

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

B2.1 SUPPLYING THE CELL

SCORE

/113

PERCENTAGE

%

STEMUP

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Gateway Biology A (9-1)

Supplying the cell

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	
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Centre number						Candidate number				
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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

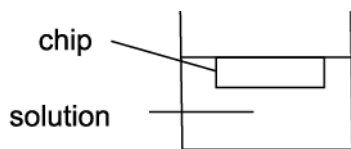
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist 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 113.
- The total number of marks may take into account some 'either/or' question choices.

1(a) An investigation is done to investigate changes in potatoes placed in different sucrose solutions.

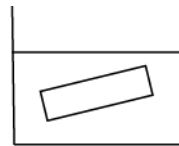
Three chips are cut from a potato.

Each chip is 5.0 cm long.

Each chip is left in a different concentration of sucrose solution for two hours.



1.0M solution



0.5M solution



0.0M solution

These are the results after two hours:

chip in **1.0M solution**

chip in **0.5M solution**

chip in **0.0M solution**

In this experiment what process causes some of the chips to change length?

-----[1]

(b) Explain why the chip in the **0.0M solution** increased in length.

-----[2]

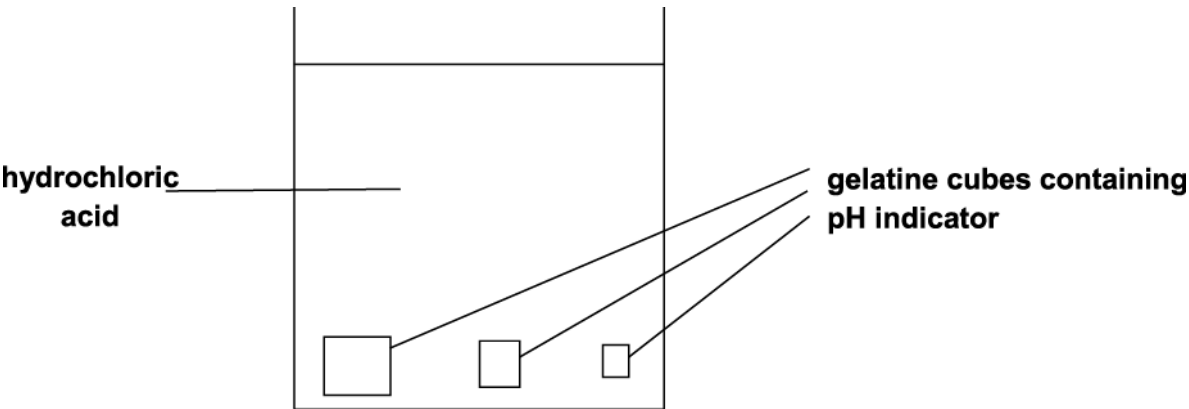
(c) Explain why the chip in the 0.5M solution stayed the same length.

[2]

2 Some students investigate the effect of the ratio of surface area:volume on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes stained blue with pH indicator.

They put different sized cubes into a beaker of hydrochloric acid and time how long it takes for the cubes to completely change colour.



The table shows their results.

length of 1 side of cube (cm)	surface area:volume ratio (cm ⁻¹)	time to completely change colour in seconds
1	-----	132
2	3	328
3	2	673

(i) Calculate the surface area:volume ratio for the cube with sides of 1 cm.

answer = _____ cm⁻¹

[1]

(ii) Calculate the rate of colour change for each of the three cubes.

Write your answers in the table below.

Show your answers in standard form.

length of 1 side of cube (cm)	rate of colour change (s ⁻¹)
1	_____
2	_____
3	_____

[2]

(iii) Use the results and your calculations in parts (i) and (ii)

Explain why most single celled organisms do **not** need a transport system (e.g. the circulatory system of multi cellular organisms).

[2]

3 In many countries people rely on bananas for food.

Black sigatoka is a disease of banana plants.

It is caused by a fungus.

Banana plants grown by farmers are usually produced asexually.

This process uses mitosis.

This means that if one banana plant can die of black sigatoka then they all can.

Write down why.

[1]

4 Look at the table. Which row describes active transport?

	only occurs across a membrane	can move substances from a low to high concentration	uses ATP	only moves substances from high to low concentration
A			✓	✓
B	✓	✓	✓	
C	✓	✓		
D	✓		✓	✓

Your answer

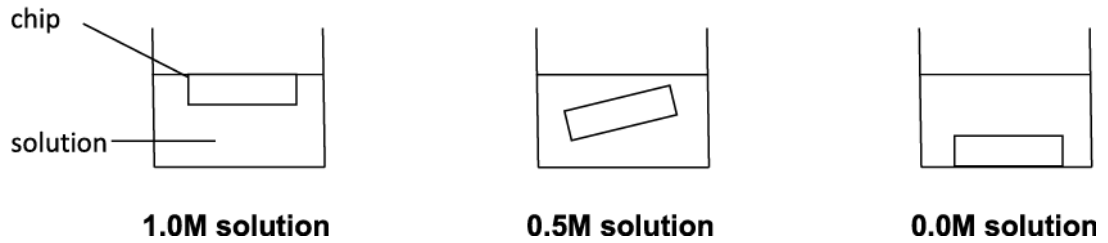
[1]

5(a) An investigation is done to investigate osmosis in potatoes.

Three chips are cut from a potato.

Each chip is 5.0 cm long.

Each chip is left in a different concentration of sucrose solution for two hours.



These are the results after two hours:

chip in **1.0M solution**

4.5 cm

chip in **0.5M solution**

5.0 cm

chip in **0.0M solution**

5.5 cm

Explain why the chip in the **0.0M solution** increased in length.

[2]

(b) Explain why the chip in the **0.5M solution** stayed the same length.

----- [2]

(c)

(i) Calculate the percentage change in length of the chip in the **1.0M solution**.

answer = ----- % [2]

(ii) In experiments like this, what is the advantage of calculating percentage change, not just the actual change?

----- [1]

(d)

- (i) Measuring the length of the chips is a quick and easy way to get results but it does **not** measure the total change to the chips.

Explain why.

-----[1]

- (ii) What could the students measure to see the total change to the chips?

-----[1]

6 Erythromycin is an antibiotic drug.

It is important to get the dose of erythromycin right.

Too much erythromycin can be harmful.

