KS4 Combined Science
Home Learning
Cell Biology
Foundation

Rastrick
High School & Sixth Form

Name: _____

Class: _____

Teacher: _____

4.1 Cell Biology

Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells.

If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells..

Lesson 1 – Animal and Plant Cells
Lesson 2 – Prokaryotic cells
Lesson 3 – Microscopy
Lesson 4 – **Required practical 1: Using a light microscope to observe cells**
Lesson 5 – Differentiation and Specialised Cells
Lesson 6 – Stem cells
Lesson 7 – Stop the clock
Lesson 8 – Chromosomes
Lesson 9 – Mitosis and the Cell Cycle
Lesson 10 – Diffusion
Lesson 11 – Adaptations for diffusion and Active Transport
Lesson 12 & 13 – **Required Practical 3: Osmosis**
Lesson 14 – Revision
Lesson 15 - Test

Lesson 1 – Animal and Plant Cells

Question & Enquiry

Relationships

4.1.1.2 Animal and plant cells

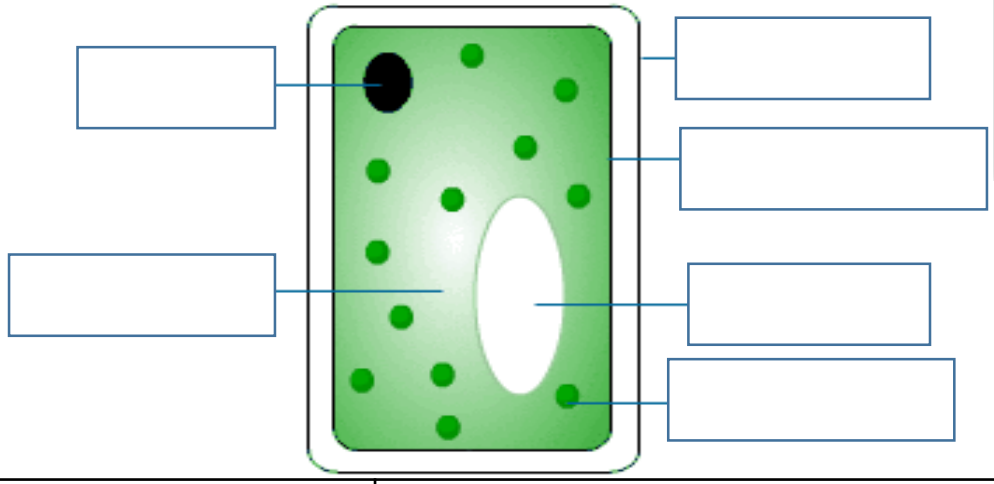
Content	Key opportunities for skills development
Students should be able to explain how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, chloroplasts in plant cells and plasmids in bacterial cells are related to their functions. Most animal cells have the following parts: • a nucleus • cytoplasm • a cell membrane • mitochondria • ribosomes. In addition to the parts found in animal cells, plant cells often have: • chloroplasts • a permanent vacuole filled with cell sap. Plant and algal cells also have a cell wall made of cellulose, which strengthens the cell.	WS 1.2 Recognise, draw and interpret images of cells.

Draw an animal cell and label the organelles:

A cell is the **smallest structural and functional unit** of an organism, which is typically **microscopic** and consists of **cytoplasm a**nd a **nucleus** enclosed in a membrane.

Name of organelle	Function
Nucleus	
Cell Membrane	
Cytoplasm	
Ribosomes	
Mitochondria	

Plant Cells: Label the diagram of a plant cell



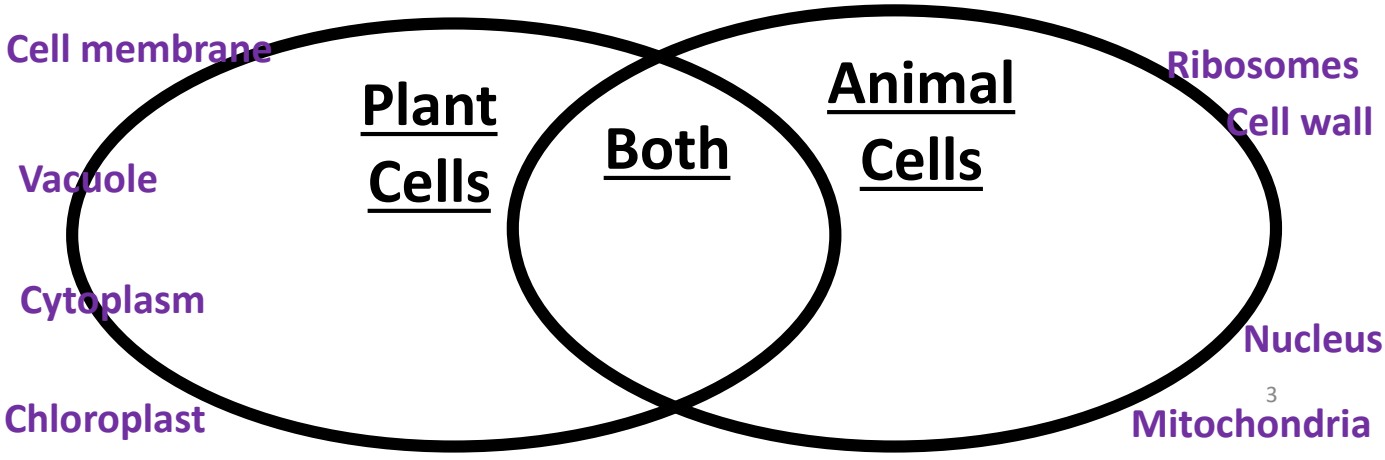
Name of organelle	Function
Cellulose Cell Wall	
Chloroplasts	
Permanent Vacuole	

Comparing plant and animal cells:

_____

_____

_____

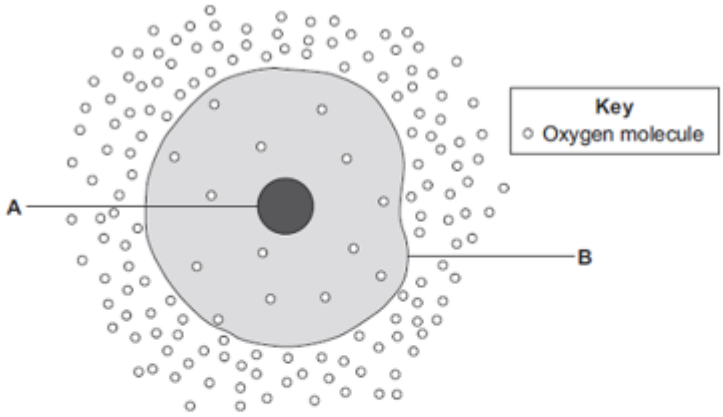


Lesson 1 – Exam Questions

Feedback & Assessment

Question & Enquiry

Q1. The diagram shows a cell.



(a) (i) Use words from the box to name the structures labelled **A** and **B** .

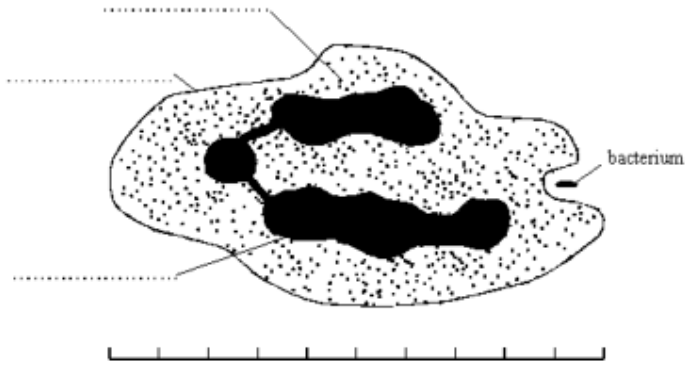
cell membrane	chloroplast	cytoplasm	nucleus

A .....

B .....

(2)

(b) The drawing shows a white blood cell ingesting a bacterium.



Literacy & Numeracy

(i) Use words from the list to label the parts of the white blood cell.

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

(3)

(ii) The scale shows that the white blood cell is 10 micrometres long.

How long is the bacterium? Show your working.

..... micrometres

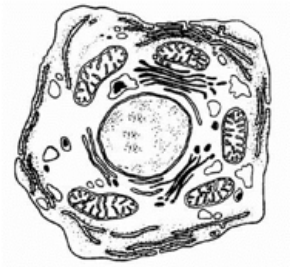
(2)

(Total 5 marks)

Feedback & Assessment

Question & Enquiry

Q2. The drawing shows an animal cell, seen at a very high magnification using an electron microscope.



(a) (i) Label a mitochondrion [plural = mitochondria].

(1)

(ii) What happens in the mitochondria?

.....

(1)

(b) (i) Name and label the structure where you would find chromosomes.

(1)

(ii) What are chromosomes made of?

.....

(1)

(c) What controls the rate of chemical reactions in the cytoplasm?

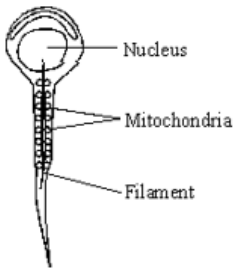
.....

(1)

(Total 5 marks)

Challenge

Q3. The diagram shows a human sperm. Inside the tail of the sperm is a filament mechanism that causes the side to side movement of the tail, which moves the sperm.



(a) Describe the function of the mitochondria and suggest a reason why they are arranged around the filament near the tail of the sperm.

.....

.....

.....

.....

(3)

(b) Explain the significance of the nucleus in determining the characteristics of the offspring.

.....

.....

.....

(2)

(Total 5 marks)

Lesson 2 – Prokaryotic cells

Question & Enquiry

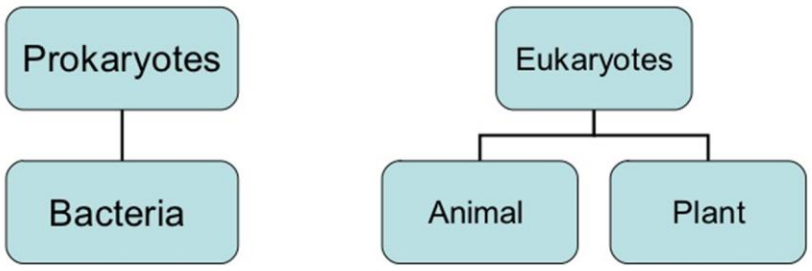
4.1.1.1 Eukaryotes and prokaryotes

Content	Key opportunities for skills development
Plant and animal cells (eukaryotic cells) have a cell membrane, cytoplasm and genetic material enclosed in a nucleus.	
Bacterial cells (prokaryotic cells) are much smaller in comparison. They have cytoplasm and a cell membrane surrounded by a cell wall. 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.	
Students should be able to demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, including the use of standard form.	MS 1b, 2a, 2h WS 4.4 Use prefixes centi, milli, micro and nano.

In and on: Match up the organelle with its function

Nucleus	Respiration
Cell Membrane	Protein synthesis
Cytoplasm	Controls the cell's activities
Ribosomes	Controls what enters and leaves the cell
Mitochondria	Chemical reactions happen here

These are two distinct types of cells with STRUCTURAL differences.

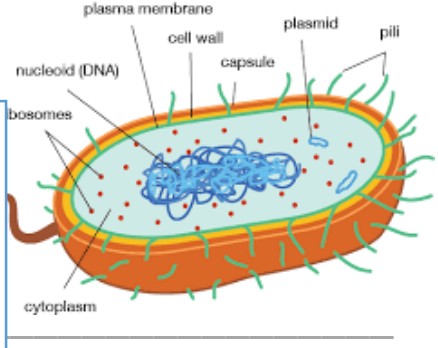


What can you see inside animal and plant cells that is not found in bacteria?

_____

Extra notes

Structure of Prokaryotic Cells



DNA not inside a n_____, floats in c_____.
Small rings of DNA found in the cytoplasm are called p_____.
Can have fl_____ (tail) to aid movement
Have a cell wall (to p_____ cell)
Cell is sometimes enclosed in a capsule.
No membrane bound o_____
Pilli help it to stick to other objects.

Put ticks and crosses into the correct columns in the table to help you compare prokaryotic and eukaryotic cells:

	Prokaryotes	Eukaryotes
DNA		
DNA enclosed in a nucleus		
Cell membrane		
Cell wall		
Plasmid DNA in cytoplasm		
Ribosomes		
Membrane-bound organelles		

Check your understanding

Feedback & Assessment

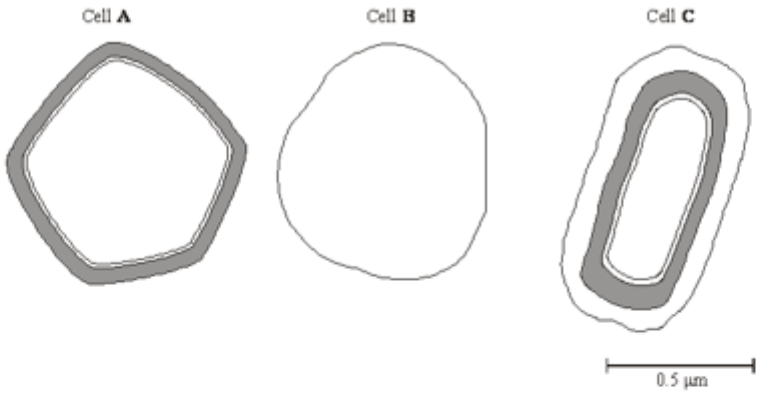
1. Which type of cell is the oldest and simplest?
2. What are 2 big differences between prokaryotic cells and eukaryotic cells?
3. What is one benefit of having DNA housed in a nucleus?
4. What is a flagellum?
5. Cilia can also be found in the human body. Which type of specialised cell has cilia and what is its function?

Lesson 2 – Exam Question

Feedback & Assessment

Challenge

Q1. The diagram shows the outer layers of three different cells, **A**, **B** and **C**.



(a) What is the evidence from the diagram that

(i) cell **B** is an animal cell,

.....

.....

(1)

(ii) cell **C** is a prokaryotic cell?

.....

.....

(1)

(b) Explain how you would calculate the magnification of cell **C**.

.....

.....

(1)

(c) Cell **A** is a plant cell. Name a polysaccharide which may be found in cell **A** but would not be found in the animal cell.

.....

(1)

(d) Penicillin is an antibiotic. It prevents the formation of bacterial cell walls. As a result, bacterial cells that have been treated with penicillin swell and burst as water enters.

Suggest why penicillin has no effect on plant cells.

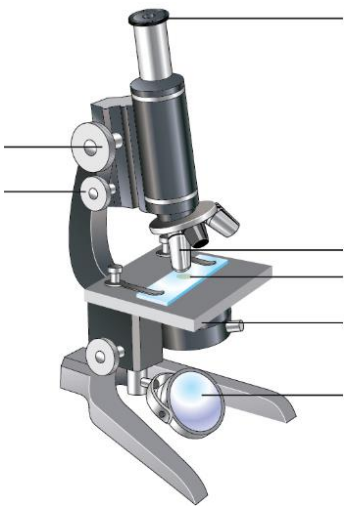
.....

.....

(1)

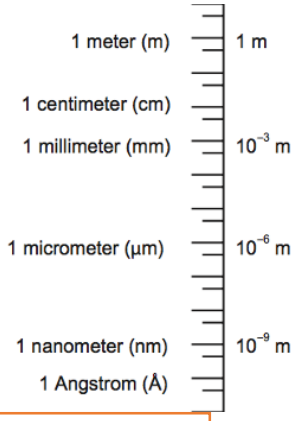
(Total 5 marks)

Lesson 3 – Microscopy



4.1.1.5 Microscopy

Content	Key opportunities for skills development
Students should be able to: • understand how microscopy techniques have developed over time • explain how electron microscopy has increased understanding of sub-cellular structures. Limited to the differences in magnification and resolution. An electron microscope has much higher magnification and resolving power than a light microscope. This means that it can be used to study cells in much finer detail. This has enabled biologists to see and understand many more sub-cellular structures.	WS 1.1
Students should be able to carry out calculations involving magnification, real size and image size using the formula: magnification = $\frac{\text{size of image}}{\text{size of real object}}$ Students should be able to express answers in standard form if appropriate.	MS 1a, 1b, 2h, 3b WS 4.4 Use prefixes centi, milli, micro and nano.



1. How many micrometres in one metre?
2. How many micrometres in one millimetre?
3. Convert 4.3cm into millimetres (mm).
4. Convert 4.3cm into micrometres (µm).
5. Convert 4,642µm into millimetres (mm).
6. Convert 85cm into micrometres (µm).
7. Convert 8,322µm into centimetres (cm)

Ext: What rule do you use for each calculation?

Magnification is the ability to make small objects seem larger, such as making a microscopic organism visible

Resolution - The shortest distance between two parts of a specimen that can be seen as two distinctly separate points

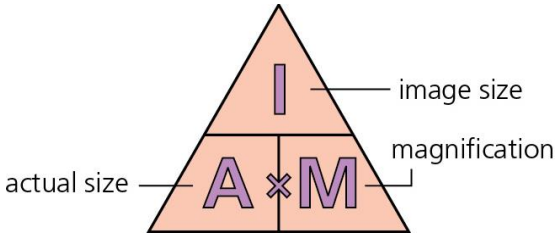
Feature	Light Microscope	Electron Microscope
Image made by?		
Magnification power		
Resolution		

Extra notes

Calculating Magnification

Real object: the specimen you put under the microscope
Image: what you see when you look through the microscope; the image of the real object appears magnified
Magnification: the number of times bigger the image looks compared to the real object

$$\text{Magnification} = \frac{\text{image size}}{\text{actual size}}$$



Use the formula triangle to write the other two formula in your booklet:

Actual size =

Image size =

Worked example:
The image of a cell in a book is 4.8cm in length. However, the real cell is only 120µm. Calculate the magnification of the cell.

