

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

B1.1 CELL STRUCTURES

SCORE

/95

PERCENTAGE

%

STEMUP

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Gateway Biology A (9-1)

Cell structures

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:

Additional resources may be supplied with this paper.

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate
forename

Candidate
surname

Centre number

Candidate number

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **95**.
- The total number of marks may take into account some 'either/or' question choices.

1 A student uses a microscope.

The magnification on the eyepiece lens is $\times 10$.

The magnification on the objective lens is $\times 4$.

What is the total magnification?

A 2.5

B 6

C 14

D 40

Your answer

[1]

2(a) A student prepares onion cell slides to view under a microscope.

Put the stages in the correct order by writing the numbers 1 to 5 in the boxes.

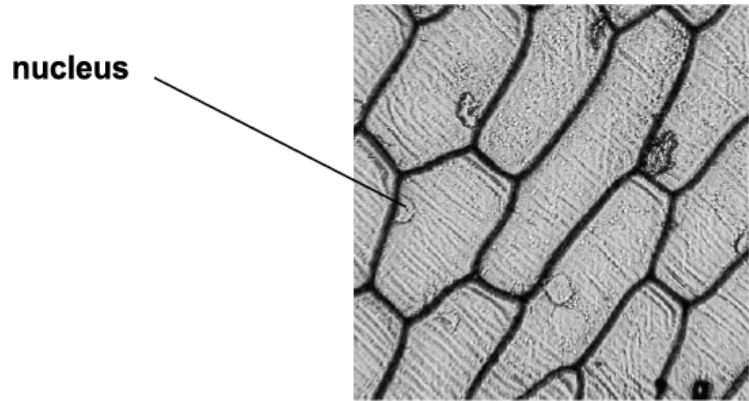
	add a drop of iodine solution
	cut the onion in to pieces
	peel off a thin layer of onion tissue
	put on a cover slip
	put the onion tissue on a slide

[2]

(b) Explain why the iodine solution is used.

[2]

(c) Look at the image below of some onion cells.



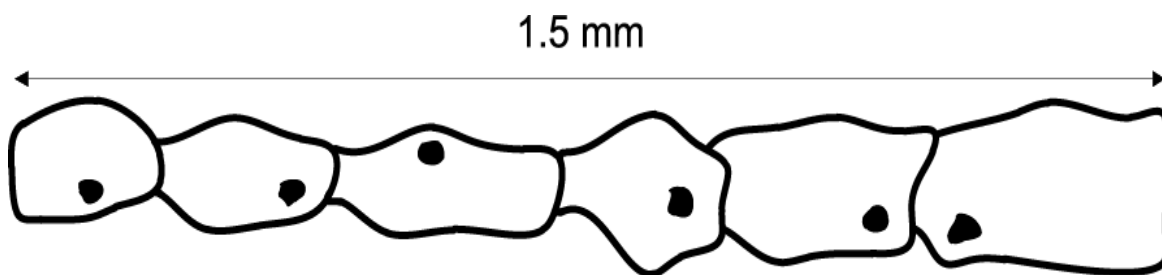
(i) Explain how the contents of the nucleus allow it to carry out its function.

----- [2]

(ii) Explain why there are no chloroplasts in these onion cells.

----- [2]

(d) The diagram shows a layer of onion cells.



The actual length of the layer is 1.5 mm.

Calculate the average length of one onion cell.

answer = ... mm [2]

(e) A student thinks that using the highest magnification of a microscope is always best.

Explain why this may **not** be true.

.....

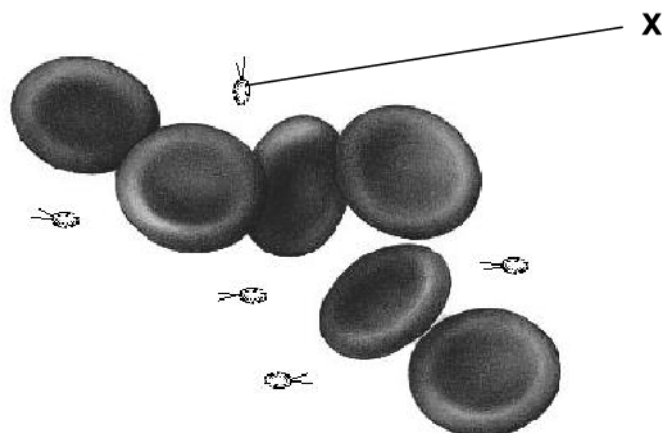
.....

..... [2]

3 Probash is ill and is having tests in hospital. The doctors took a sample of blood from Probash.

They looked at the specimen under a light microscope.

This is a picture of what they saw.



From this picture, the doctors decide that Probash's illness is caused by bacteria (labelled X).

(i) Why do the doctors not think that the structures labelled X are viruses?

-----[1]

(ii) What equipment could the doctors use to get a clearer image to confirm their ideas?

-----[1]

4 Which does **not** contain DNA?

- A cell membrane
- B chromosome
- C nucleus
- D plasmid

Your answer

☐

[1]

5 The diameter of a human egg cell is $120\mu\text{m}$.

What is the diameter in mm?

$$1\mu\text{m} = 1 \times 10^{-3}\text{mm}.$$

A 1.2×10^{-1}

B 1.2×10^{-2}

C 1.2×10^{-3}

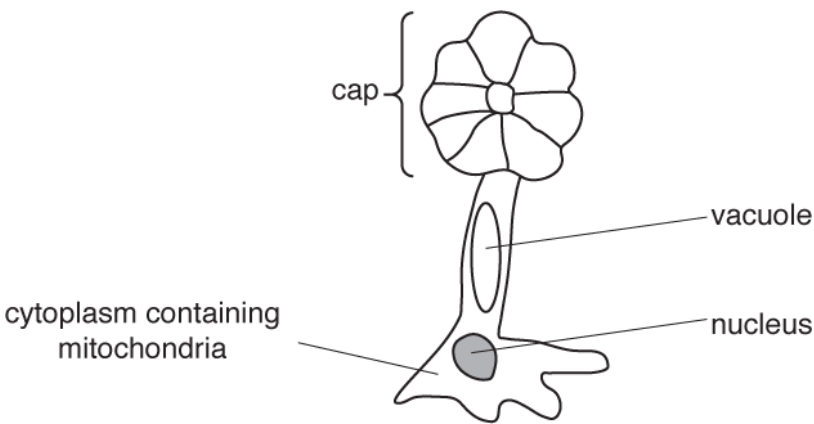
D 1.2×10^{-4}

Your answer

[1]

6(a) *Acetabularia* is a single-celled organism that lives in the sea.

