The human body – 2021/20 GCSE 21st Biology Combined Science B

1. Nov 2021/Paper_J260/01/No.1

Our bodies work constantly to keep our internal environment the same.

(a) What is this process called?

Tick (✓) **one** box.

Homeostasis ☐

Homozygous ☐

Homologous ☐

Hormonal ☐

[1]

(b) The human body maintains an internal temperature of around 37 °C.

Why is it important that this temperature is maintained?

Tick (✓) **one** box.

Enzymes in the human body only work at 37 °C. ☐

Enzymes in the human body stop working at 37 °C. ☐

Enzymes in the human body work best at 37 °C. ☐

Enzymes in the human body work too quickly above 37 °C. ☐

[1]

(c) Diabetes is a disease that affects our body's ability to keep blood sugar concentration constant. There are two main types of diabetes, Type 1 and Type 2.

Complete the table by deciding if each statement is correct for **Type 1 diabetes only**, **Type 2 diabetes only** or **both** types of diabetes.

Tick (✓) **one** box in each row.

Statement	Type 1 diabetes only	Type 2 diabetes only	Both types of diabetes
The body no longer responds to insulin produced.			
Treated using a combination of diet and exercise.			
Can be treated with insulin injections.			
Diet should not contain too much sugar.			
The pancreas stops producing insulin.			

[5]

(d) Complete the sentences to describe how insulin controls blood sugar level.

Put a (ring) around the correct answers.

Eating a sugary food **increases** / **decreases** blood sugar level.

The change in blood sugar level causes an **increase** / **decrease** in the amount of insulin released from the pancreas.

The change in insulin level **increases** / **decreases** the absorption of blood sugar by cells.

[2]

2. Nov 2021/Paper_J260/01/No.2

Ben has cardiovascular disease and is at risk of having a heart attack.

(a) Here are five items of information about Ben:

A Ben is 67 years old.
B Ben walks his dog twice a day.
C Ben smokes 20 cigarettes a day.
D Both of Ben's parents had a heart attack when they were in their 60s.
E Ben is not overweight.

(i) Which **two** items of information about risk can Ben **not** change?

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

(ii) Which **two** items of information help to **reduce** Ben's chances of a heart attack?

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

(b) Cardiovascular disease can damage the heart.

Complete each sentence about how damage to heart muscle cells affects the circulation of blood.

Use the words.

You can use each word once, more than once, or not at all.

less **more** **the same**

After heart muscle cells are damaged, the strength of the muscle contraction is

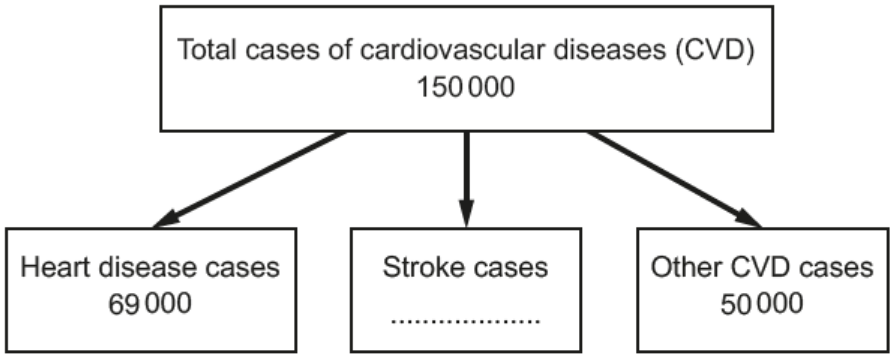
.....

This means the blood pressure is .....

So, the volume of blood supplied to the body with each contraction is .....

[2]

(c) The diagram shows data on the number of people with cardiovascular disease (CVD).



(i) Of the total number of cases of cardiovascular disease, how many cases were from stroke?

Stroke cases = ... **[2]**

(ii) Calculate the percentage of cardiovascular disease cases that were caused by heart disease.

Percentage = ... % **[2]**

(iii) 1 person every 3 minutes is diagnosed with CVD.

Calculate how many diagnosed cases there would be in **one** day.

Diagnosed cases = ... **[2]**

3. Nov 2021/Paper_J260/01/No.4

Blow fly larvae have reflex responses to light. A student is investigating this reflex, as shown in **Fig. 4.1**.