Image =
Real object =

Magnification = size of image / size of real object
Magnification =
Magnification =

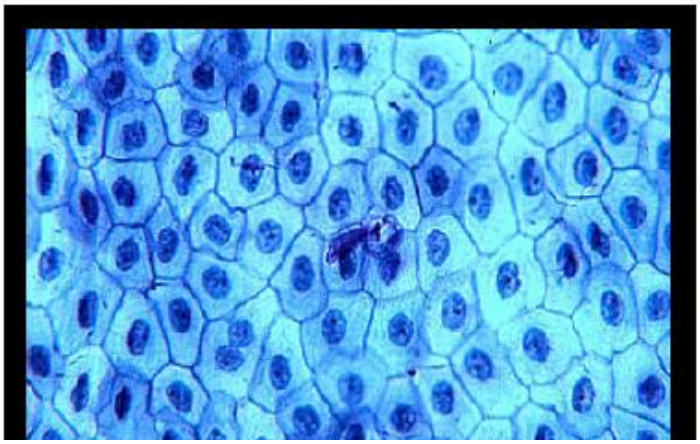
When dividing any two numbers the units must be **equal** for them **to cancel out.**

1. A heart muscle cell with a length of 23µm is magnified 200x. What is the image size in mm?

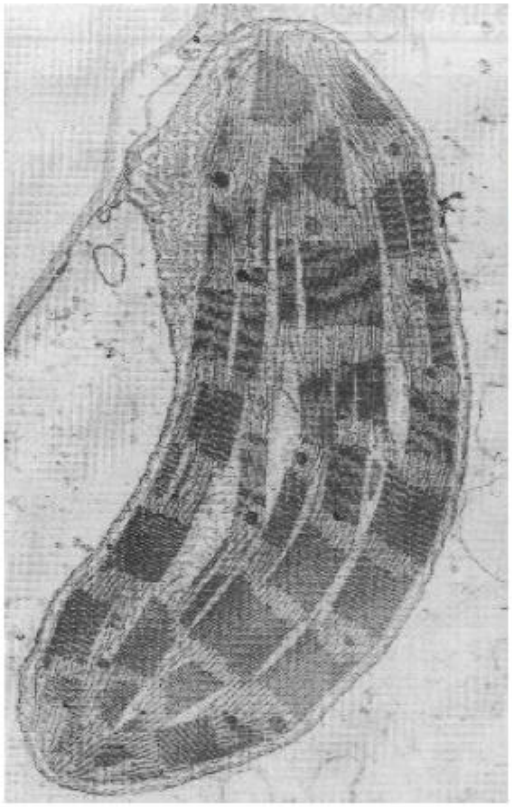
2. A root hair cell image is 7.8 cm in length. The image is being magnified 4500x. Calculate the real length of the object in mm.

3. The image of a nerve cell measures 3.5 cm. It has been magnified 3000x. Calculate the real size of the nerve cell, giving your answer in micrometres.

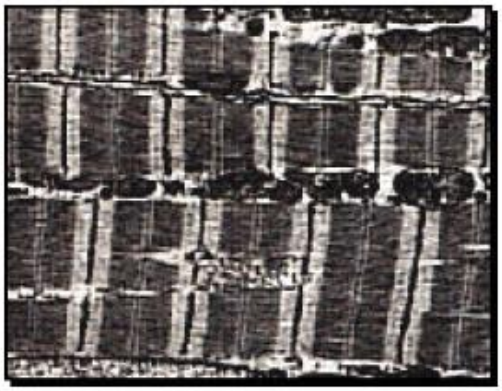
Now try these yourself



Magnification is x100
What is the actual size of one of these epithelial cells?



If the actual length of this chloroplast is 10μm, what is the magnification?



The optic magnification is x60 and the eyepiece magnification is x10, what is the actual length of:

a) the white stripe of the muscle fibre?
b) the dark stripe of the muscle fibre?
c) a mitochondrion?

Standard form

A. Put these numbers into standard form:

1. 6 000
2. 400
3. 80 000
4. 9 000
5. 400 000
6. 4 000
7. 450
8. 55 000
9. 350
10. 750 000

B. Change each of these numbers to an ordinary number

1. 6×10^{2}
2. 2×10^{3}
3. 5×10^{7}
4. 9×10^{8}
5. 3.7×10^{9}
6. 2.8×10^{1}
7. 9.9×10^{5}
8. 7.1×10^{4}

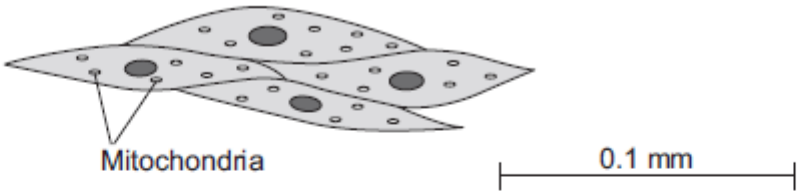
C. Put these numbers into standard form:

1. 0.007
2. 0.04
3. 0.000 005
4. 0.0234
5. 0.000 002 3
6. 0.006 7
7. 0.000 002 34
8. 0.06 7
9. 0.3
10. 0.000 045

D. Change each of these to a large or small number:

1. 5.5×10^{-6}
2. 6.5×10^{-4}
3. 3.2×10^{5}
4. 2.9×10^{2}
5. 3.167×10^{-2}
6. 1.115×10^{4}
7. 1.412×10^{-3}
8. 7.2×10^{1}
9. 9.01×10^{-2}
10. 1.17×10^{5}

The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a) The figure above is highly magnified.

The scale bar in the figure above represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of the figure above.

_____

_____

_____

Magnification = _____ times

(2)

(c) The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria?

_____

_____

_____

_____

(2)

(d) The muscle cells also contain many ribosomes. The ribosomes cannot be seen in **Figure above**.

(i) What is the function of a ribosome?

_____

(1)

(ii) Suggest why the ribosomes **cannot** be seen through a light microscope.

_____

(1)

(Total 8 marks)

Lesson 4 – Required Practical
Using a Light Microscope

Relationships

Required practical activity 1: use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.

How to Prepare a Microscope Slide: Risk Assessment

Question & Enquiry

Complete your risk assessment table.

Hazard	Risk	Prevention

Equipment:

- a small piece of onion
- a knife or scalpel
- a white tile
- forceps
- a microscope slide
- a coverslip
- a microscope
- iodine solution in a dropping bottle

Procedure:

1. Collect a thin piece of onion skin
2. Spread the skin on to a glass slide so that it is flat and not overlapped
3. Stain the cells by adding two drops of iodine
4. Carefully lower a coverslip onto the slide so that air is pushed out
5. Use a piece of filter paper to soak up any liquid from around the edge of the coverslip.
6. Put the slide on the microscope stage.
7. Turn the nosepiece to the lowest power objective lens.
8. Looking from the side (**not** through the eyepiece) turn the coarse adjustment knob so that the end of the objective lens is almost touching the slide.
9. Now looking through the eyepiece, turn the coarse adjustment knob in the direction to increase the distance between the objective lens and the slide. Do this until the cells come into focus.
10. Now rotate the nosepiece to use a higher power objective lens.
11. Slightly rotate the fine adjustment knob to bring the cells into a clear focus and use the low-power objective (×40 magnification) to look at the cells.
12. When you have found some cells, switch to a higher power (×100 or ×400 magnification).
13. In the space below make a clear, labelled drawing of some of these cells. Make sure that you draw and label any component parts of the cell.

Label this drawing of a cheek cell.

Use the eyepiece graticule to measure the length of one of the epidermal cells that you have drawn. Remember to include the units.
Now measure the same cell in your drawing.
Calculate the magnification of your drawing, using the formula:

$$\text{magnification} = \frac{\text{length of drawing of cell}}{\text{actual length of cell}}$$

Write the magnification underneath your drawing.

Extension:

- State why iodine is added to the cell before you look at it under the microscope?
- Explain how electron microscopy has increased understanding of subcellular structures

Challenge

Practical: Looking at animal cells (cheek cells) under the microscope

Method:

- Rub the cotton bud over the inside of your cheek to remove some of the cells.
- Wipe the cotton bud over the surface of a glass slide.
- Place the cotton bud in **disinfectant**.
- Stain the cells with 2 drops of methylene blue stain.
- Remove some of the stain using paper towel.
- Use a mounted needle to lower the cover slip so the air is pushed out.
- Draw the cells and label the structures.
- Once you have finished, place the slide and cover slip in **disinfectant**.
- Pack away your microscope carefully.

Method 1

1. Place your slide on a microscope stage and observe using the lowest power objective lens.
2. Focus in on the image and then increase the magnification until you can clearly observe the cell's structure.
3. Make a drawing of what you observe, labelling any structures you recognise. Ensure that you record the magnification you used when making your observations.

Cheek Cells – draw and label the organelles you might see

What is the magnification?

Literacy Task

You must write a series of instructions for someone to be able to use a microscope, describing and explaining how a microscope works. You are going to swap them with another group and have a go at using the microscope only following the instructions. Feedback to the original group

Speaking & Listening
Ambitious Vocabulary
Formal Situations
Active Listening

Reading
Pre-complex Texts
DARTs
Comprehension

Writing
Modelling Genres
Scaffolds
Extended Pieces

Feedback & Assessment

Relationships

Lesson 5 – Differentiation & Specialised Cells

4.1.1.3 Cell specialisation

Content

Students should be able to, when provided with appropriate information, explain how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism.

Cells may be specialised to carry out a particular function:

- sperm cells, nerve cells and muscle cells in animals
- root hair cells, xylem and phloem cells in plants.

4.1.1.4 Cell differentiation

Content

Students should be able to explain the importance of cell differentiation.

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

- Most types of animal cell differentiate at an early stage.
- Many types of plant cells retain the ability to differentiate throughout life.

In mature animals, cell division is mainly restricted to repair and replacement. As a cell differentiates it acquires different sub-cellular structures to enable it to carry out a certain function. It has become a specialised cell.

In & On: Write down as many types of cell as you can think of

Make 9 correct sentences by choosing a word or phrase from each column.

Animal cells	contain	a nucleus	where	chemical reactions take place to keep the cell alive
Plant cells		cytoplasm	which	energy is released from glucose during respiration
		mitochondria		supports the cell and stops it collapsing or bursting
		a cell membrane		controls what happens in the cell
		ribosomes		transfer energy from light and use it to make food
		a cell wall		contains the cell sap and keeps the cell firm
		a vacuole		manufactures protein for the cell
		chloroplast		controls what enters and leaves the cell

Writing
Modelling Genres
Scaffolds
Extended Pieces

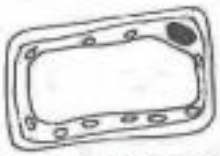
P:\Departmental\Science\Schemes of Work\KS3\KS3 2019 onwards\Year 9\Organisms 3 - Cells\Lessons\Lesson 5 - Differentiation and specialised cells

Literacy & Numeracy

Embryonic cells are _____. They are called _____ CELLS.

They have not *yet* acquired a special structure and function.

Differentiated cells are _____ cells.

CELL	FUNCTION	ADAPTATI
 Palisade cell (from leaf)		
 Red blood cells		
 Ciliated cell (in oviduct)		
 Nerve cell (motor neurone)		
 Root hair cell		
 Sperm cell		
 Muscle cell		

Lesson 5 – Exam questions

1. Name parts A, B and C of these muscle cells.

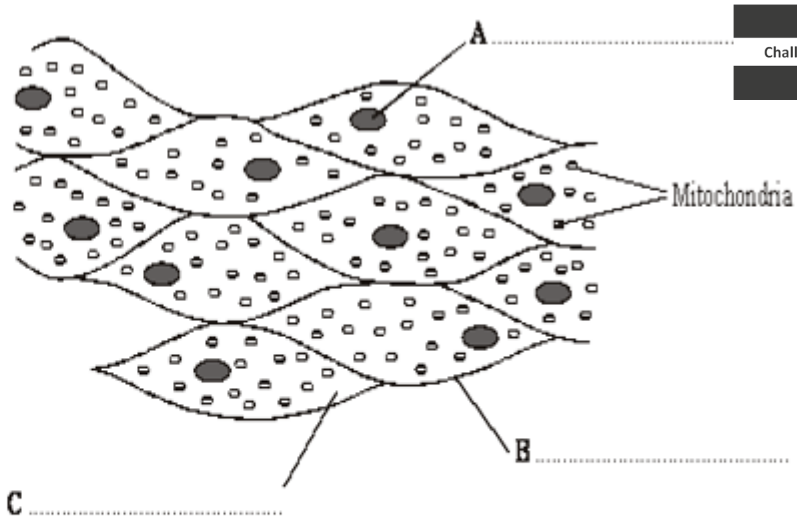
2. Explain the role of parts A, B and C.

A = _____

B = _____

C = _____

3. Give one adaptation to being a muscle cell which the diagram shows.



_____

4. Explain the answer given to Q3.

_____

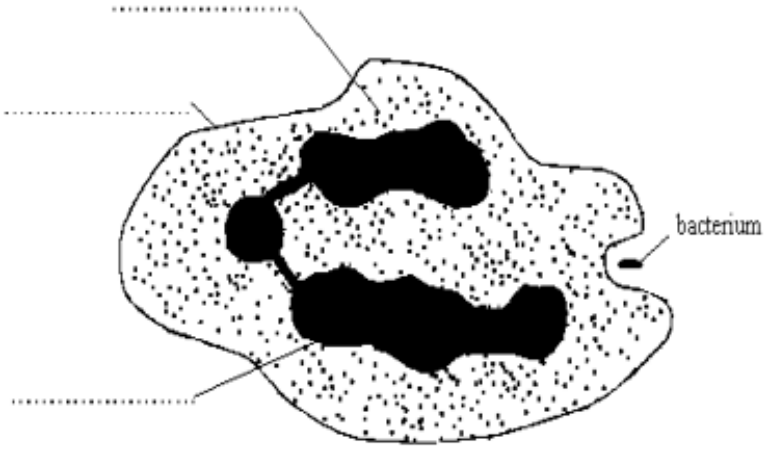
1. The diagram shows a white blood cell. Some white blood cells produce antibodies and some enzymes, which are proteins.

Give one adaptation which can be seen from this diagram.

_____

_____

_____



2. Protein synthesis requires a lot of energy.

Suggest another adaptation which this cell would have which is not visible from this diagram.

_____

_____

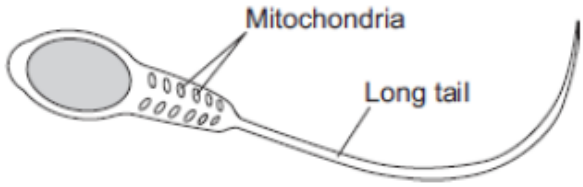
3. Explain the adaptations related to the nucleus of sperm and egg.

_____

_____

(b) Cells can be specialised for a particular job.

The diagram shows the structure of a human sperm cell.



Describe how the long tail and the mitochondria help the sperm to do its job.

Long tail.....

.....

.....

Mitochondria.....

.....

.....

(4)
(Total 9 marks)

Challenge

Feedback & Assessment

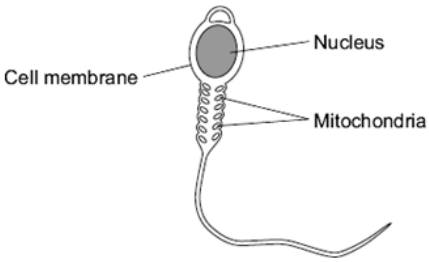
Writing
Modelling Genres
Scaffolds
Extended Pieces

Extra notes Extra notes Extra notes Extra notes Extra notes

Lesson 6 – Stem Cells

Q1. Cells in the human body are specialised to carry out their particular function.

(a) The diagram shows a sperm cell.



The sperm cell is adapted for travelling to, then fertilising, an egg.

(i) How do the mitochondria help the sperm to carry out its function?

.....

.....

(1)

(ii) The nucleus of the sperm cell is different from the nucleus of body cells.

Give **one** way in which the nucleus is different.

.....

.....

(1)

(b) Stem cells from human embryos are used to treat some diseases in humans.

Explain why.

.....

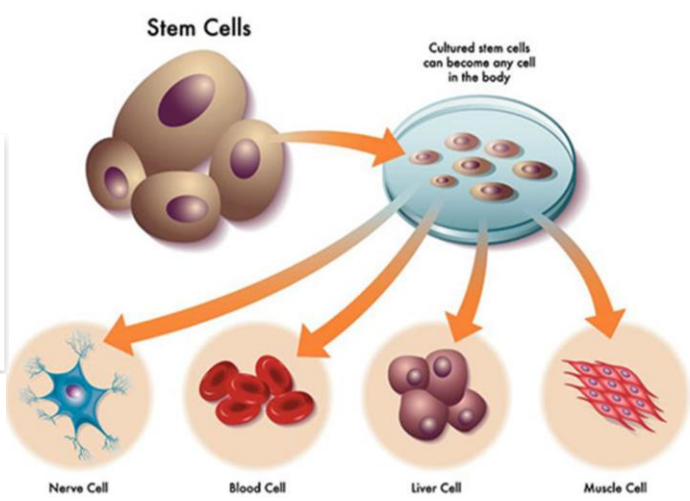
.....

.....

.....

(2)

(Total 4 marks)



Watch the video and answer these questions:

Where do stem cells come from?

What can stem cells be used to treat?

What ethical issues (right or wrong arguments) does it produce?

A stem cell is a cell that has not yet become a _____ cell

Stem cells can be acquired from e_____, adult b_____ m_____ and u_____ c_____ in the womb.

Plant stem cells come from the tips of r_____ and s_____.

Other features:

-
-

Adult stem cells

We have stem cells in our body e.g. in bone marrow

Embryonic stem cells

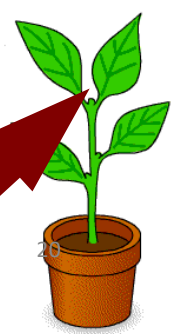
These come from a developing embryo- usually one which has been discarded after IVF.

Stem Cells in Plants – Meristems

Cells from the meristem behave like stem cells – they can develop into any kind of cell. Cloned plants can be produced from these cells. What are the advantages of this?

Plant growth occurs in areas called meristems.

Stem cells can come from meristems.



e.g. this meristem causes the plant to grow upwards.

Watch the video clip about Parkinson's Disease carefully and answer these 6 questions:

1. What are the symptoms of Parkinson's?

2. What is the current treatment for Parkinson's?

3. What chemical do the neurones in the brain communicate with?

4. What do Dopamine cells do?

5. What would happen if the Deep Brain stimulation wire were to hit a blood vessel?

Reading
Pre-complex Texts
DARTs
Comprehension

Challenge

Read the highlighting exercise about Stem cells.
Highlight any information that you think helps to explain why Stem cells might be able to help people suffering from diseases like Parkinson's or paraplegia.

STEM CELLS – THE FUTURE OF MEDICINE?

Christopher Reeve was an American actor, most famous for his role as Superman in the original movies. His career ended in 1995, when he was thrown from a horse and was paralysed from the neck down, unable to move his arms or legs. This was the kind of injury for which there was no cure. Medicine had not advanced to the stage where it could repair such damage to his spinal cord. However, some scientists had begun work on a radical idea, which Reeve gave his full support to. That idea was to use stem cells to repair damaged tissues, which would allow his spinal cord to recover and transmit nerve impulses again.

