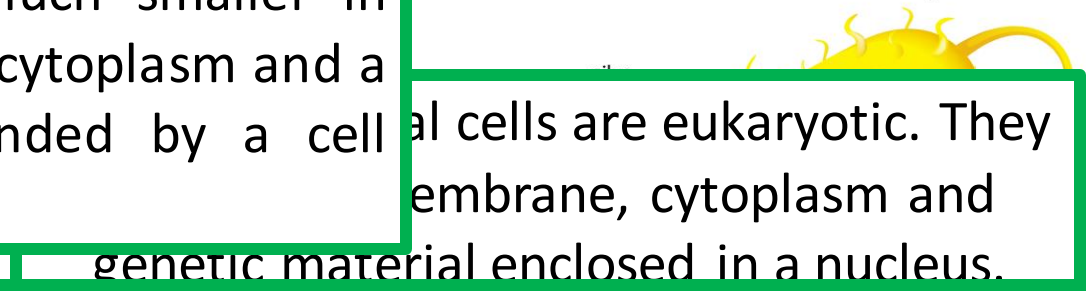
Cell Biology

Biology Paper 1

1.1.1 Eukaryotes and Prokaryotes

Prokaryotic cells are much smaller in comparison. They have cytoplasm and a cell membrane surrounded by a cell wall.



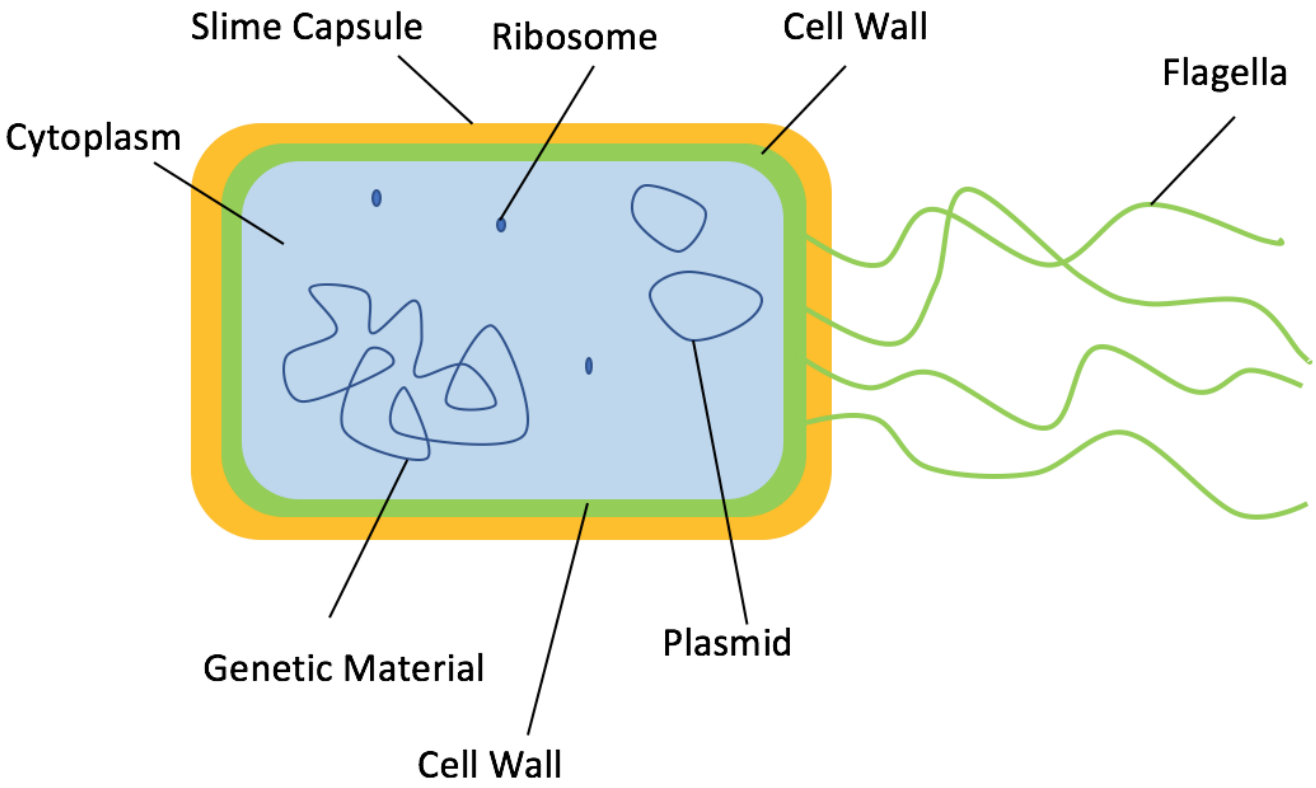
al cells are eukaryotic. They
embrane, cytoplasm and
genetic material enclosed in a nucleus.

The genetic material is not enclosed in a nucleus. It is a single DNA loop and there may be one or more small rings of DNA called plasmids.

Key Term	Definition	Example
Eukaryotic Cell		
Prokaryotic Cell		

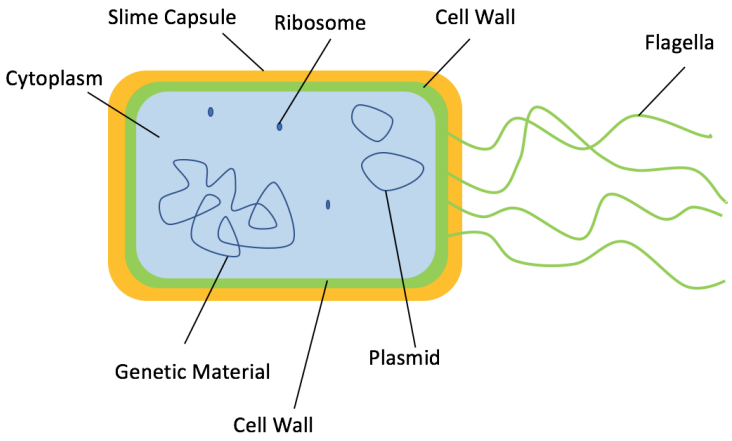
CS/F CS/H SS/F SS/H

1.1.1 Eukaryotes and Prokaryotes



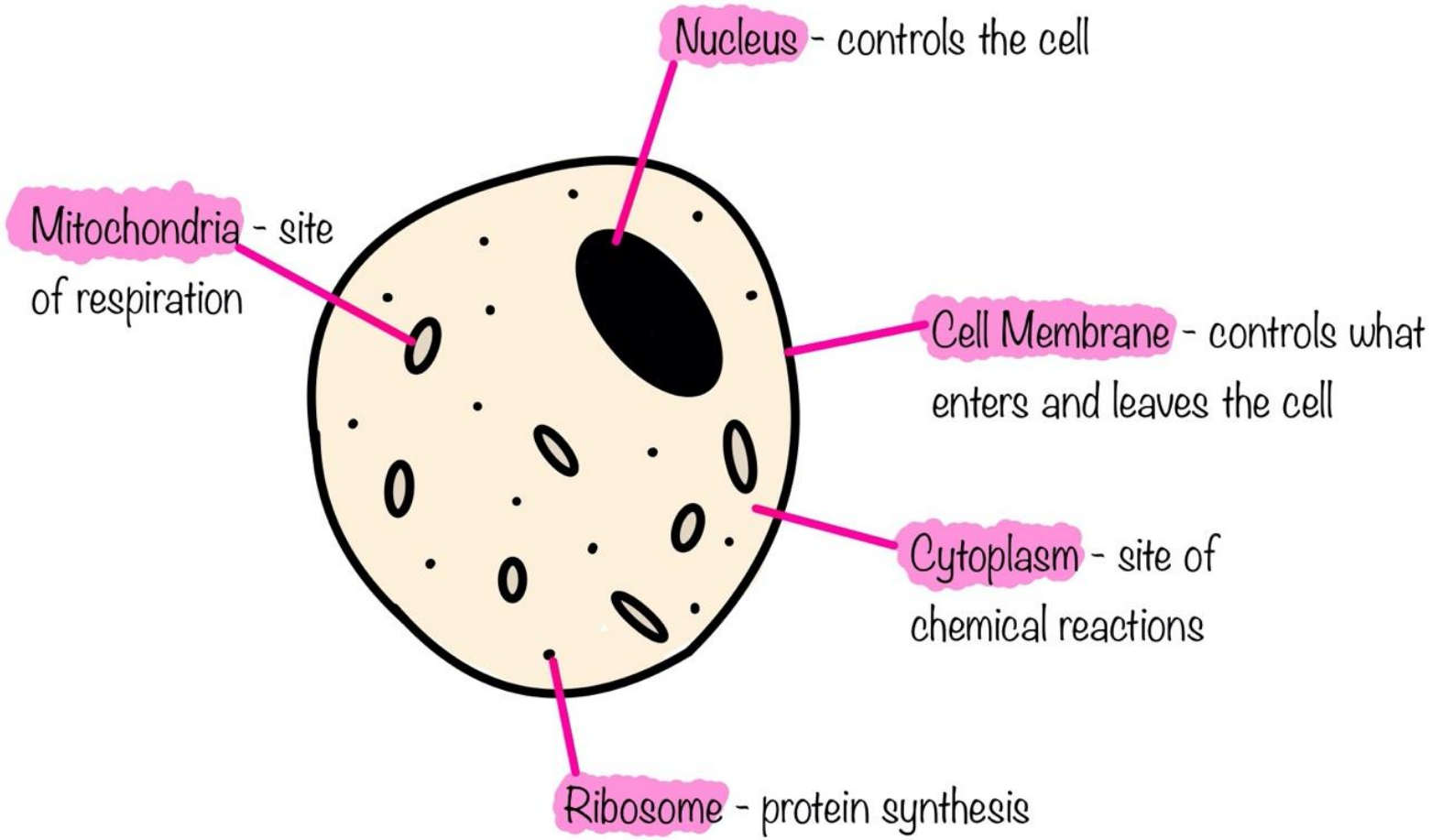
CS/F CS/H SS/F SS/H

1.1.1 Eukaryotes and Prokaryotes



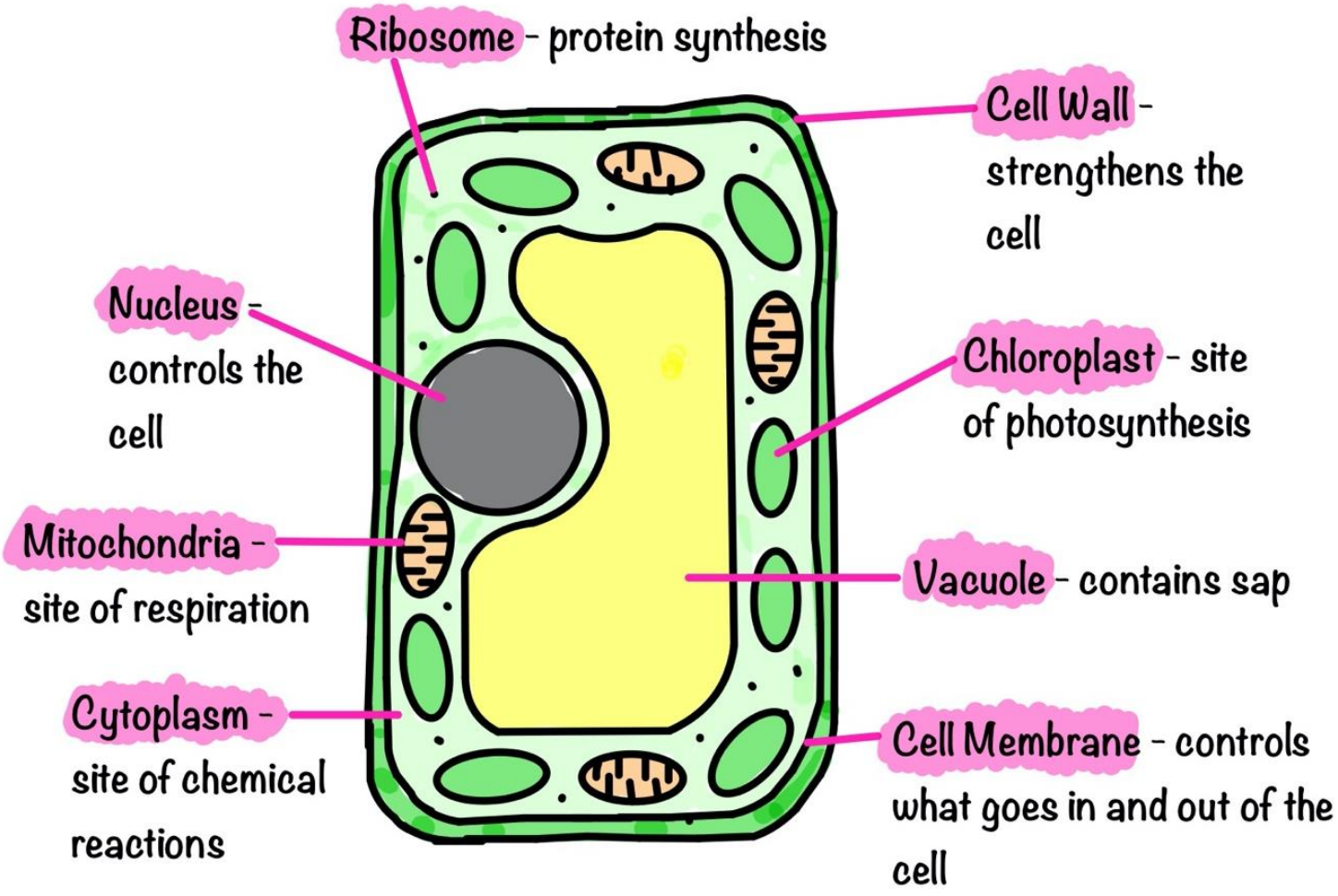
Cell Part	Function
Slime Capsule	Protects the cell
Flagella	Rotate to bring about movement
Plasmid	Small section of DNA that often provides a genetic advantage to the cell.
Genetic Material	Controls the cell.

