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H

GCSE (9–1) Biology A (Gateway Science)

J247/03 Paper 1, B1–B3 and B7 (Higher Tier)

Tuesday 15 May 2018– Afternoon

Time allowed: 1 hour 45 minutes

You must have:
- a ruler (cm/mm)

You may use:
- a scientific or graphical calculator
- an HB pencil

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document consists of **32** pages.

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SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

1 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]**

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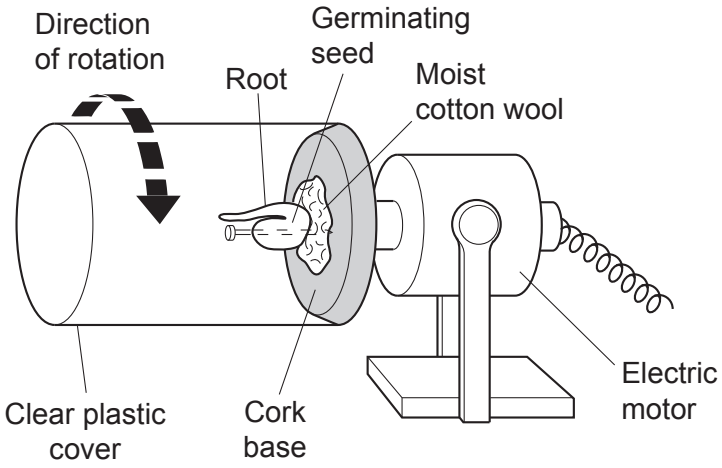
2 The diagram shows apparatus used in experiments on tropisms.



When the apparatus rotates, the root grows horizontally.

Which tropism is **not** showing its usual effect on the root?

A Negative gravitropism

B Positive gravitropism

C Negative phototropism

D Positive phototropism

Your answer ☐ **[1]**

3 During protein synthesis the DNA that codes for a particular protein is copied. This copy is called mRNA.

The diagram below shows the base sequence for a section of DNA.

G G T G C A T A T

What would be the complementary sequence of mRNA for this section of DNA?

A C C A C G T A T A

B C C A C G U A U A

C G G T G C A T A T

D G G U G C A U A U

Your answer ☐ **[1]**

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4 A student uses a simple potometer to study the effect of different temperatures on the cut shoot of a plant.

What does the potometer actually measure?

A Volume of water evaporating from the leaves of the shoot

B Volume of water produced by respiration in the shoot

C Volume of water taken up by the shoot

D Volume of water used in photosynthesis in the shoot

Your answer ☐ **[1]**

5 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]**

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

A Cell wall

B Cytoplasm

C Nucleus

D Plasmid

Your answer ☐ **[1]**

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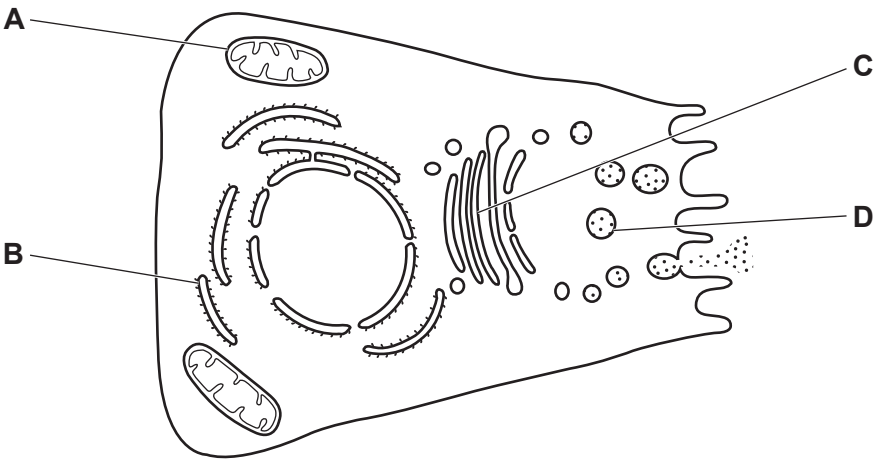
7 This is a cell.



Where does cellular respiration occur?

Your answer ☐ **[1]**

8 A light source is placed 0.5 m from a plant. The relative light intensity falling on the plant is 2 units.

The light source is moved to 1 m away.

What is the relative light intensity falling on the plant now?

A 0.125

B 0.25

C 0.5

D 1.0

Your answer ☐ **[1]**

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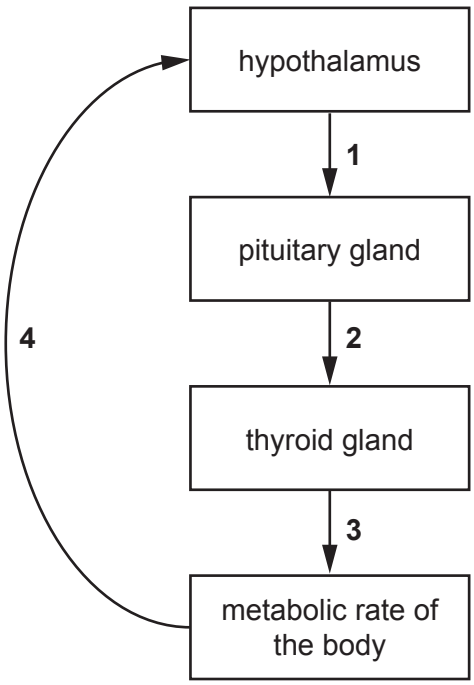
9 The level of thyroxine in the body is controlled by negative feedback.

