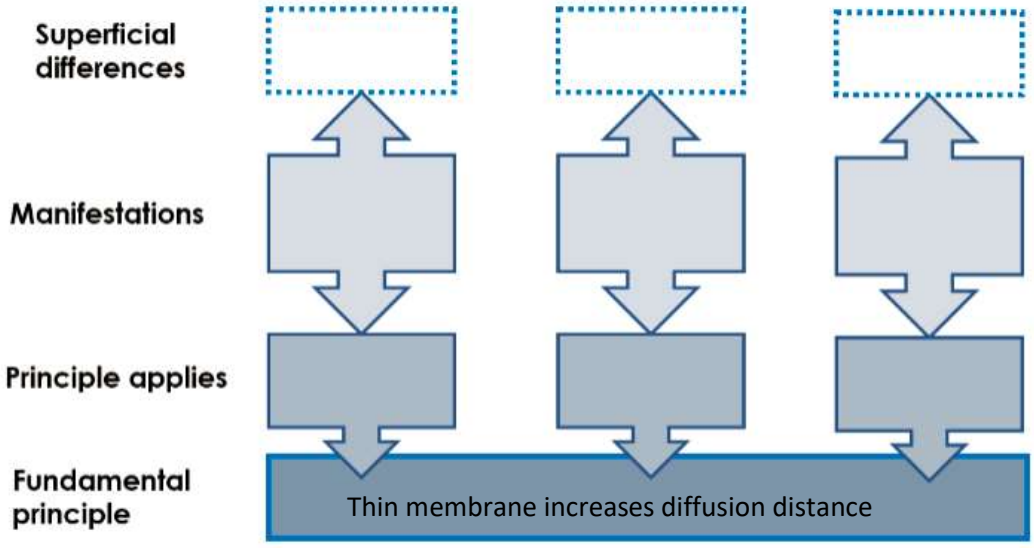
We see this principle in the case of **the alveoli**

Another manifestation of this principle is **found in the gills of fish**

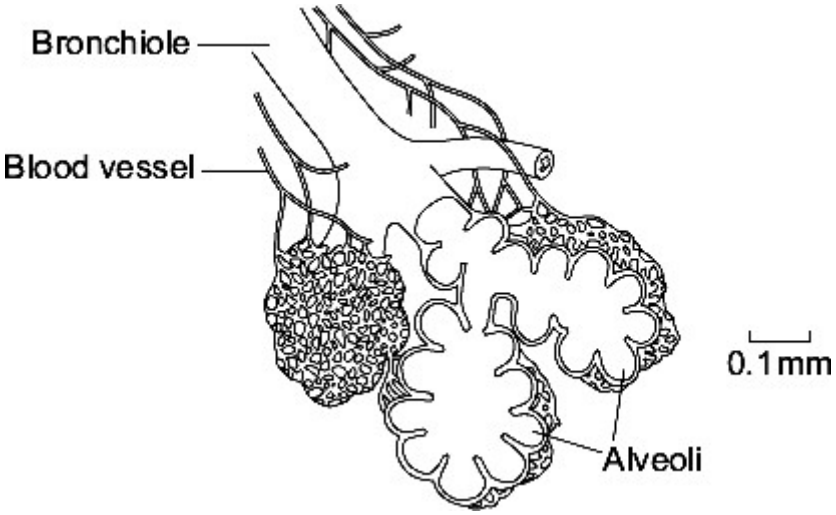
This effect has an application in **fish absorbing oxygen for respiration**

<u>Now create your own</u> ☺


Superficial differences
Manifestations
Principle applies
Fundamental principle
Increasing surface area increases rate of diffusion


Superficial differences
Manifestations
Principle applies
Fundamental principle
Thin membrane increases diffusion distance