Unfortunately, despite his support for Stem cell research, Christopher Reeve died in 2004, aged 52, before a clinical trial of this treatment was ready for him to participate in.

Most adult cells in the body adapt and change to do a particular function, and having done so cannot change into other type of cells. Stem cells are different. They are cells which are still at an early stage of development, and retain the potential to turn into many different types of cell: liver cells, brain cells, skin, bone, nerve. The most useful types of stem cell are ones from embryos as they have the ability to become virtually any type of cell in the body. Other types of stem cell can be found in adult bone marrow and blood from a baby's umbilical cord, but these stem cells usually only have the potential to develop into a narrow range of cells.

Among the conditions which scientists believe may eventually be treated by stem cell therapy are Parkinson's disease, Alzheimer's disease, heart disease, stroke, arthritis, diabetes, burns and spinal cord damage.

You can easily grow stem cells in a Petri dish in large numbers. Studies have shown that if you inject stem cells into the damaged part of the body, and trigger them to change into the type of cell you want (e.g. nerve cells in the spinal cord),it should be possible to replace damaged tissue with healthy tissue.

Some people argue that stem cells taken from embryos are a slippery slope to cloning a whole human being; they think that it de-values life. Those in the pro-life movement argue that a human embryo is a human life and is entitled to protection. They warn of a brave new world of 'embryo farms' and 'cloning mills' for the cultivation of human spare parts. And they argue that scientists can achieve the same results using adult stem cells— immature cells found in bone marrow and other organs in adult human beings, as well as in umbilical cords normally discarded at birth.

However, these adult stem cells, useful as they may be for some diseases, have thus far proved incapable of producing the full range of cell types that embryonic stem cells can.

Scientists point out that fertility clinic freezers worldwide are bulging with thousands of unwanted embryos slated for disposal. Those embryos are tiny and have no identifying features or hints of a nervous system. If parents agree to donate them, supporters say, it would be unethical not to do so in the quest to cure people of disease.

Consider the biggest killer of all in the U.S: heart disease. Embryonic stem cells can be trained to grow into heart muscle cells that, even in a laboratory dish, clump together and pulse in spooky unison. And when those heart cells have been injected into mice and pigs with heart disease, they've filled in for injured or dead cells and sped recovery. Similar studies have suggested stem cells' potential for curing conditions such as diabetes and spinal cord injury.

Critics point to worrisome animal research, showing that embryonic stem cells sometimes grow into tumours or morph into unwanted kinds of tissues—possibly forming, for example, dangerous bits of bone in those hearts they are supposedly repairing. But supporters respond that such problems are rare and a lot has recently been learned about how to prevent them.

Complete the sentences:

Stem cells are...

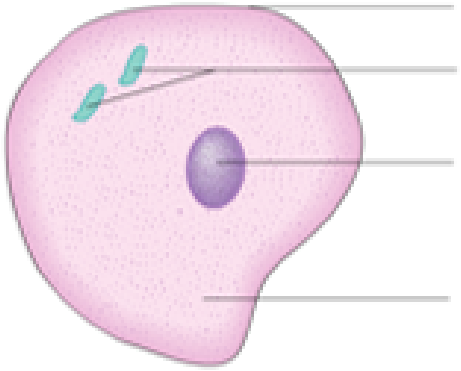
Scientists are interested in them because...

The possible advantages of stem cells are...

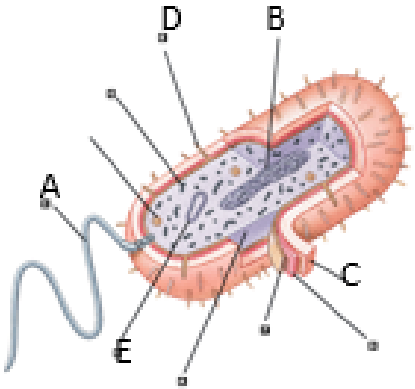
Some people object to using stem cells because...

This debate is not one which Science can answer because...

1. Label the structures of the animal cell.
2. State the function of each of the structures



What type of cell is shown below?.....



Name the structures A-E:

A

B

C

D

E

B and E contain the same molecule. What is it?

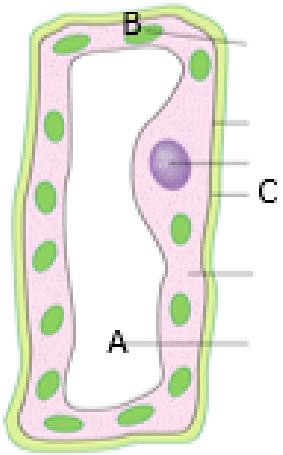
.....

How is this type of cell different from a eukaryotic cell?.....

.....

Lesson 7 – Stop the clock

1. Label the structures of the plant cell



What is the function of :

A

B

C

Specialised cells

Name 5 different specialised cells:

A

B

C

D

E

Pick one of the cells you have named. Draw a picture of it . State the cell's function and how it is adapted for that function.

Magnification

Name 2 different types of microscope:

1.

2.

How are they different?.....

.....

An algal cell was observed at a magnification Of x400. The image size was 2 mm. Calculate the actual size. Show workings out.

Lesson 8 – Chromosomes

4.1.2.1 Chromosomes

Content	Key opportunities for skills development
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.	WS 1.2 Use models and analogies to develop explanations of how cells divide.

In & On:

Unscramble these parts of a cell and then arrange them in order of size (smallest to largest):

RESOCMOHOM

EENG

LELC

USNLCUE

Key Word	Definition
	The part of the cell which contains genetic information (chromosomes).
	Long, thin, thread-like structures found in the nucleus of a cell made from a molecule of DNA. Chromosomes carry the genes.
	Deoxyribonucleic Acid, the chemical that makes up chromosomes. DNA carries genetic info.
	Chemicals in living things that are polymers made by joining together amino acids.
	A section of DNA giving the instructions for a cell about how to make one kind of protein.
	Image of chromosome pairs arranged in descending size.

Quick fire questions:

1.Which organelle in the cell contains the genetic information?

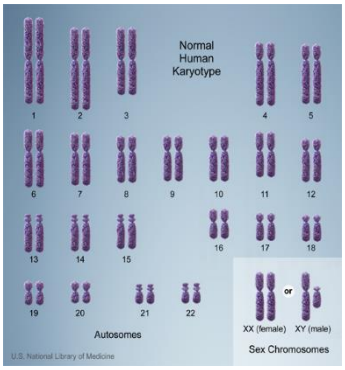
2.What are chromosomes?

3.What are the sections of chromosomes called?

4.How many chromosomes do humans have in a skin cell?

/4

Human Karyotype – in a diploid cell……



- **46 chromosomes**
- **23 *pairs* of chromosomes** – one from each parent.
- Chromosomes are made up of **lots of genes.**

Each Gene codes for a different protein (characteristic)

- You inherit **2 copies** of every gene
- Copies of same gene are called **ALLELES**

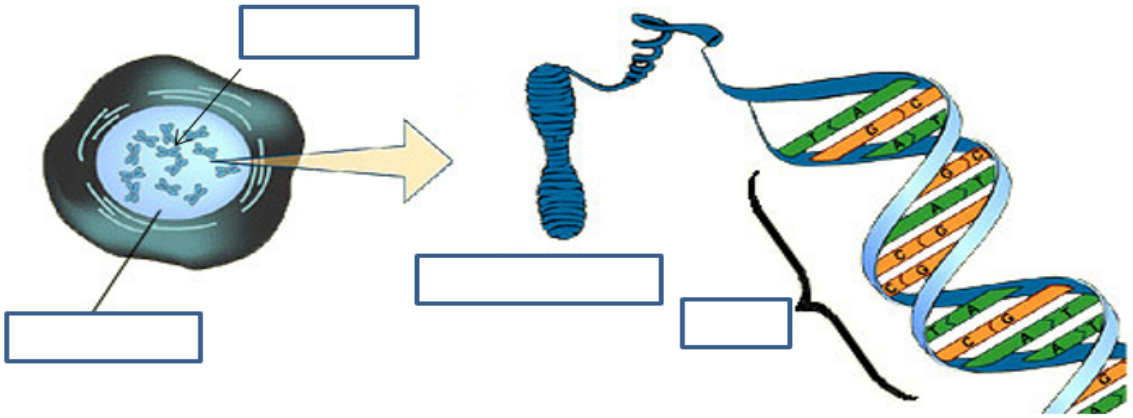
GAMETES are _____ _____ (sperm and egg)

They are _____ cells as they only contain ____ chromosomes in the nucleus

Why do gametes needs to be haploid not diploid?

_____

_____



Use the words below to label the boxes

Chromosome **nucleus** **DNA** **Gene**

Complete the following paragraph:

Humans have ..... strips of DNA in every cell apart from ..... cells.

These strips of DNA are called ..... The chromosomes are arranged in ....., one from each .....

Each chromosome is divided into sections. These sections are called ..... Each gene codes for a particular .....

chromosomes	characteristic	sex	pairs	46
	genes	parent		

Look at the list of things found inside cells.

amino acid

bases

chromosomes

DNA

genes

protein

Feedback & Assessment

Finish the following sentences.

Choose the best words from the list.

Inside cells, there are coded instructions called ..... .

The instructions are made of a chemical called ..... .

The instructions are carried inside the nucleus on structures called ..... .

[3]

Karyotype diagnoses

Relationships

Karyotype A	Karyotype B
Karyotype C	Karyotype D

Use these words to complete this passage; you may use some of these words **more than once**:

gene protein DNA microscope genetic code chromosomes double-helix sexual amino acid bases nucleus cell pairs division

Literacy & Numeracy

Genetic Material

If you look at a …… through a powerful …… you can see a circular organelle called the …… . When a cell is about to, or is undergoing cell ……, you can see tiny thread like structures called …… . A typical human cell contains 23 …… of …… . They exist in …… because they are inherited from two parents during …… reproduction.

When a chromosome is unravelled it is composed of a long molecule of …… . This molecule consists of two parallel strands, twisted and joined together to form a …… shape. Between these two strands is a series of chemical …… ; there are four of them represented by the letters A, C, G and T, and the order of these …… forms the …… . A sequence of three of these …… codes for one …… . Therefore, a long sequence of these …… codes for a sequence of ……. ……s, which will be joined together to form a …… during a process called …… synthesis . A section of DNA which codes for a protein is called a …… . Therefore, one ……codes for one …… .

Edward's Syndrome

- Small head, jaw and mouth
- Clenched hands, malformed fingers and absent thumbs
- Webbed feet
- Heart, kidney, brain, digestive and genital malformations
- Delayed growth and development
- Infections of the lungs and urinary tract

B

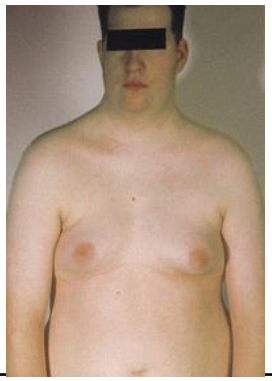
Turner's Syndrome

- Short Stature
- Broad Chest
- Low ears and hair line
- Webbed neck
- Infertility
- Heart Disease
- Hypothyroidism
- Diabetes
- Vision Problems
- Hearing Issues

A

Kleinfelter's Syndrome

- Most common sex chromosome abnormality in males
- Hypogonadism
- Reduced Fertility
- Feminine Traits
- Enlarged breast tissue



C

Down Syndrome

- Decreased or poor muscle tone
- Short neck
- Small head, ears and mouth
- Upward slanting eyes
- Wide short hands
- Cognitive impairment (particularly with thinking and learning)

D

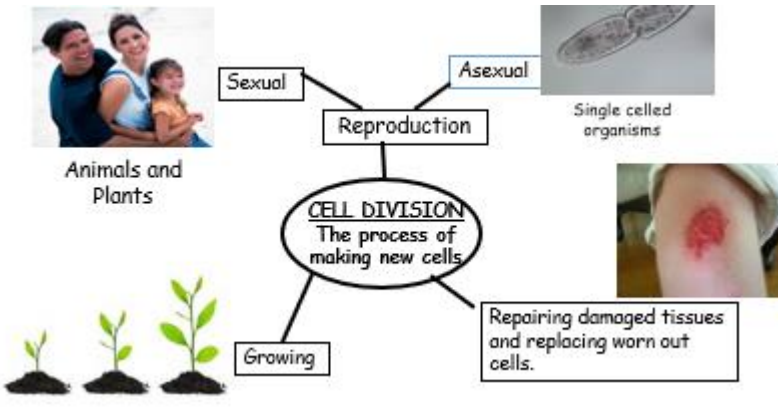
Lesson 9 – Mitosis and the Cell Cycle

Why do we need new cells and how do we get them?

Question & Enquiry

In & On - Heads and Tails. Match the statement on the left to that on the right.

Chromosome	The building blocks of a protein chain.
DNA	A section of a chromosome which codes for one protein.
Homologous pair	A strand of DNA.
Gene	Made by the cell usually as an enzyme.
Amino Acid	The chemical which codes for life.
Protein	2 identical chromosomes - one from each parent.



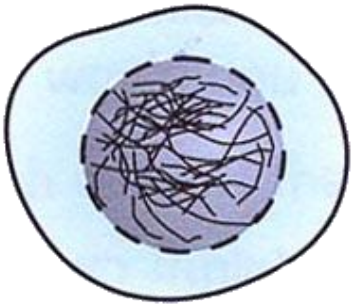
Mitosis

- Cell division is needed to replace cells in our body, or increase the number of cells when we are growing
- New body cells are produced by a type of cell division called MITOSIS
- One DIPLOID body is cell is copied to produce 2 IDENTICAL NEW DIPLOID CELLS

Stages of Mitosis

Stage	Description	Diagram
Interphase		
1		
2		
3		
4		
5		

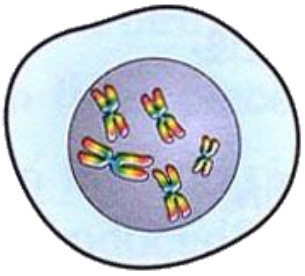
Interphase



This is a normal body cell.
Cells spend most of their life in interphase.

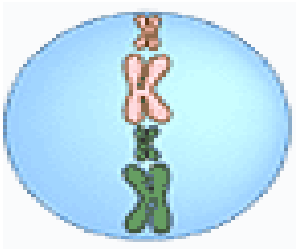
When it is not dividing the DNA is spread out into longer and thinner chromosomes, making it difficult to see individual strands.

Stage 1



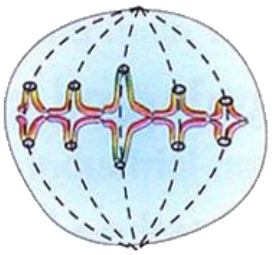
- The chromosomes get shorter and more tightly coiled
- Each chromosome copies itself (DNA replication) with the two copies held together in the centre producing an X shape.

Stage 2



- Copied chromosomes line up in the centre of the cell

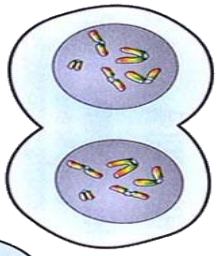
Stage 3



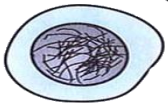
- Original and copied chromosomes move to opposite ends of the cell

Stage 4

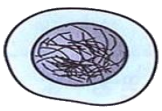
The cytoplasm starts to divide and a new cell membrane forms around the two new cells as it does so.



Stage 5 - Cell division



- New nuclei form in each of the two new cells



4.1.2.2 Mitosis and the cell cycle

Content

Cells divide in a series of stages called the cell cycle. Students should be able to describe the stages of the cell cycle, including mitosis.

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. 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.

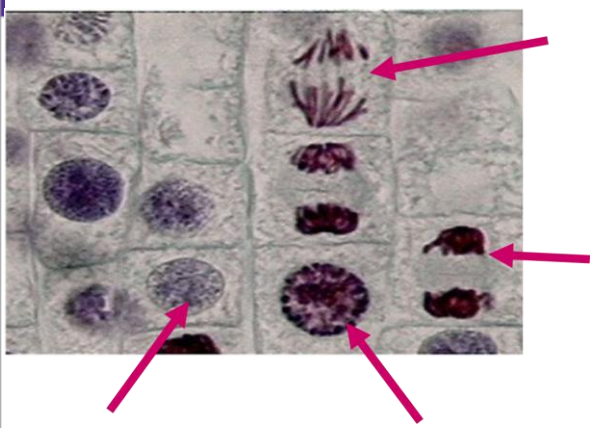
Finally the cytoplasm and cell membranes divide to form two identical cells.

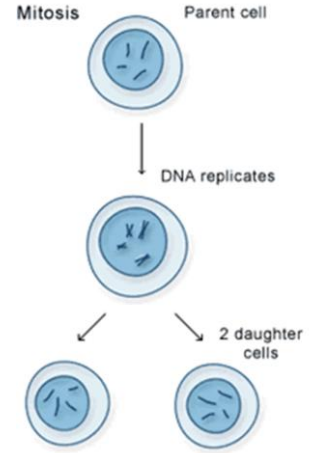
Students need to understand the three overall stages of the cell cycle but do not need to know the different phases of the mitosis stage.

Cell division by mitosis is important in the growth and development of multicellular organisms.

Students should be able to recognise and describe situations in given contexts where mitosis is occurring.

Cells undergoing mitosis – explain what is happening at each arrow





Stage 1: Copies of the DNA are made

Stage 2: The nucleus divides

Stage 3: The cell divides. Each new nucleus contains the same amount of DNA as the nucleus in the parent cell.

1. What is mitosis?
2. Why is mitosis important?
3. What would happen if mitosis didn't take place?
4. Suggest one advantage and one disadvantage of asexual reproduction.
5. What cells in the body reproduce by mitosis?
6. Which cells in the body do you think are **not** made by mitosis?
7. How many parents does a cell that reproduces by sexual reproduction have?
8. How many parents does a cell that reproduces by asexual reproduction have?
9. Can you give an example of what happens when mitosis goes wrong?

Question & Enquiry

Challenge

Feedback & Assessment

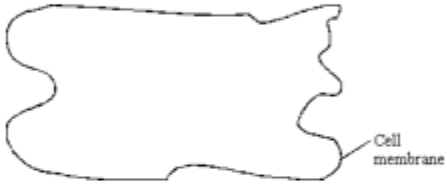
Lesson 9 – Exam Questions

Feedback & Assessment

Challenge

Q1. (a) The diagram shows a normal body cell which has six chromosomes.

