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F

Friday 06 November 2020 – Afternoon

GCSE (9–1) Biology A (Gateway Biology) J247/01

Paper 1 (Foundation Tier)

Time allowed: 1 hour 45 minutes

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

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

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

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 has **32** pages.

ADVICE
- Read each question carefully before you start your answer.

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SECTION A

Answer **all** the questions.

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

Write your answer to each question in the box provided.

1 What is meant by the term cell differentiation?

A Cells become organs

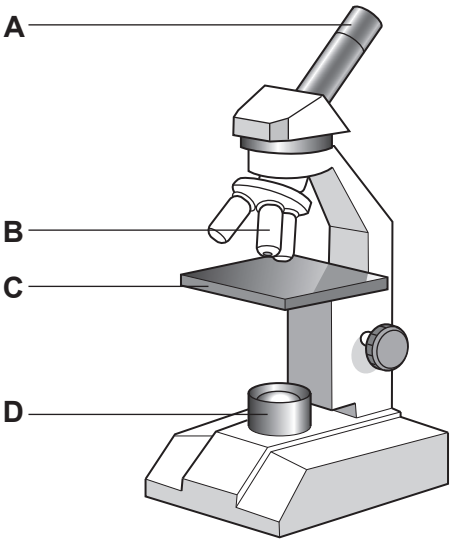
B Cells become organ systems

C Cells become specialised

D Cells become tissues

Your answer ☐ **[1]**

2 The diagram shows a light microscope.



Which label is pointing to the eyepiece lens?

Your answer ☐ **[1]**

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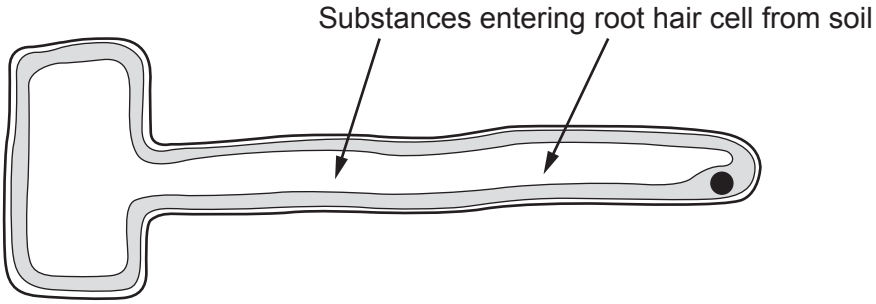
3 Which substances are absorbed from the soil by the root hair cell?



A Carbohydrates and proteins

B Carbon dioxide and nitrogen

C Proteins and vitamins

D Water and mineral ions

Your answer ☐ **[1]**

4 Which monomer is used to make proteins?

A Amino acid

B Fatty acid

C Glucose

D Glycerol

Your answer ☐ **[1]**

5 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]**

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6 Which process moves food around in plants?

A Osmosis

B Respiration

C Translocation

D Transpiration

Your answer ☐ **[1]**

7 Some plants can wilt if they lose more water than they take up.

Which conditions make a plant **most** likely to wilt?