1.1.2 Animal and Plant Cells



CS/F CS/H SS/F SS/H

1.1.2 Animal and Plant Cells

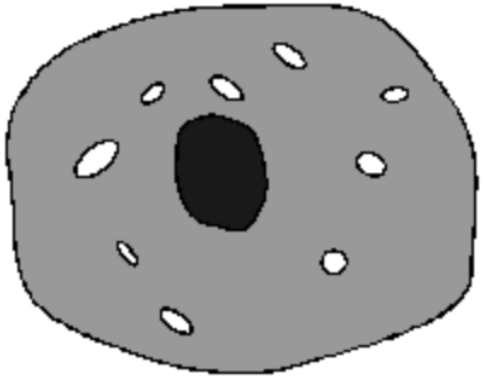


CS/F CS/H SS/F SS/H

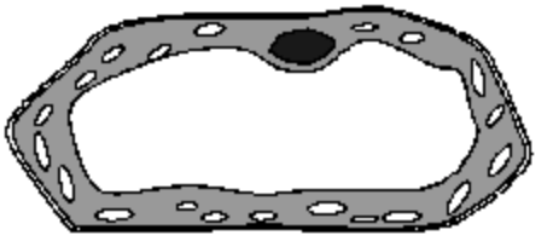
Exam Practice

L2

The diagrams show a cheek cell from a human and a leaf cell from a plant.



Cheek cell



Leaf cell

(a) The two cells have a number of parts in common.

(i) On the cheek cell, label **three** of these parts which both cells have.

(3)

Nucleus Cytoplasm Cell Membrane

Mitochondria

Exam Practice

L2

In the table, write the names of the **three** parts you have labelled above and describe the main function of each part.

Part	Function
Nucleus	Controls the cell
Cytoplasm	Site of chemical reactions in cells
Cell Membrane	Controls what enters and leaves cell

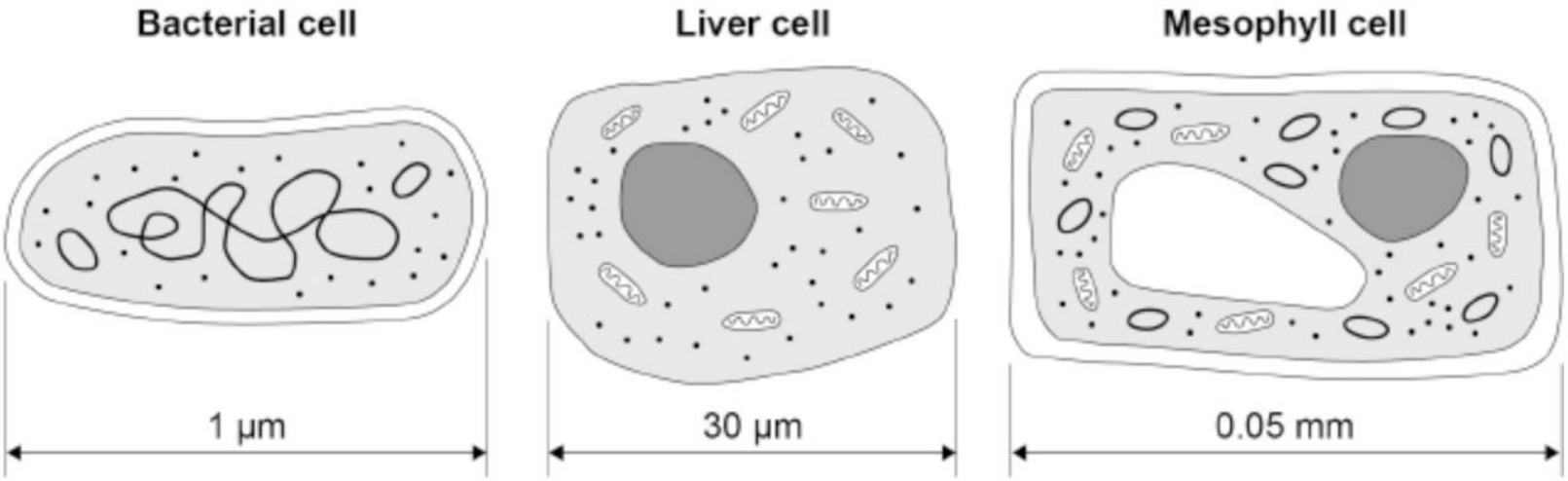
(3)

Mitochondria — Site of respiration

Exam Practice

L2

The diagram below shows three types of cell.



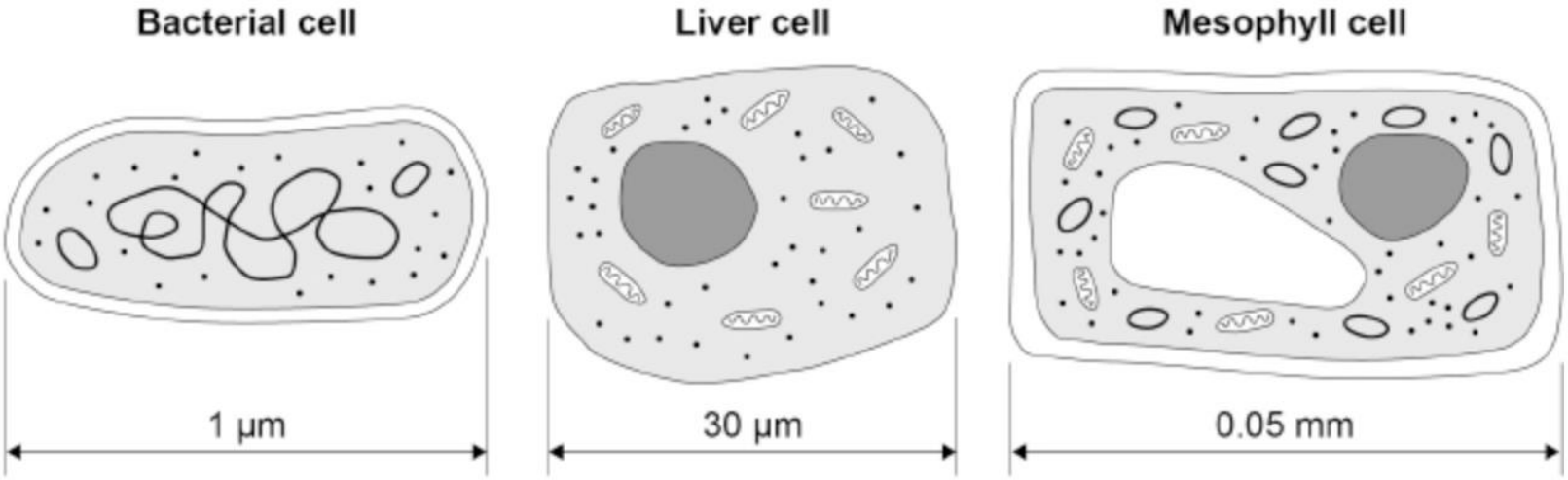
(a) Give **two** similarities between the prokaryotic cell and the eukaryotic cells in the diagram above.

1 Both have cytoplasm/cell membrane/ribosomes/ DNA

2 _____

(2)

The diagram below shows three types of cell.



Give **three** differences between the prokaryotic cell and the eukaryotic cells in the diagram above.

1 Prokaryote is smaller

Prokaryote has no nucleus

2 Prokaryote has no mitochondria

Prokaryote has plasmids

3 Prokaryote has loop of DNA

1.1.2 Animal and Plant Cells

Think
Pair
Share

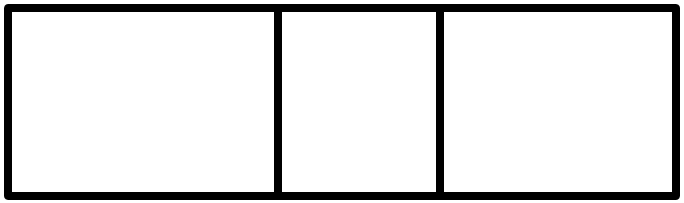
How do you prepare a slide of cells to observe under a microscope?

Add a drop of water to the microscope slide.

Place a thin layer of tissue on the slide.

Stain the tissue with a couple of drops of iodine solution.

Place the coverslip on top.



1.1.2 Animal and Plant Cells

Think
Pair
Share

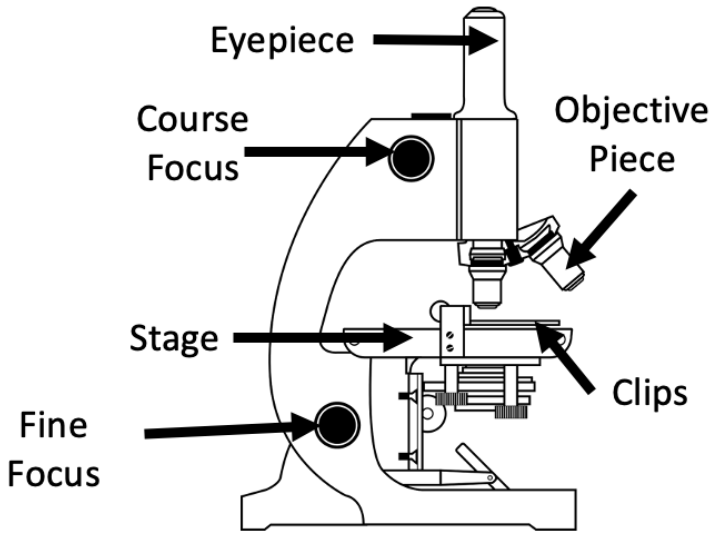
How do you set up and use a microscope to observe cells?

Place the slide on the stage and use the lowest power objective lens.

Turn the course focus wheel to bring the image into focus.

Increase the power of the objective lens to increase magnification.

Turn the fine focus wheel to bring the image into clearer focus.



CS/F CS/H SS/F SS/H

1.1.2 Animal and Plant Cells

Think
Pair
Share

What are the risks in this experiment and how could they be minimised?

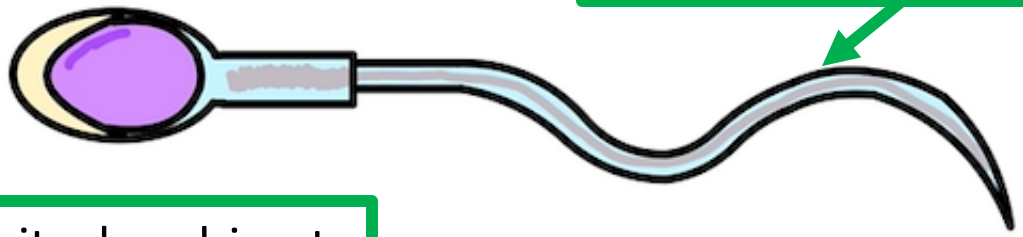
Hazard	Risk	Plan to Minimise Risk

1.1.3 Cell Specialisation

Cells may be specialised to carry out a particular function:

Sperm Cell

A tail which whips from side to side for movement.



Lots of mitochondria to provide energy for the movement of the tail.

Streamlined shape.

Function Transport genetic material from the father and fertilise an egg cell.

CS/F CS/H SS/F SS/H

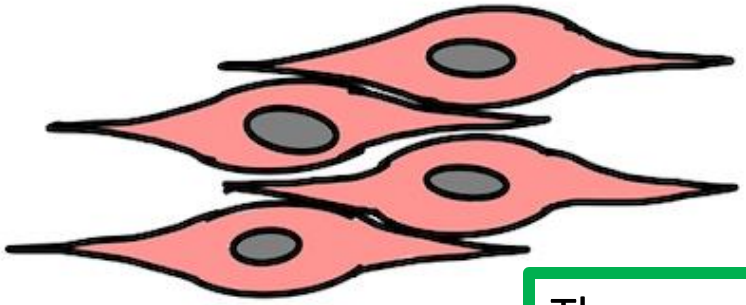
1.1.3 Cell Specialisation

Cells may be specialised to carry out a particular function:

Muscle Cell

Have special proteins that can slide over each other making fibres contract.

Have lots of mitochondria to transfer energy required for contraction.



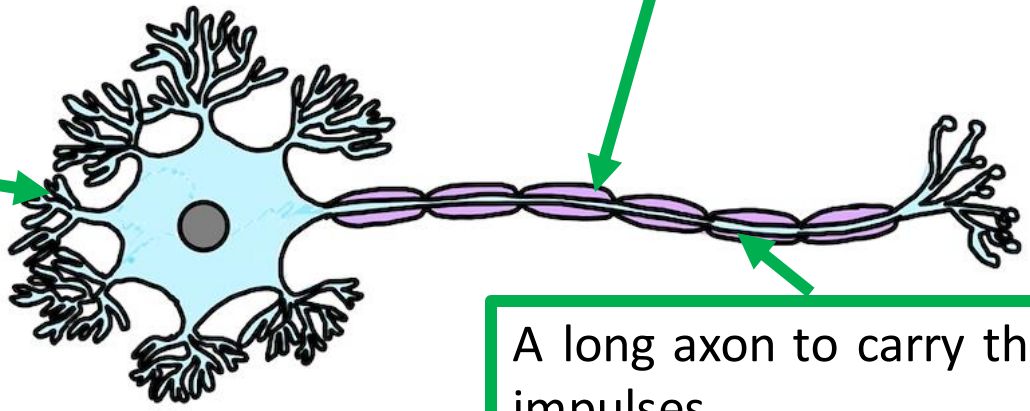
They can store glycogen.