It has rather an unusual shape.



Draw lines to join each **structure** in *Acetabularia* to its **job**.

structure	job
vacuole	contain chromosomes
mitochondria	support
nucleus	respiration

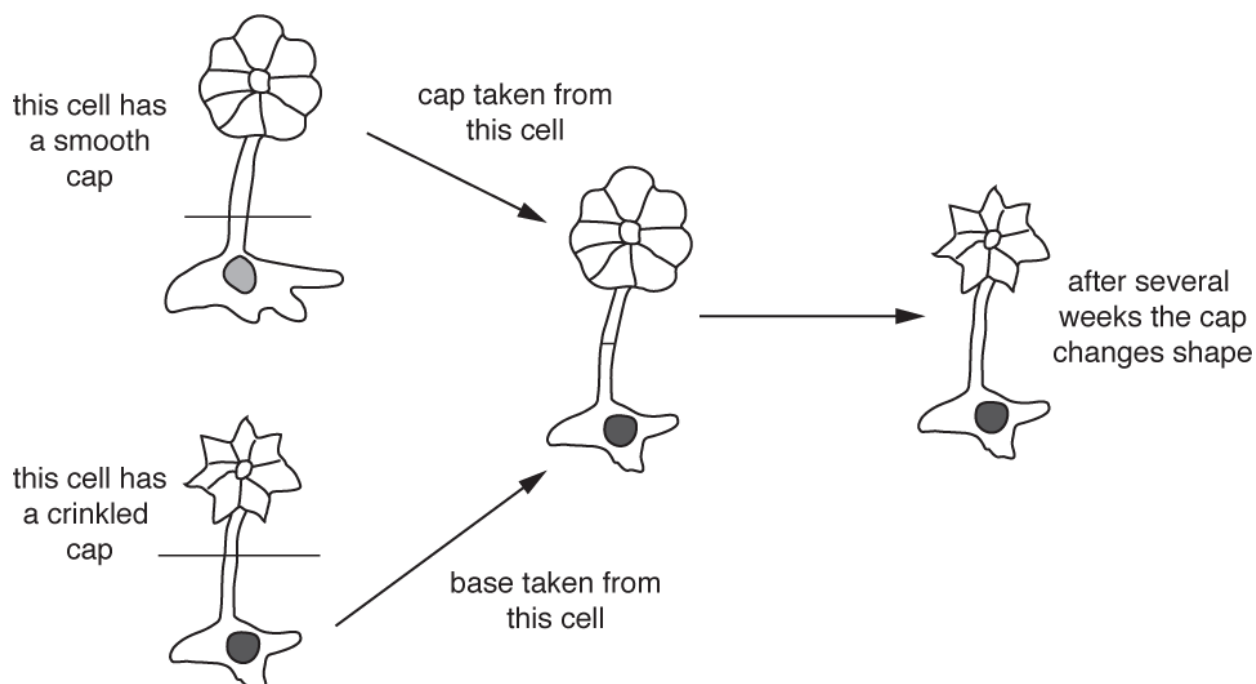
[2]

(b)

A scientist does an experiment with two types of *Acetabularia*.

The two cells have different shaped caps.

The scientist takes parts from each cell and joins them together.



The shape of the cap depends on which **proteins** are made by the cell.

Write about how the making of proteins is controlled in a cell.

Use this idea to explain the results of the scientist's experiment.

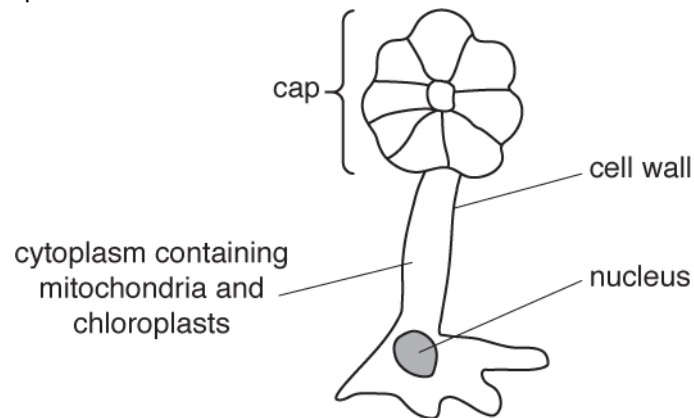


The quality of written communication will be assessed in your answer to this question.

[6]

7(a) *Acetabularia* is a unicellular organism that lives in the sea.

It has rather an unusual shape.



(i) Write down **two** features shown in the diagram of *Acetabularia* that tell you that it is **not** a bacterium.

1 -----

2 ----- [2]

(ii) *Acetabularia* is one of the largest unicellular organisms.

To be larger, organisms need to be multicellular.

What is an advantage of being larger and multicellular?

Put a tick (✓) next to the **correct** answer.

Some genes can be lost from some cells.

☐

Both aerobic and anaerobic respiration can occur.

☐

Cells are able to differentiate and specialise.

☐

Organisms are able to clone themselves.

☐

[1]

(iii) To become multicellular, specialised organ systems may be needed.