A Higher wind speed and lower temperature

B Lower wind speed and lower temperature

C Lower wind speed and higher temperature

D Higher wind speed and higher temperature

Your answer ☐ **[1]**

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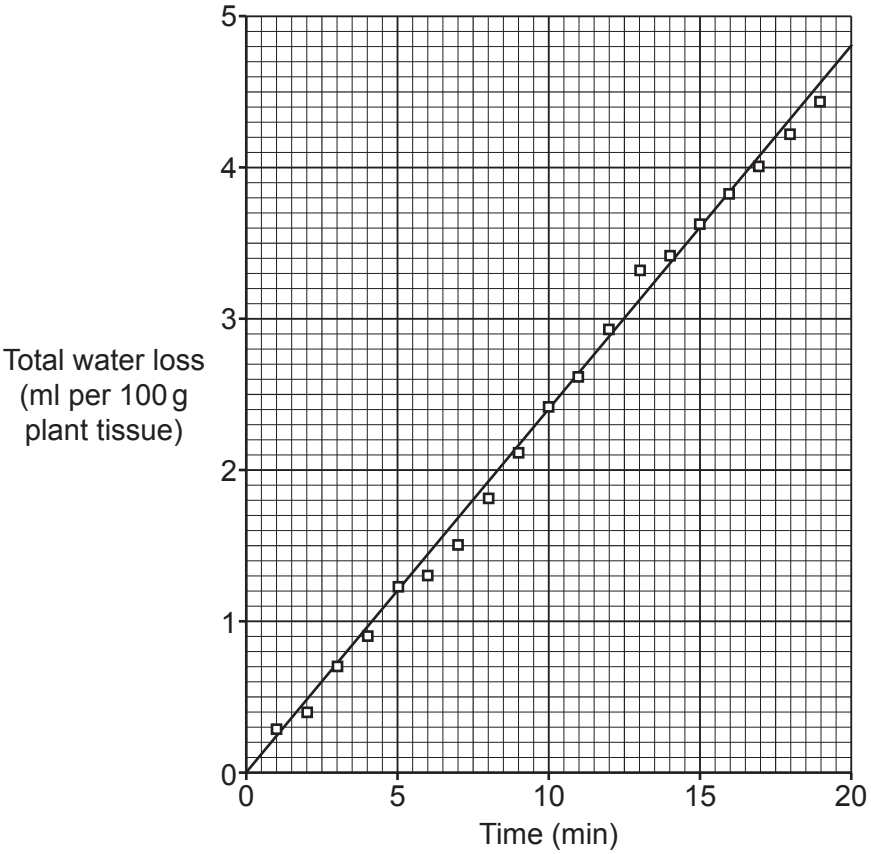
8 The graph shows total water loss from a plant.



Calculate the water lost between 5 and 15 minutes using the line of best fit.

A 2.2 ml per 100 g

B 2.4 ml per 100 g

C 2.6 ml per 100 g

D 2.8 ml per 100 g

Your answer ☐ **[1]**

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9 When a woman reaches the age of about 50, eggs are released less often from her ovaries. To try and correct this, her body increases the production of one hormone.

Which hormone is this?

A Adrenaline

B FSH

C Progesterone

D Testosterone

Your answer ☐ **[1]**

10 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]**

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11 Plants growing in swamps have special roots that grow **upwards** through waterlogged soil to get oxygen from air.

What type of response do these roots show?

A Negative germination

B Negative gravitropism

C Positive germination

D Positive gravitropism

Your answer ☐ **[1]**

12 A light microscope resolution is 0.2 μm. An electron microscope resolution is 0.0001 μm.

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]**

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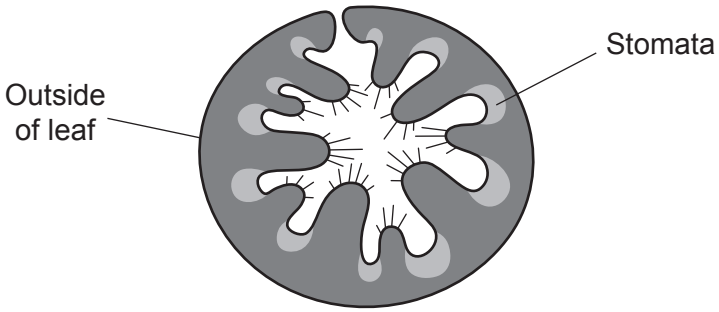
13 Marram grass grows on sand dunes with very little water available. It has a leaf that is curled in on itself so that the stomata are hidden on the inside, as shown in the diagram.



Why does this adaptation help the plant to survive on sand dunes?

A Increases gas exchange from the stomata.

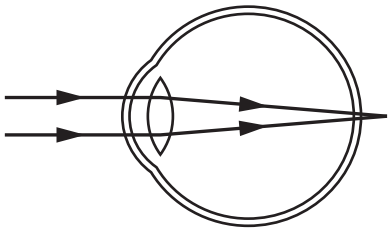
B Reduces air movement around the stomata.

