OCR
Oxford Cambridge and RSA

F

Friday 06 November 2020 – Morning

GCSE (9–1) Combined Science B (Twenty First Century Science)

J260/01 Biology (Foundation Tier)

Time allowed: 1 hour 45 minutes

8270804048

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

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

J260001

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 **95**.
- 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 **28** pages.

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

Answer **all** the questions.

1 **(a)** Put a (ring) around the correct option to complete each sentence about the structure of DNA.

DNA is a long-chain molecule, which is made from smaller molecules called **amino acids / nucleotides / sugars**.

These smaller molecules join to form a **monomer / polymer / protein**.

Two strands of DNA form a **double / single / triple** helix.

[3]

(b) **(i)** The method for using a light microscope to see a sample of cells is shown below, but is **not** in the correct order.

A A higher power objective lens is selected and used to focus the image.

B A stain is added to the cells.

C The cells are squashed into a thin layer on the slide.

D The lowest objective lens is selected and used to focus the image.

E The prepared slide is placed on the microscope stage.

Write the letters in the boxes to give the correct order for the method.

The first one has been done for you.

C				

[3]

(ii) A student calculates the length of a plant and animal cell using a light microscope.

The length of the plant cell is 100 μm.
The length of the animal cell is 25 μm.

How many times **bigger** is the plant cell compared to the animal cell?

Put a (ring) around the correct answer.

2500 **40** **4** **0.25** **[1]**

(c) Animal cells are approximately 10 times bigger than bacterial cells.

Which statement about **order of magnitude** for animal cells and bacterial cells is **true**?

Tick (✓) **one** box.

Animal cells are the **same** order of magnitude as bacterial cells. ☐

Animal cells are **ten** orders of magnitude bigger than bacterial cells. ☐

Animal cells are **two** orders of magnitude bigger than bacterial cells. ☐

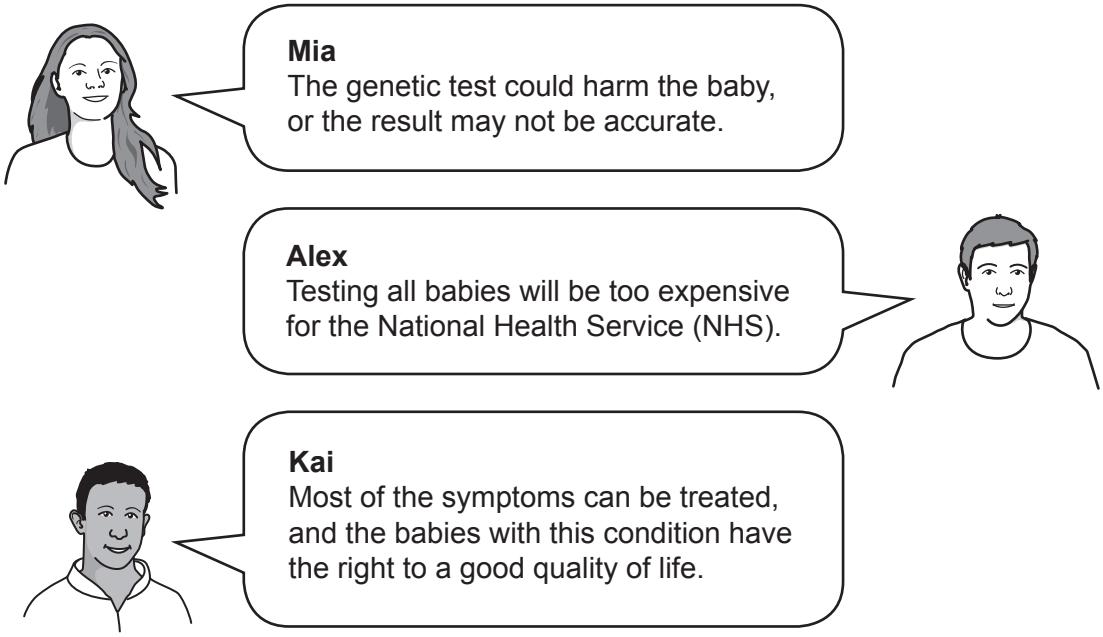
Animal cells are **one** order of magnitude bigger than bacterial cells. ☐

[1]

2 DiGeorge syndrome is a genetic disorder caused by the deletion of a small part of chromosome 22.

A genetic test can be used to show if babies have this disorder.