(i) Complete the diagram below to show **one** cell produced from this cell by *mitosis*.



(3)

Q2. (a) How many pairs of chromosomes are there in a body cell of a human baby?

.....

(b) Place the following in order of size, **starting with the smallest,** by writing numbers **1 – 4** in the boxes underneath the words.

chromosome	nucleus	gene	cell
☐	☐	☐	☐

(1)

(c) For a baby to grow, its cells must develop in a number of ways.

Explain how each of the following is part of the growth process of a baby.

(i) Cell enlargement

.....

(1)

(ii) The process of cell division by mitosis

.....

.....

.....

(3)

(d) Why is cell specialisation (differentiation) important for the development and growth of a healthy baby from a fertilised egg?

.....

.....

(2)
(Total 8 marks)

Lesson 10 – Diffusion

4.1.3.1 Diffusion

Content	Key opportunities for skills development
Substances may move into and out of cells across the cell membranes via diffusion. 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. Some of the substances transported in and out of cells by diffusion are oxygen and carbon dioxide in gas exchange, and of the waste product urea from cells into the blood plasma for excretion in the kidney. Students should be able to explain how different factors affect the rate of diffusion. Factors which affect the rate of diffusion are: • the difference in concentrations (concentration gradient) • the temperature • the surface area of the membrane.	WS 1.2 Recognise, draw and interpret diagrams that model diffusion. WS 1.5 Use of isotonic drinks and high energy drinks in sport.

Unscramble these words:

owl	
vome	
ghhi	
lecl	
smosois	
lelomcue	
dagtrien	
sufifidon	
trancionteno c	

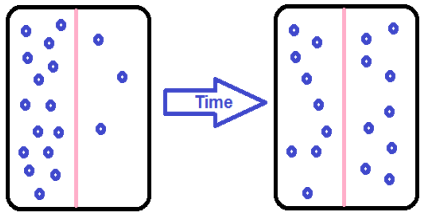
Definition of diffusion:

_____

_____

_____

_____



Practical – Factors affecting the ***rate*** of diffusion

Aim: To investigate the affect of concentration on the rate of diffusion

Concentration of Hydrochloric acid (M)	Diameter of phenolphthalein diffused out (cm)
0.1	2cm
0.2	4cm
0.4	6cm

Work in pairs.
1. Pour 25ml of 0.1 M, 0.2M and 0.4M Hydrochloric acid into separate beakers.
2. Pick up 3 of the 3 x 2cm agar cubes which have been pre-cut and put 1 cube into each of the 3 Hydrochloric acid solutions.
3. Note the time. Let them soak for 10 minutes with periodic gentle stirring and turning.
4. After 10 minutes, use a spoon or tongs to remove the blocks and blot dry with a paper towel.
5. Cut each cube in half and measure the distance of phenolphthalein solution that has diffused out of the agar.

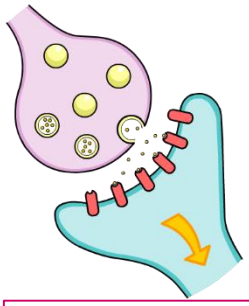
What is your hypothesis: _____

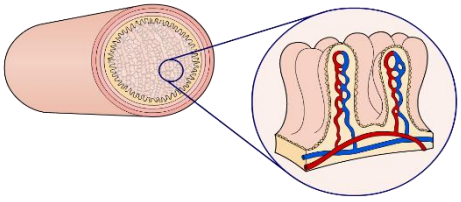
_____

_____

Factors affecting the rate of diffusion:

Temperature	Concentration	Surface Area
As the temperature increases the rate of diffusion _____	As the concentration gradient increases, the rate of diffusion _____	As surface area increases, the rate of diffusion will _____





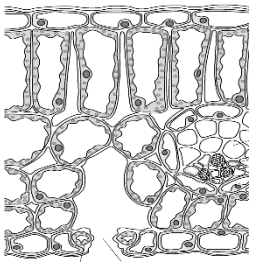
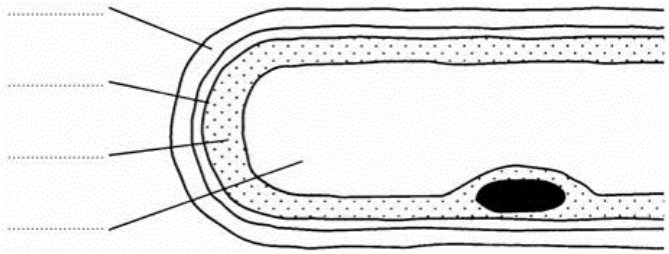


Diagram of: Found in: Diffusion of:	Diagram of: Found in: Diffusion of:	Diagram of: Found in: Diffusion of:	Diagram of: Found in: Diffusion of:

The drawing shows part of a root hair cell.

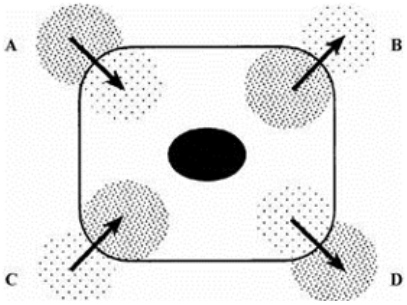


(a) Use words from the list to label the parts of the root hair cell.

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.

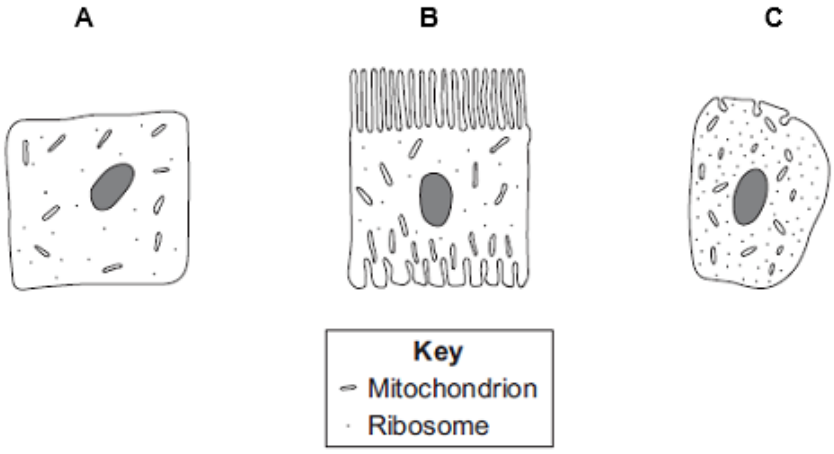
.....

(1)
(Total 7 marks)

Feedback & Assessment

Challenge

Q3. Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(a) Which cell, **A**, **B** or **C**, appears to be best adapted to increase diffusion into or out of the cell? ☐

Give **one** reason for your choice.

.....

.....

(1)

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

Name the enzyme produced by the salivary glands.

.....

(1)

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

.....

.....

.....

.....

(2)
(Total 4 marks)

Lesson 11 – Adaptations for Diffusion and Active transport

Question & Enquiry

Students should be able to calculate and compare surface area to volume ratios.

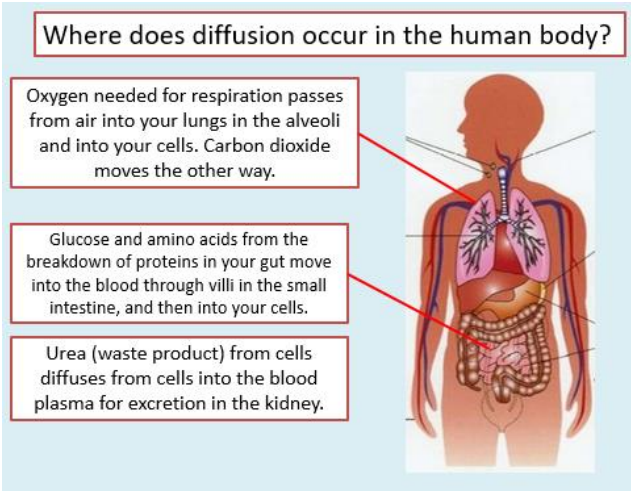
Students should be able to explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area to volume ratio.

Students should be able to explain how the small intestine and lungs in mammals, gills in fish, and the roots and leaves in plants, are adapted for exchanging materials.

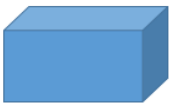
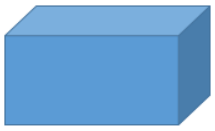
In multicellular organisms, surfaces and organ systems are specialised for exchanging materials. This is to allow sufficient molecules to be transported into and out of cells for the organism's needs. The effectiveness of an exchange surface is increased by:

- having a large surface area
- a membrane that is thin, to provide a short diffusion path
- (in animals) having an efficient blood supply
- (in animals, for gaseous exchange) being ventilated.

Where does diffusion occur in the human body?



Calculating Surface Area and Volume

Shape	Height (cm)	Width (cm)	Depth (cm)	Surface area (cm2)	Volume (cm3)	Surface Area : Vol ratio
	5	10	5			
	5	5	5			
	6	12	6			
	15	5	5			
	7	21	6			

For each shape, calculate the surface area and the volume and record in the table.

In the final column, work out the ratio of surface area to the volume e.g. 1:1 or 3:1

The rate of diffusion is _____ when the surface area to volume ratio is increased.

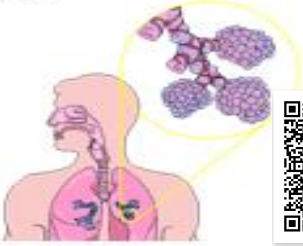
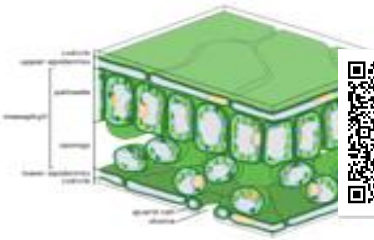
This is because <u>the larger the surface area, the more particles can diffuse at any one time</u>.

Complex organisms have evolved specialised exchange surfaces where diffusion takes place e.g. the alveoli in the lungs and the villi in the small intestine.

These structures have a greatly increased surface area to volume ratio, to speed up the rate of exchange.

Extra notes Extra Notes

Explain how the following are adapted for exchanging materials by diffusion:

Example	Explanation
Small Intestine 	
Inside the lungs 	
Gills of a Fish 	
Roots 	
Inside the leaf 	

Adaptations for faster diffusion in animals are:

- Very _____ walls (one cell thick) for a shorter diffusion path
- _____ surface area so more particles can diffuse at the same time
- Moist surface so gases can dissolve
- Good _____ supply to maintain the concentration gradient

Question & Enquiry

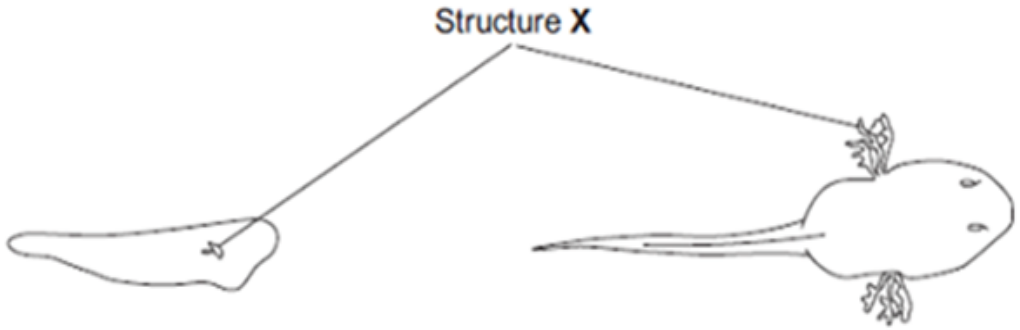
Feedback & Assessment

Q1.

The young stages of frogs are called tadpoles. The tadpoles live in fresh water.

The drawings show a tadpole just before hatching and three days after hatching.

Structure **X** helps in the exchange of substances between the tadpole and the water.



Tadpole just before hatching

Tadpole three days after hatching

(a) Name **one** substance, other than food, that the tadpole needs to exchange with the water in order to grow.

_____

(1)

(b) Suggest how the changes in the tadpole shown in the drawings help it to survive as it grows larger.

You should **not** refer to movement in your answer.
To gain full marks you should refer to structure **X**.

_____

_____

_____

_____

_____

_____

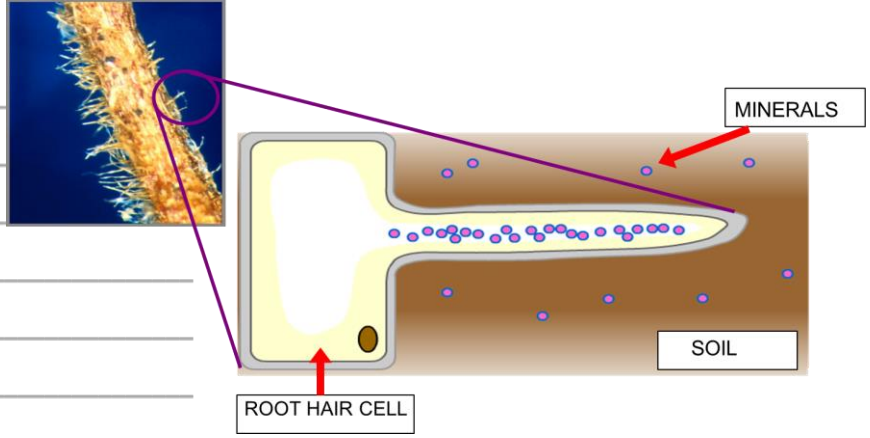
_____

_____

(4)

(Total 5 marks)

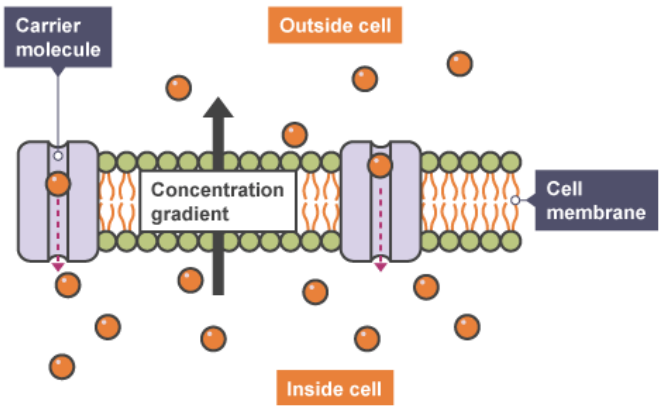
Active Transport



Active Transport: is the movement of dissolved substances e.g. _____ and _____, from an area of _____ concentration to an area of _____ concentration, **against a concentration gradient**. This requires _____ from respiration.

4.1.3.3 Active transport

Content	Key opportunities for skills development
Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This requires energy from respiration. Active transport allows mineral ions to be absorbed into plant root hairs from very dilute solutions in the soil. Plants require ions for healthy growth. It also allows sugar molecules to be absorbed from lower concentrations in the gut into the blood which has a higher sugar concentration. Sugar molecules are used for cell respiration. Students should be able to: • describe how substances are transported into and out of cells by diffusion, osmosis and active transport • explain the differences between the three processes.	There are links with this content to Cell specialisation.



How are plant roots adapted to absorb water and mineral ions?

Adaptation	Function
Branches and root hair cells	
Lots of mitochondria in root hair cells	

Examples of active transport include:

- uptake of **glucose** by epithelial cells in the **villi** of the small intestine
- uptake of ions from soil water by root hair cells in plants

(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.

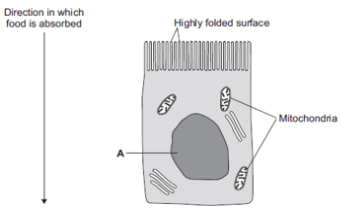
Give **one** substance that plants absorb by active transport.

.....

(1)

(Total 8 marks)

Q1. 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.

.....

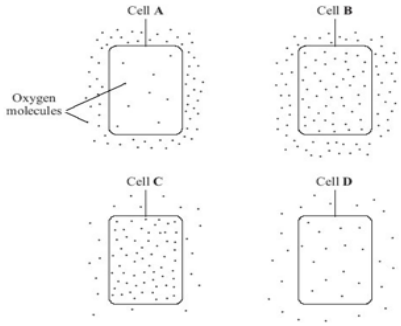
.....

(1)

Lesson 12 – Osmosis

Content	Key opportunities for skills development
Water may move across cell membranes via osmosis. Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.	WS 1.2 Recognise, draw and interpret diagrams that model osmosis.
Students should be able to: • use simple compound measures of rate of water uptake • use percentages • calculate percentage gain and loss of mass of plant tissue.	MS 1a, 1c
Students should be able to plot, draw and interpret appropriate graphs.	MS 4a, 4b, 4c, 4d

(a) The diagrams show cells containing and surrounded by oxygen molecules. Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest? ☐

(b) Draw a ring around the correct word to complete each sentence.

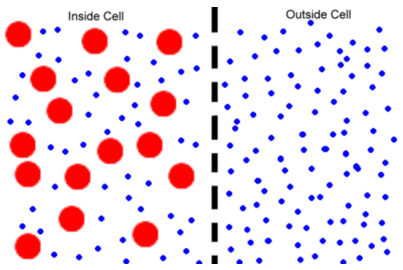
(i) Oxygen is taken into cells by the process of (diffusion / osmosis / respiration).

(ii) Cells need oxygen for (breathing / photosynthesis / respiration). ☐

(iii) The parts of cells that use up the most oxygen are the (membranes / mitochondria / nuclei).

(iv) Some cells produce oxygen in the process of (diffusion / photosynthesis / respiration).

Osmosis is the movement of _____ from a _____ to _____ concentration of water across a _____ _____ membrane.



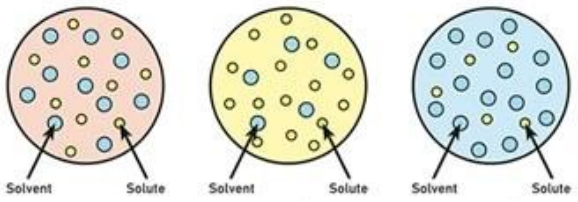
(1)

Types of Solutions

(1)

Isotonic	Hypertonic	Hypotonic
Iso = Same Tonic = Strength	Hyper = More Tonic = Strength	Hypo = Less Tonic = Strength

(1)



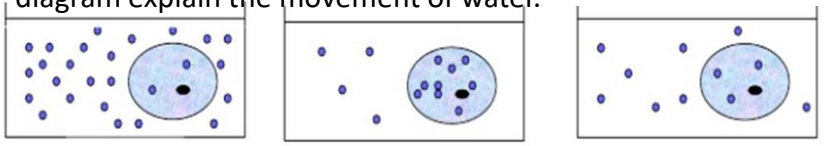
(1)

Same concentration of solutes and solvent

More solutes and Less solvent

Fewer solutes and More solvent

Draw an arrow to show the net movement of water by osmosis. Under each diagram explain the movement of water.