However, recently some strains of bacteria have developed resistance to low concentrations of erythromycin.

To see how effective erythromycin is, it is tested using bacteria grown on agar plates.

This method is used:

- A petri dish is used that has the bacteria growing evenly over the surface.
- A disc of filter paper is soaked in erythromycin.
- The disc is placed on the agar in the centre of the petri dish using sterile forceps.
- The dish is incubated at 37°C.

(i) Why did the scientists incubate the dish at 37°C rather than at higher or lower temperature?

----- [2]

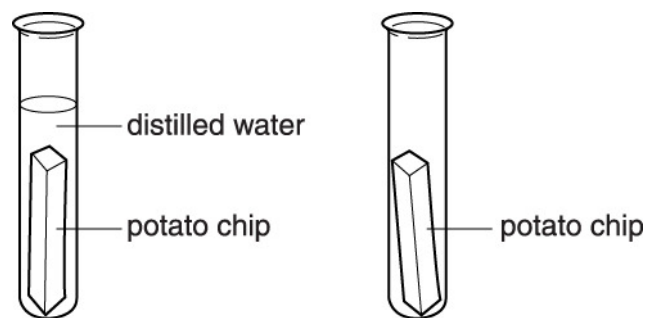
(ii) Why is the filter paper disc moved using sterile forceps?

----- [1]

7 Katie cuts two chips from a potato.

She puts one of the chips into a test tube of distilled water.

Katie puts the other chip into an empty test tube.



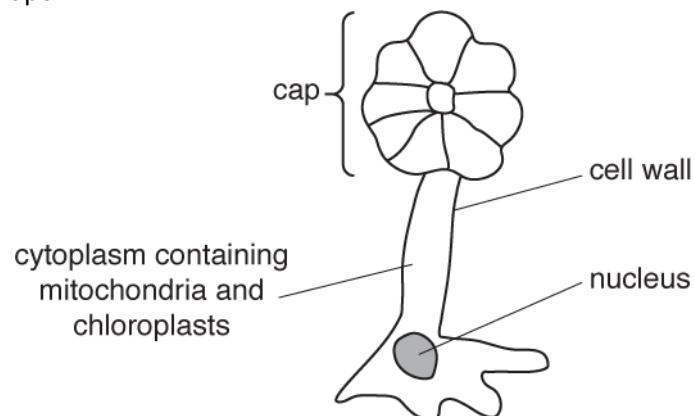
Water enters the cells of the potato chip that has been left in distilled water by osmosis.

Explain why.

----- [2]

8 *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]

9 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.

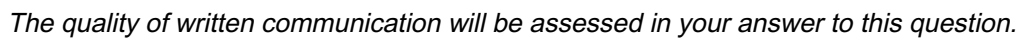
in test tube **A**



in test tube **B**



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



[6]

- 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

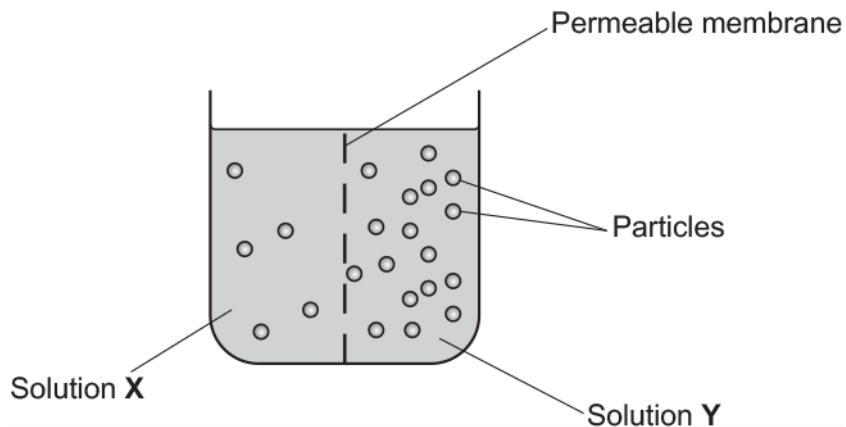
Explain the results including the correct scientific terms to describe the appearance of the cells in the solution at the end of the investigation.



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

[6]

11 Look at the diagram. It shows the particles dissolved in two solutions.



The particles can diffuse through the permeable membrane.

Which statement about the particles is true in this diagram?

- A Particles move in both directions across the permeable membrane.
- B Particles only move from X to Y.
- C Particles only move from Y to X.
- D Particles stop moving when the concentrations become equal.

Your answer

[1]

12 Why do plant root hair cells use active transport to take in minerals?

- A Minerals are dissolved in water in the soil.
- B Minerals are needed by the plant in very low concentrations.
- C Minerals are present at very high concentrations in the soil.
- D Minerals are present at very low concentrations in the soil.

Your answer

[1]

13 Which one of these stages comes **first** during mitosis?

- A The nuclear membrane forms.
- B The nuclear membrane breaks down.
- C Chromosomes separate.
- D Chromosomes line up on the equator.

Your answer

[1]

14 Which process produces gametes?

- A Diffusion
- B Fertilisation
- C Meiosis
- D Mitosis

Your answer

[1]

15 Retinitis pigmentosa is a genetic condition.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

If people have retinitis pigmentosa then the cells in their retina are damaged.

(i) Scientists want to use stem cells as a treatment for this condition.

Why might stem cells be able to repair the retina?

----- [2]

(ii) Write down **two** reasons why medical treatments are tested on animals first.

----- [2]

16 Look at some of the stages in mitosis.

- 1 The nuclear membrane forms.
- 2 The nuclear membrane breaks down
- 3 Chromosomes separate.
- 4 Chromosomes line up on the equator

What is the correct order of these stages during mitosis?

- A 1 → 3 → 2 → 4
- B 1 → 4 → 3 → 2
- C 2 → 4 → 3 → 1
- D 3 → 2 → 4 → 1

Your answer

[1]

17 A plant cell is placed in a solution with a higher solute concentration than the cell contents.

What will happen to the plant cell?

- A Absorb water until it bursts.
- B Absorb water until it is turgid.
- C Lose cytoplasm and shrink.
- D Lose water and become flaccid.

