

## Section 1 – Cell Structure and Function

### Answer Key

1.1	What are the differences between a prokaryote and a eukaryote?	Prokaryotes do not contain a nucleus, whereas eukaryotes do. Prokaryotes are smaller.
1.2	Name the 5 common features of a plant or animal cell.	<b>Cell membrane</b> , cytoplasm, nucleus, mitochondria, ribosomes.
1.3	State the 3 feature structures that a plant cell contains and an animal does not.	Chloroplasts, cell wall, vacuole.
1.4	What is the function of a nucleus?	Contains genetic material and controls the activities of a cell.
1.5	<b>What is the function of a cell membrane?</b>	<b>To control which substances move in and out of the cell.</b>
1.6	What is the function of cytoplasm?	Contains all the organelles and is the site of many chemical reactions.
1.7	<b>What is the function of mitochondria?</b>	<b>The site of aerobic respiration where energy is released.</b>
1.8	What is the function of ribosomes?	The site of protein synthesis, where new proteins are made.
10.	What is the function of chloroplast?	It is filled with chlorophyll, absorbs light and is where photosynthesis happens.
11.	What material makes up cell walls in plants?	Cellulose
12.	State why prokaryotes do not contain membrane bound organelles?	Membrane bound organelles are too large to fit in a prokaryote.

## Section 2 – Specialised Cells

### Answer Key

2.1	<b>What is a specialised cell?</b>	<b>A cell that has specific features or adaptations to perform a particular job.</b>
2.2	Describe how a sperm cell is adapted	Tail/flagellum – for locomotion/movement Acrosome – to digest the egg cell surface Many mitochondria – for respiration to release energy to swim to the egg
2.3	Describe how the muscle cell is adapted.	Many mitochondria for respiration to release energy to the muscle for contraction
2.4	<b>Describe how the root hair is adapted.</b>	<b>Hair/projection – to increase the surface area to absorb more water/nutrients</b> <b>No chloroplasts – not needed to photosynthesise</b>
2.5	Describe how a nerve cell is adapted.	Long axon – to carry messages long distances. Many dendrites to make many connections.
2.6	<b>Describe how a xylem cell is adapted.</b>	<b>Dead, hollow cells that form a tube.</b> <b>Lignin for the strength and to withstand water pressure</b>
2.7	Describe how a phloem cell is adapted.	Live cell, contains sieve plates to distribute sugar evenly across the body
2.8	Describe how a red blood cell is adapted.	No nucleus and biconcave to increase the surface area in order to carry more haemoglobin which binds the oxygen.
2.9	What is cell differentiation?	When a cell becomes a specialised cell.
2.10	When do most cells differentiate in an animal?	Embryonic Stage
2.11	When do cells differentiate in a plant?	They can differentiate throughout their life time
2.12	In mature animals what is the cell differentiation used for?	Repair of damaged tissues or cells.

### Section 3 – Microscopes and Magnification

#### Answer Key

3.1	Name 2 types of microscopes.	Light microscope Electron microscope
3.2	State 2 advantages of a light microscope.	Portable, easy to use, see colour, inexpensive, live specimens
3.3	State 2 disadvantages of a light microscope	Low magnification Low resolution
3.4	State 2 advantages of an electron microscope	3D images, high magnification
3.5	State 2 disadvantages of an electron microscope	expensive, black and white images only, specimen must be dead
3.6	What is meant by resolution or resolving power?	This ability to distinguish between 2 points.
3.7	What is an order of magnitude?	Order objects/items in order of size.
3.8	<b>How do you calculate magnification?</b>	<b>Magnification = Image size/Actual size</b>
3.9	How do you rearrange the equation to calculate the actual size of the image?	Actual size = Image size / Magnification
3.10	What is 1200000nm as a standard form.	$1.26 \times 10^6$
3.11	What is 0.000000.1 $\mu$ m as a standard form?	$1 \times 10^{-7}$
3.12	How do you rearrange the equation to calculate the image size?	Image size = Magnification x Actual size