The diagram shows how this takes place.



Which numbers on the diagram represent the hormones TSH and thyroxine?

A **2** = thyroxine **3** = TSH

B **1** = TSH **3** = thyroxine

C **3** = TSH **4** = thyroxine

D **2** = TSH **3** = thyroxine

Your answer ☐ **[1]**

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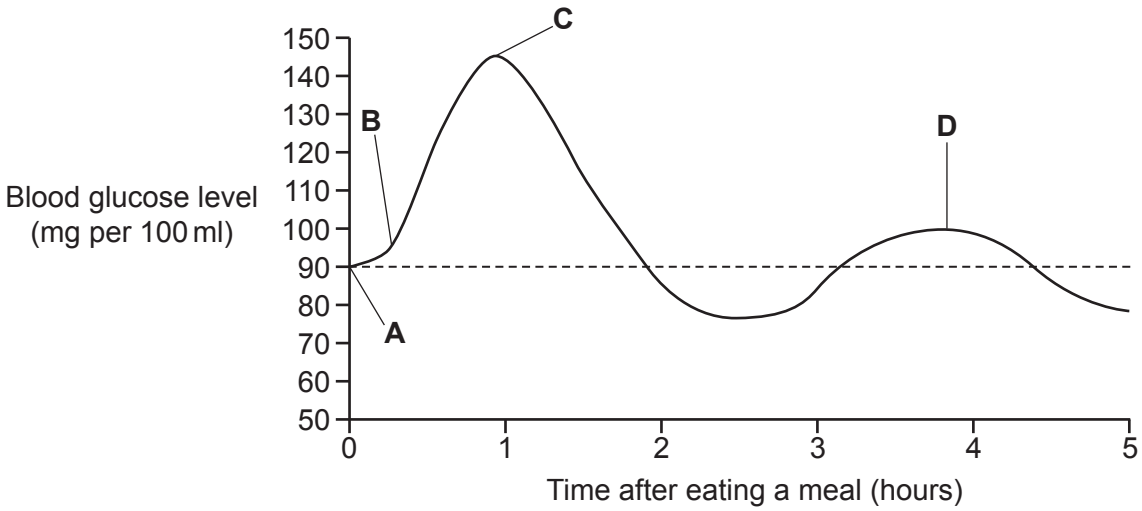
10 The graph shows blood glucose levels after eating a meal.



Which point **A**, **B**, **C** or **D** on the graph would the insulin level in the blood be at its highest level?

Your answer ☐ **[1]**

11 Which hormone is important in the fruit ripening process in plants?

A Ethene

B Gibberellin

C Progesterone

D Thyroxine

Your answer ☐ **[1]**

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12 The surface area of a single red blood cell is 1.5×10^{-4} mm^2.

The volume is 1×10^{-7} mm^3.

What is the surface area to volume ratio of a red blood cell?

A 0.0015 : 1

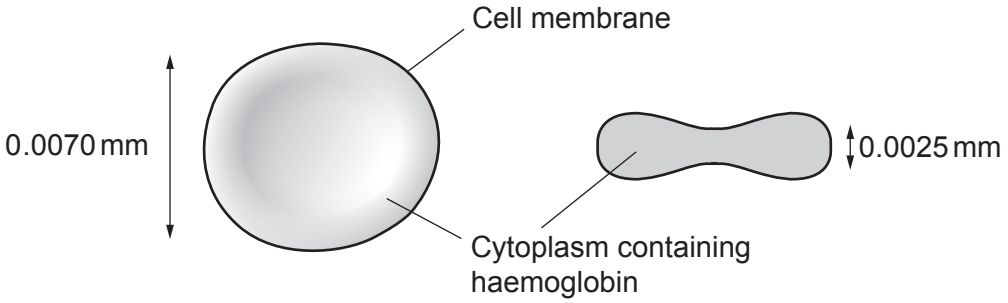
B 0.7 : 1

C 1.5 : 1

D 1500 : 1

Your answer ☐ **[1]**

13 The diagram shows a red blood cell.



	Distance oxygen travels to get to haemoglobin from blood plasma	Surface area to volume ratio	Nucleus present
A	Large	Small	Yes
B	Short	Large	Yes
C	Short	Large	No
D	Large	Large	No

Which row in the table shows how red blood cells are adapted for transport of oxygen?

Your answer ☐ **[1]**

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14 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]**

15 Sieve plates are structures found in plants.

What is their location and function?