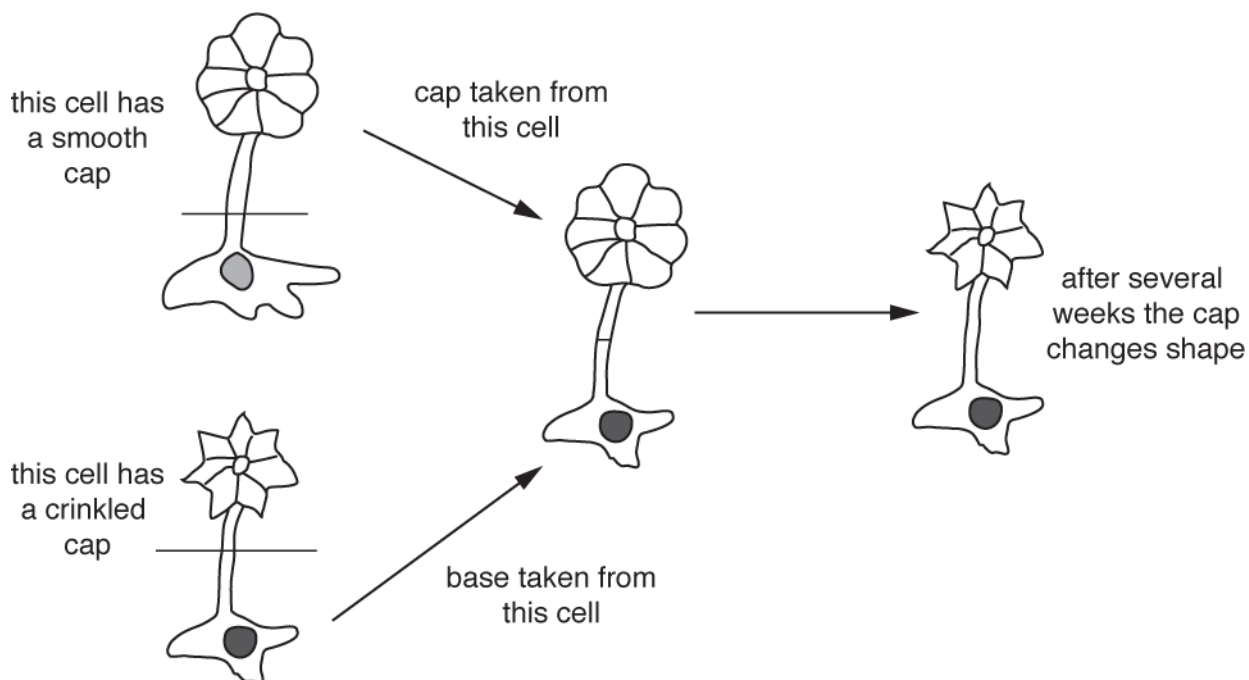
Write down **one** of these systems and explain why it is needed.

[1]

(b) A scientist did an experiment with two types of *Acetabularia*.

The two types of *Acetabularia* had different shaped caps.

The diagram shows the scientists experiment.



The shape of the cap depends on which **proteins** are made by the cell.

Explain how the nucleus codes for proteins that are made elsewhere in the cell and suggest why it took several weeks for the cap to change shape.



The quality of written communication will be assessed in your answer to this question.

[6]

8 Mia investigates the effect of two liquids on animal cells.

She puts 5 cm³ of distilled water into test tube **A**.

She puts 5 cm³ of concentrated salt solution into test tube **B**.

Mia then adds 3 drops of blood to each of the test tubes.

She records the appearance of the test tubes as soon as the blood is added and then again after 2 minutes.

Here is her results table.

Test tube	Contents	Appearance at start	Appearance after two minutes
A	distilled water and blood	cloudy	clear red liquid
B	concentrated salt solution and blood	cloudy	cloudy

The diagrams show what has happened to the cells in the different liquids.

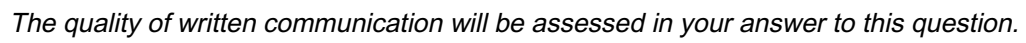
in test tube **A**



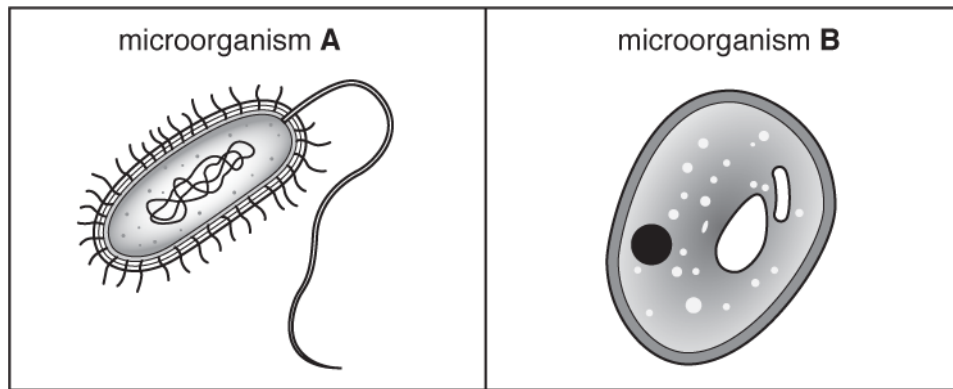
in test tube **B**



Use ideas about **osmosis** to explain the results.

[6]

9 Look at the diagrams of two different microorganisms.



One of the microorganisms is yeast and one is a bacterium.

Which is a bacterium? Choose from A or B -----

Write down **two** reasons for your answer.

1

2

[2]

10 Mia investigates the effect of salt concentration on animal cells.

She puts 5 cm³ of distilled water into a test tube.

Mia then adds 3 drops of blood to this test tube.

The liquid in the test tube is cloudy.

If the blood cells burst and release their contents then the solution becomes clear.