## Section – Culturing Microorganisms (Triple Content)

### Answer Key

1.	What is binary fission?	Bacteria reproduction.
2.	What is culture medium?	Liquid/gel with specific nutrients to support microorganisms growth
3.	What must be done to an inoculating loop before transferring the microorganism to the agar?	Sterilise/pass through a flame
4.	<b>Why can't a petri dish be completely sealed when growing bacteria?</b>	<b>To allow oxygen in, preventing harmful anaerobic bacteria from growing.</b>
5.	We must not incubate cultures above 25 degrees?	Prevent harmful bacteria growth.
6.	How long does it take bacteria to multiply in the optimum conditions?	20 mins
7.	<b>What are aseptic techniques?</b>	<b>Procedures in micro biology practical to avoid contamination</b>
8.	<b>What is a zone of inhibition?</b>	<b>An area on the nutrient agar plate where there is no bacterial growth due to presence of antibiotics/disinfectants</b>
9.	How can you calculate the zone of inhibition?	$\pi r^2$
10.	<b>What does the zone of inhibition tell us?</b>	<b>How effective an antibiotic, antiseptic or disinfectant is at killing bacteria</b>

## Section 4 – Cell Division

### Answer Key

4.1	What are genes?	A section of DNA that codes for a particular protein.
4.2	In what arrangement do we normally find Chromosomes?	In pairs.
4.3	How many chromosomes does a human adult sell have?	46 or 23 pairs.
4.4	<b>What happens to the cell before it divides?</b>	<b>Cell growth, subcellular components increase, DNA replicates.</b>
4.5	<b>What is produced during mitosis?</b>	<b>2 x Genetically identical daughter cells.</b>
4.7	<b>How many cell divisions are there in mitosis</b>	<b>Mitosis -1</b>
4.8	<b>Why is mitosis important?</b>	<b>Growth and repair</b>
4.9	What do you call a cell with 1 set of chromosomes?	Haploid
4.10	What do you call a cell with 2 sets of chromosomes?	Diploid
4.11	What type of cell is produced during meiosis in males and females?	Males – sperm Females – egg

## Section – Stem Cells

### Answer Key

1.	<b>What is a stem cell?</b>	<b>An undifferentiated cell that has the potential to specialise.</b>
2.	<b>Define adult stem cells.</b>	<b>Stem cells that can only differentiate into a specific type of cell.</b>
3.	Name another type of stem cell found in animals.	Embryonic stem cells
4.	Where is the answer to number 3 found?	Embryos, umbilical cord
5.	Where are adult stem cells found?	Bone marrow
6.	<b>Which type of stem cells would be more useful?</b>	<b>Embryonic stem cells as they can differentiate into many types of cell.</b>
7.	<b>What is a plant stem cell called?</b>	<b>Meristem</b>
8.	Where would you find plant stem cells?	Tips of shoots and roots
9.	How are plant stem cells different from adult stem cells or embryonic stem cells?	They can differentiate throughout their life.
10.	<b>What are the advantages of using adult stem cells?</b>	<b>Easier to obtain, effective, no ethical issues, abundant supply, little or no problems with immune rejection.</b>
11.	<b>What are the advantages of using embryonic stem cells?</b>	<b>Can differentiate into any type of cell, potential to cure diseases such as blindness, diabetes and cancers</b>
12.	Why might people be against the use of stem cells?	Ethical reasons surrounding the use of embryos, may not know the side effects, potential rejection.