Lesson 12 – Osmosis Required Practical

Required practical activity 3: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.

Investigating osmosis in potato tissue

Osmosis is the movement of water through a selectively permeable membrane from an area of high concentration of water to an area of lower concentration of water.

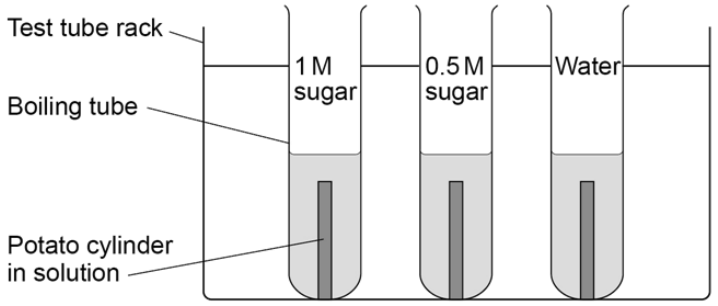
Plant tissues, such as potato, can be used to investigate osmosis.

In this experiment potatoes are cut into equal sized cylinders. The changes in length and mass after leaving them overnight in sugar solution and distilled water can then be accurately compared.

Method

You are provided with the following:

- a potato
- a scalpel
- 1 M sugar solution
- distilled water
- a cork borer
- a 10 cm^3 measuring cylinder
- three boiling tubes
- paper towels
- a white tile
- 0.5 M sugar solution
- a top-pan balance.
- a ruler
- labels
- a test tube rack



1. Using a cork borer, cut three potato cylinders of the same diameter.
2. Trim the cylinders so that they are all the same length (about 3 cm).
3. Accurately measure and record the length and mass of each potato cylinder.
4. Measure out 10 cm^3 of the 1 M sugar solution and place into the first boiling tube (labelled 1 M sugar).
5. Measure out 10 cm^3 of 0.5 M sugar solution and place into the second boiling tube (labelled 0.5 M sugar).
6. Measure out 10 cm^3 of the distilled water into the third boiling tube (labelled water).
7. Add one potato cylinder to each tube (make sure you know which one is which in terms of the length and mass).
8. Leave the potato cylinders in the boiling tubes overnight in the test tube rack.
9. Remove the cylinders from the boiling tubes and carefully blot them dry with the paper towel
10. Re-measure the length and mass of each cylinder (make sure you know which is which).
11. Record your lengths and masses in a table such as the one below.

Relationships

Challenge

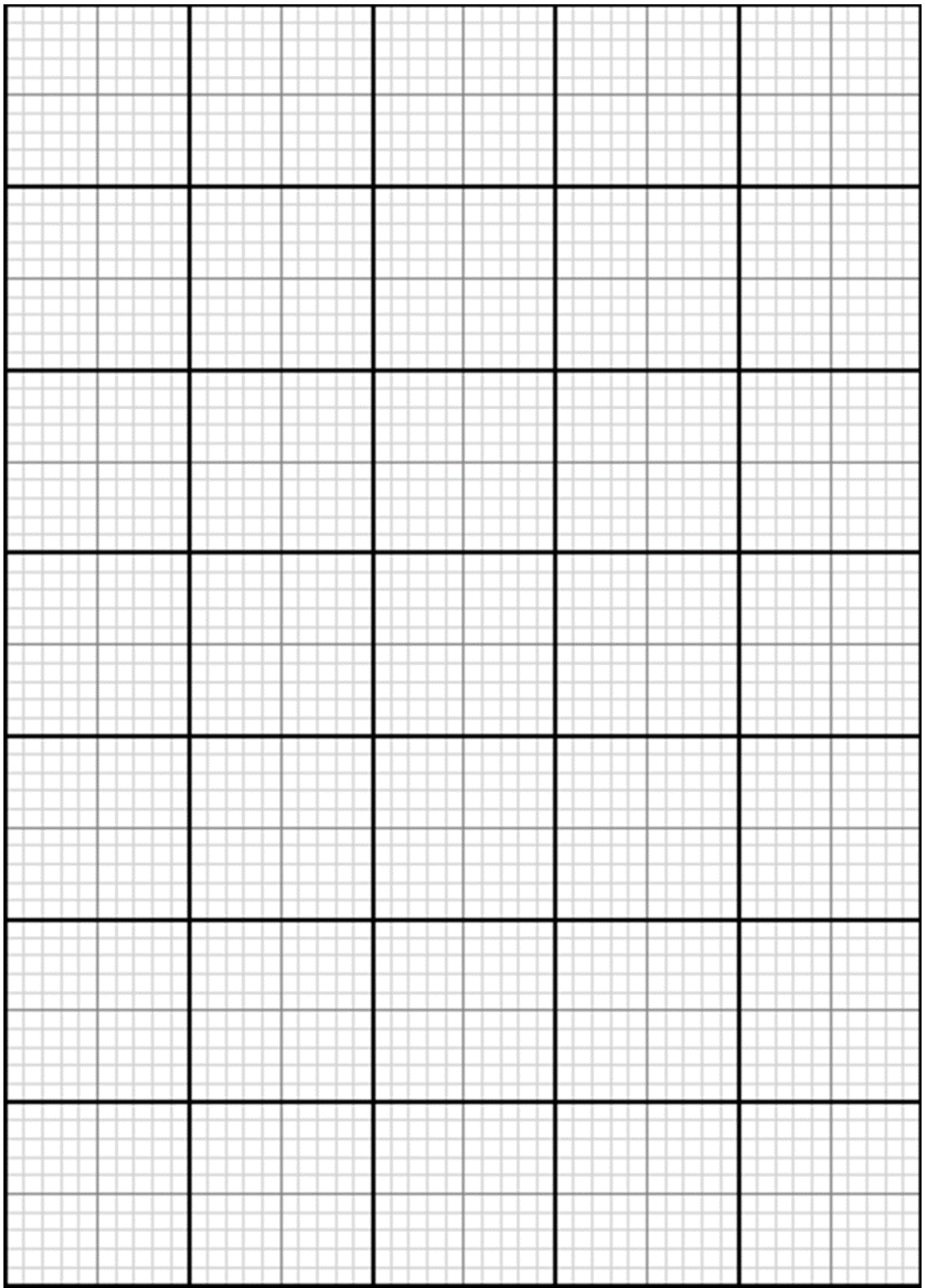
Literacy & Numeracy

	1 M sugar solution	0.5 M sugar solution	Distilled wa
Initial length in mm			
Final length in mm			
Change in length in mm			
Initial mass in g			
Final mass in g			
Change in mass in g			

From the change in mass, work out the % change in mass for each potato.
(change in mass ÷ mass at start x 100)
Why do we use the % change in mass instead of just 'change in mass'?

Concentration of solution (M)	% change in mass
0.0	16.2
0.5	10.3
1.0	3.2

12. Plot a graph with '% change in mass in g' on the y-axis against 'Concentration of sugar solution' on the x-axis.



Osmosis required practical:
Conclusion

Literacy & Numeracy

Challenge

Writing
Modelling Genres
Scaffolds
Extended Pieces

Q1. Cells, tissues and organs are adapted to take in different substances and get rid of different substances.

The table shows the concentration of four ions outside cells and inside cells.

Ion	Concentration outside cells in mmol per dm^3	Concentration inside cells in mmol per dm^3
Sodium	140	9
Potassium	7	138
Calcium	2	27
Chloride	118	3

Feedback & Assessment

(a) Use information from the table above to complete the following sentences.

Sodium ions will move into cells by the process of _____ .

Potassium ions will move into cells by the process of _____ .

(i) The bag in drink **A** got heavier after 20 minutes.

Explain why.

_____

_____

_____

_____

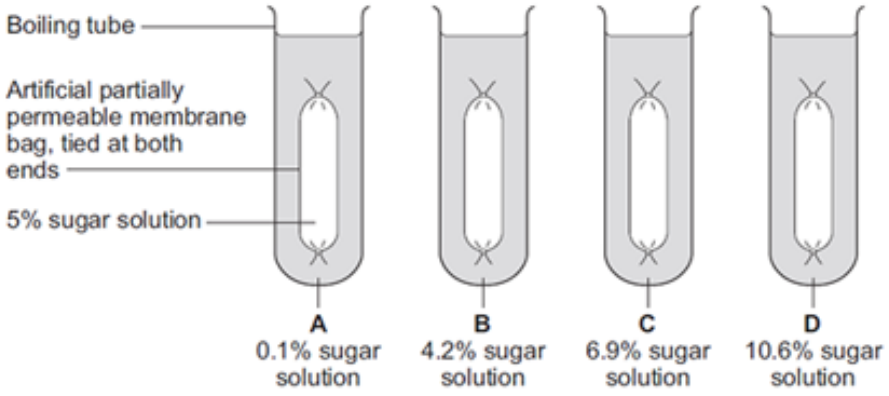
(3)

(b) Some students investigated the effect of the different concentrations of sugar in four drinks, **A**, **B**, **C** and **D**, on the movement of water across a partially permeable membrane.

The students:

- made four bags from artificial partially permeable membrane
- put equal volumes of 5% sugar solution in each bag
- weighed each bag containing the sugar solution
- placed one bag in each of the drinks, **A**, **B**, **C** and **D**
- after 20 minutes removed the bags containing the sugar solution and weighed them again.

The diagram below shows how they set up the investigation.



(ii) In which drink, **A**, **B**, **C** or **D**, would you expect the bag to show the smallest change in mass?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(iii) Explain why you think the bag you chose in part **(b)(ii)** would show the smallest change.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q2.

The diagrams show the same cell of a common pond plant.

Diagram A shows the cell in a hypotonic solution.

Diagram B shows the same cell in a hypertonic solution.

Diagram A

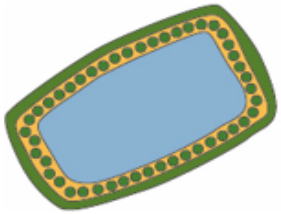


Diagram B

(a) What is a **hypertonic** solution?

_____

_____

_____

(b) What word is used to describe plant cells placed in:

(i) a **hypotonic** solution

_____

(ii) a **hypertonic** solution?

_____

(c) Explain what has happened to the plant cell in **diagram B**.

_____

_____

_____

_____

_____

_____

(d) Animal cells will also change when placed in different solutions.

Some red blood cells are put in a hypotonic solution.

Describe what would happen to these red blood cells **and** explain why this is different from what happened to the plant cell in **diagram A**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 12 marks)

(2)

	Diffusion	**Osmosis**	**Active transport**
Does a substance travel down a concentration gradient?			
Does a substance travel against a concentration gradient?			
Is energy needed?			
Substance moved			
Extra information			

(1)

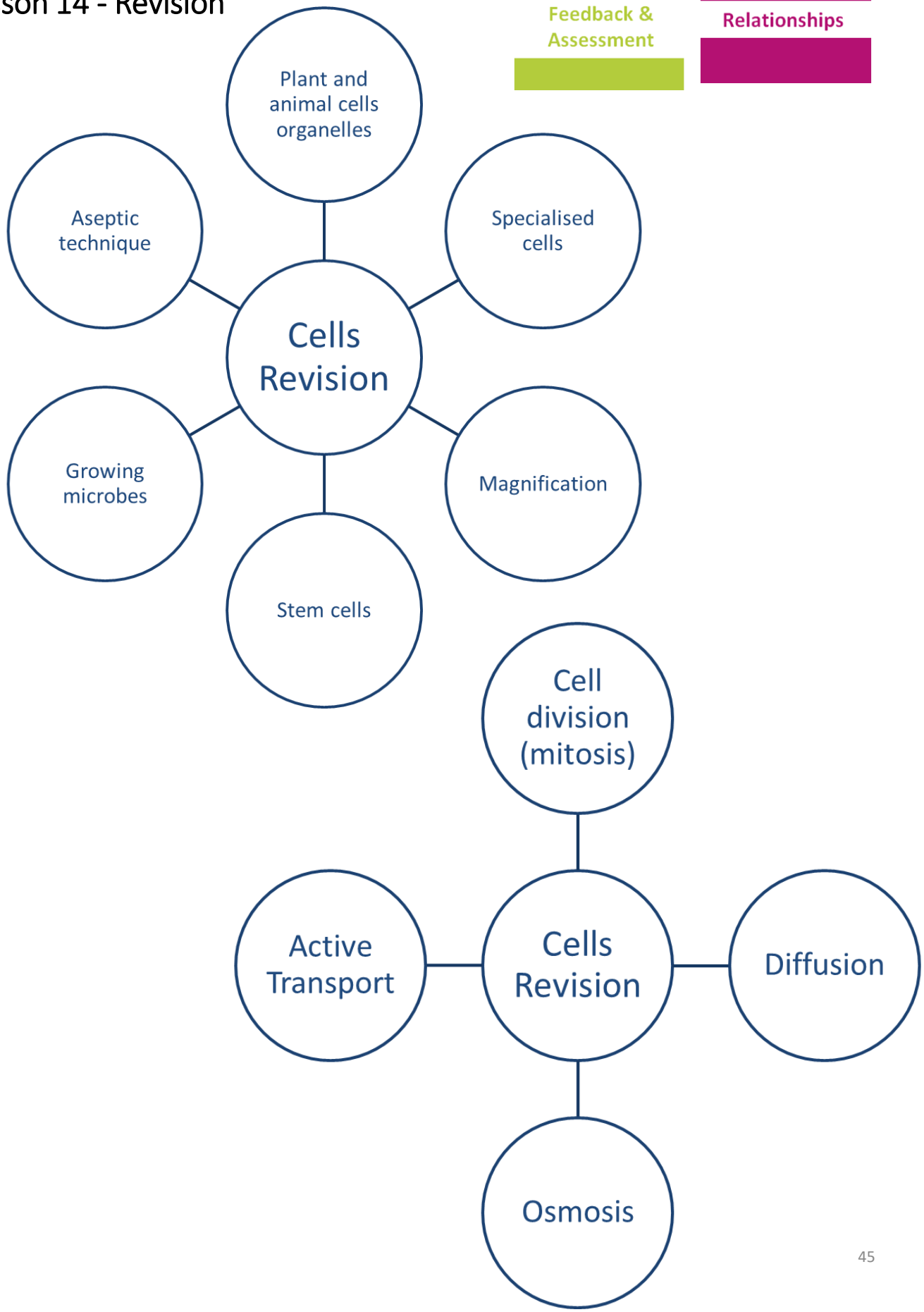
(1)

(4)

Lesson 14 - Revision

Feedback & Assessment

Relationships



a

Draw and label a typical plant cell.

Which organelle is...

- the site of aerobic respiration?

_____

- the site of protein synthesis?

_____

- the site of photosynthesis?

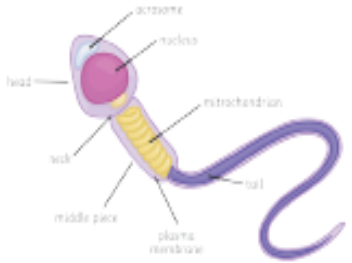
_____

b

Sperm cells are specialised cells. Explain how the acrosome helps the sperm cell to carry out its function.

_____

_____



c

Draw and label the parts of a typical bacterial cell.

d

Why do cells undergo mitosis?

_____

What has to happen before the cell divides?

_____

_____

What happens to the cell during mitosis?

1. _____

_____

2. _____

_____

3. _____

e

What are 'embryonic' stem cells?

_____

Name two medical conditions that could be treated with embryonic stem cells in the future.

1. _____
2. _____

f

Diffusion is: (Tick the correct box.)

a. The movement of water particles from a high water concentration to a lower water concentration across a partially permeable membrane. ☐

b. The spreading out of the particles of any gas or liquid from an area of high concentration to an area of lower concentration. ☐

c. The movement of particles from a low concentration to a higher concentration. ☐

g

Light microscopes have objective lenses.

What is the purpose of the objective lens?

_____

h

What is osmosis?

_____

_____

_____

i

Name three substances that are transported into, or out of, animal cells by diffusion.

1. _____
2. _____
3. _____

j

Name the tubes that transport the food around the plant.

_____

k

How many chromosomes does...

- a human skin cell contain?

_____

- a human gamete contain?

_____

l

Name the tubes that transport water up the stem of a plant.

_____

m

Draw and label a typical animal cell.

Which organelle is...

- the site of aerobic respiration?

_____

- controls the movement of substances in and out of the cell?

_____

- contains the genetic information?

_____

n

Root hair cells are specialised cells. Describe how the root hair cell is adapted to carry out its function.

_____

_____

o

How do prokaryotic cells differ from eukaryotic cells?

_____

_____

_____

p

Plants can be cloned from meristem cells. Give two advantages of cloning plants.

1. _____
2. _____

q

Describe two ways in which active transport is different to diffusion.

1. _____
2. _____

r

Describe how active transport is used by the following:

1. plants

   _____

2. animals

   _____

   _____

s

Where in the body are adult stem cells found and how do they differ from embryonic stem cells?

_____

_____

t

Write each of the following numbers in standard form.

2500 _____

0.003 _____

4 200 000 _____

0.00000006 _____

u

The unit centimetres is written as cm. What do each of the following units represent?

mm: _____

μm: _____

nm: _____

pm: _____

v

What is the equation for calculating the magnification of an image?

_____

w

Describe three ways that exchange surfaces are adapted to their function.

1. _____
2. _____
3. _____

x

Why do some people object to embryonic stem cell research?

_____

_____

_____

y

Which has a bigger surface area to volume ratio, an elephant or a mouse?

_____

z

The width of a cell is 0.025mm; under the microscope it is 10mm.

What was the magnification?