A Found in phloem and allow movement of sucrose

B Found in phloem and allow movement of water

C Found in xylem and allow movement of sucrose

D Found in xylem and allow movement of water

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

16 Students investigate how to extract DNA from peas.

Stage 1:

- Chill 10 cm^3 of ethanol. Keep it on ice throughout the method for use in stage 2.
- Make a thick 'soup' by blending 100 cm^3 of peas with salt and cold water. Blend for 15 seconds in an electric blender.
- Strain the 'soup' through a mesh strainer and collect the liquid part in a beaker.
- Add 30 cm^3 of washing-up liquid and swirl to mix.
- Let the mixture settle for 5–10 minutes in a water bath at 60 °C.

(a) One group of students made a water bath using a beaker of water, thermometer and Bunsen burner. Another group used an electric water bath.

Write down **two** advantages of using an electric water bath.

1 .....

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2.....

.....
[2]

(b) Low temperatures protect DNA by slowing down the activity of enzymes that destroy DNA. High temperatures break down membranes in the cell.

To extract DNA, some methods use a water bath at 60 °C but other methods do not use an increased temperature.

Suggest **two** reasons for the different methods.

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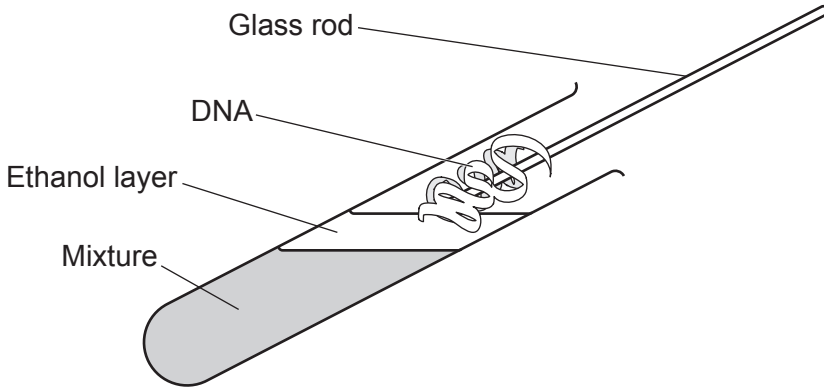
Stage 2 isolates the DNA.



- Pour the mixture collected from stage **1** into a test tube until a third full. Add protease enzymes to the test tube.
- Slowly pour cold ethanol at an angle of 45° into the tube. Ethanol will float on top.
- DNA is soluble in water, but salted DNA does not dissolve in ethanol and will form white clumps where the water and ethanol layers meet.
- Twirl a glass rod and the DNA will collect on the rod.
- Dry the sample on a pre-weighed filter paper and measure the mass of product.

(c) Suggest **two** safety precautions which should be taken at stage **2**.

Explain why each safety precaution is needed.

1 Safety precaution: .....

Explanation: .....

2 Safety precaution: .....

Explanation: .....

[2]

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(d) Look at the table. It shows the results from the two groups of students in the investigation.

Type of water bath used	Mass of DNA collected (mg)			
	Test 1	**Test 2**	**Test 3**	**Mean**
Beaker of water and Bunsen burner				22.9
Electric	33.6	32.3	33.3	.....

(i) Calculate the mean mass collected in the investigation using the electric water bath.

Give your answer to **1** decimal place.

Answer = ... mg **[2]**

(ii) The range of the three test readings for the beaker of water and Bunsen burner was 3.4.

Does the evidence support using an electric water bath instead of a beaker of water and Bunsen burner?

Explain your answer.

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

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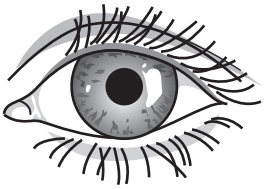
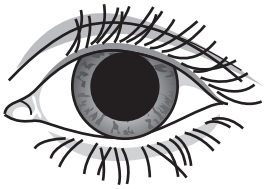
17 A girl walks from a sunny beach into a dark café.

Diagram **A** shows the girl's left eye on the beach.



A



B

(a) Diagram **B** shows the girl's left eye after she enters the café.

Explain how you can tell this and how this change happens.

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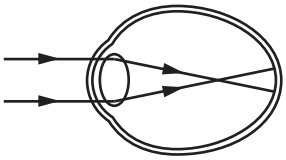
..... **[3]**

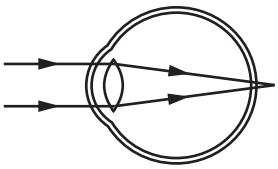
(b) Look at the diagrams.

They show how light is focused in people with different eye defects.

Person **X**



Person **Y**



(i) Name the eye defect in each person.

Person **X** .....

Person **Y** .....

[2]

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(ii) Identify the type of corrective lens needed by person **X** and **Y** and explain how the lenses work.