C Increases photosynthesis by the leaf.

D Increases water uptake by the leaf.

Your answer ☐ **[1]**

14 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]**

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15 Anaesthetics used during operations slow down breathing and heart rate.

Which part of the brain do anaesthetics act on to do this?

A Cerebrum

B Cerebellum

C Medulla

D Pituitary

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

16 **(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**.

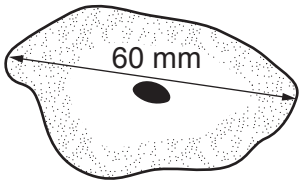

Fig. 16.1

(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 = × ..... **[2]**

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

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

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(c) Some students make a model of DNA.

They use four different colours of round sweets to represent the bases and attach them to two candy laces. **Fig. 16.2** shows their model.

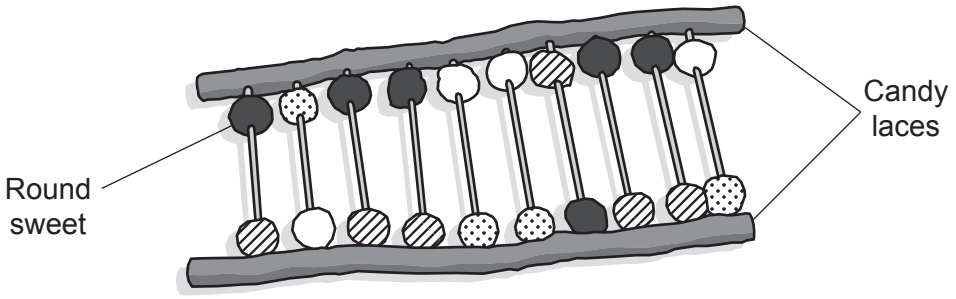

Fig. 16.2

(i) Why did the students use four different colours of round sweets in their model of DNA?

.....

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

(ii) Write down the names of the **two** types of chemical group represented by the candy laces.

1 .....

2 .....
[2]

(d) Respiration is a reaction that happens in all cells.

(i) Why do cells need respiration?

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

(ii) Cells use aerobic respiration when oxygen is available.

What are the **two** products of aerobic respiration?

1 .....

2 .....
[2]

(iii) Aerobic respiration releases heat energy.

What term describes a reaction that releases heat energy?

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

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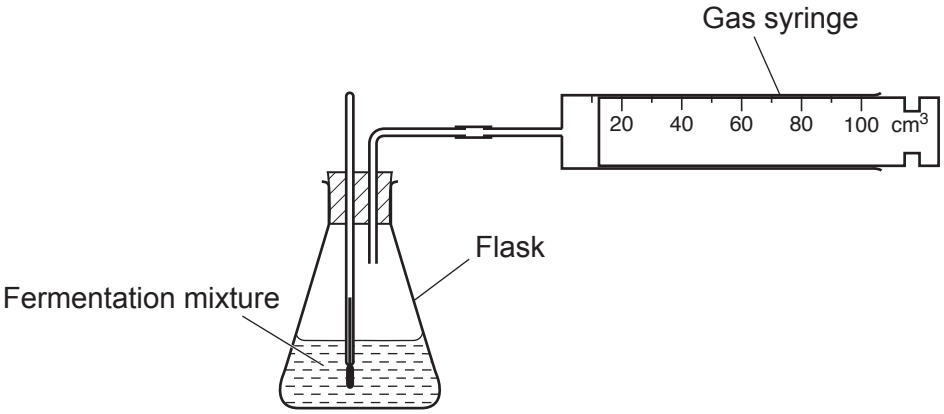
17 Fermentation involves enzymes breaking down sugar and releasing carbon dioxide gas.

The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.
She measures the volume of carbon dioxide released in 10 minutes.
The diagram shows the apparatus she uses.



(a) Using a Bunsen burner to heat a water bath is **one** way the student could keep the flask at a constant temperature.