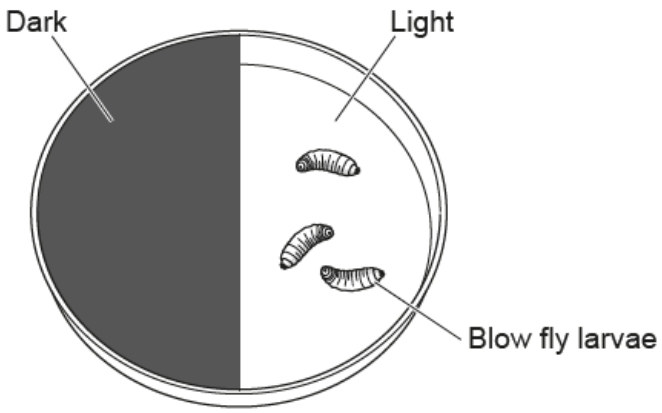


Fig. 4.1

(a) (i) The student is given a method for their investigation, but it is **not** in the correct order.

Method

1. After two minutes count the number of larvae visible.

2. Put on the disposable gloves.

3. Put the lid on the Petri dish.

4. Take the lid off the Petri dish.

5. Turn on the lamp and start the stop clock.

6. Use the tweezers to transfer 10 larvae to the Petri dish.

Write the numbers in the correct order. The first one has been done for you.

2					

[4]

(ii) Some Petri dishes are glass.

Why is it safer to use a plastic Petri dish?

.....

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

(iii) The student notices the lamp gets hot.

Which explanation is correct for how heat could affect the results of the investigation?

Tick (✓) **one** box.

The heat is a waste of energy. ☐

The heat could damage the Petri dish. ☐

The larvae could respond to the heat. ☐

The student could get hurt. ☐

[1]

(b) The blow fly larvae's eyes (receptors) are linked by the nervous system to its muscles (effectors).

The list shows three other parts of the nervous system.

Motor neuron **Relay neuron** **Sensory neuron**

Add the **three** parts to **Fig. 4.2** to show their correct order within the nervous system of blow fly larvae.

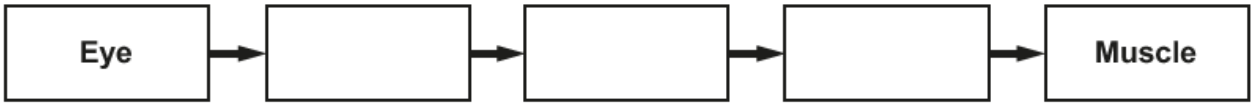


Fig. 4.2

[2]

(c) **Fig. 4.3** shows the structure of a synapse.

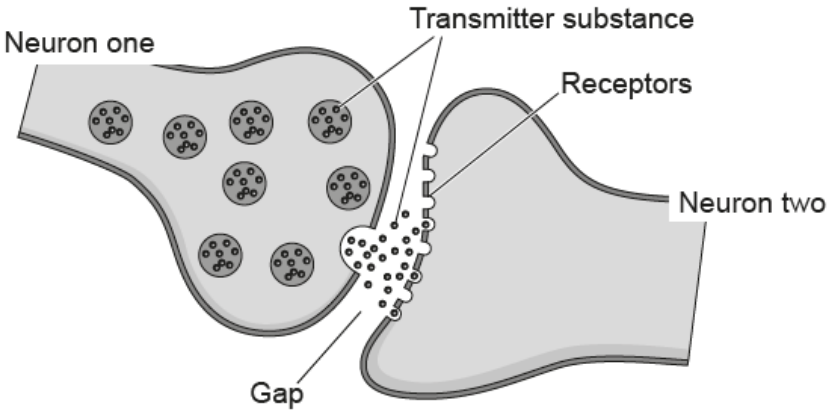


Fig. 4.3

Complete each sentence about how a synapse works.

Use the words.

You can use each word once, more than once, or not at all.

enzymes **diffuse** **receptors** **active site** **impulse**

Neuron one has transmitter substances which are released into the gap.

The transmitter substances ..... across the gap and bind to the

..... on neuron two. This stimulates neuron two.

[2]

4. Nov 2021/Paper_J260/04/No.3

(a) Jack is interested in the effect of different types of exercise on his pulse rate.

Describe how Jack could investigate the effect of different types of exercise on his pulse rate.

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

(b) **Fig. 3.1** shows Jack's pulse rate before, during and after some exercise.