The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



(a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

_____

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

_____

_____

_____

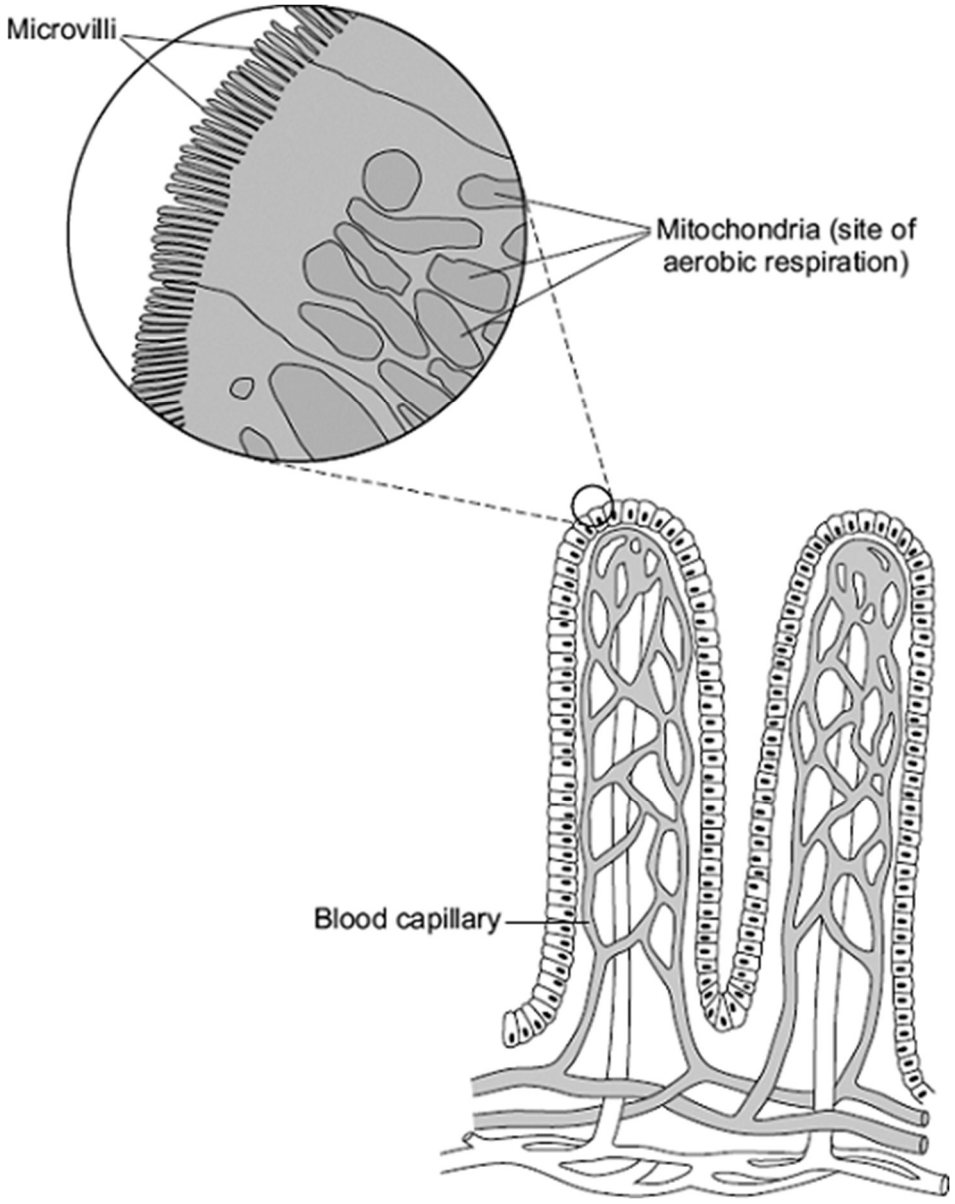
_____

(2)

(Total 6 marks)

The villi of the small intestine absorb the products of digestion.

2. The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as seen with an electron microscope.



Describe and explain how the villi are adapted to maximise the rate of absorption of the products of digestion.

_____

_____

_____

_____

(Total 6 marks)

Answer

a) large surface / large area

1

thin / short distance (from air to blood) / one cell thick / two cells thick

1

good blood supply / many capillaries / capillary network / many blood vessels

ignore moist surface

1

(b) (i) diffusion

ignore gaseous exchange

1

(ii) brings (more) oxygen / air into the lungs / alveoli

1

keeps O_2 level high in alveoli

or

maintains concentration difference (between alveoli and blood) / keeps O_2concentration in alveoli > O_2 concentration in blood gains **2** marks

1

[6]

2. D – *many* microvilli (1)
Ex – provide large surface area (1)

five *points made*
max ***3*** *descriptions*
max ***3*** *explanations*

D – *many* capillaries / *good* blood supply (1)
Ex – maintain concentration / diffusion gradient **or** quickly removes food (1)

D – thin wall / one cell thick surface / capillaries near surface (1)

allow villi are thin
ignore villi are one cell thick

Ex – short distance for food to travel (1)

D – *many mitochondria (1)*
Ex – provide energy / ATP for active uptake / transport (1)

[5]

sd