(i) What other way could be used to keep the flask at a constant temperature?

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

(ii) She chooses to use a Bunsen burner and water bath.

Give **one** safety precaution she should take.

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

(iii) Explain why using a Bunsen burner and water bath may introduce errors into her results.

.....

.....

.....

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

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(b) The table shows the student's results.

Temperature (°C)	Volume of carbon dioxide gas released in 10 minutes (cm^3)				
	Trial 1	**Trial 2**	**Trial 3**	**Mean**	**Range**
25	23	25	22	23	22–25
30	34	29	33	.....	29–34

(i) Calculate the **mean** for the results at 30 °C and **complete the table**.

[2]

(ii) The student repeated the experiment at two more temperatures, 20 °C and 35 °C, to get enough readings to plot a line graph.

Which measurement should the student plot on the **x-axis**?

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

(iii) Describe **one** way that the range would improve any conclusions made from the graph.

.....

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

(iv) The mean volume at a temperature of 20 °C was 15 cm^3 and for a temperature of 35 °C it was 27 cm^3.

Describe what the student's results show about the effect of temperature on enzyme activity.

.....

.....

.....

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

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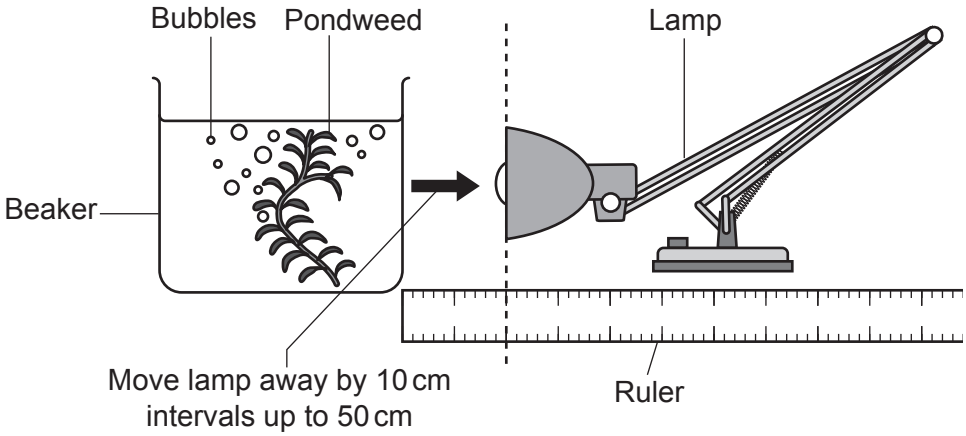
18 Two students investigate photosynthesis. Look at the notes from their investigation.

Aim of the experiment

To use pondweed to see how light intensity affects the rate of photosynthesis.

Method

1. Set up the apparatus as in the diagram.
2. Leave the pondweed for five minutes so it can adjust to the new light intensity.
3. Count the number of bubbles given off by the pondweed in one minute.
4. Move the lamp 10 cm further away from the beaker.
5. Leave the pondweed for five minutes so it can adjust again.
6. Count the number of bubbles given off by the pondweed in one minute.
7. Repeat by moving the lamp further away from the beaker by 10 cm intervals until 50 cm is reached.



(a) What is the **independent** variable in their investigation?

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

(b) **(i)** Explain why counting the number of bubbles will not give an **accurate** measure of the rate of photosynthesis.

.....

.....

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

(ii) Describe how the students could develop their investigation to improve the **accuracy** of their results.

.....

.....

.....