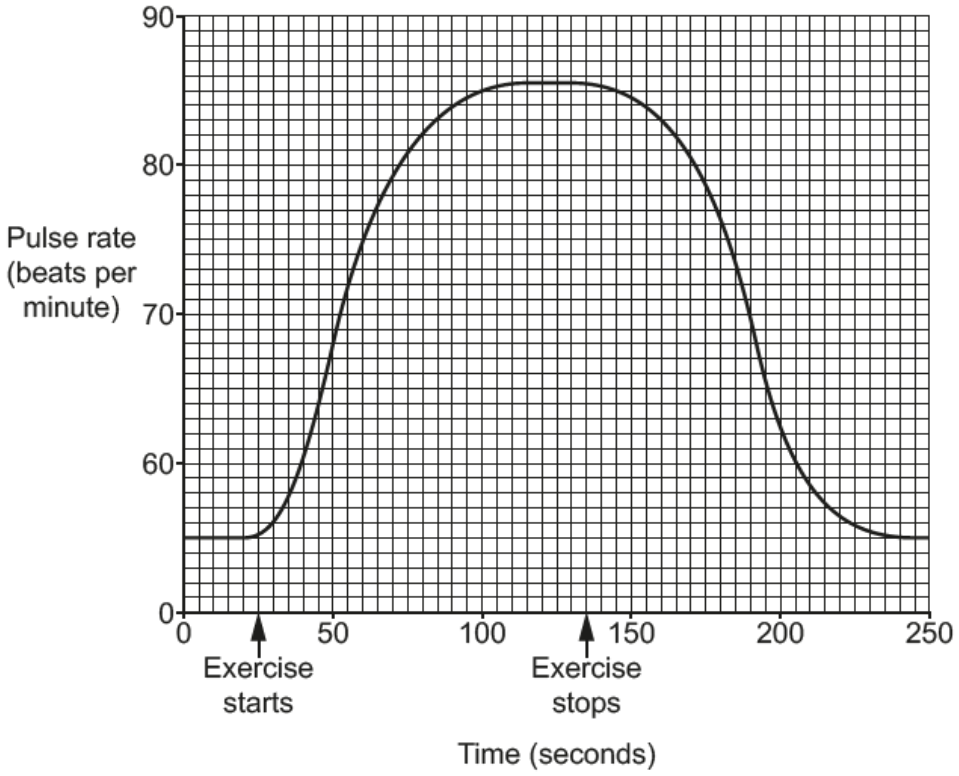

Fig. 3.1

Recovery rate is the time it takes for the pulse rate to return to the resting rate after exercise stops.

Calculate Jack's recovery rate using **Fig. 3.1**.

Give your answer in **minutes** and **seconds**.

Recovery rate = ... minutes ..... seconds **[3]**

(c) Jack measures the pulse rates of two people during and after exercise.

One person is fit and the other is unfit.

The results are shown in **Fig. 3.2**.

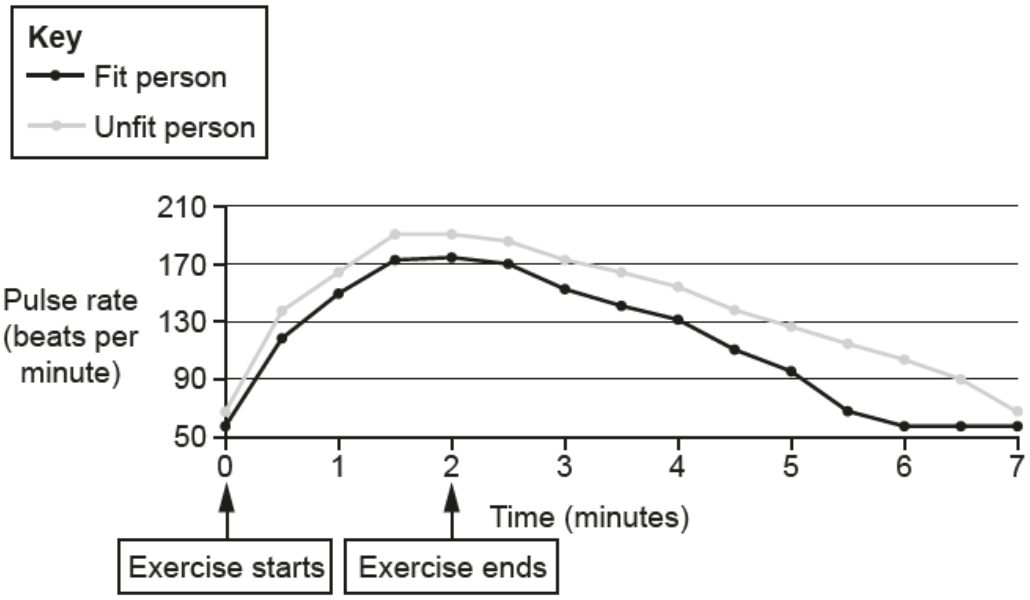

Fig. 3.2

(i) Jack concludes that the fitter a person is, the faster the recovery rate.