Your answer

[1]

18 Which is a function of carrier proteins in a cell membrane?

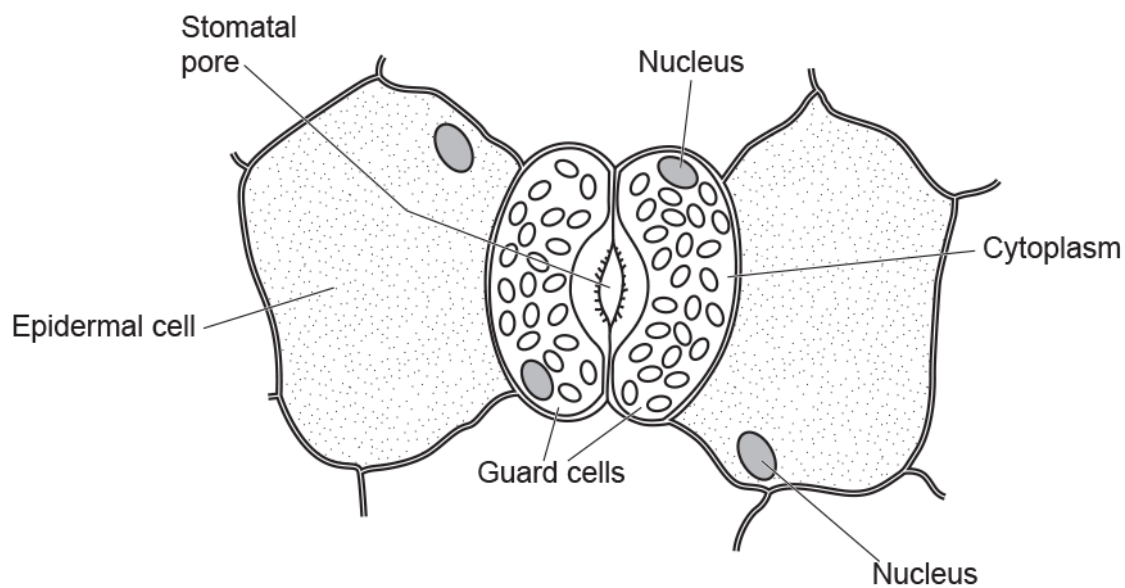
- A Transfer impulses across a synapse
- B Transfer molecules by active transport
- C Transport amino acids in protein synthesis
- D Transport molecules around the blood

Your answer

[1]

19

The diagram shows structures on the surface of a leaf.



- (i) Photosynthesis occurs in the guard cells but not the epidermal cells.

Explain why this is important in the control of the rate of transpiration in the plant.

-----[4]

(ii) Explain why guard cells are an example of specialised cells.

-----[2]

20

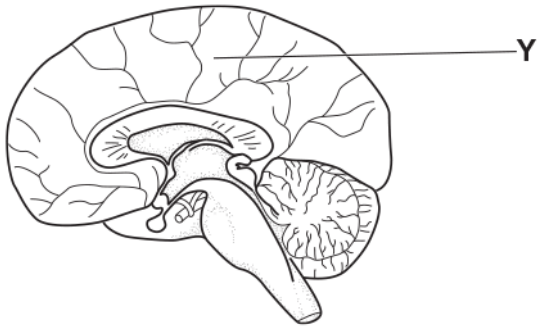
(i) Motor neurone disease (MND) is a condition that affects reaction times. MND affects the speed of nerve impulse in motor neurones.

Stem cells taken from the skin of people with MND are used in research. The stem cells can be grown in the lab and used to measure the speed of the nerve impulse.

Which special feature of stem cells makes this possible?

-----[1]

(ii) The diagram shows the brain.



Name part Y and explain why it is an important area of the brain in the research of MND.

Part Y:

Explanation: [2]

(iii) Measuring the speed of the nerve impulse in the brain is more difficult than using stem cells.

Suggest **two** reasons why.

.....
.....
..... [2]

21 Retinitis pigmentosa is a genetic condition that affects the eyes.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

The condition causes rod cells in the retina to break down.

(i) Explain why stem cells could be used as a treatment for this condition.

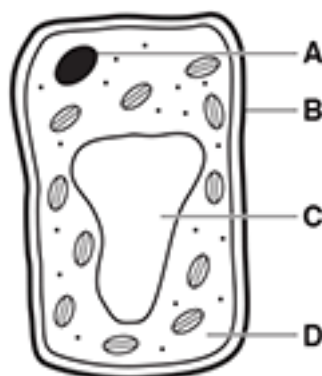
----- [2]

(ii) Why is it an advantage to use stem cells from the patient rather than from another person?

----- [1]

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

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

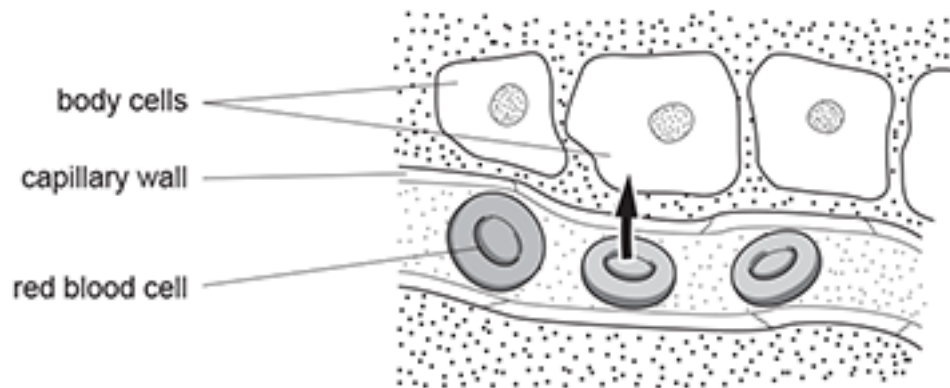


Your answer

[1]

23 The diagram shows the direction of **oxygen** transfer from red blood cells to body cells.

What process does the arrow show?