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

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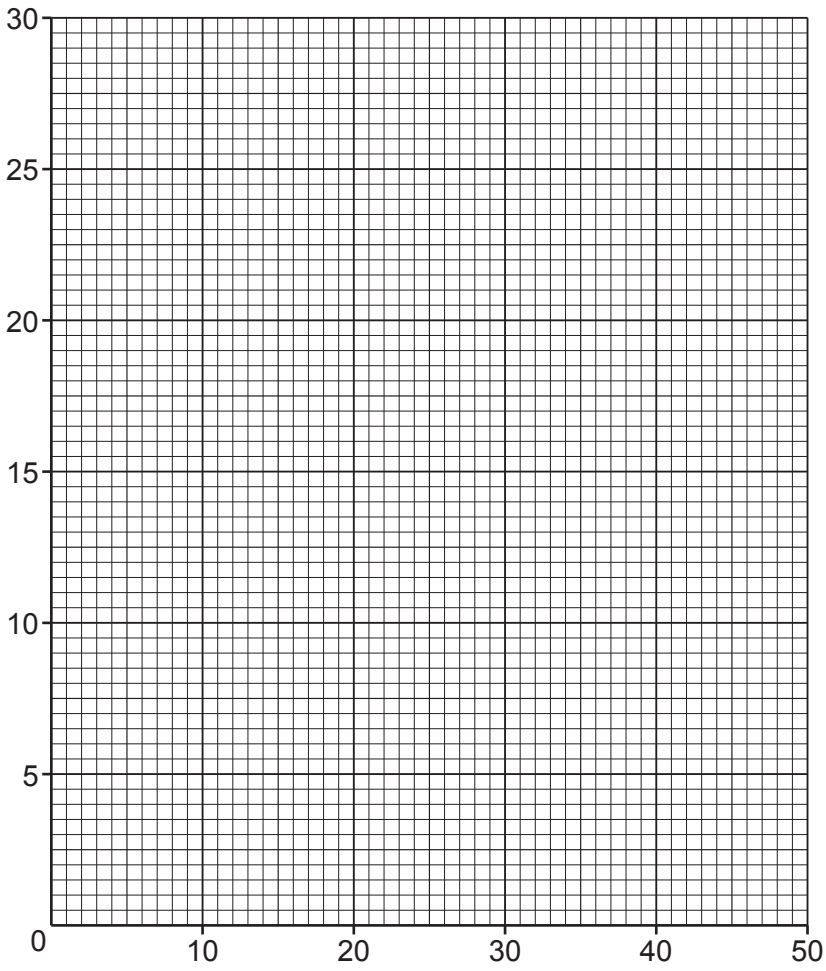
(c) The table shows the results.

Distance from lamp to beaker (cm)	Number of bubbles given off (per minute)
10	30
20	14
30	6
40	2
50	0

(i) One student started to draw a graph but did not finish.

Complete the graph using the results in the table and draw a curve of best fit.



[4]

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(ii) Write down what the students could conclude from their investigation.

Include data from the results table in your answer.

.....

.....

.....

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

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19 Hormones are used in some methods of contraception.

(a) **(i)** Which **two** hormones are found in the most commonly used contraceptive pills?

Put a ring around the **two** correct answers.

FSH **Insulin** **Oestrogen** **Progesterone** **Testosterone** **[1]**

(ii) How does the contraceptive pill containing the two hormones prevent pregnancy?

.....

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

(b) Contraceptive hormones can be used by women in different ways.

Method 1
One contraceptive pill is taken every day at around the same time of day for 21 days.
Then no pill is taken for seven days.

Fewer than 1 in 100 women will get pregnant in a year if they use the contraceptive pill correctly. However, typically 9 in 100 women will get pregnant in a year.

Method 2
A contraceptive implant is a small flexible plastic rod containing hormones. It is inserted under the skin of a woman by a doctor or nurse. It is reversible and needs replacing after 3 years.

Fewer than 1 in 100 women using the contraceptive implant will get pregnant in a year.

Which method is more successful?

Evaluate the information to explain why.

.....

.....

.....

.....

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

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(c) Non-hormonal contraceptive methods have different success rates in preventing women from getting pregnant. The graph shows the success rates of non-hormonal contraceptive methods.

Adapted from 'Effectiveness of birth control methods', from J U Adams, 'Long-term birth control is the most reliable. So why do so few young women use it?', The Washington Post, 24 April 2017, www.washingtonpost.com. Item removed due to third party copyright restrictions.

(i) Write down **two** conclusions from the graph about success rates.