Do you agree with Jack's conclusion?

Yes ☐

No ☐

Use **Fig. 3.2** to explain your answer.

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

(ii) Suggest **one** way in which Jack could improve his investigation to increase confidence in his conclusion.

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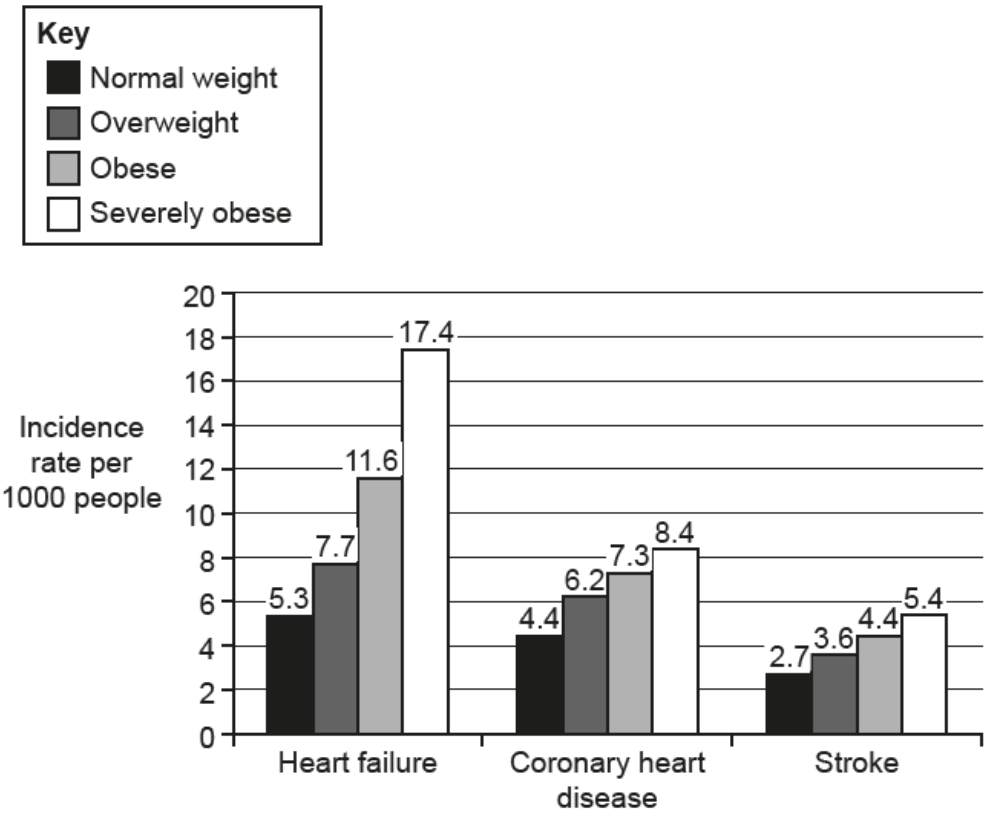
..... **[1]**

5. Nov 2021/Paper_J260/04/No.4

The graph shows the effect of weight on the incidence rate of heart failure, coronary heart disease and stroke per 1000 people.



(a) Identify **one** trend shown by the data in the graph.

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

(b) Health checks are carried out by the NHS when individuals turn 40. These health checks help health professionals to find out who is at greater risk of cardiovascular disease.

The table shows some of the questions asked at the health check and the answers provided by two patients.

Question	Patient 1	Patient 2
Do you smoke?	Yes	Yes
How many units of alcohol do you drink per week?	4	20
What word describes your weight?	Normal	Obese
Do you have a family history of heart disease?	No	Yes, my father has had a heart attack.

Suggest which patient is at a **higher** risk of cardiovascular disease.

Use the table to support your answer.

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

(c) Write down **one** additional question that the health professional could ask the patients to help assess their risk of cardiovascular disease.