(a) Some friends are discussing if babies should be genetically tested for DiGeorge syndrome soon after they are born.



(i) Which friend is considering risk?

.....

[1]

(ii) Which friend has a concern that should be answered by government and society?

.....

[1]

(iii) Which friend is thinking about ethical issues?

.....

[1]

(iv) Give **one** other example of when a genetic test could be used.

.....

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

(b) 679 106 babies were born in the UK in 2017.

It is estimated that 1 in every 2000 babies are born with DiGeorge syndrome.

Calculate the expected number of babies born in 2017 with DiGeorge syndrome.

Give your answer to the **nearest whole number.**

Expected number = ... **[2]**

(c) Scientific discoveries are often reported in newspapers.

Why is it important that scientific discoveries are reported in newspapers?

Tick (✓) **two** boxes.

More people read newspapers than scientific journals. ☐

Scientists write in newspapers to make money. ☐

Other scientists can check the validity of the work. ☐

The government can see the risks involved in the research. ☐

The research could affect people's lives so they should know about it. ☐

[2]

3 **(a)** Suggest **three** lifestyle factors which can affect good health.

1 .....

2 .....

3 .....

[3]

(b) **(i)** *Salmonella* bacteria can cause food poisoning.

Fig. 3.1 shows some of the body's natural defences against disease.

Which **two** natural defences protect us against *Salmonella*?

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

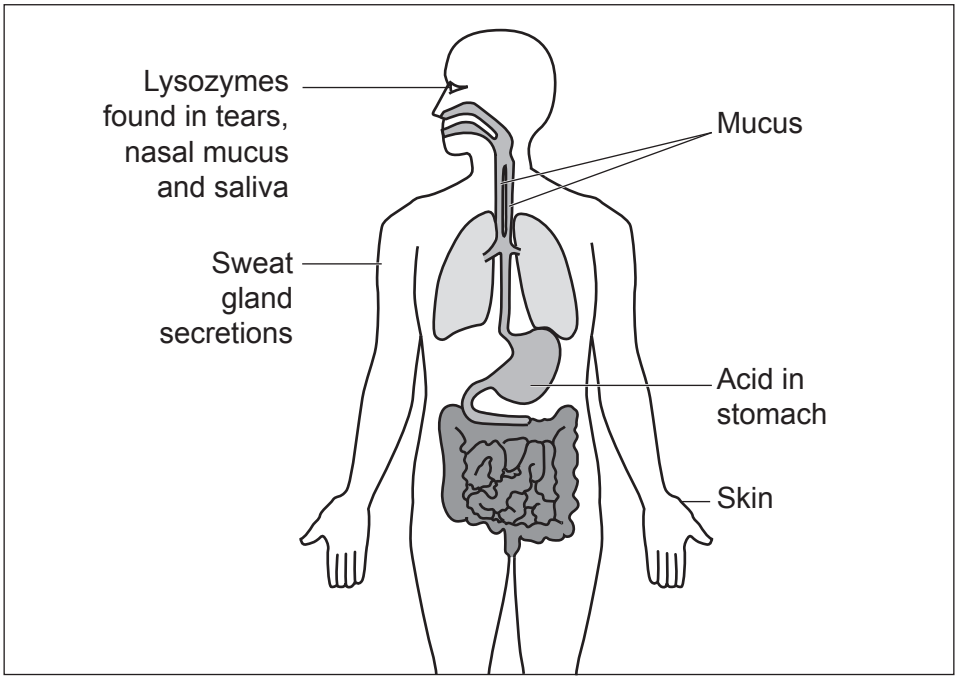


Fig. 3.1 **[2]**

(ii) A population of *Salmonella* bacteria reproduce approximately every 30 minutes.

Calculate how many *Salmonella* bacteria will be present after four hours, when starting with one bacterium in the population.

Assume no bacteria have died.

Number of *Salmonella* = ... **[2]**

(iii) *Salmonella* infections can be treated with antibiotics.

Which **two** statements explain why doctors do **not** usually give antibiotics to people infected with *Salmonella* bacteria?