1 .....

.....

2 .....

.....
[2]

(ii) Suggest **one** reason why sterilisation is not widely used in couples without children.

.....

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

(iii) The diaphragm is a circular dome made of thin soft latex with a flexible rim.
It fits inside the vagina forming a seal.

Suggest how a diaphragm acts as a contraceptive.

.....

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

(iv) The cervical cap is like the diaphragm but smaller. It fits over the cervix.

Explain the difference in success rates between the cervical cap and diaphragm.

.....

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

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20 **Fig. 20.1** shows a section through the skin on the back of the hand.

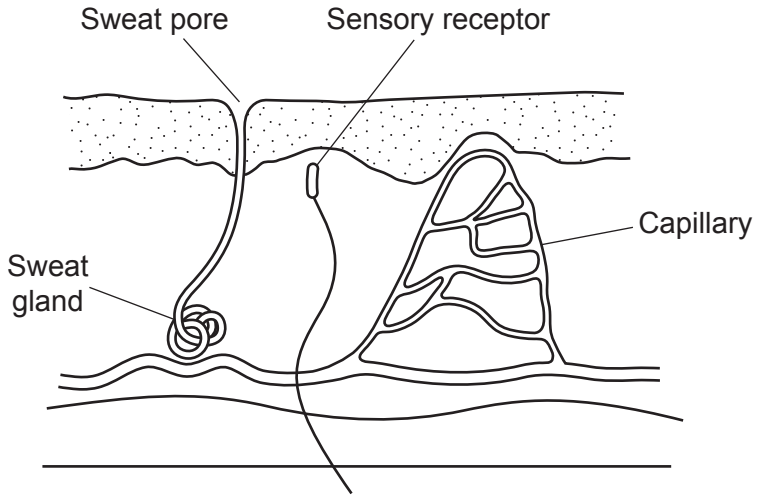

Fig. 20.1

(a) **(i)** Which part of the skin detects something touching the back of the hand?

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

(ii) The body responds when something touches the back of the hand.

Complete the sentences to explain how this happens.

The ..... receives impulses from the skin along sensory neurones.

These impulses are processed and other impulses are sent along

..... neurones to bring about responses.

[2]

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(b) The skin on some areas of the body contains hairs. Modern hair shampoos contain cleaning agents. One cleaning agent is made from fatty acids.

Explain how a **polymer** found in plants and animals can be treated to obtain these fatty acids.

.....

.....

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

(c) **(i)** The skin is important for controlling body temperature.

Explain why overheating of the body may stop chemical reactions in cells.

.....

.....

.....

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

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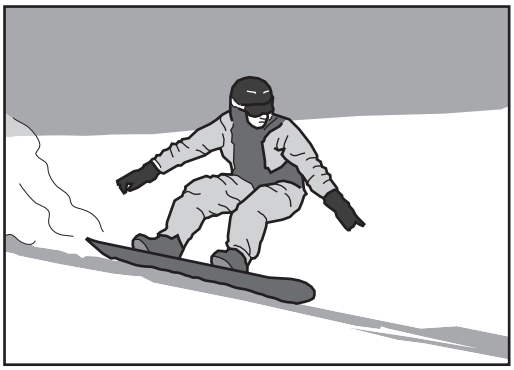
(ii)* Look at **Fig. 20.2** which shows two people riding on boards.

Person A is riding a board on sand in a hot desert. **Person B** is riding a board on snow.

Person A



Person B

Fig. 20.2

Explain the different problems of temperature regulation for these two people and give examples of the ways their bodies solve these problems.

.....

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..... **[6]**

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

They use hydrochloric acid and gelatine cubes that have been stained blue using a pH indicator solution. The indicator will turn red in acidic conditions.

They put different sized cubes into 3 different test tubes of hydrochloric acid and time how long it takes for the cubes to completely change to red.

Fig. 21.1 shows the apparatus they use.