Mia times how long it takes for the liquid to go clear.

She then repeats the method with different concentrations of salt solution.

Here is her results table.

Concentration of salt in %	Time to go clear in seconds
0.00	20
0.25	300
0.50	600
1.00	remained cloudy after 15 minutes
2.00	remained cloudy after 15 minutes

Explain the results including the correct scientific terms to describe the appearance of the cells in the solution at the end of the investigation.



The quality of written communication will be assessed in your answer to this question.

[6]

11 A student uses a microscope to look at plant cells on a slide.

Which of these methods should they use first?

- A Highest power objective lens and focus moving the lens away from the slide
- B Highest power objective lens and focus moving the lens towards the slide
- C Lowest power objective lens and focus moving the lens away from the slide
- D Lowest power objective lens and focus moving the lens towards the slide

Your answer

[1]

12 The microscope used by the student has an eyepiece lens with a magnification of $10\times$.

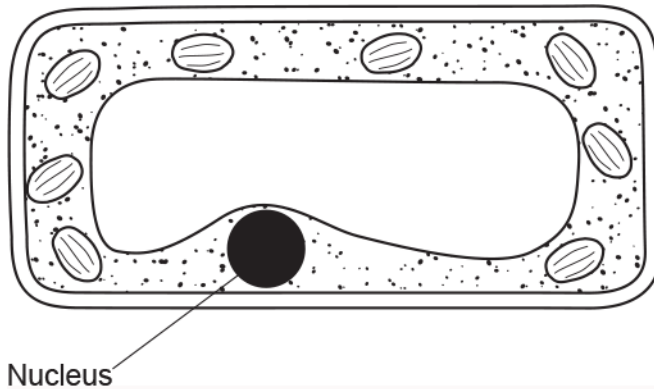
Which objective lens would give an image magnification of $200\times$?

- A $10\times$
- B $20\times$
- C $30\times$
- D $200\times$

Your answer

[1]

13 Look at the diagram showing a plant cell.

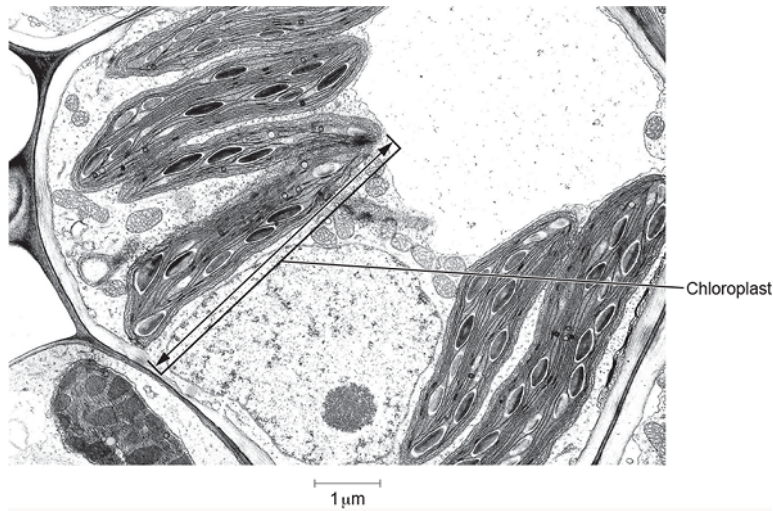


(i) The diameter of the nucleus in the diagram is 10 millimetres. The actual size of the nucleus is 10 micrometres.

Calculate the magnification of the diagram.

Answer = ... × [2]

(ii) Look at the picture of part of a plant cell.



Use the arrow on the picture and the scale to estimate the length of the chloroplast.

Answer = ... μm [1]

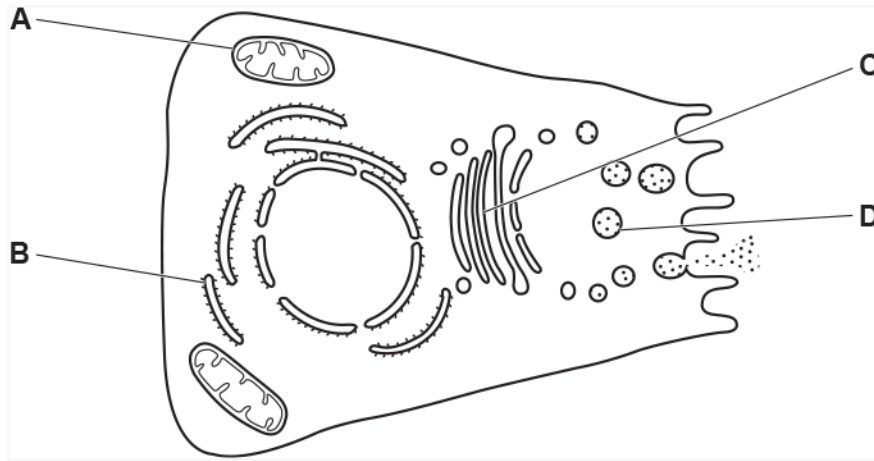
14 Which of these structures is found in eukaryotic but **not** prokaryotic cells?

- A Cell wall
- B Cytoplasm
- C Nucleus
- D Plasmid

Your answer

[1]

15 This is a cell.



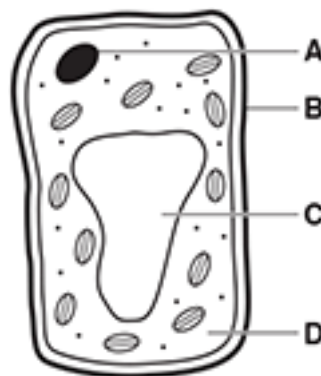
Where does cellular respiration occur?

Your answer

[1]

16 The diagram shows a plant cell observed using a light microscope.

Which label is pointing to a structure that contains genetic material?