Tick (✓) **two** boxes.

Antibiotic use causes individual bacteria to become resistant. ☐

Antibiotics do not kill viruses. ☐

Antibiotic use increases the chance of antibiotic-resistant bacteria surviving. ☐

Salmonella bacteria don't cause symptoms in people. ☐

The body's immune system will usually kill all the *Salmonella* bacteria. ☐

[2]

(c) A researcher tested the effectiveness of **three** different concentrations of antibiotic on the growth of *Salmonella* bacteria.

Paper discs were soaked in each antibiotic and then placed on an agar plate which was covered in the *Salmonella* bacteria. One other paper disc was soaked in sterile water as a control disc.

The clear zones are where the bacteria did not grow. The results are shown in **Fig. 3.2**.

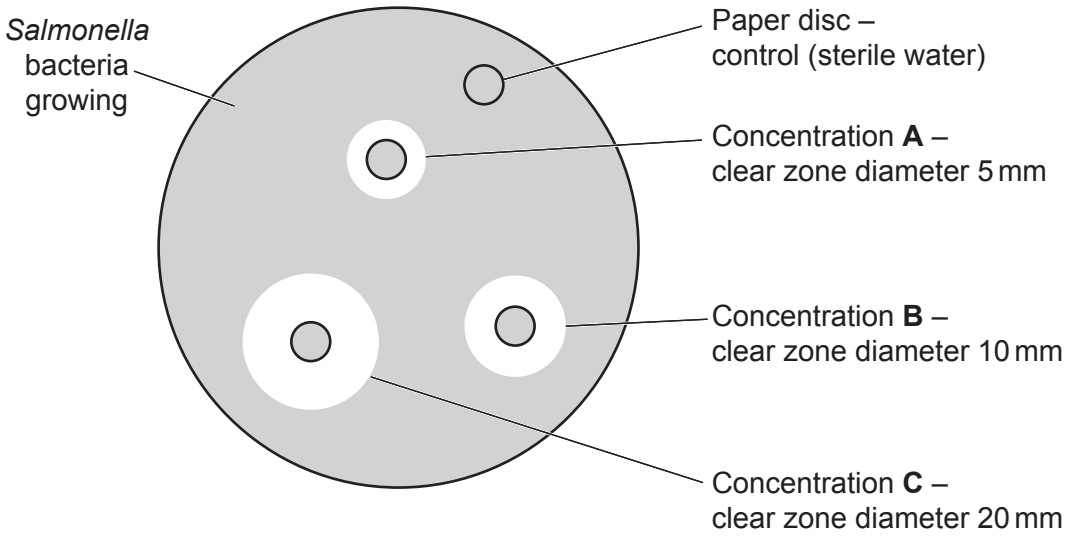


Fig. 3.2

(i) Which concentration of antibiotic, **A**, **B**, or **C**, was the most effective?

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

(ii) Calculate the cross-sectional area of the clear zone (including the area of the disc) for the most effective concentration of antibiotic.

Use a clear zone diameter given in **Fig. 3.2**.

Use the formula: πr^2

$\pi = 3.14$

Cross-sectional area = ... mm^2 **[3]**

(d) Some antibiotics work by attacking bacterial cell walls.

Why do these antibiotics **not** attack human cells?

Tick (✓) **one** box.

Human cells do not have a cell wall. ☐

Human cells have a cell wall and a cell membrane. ☐

The cell wall in human cells is too thick. ☐

The cell wall in human cells is too thin. ☐

[1]

(e) (i) Drug companies are trying to develop new medicines.

The four stages in the testing of a new medicine are given below, but are **not** in the correct order.

A Animal testing

B Healthy human volunteers

C Cultured human cells

D Human volunteers with disease

Write the **letters** in the boxes to give the correct order of the stages for the testing of new medicines.

☐ ☐ ☐ ☐

[3]

(ii) Which stage, **A**, **B**, **C** or **D**, **only** assesses the **safety** of the new medicine?

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

4 (a) (i) Shorthorn cattle were kept by 18th century farmers as they produced both meat and milk.

By the 20th century, farmers used selective breeding to produce two types of shorthorn cattle:

Type **A** – cattle that produced a large quantity of good quality meat, but produced little milk.