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

6. Nov 2020/Paper_J260/01/No.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.

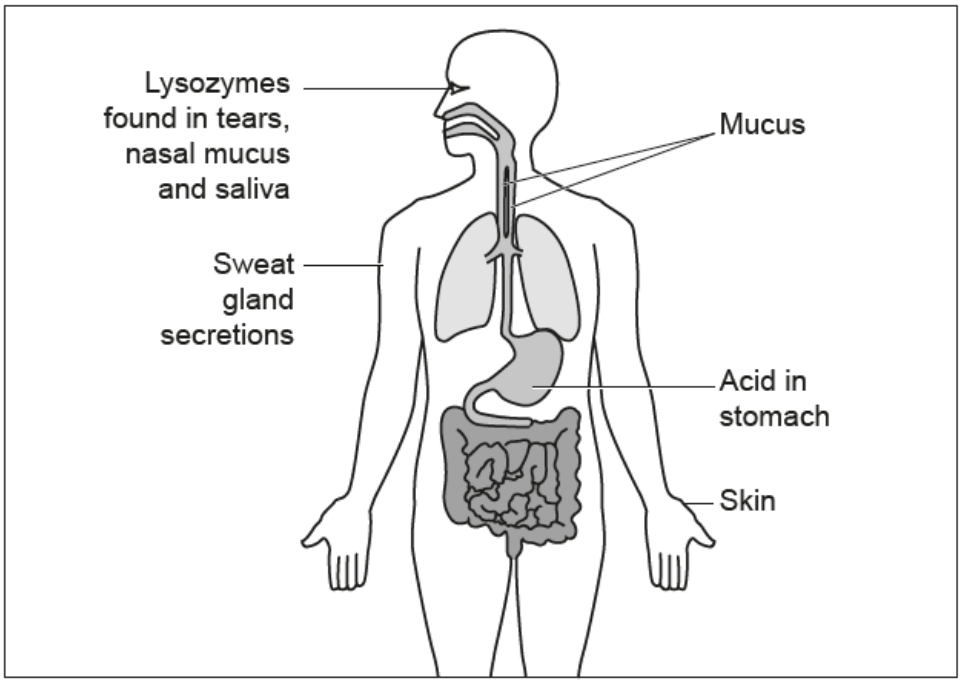

Fig. 3.1

[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**.

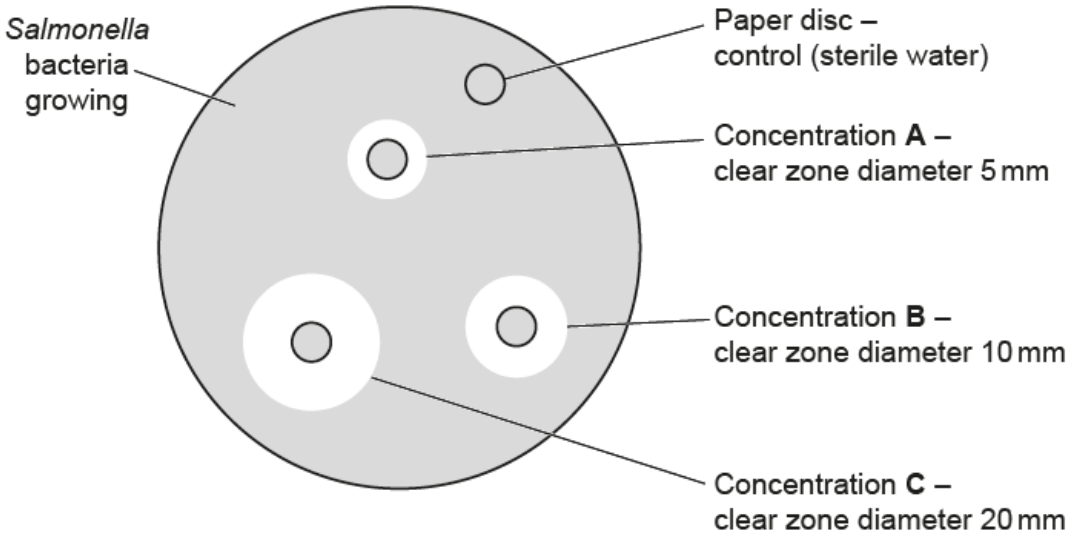

Fig. 3.2

(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]

7. Nov 2020/Paper_J260/01/No.5

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

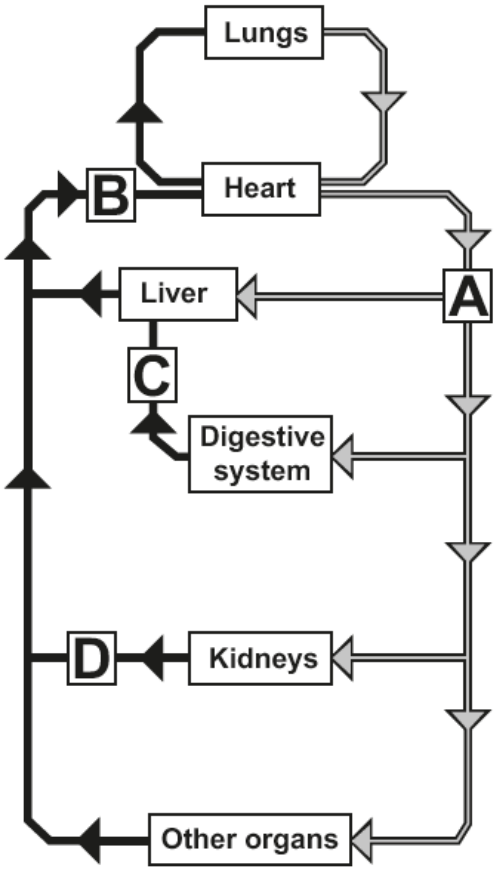

Fig. 5.1

(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.