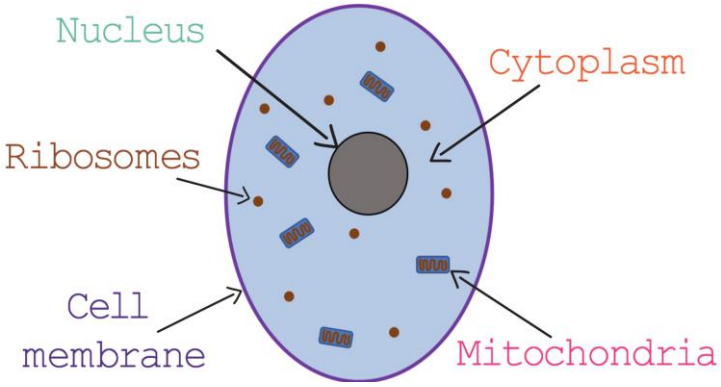
_____

Extra notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes

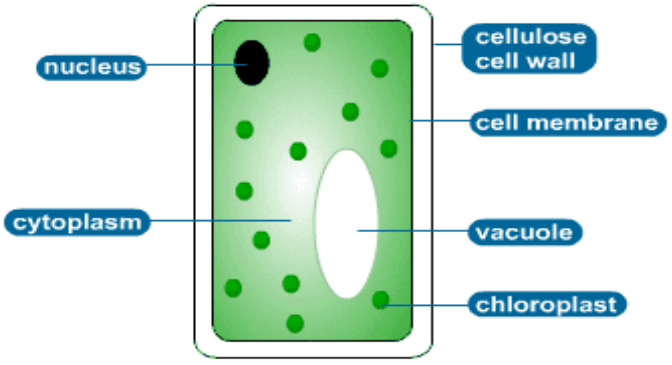
Extra notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes Extra Notes

Lesson 1 Answers

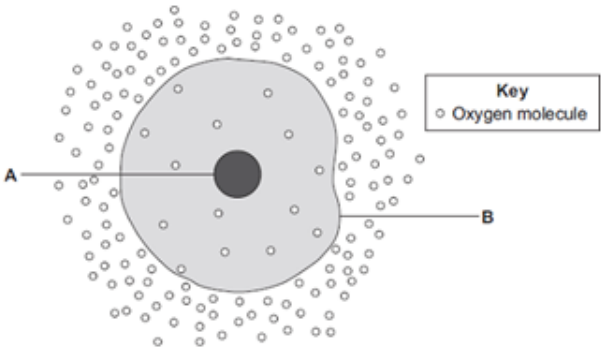
Draw an animal cell and label the organelles:



Name of organelle	Function
Nucleus	Contains DNA and controls what happens in the cell
Cell Membrane	Controls what comes in and out of the cell,
Cytoplasm	Where chemical reactions occur,
Ribosomes	Protein synthesis (production)
Mitochondria	Where respiration occurs to produce ATP



Q1. The diagram shows a cell.



(a) (i) Use words from the box to name the structures labelled **A** and **B**.

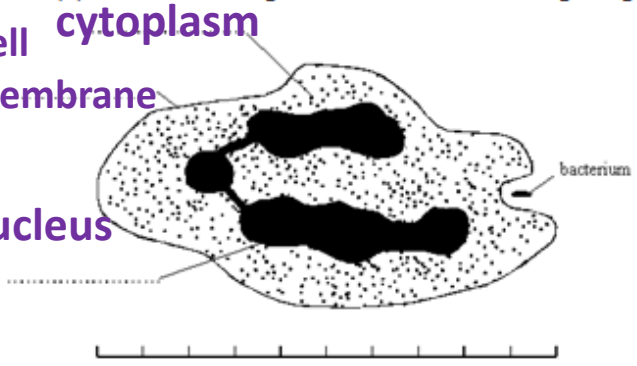
cell membrane	chloroplast	cytoplasm	nucleus

A nucleus

B Cell membrane

(2)

(b) The drawing shows a white blood cell ingesting a bacterium.



(i) Use words from the list to label the parts of the white blood cell.

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

(3)

(ii) The scale shows that the white blood cell is 10 micrometres long.

How long is the bacterium? Show your working.

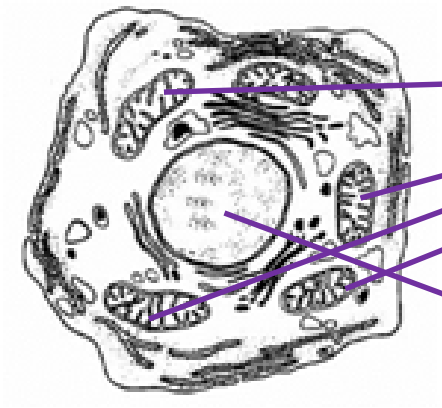
0.5 micrometres

(2)

(Total 5 marks)

5 / 100 × 10

Q2. The drawing shows an animal cell, seen at a very high magnification using an electron microscope.



(a) (i) Label a mitochondrion [plural = mitochondria].

(1)

(ii) What happens in the mitochondria?

respiration

(1)

(b) (i) Name and label the structure where you would find chromosomes.

(1)

(ii) What are chromosomes made of?

DNA / genes

(1)

(c) What controls the rate of chemical reactions in the cytoplasm?

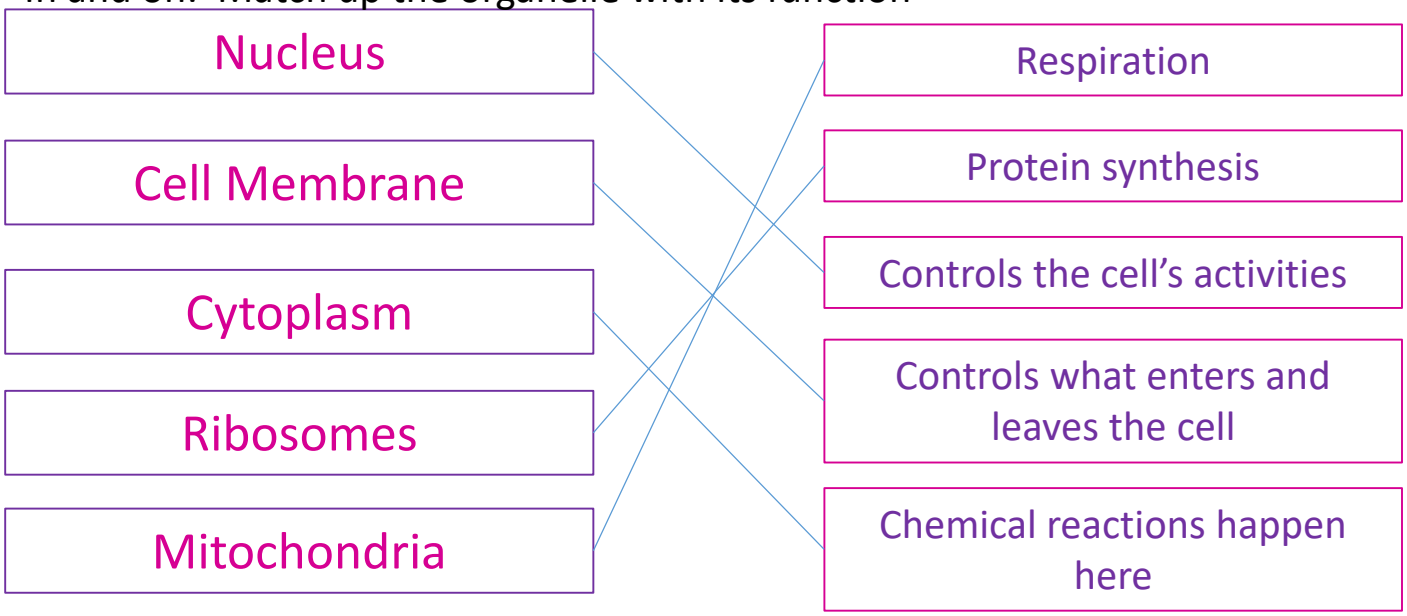
enzymes

(1)

(Total 5 marks)

Lesson 2: Answers

In and on: Match up the organelle with its function



Structure of a Prokaryotic cell

- DNA not inside a nucleus, floats in cytoplasm.
- Small rings of DNA found in the cytoplasm are called plasmids
- Can have flagella (tail) to aid movement
- Have a cell wall (to protect cell)
- Cell is sometimes enclosed in a capsule
- No membrane bound organelles
- Pilli help it to stick to other objects

	Prokaryotes	Eukaryotes
DNA	✓	✓
DNA enclosed in a nucleus		✓
Cell membrane	✓	✓
Cell wall	✓	✓
Plasmid DNA in cytoplasm	✓	
Ribosomes	✓	✓
Membrane-bound organelles		✓

Check your understanding

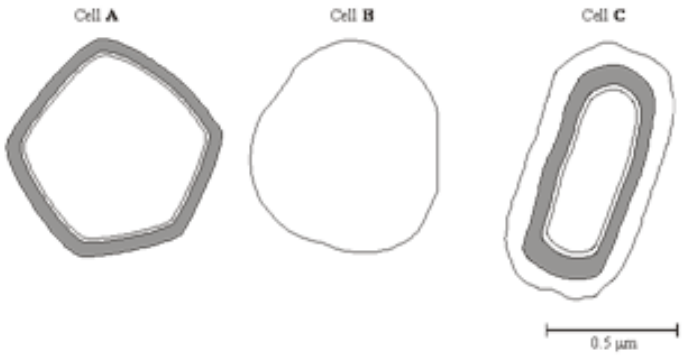
1. Which type of cell is the oldest and simplest? Prokaryotes
2. What are 2 big differences between prokaryotic cells and eukaryotic cells?

Prokaryotes - free DNA, no organelles
Eukaryotes – DNA in a nucleus, have organelles

3. What is one benefit of having DNA housed in a nucleus? Protects the DN
4. What is a flagellum? A tail-like structure for movement of the cell
5. Cilia can also be found in the human body. Which type of specialised cell has cilia and what is its function?

Ciliated cell – to sweep up dust and bacteria so they don't enter the lungs

Q1. The diagram shows the outer layers of three different cells, **A**, **B** and **C**.



(a) What is the evidence from the diagram that

(i) cell **B** is an animal cell,

no cell wall / only has (plasma) membrane

(1)

(ii) cell **C** is a prokaryotic cell?

has capsule / slime layer

(1)

(b) Explain how you would calculate the magnification of cell **C**.

correct approach which makes use of scale bar e.g. measure cell and compare to scale bar

(1)

(c) Cell **A** is a plant cell. Name a polysaccharide which may be found in cell **A** but would not be found in the animal cell.

cellulose / starch / amylose

(1)

(d) Penicillin is an antibiotic. It prevents the formation of bacterial cell walls. As a result, bacterial cells that have been treated with penicillin swell and burst as water enters.

Suggest why penicillin has no effect on plant cells.

plant cell wall made of a different substance/cellulose / penicillin does not affect cellulose

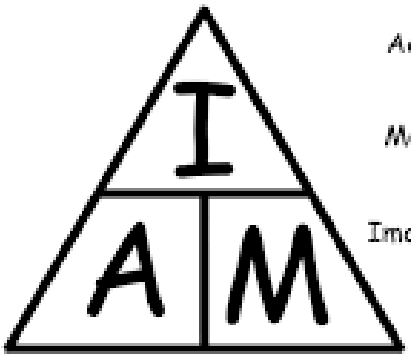
(1)

(Total 5 marks)

Lesson 3 - Answers

Answers:

1. 1,000,000 µm
2. 1000 µm
3. 43 mm
4. 43,000 µm
5. 4.642 mm
6. 850,000 µm
7. 0.8322 cm

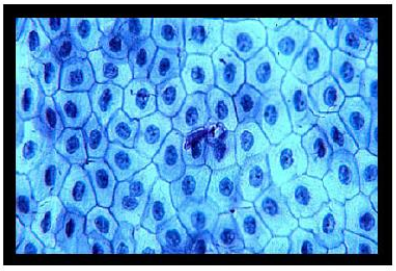


Actual Image = Image Size / Magnification

Magnification = Image Size / Actual Image

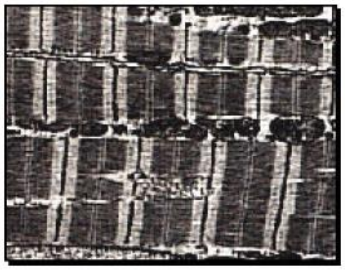
Image Size = Actual x Magnification

Now try these yourself



Magnification is x100
What is the actual size of one of these epithelial cells?

If the actual length of this chloroplast is 10µm, what is the magnification?



The optic magnification is x60 and the eyepiece magnification is x10, what is the actual length of:

a) the white stripe of the muscle fibre?
b) the dark stripe of the muscle fibre?
c) a mitochondrion?

Standard Form Answers

1. 6 000
2. 400
3. 80 000
4. 9 000
5. 400 000
6. 4 000
7. 450
8. 55 000
9. 350
10. 750 000

A

1. 6×10^3
2. 4×10^2
3. 8×10^4
4. 9×10^3
5. 4×10^5
6. 4×10^3
7. 4.5×10^2
8. 5.5×10^4
9. 3.5×10^2
10. 7.5×10^5

ordinar

1. 6×10^2
2. 2×10^3
3. 5×10^7
4. 9×10^8
5. 3.7×1
6. 2.8×1
7. 9.9×1
8. 7.1×1

B

1. 600
2. 2,000
3. 50,000,000
4. 900,000,000
5. 3,700,000,000
6. 28
7. 990,000
8. 71,000
9. 397
10. 817.2

C. Put these numbers into standard form:

1. 0.007
2. 0.04
3. 0.000 005
4. 0.0234
5. 0.000 002 3
6. 0.006 7
7. 0.000 002 34
8. 0.06 7
9. 0.3
10. 0.000 045

C

1. 7×10^{-3}
2. 4×10^{-2}
3. 5×10^{-6}
4. 2.34×10^{-2}
5. 2.3×10^{-6}
6. 6.7×10^{-3}
7. 2.34×10^{-6}
8. 6.7×10^{-2}
9. 3×10^{-1}
10. 4.5×10^{-5}

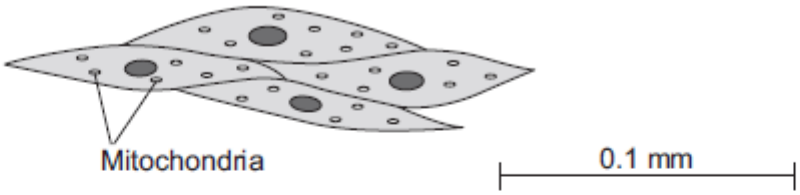
D. Change each of these to a large or small number:

1. 5.5×10^{-6}
2. 6.5×10^{-4}
3. 3.2×10^5
4. 2.9×10^2
5. 3.167×10^{-2}
6. 1.115×10^4
7. 1.412×10^{-3}
8. 7.2×10^1
9. 9.01×10^{-2}
10. 1.17×10^5

D

1. 0.0000055
2. 0.00065
3. 320,000
4. 290
5. 0.03167
6. 11,150
7. 0.001412
8. 72
9. 0.0901
10. 117,000

The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a) The figure above is highly magnified.

The scale bar in the figure above represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of the figure above.

Image size 80 mm acceptable range 390-410

Actual size 0.2 mm

allow 1 mark for answer in range of 39 to 41
allow 1 mark for answer in range of 3900 to 4100

Magnification = 400 times

(2)

(c) The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria?

to release / give / supply / provide energy

do not allow to 'make' / 'produce' / 'create' energy

by (aerobic) respiration or from glucose

(2)

(d) The muscle cells also contain many ribosomes. The ribosomes cannot be seen in **Figure above**.

(i) What is the function of a ribosome?

To make proteins (protein synthesis)

(1)

(ii) Suggest why the ribosomes **cannot** be seen through a light microscope.

too small / very small

allow light microscope does not have sufficient magnification / resolution

(1)

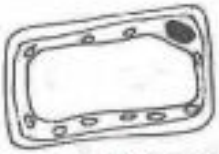
(Total 8 marks)

Embryonic cells are **UNDIFFERENTIATED.** . They are called STEM CELLS.

They have not *yet* acquired a special structure and function.

Differentiated cells are specialised cells cells.

Lesson 5: Answers

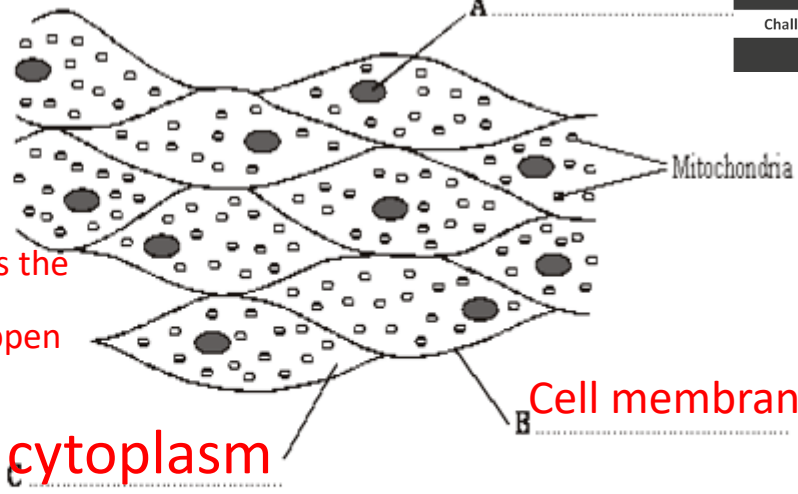
CELL	FUNCTION	ADAPTATIONS
 Palisade cell (from leaf)	They are specialised to maximise the amount of Photosynthesis that a leaf can do,	they are packed full of chloroplasts The shape is tall and thin, allowing lo of them to be packed together in a leaf. This maximises the chances of catching light.
 Red blood cells	to pick up oxygen from the lungs and transport these to the tissues of the body.	to contain haemoglobin biconcave shape. This provides a larger surface area for the absorption of oxygen. very small and flexible,
 Ciliated cell (in oviduct)	removing mucus which contains trapped pathogens and other airborne particles.	The ciliated epithelial cells do this by having tiny little hairs which protrude from the surface and waft continuously to push mucus
 Nerve cell (motor neurone)	to carry electrical impulses around the body.	It has a long thin section of the cell calle axon which acts to carry impulses have dendrites, which are on the end of the neurone, allowing the neurone to conne other neurones and send/receive information
 Root hair cell	maximising the amount of water and minerals which the plant absorbs from the soil.	long protrusion which sticks out from the cell. large vacuole in the centre of the cell. they contain large numbers of mitochondria to provide the cell with energy.
 Sperm cell	to swim to meet the egg after they are released.	streamlined shape which sperm have to reduce resistance large numbers of mitochondria, which give the sperm energy.
 Muscle cell	they contract to bring about movement.	To allow this, muscle cells are elongated and have protein fibres in them that can shorten the cell.