Type **B** – cattle that produced poor quality meat, but lots of milk.

Describe how farmers used **selective breeding** to produce type **A** shorthorn cattle.

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

(ii) In the 18th century the human population of the world was approximately 1 billion.
The human population of the world now is approximately 8 billion.

Suggest **two** ways in which selective breeding has helped humans.

1. .....

.....

2. .....

.....

[2]

(b) Coat colour in cattle is controlled by genes.

A red cow and a black bull reproduce. The coat colour of the offspring is black, as shown in **Fig. 4.1**.

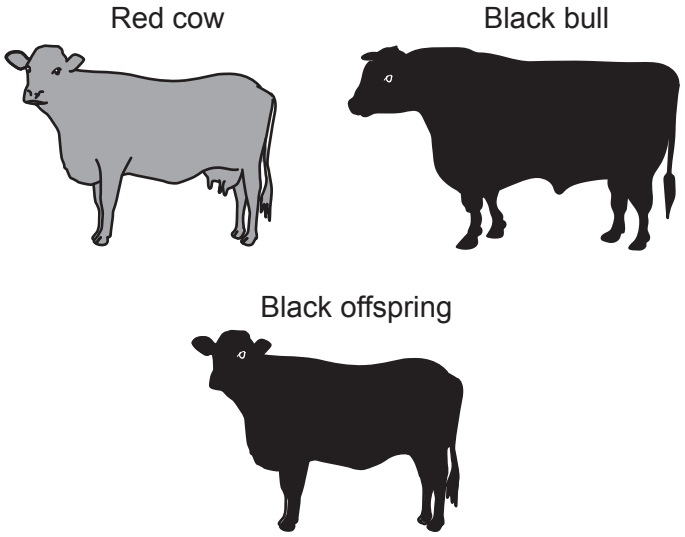

Fig. 4.1

(i) The dominant allele for coat colour is black.

Write down the genotype of a homozygous red cow and a homozygous black bull.

Use **B** to represent the black allele and **b** to represent the red allele.

Genotype of red cow .....

Genotype of black bull ..... **[1]**

(ii) When a homozygous red cow and a homozygous black bull (first generation) are mated **all** of the offspring (second generation) are black with the genotype **Bb**.

If the offspring of homozygous red cows and homozygous black bulls (second generation) breed, some of the offspring in the third generation are black **and** some are red.

Complete the Punnett square to show the expected percentage of black cattle and red cattle in the **third** generation.

Percentage of black cattle = ...%

Percentage of red cattle = ...% **[3]**

(iii) A cow has 60 chromosomes in each of its body cells.

Egg cells are produced by meiosis of body cells.

How many chromosomes are there in the egg cell of a cow?

Tick (✓) **one** box.

15 ☐

30 ☐

60 ☐

120 ☐

[1]

(c) Cows are used in conservation grazing to help prevent grassland turning into woodland. This helps maintain biodiversity.

Draw lines to connect each cow behaviour with how the behaviour helps maintain biodiversity.

Cow behaviour	**How behaviour helps maintain biodiversity**
Cow excretes faeces and urine, which are a form of organic fertiliser.	Allows new plants to start to grow.
Cows eat large fast-growing bracken plants.	Increases the amount of nitrates in the soil.
Grazing produces patches of bare earth.	Reduces competition, so smaller plants can grow.
Hooves tread seeds into the soil.	Seeds are less likely to be eaten by birds.

[3]

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5 **Fig. 5.1** shows a model of the circulatory system in a human.