## Section 5 – Transport Across Membranes

### Answer Key

5.1	<b>What is diffusion?</b>	<b>The movement of particles from an area of higher concentration to an area of lower concentration, down a concentration gradient.</b>
5.2	<b>What is osmosis?</b>	<b>The movement of water particles from a higher water concentration (dilute) to a lower water concentration (concentrated), down a concentration gradient, through a partially permeable membrane</b>
5.3	<b>What is active transport?</b>	<b>The movement of particles against a concentration gradient, from a lower concentration to a higher concentration requiring energy, from respiration</b>
5.4	State 3 molecules that can move by diffusion in an animal cell.	Oxygen, carbon dioxide and glucose
5.5	<b>How can we increase the rate of diffusion?</b>	<b>Increase the concentration gradient, decrease the diffusion distance/thickness of surface, increase the surface area, increase the temperature</b>
5.6	How is a root hair cell adapted for osmosis?	Lots of hairs that increases the surface area so more water can be absorbed
5.7	How are cells in the small intestine adapted for active transport?	Many mitochondria to release energy for active transport.
5.8	What is required for active transport/	Energy
5.10	Define the terms solute and solvent.	Solute – Soluble solid substance that dissolves in a solvent  Solvent – A liquid that the solute dissolves in to form a solution
5.12	What are the differences between hypertonic, hypotonic and isotonic?	Hypertonic – Concentrated solution Hypotonic – Dilute solution Isotonic – Both solutions have the equal concentration strength

## FOUNDATION TIER

### Q1.

The following are precautions taken when preparing a streak of bacteria on an agar jelly plate.

Give a reason for each.

- (i) The inoculating loop is heated in a hot bunsen flame.

REASON:

---

---

(1)

- (ii) The loop is allowed to cool before putting it into the bacterial culture.

REASON:

---

---

(1)

- (iii) The lid of the petri dish is only partly opened.

REASON:

---

---

(1)

- (iv) The petri dish is sealed with sticky tape.

REASON:

---

---

(1)

(Total 4 marks)



**Q2.**

- (a) Put a tick (✓) in the correct boxes in the table below to show which of the parts given are present in the cells and organisms listed.

	CYTOPLASM	NUCLEUS	CELL WALL	GENES
Leaf mesophyll cell				
Sperm				

(2)

- (b) (i) What is the main job of a leaf mesophyll cell?

---

---

(1)

- (ii) Explain **one** way in which the structure of the leaf mesophyll cell helps it to carry out its job.

---

---

---

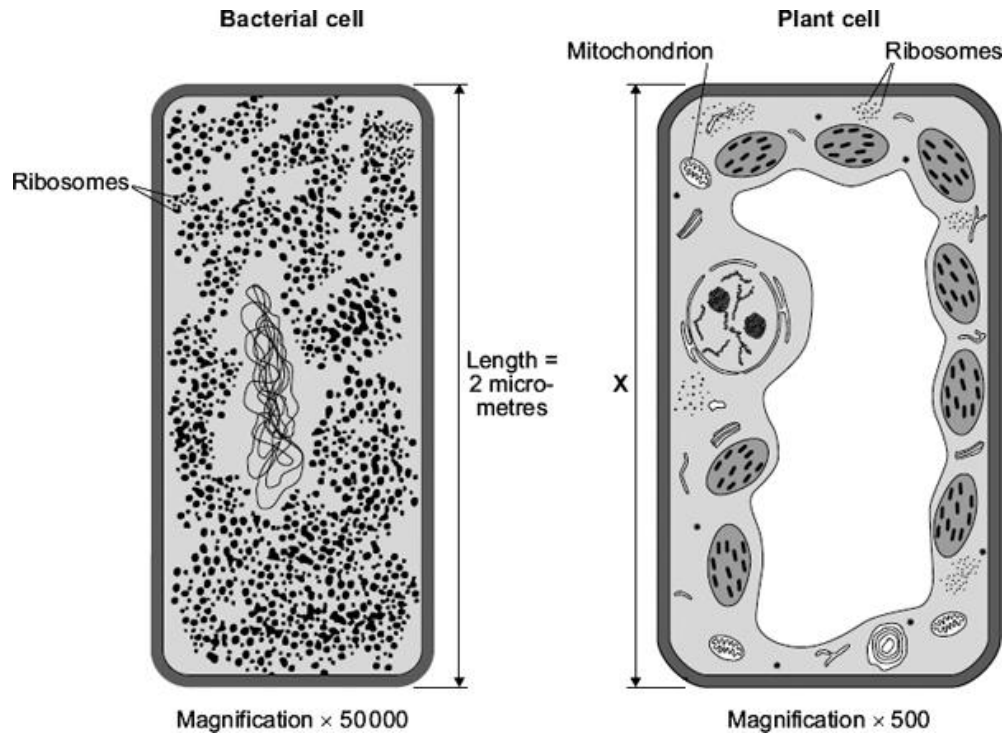
---

(2)

(Total 5 marks)

**Q3.**

The diagram shows two cells, a bacterial cell and a plant cell.