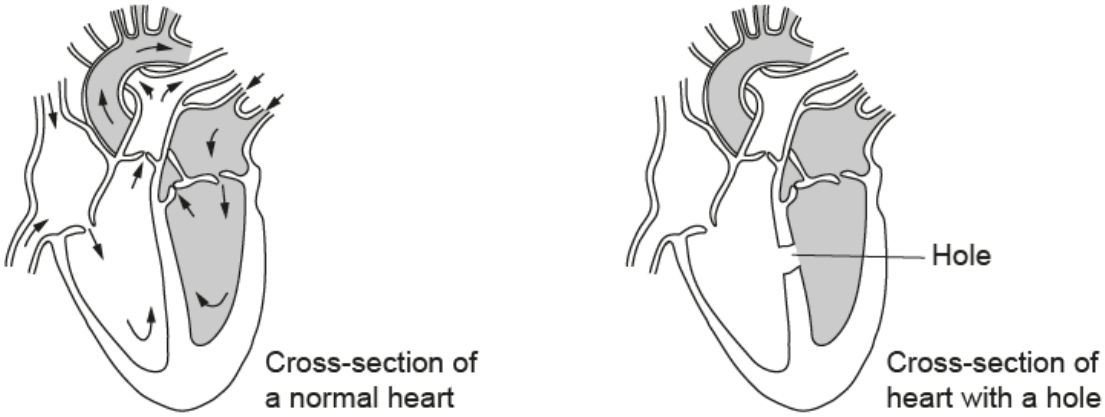

Fig. 5.2

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]**

8. Nov 2020/Paper_J260/01/No.6

(a) Blood transports many substances around the body.

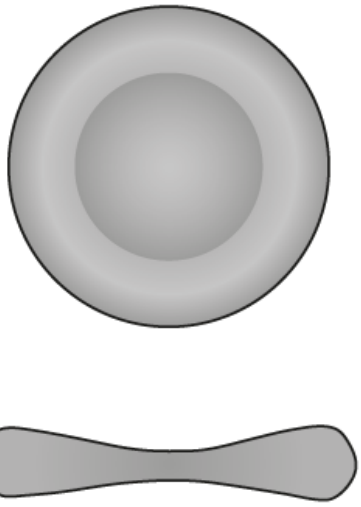
Complete the table to show whether each substance is transported in the blood by the **plasma** or by the **red blood cells**.

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]

9. Nov 2021/Paper_J260/05/No.5

A student is investigating the effect of eating sugar on blood sugar concentration.

The student eats 20 g of glucose, and then measures their blood sugar concentration every minute for 7 minutes. **Fig. 5.1** shows their results.