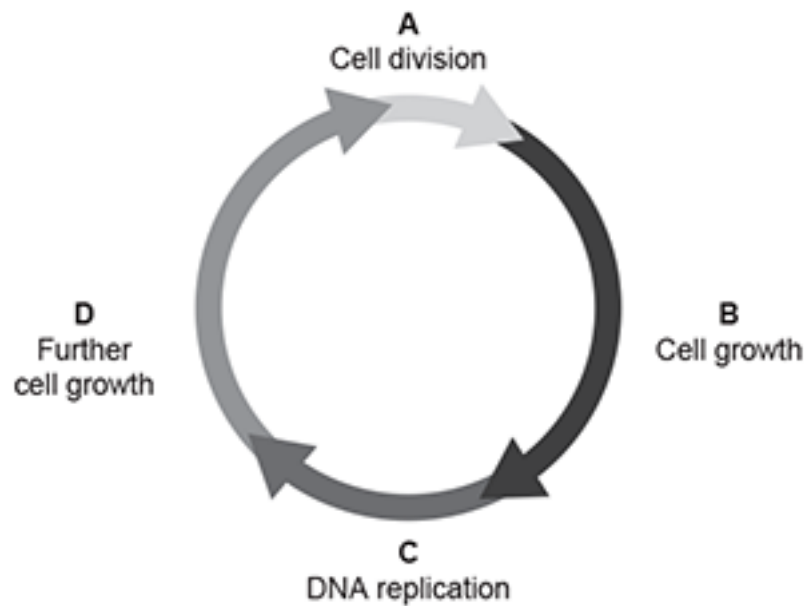


- A Active transport
- B Diffusion
- C Osmosis
- D Transpiration

Your answer

[1]

24 During which phase of the cell cycle does mitosis happen?



Your answer

[1]

25 An experiment is carried out to find the concentration of potato tissue.

Four chips are cut from a potato.



At the start, each chip is 50 mm long, 10 mm wide and 10 mm high.

Each chip is put in a different sucrose solution A, B, C and D.

The volumes of the chips are calculated after 1 hour.

Sucrose solution	Volume of chip (mm ³)
A	50
B	500
C	5000
D	50 000

Which sucrose solution has the same concentration as the potato tissue?

Your answer

[1]

26(a) A scientist clones a cauliflower plant.



He uses small pieces of the cauliflower plant called explants.

This is the method the scientist uses to get the explants:

- Place the equipment in a beaker of bleach and swab the bench with 70% alcohol.
- Collect a small piece of cauliflower and place on a white tile.
- Use a scalpel to cut the piece of cauliflower lengthways into small 3–5 mm pieces called explants.
- Measure the mass of the explants.

(i) Suggest why the scientist uses a scalpel rather than a kitchen knife.

----- [1]

(ii) Write down **one** safety precaution that the scientist should take when using a scalpel.

----- [1]

(iii) The explants are then prepared for cloning by placing on an agar jelly plate.

Agar jelly contains water, sugars and minerals.



Agar jelly plate

When the explants are placed on the agar jelly plate they have no roots or leaves.

Explain why the explants must be placed on the agar jelly plate.

[2]

(b) To grow the explants, the scientist places the agar jelly plate in a warm room near to a window.

(i) Explain why this will help the explants grow and develop into clones.

----- [2]

(ii) Using a heated cabinet with light bulbs inside the cabinet would improve this method.

Explain why.

----- [2]

(iii) The scientist examines the agar jelly plate regularly.

Growth of the explants is visible in the plate within 10 days and parts of the explants are turning green.



What conclusion can be made about why the explants have parts that are turning green?

----- [1]

(c) The mass of the explants at the start was 15 g.

After 10 days the mass of the explants was 28 g.

Calculate the percentage increase in mass of the explants.

Give your answer to 1 decimal place.

Percentage increase = ... % [3]

(d) The cells in cauliflower explants behave the same way as embryonic stem cells do in animals.

Explain why it is more difficult to clone adult animals than to clone cauliflowers.

----- [2]

27 The lining of the uterus is shed during menstruation.

New cells are needed to replace the lining of the uterus.

Describe the processes that occur to make these new cells.

[3]

28 Why are stem cells useful for repairing damaged tissues?

- A They are easily obtained from any organ.
- B They are not attacked by pathogens such as bacteria.
- C They are haploid.
- D They can divide to form different types of cell.

Your answer

☐

[1]

29 A salt marsh is a large, muddy area of land where a river joins the sea.

When the tide comes in, the salt marsh gets covered with seawater.

Suggest **one** reason why salt marshes are difficult places for plants to grow

[1]

30 An experiment is carried out to find the concentration of potato tissue.

Four chips are cut from a potato.



At the start, each chip is 50 mm long, 10 mm wide and 10 mm high.

Each chip is put in a different sucrose solution A, B, C and D.

The volumes of the chips are calculated after 1 hour.

Sucrose solution	Volume of chip (mm ³)
A	50
B	500
C	5000
D	50 000

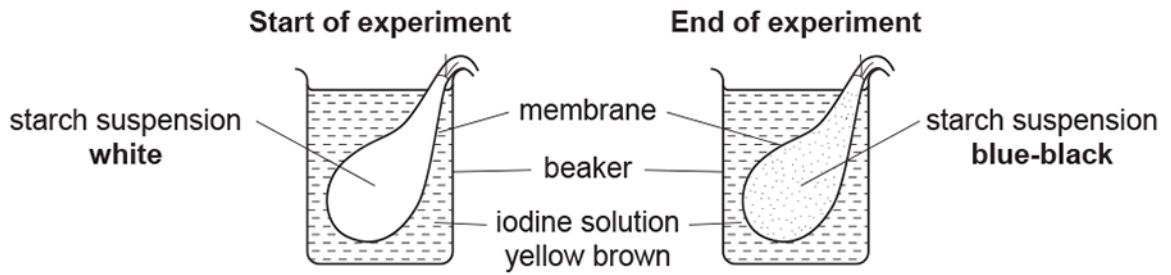
Which sucrose solution has the same concentration as the potato tissue?

Your answer

[1]

31(a) An experiment is set up to investigate how substances move into and out of cells.

Look at the results.