Function To contract and relax to bring about movement.

1.1.3 Cell Specialisation

Cells may be specialised to carry out a particular function:

Nerve Cell



Function Carry electrical impulses around the body.

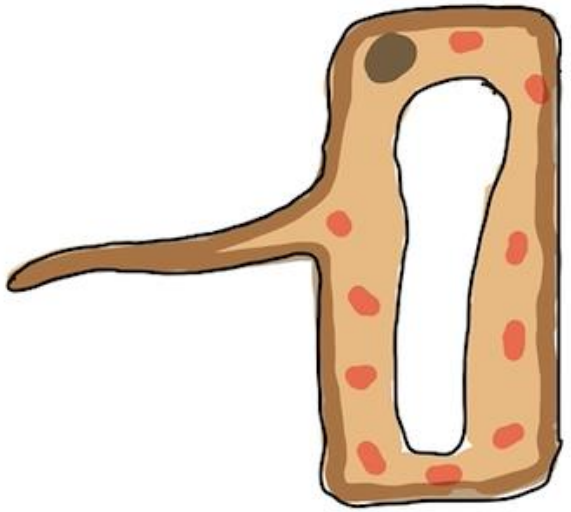
1.1.3 Cell Specialisation

Cells may be specialised to carry out a particular function:

Root Hair Cell

Large surface area for increased absorption.

Lots of mitochondria to provide energy for active transport



Function Absorb water and dissolved mineral ions.

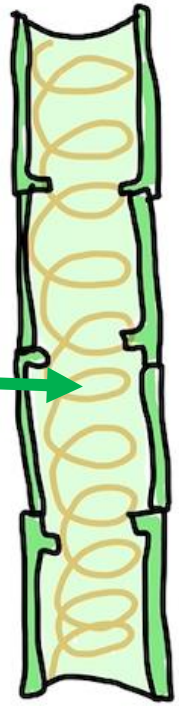
1.1.3 Cell Specialisation

Cells may be specialised to carry out a particular function:

Xylem

Hollow tube to allow more water to travel through.

Spirals of lignin to make it strong to withstand the pressure of water moving through.



Function Transports water.

1.1.3 Cell Specialisation

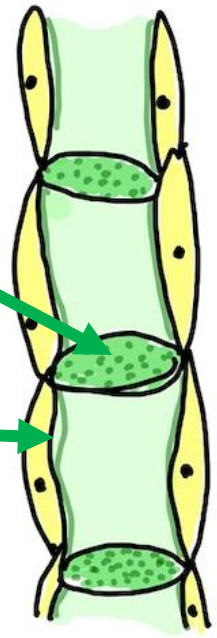
Cells may be specialised to carry out a particular function:

Phloem

Lose internal structure for more space.

Have sieve plates to allow water carrying dissolved sugars to move freely.

Have companion cells to help keep them alive.



Function

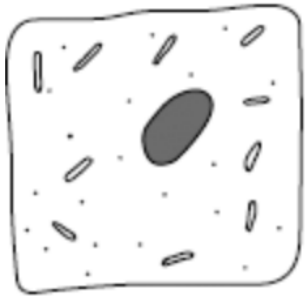
Transports sugars.

Exam Practice

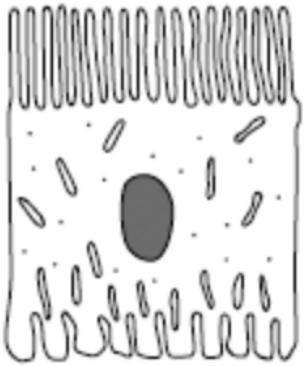
L2

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.

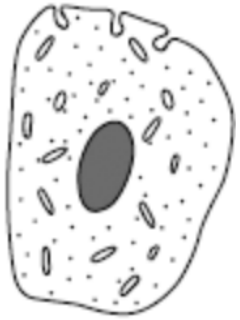
A



B



C



(a) Which cell, **A**, **B** or **C**, appears to have adaptations to increase diffusion into or out of the cell? **B**

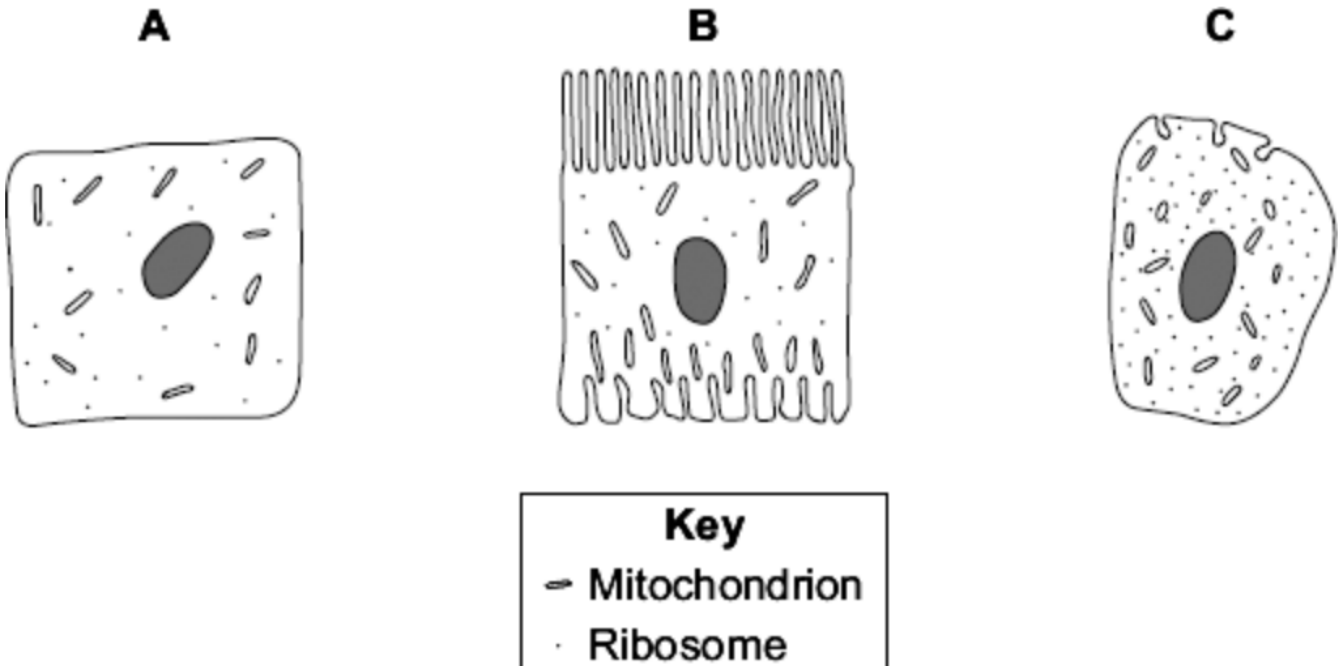
Give **one** reason for your choice.

Large surface area

Exam Practice

L2

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(b) (i) Cell **C** is found in the pancreas.

Name **one** useful substance produced by the pancreas.

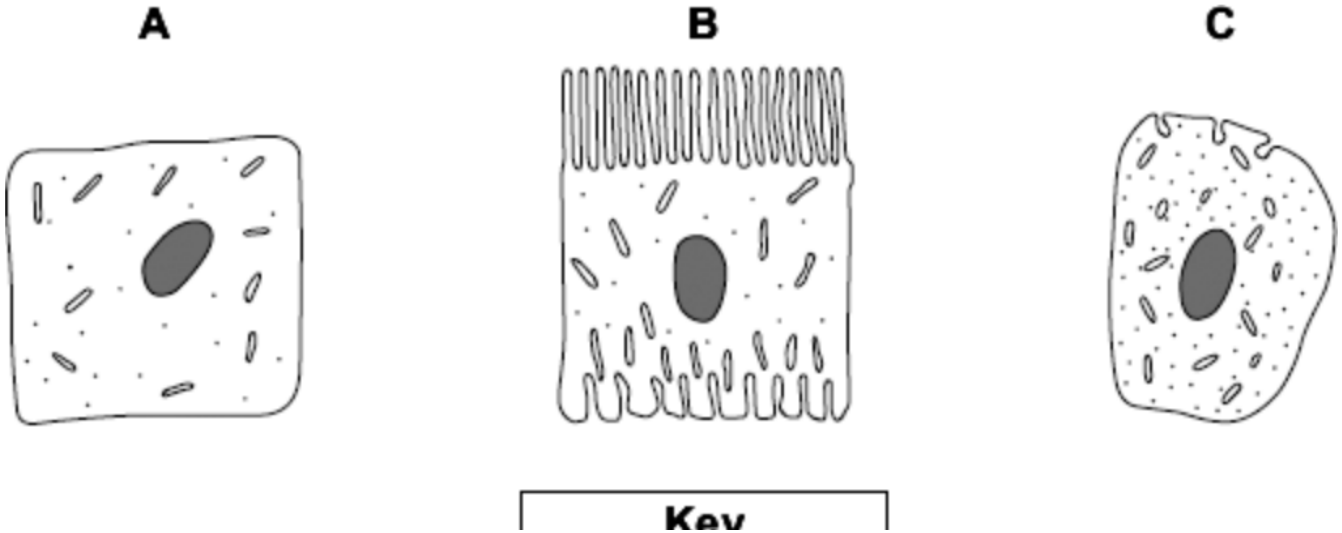
Named enzyme/insulin

(1)

Exam Practice

L2

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(ii) Use information from the diagram to explain how cell **C** is adapted for producing this substance.

Lots of ribosomes.. ..to make proteins

Lots of mitochondria... ..for energy to make proteins

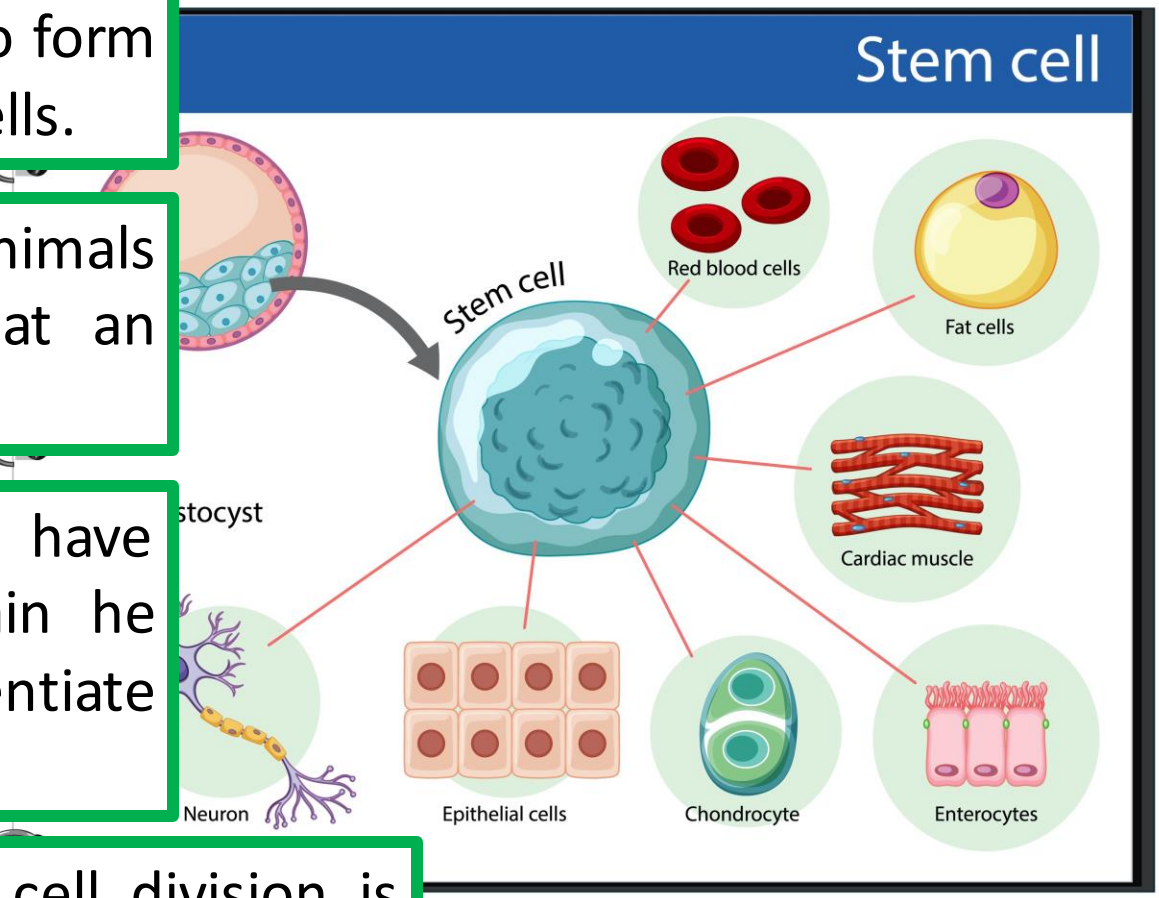
1.1.4 Cell Differentiation

As an organism develops, cells differentiate to form different types of cells.

Most type of animals cells differentiate at an early stage.

Many plants cells have the ability to retain he ability to differentiate throughout life.

In mature animals cell division is for growth and repair,



CS/F CS/H SS/F SS/H

1.1.4 Cell Differentiation

Key Term	Definition	Example
Specialised Cell		

CS/F CS/H SS/F SS/H

1.1.5 Microscopy

Think
Pair
Share

What are the differences between electron microscopes and light microscopes?

Electron microscopes are larger and so not portable.

They are also more expensive.

They are more difficult to use and require monitors to view the image.

It cannot be used to view live specimums.