Your answer

[1]

17(a) The diagram shows cells that are important in the process of **transpiration** in plants.



The diameter of cell X has been magnified 500 $\times$.

Calculate the actual diameter of cell X.

Use the equation: actual diameter = measured size $\div$ magnification

Diameter = ... mm [2]

(b) Light microscopes let us see objects as small as 0.2 micrometres.

The diameter of cells similar to cell X, can vary between 0.008 mm and 0.5 mm.

(1 mm = 1000 micrometres)

Is it possible to see all these types of cells using a light microscope?

Explain your answer.

----- [2]

(c) State why electron microscopy has increased our knowledge of sub-cellular structures.

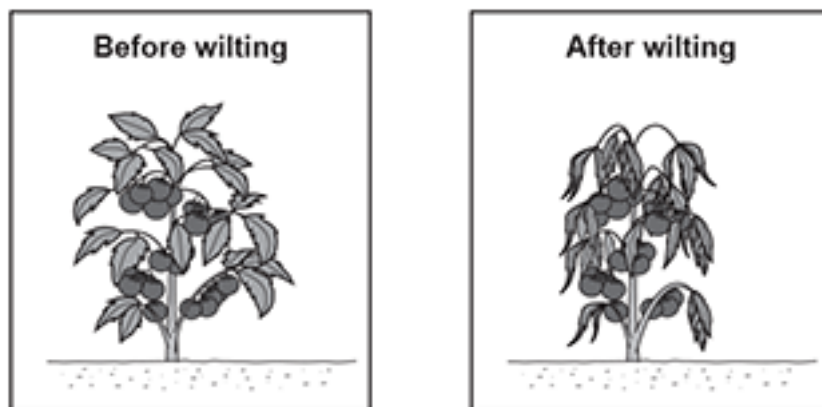
----- [1]

18 A gardener carries out an experiment using two similar tomato plants. The tomato plants are grown in pots.

She puts one inside a glasshouse and one outside beside the glasshouse.

To decide which plant loses the most water, the gardener looks to see which plant wilts first.

The diagrams show a plant before and after it has wilted.



(i) On a windy day, the plant **outside** the glasshouse wilts first.

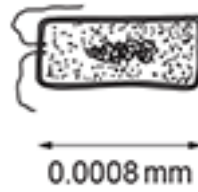
Explain why.

----- [2]

(ii) The gardener's results do not provide very accurate information about the effect of wind on water loss.

How could the gardener improve the design of her experiment?

- 19 Look at the bacterial cell that causes disease in humans.



The human eye can see objects 0.1 mm in size.

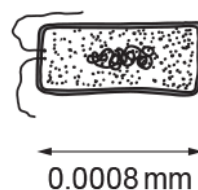
What **minimum** magnification will be needed before the eye can see this bacterial cell?

- A 12.5×
- B 125×
- C 1250×
- D 12500×

Your answer

[1]

20 Look at the bacterial cell that causes disease in humans.



The human eye can see objects 0.1 mm in size.

What **minimum** magnification will be needed before the eye can see this bacterial cell?

- A 12.5×
- B 125×
- C 1250×
- D 12500×

Your answer

[1]

21 A cell structure measures 1 micrometre in diameter.

What is the diameter of the cell structure in metres?

- A 1×10^{-3} metres
- B 1×10^{-6} metres
- C 1×10^{-9} metres
- D 1×10^{-12} metres

Your answer

[1]

22 A human cell has 10 000 mitochondria and a yeast cell has 10.

By how many orders of magnitude are there more mitochondria in a human cell than in a yeast cell?

- A 2
- B 3
- C 10
- D 1000

Your answer

[1]

23(a) A scientist observes some of the tissues of the growing plants using a light microscope.

The diagram shows some of the plant cells.



The diameter of X has been magnified 500×.

What is the actual diameter of X?

Give your answer in **standard form**.

Diameter = ... mm [2]

(b) Transmission **electron** microscopes (TEM) work by passing a beam of electrons through a very thin slice of an object.

Suggest one advantage and one disadvantage of using TEM rather than a light microscope to look at cells.

advantage

disadvantage [2]

24(a) Rats are a major pest in many areas of the world. They can reduce food security and spread diseases.



Warfarin is a chemical that is used as a rat poison. It stops platelets working in the blood.

Describe the function of platelets in the blood.

----- [2]

(b) Some rats are resistant to warfarin. When fed with large amounts of warfarin the rats do not die.

Scientists found that the resistance is due to the dominant allele **R**.

Two resistant rats (**Rr**) mate.

Complete this genetic diagram to find the ratio of resistant rats to non-resistant rats that would be expected to be produced.

		Rr	
Rr	R		
	r		

Ratio = ... [3]

(c) After several years, the percentage of resistant rats in the population had increased.

Use Darwin's theory of natural selection to explain this observation.

[3]

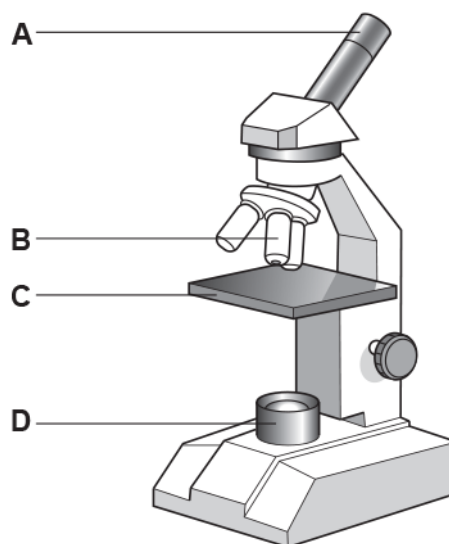
(d) Scientists are now trying to find another poison to use on rats.

They have introduced a chemical called phosphine. This blocks the action of mitochondria in rat cells.

Explain why this might kill rats.