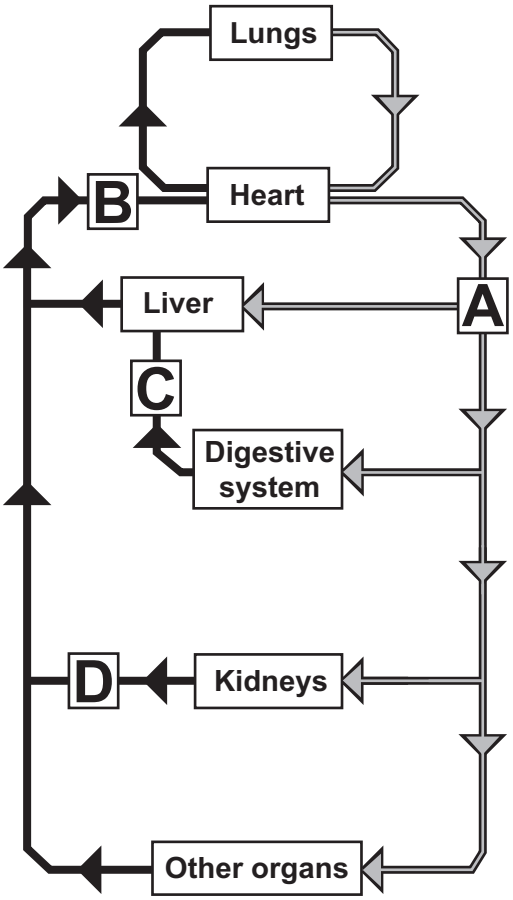

Fig. 5.1

(a) The circulatory system moves substances around the body.

The blood vessels, **A**, **B**, **C** and **D**, in **Fig. 5.1** each carry different compositions of blood.

Identify which blood vessel carries which blood composition. Tick (✓) **one** box in each row.

Blood composition	**A**	**B**	**C**	**D**
The highest concentration of carbon dioxide.				
The highest concentration of dissolved food.				
The highest concentration of oxygen.				
The lowest concentration of urea.				

[4]

(b) Explain how the structure of the **heart** is adapted to pump blood around the body.

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

(c)* Some babies are born with a hole in the heart.

Fig. 5.2 show a cross-section of normal heart and a heart that has a hole in it.

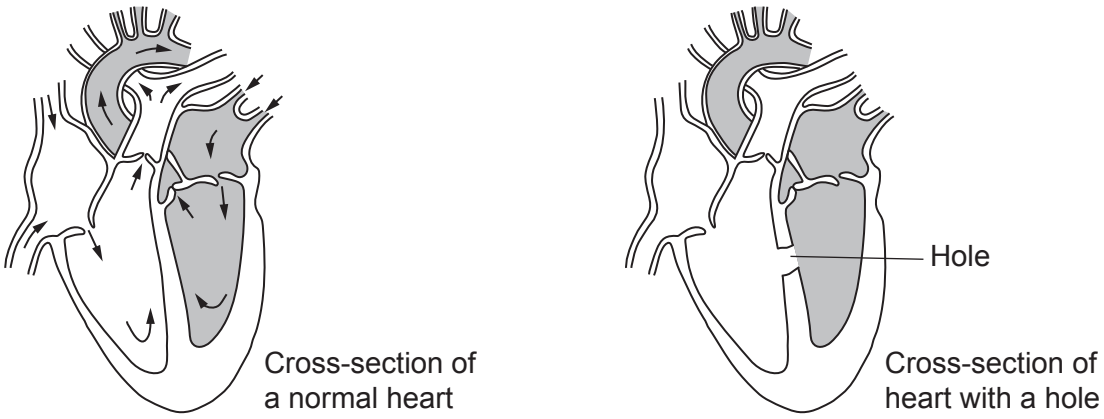

Fig. 5.2

Suggest how the hole in the heart will change the circulation of blood and how this will affect the cellular activity in the baby.

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

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6 **(a)** Blood transports many substances around the body.

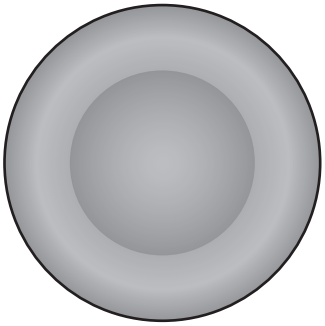
Complete the table to show whether each substance is transported in the blood by the **plasma** or by the **red blood cells**.

Tick (✓) **one** box in each row.

Substance	Plasma	Red blood cells
Carbon dioxide		
Dissolved food		
Oxygen		
Water		

[2]

(b) The diagram shows two views of a red blood cell.



Explain how the shape of a red blood cell is adapted to its function.

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

(c) Red blood cells have an approximate diameter of 7.8×10^{-3} mm.

Convert 7.8×10^{-3} mm into decimal form.