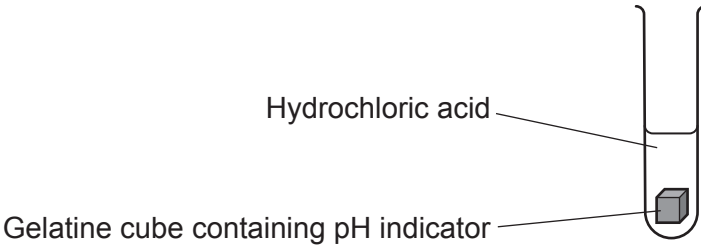

Fig. 21.1

The table shows the students' results.

Length of each side of the cube (mm)	surface area : volume ratio	Time to completely change colour (seconds)
2	.....	32
4	3 : 2	61
6	1 : 1	170

(a) **(i)** Calculate the surface area : volume ratio for the cube with sides of 2 mm.

surface area : volume ratio = ... **[2]**

(ii) What conclusion can be made about the effect of surface area : volume ratio on the rate of diffusion?

.....

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

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(iii) Emphysema causes some of the walls of alveoli in the lungs to break down. This produces a smaller number of larger air sacs.

Use the results to explain the effect of emphysema on oxygen diffusing into the blood.

.....

.....

.....

.....

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

(b) In a condition called sickle cell anaemia, the red blood cells can change shape. This reduces the amount of oxygen getting to cells in the body.

Fig. 21.2 shows a red blood cell and a sickled red blood cell.

Red blood cell **Sickled red blood cell**

Fig. 21.2

Explain why sickle cell anaemia reduces the amount of oxygen getting to cells in the body.

.....

.....

.....

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

(c) Red blood cells burst when they are placed in a solution with a much higher water potential than the red blood cells. This is called lysis.

Explain why lysis happens.

.....

.....

.....

.....

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

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22 **Fig. 22.1** shows the mass of urea in the urine plotted against the BMI (Body Mass Index) for nine boys. BMI is a value often used to see if a person is a healthy mass for their height.

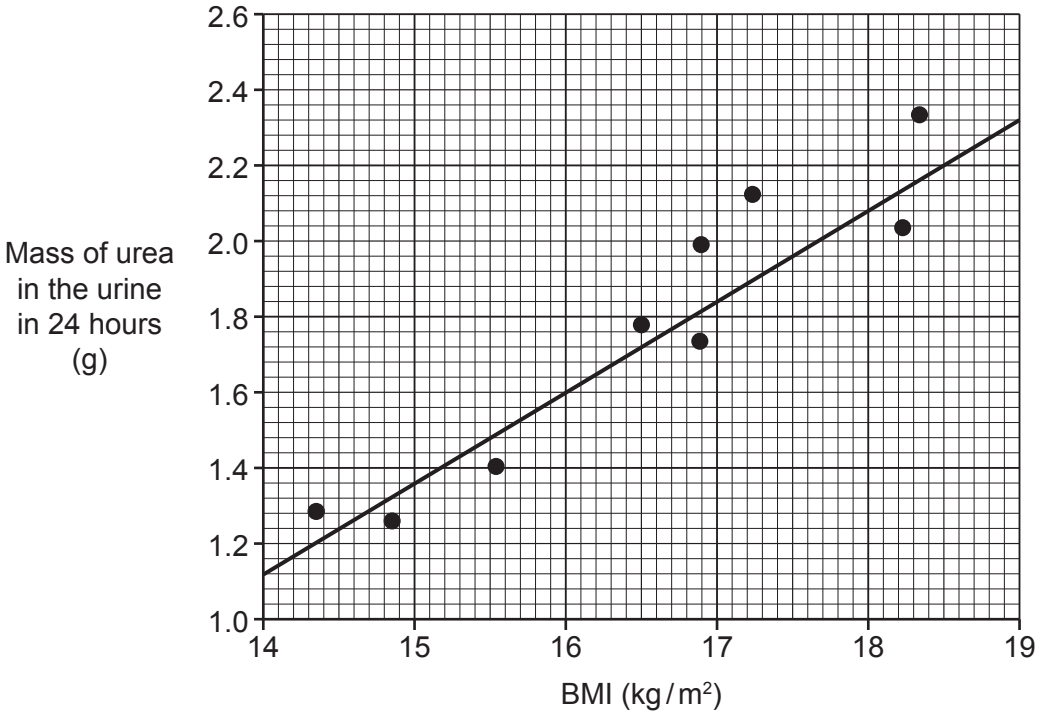

Fig. 22.1

(a) **(i)** What does the graph show about the relationship between BMI and the mass of urea in the urine?