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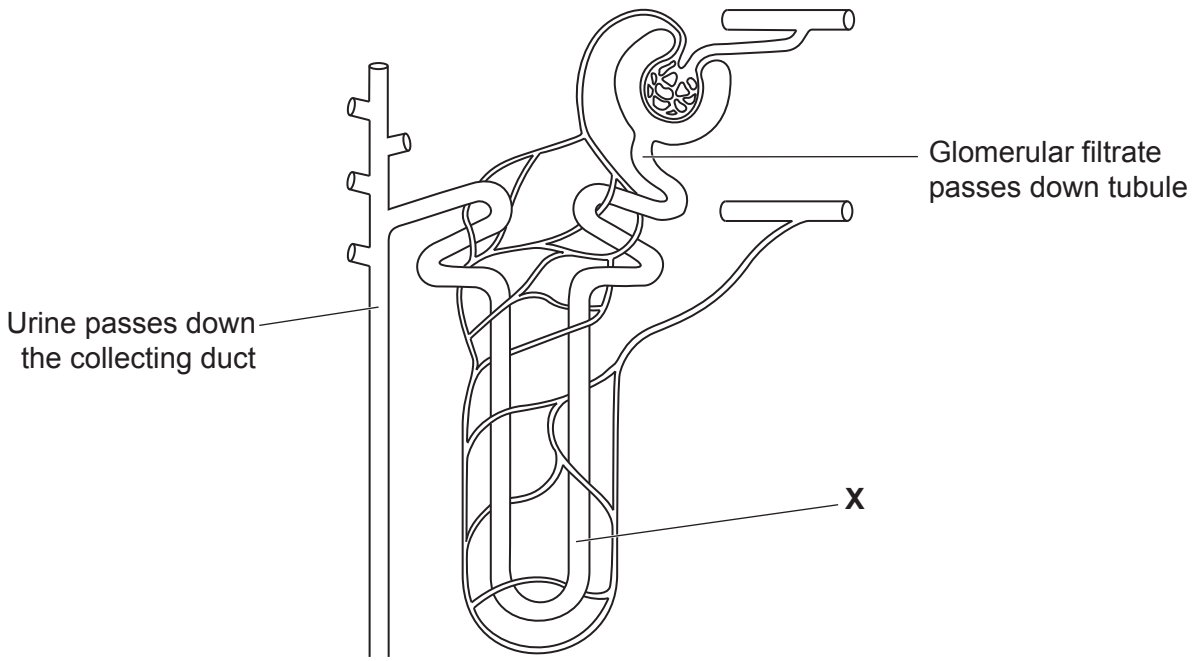
18 The diagram shows a kidney tubule (nephron).



(a) **(i)** What is the name of part **X**?

..... **[1]**

(ii) The hormone ADH affects the permeability of part of the kidney tubule.

Name the part of the tubule affected by ADH.

..... **[1]**

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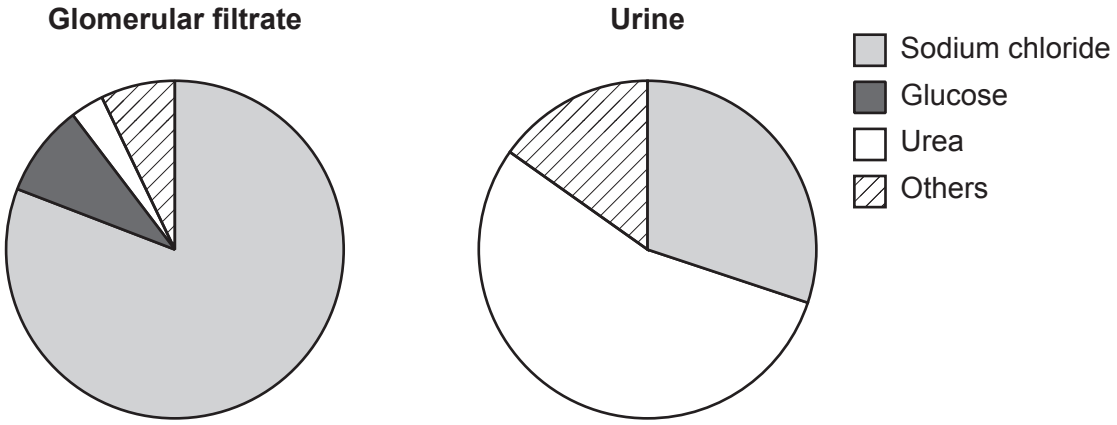
(b) The diagram shows the composition of glomerular filtrate and urine.



What evidence is there to suggest that selective reabsorption occurs in the kidney tubule?

Use evidence from the diagram to support your answer.

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..... **[4]**

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(c)* Sports drinks are usually one of three types. Look at the table of information on these types of sports drink.

Sports drink	Concentration of solutes relative to body fluids	Mass of carbohydrates (g) (mainly sugars)	Order of how quickly the drink is absorbed
Hypotonic	Less	<4	1
Isotonic	Same	4 – 8	2
Hypertonic	More	>8	3

An athlete is going to run a 10 000 metre race. About an hour before the race the athlete drinks a hypertonic sports drink.

The athlete completes the 10 000 metre race. After the race the athlete drinks an isotonic sports drink.