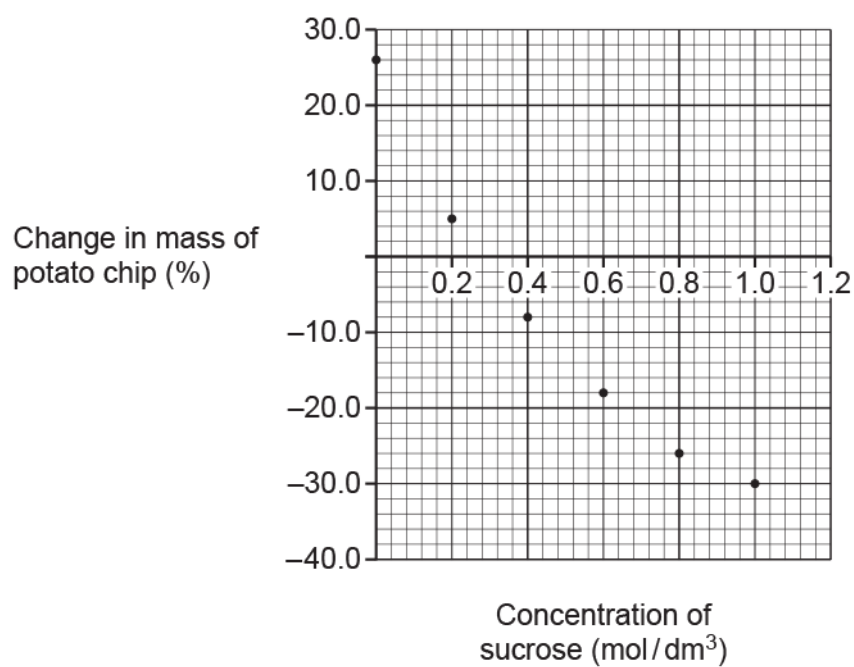


Explain the results of this experiment.
Use ideas about molecules in your answer.

[3]

(b) Plant cells are affected by osmotic conditions.

Look at the graph. It shows the percentage change in mass of potato chips in different concentrations of sucrose.



(i) Draw a curve of best-fit on the graph.

[1]

(ii) Use the graph to estimate the concentration of sucrose that has the same water potential as the potato cells.

Concentration = ... mol / dm³ [1]

(iii) In a different experiment a sucrose concentration of 0.0 mol / dm³ increases the mass of a carrot chip by 30%.

The carrot chip shows a 10% decrease in mass compared with its original mass for every 0.2 mol / dm³ increase in sucrose concentration.

Calculate the x-axis intercept for the carrot chip.

x-axis intercept = ... mol / dm³ of sucrose [1]

(c) Osmotic conditions can increase the size of plant tissue but stem cells are responsible for growth of new cells.

What name is given to plant tissue that contains stem cells?

----- [1]

32 Scientists are using human embryonic stem cells to grow cells to treat type 1 diabetes.

Explain why scientists use embryonic rather than adult stem cells.

----- [2]

33(a) A scientist clones a cauliflower plant.



He uses small pieces of the cauliflower plant called explants.

This is the method the scientist uses to get the explants:

- Place the equipment in a beaker of bleach and swab the bench with 70% alcohol.
- Collect a small piece of cauliflower and place on a white tile.
- Using a scalpel cut the piece of cauliflower lengthways into small 3–5 mm pieces called explants.
- Measure the mass of the explants.

What equipment should be used to measure the mass of the explants to 1 hundredth of a gram?

-----[1]

(b) The scientist prepares the explants for cloning on an agar jelly plate.

He does this by placing the explants on the agar.

To grow the explants into cauliflower plants, the scientist places the agar jelly plate in a warm room near to a window.

(i) Before they form new plant structures, the explants must take in sugars from the agar jelly.

Explain why explants cannot make their own sugars.

----- [2]

(ii) The experiment could be improved by placing the agar jelly plate with explants into a heated cabinet containing light bulbs.

Describe how this cabinet could be further improved to maximise the growth and development of the explants.

----- [2]

34 What is meant by the term cell differentiation?

- A Cells become organs
- B Cells become organ systems
- C Cells become specialised
- D Cells become tissues

Your answer

[1]

35 Which type of cell can divide to produce a range of different cell types?

- A Heart cell
- B Neurone cell
- C Sperm cell
- D Stem cell

Your answer

[1]

36 A student models the process of mitosis using cookies and sprinkles.



Mitosis is part of the cell cycle.

Which part of the cell cycle has the student modelled?

- A Cell division
- B Chromosome movement
- C DNA replication
- D Growth of cell

Your answer

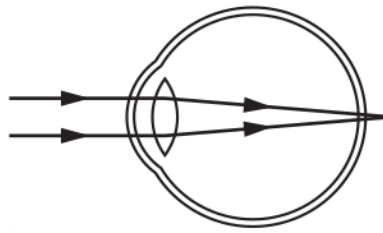
[1]

37 Treatment for cancer often involves powerful medicines that stop cells dividing all over the body.

Write down the name of the type of cell division that occurs when body cells divide.

-----[1]

38 Look at the diagram showing an eye defect.



What is the defect and which lens could be used to correct it?

- A Long-sightedness, corrected with a concave lens
- B Long-sightedness, corrected with a convex lens
- C Short-sightedness, corrected with a concave lens
- D Short-sightedness, corrected with a convex lens

Your answer

[1]

39 A student models the process of mitosis using cookies and sprinkles.



Mitosis is part of the cell cycle.

Which process in the cell cycle has the student modelled?

- A Cell division
- B Chromosome movement
- C DNA replication
- D Growth of cell

Your answer

[1]

- 40 In people with multiple sclerosis their immune cells stop working as they should. HSCT is a treatment for multiple sclerosis which destroys all the immune cells.

Once the immune cells are destroyed, cells from a patient's bone marrow can replace the immune cells.

What type of cell is used to replace the destroyed immune cells?

- A Neurone cell
- B Red blood cell
- C Stem cell
- D White blood cell

Your answer

[1]

- 41 Arsenic is a toxin that stops respiration in cells.

What other cell process would be stopped because of arsenic?