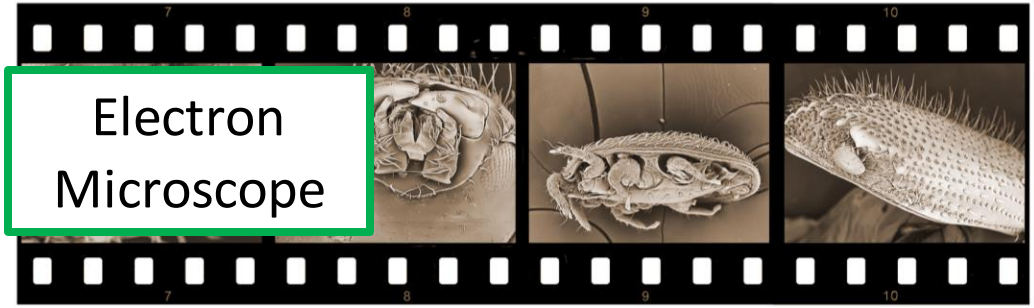
CS/F CS/H SS/F SS/H

1.1.5 Microscopy

Think
Pair
Share

What are the differences between electron microscopes and light microscopes?

Electron Microscope



An electron microscope has a greater magnification...

..and a greater resolution.

Light Microscope

The electron microscope has increased our understanding of sub cellular structures.

CS/F CS/H SS/F SS/H

1.1.5 Microscopy

Key Term	Definition
Resolution	
Magnification	

Magnification = Size of Image / Size of Real Object

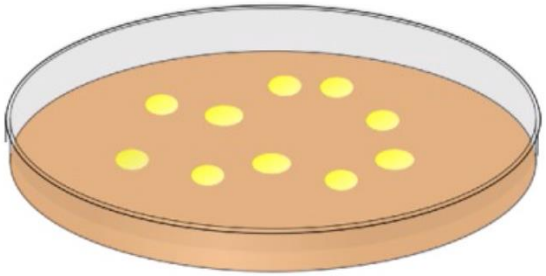
1.1.6 Culturing Microorganisms

1. Petri dish and agar are sterilised

2. Sterilise inoculating loop before use by passing it through a Bunsen burner flame

3. Use inoculating loop to transfer bacteria to the agar plate

4. Seal with tape and place upside down



5. Incubate at 25°C

1.1.6 Culturing Microorganisms

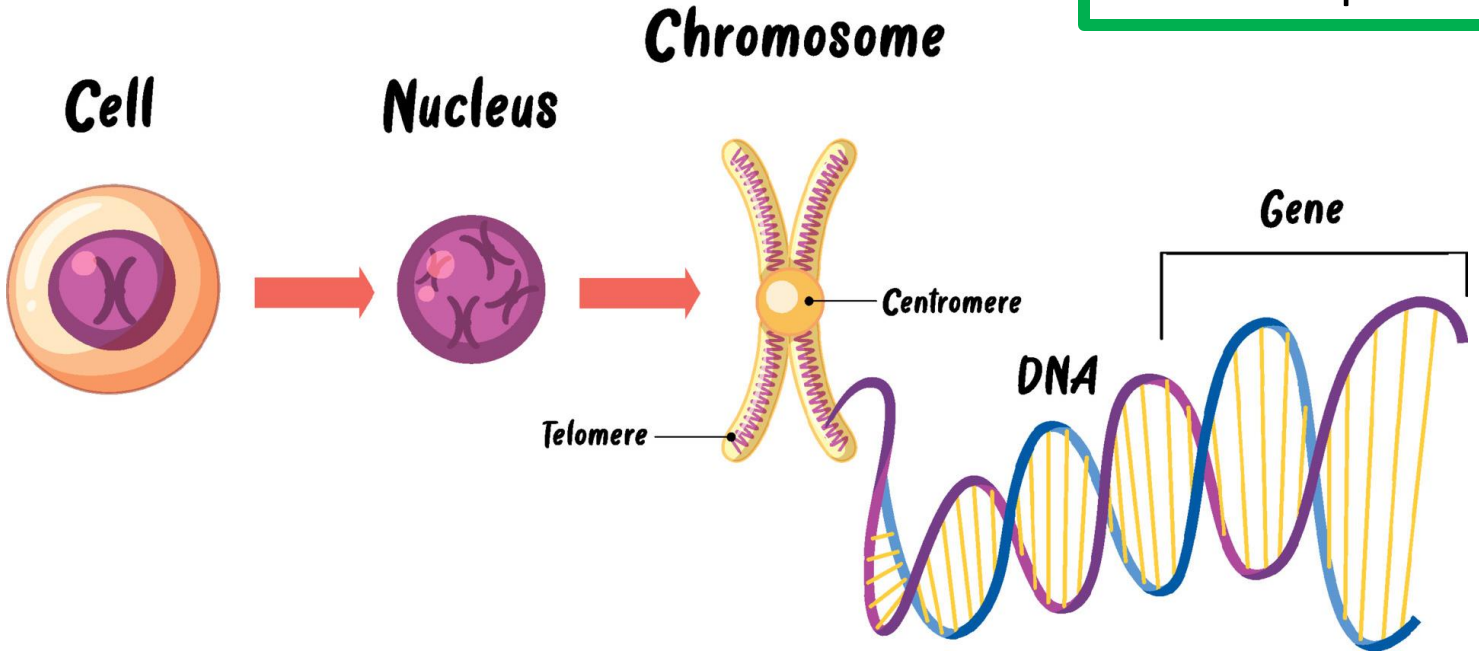
Step	Justification
Petri dish and agar are sterilised	
Sterilise inoculating loop before use by passing it through a flame	
Use inoculating loop to transfer bacteria to the agar plate	
Seal with tape and place upside down	
Incubate at 25C	

1.2.1 Chromosomes

The nucleus of a cell contains chromosomes made of DNA molecules

Each chromosome carries a large number of genes.

In body cells the chromosomes are normally found in pairs.

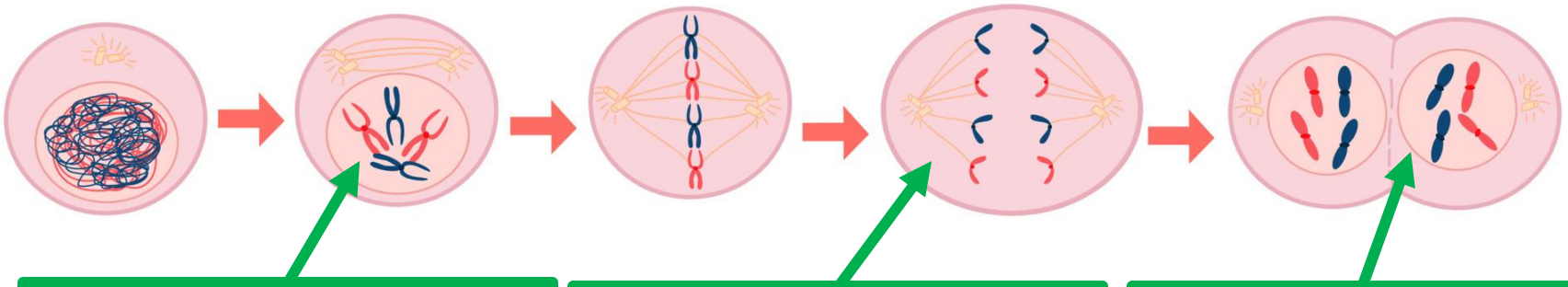


CS/F CS/H SS/F SS/H

1.2.2 Mitosis and the Cell Cycle

Key Term	Definition
Chromosome	
Mitosis	

1.2.2 Mitosis and the Cell Cycle



The DNA replicates to form two copies of each chromosome.

In mitosis one set of chromosomes is pulled to each end of the cell and the nucleus divides.

Finally the cytoplasm and cell membranes divide to form two identical cells.

During the cell cycle the genetic material is doubled and then divided into two identical cells.

Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria.

CS/F CS/H SS/F SS/H

Exam Practice

L1

Which process makes two identical new body cells for growth and repair?

Tick (✓) **one** box.

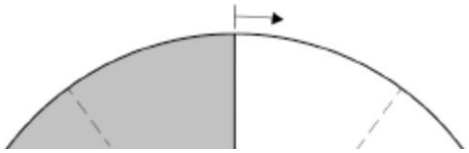
Differentiation	
Fertilisation	
Mitosis	X

(1)

Exam Practice

L2

The chart shows the three stages of a cell cycle.



Draw **one** line from each stage of the cell cycle to what happens during that stage.

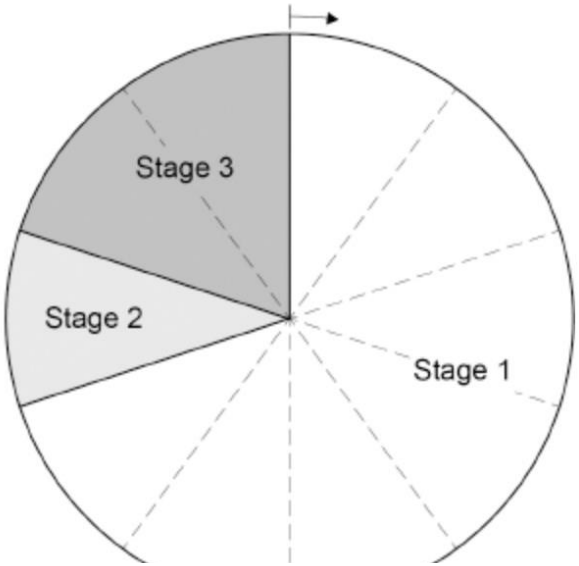
Stage of cell cycle	What happens during that stage
Stage 1	One set of chromosomes is pulled to each end of the cell
Stage 2	The cytoplasm and cell membrane divide to form two new cells
Stage 3	The cell grows and the chromosomes replicate

(2)

Exam Practice

L2

The chart shows the three stages of a cell cycle.



What percentage of the total time for the cell cycle is taken by stage 1?

7/10 x 100

Percentage = 70 %

(2)

Exam Practice

L2

A cell divides to form two new cells every 24 hours.

How many days will it take for the original cell to divide into 8 cells?

Tick (✓) **one** box.

1		3	X	6		8	

(1)

The chromosomes contain the genetic material.

Name the chemical which the genetic material is made from.

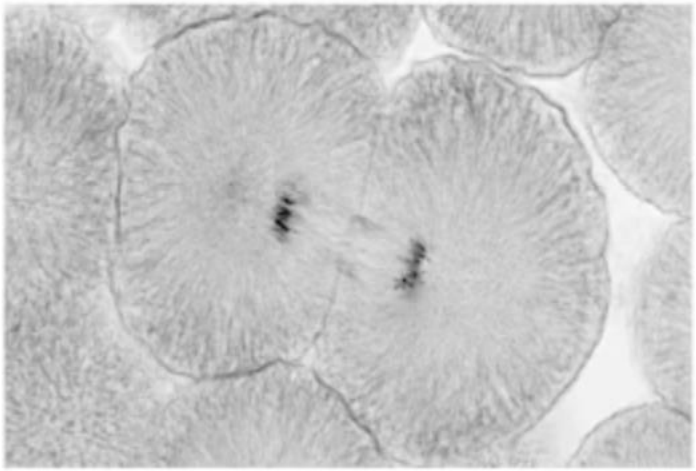
DNA

(1)

Exam Practice

L2

A



Describe what is happening in photograph **A**.

Cytoplasm and cell membrane dividing

To make two identical daughter cells

Exam Practice

L3

(c) A student wanted to find out more about the cell cycle.

The student made a slide of an onion root tip.

She counted the number of cells in each stage of the cell cycle in one field of view.

The table below shows the results.

		Stages in the cell cycle				
	Non-dividing cells	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Total**
Number of cells	20	9	4	2	1	36

Each stage of the cell cycle takes a different amount of time.

Which stage is the fastest in the cell cycle?

Give a reason for your answer.

Stage 4

Reason Only one cell in this stage

Exam Practice

L3

		Stages in the cell cycle				
	Non-dividing cells	Stage 1	Stage 2	Stage 3	Stage 4	Total
Number of cells	20	9	4	2	1	36

The cell cycle in an onion root tip cell takes 16 hours.

Calculate the length of time **Stage 2** lasts in a typical cell.

Give your answer to 2 significant figures.