Explain how the race causes changes in water, salt and sugar levels in the athlete's body and explain the athlete's choice and timing of drinks.

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19 A class of students investigate if right handed people are faster with their dominant right hand.

Student **A** drops a ruler while student **B** catches it.

They then measure the position of student **B**'s thumb on the ruler, this is the drop distance.

The diagram shows how the measurements were taken.

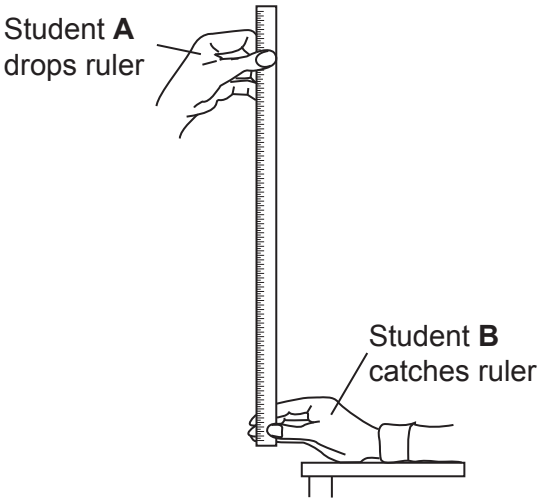

Fig. 19.1

The drop distance is converted into a reaction time. The reaction time in seconds for each hand is recorded in a table.

(a) **(i)** Identify **two** possible sources of error in this method of measuring reaction time.

1 .....

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2 .....

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[2]

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(ii) A second method of measuring reaction time involves a computer reaction time program shown in **Fig. 19.2**.

Each student is asked to click the "Start" button. After a 3-second delay a number randomly flashes up. The student moves the mouse to click on the flashing number.

Left hand is used first then the right hand.

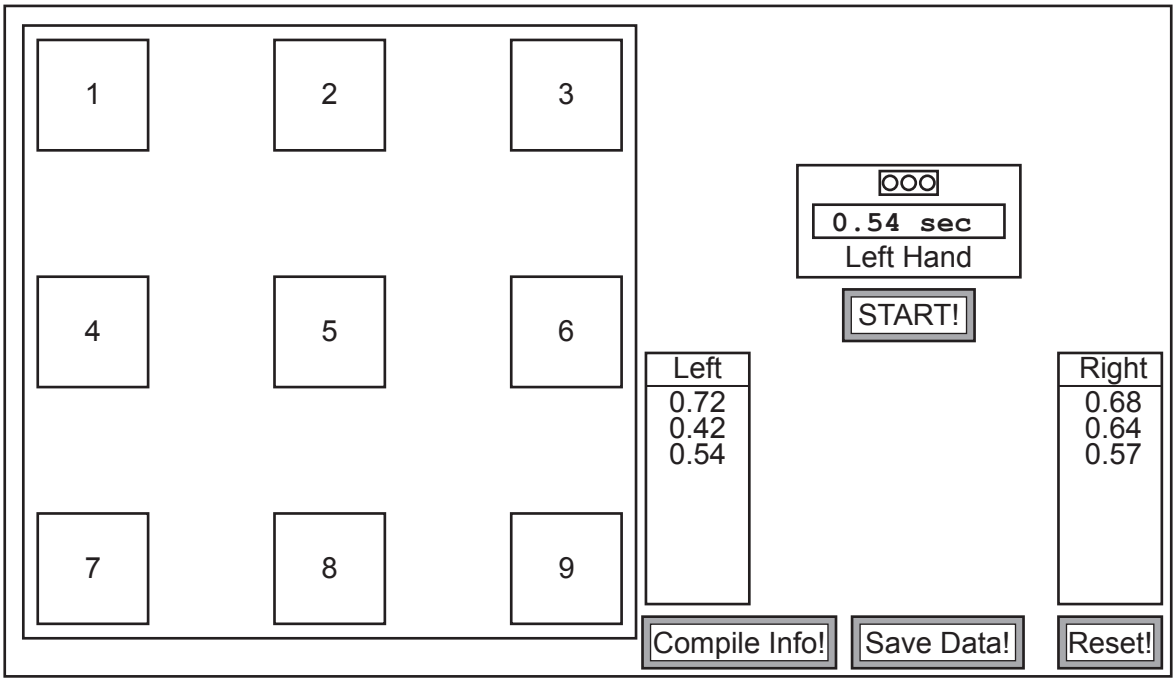

Fig. 19.2

This second method is a better design than the first method but it could still be improved.

Explain why it is a better designed experiment than the first method and suggest how this second method could be improved.

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..... **[3]**

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(b) The table shows the results for ten **right handed** students in the class.

Reaction time (seconds)	
Left non-dominant hand	**Right dominant hand**
0.22	0.21
0.23	0.25
0.27	0.23
0.24	0.24
0.25	0.24
0.25	0.25
0.25	0.26
0.25	0.26
0.25	0.26
0.27	0.28
Mean = 0.25	Mean = 0.25

(i) Calculate the **median** for the right dominant hand.