[3]

25 The diagram shows a light microscope.



Which label is pointing to the eyepiece lens?

Your answer

[1]

26 A light microscope resolution is $0.2\text{ }\mu\text{m}$. An electron microscope resolution is $0.0001\text{ }\mu\text{m}$.

How many times closer can two objects be seen as separate objects by using an electron microscope compared to using a light microscope?

- A 2x
- B 20x
- C 200x
- D 2000x

Your answer

[1]

27(a) Cells contain structures that have different features.

Complete the table using structures from this list.

- cell membrane
- chloroplast
- mitochondria
- nucleus
- ribosomes

Feature	Structure
Contains chlorophyll for photosynthesis	
Contains enzymes for respiration	
Has receptor molecules for communication	

[3]

(b) A student uses a light microscope to see cheek cells.

One cell is shown in Fig. 16.1.

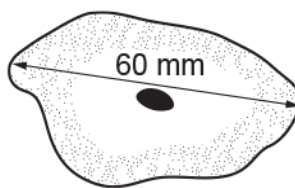


Fig. 16.1

(i) The actual size of the cheek cell is 0.03 mm.

Calculate the magnification of the drawing.

Use the equation: magnification = measured size ÷ actual size

Magnification = $\times$ [2]

(ii) Which type of substance is used to make structures inside the cell easier to see when using a light microscope?

----- [1]

28 The resolution of an electron microscope is 0.1 nanometres.

The resolution of the eye is 100 micrometres.

How many times greater is the resolution of the electron microscope than the eye?

(1 micrometre = 1000 nanometres)

- A 1000
- B 10 000
- C 100 000
- D 1 000 000

Your answer

[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			D	1	
			Total	1	
2	a		4 1 2 5 3 all correct = 2 one out of sequence = 1	2	
	b		as a stain (1) so can see organelles (1)	1 1	allow to increase contrast
	c	i	contains genes / genetic material / DNA (1)	1	
		i	controls cell (functions) (1)	1	allow protein synthesis
		ii	(onion cells) do not photosynthesize (1)	1	
		ii	(because) they are underground / in the dark (1)	1	
	d		0.25 (mm) (2)	2	allow $1.5 \div 6$
	e		more difficult to focus (1) smaller field of view (1)	1 1	
			Total	12	
3		i	structure X is too big to be a virus	1	allow viruses cannot be seen with a light microscope
		ii	use an electron microscope (1)	1	
			Total	2	
4			A	1	
			Total	1	
5			A	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
6	a		vacuole mitochondria nucleus contain chromosomes support respiration	2	all three correct = 2 marks one or two correct = 1 mark

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	b	[Level 3] Answer includes a correct description of how protein synthesis is controlled and is able to link this to the change in shape of the cap Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Answer includes a correct description of how protein synthesis is controlled or links change in shape of the cap to the movement of the nucleus Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer includes a correct statement about how protein synthesis is controlled. or Links change in shape of the cap to production of different proteins / presence of different genes. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade C Indicative scientific points about protein synthesis may include: • Proteins are coded for by genes / DNA • Genes / DNA are kept in the nucleus (on chromosomes) • The genes contain a sequence of bases that code for the protein Indicative scientific points about the experiment include: • The cap changes shape because the cell starts to make different proteins • The different proteins are made because the nucleus has come from the cell with the crinkled cap • Therefore the cell's DNA / genes are now coding for proteins that make the cap crinkle Use the L1, L2, L3 annotations in Scoris; do not use ticks.
		Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance								
7	a	i	any two from: has a nucleus ora (1) has mitochondria ora (1) has chloroplasts ora (1)	2	not cell wall not cytoplasm not cap								
		ii	<table><tr><td>some genes can be lost from some cells</td><td></td></tr><tr><td>both aerobic and anaerobic respiration can occur</td><td></td></tr><tr><td>cells are able to differentiate and specialise</td><td>✓</td></tr><tr><td>organisms are able to clone themselves</td><td></td></tr></table>	some genes can be lost from some cells		both aerobic and anaerobic respiration can occur		cells are able to differentiate and specialise	✓	organisms are able to clone themselves		1	more than one answer = 0
some genes can be lost from some cells													
both aerobic and anaerobic respiration can occur													
cells are able to differentiate and specialise	✓												
organisms are able to clone themselves													
		iii	nervous or hormone system to communicate between cells / transport or circulation or cardiovascular system to carry nutrients / oxygen / blood / CO ₂ around the organism excretory or gas exchange system to exchange materials with the surroundings (1)	1	ignore named organs e.g. kidney / heart etc. for system allow explained alternative systems e.g. respiratory system / reproductive / digestive								