- A Active transport
- B Diffusion
- C Osmosis
- D Transpiration

Your answer

[1]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		osmosis (1)	1	
	b		absorbed water (1)	1	allow (movement) from higher to lower water potential / from higher to low water concentration
			Higher water potential / water concentration outside ORA (1)	1	
	c		(potato has) same water potential / water concentration (as solution) (1)	1	
			no (net) water loss or gain (1)	1	
			Total	5	
2		i	6:1	1	
		ii	7.6×10^{-3} 3.0×10^{-3} 1.5×10^{-3} correct calculation of 1 / time (1)	1	
		ii	answer in standard form (1)	1	
		iii	Comment on the rate of colour change / smaller block changed faster (1)	1	ORA
		iii	Diffusion alone is sufficient in smaller organisms / smaller organisms have a larger surface area to volume ratio / diffusion alone may not be effective in multi cellular organisms (may require circulatory system) (1)	1	
			Total	5	
3			all genetically identical / all have the same genes (1)	1	all clones (1)
			Total	1	
4			B	1	
			Total	1	
5	a		absorbed water (1)	1	allow (movement) from higher to lower water potential / from higher to low water concentration
			higher water potential / water concentration outside ora (1)	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	b		(potato has) same water potential / water concentration (as solution) (1)	1	
			no (net) water loss or gain (1)	1	
	c	i	–10 (%) (2) but 10 (%) (1)	2	
		ii	can still compare even if original sizes are different (1)	1	
	d	i	ignores changes to width (1)	1	
		ii	measure (changes to) volume / mass (1)	1	
			Total	9	
6		i	any higher and the bacteria might be killed / bacterial enzymes denatured (1)	1	allow optimum temperature for the bacteria / bacterial enzymes
		i	any lower and the erythromycin would diffuse slower / bacteria would reproduce more slowly so takes longer to get the results (1)	1	allow spread out slower
		ii	prevent contamination by other microbes (1)	1	not germs / bugs
			Total	3	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7			(cells) have partially permeable membrane (1) potato / cells are more concentrated than the distilled water (1)	2	allow semi-permeable membrane answer must be comparative allow cells have lower water concentration (than distilled water) allow correct ref. to concentration gradient allow higher level answers relating to water potential assume unqualified references to concentration refer to solute e.g. water moves from high to low concentration = 0 but water moves from high water concentration to low water concentration = 1 Examiner's Comments The common weakness in answers was to make unqualified references to concentration. To say that water would move from an area of high water concentration to an area of low water concentration would have gained a mark. However to say that water would move from a high concentration solution to a low concentration solution would not. Unqualified references to concentration were taken by markers to refer to solute concentration. The second mark was for reference to a partially permeable membrane. 'Semi-permeable membrane' was acceptable, but 'partially permeable wall' was not. Neither was 'permeable membrane'.
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance								
8		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								
			Total	4									