Answer = ... **[2]**

(ii) The mean and median for the left non-dominant hand are identical.

What **other** conclusions can be made about reaction times in these ten students?

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

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(c) **(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?

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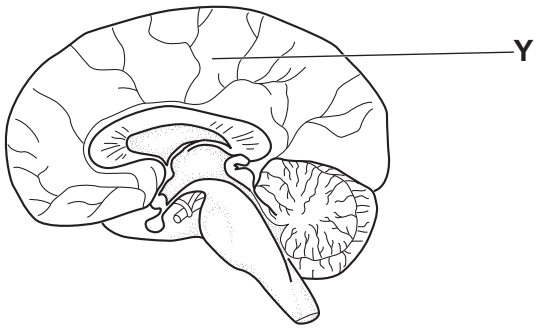
..... **[1]**

(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.

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

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20 **(a)** This question is about control and coordination.

The diagrams show a section through the skin in two different conditions.

Diagram A

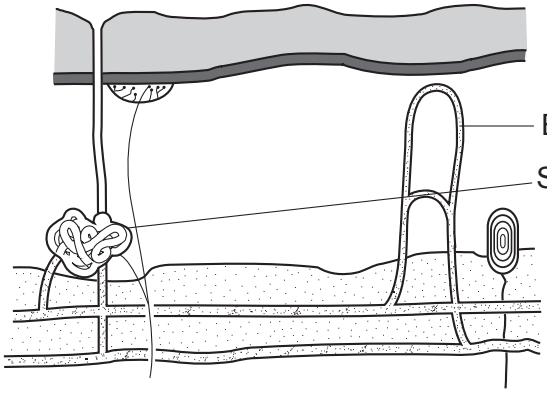
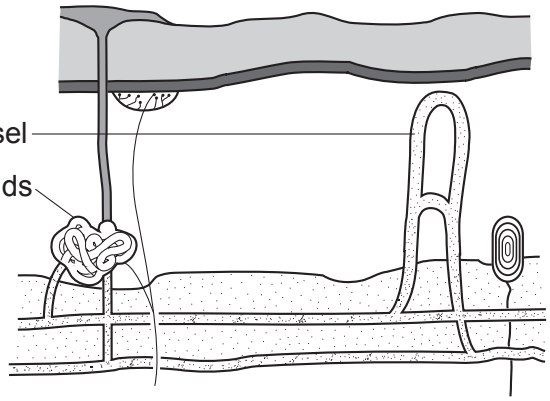


Diagram B



Which diagram shows the skin in a hot, humid environment?

Explain your answer.

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..... **[3]**

(b) Adrenaline is an important hormone in the body. It helps to prepare the body for a 'fight or flight' response.

Sports injuries which involve cuts and bleeding are often treated with a dilute solution of adrenaline.

Explain why.

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

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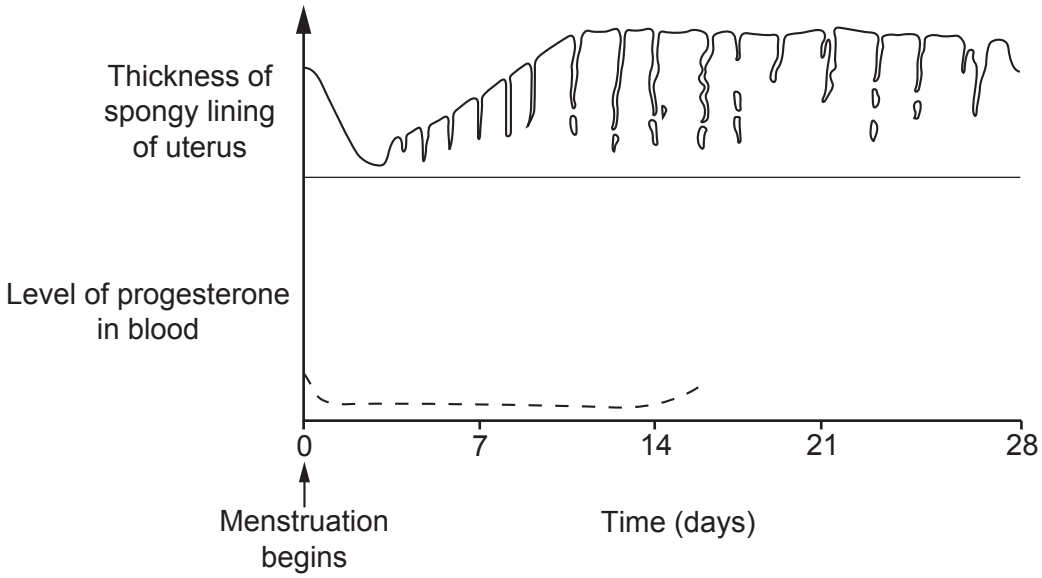
(c) The graph shows how the lining of the uterus changes during the menstrual cycle and also shows the level of progesterone in the blood.



(i) Where in the ovary is progesterone produced?