Tick (✓) **one** box.

0.00078 mm ☐

0.0078 mm ☐

0.078 mm ☐

0.78 mm ☐

[1]

7 **(a)** **Fig. 7.1** shows a labelled cross section of a leaf.

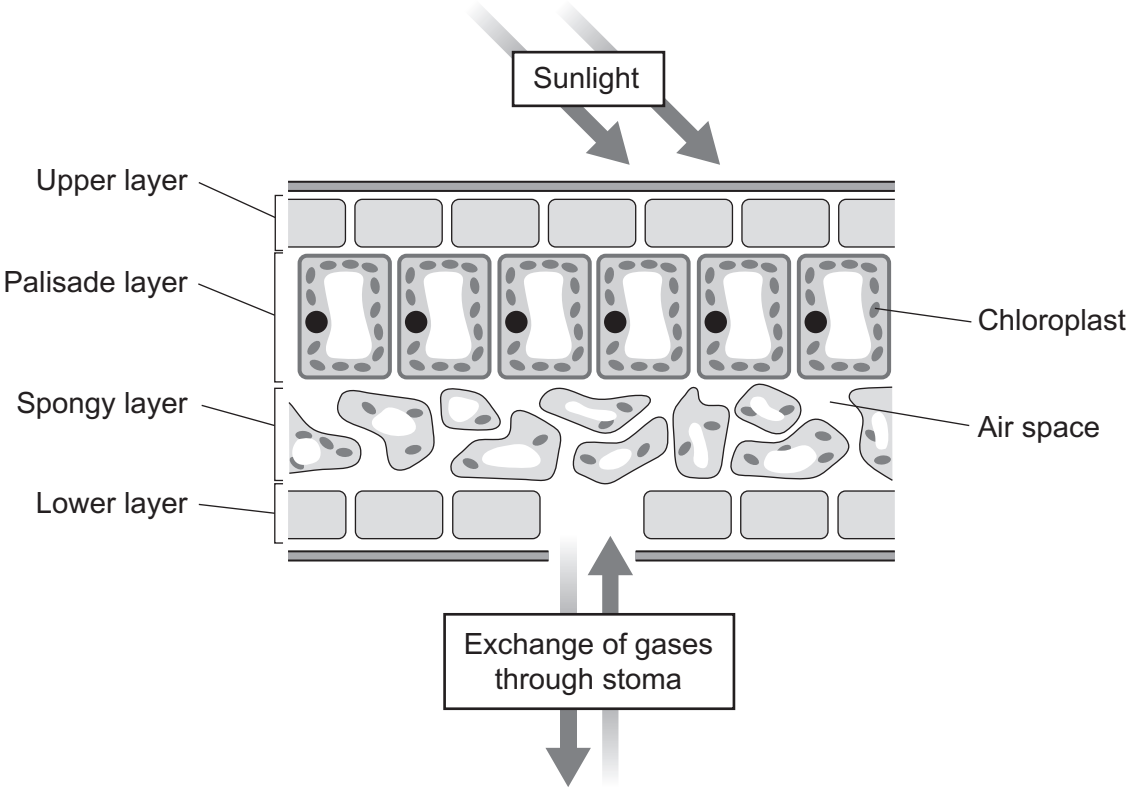


Fig. 7.1

Explain why more photosynthesis takes place in the palisade layer than the spongy layer.

Use **Fig. 7.1** to support your answer.

.....

.....

.....

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

(b) Two transport tissues are found in plants.

(i) Name the transport tissue that transports water and minerals.

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

(ii) Name the transport tissue that transports sugars.

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

(iii) The sugars that are made by photosynthesis move into a transport tissue to go to the rest of the plant.

Which process moves sugars into the transport tissue?

Put a (ring) around the correct answer.

Active transport **Respiration** **Osmosis** **Transpiration** **[1]**

(iv) A student uses a microscope to count the number of stomata in a field of view.

The student counts the number of stomata in three other fields of view, and his results are shown in the table.

Number of stomata per field of view				**Mean**
9	11	14	10	

Calculate the mean number of stomata per field of view.

Use the data in the table.

Mean number of stomata = ... **[1]**

(c) Some of the sugars that are made by photosynthesis are joined together to make a large storage molecule.