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9			[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
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 2.1)	
			Total	1	
12			D ✓	1 (AO 1.2)	<u>Examiner's Comments</u> Very few candidates were aware of the reasons for active transport on this recall question. Many opted for 'A'. Others that had more of an awareness that concentration was involved chose the high concentrations, clearly unsure about the reason why active transport is needed.
			Total	1	
13			B ✓	1 (AO 2.1)	
			Total	1	
14			C ✓	1 (AO1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15		i	idea that stem cells are not differentiated / can still specialised✓ they can replace damaged cells / develop into/change/divide/become retina cells ✓	2 (AO 1.2)	ALLOW stem cells are unspecialised / can differentiate/grow into any (type of) cell ALLOW can differentiate/specialise into retina cells = 2 marks IGNORE can repair retina <u>Examiner's Comments</u> There were some good examples demonstrating their knowledge and understanding of stem cells in this answer. Most common non-credited answers were just repeating the question that they can repair the retina but not describing how. Exemplar 6 gained full marks. Exemplar 6 Why might stem cells be able to repair the retina? stem cells are undifferentiated cells meaning they can be modified to do anything. So scientists are able to modify stem cells to replace the faulty cells in the retina. [2]
		ii	any two from: to see if it works ✓ make sure it is safe / identify side effects✓ to find the correct dosage✓	2 (AO 1.2)	ALLOW see results ALLOW could go wrong / unknown effect IGNORE can't test on humans <u>Examiner's Comments</u> The vast majority of candidates scored at least 1 mark here for side effects / make sure it is safe. The least scored marking point was to find the correct dosage.
			Total	4	
16			C ✓	1 (AO 1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17			D ✓	1 (AO 1.2)	
			Total	1	
18			B ✓	1 (AO 1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
19		i	photosynthesis makes sugars in guard cells ✓ epidermal cells (dont photosynthesise so) lower in sugar than guard cell ✓ and any two from: epidermal cells higher osmotic / water potential than guard cells ✓ ORA water enters guard cells (by osmosis) ✓ ORA increasing turgidity of guard cell opens stomata ✓ ORA due to thicker inner cell wall ✓ opening / size of stoma affects transpiration rate ✓	4 (AO 2 × 1.1) (AO 2 × 2.1)	ALLOW correct description of transpiration linked to the size of stoma <u>Examiner's Comments</u> Candidates found this question one of the most challenging on the paper. Few candidates demonstrated a good knowledge of the mechanism of stomatal opening. Many candidates seemed to reverse the question and tried to explain how the rate of transpiration controlled photosynthesis in guard cells.
		ii	they have differentiated ✓ have a specific job to do (in the leaf/plant) ✓	2 (AO 2 × 1.1)	ALLOW they have adapted (to their function) ALLOW no other cells do the same job ALLOW they can open / close stomata they have adapted to a specific job / they are adapted to open and close stomata = 2 marks <u>Examiner's Comments</u> There were some good answers focussing on the structural differentiation of guard cells and the fact that they have a specific role.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
20		i	(skin stem cell) differentiates into (motor) neurone ✓	1 (AO 2.2)	ALLOW differentiates into MN (taken from abbreviation of motor neurone disease to MND in stem of question) <u>Examiner's Comments</u> This question was referring to the ability of stem cells to be able to produce nerve cells that could be used to measure the speed of impulses. Most candidates did not refer to nerve cells in their answers. This is shown in exemplar 6, which gained 1 mark. Exemplar 6 <i>Stem cells are undifferentiated</i> [1]
		ii	cerebru ✓ idea that area of brain controlling motor function / movement / conscious activities ✓	2 (AO 1.1) (AO 2.1)	ALLOW cerebral cortex / motor cortex IGNORE it is the area that coordinates reactions. DO NOT ALLOW a list of correct functions of the cerebrum without the importance of movement being highlighted <u>Examiner's Comments</u> The region labelled Y was correctly identified by many candidates, although there was some confusion with the cerebellum. The explanation did not always gain marks, as many candidates simply listed all the functions of the cerebrum.
		iii	Any two from: difficult to access brain (due to skull) ✓ large number of neurones / large number of nerve impulses in the brain/ difficult to follow a single neurone ✓ ethical issues of researching on brain / risk of damage ✓	1 (AO 2 × 2.2)	IGNORE difficult to take measurements in brain unless qualified <u>Examiner's Comments</u> There were many correct references to the difficulty of access to the brain and the risk of damage. Some candidates incorrectly referred to differences in conduction velocities in the two types of cell.
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
21		i	stem cells are not differentiated/can still specialise ✓ they could become rod cells ✓	1 (AO 1.2) 1 (AO 2.1)	ALLOW stem cells are unspecialised / can grow into any type of cell / have ability to differentiate <u>Examiner's Comments</u> Most candidates were able to describe what a stem cell is assessing AO1.1, and many had the AO2.1 idea that they could become rod cells. Some missed the AO2.1 mark by referring to damaged or mutated cells, instead of the rod cells.
		ii	idea it would not be detected as foreign cells (by the immune system/WBC) ✓ OR idea it would not be rejected (by the body) ✓	1 (AO2.2)	ALLOW accepted (by the body) / (body) more likely to accept <u>Examiner's Comments</u> This AO2 question was generally answered well. Lower ability candidates stated that stem cells from another person "wouldn't work". Marks are scored more frequently when candidates avoid general terms, and responses are specific to the question asked.
			Total	3	
22			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
23			B	1 (AO 1.1)	<u>Examiner's Comments</u> This is an AO1.1 question testing recall of transport in and out of cells. In general, candidates chose either A or B. Only candidates who performed well overall chose the correct answer B.
			Total	1	
24			A	1 (AO 1.1)	
			Total	1	
25			C	1 (AO 2.2)	<u>Examiner's Comments</u> This is an AO2.2 question testing the ability to apply knowledge of osmosis to changes in volume, and was well answered by many candidates. Candidates clearly understood there would be no change in volume if put in the same sucrose concentration.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
26	a	i	Any one from: provides a fine/clean cut ✓ for more accurate/precise cutting measurement ✓	1 (AO 2.2)	ALLOW scalpel is sharper ALLOW easier to cut with scalpel IGNORE more hygienic <u>Examiner's Comments</u> Most candidates scored this AO2.2 mark, many correctly referring to precision or sharpness. However, several responses identified a concern about contamination with a kitchen knife and this was not appropriate in the context of the stem of the question so did not gain credit.
		ii	cut in a direction away from yourself / where possible cut using a cutting board ✓	1 (AO 2.2)	ALLOW place cover over scalpel if not in use ALLOW idea of keep fingers away from cutting/sharp edge/blade IGNORE safety gloves <u>Examiner's Comments</u> Again, many candidates scored this AO2.2 mark, with many correctly referring cutting away from yourself or, in some cases, keeping fingers away from the blade. However, several responses identified wanting to wear gloves, goggles etc and these were not accepted for correct responses. Some also wrote about being sensible, careful or responsible with the scalpel but not how to do that, so did not gain credit.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	No roots to take up minerals/water ✓ No shoots so no photosynthesis/sugars ✓	2 (AO 2 x 2.2)	ALLOW (cells absorb) sugars for respiration/energy ALLOW to provide water/sugar/minerals/nutrients scores 1 mark if no other mark <u>Examiner's Comments</u> AfL In this AO2.2 question the most common response was about being able to see the explants clearly or preventing contamination and very few candidates referred to the words in the question explaining there were no roots or leaves. Candidates should be encouraged to highlight, key words or phrases that might be important to consider in their responses. Most candidates who scored got the 1 mark for the allow in the guidance column of the mark scheme. It was very rare that any candidate scored 2 marks.
	b	i	warmth needed for (chemical) reactions / respiration / photosynthesis / growth ✓ light for photosynthesis / chlorophyll produced ✓	2 (AO 2 x 2.1)	ALLOW warmth speeds up metabolism/enzymes/mitosis/reproduction IGNORE bacteria ALLOW light/sunlight so plant can make sugar IGNORE Sun <u>Examiner's Comments</u> This AO2.1 question mainly gained marks from candidates who referred to warm conditions speeding up growth. Few mentioned light, and even fewer were able to link the light to photosynthesis.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	temperature can be controlled / kept at optimum temperature ✓ idea that light can be provided 24 hours / continuous light source ✓	2 (AO 3.3a)	ALLOW keeps constant temperature IGNORE keep heat constant ALLOW idea that air movement is constant ALLOW may go dark at night near window / avoids night-time conditions / avoids sunlight variability AW <u>Examiner's Comments</u> Candidates were able to identify that this AO3.3a question as developing an experiment by introducing an element of control. Where candidates only scored 1 mark it was usually for the idea of controlling the light by allowing continuous light. Some candidates did not score the first marking point as they were describing controlling heat rather than temperature, which was not given.
		iii	leaf cells / cells producing stems / chlorophyll being produced ✓	2 (AO 3.2a)	ALLOW explants are making chloroplasts / able to photosynthesise <u>Examiner's Comments</u> This AO3 question proved quite challenging but candidates who did gain credit usually gained the mark for recognition of photosynthesis, with fewer identifying that chlorophyll would be present. There were a significant number of candidates who wrote about growth of mould.