..... **[1]**

(ii) Draw a line to continue the graph to show the levels of progesterone until day 28 (assume that an egg has not been fertilised). **[2]**

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(d) **(i)** An egg develops in a follicle before ovulation. The follicle has a diameter of 25×10^{-3} mm at the start. This follicle grows to 20 mm in diameter just before the egg is released.

Calculate the increase in size of the diameter of the follicle.

Give your answer to **2** decimal places.

Answer = ... mm **[3]**

(ii) The failure of a follicle to increase in size can result in less production of oestrogen.

Explain what effect this may have on the uterus.

..... **[1]**

(iii) Explain how hormones can be used to treat infertility in women.

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..... **[3]**

(iv) Infertility can also be caused by problems in the male.

Plasmin is a protease enzyme important in sperm movement.

Explain how changes to the structure of DNA could result in the plasmin enzyme being faulty.

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

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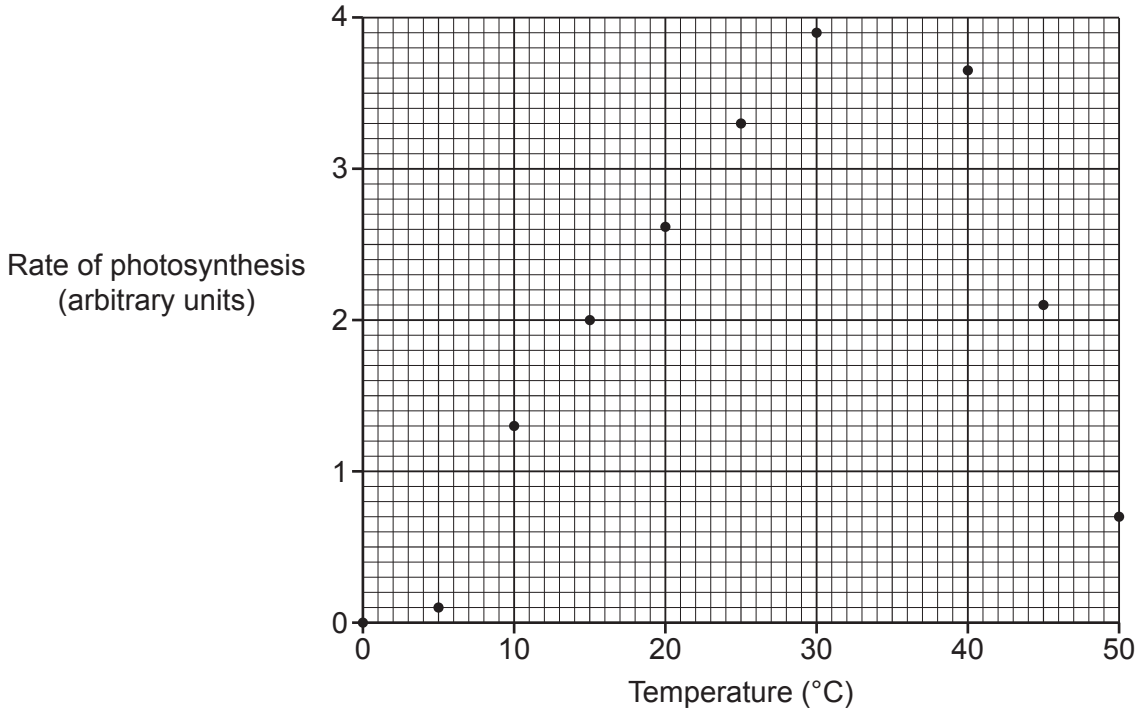
21 **(a)** Photosynthesis involves reactions that are endothermic.

What is meant by the term endothermic reaction?

..... **[1]**

(b) The graph is from an experiment to show the effect of temperature on the rate of photosynthesis.



Draw a line of best fit. **[1]**

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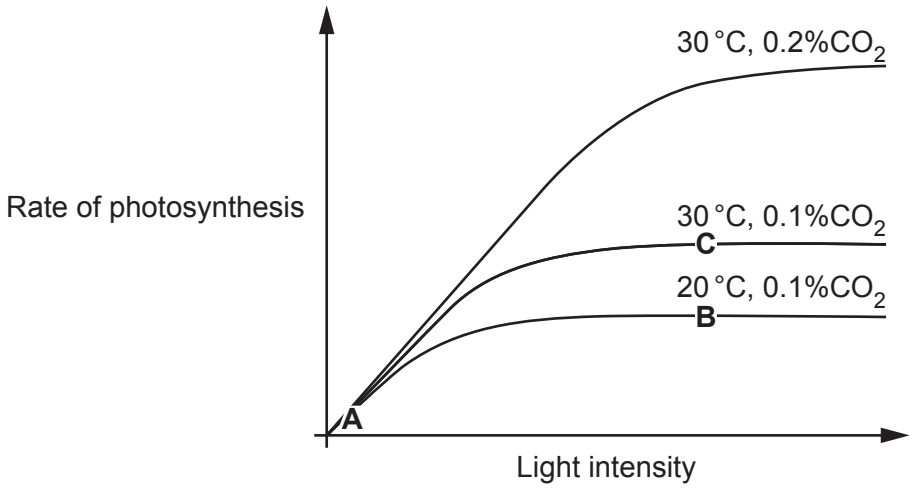
(c) Look at the graph. It shows how light intensity affects the rate of photosynthesis.