- (a) (i) Both the bacterial cell and the plant cell contain ribosomes.

What is the function of a ribosome?

---



---

(1)

- (ii) The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Give **one** other way in which the plant cell is different from the bacterial cell.

---



---

(1)

- (b) (i) Both cells are drawn the same length, but the magnification of each cell is different.

The real length of the bacterial cell is 2 micrometres.

Calculate the real length, **X**, of the plant cell. Give your answer in micrometres.

Show clearly how you work out your answer.

---



---

**X** = \_\_\_\_\_ micrometres

(2)

- (ii) Most mitochondria are about 3 micrometres in length.

The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Use your answer to part (b)(i) and the information in the diagram to suggest why.

---

---

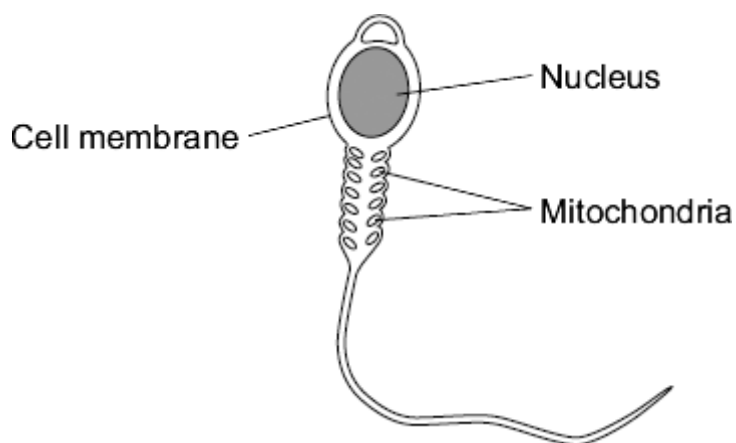
(1)

(Total 5 marks)

#### Q4.

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.

---

---

---

---

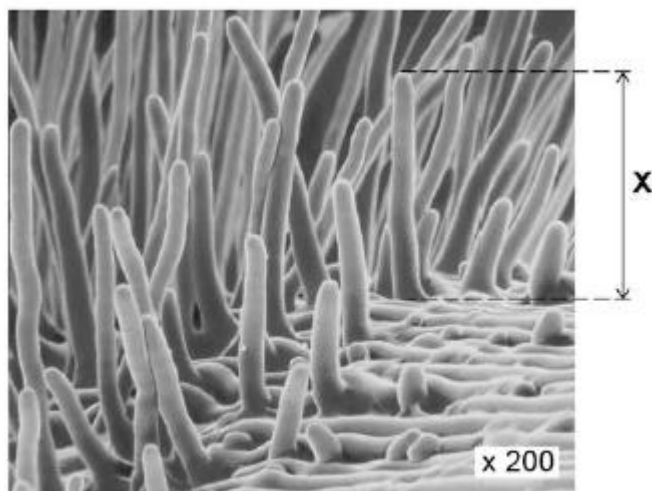
(2)

(Total 4 marks)

## HIGHER TIER

### Q5.

The image below shows part of a root from a cress plant.



- (a) What type of microscope was used to create the image above?

\_\_\_\_\_  
(1)

- (b) The magnification of the cress root in the image above is  $\times 200$ .  
There are 1000 micrometres ( $\mu\text{m}$ ) in a millimetre (mm).

Calculate the real length of the root hair, **X**.

Give your answer in micrometres ( $\mu\text{m}$ ).

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Real length **X** = \_\_\_\_\_  $\mu\text{m}$

(2)

- (c) Root hair cells take up water from the soil.