4/36 x 16 x 60

=106.7

=110

Time in **Stage 2** = _____ minutes

(3)

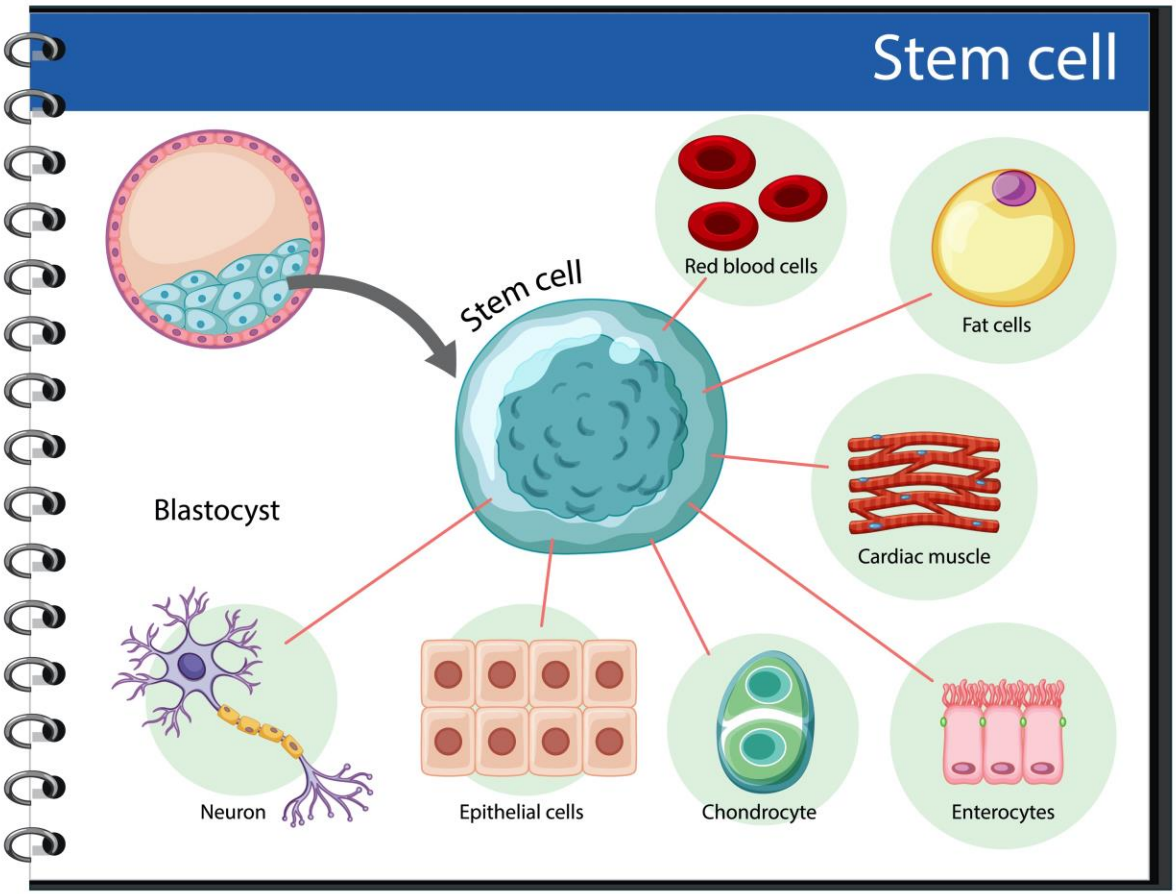
1.2.3 Stem Cells

Key Term	Definition
Stem Cell	
Undifferentiated Cell	

1.2.3 Stem Cells

This stem cell can divide and differentiate to form lots of different specialised cells.

This stem cell is an embryonic stem cell.



1.2.3 Stem Cells

Type of Stem Cell	Facts
Meristem	
Embryonic Stem Cell	
Adult Stem Cell	

1.2.3 Stem Cells

Key Term	Definition
Therapeutic Cloning	

Advantages: Not rejected by the patients body, could be used to treat different conditions such as paralysis or diabetes.

Disadvantages: Risk of viral infection, some people have ethical or religious objections.

Exam Practice

L2

Read the information about stem cells.

Stem cells are used to treat some human diseases.

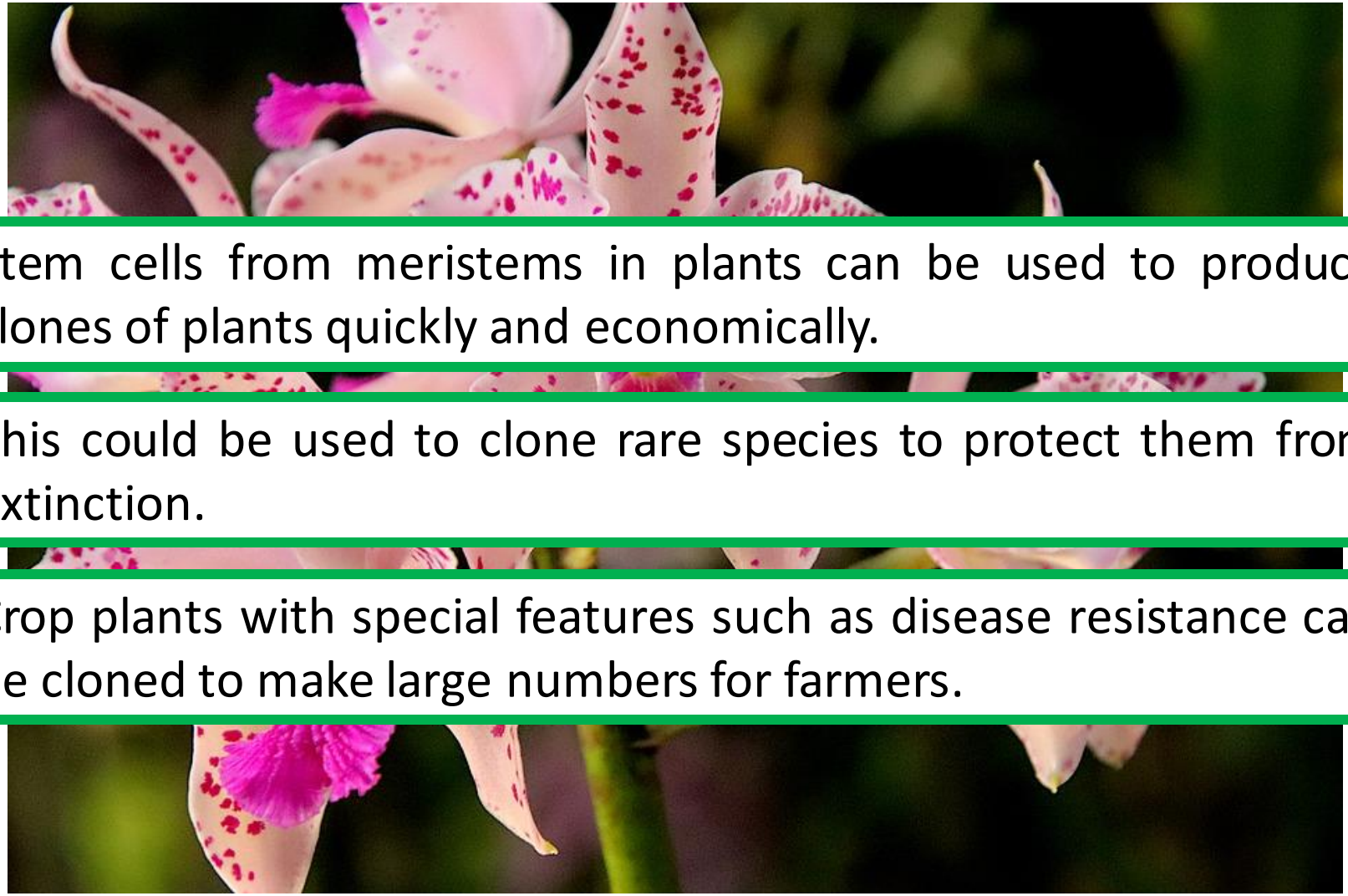
Embryonic	Adult
Lots of disorders treated	Limited number of disorders treated
Painless	Pain (may deter donors)
Harm to embryo	Safe (does not kill donor)
Embryo can't give consent	Donor can give consent

Evaluate the use of stem cells from embryos or from adult bone marrow for treating human diseases.

You should give a conclusion to your evaluation.

(Total 5 marks)

1.2.3 Stem Cells



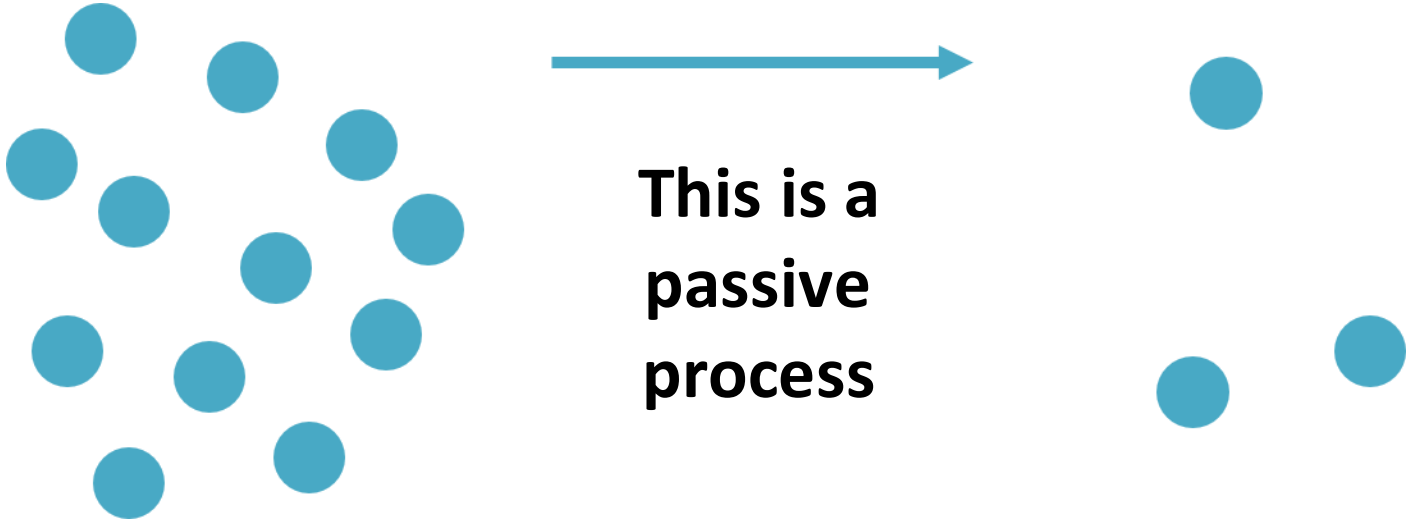
Stem cells from meristems in plants can be used to produce clones of plants quickly and economically.

This could be used to clone rare species to protect them from extinction.

Crop plants with special features such as disease resistance can be cloned to make large numbers for farmers.

1.3.1 Diffusion

Key Definition: **Diffusion** is the spreading out of the particles of any substance in solution, or particles of a gas, resulting in a net movement from an area of higher concentration to an area of lower concentration.

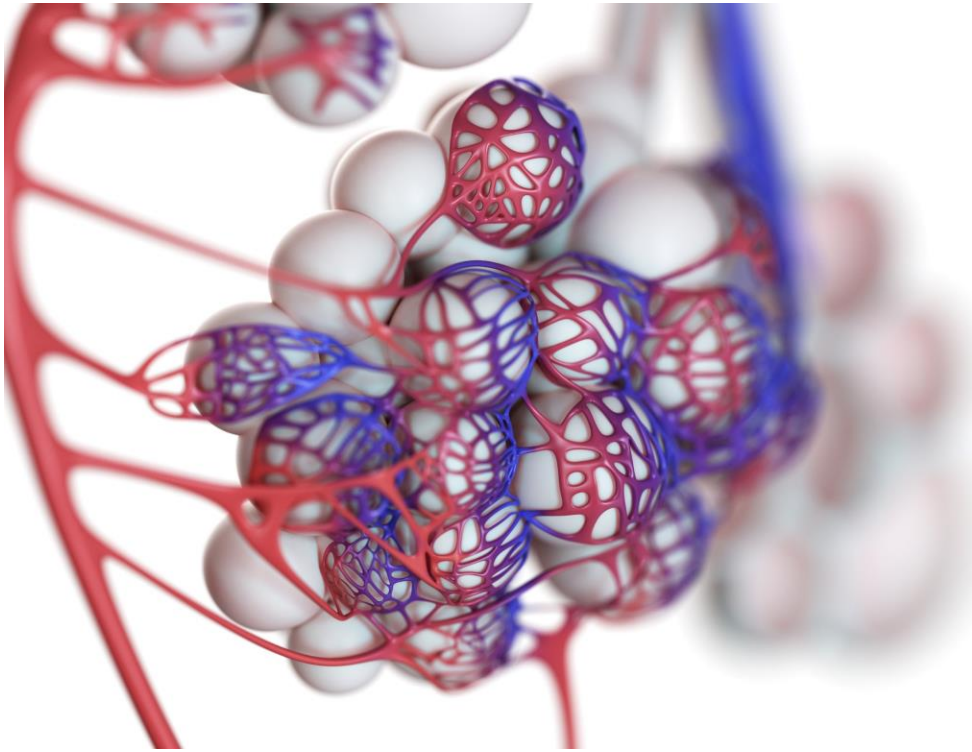


High Concentration **Low Concentration**

CS/F CS/H SS/F SS/H

1.3.1 Diffusion

Examples of diffusion include:



Oxygen diffusing from the alveoli into blood in the capillaries

Carbon dioxide diffusing from the from the blood in the capillaries into the alveoli

Urea diffusing out of the blood plasma into the kidneys to be excreted.

CS/F CS/H SS/F SS/H

1.3.1 Diffusion

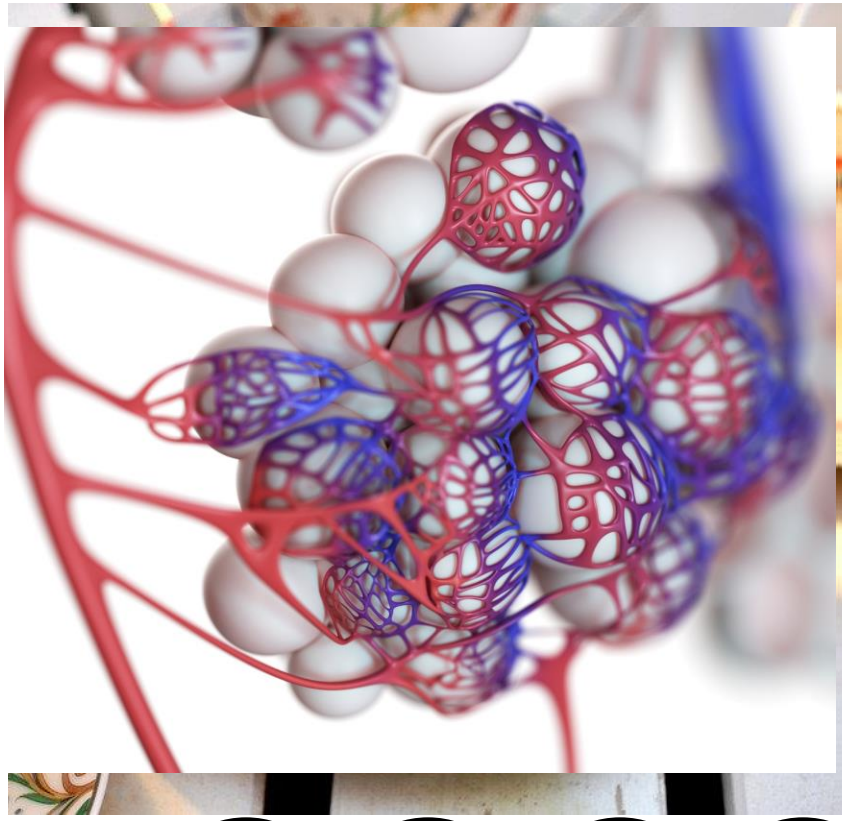
Different factors affect the rate of diffusion. For example:

Difference in Concentration

- The bigger the difference in concentration, the faster the rate of diffusion. This is because there is a greater concentration gradient. The particles are moving faster.