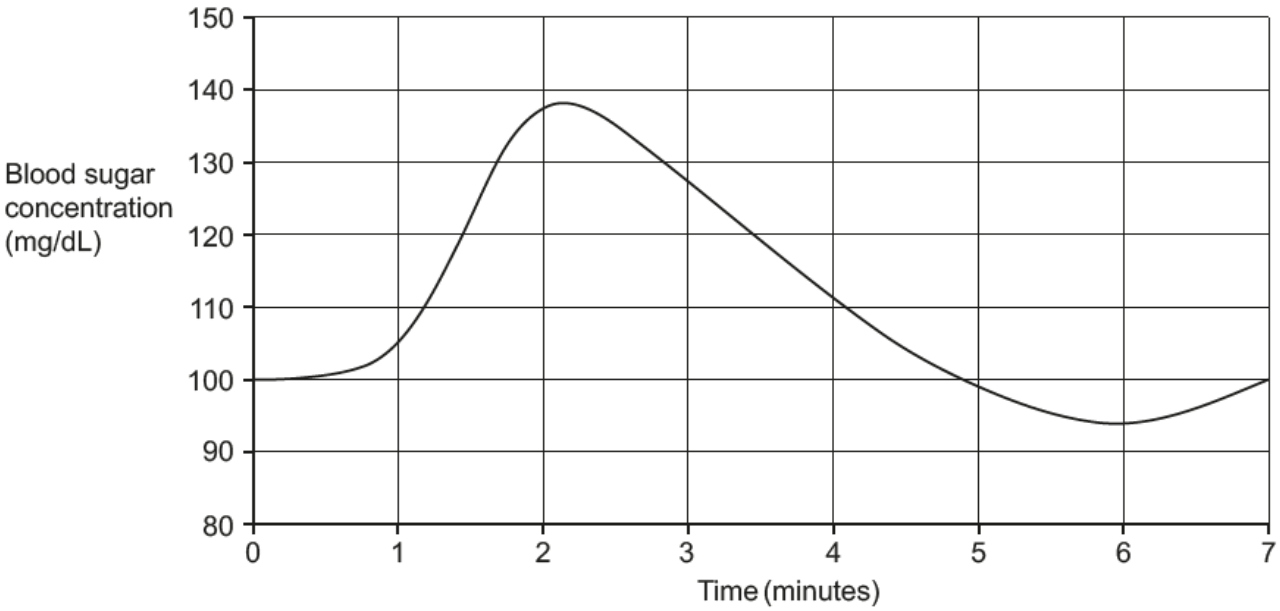

Fig. 5.1

(a) Explain how insulin and glucagon work together to cause the observed changes to the blood sugar concentration, between **2** and **7 minutes**.

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

(b) Two friends both have diabetes, but their diabetes is treated differently.
Charlie has Type 1 diabetes. Taylor has Type 2 diabetes.

Draw lines to connect Charlie and Taylor to one correct **cause** and one correct **treatment** of their diabetes.

Cause		**Treatment**
Cells stop being able to use glucagon.		Change in diet alone can be used.
Cells stop being able to use insulin.	**Charlie** (Type 1)	Glucagon injection always needed.
Pancreas stops making glucagon.	**Taylor** (Type 2)	Insulin injection is always needed in treatment.
Pancreas stops making insulin.		

[2]

(c) Glycogen is a long-chain carbohydrate, which is stored in animal cells.

Explain how the partially permeable membrane allows the movement of glucose in and out of animal cells, but **not** glycogen.

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

Fig. 5.2 shows data on diabetes and cardiovascular disease in middle-aged Australian women, collected in eight surveys (S1 to S8) over a 20-year study.

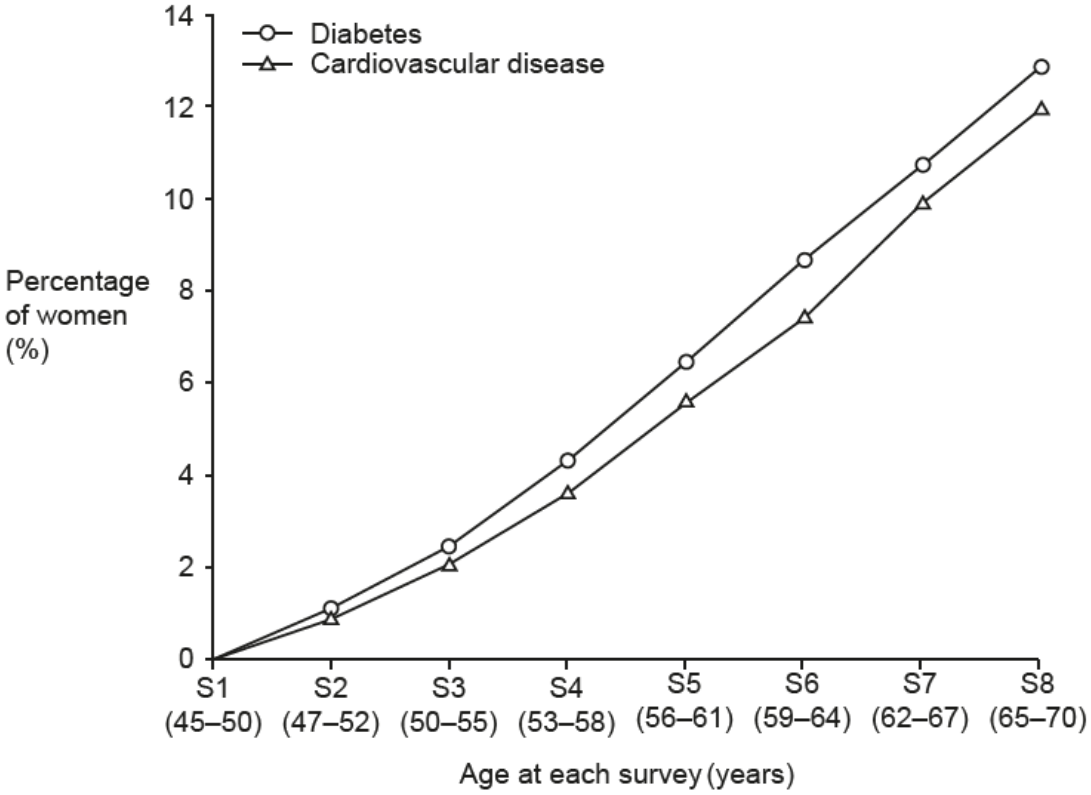

Fig. 5.2

(d) (i) What does the graph show about the relationship between diabetes and cardiovascular disease?