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	b		[Level 3] includes a correct description of protein synthesis AND describes where proteins are made AND correctly links this to the change in shape of the cap over a period of time. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] includes a correct description of protein synthesis AND describes where proteins are made OR correctly links this to the change in shape of the cap over a period of time. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] includes simple description of protein synthesis OR describes where proteins are made OR why it takes several weeks for the change in the cap. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade A* Indicative scientific points about protein synthesis at level 2/3 may include: • the order of bases codes for the order of amino acids • mRNA carries the code from the DNA • triplet base code read for amino acid Indicative scientific points about where proteins are made may include: • proteins are made on the ribosomes • in the cytoplasm Indicative scientific points about why it takes several weeks for the change in the cap: • time taken for the proteins in the cap to be replaced / make different proteins • mRNA from the old nucleus takes some time to be replaced by mRNA from new nucleus Indicative scientific points about protein synthesis at level 1 may include: • proteins are coded for by DNA / genes • sequence of bases that code for the protein Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	10	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
8			[Level 3] Explain the results in terms of direction of water movement AND differences in concentration between the liquid and the cells. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Explain the results in terms of direction of water movement without referring to differences in concentration. Or gives a complete explanation for one tube only Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] States that water is moving in or out of the cells without reference to the correct direction OR links the idea of osmosis to water movement. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0marks)	6	This question is targeted at grades up to C Indicative scientific points at Level 3 may include: • tube A - cells burst because water moves in (by osmosis) from an area of higher water concentration • tube B - cells shrink because water moves out (by osmosis) because there is a higher water concentration inside the cells Indicative scientific points at Level 2 may include: • tube A - cells burst because water moves in (by osmosis) • tube B- cells shrink because water moves out (by osmosis) Indicative scientific points at Level 1 may include: • water moves into the cells • water moves out of the cells • water caused the cell to burst / shrink • osmosis is the movement of water (across a partially-permeable membrane) • when cells burst makes the liquid go clear If reference to salt solution moving out of red blood cells then answer is limited to level 1 Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9			(A) has a flagellum (1) does not have a nucleus (1)	2	If answer B then no marks ignore tail allow has DNA in the cytoplasm / DNA in a loop
			Total	2	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
10	[Level 3] States the effects are due to osmosis AND Explain the results in terms of direction of movement AND uses the terms lysis and crenation correctly Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] States the effects are due to osmosis and attempts to explain the results in terms of direction of movement OR States the effects are due to osmosis and uses the terms lysis and crenation correctly Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] States the effects are due to osmosis. OR uses the terms lysis or crenation correctly Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0marks)	6	This question is targeted at grades up to A* Indicative scientific points at that may be include: • effects are due to osmosis • at low concentrations / cells burst / liquid goes clear due to lysis / haemolysis not turgid • high concentrations / cells shrivel / liquids remain cloudy due to crenation not plasmolysis / flaccid direction of movement • at low concentrations / cells burst / liquid goes clear because water moves into cells when salt concentration of solution is lower (than salt concentration inside cells) or at low concentrations / cells burst / liquid goes clear because water moves into cells when water concentration of solution is higher (than water concentration inside cells) or at low concentrations / cells burst / liquid goes clear because water moves into cells when solution is hypotonic • at high concentrations / cells do not burst / liquid stays cloudy because water moves out of cells when salt concentration of solution is higher (than salt concentration inside cells) or at high concentrations / cells do not burst / liquid stays cloudy because water moves out of cells when water concentration of solution is lower (than water concentration inside cells) or at high concentrations / cells do not burst / liquid stays cloudy because water moves out of cells when solution is hypertonic allow reverse arguments for each direction of movement