What is the name of this large storage molecule?

Tick (✓) **one** box.

Fatty acid ☐

Lipid ☐

Protein ☐

Starch ☐

[1]

8 Amaya feeds birds in her garden.

She wants to see if there is a relationship between the body mass of the bird and how often they are feeding.

(a) Amaya records how often she sees each bird species feeding and produces a dominance rank, as shown in the table.

The highest ranked species, the house sparrow, is seen feeding the most.

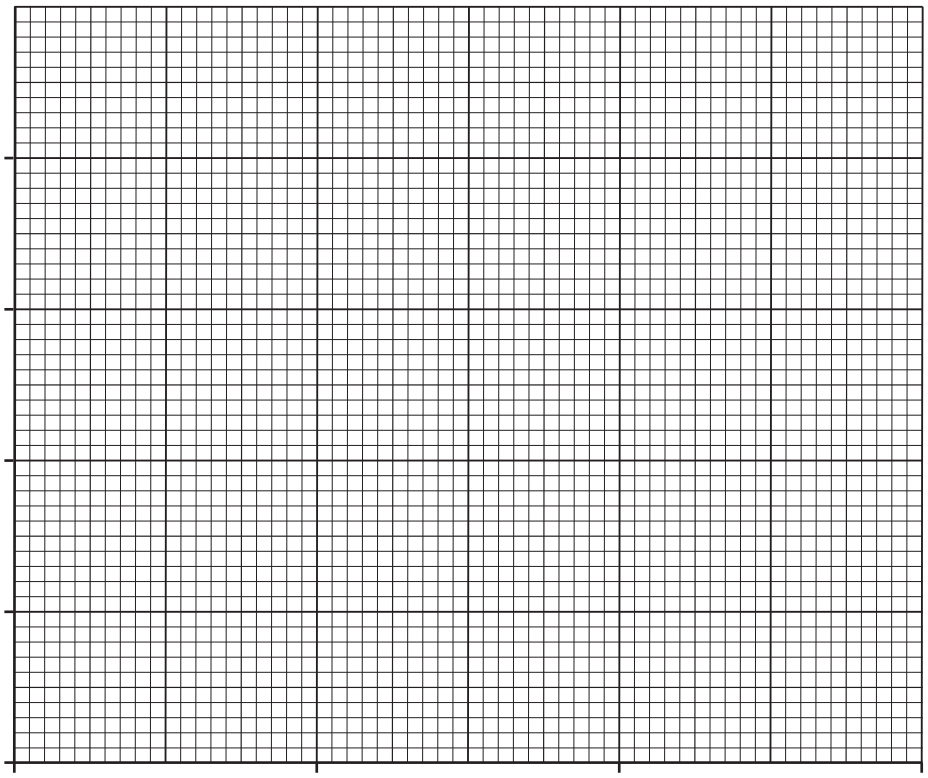
She finds out the mean body mass for each bird species from doing some research.

Bird species	**Mean body mass (g)**	**Rounded body mass (g)**	**Dominance rank**
House sparrow	27.3		1
Nuthatch	21.6		2
Goldfinch	15.5		3
Chaffinch	21.8		4
Coal tit	9.4		5

Complete the table by rounding the mean body mass of each bird species to the **nearest whole number**. **[2]**

(b) **(i)** Plot a graph of dominance rank against rounded body mass, using the data in the table. **[2]**

(ii) Draw a line of best fit. **[1]**



(c) Before Amaya collected the data, she wrote the following hypothesis:

The greater the mass of the species of bird, the more often the species will feed.

(i) Do Amaya's findings **support** her hypothesis?

Use the graph to explain your answer.

.....

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

(ii) Explain why Amaya's findings do **not** prove her hypothesis.

.....

.....

.....

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

(d) The birds in Amaya's garden are part of a community that includes plants and other animal species.

The species in this community are interdependent.

Give **two** reasons why this interdependence is important for the species in the community.

1 .....

.....

2 .....

.....

[2]

9 **(a)** Complete the sentences to describe the process of photosynthesis.

Use words from the list.