Lesson 5 – Exam questions

Feedback & Assessment

Challenge

1. Name parts A, B and C of these muscle cells.



2. Explain the role of parts A, B and C.

A = Controls the cell

B = Controls what enters and leaves the cell

C = Where chemical reactions happen

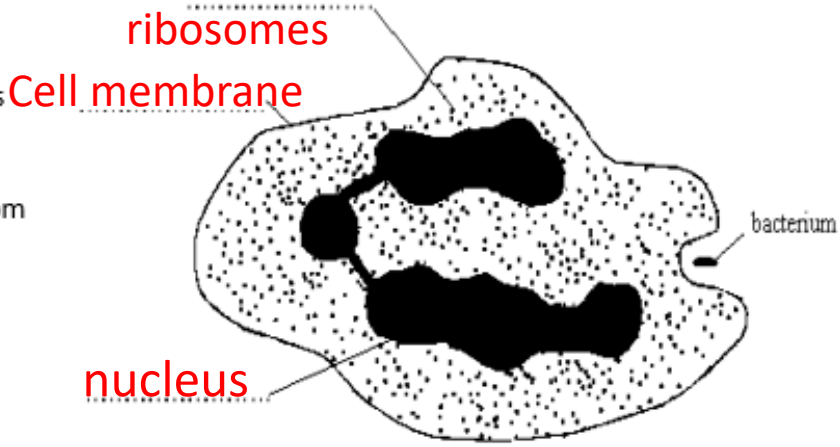
3. Give one adaptation to being a muscle cell which the diagram shows.

All connected together - can contract together to move the body

4. Explain the answer given to Q3.

Lots of mitochondria to provide energy for muscles to contract

1. The diagram shows a white blood cell. Some white blood cells produce antibodies and some enzymes, which are proteins.



Give one adaptation which can be seen from this diagram.

Lots of ribosomes (for ~~protein~~ synthesis)

2. Protein synthesis requires a lot of energy.

Suggest another adaptation which this cell would have which is not visible from this diagram.

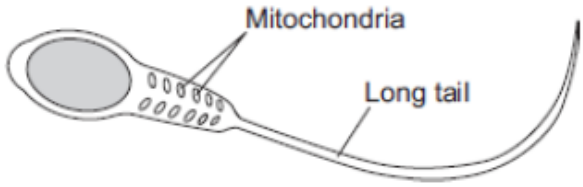
Lots of mitochondria

3. Explain the adaptations related to the nucleus of sperm and egg.

Half normal number of chromosomes (23) so that fertilisation produces a cell with the full set of chromosomes (46)

(b) Cells can be specialised for a particular job.

The diagram shows the structure of a human sperm cell.



Describe how the long tail and the mitochondria help the sperm to do its job.

Long tail Used for swimming

So the sperm can get to the egg

Mitochondria Releases **energy** for the sperm

In respiration

(4)
(Total 9 marks)

Challenge

Feedback & Assessment

Writing
Modelling Genres
Scaffolds
Extended Pieces

Extra notes Extra notes Extra notes Extra notes Extra notes

Lesson 6 – Stem Cells

Watch the video and answer these questions:

Where do stem cells come from?

What can stem cells be used to treat?

What ethical issues (right or wrong arguments) does it produce?

Stem cells can be acquired from **embryos**, **adult bone marrow** and **umbilical cords** in the womb.

A stem cell is a cell that has not yet become a specialised cell

Stem cells can be acquired from **embryos**, **adult bone marrow** and **umbilical cords** in the womb.

Plant stem cells come from the **tips of roots** and **shoots**.

Other features:

Can replicate many times

Has the potential to become different types of cell

Adult stem cells

We have stem cells in our body e.g. in bone marrow

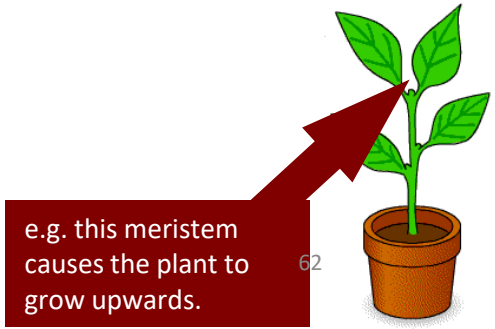
Embryonic stem cells

These come from a developing embryo- usually one which has been discarded after IVF.

Stem Cells in Plants – Meristems

Cells from the meristem behave like stem cells – they can develop into any kind of cell. Cloned plants can be produced from these cells. What are the advantages of this?

Plant growth occurs in areas called meristems. Stem cells can come from meristems.

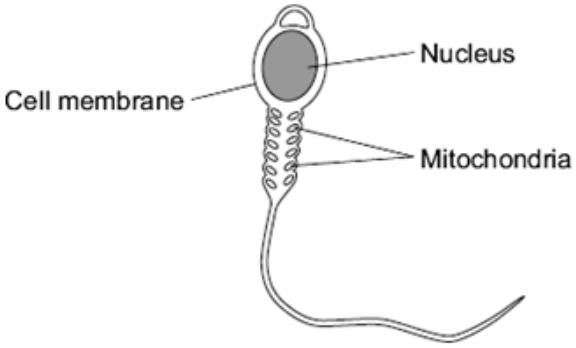


e.g. this meristem causes the plant to grow upwards.

Lesson 6 – answers

Q1. Cells in the human body are specialised to carry out their particular function.

(a) The diagram shows a sperm cell.



The sperm cell is adapted for travelling to, then fertilising, an egg.

(i) How do the mitochondria help the sperm to carry out its function?

Provide / release energy

(1)

(ii) The nucleus of the sperm cell is different from the nucleus of body cells.

Give **one** way in which the nucleus is different.

do **not** accept produce / create / generate / make energy
do **not** allow release energy for respiration

(1)

(b) Stem cells from human embryos are used to treat some diseases in humans.

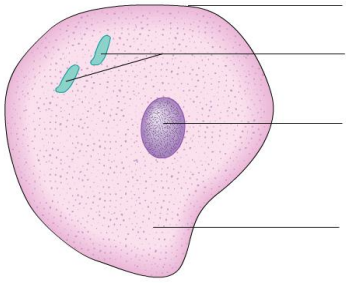
Explain why.

It contains half the (number of) chromosomes
(contains one set of chromosomes **or** contains 23 chromosomes)
allow genetic information / DNA / genes / alleles instead of chromosomes

(2)
(Total 4 marks)

Answers

A.



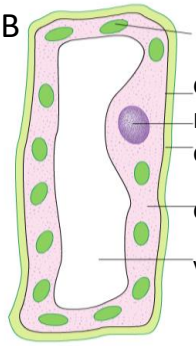
Cell membrane – controls what goes in and out of cells

Mitochondria – site of respiration

Nucleus – contains DNA, controls activities of cell

Cytoplasm – site of enzyme reactions

B



Chloroplast

Cell membrane

Nucleus

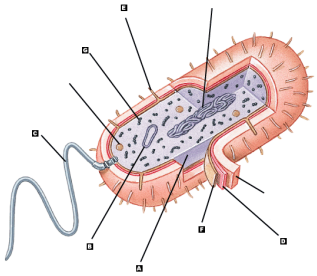
Cell wall

Cytoplasm

Vacuole

A = vacuole – contains sap, keeps cell turgid
B= chloroplast – site of photosynthesis
C= cell wall – supports the cell

Type of cell = bacteria



A = flagella
B = DNA
C= cell wall
D = pilli
E = plasmid

B and E both contain DNA. E is a plasmid which is a circular piece of DNA.

Bacteria are prokaryotic cells and their DNA is not contained in a nucleus. Eukaryotic cells have their DNA in a nucleus.

Specialised cells

Any 5 cells from:
Sperm
Egg
Red blood cell
White blood cell
Nerve cell
Root hair cell
Muscle cell
Epithelial cell

Magnification

1. Light microscope
2. Electron microscope

Light microscope use light to see the sample, electron microscope uses electrons.

Electron microscopes have a higher resolution compared to light microscopes.

Calculation

Convert image size to micrometres
2 x 1000 = 2000

Actual size = image/magnification
2000/400 = 5

Lesson 8 Answers

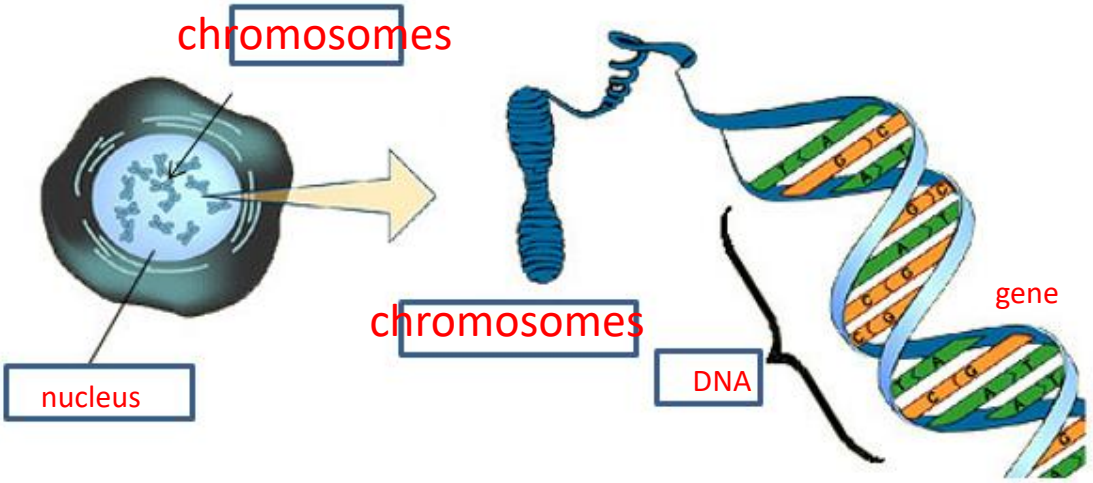
- *Gene*
- *Chromosome*
- *Nucleus*
- *Cell*

Key Word	Definition
NUCLEUS	The part of the cell which contains genetic information (chromosomes).
CHROMOSOMES	Long, thin, thread-like structures found in the nucleus of a cell made from a molecule of DNA. Chromosomes carry the genes.
DNA	Deoxyribonucleic Acid, the chemical that makes up chromosomes. DNA carries genetic info.
PROTEINS	Chemicals in living things that are polymers made by joining together amino acids.
GENE	A section of DNA giving the instructions for a cell about how to make one kind of protein.
KARYOTYPE	Image of chromosome pairs arranged in descending size.

GENES **CHROMOSOME** **NUCLEUS** **KARYOTYPE**
PROTEIN **DNA**

Quick fire Questions

1. Nucleus
2. Long coiled molecules of DNA
3. Genes
4. 46 (23 pairs)



Use the words below to label the boxes

Chromosome **nucleus** **DNA** **Gene**

Complete the following paragraph:

Humans have ..... 46 ..... strips of DNA in every cell apart from ..... chromosomes ..... cells.

These strips of DNA are called ..... parent ..... The chromosomes are arranged in ..... pairs ....., one from each ..... sex .....

Each chromosome is divided into sections. These sections are called ..... genes ..... Each gene codes for a particular ..... characteristic .....

chromosomes	characteristic	sex	pairs	46
	genes	parent		

Look at the list of things found inside cells.

amino acid

bases

chromosomes

DNA

genes

protein

Finish the following sentences.

Choose the best words from the list.

Inside cells, there are coded instructions called genes.

The instructions are made of a chemical called DNA.

The instructions are carried inside the nucleus on structures called chromosomes.

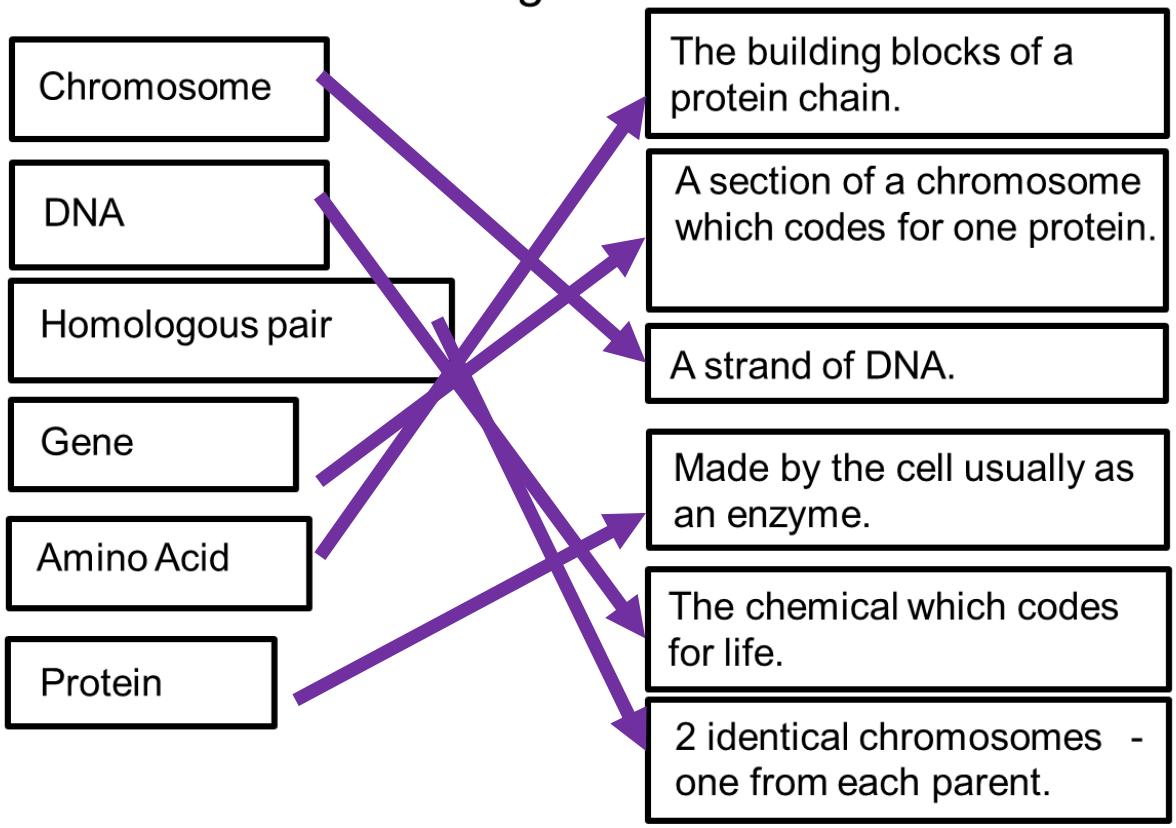
[3]

If you look at a **cell** through a powerful **microscope** you can see a circular organelle called the **nucleus**. When a cell is about to, or is undergoing cell **division**, you can see tiny thread like structures called **chromosomes**. A typical human cell contains 23 **pairs** of **chromosomes**. They exist in **pairs** because they are inherited from two parents during **sexual** reproduction.

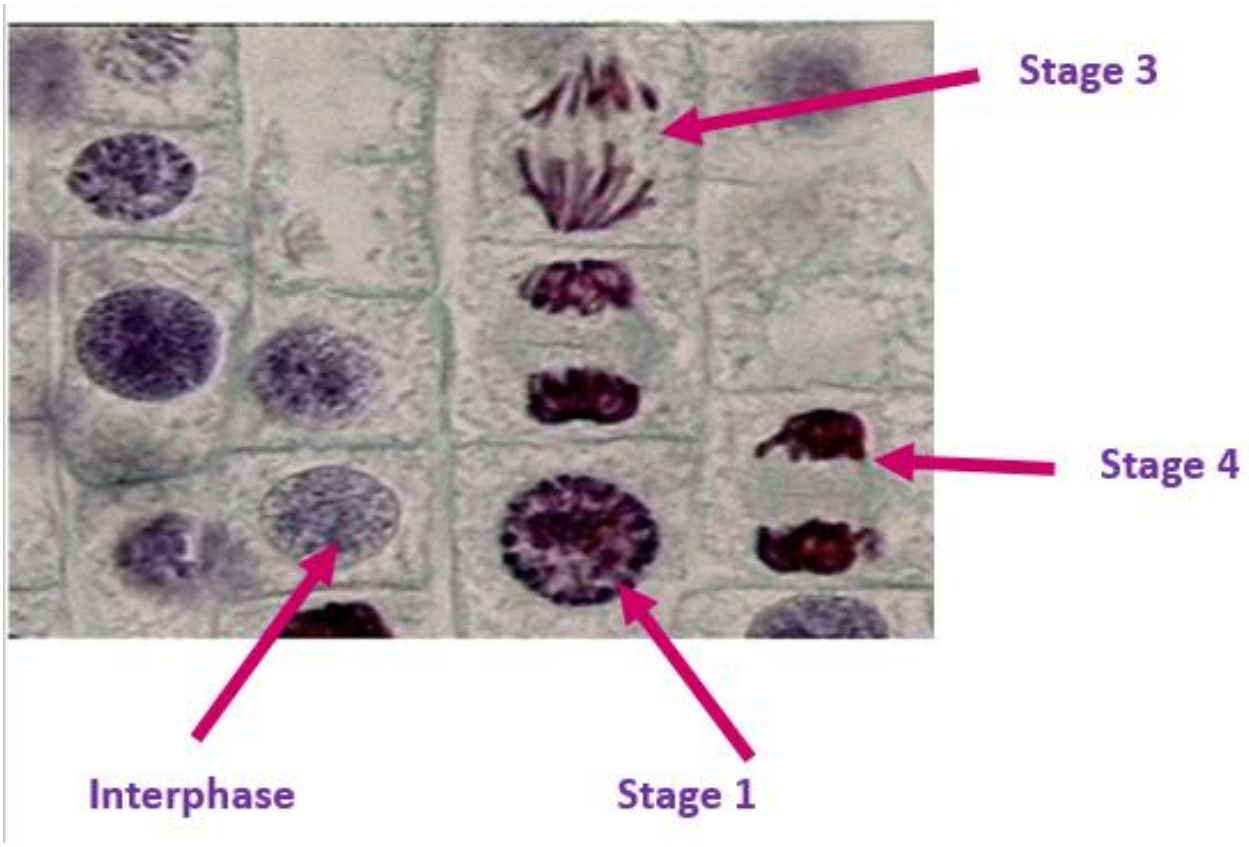
When a chromosome is unravelled it is composed of a long molecule of **DNA**. This molecule consists of two parallel strands, twisted and joined together to form a **Double-helix** shape. Between these two strands is a series of chemical **bases**; there are four of them represented by the letters A, C, G and T, and the order of these **bases** forms the **Genetic code**. A sequence of three of these **bases** codes for one **Amino acid**. Therefore, a long sequence of these **bases** codes for a sequence of **Amino acids**, which will be joined together to form a **protein** during a process called **protein** synthesis. A section of DNA which codes for a protein is called a **gene**. Therefore, one **gene** codes for one **protein**.