Surface Area of the Membrane

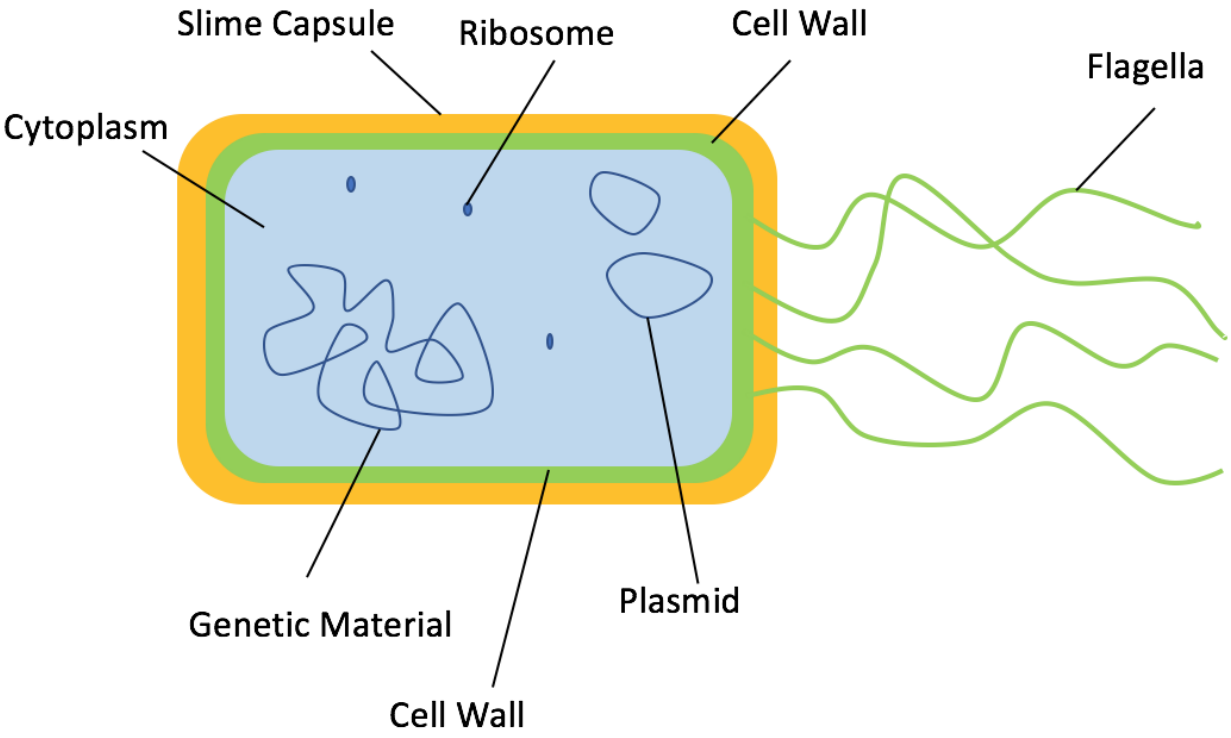
- An example is gaseous exchange in the lungs. The bigger the surface area, the faster the rate of diffusion. This is because there is a greater area for particles to diffuse across.



CS/F CS/H SS/F SS/H

1.3.1 Diffusion

A **single-celled organism** such as bacterium have a relatively **large surface area to volume ratio**. This allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.



1.3.1 Diffusion

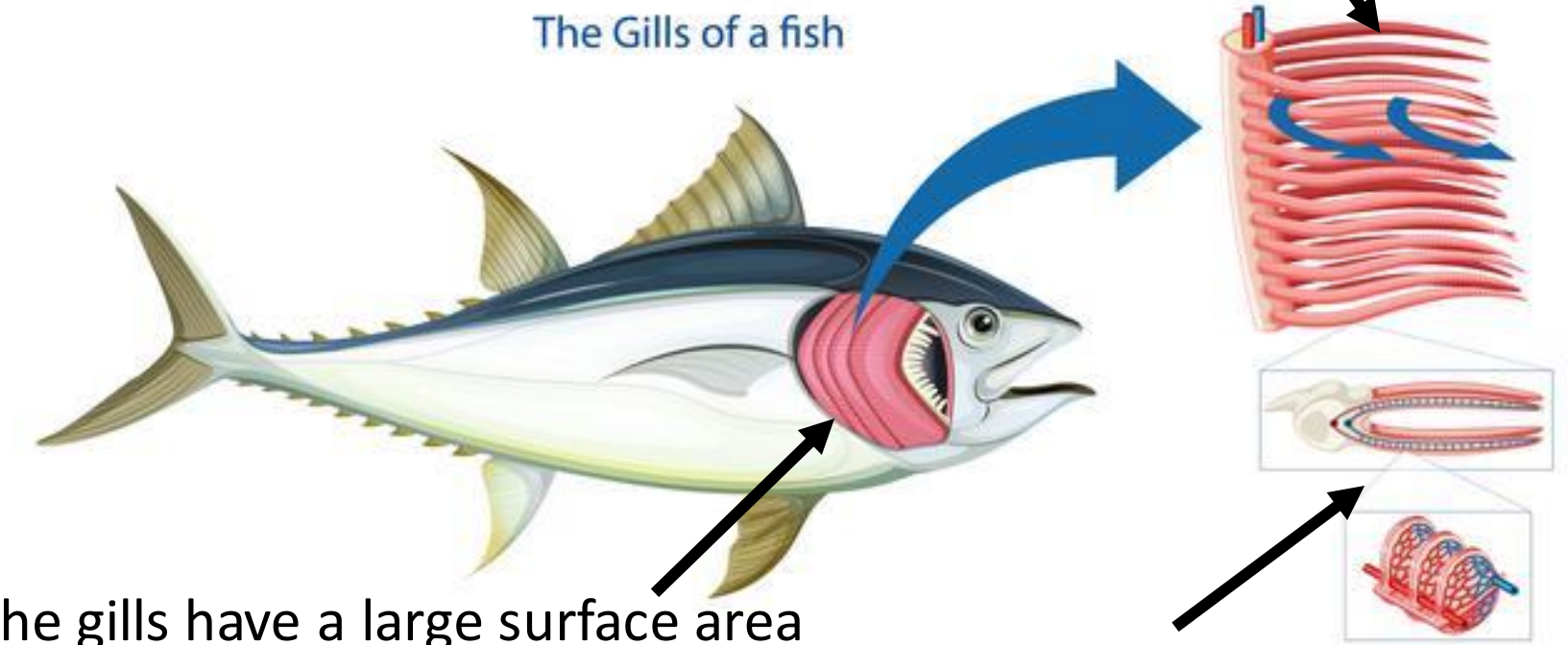
Exchange Surfaces

- In multicellular organisms, surfaces and organ systems are specialised for exchanging materials.
- This is to allow sufficient molecules to be transported into and out of cells for the organism's needs.

1.3.1 Diffusion

Exchange Surfaces

For example, in fish gills:



The gills are well ventilated

The gills have a large surface area

The membranes are also very thin to have a short diffusion path.

There is an efficient blood supply which surrounds the gills

CS/F CS/H SS/F SS/H

1.3.1 Diffusion

Exchange Surfaces

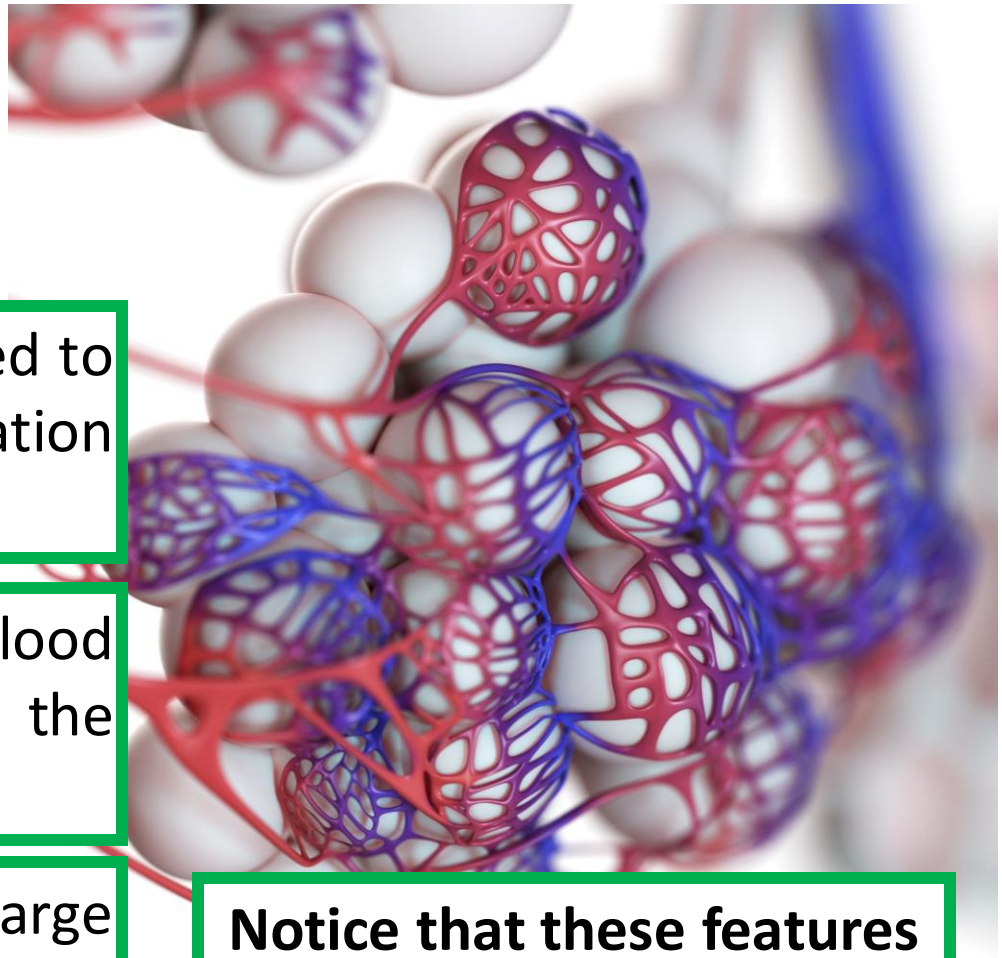
For example, in lungs:

The alveoli are well ventilated to maintain a steep concentration gradient

There is an efficient blood supply which surrounds the alveoli

Lots of alveoli to provide a large surface area

The walls are also very thin to have a short diffusion path



Notice that these features are the same as the gills of a fish

CS/F CS/H SS/F SS/H

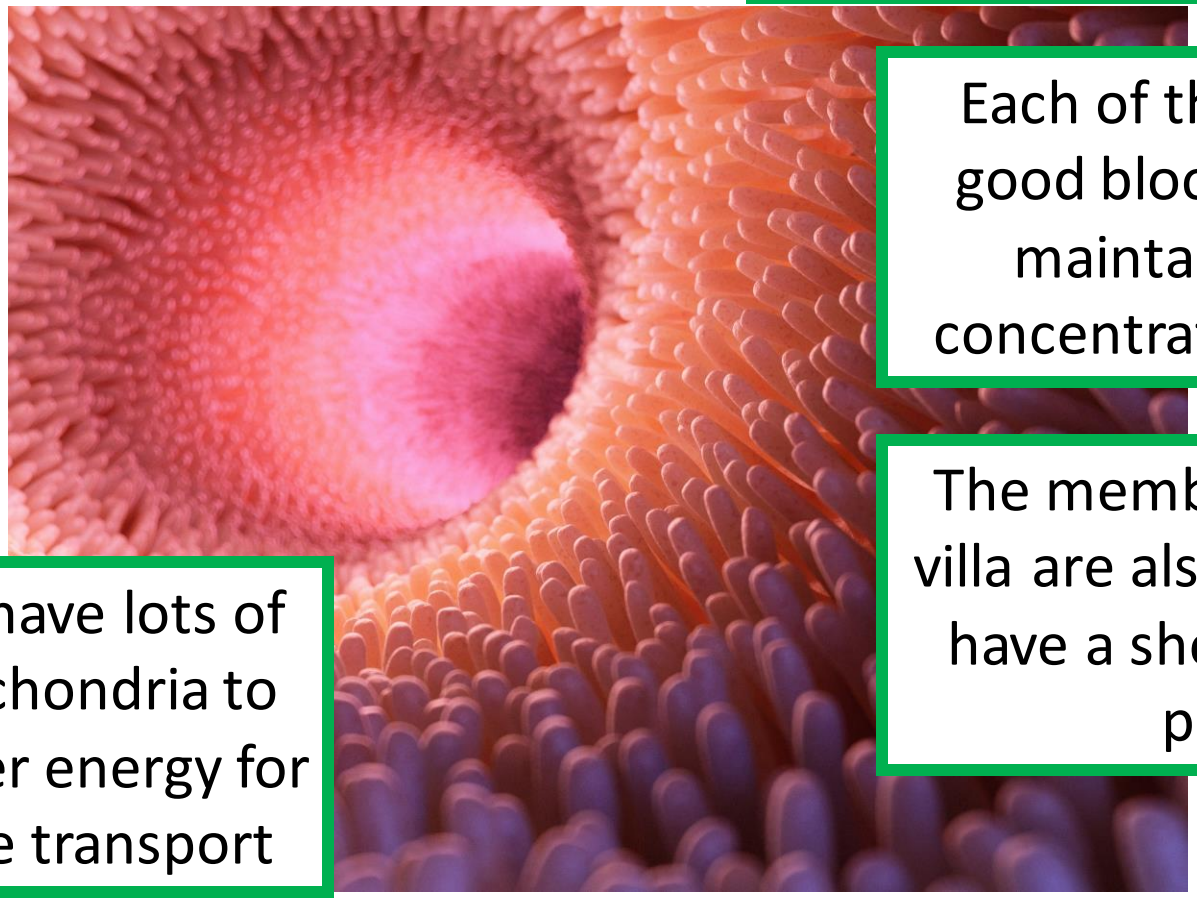
1.3.1 Diffusion

Exchange Surfaces

For example, in the small intestine:

It has a large surface area:

1. It is very long
2. It has villi which can be seen in the image below



Each of the villi has a good blood supply to maintain a steep concentration gradient

The membranes of the villa are also very thin to have a short diffusion path.