You may use the words once, more than once or not at all.

carbon dioxide	**chlorophyll**	**energy**	**glucose**
light	**oxygen**	**protein**	**respiration**
starch	**transpiration**	**water**	

Photosynthesis has two main stages. The first stage requires light and ..... to split water molecules into hydrogen and the waste product ..... . Some of the waste product is used for ..... by the plant, and the excess is released from the leaves. The hydrogen is transferred to the second stage.

In the second stage carbon dioxide and hydrogen combine to make ..... . The process of photosynthesis is endothermic, and endothermic processes require transfer of..... from the surroundings.

[3]

(b) A student is investigating the requirements of photosynthesis.

The student sets up **three** tubes, **Tube A**, **Tube B**, and **Tube C** as shown in **Fig. 9.1**, and leaves them for 24 hours in a room with windows.

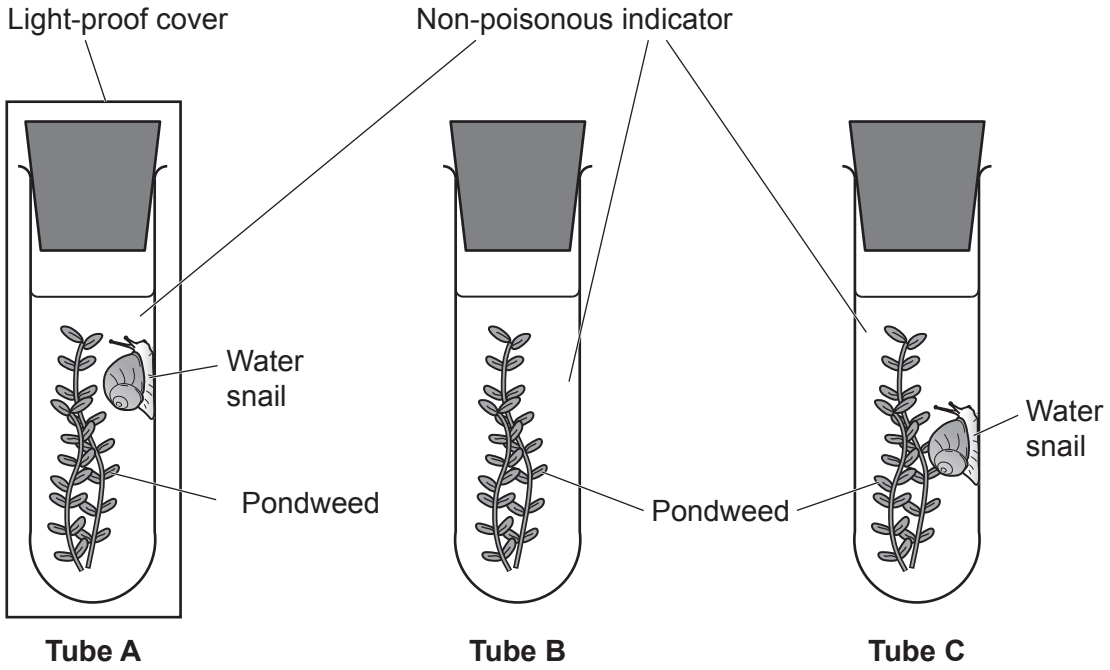


Fig. 9.1

Table 9.1 shows the indicator colour changes when the carbon dioxide level changes.

Carbon dioxide level	**Indicator colour change**
Decreases	Red to purple
Increases	Red to yellow

Table 9.1

Table 9.2 shows the colour of the indicator at the start, and at the end after 24 hours, for each tube.

Tube	**Colour of indicator at the start**	**Colour of indicator at the end after 24 hours**
A	Red	Yellow
B	Red	Purple
C	Red	Red

Table 9.2

(i) Which tube, **A**, **B** or **C**, shows that carbon dioxide is needed for photosynthesis to occur?

Explain your answer.

Tube .....

Explanation

.....

.....

.....

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

(ii) Which tube, **A**, **B** or **C**, shows that light is needed for photosynthesis to occur?

Explain your answer.

Tube .....

Explanation

.....

.....

.....

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

(iii) Explain why the indicator in **Tube C** does **not** change colour.

.....

.....

.....

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

(iv) Identify **one** variable that should be kept the same in the student's investigation.

.....

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

END OF QUESTION PAPER

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).