# Scaling up – 2021/20 GCSE Gateway Biology Combined Science A

**1.** Nov 2021/Paper_J250/01/No.7

Which process allows substances to enter cells against a concentration gradient?

**A** Active transport

**B** Diffusion

**C** Mitosis

**D** Osmosis

Your answer ☐ **[1]**

**2.** Nov 2021/Paper_J250/01/No.10

Which row describes the correct direction of blood flow through the **left** side of the heart?

**A** pulmonary artery → atrium → ventricle → vena cava

**B** pulmonary artery → ventricle → atrium → aorta

**C** pulmonary vein → ventricle → atrium → vena cava

**D** pulmonary vein → atrium → ventricle → aorta

Your answer ☐ **[1]**

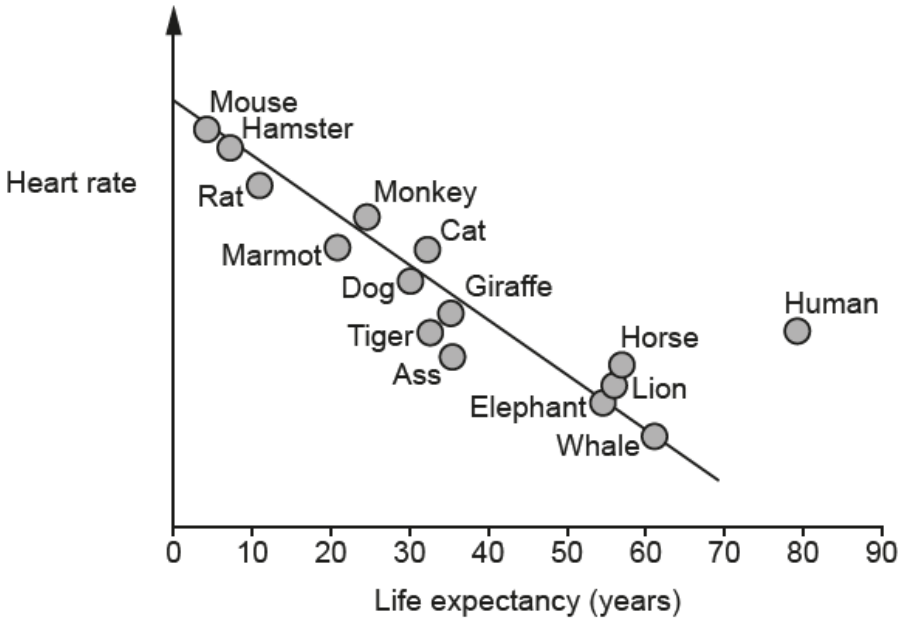
**3.** Nov 2021/Paper_J250/01/No.13

Heart rate is the number of times the heart beats each minute to pump blood around the circulatory system.

**(a)** Which structures inside the heart stop the blood flowing the wrong way?

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

**(b)** The graph shows the average life expectancy of different animals compared to their heart rate.




**(i)** Which animal has the **highest** heart rate?

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

**(ii)** Describe the relationship between life expectancy and heart rate seen in the graph.

.....

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

**(iii)** Humans do **not** fit the pattern.

How does the graph show this?

.....

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

**4.** Nov 2020/Paper_J250/01/No.9

Look at the table.

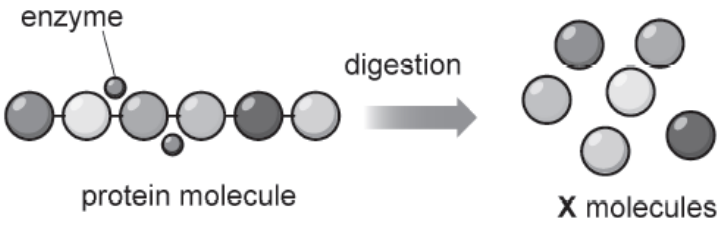
| | Requires energy | Movement down a concentration gradient | Substance(s) moved |
|---|---|---|---|
| **A** | yes | no | water and glucose |
| **B** | no | no | water only |
| **C** | yes | yes | water and glucose |
| **D** | no | yes | water only |

Which row in the table describes osmosis?

Your answer ☐ **[1]**

**5.** Nov 2020/Paper_J250/01/No.6

The diagram represents the digestion of protein by an enzyme.




What name describes the **X** molecules?

**A** Amino acids

**B** Fatty acids

**C** Glucose

**D** Glycerol

Your answer ☐ **[1]**

**6.** Nov 2020/Paper_J250/01/No.7

Which substances are transported in the xylem vessels?

**A** Mineral ions only

**B** Sucrose only

**C** Water and mineral ions

**D** Water and sucrose

Your answer ☐ **[1]**

**7.** Nov 2020/Paper_J250/01/No.8

Which chamber of the heart receives blood directly from the pulmonary vein?

**A** Left atrium

**B** Left ventricle

**C** Right atrium

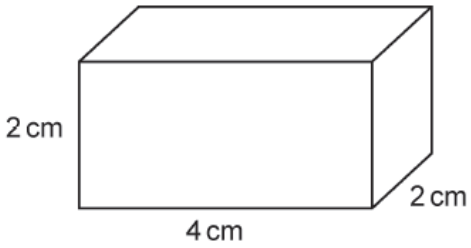
**D** Right ventricle

Your answer ☐ **[1]**

**8.** Nov 2020/Paper_J250/01/No.10

A student investigates the rate of diffusion using blocks of agar.