Explain **one** way in which the root hair cell is adapted to this function.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2)

The table shows the water uptake by a plant's roots on two different days.

	Mean water uptake in cm <sup>3</sup> per hour
Cold day	1.8
Hot day	3.4

- (d) Explain why the mean rate of water uptake is higher on a hot day than on a cold day.

---

---

---

---

---

---

(3)

- (e) The concentration of mineral ions in the soil is lower than in root hair cells.  
Root hair cells take up mineral ions from the soil.  
Root hair cells contain mitochondria.

Explain why root hair cells contain mitochondria.

---

---

---

---

---

---

---

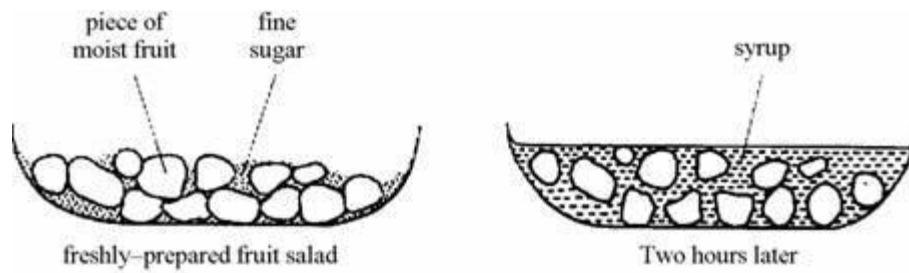
---

(4)

(Total 12 marks)

**Q6.**

A cook prepares a fresh fruit salad by cutting up a variety of fruits and placing them in a bowl with layers of sugar in between. After two hours the fruit is surrounded by syrup (concentrated sugar solution).



Explain, as fully as you can, why syrup (concentrated sugar solution) was produced after two hours.

---

---

---

---

---

---

---

---

(Total 4 marks)

**Q7.**

Read the information about stem cells.

Stem cells are used to treat some human diseases.

Stem cells can be collected from early embryos. These stem cells have not begun to differentiate, so they could be used to produce any kind of cell, tissue or organ. The use of embryonic stem cells to treat human diseases is new and, for some diseases, trials on patients are happening now.

Stem cells can also be collected from adult bone marrow. The operation is simple but may be painful. Stem cells in bone marrow mainly differentiate to form blood cells. These stem cells have been used successfully for many years to treat some kinds of blood disease. Recently there have been trials of other types of stem cell from bone marrow. These stem cells are used to treat diseases such as heart disease.

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

You should give a conclusion to your evaluation.

---

---

---

---

---

---

---

---

---

---

---

**(Total 5 marks)**



## Mark schemes – Cell Biology

### Q1.

- (i) the loop is sterilised  
*accept to kill anything on the loop*  
  
**or**  
to kill any bacteria on it;  
*do not credit to clean the loop*  
  
1
- (ii) if hot it would kill bacteria picked up (from culture);  
*accept 'microorganisms' or 'microbes'*  
*accept entry of contaminated air but reject entry of air unqualified*  
  
1
- (iii) to prevent entry (from the air) of unwanted bacteria or bacterial spores or fungal spores;  
*accept so can't breath on it*  
*accept 'microorganisms' or 'microbes'*  
  
1
- (iv) so that the (petri) dish is not opened (after bacteria are cultured)  
**or** to reduce evaporation  
**or** drying of the agar,  
*accept 'microorganisms' or 'microbes'*  
*accept to prevent anything relevant getting in/out*  
*reject references to spillage*  
  
1

[4]

### Q2.

- (a) mesophyll / / / / (all correct) sperm / / x / (all correct)  
*for 1 mark each*  
  
2
- (b) (i) absorbs light/to produce food/photosynthesis  
*(allow references to gaseous exchange)*  
*for 1 mark*  
  
1
- (ii) has chlorophyll/chloroplasts to absorb light/produce food  
*for 1 mark each*  
*(if linked to gas exchange allow – moist surface/ dissolve gases)*  
  
2

[5]