Cells have lots of mitochondria to transfer energy for active transport

Exam Practice

L3

D

F

Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

Lots of alveoli.. ..to provide a large surface area

Capillary and alveoli walls one cell thick.. ..short diffusion pathway

Well ventilated... ..to maintain steep concentration gradient.

Good blood supply... are adapted for efficient exchange of gases by diffusion. ..to maintain steep concentration gradient.

(6)

1.3.1 Diffusion

Exchange Surfaces

For example, in the roots:

They have a large surface area

They have a thin membrane to provide a short diffusion pathway

There are lots of mitochondria in the root hair cells to transfer energy

1.3.1 Diffusion

Exchange Surfaces

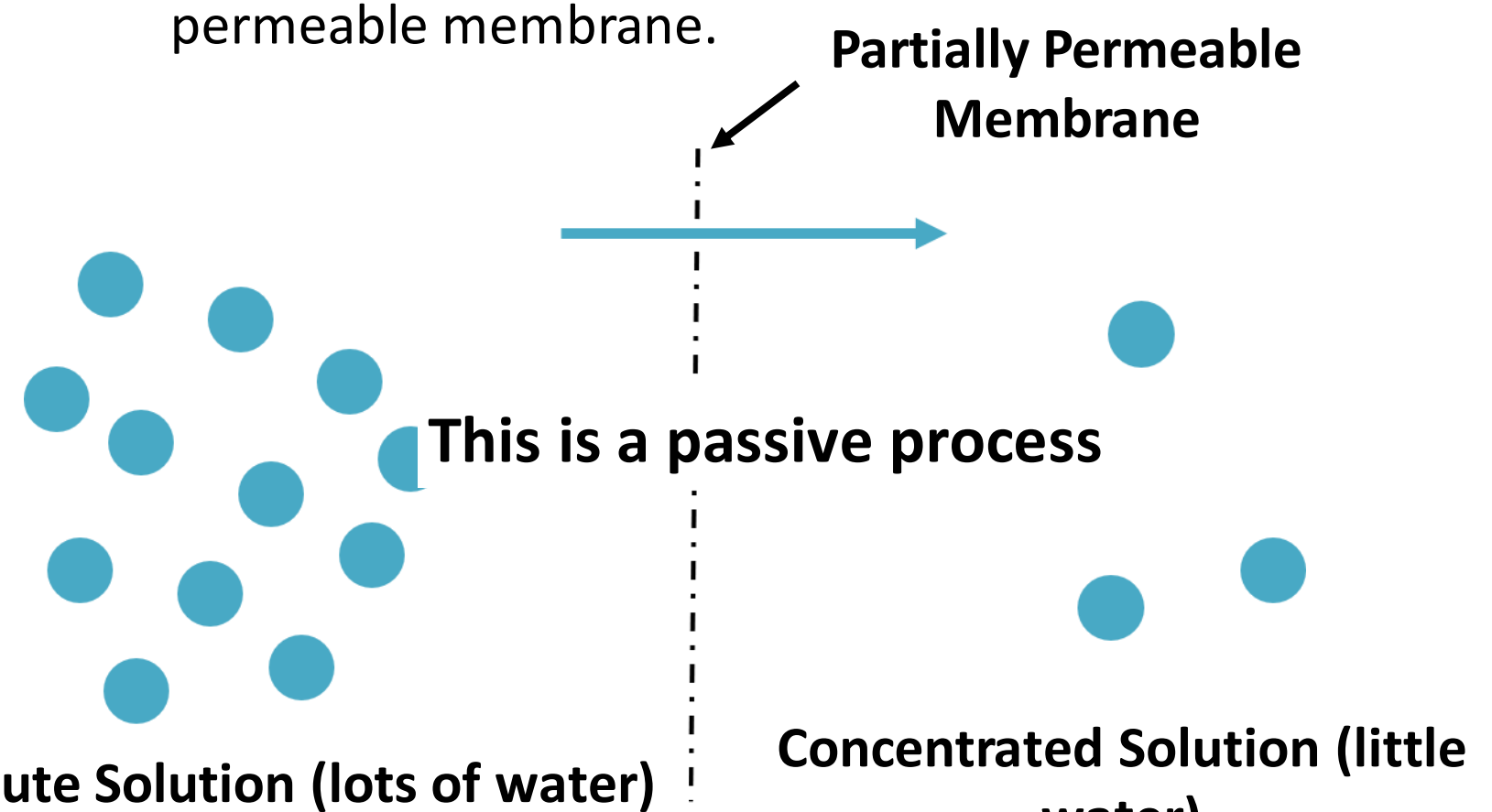
For example, in the leaf:

They have a large surface area

They are thin to provide a short diffusion pathway

1.3.2 Osmosis

Key Definition: **Osmosis** is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.

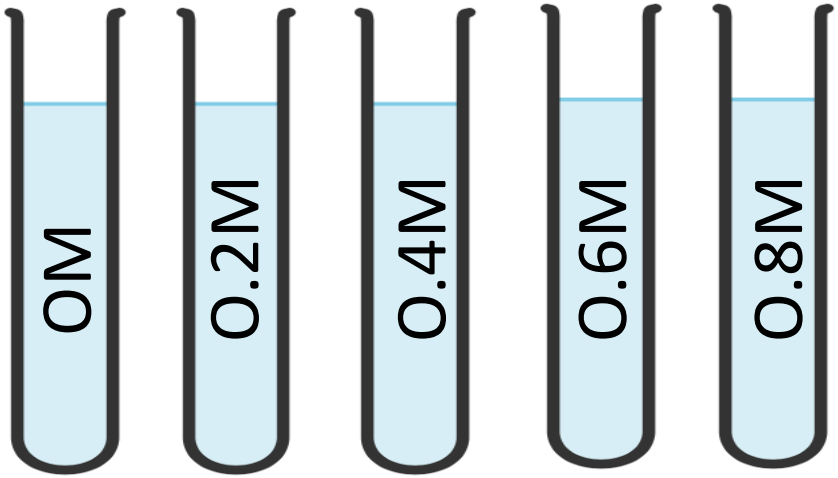


CS/F CS/H SS/F SS/H

1.3.2 Osmosis

Think
Pair
Share

How could you use this equipment to determine the concentration of a potato piece?



CS/F CS/H SS/F SS/H

1.3.2 Osmosis

Think
Pair
Share

How could you use this equipment to determine the concentration of a potato piece?

5.
Repeat for different

This co

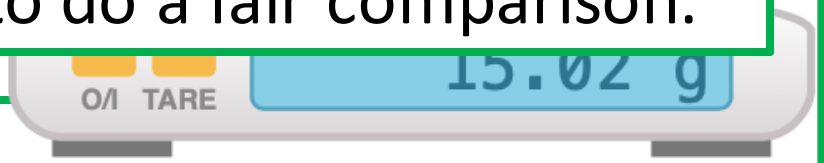
This prevents
any excess water

7.
Calculate the percentage change in mass.

This gives us a range of

All the potato pieces would have different starting masses and this enables us to do a fair comparison.

concentration.



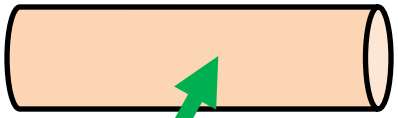
CS/F CS/H SS/F SS/H

1.3.2 Osmosis

Think
Pair
Share

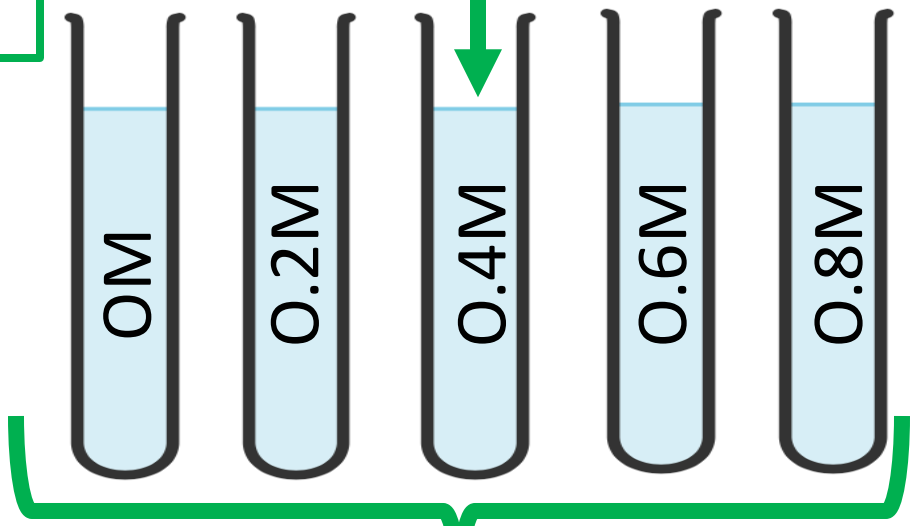
What are the potential sources of error in this experiment?

Inaccuracy in the balance



Cylinders dried a different amount.

Evaporation from tubes



Inaccuracy in the concentrations of the solutions

CS/F CS/H SS/F SS/H

1.3.2 Osmosis

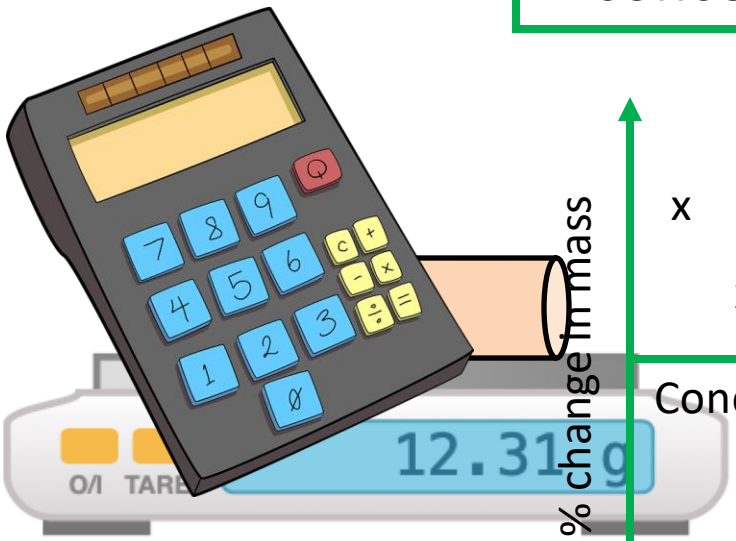
Think Pair Share

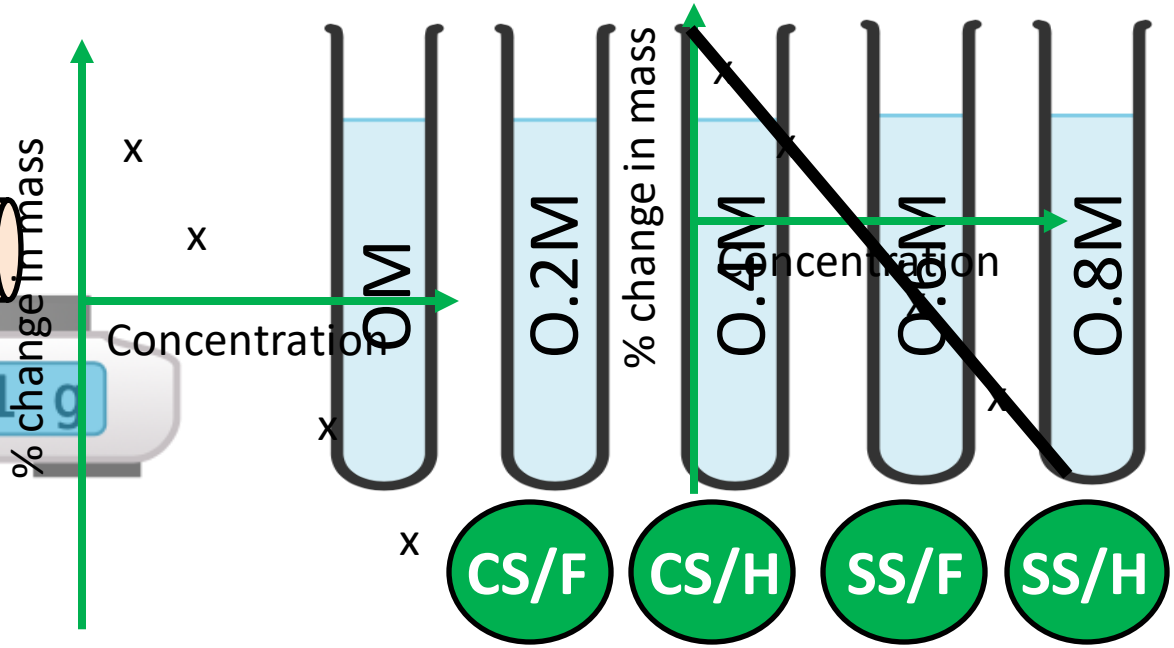
How do you use the results from this experiment to determine the concentration of a potato piece?