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

(ii) Suggest **two** further pieces of data that would give greater confidence that the relationship between diabetes and cardiovascular disease is valid.

1 .....

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2 .....

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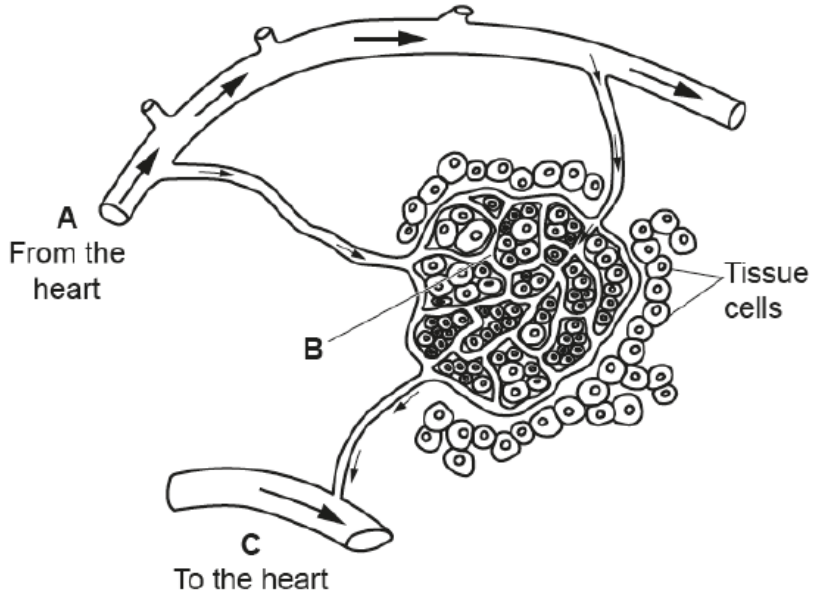
[2]

10. Nov 2020/Paper_J260/05/No.4

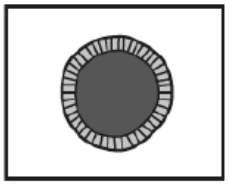
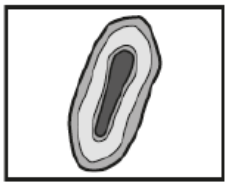
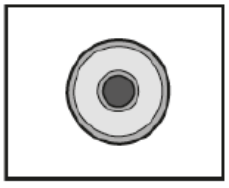
The diagram shows part of the human circulatory system.

Three different types of blood vessels **A**, **B** and **C** are shown in the diagram.

The arrows on the diagram show the direction of blood flow.



(a) Draw lines to connect blood vessels, **A**, **B** and **C**, to their correct names and their correct drawings.

Blood vessel	Name of blood vessel	Drawing of blood vessel
A	Artery	
B	Capillary	
C	Vein	

[2]

(b) Explain why exchange surfaces and transport systems are needed in multicellular organisms.

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

11. Nov 2020/Paper_J260/05/No.9

The oesophagus is an organ that carries food and liquid from the mouth to the stomach.

Scientists have made an artificial oesophagus. To make the artificial oesophagus the scientists used:

- stem muscle cells from adult mice
- stem connective tissue cells from adult humans
- stem skin cells from adult rats.

(a) Explain why scientists used **adult** stem cells.

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

(b) The scientists used stem cells from mice, humans and rats.

How was this an advantage when analysing the tissues in the artificial oesophagus?

Tick (✓) **one** box.

The scientists could check only one type of tissue was produced. ☐

The scientists could confirm the source of each tissue in the artificial oesophagus. ☐

The scientists could justify using three types of stem cell. ☐

The scientists could make sure that the artificial oesophagus worked. ☐

[1]

(c) An artificial oesophagus may benefit people in the future but there are **risks** and **ethical** issues.

(i) Suggest **one** risk associated with this research.

.....

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

(ii) Suggest **one** ethical issue associated with this research.

.....

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

(d) Adult humans cannot regrow lost or damaged organs, but most plants can.

Explain why most plants can regrow organs.

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