Lesson 9: Answers

In & On - Heads and Tails. Match the statement on the left to that on the right.



1. What is mitosis?
2. Why is mitosis important?
3. What would happen if mitosis didn't take place?
4. Suggest one advantage and one disadvantage of asexual reproduction.
5. What cells in the body reproduce by mitosis?
6. Which cells in the body do you think are **not** made by mitosis?
7. How many parents does a cell that reproduces by sexual reproduction have?
8. How many parents does a cell that reproduces by asexual reproduction have?
9. Can you give an example of what happens when mitosis goes wrong?


Stage 3
Stage 4
Interphase
Stage 1

Q1. (a) The diagram shows a normal body cell which has six chromosomes.

(i) Complete the diagram below to show **one** cell produced from this cell by *mitosis*.

- **6 chromosomes**
- **same 3 homologous pairs**
- **nuclear membrane drawn**

(3)

Q2. (a) How many pairs of chromosomes are there in a body cell of a human baby?

23

(b) Place the following in order of size, **starting with the smallest,** by writing numbers **1 – 4** in the boxes underneath the words.

chromosome	nucleus	gene	cell
2	3	1	4

(1)

(c) For a baby to grow, its cells must develop in a number of ways.

Explain how each of the following is part of the growth process of a baby.

(i) Cell enlargement

(cells which are bigger) take up more space

(cells) have to get bigger or mature to divide

(1)

(ii) The process of cell division by mitosis

- **chromosomes duplicate or make exact copies of self**
- **nuclei divide (accept chromosomes separate)**
- ~~**identical (daughter) cells formed**~~

accept for example, skin cells make more skin cells or cells are clones

(3)

(d) Why is cell specialisation (differentiation) important for the development and growth of a healthy baby from a fertilised egg?

Differentiation mark:

- **babies need or are made of different types of cells or cells that have different functions**

accept different cells are needed for different organs

(2)

Division or specialisation mark:

- **as fertilised egg starts to divide each cell specialises to form a part of the body**

accept specialised cells make different parts of the body

Growth mark:

- **specialised cells undergo mitosis to grow further cells**

accept cells divide or reproduce to form identical cells

(Total 8 marks)

Lesson 10 - Answers

Unscramble these words:

- **owl** — **low**
- **vome** — **move**
- **ghhi** — **high**
- **lecl** — **cell**
- **smosois** — **osmosis**
- **lelomcue** — **molecule**
- **dagtrien** — **gradient**
- **sufifidon** — **diffusion**
- **trancіontenoc** — **concentration**

Temperature	Concentration	Surface Area
As the temperature increases the rate of diffusion **increases**	As the concentration gradient increases, the rate of diffusion **increases**	As surface area increases, the rate of diffusion will **increases**
At higher temperatures particles have more energy so move faster	Diffusion is faster when the difference in concentration is greater	There is more accessible surface for particles to move through

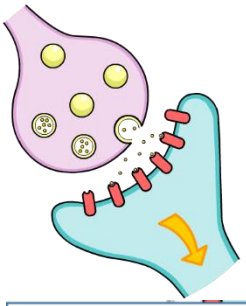


Diagram of: synapse

Found in: Gap between neuron

Diffusion of: Chemicals (neurotransmitters)

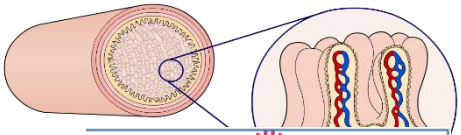


Diagram of: villi

Found in: Small intestine

Diffusion of: Glucose, amino acids, fatty acids

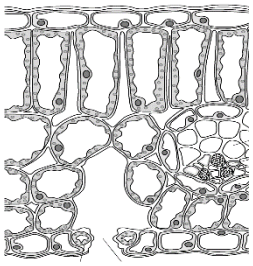


Diagram of: Palisade and mesophyll tissue

Found in: leaves

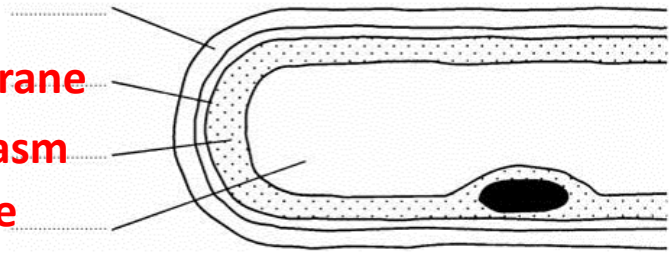
Diffusion of: Carbon dioxide and oxygen

Diagram of: alveolus

Found in: lungs

Diffusion of: Carbon dioxide and oxygen

The drawing shows part of a root hair cell.

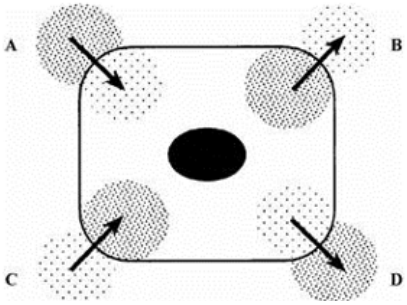


(a) Use words from the list to label the parts of the root hair cell.

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; A .....

(ii) movement of carbon dioxide molecules? B .....

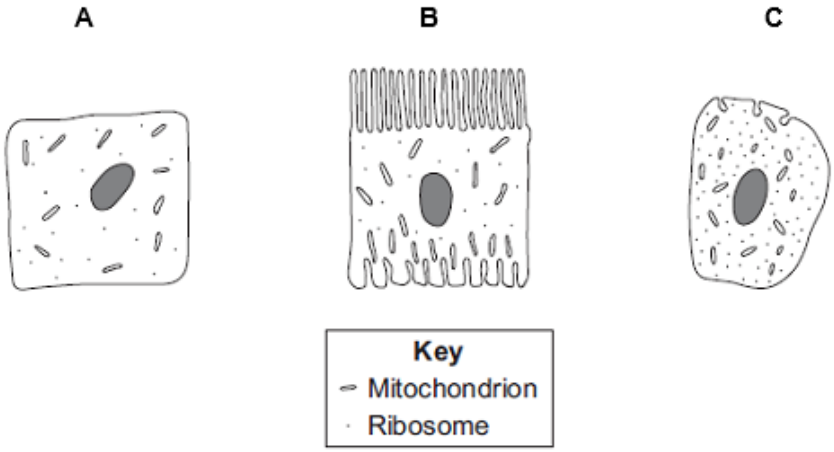
(2)

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

..... Diffusion .....

(1)
(Total 7 marks)

Q3. Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



Feedback & Assessment

Challenge

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

Give **one** reason for your choice.

.....

Increased surface area

.....

(1)

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

Name the enzyme produced by the salivary glands.

Amylase

.....

(1)

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

.....

Cell C has lots of mitochondria and ribosomes for protein synthesis.

.....

.....

.....

(2)
(Total 4 marks)

Lesson 11 - Answers

Question & Enquiry

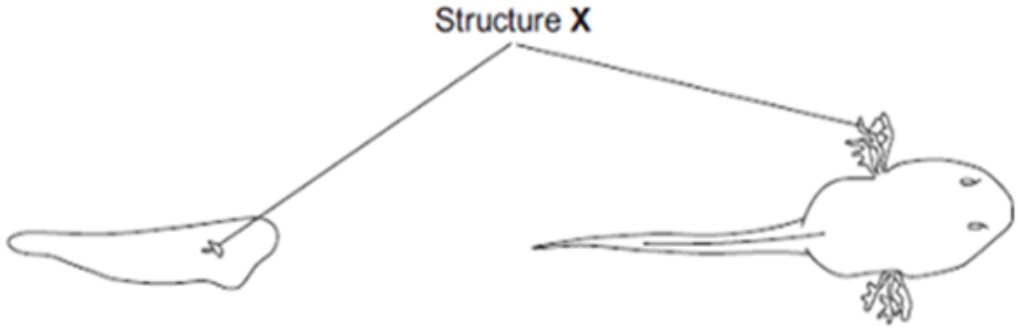
Feedback & Assessment

Q1.

The young stages of frogs are called tadpoles. The tadpoles live in fresh water.

The drawings show a tadpole just before hatching and three days after hatching.

Structure **X** helps in the exchange of substances between the tadpole and the water.



Tadpole just before hatching

Tadpole three days after hatching

(a) Name **one** substance, other than food, that the tadpole needs to exchange with the water in order to grow.

oxygen / O_2 **Or carbon dioxide / CO_2**

allow O2 *allow CO2*

do not accept O^2 *do not accept CO^2*

(1)

(b) Suggest how the changes in the tadpole shown in the drawings help it to survive as it grows larger.

You should **not** refer to movement in your answer.
To gain full marks you should refer to structure **X**.

any four from:

ignore references to tail used for locomotion

ignore reference to nostrils

- because structure X / gills has threads / filaments or is thin or tadpole has longer tail
- there is an increased surface area
- there is a shorter diffusion pathway
- therefore an increase in exchange

ignore food

- eyes (now visible in older tadpole)
- so that food / danger etc can be seen

accept reference to a good blood supply

accept increased water flow over gills / tail will increase diffusion of gases

(4)

(Total 5 marks)

Active Transport

Active transport is the movement of dissolved substances e.g. ions and sugars, from an area of **low** concentration to an area of **high** concentration, **against a concentration gradient**. This requires **energy** from respiration.

Adaptation	Function
Branches and root hair cells	Increases the surface area of the roots for faster absorption of water
Lots of mitochondria in root hair cells	Provides energy from respiration for absorption of mineral ions by active transport

(c) Epithelial cells also carry out active transport.

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

Sugar / glucose

accept amino acids

(1)

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

They have to move from low to high concentration (moving against a concentration gradient)

(1)

(ii) Suggest why epithelial cells have many mitochondria.

Active transport needs **energy** from **respiration**

(2)

(d) Some plants also carry out active transport.

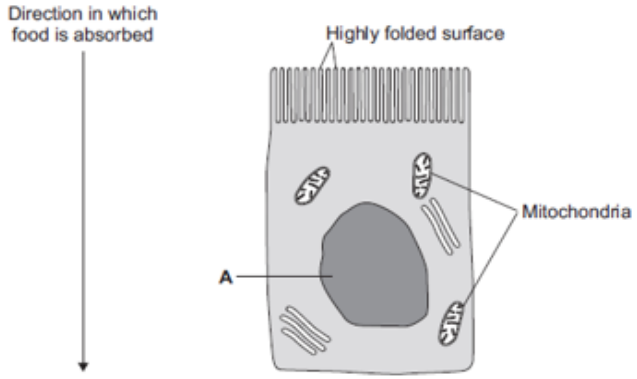
Give **one** substance that plants absorb by active transport.

Minerals / ions

accept named mineral or ion

(1)
(Total 8 marks)

Q1. 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**?

nucleus

(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)

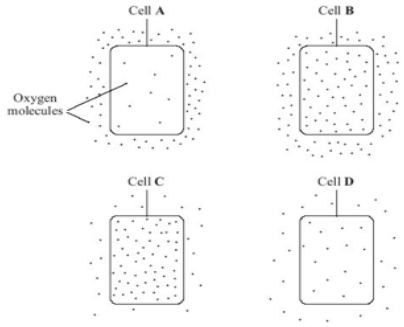
(b) Suggest how the highly folded cell surface helps the epithelial cell to absorb soluble food.

Increases the (gives it a larger) surface area

(1)

Lesson 12 Answers

(a) The diagrams show cells containing and surrounded by oxygen molecules.
Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest? A **(1)**

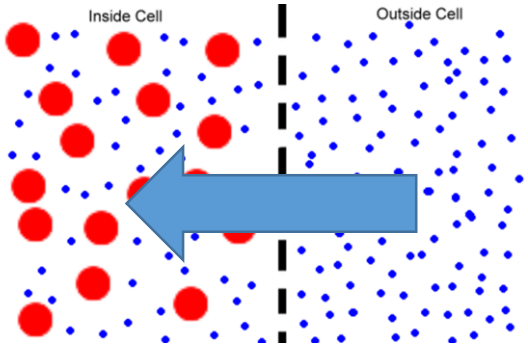
(b) Draw a ring around the correct word to complete each sentence.

(i) Oxygen is taken into cells by the process of diffusion / osmosis / respiration. **(1)**

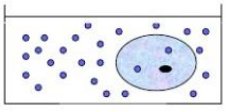
(ii) Cells need oxygen for breathing / photosynthesis / respiration. **(1)**

(iii) The parts of cells that use up the most oxygen are the membranes / mitochondria / nuclei. **(1)**

(iv) Some cells produce oxygen in the process of diffusion / photosynthesis / respiration. **(1)**

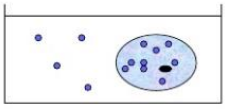


Draw an arrow to show the net movement of water by diagram explain the movement of water.



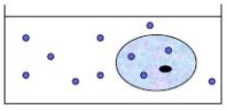
Water will move into the cell

Solution outside is hypotonic



Water will move out of the cell

Solution outside is Hypertonic



Water concentration is equal inside and outside the cell.

Solution outside is isotonic

Osmosis is the **movement of water** from a **high to low concentration** (of water) across a **partially permeable membrane.**

Q1. Cells, tissues and organs are adapted to take in different substances and get rid of different substances.

The table shows the concentration of four ions outside cells and inside cells.

Ion	Concentration outside cells in mmol per dm^3	Concentration inside cells in mmol per dm^3
Sodium	140	9
Potassium	7	138
Calcium	2	27
Chloride	118	3

(a) Use information from the table above to complete the following sentences.

Sodium ions will move into cells by the process of diffusion .

Potassium ions will move into cells by the process of Active transport .

(i) The bag in drink **A** got heavier after 20 minutes.

Explain why.

higher concentration of water outside the bag **or** in the drink / boiling tube

(Or concentration of sugar in the bag was higher (than in the drink)

(3)

(so) water moved in (to the tubing)

*allow water moves down **its** concentration gradient*

*do **not** allow sugar moving*

by osmosis

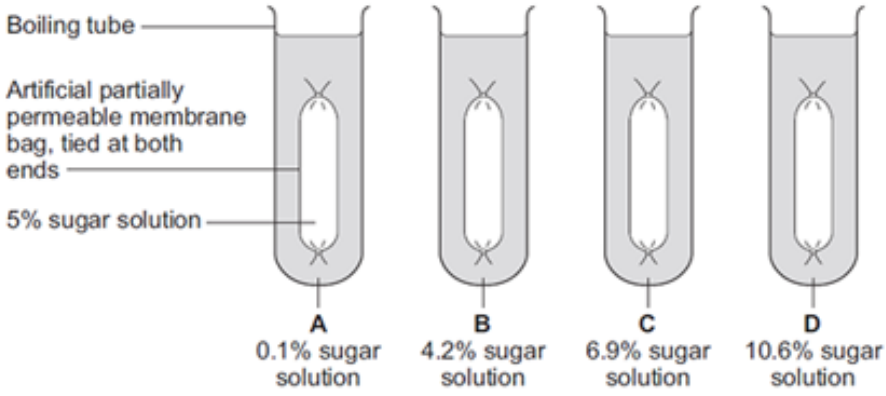
*do **not** allow sugar moving by osmosis **or** water moving by active transport*

(b) Some students investigated the effect of the different concentrations of sugar in four drinks, **A**, **B**, **C** and **D**, on the movement of water across a partially permeable membrane.

The students:

- made four bags from artificial partially permeable membrane
- put equal volumes of 5% sugar solution in each bag
- weighed each bag containing the sugar solution
- placed one bag in each of the drinks, **A**, **B**, **C** and **D**
- after 20 minutes removed the bags containing the sugar solution and weighed them again.

The diagram below shows how they set up the investigation.



(ii) In which drink, **A**, **B**, **C** or **D**, would you expect the bag to show the smallest change in mass?

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

(iii) Explain why you think the bag you chose in part **(b)(ii)** would show the smallest change.

closest to the concentration in the bag **or** to 5%

allow small(est) diffusion gradient

(so rate of) diffusion / osmosis is slow

~~*allow (so) less water moves in (to the bag)*~~

(2)

(Total 8 marks)

Q2.

The diagrams show the same cell of a common pond plant.

Diagram A shows the cell in a hypotonic solution.

Diagram B shows the same cell in a hypertonic solution.

Diagram A

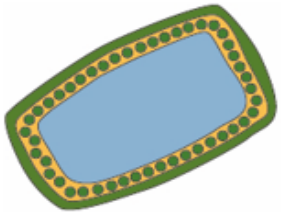


Diagram B

(a) What is a **hypertonic** solution?

more concentrated
- than the cell / cytoplasm (*must be a comparison*)
- *accept more salty / solutes / ions*
- *accept cell is less concentrated than solution for **2** marks*

(b) What word is used to describe plant cells placed in:

(i) a **hypotonic** solution

turgid

(1)

(ii) a **hypertonic** solution?

plasmolysed / flaccid

(1)

(c) Explain what has happened to the plant cell in **diagram B**

any four from:
- water left the cell (in A)
- by osmosis
- from dilute to more concentrated solution
- (accept from high to low water concentration)
- via partially permeable membrane
- so cell membrane shrank away from cell wall

(4)

(d) Animal cells will also change when placed in different solutions.

Some red blood cells are put in a hypotonic solution.

Describe what would happen to these red blood cells **and** explain why this is different from what happened to the plant cell in **diagram A**.

- water enters the cells (by osmosis)

allow 1 mark for:
- they burst / lyse / lysis occurs
- water leaves and cell shrinks (if they think it is hypertonic solution)
- animal cells have no cell wall or plant cells have a cell wall
- cell wall prevents lysis / bursting / allows turgidity

allow correct description

(4)

	Diffusion	Osmosis	Active transport
Does a substance travel down a concentration gradient?	Yes	Yes	No
Does a substance travel against a concentration gradient?	No	No	Yes
Is energy needed?	No	No	Yes
Substance moved	Dissolved solutes	Water	Dissolved solutes
Extra information	Gases also diffuse	Partially permeable membrane needed	Carrier protein needed