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

(ii) A boy has a BMI of 16. He produces 1000 cm^3 of urine in 24 hours.

Calculate the concentration of urea in the boy's urine.

Concentration = ...g / cm^3
[2]

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(iii) **Fig. 22.2** shows the mass of urea in the urine against the BMI for nine **different** boys.

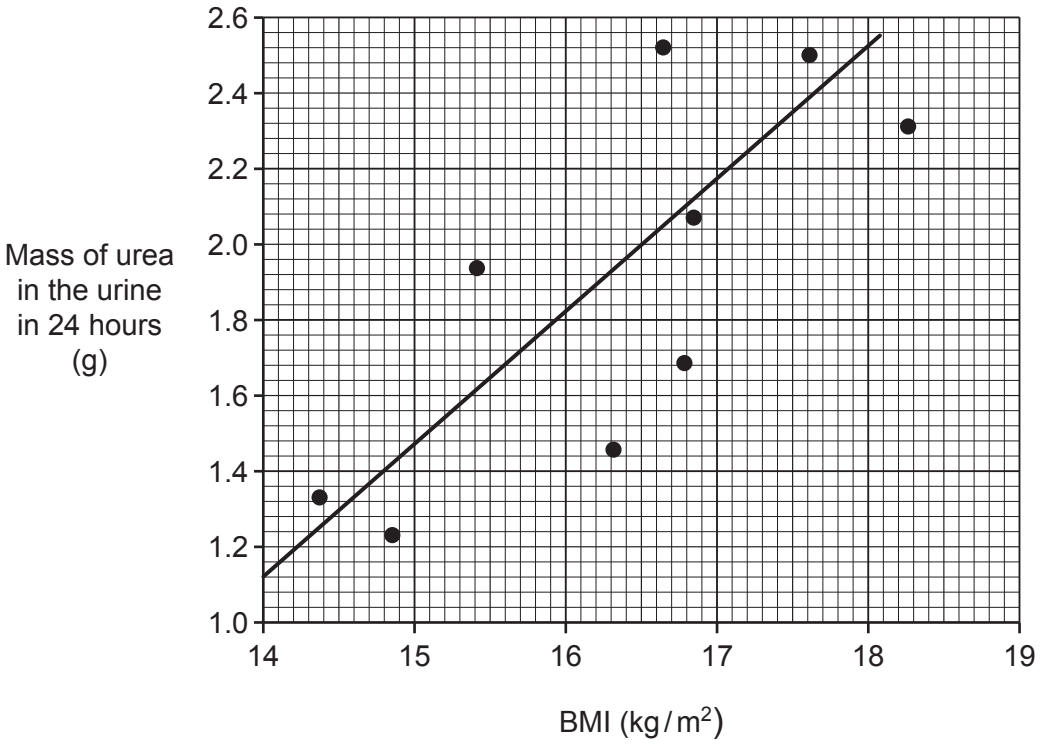

Fig. 22.2

Give **two** differences in the relationship between BMI and the mass of urea in the urine shown in **Fig. 22.1** and **Fig. 22.2**.

1 .....

.....

2 .....

.....

[2]

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(b) The kidney filters the blood. The fluid produced by filtering the blood passes through kidney tubules.

Each kidney tubule contains a number of different parts.

Put a number (**1** to **5**) in the boxes to show the order of the parts that the liquid passes through.

The first one has been done for you.

Bowman's capsule	**1**
Collecting duct	
Proximal convoluted tubule	
Loop of Henlé	
Second coiled region	

[3]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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