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	c	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 86.7 (%) award 3 marks 13 ÷ 15 ✓ = 86.666666... (%) ✓ = 86.7 (%) (1 decimal place) ✓	3 (AO 2 x 2.2) (AO 1.2)	ALLOW 86.6 (recurring) ALLOW ECF for % calculation if incorrect substitution of values from question ALLOW ECF for answer given to 1 decimal place <u>Examiner's Comments</u> This question covering AO1.2 and AO2.2 was challenging. Some common errors included not using a calculator but rather using an estimation method leading to inaccurate responses and also not working out the change in mass. A significant number of those who correctly completed the calculation did not round it correctly, giving 86.6 as their answer or commonly 86.6 recurring. Exemplar 1 Give your answer to 1 decimal place. $28 \div 15 = 1.8666666666666667$ $\frac{13}{28} \times 100 = 46.42857142857143$ Percentage increase = 46.4 % [3]  AfL In this exemplar, ECF was applied to the percentage calculation with incorrect value (though numbers are linked to the question), then correct rounding was done by the candidate. This highlights how important it is for candidates to show their working out as the candidate would not have scored any marks if all they had put was 46.4 on the answer line, as it would not have been possible to apply ECF.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d		plant/cauliflower cells can differentiate into any cell/become specialised (and make a new individual) ✓ the type of cell adult stem cells can differentiate into is limited / adult stem cells are difficult to obtain ✓	2 (AO 2.1)	If not specified assume answer refers to adult animals ALLOW embryonic cells can differentiate into any cell and make a new individual ALLOW adult animals no longer have embryonic (stem) cells ALLOW animals cells cannot differentiate into any cell ALLOW higher level answers relating to cloning techniques e.g. animal cells with no cell wall so osmotic medium needs balancing precisely to avoid cells bursting <u>Examiner's Comments</u> This AO2.1 question found candidates having considerable difficulty in applying their knowledge and understanding of stem cells. Most concentrated on the idea of animals being larger or more developed or advanced than cauliflowers. Others discussed ethics and only higher ability candidates were writing about differences in ability to differentiate in their responses.
			Total	14	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
27			Any three from: mitosis ✓ DNA replicates ✓ chromosomes separate ✓ cells divide into two new cells ✓ cells grow ✓	3 (AO 1.1)	ALLOW chromosomes are copied ALLOW DNA duplicates/doubles ALLOW (identical) daughter cells produced each with own copy of chromosomes ALLOW cell splits into two <u>Examiner's Comments</u> A large number of candidates found this AO1.1 question about cell division challenging and did not identify it as asking about how new cells are made, so did not make the link to cell division. Many described how the menstrual cycle was controlled by hormones and how they affected the thickness of the lining. There were some very good responses from those candidates that recognised this was about cell division but some mentioned meiosis rather than mitosis.
			Total	3	
28			D	1 (AO 1.1)	
			Total	1	
29			plants receive less light (for photosynthesis) / salt water/concentration affects osmosis / water is drawn out of the plants ✓	1 (AO 2.1)	<u>Examiner's Comments</u> Candidates found this question one of the most challenging on the paper. Few candidates could apply their knowledge of salt water on osmosis in plant cells or light on photosynthesis. Exemplar 1 demonstrates a common response which did not score. Exemplar 1 Suggest one reason why salt marshes are difficult places for plants to grow. When the ~~star~~ tide comes in, the plants would be submerged in water and may drown. [1]
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
30			C	1 (AO 2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
31	a		iodine (molecules) moved into bag / through membrane ✓ starch (molecules) cannot move through membrane / out of the bag ✓ starch molecule are large / iodine molecule are small / starch molecules larger than iodine / ORA ✓	3 (AO 2 x 3.2a) (AO 2.1)	ALLOW iodine moved into starch solution DO NOT ALLOW iodine moved by osmosis through membrane ALLOW starch cannot diffuse through membrane DO NOT ALLOW starch cannot move by osmosis through membrane ALLOW iodine smaller than pores in membrane/ORAV <u>Examiner's Comments</u> Many of the candidates understood that the iodine molecules must have entered the bag. However, some of them put this down to osmosis rather than diffusion and therefore lost this mark. Few candidates commented on the fact that starch molecules could not leave the bag and did not explain this in terms of the size of the molecules.
	b	i	suitable best-fit curve ✓	1 (AO 2.2)	DO NOT ALLOW obvious double lines or lines drawn with ruler <u>Examiner's Comments</u> The ability of candidates to draw a best fit curve seems to be improving and less double lines or sketched lines were seen.
		ii	answer should match where curve of best fit crosses X axis on candidates own line of best fit	1 (AO 3.2a)	ALLOW +/- half a small square ie +/- 0.02 from intercept on candidates graph <u>Examiner's Comments</u> Some candidates had difficulties with the scale, but most could read off the intercept.
		iii	0.6 (mol/dm ³) ✓	1 (AO 2.2)	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		meristem ✓	2 (AO 1.1)	ALLOW cambium Examiner's Comments Although some of the spellings varied, a number of candidates correctly identified meristems.
			Total	7	
32			embryonic stem cells are able to differentiate into any cell / totipotent / adult stem cells are limited / pluripotent ✓ therefore insulin producing cells are easier to develop from embryonic stem cells/adult stem cells are not ✓	2 (AO 1.1) (AO 2.1)	IGNORE adult stem cells are already specialised ALLOW difficult to locate adult stem cells IGNORE embryonic stem cells can repair all parts Examiner's Comments The majority of candidates correctly explained the totipotent nature of embryonic stem cells but few candidates went on to explain the consequences of this in replacing pancreatic cells. Exemplar 6 shows an example of a common answer that only scores the first marking point. Exemplar 6 embryonic stem cells can specialise to become any type of cell whereas adult stem cells can only specialise to become a cell from their own tissue [2]
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
33	a		digital balance/scales / electronic balance/scales ✓	1 (AO 1.2)	ALLOW analytical balance/scales / scientific balance/scales ✓ IGNORE balance/scales unqualified / sensitive scales <u>Examiner's Comments</u> Many candidates did not concentrate on the accuracy needed and just stated 'a mass balance'.
	b	i	no chloroplasts / no chlorophyll / no leaves ✓ they cannot photosynthesise ✓	2 (AO 2 x 2.1)	DO NOT ALLOW chlorophyll removed by alcohol no chlorophyll/chloroplasts/leaves to allow photosynthesis = 2 marks <u>Examiner's Comments</u> There were many good answers seen here, with candidates linking the inability to photosynthesise to the absence of leaves or chlorophyll.
		ii	Any two from: include a thermostat ✓ keep the temperature constant/at optimum ✓ control the humidity ✓ circulate air inside the cabinet / keep well ventilated / give a supply of carbon dioxide ✓	2 (AO 3.3a)	IGNORE include insulation ALLOW increase humidity/water vapour IGNORE water the plants ALLOW give a supply of oxygen <u>Examiner's Comments</u> A common improvement was suggesting the provision of extra carbon dioxide, but a number of candidates concentrated on the heating or lighting rather than exploring 'further improvements'.
			Total	5	
34			C ✓	1 (AO1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
35			D ✓	1 (AO1.1)	
			Total	1	
36			A ✓	1 (AO1.1)	
			Total	1	
37			mitosis ✓	1 (AO1.1)	
			Total	1	
38			B ✓	1 (AO1.1)	
			Total	1	
39			B ✓	1 (AO1.1)	
			Total	1	
40			C ✓	1 (AO2.1)	
			Total	1	
41			A ✓	1 (AO2.1)	
			Total	1	