**Q3.**

- (a) (i) makes / produces / synthesises protein / enzyme 1
- (ii) plant cell has nucleus / vacuole / chloroplasts / chlorophyll  
**or** plant cell is much larger  
*'It' = plant cell*  
*allow correct reference to DNA or chromosomes*  
*allow plant cell has fewer ribosomes*  
*allow cellulose (cell wall)* 1
- (b) (i) 200  
*correct answer with or without working gains 2 marks*  

$$\text{if answer incorrect, allow 1 mark for } \frac{2 \times 50,000}{500} \text{ or } \frac{100,000}{500}$$
**or** 100 2
- (ii) bacterial cell is too small / bacterial cell about same size as a mitochondrion / 'no room'  
*ignore references to respiration* 1
- [5]**

**Q4.**

- (a) (i) release energy  
*allow provide / supply / give energy*  
*do **not** accept produce / create / generate / make energy*  
*do **not** allow release energy for respiration* 1
- (ii) contain half the (number of) chromosomes **or** contains one set of chromosomes **or** contains 23 chromosomes  
*allow genetic information / DNA / genes / alleles instead of chromosomes*  
*accept haploid* 1
- (b) any two from:
- (stem cells) are unspecialised / undifferentiated  
*allow description eg 'no particular job'*
  - are able to become differentiated  
**or** can form other types of cell / tissue / organ
  - stem cells can / able to divide / multiply
- 2
- [4]**

**Q5.**

- (a) electron (microscope)

- 1
- (b)  $\frac{30000}{200}$
- 1
- an answer of 150 (µm) scores 2 marks*
- 150 (µm)
- if answer is incorrect allow for 1 mark sight of 0.015 / 0.15 / 1.5 / 15*
- allow ecf for incorrect measurement of line X for max 1 mark*
- 1
- (c) **either**
- large surface area
- allow (vacuole contains) cell sap that is more concentrated than soil water (1)*
- 1
- for more / faster osmosis
- create / maintain concentration / water potential gradient (1)*
- or**
- allow thin (cell) walls
- for short(er) diffusion distance
- 1
- (d) (on hot day) more water lost
- allow converse for a cold day if clearly indicated*
- 1
- more transpiration
- or**
- more evaporation
- 1
- so more water taken up (by roots) to replace (water) loss (from leaves)
- 1
- (e) (aerobic) respiration occurs in mitochondria
- do **not** accept anaerobic respiration*
- 1
- (mitochondria / respiration) release energy
- do **not** accept energy produced / made / created*
- 1
- (energy used for) active transport
- 1
- to transport ions, against the concentration gradient
- or**
- from a low concentration to a high concentration
- 1

[12]

**Q6.**

*ideas that*

sugar has dissolved in moisture (on surface of fruit)  
this solution more concentrated than solution inside fruit  
osmosis / diffusion movement of water out of fruit  
through partially permeable membrane (of fruit cells)

*any four for 1 mark each*

*allow explanations in terms of concentrations of water molecules for full marks*

[4]

**Q7.**

Marks should **not** be awarded for simply copying the information provided

A mark may be awarded for a comparison between treatments if the answer only involves copied information

any **four** from:

*For all 4 marks to be awarded, there must be at least 1 pro  
and 1 con*

embryo stem cells – examples of

pros

- can treat a wide variety / lots of diseases / problems
- many available / plentiful
- using them better than wasting them
- painless

cons

- (possible) harm / death to embryo
- (relatively) untested / unreliable / may not work  
*allow long term effects not known  
or may be more risky*
- embryo can't be 'asked' / 'embryo rights' idea

adult bone marrow stem cells – examples of

pros

- no ethical issues (in collection) **or** permission given
- quick recovery
- (relatively) safe  
*allow does not kill (donor) / low risk*
- well tried / tested / know they work

cons

- operation hazards eg infection
- few types of cell / tissue produced **or** few diseases / problems treated
- painful so may deter donors

4

Conclusion to evaluation:

A reasoned conclusion from the evidence

1

**[5]**