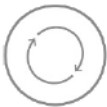
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	
11			C ✓	1 (AO 2.2)	<u>Examiner's Comments</u> The question assessed AO2.2 practical skills needed for using a microscope. Candidates did not demonstrate an awareness of skills in using a microscope. Few candidates identified the correct response. All distractors were seen in significant numbers. This is clearly an area where candidates could develop application of skills in a practical situation.
			Total	1	
12			B ✓	1 (AO 2.2)	<u>Examiner's Comments</u> The question assessed AO2.2 mathematical and practical skills needed for using a microscope. Most candidates were able to calculate the correct magnification for the objective lens. The most common distractor chosen by candidates was 200x. This indicates these candidates seemed unaware of the combined magnification power of the eyepiece and objective lenses to the overall magnification which the question was assessing.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
13		i	First check answer on answer line If answer = 1000 (x) award 2 marks $\frac{10}{0.01}$ ✓ 1000 (x) ✓	2 (AO 1.2) (AO 2.2)	<u>Examiner's Comments</u> This question assessed their AO1.2 mathematical and AO2.2 practical skills. Some candidates correctly gave 1000 and scored 2 marks. However, the working out of nearly all candidates indicated that there was little understanding of the calculation required, as single marks were very rare. The most common incorrect response was 100.
		ii	5(μm)	1 (AO 2.2)	ALLOW +/- 1 μm tolerance <u>Examiner's Comments</u> The question assesses AO2.2. A significant number of candidates were able to get the correct answer within tolerance. The most common error was to just measure the length of the chloroplast to 7.5 and fail to use the scale measurement to adjust the estimate.
			Total	3	
14			C ✓	1 (AO 1.1)	
			Total	1	
15			A ✓	1 (AO 1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
16			A	1 (AO 1.1)	<u>Examiner's Comments</u>  AFL There were occasionally some candidates who had 'No Response' answers which could be easily overcome through developing examination technique. Candidates should also be discouraged from choosing numbers from the set of alternatives and entering this in their answer box, rather than the letter of the alternative they think is correct.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17	a		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.04 (mm) award 2 marks 20 ÷ 500 ✓ = 0.04 (mm) ✓	2 (AO 2.2)	ALLOW 0.038 – 0.042 ALLOW 19 ÷ 500 OR 21 ÷ 500 ALLOW 40 µm/micrometres ALLOW 0.004 for 1 mark due to incorrect units for measurement <u>Examiner's Comments</u> This AO2.2 question often resulted in candidates only scoring 1 mark, with relatively few candidates answering this correctly. Common mistakes were inaccurate measurement of the line, not converting the measurement into mm and not applying the formula correctly. Quite a few candidates wrote 2/500 = 250.
	b		(yes) smallest (size of cell) 8 µm/0.8 thousands of a millimetre ✓ (size is) greater than 0.02 thousands of a millimetre / 0.2 µm ✓	2 (AO 2.2)	If answer is no award zero marks <u>Examiner's Comments</u> This AO2.2 question was testing candidates' ability to work scientifically and interconvert units. It proved challenging. The vast majority of candidates concluded that the cells could not be seen so did not gain credit. Those that thought the cells could be seen often did not explain why adequately e.g. 'it has a better magnification', and did not use the measurements in the stem. Some did attempt to convert but were unsuccessful.
	c		(sub-cellular) structures were not clearly visible until electron microscopy ✓	1 (AO 1.1)	ALLOW idea that smaller organelles/structures can now be seen by electron microscope ALLOW electron microscopes have a higher resolution / magnification ALLOW (sub-cellular) structures/organelles shown in more detail/easier to see <u>Examiner's Comments</u> The question was testing AO1 recall of the use of EM. Many candidates simply said 'it allows us to see cells in more detail' or similar without linking this to subcellular structures.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
18		i	Any two from: idea of being more exposed to the wind OR plant in glasshouse is protected from wind/sheltered ✓ moving air increases transpiration/water loss ✓ wind blows the water (vapour) away from the leaf ✓	2 (AO 2.1)	ALLOW greater humidity in glasshouse ALLOW leaves moved by wind/air movement ALLOW more evaporation/diffusion of water (need comparative statement) ALLOW higher level response e.g. the cells losing water and become plasmolysed if no other marks awarded ALLOW link between wind and water loss for 1 mark <u>Examiner's Comments</u> Most marks gained on this AO2.1 question were often for the idea of wind causing water loss or drying out the plant. However, some candidates incorrectly thought it may be colder/less sunny in the wind and therefore there would be less photosynthesis.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	Any three from: control the temperature ✓ control light intensity ✓ cover the pot/prevent water loss from pot ✓ (balance) to measure plant mass before and after ✓ repeats ✓ set up using a potometer ✓	3 (AO 3.3a)	IGNORE control the heat IGNORE references to time unless linked to potometer ALLOW control amount of light ALLOW control amount of wind e.g. use of fan ALLOW control amount of water given to plants ALLOW measure fresh weight of leaves at regular intervals ALLOW measure water loss ALLOW remove leaves from plant and keep one set of leaves sealed in bag another set in air from fan <u>Examiner's Comments</u> This question targeted AO3.3a on developing experimental procedures. The most common correct responses were for measuring water loss, repeats and controlling the wind by using a fan. Quite a few candidates wrote 'make sure you only change one variable' without identifying which one.
			Total	5	
19			B	1 (AO 2.2)	
			Total	1	
20			B	1 (AO 2.2)	
			Total	1	
21			B	1 (AO 1.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
22			B	1 (AO 2.2)	<u>Examiner's Comments</u> The majority of candidates did not understand the concept of orders of magnitude and choose distractor D as their answer.
			Total	1	
23	a		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4×10^{-2} (mm) award 2 marks 0.04 ✓ = 4×10^{-2} (mm) ✓	2 (AO 2.2)	ALLOW correct variations of standard form <u>Examiner's Comments</u> Many candidates could correctly convert the answer of 0.04mm to standard form and so gained 2 marks. There were a number who simply answered 0.04 and so scored one of the available marks.
	b		increased resolution / high magnification / sub-cellular structures visible ✓ (can only be done on) dead material / thin sections only / gives 2-D / expensive (equipment) / possible distortion of material in preparation / less mobile / preparation takes longer/is more complex / (only) black and white images ✓	2 (AO 2.2)	IGNORE clearer/sharper/more detailed images / can see small cells <u>Examiner's Comments</u> Candidates displayed a good knowledge of the advantages and disadvantages of the TEM and full marks were common here.
			Total	4	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
24	a		clots the blood ✓ prevents bleeding / allows wounds to heal / forms a scab ✓	2 (AO 1.1)	IGNORE clump blood ALLOW prevents pathogens getting into the body <u>Examiner's Comments</u> There was some confusion in the responses describing the role of platelets whereby candidates thought platelets had a role in the specific immune response. Only higher ability candidates gained a mark here.
	b		R r R RR Rr r Rr rr Rr ratio 3 : 1 ✓ ✓ ✓	3 (AO 2.1) <	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		Any three from: variation with some rats resistant and some who are not ✓ (resistant rats) more likely to survive/less likely to be killed ORA ✓ (resistant rats more likely) reproduce ORA ✓ pass on the allele / gene for resistance ORA ✓	3 (AO 2.1)	IGNORE selective breeding ALLOW mutation for resistance ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is passed on / genes are passed on <u>Examiner's Comments</u> Candidates had to apply their knowledge of natural selection to explain why the percentage of resistant rats was increasing. There were a range of marks given for this question. Most none scoring responses were too vague and not using key terms. Most candidates did not appreciate that there was variation for resistance within the population.
	d		Any two from: (stops/less) respiration ✓ (no/less) energy/ATP ✓ key process interrupted e.g. cell metabolism/protein synthesis/chemical reactions/active transport ✓	3 (AO 2.1)	<u>Examiner's Comments</u> This question was one of the most challenging application of knowledge and understanding questions. The most common awarded mark was appreciation that energy release would be affected. A lot of responses were very general and would say the rat can't breathe or can't get any oxygen.
			Total	11	
25			A ✓	1 (AO1.2)	
			Total	1	
26			D ✓	1 (AO2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance								
27	a		<table><tr><th>Feature</th><th>Structure</th></tr><tr><td>chlorophyll for photosynthesis</td><td>chloroplast ✓</td></tr><tr><td>enzymes for respiration</td><td>mitochondria ✓</td></tr><tr><td>receptor molecules for communication</td><td>cell membrane ✓</td></tr></table>	Feature	Structure	chlorophyll for photosynthesis	chloroplast ✓	enzymes for respiration	mitochondria ✓	receptor molecules for communication	cell membrane ✓	3 (AO1.1)	
			Feature	Structure									
			chlorophyll for photosynthesis	chloroplast ✓									
			enzymes for respiration	mitochondria ✓									
receptor molecules for communication	cell membrane ✓												
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = (×) 2000 award 2 marks 60(mm) ÷ 0.03(mm) ✓ = (×) 2000 ✓	2 (AO2.2)									
		ii	(use of a) stain ✓	1 (AO1.2)	ALLOW named stain e.g. iodine / methylene blue / eosin ALLOW dye IGNORE colouring								
			Total	6									
28			D ✓	1 (AO2.2)									
			Total	1									