You need to calculate the % change in mass.

Then plot the % change in mass against concentration.

Draw a line of best fit. The point at which the line crosses the X-axis is the concentration.





1.3.2 Osmosis

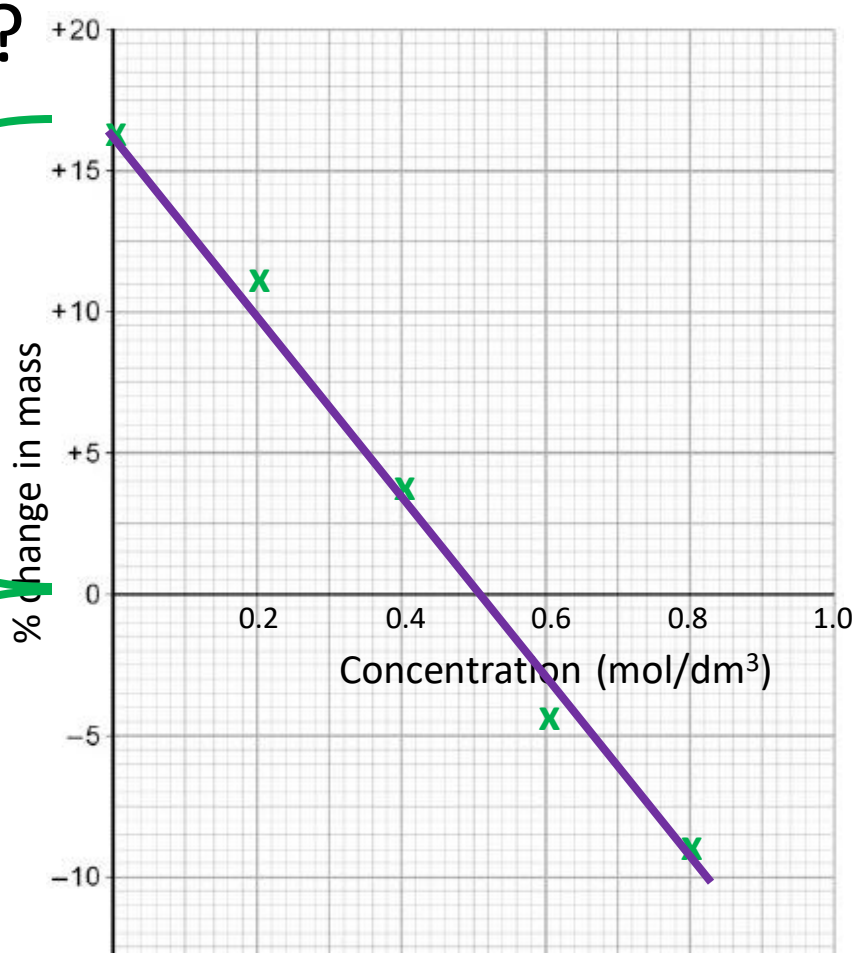
Think
Pair
Share

At different concentrations the potato gains, or loses mass. Why?

The potato changes mass when it gains or loses water.

If it gains water it will increase in mass.

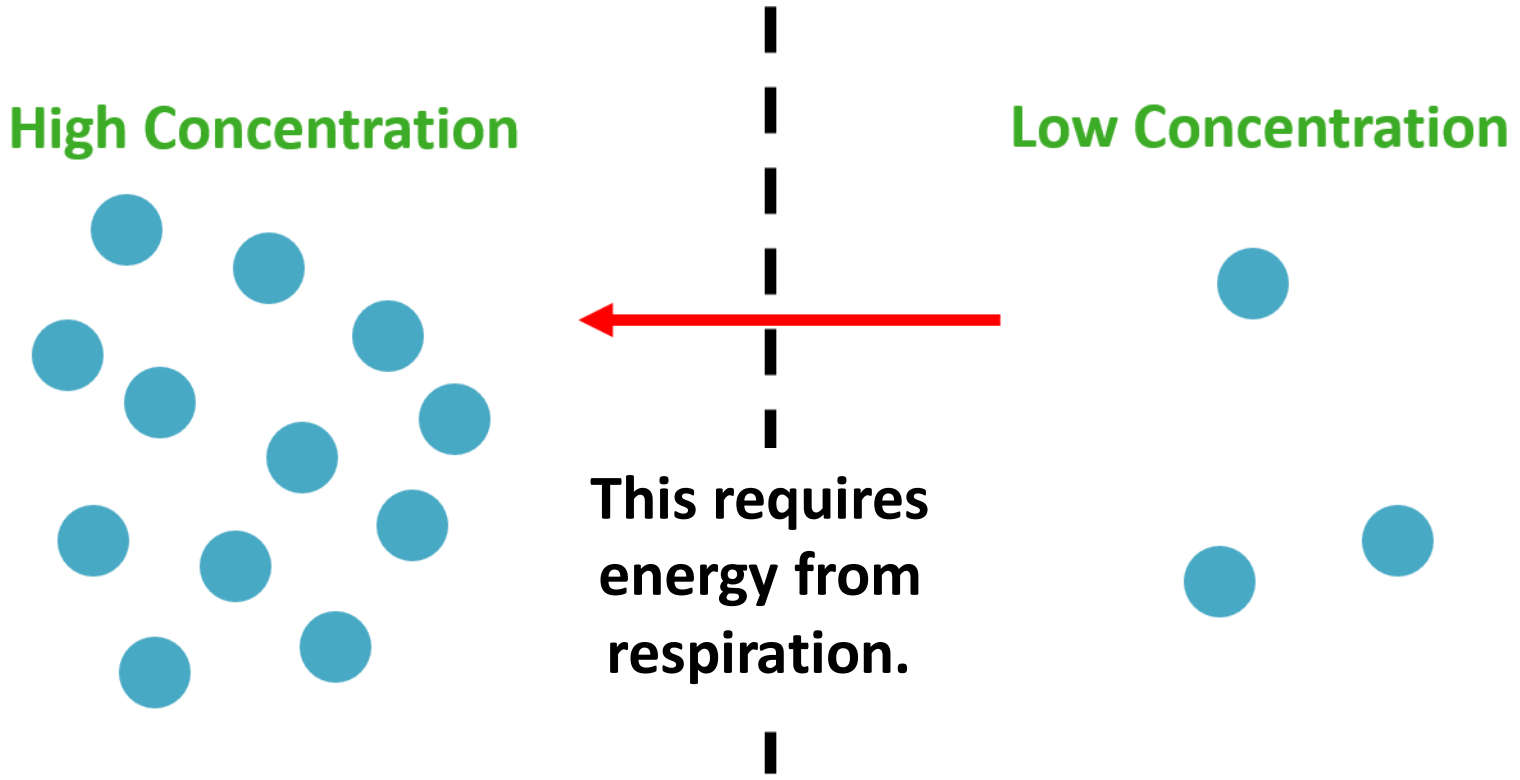
If it loses water it will decrease in mass.



CS/F CS/H SS/F SS/H

1.3.3 Active Transport

Key Definition: **Active transport** moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient).



CS/F CS/H SS/F SS/H

Exam Practice

L2

What is osmosis?

Movement of water from a dilute to concentrated solution

Through a partially permeable...

..membrane

Passive process

(3)

Exam Practice

L2

The student:

- looks at a plant cell using a microscope
- adds water to the cell.

The plant cell swells up.

Explain why, as fully as you can.

Concentration of the cell was higher than the surrounding solution

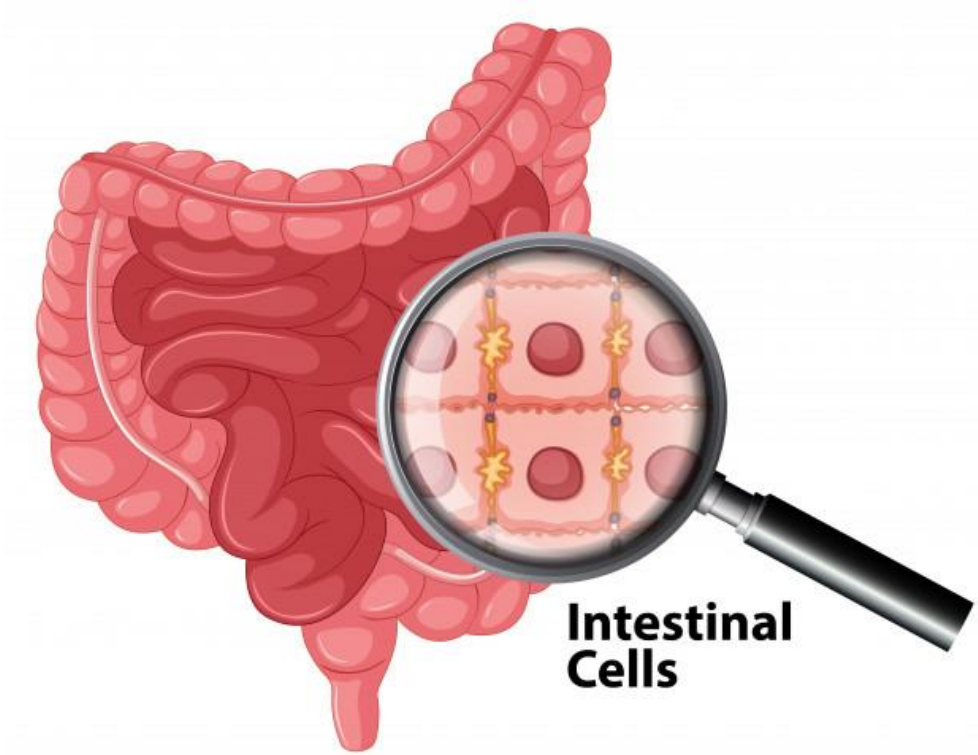
Water moved in... By osmosis

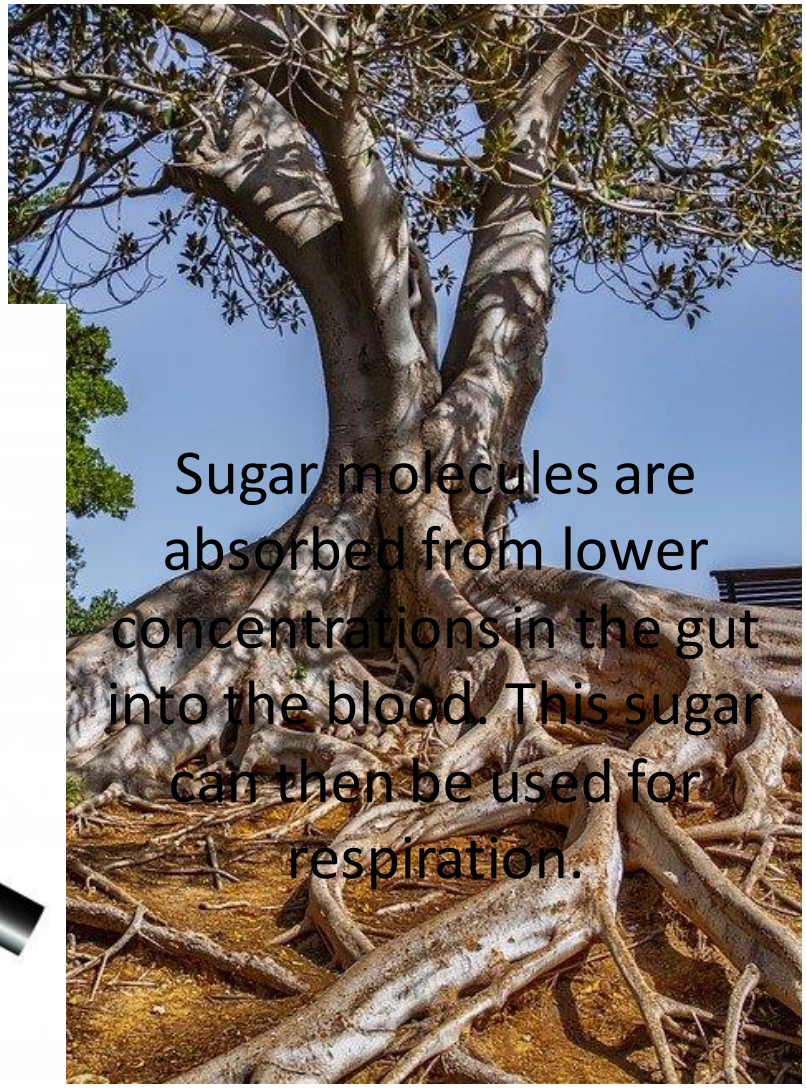
Across a semi-permeable membrane

1.3.3 Active Transport

Active Transport

Examples of active transport include:





CS/F CS/H SS/F SS/H