The lines show different carbon dioxide concentrations and temperatures.



Explain what is limiting the rate of photosynthesis at the three points **A**, **B** and **C** on the graph.

Use evidence from the graph in your answer.

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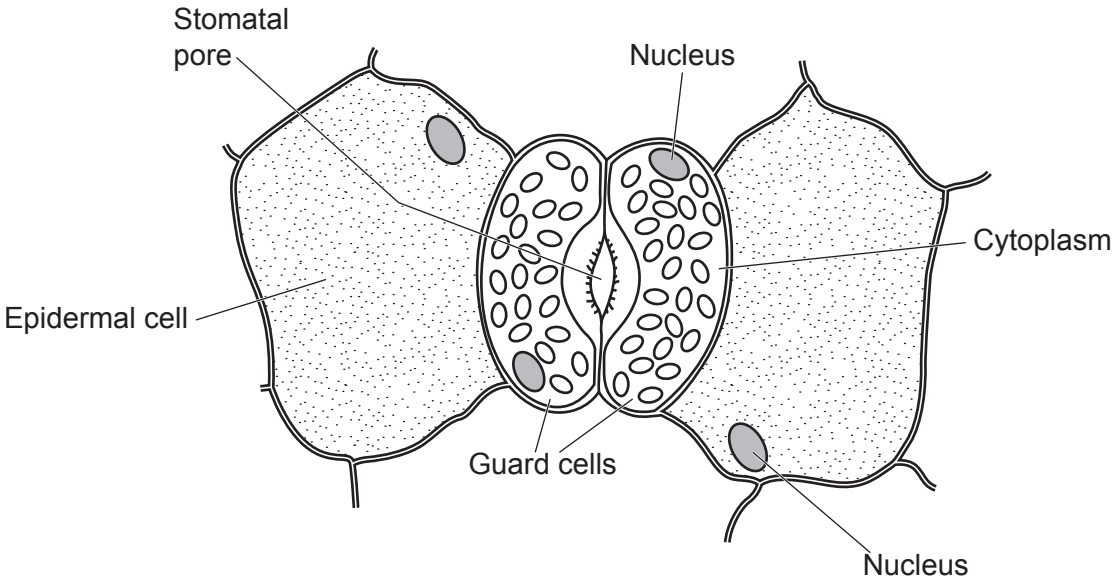
(d) The diagram shows structures on the surface of a leaf.



(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.

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..... **[4]**

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

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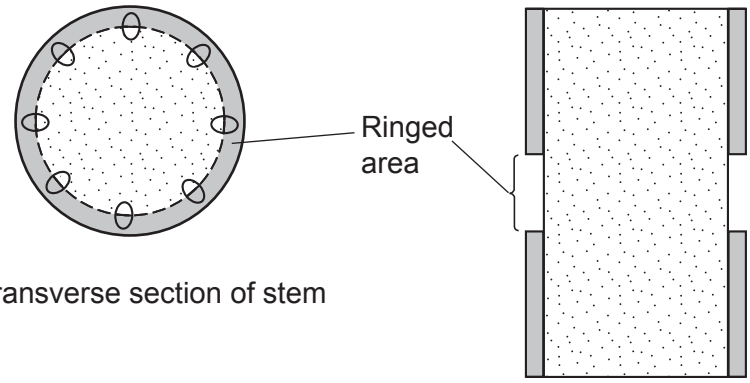
(e) An experiment was done to look at the effect of 'ringing' on a tree trunk. Ringing removes a strip of plant tissue from around the stem of the tree.

The diagram shows where the stem is ringed.

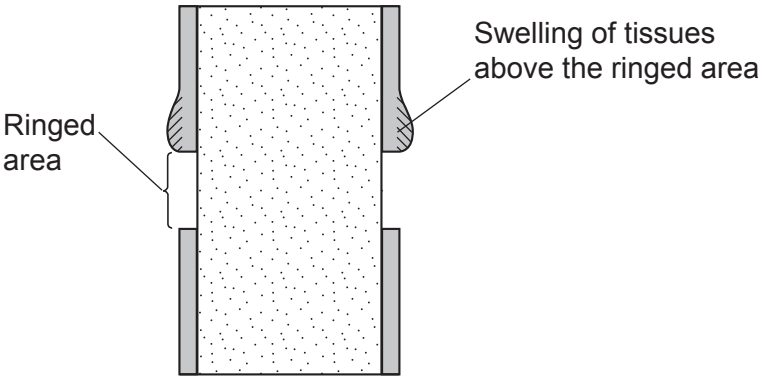


Transverse section of stem

Longitudinal section of stem

The results were recorded after one week.

The diagram shows the results.



Longitudinal section of stem

What conclusions can be made about the results?

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..... **[3]**

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

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