The diagram shows one of the blocks of agar they use.




The block has a surface area of 40 $cm^2$.

What is the surface area to volume ratio of this block of agar?

**A** 1 : 2

**B** 1 : 2.5

**C** 2 : 1

**D** 2.5 : 1

Your answer ☐ **[1]**

**9.** Nov 2020/Paper_J250/01/No.11

**(a)** **Fig. 11.1** shows a red blood cell.

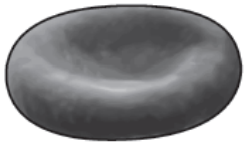


**Fig. 11.1**

Complete these sentences about this red blood cell.

Choose words from the list.
You may use each word once, more than once or not at all.

**biconcave** **cytoplasm** **nucleus** **plasma**

**round** **square** **vacuole** **water**

The red blood cell has a ..... shape to increase its surface area.

There is more room to transport oxygen because the cell does **not** have a

..... .

The red blood cell is transported in a liquid called ..... .

**[3]**

**(b)** **Fig. 11.2** shows two different blood vessels, **X** and **Y**, from the human body.

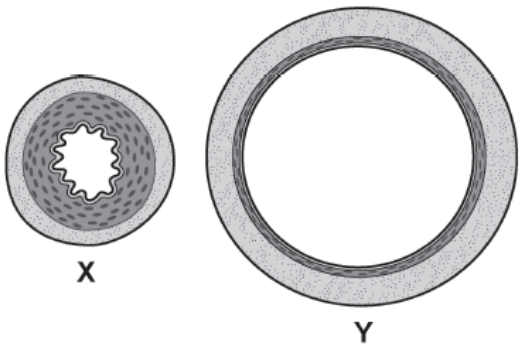



**Fig. 11.2**

Which blood vessel, **X** or **Y**, is an **artery**? .....

Write down **two** pieces of evidence seen in **Fig. 11.2** to support your answer.

1 .....

2 .....

**[2]**

**(c)** **Fig. 11.3** shows the structure of a human heart.

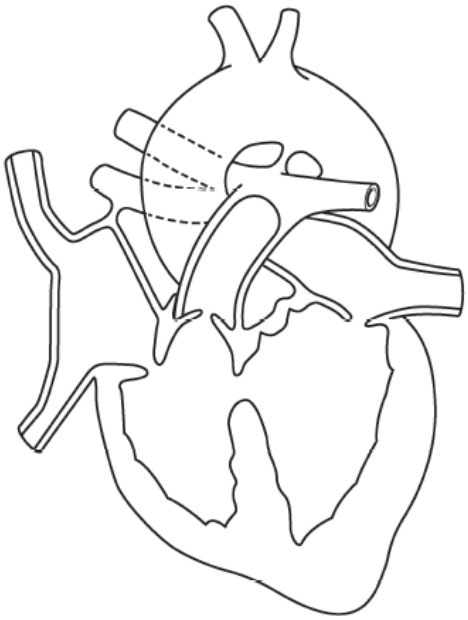


**Fig. 11.3**

The heart has a defect.

**(i)** Draw the letter **X** on the diagram to show the position of the defect. **[1]**

**(ii)** Explain how this defect might affect the transport of oxygen around the body.

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

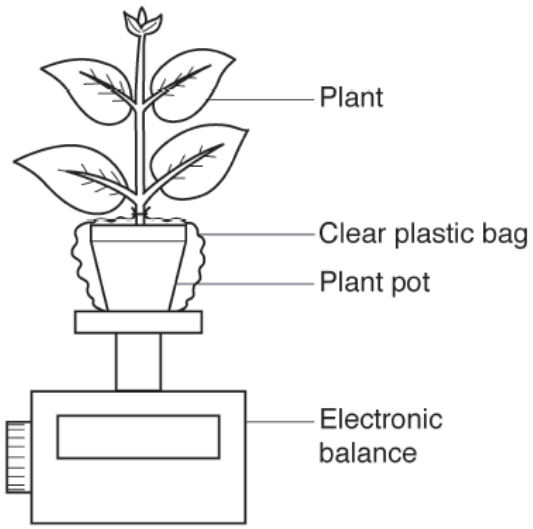
**10.** Nov 2020/Paper_J250/01/No.13

A student investigates transpiration rate in six plants.

The plants are the same size, age and type.

The student adds the same volume of water to the soil in the plant pots and covers each pot with a clear plastic bag. They then measure the mass of each plant.

The diagram shows the apparatus they use.




Three plants are placed in the light and three in the dark. After 24 hours the student measures the mass again.

**(a)** Write down **two** variables that were controlled in the investigation.

1 .....

2 .....

**[2]**

**(b)** What should the student do to reduce the effect of **random errors**?

.....

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

**(c)** The table shows the results of the student's investigation.

| Plant | Light or dark | Mass at start (g) | Mass after 24 hours (g) | Change in mass (g) |
|---|---|---|---|---|
| **A** | light | 148 | 124 | 24 |
| **B** | light | 146 | 114 | 32 |
| **C** | light | 147 | 111 | 36 |
| **D** | dark | 150 | 139 | 11 |
| **E** | dark | 147 | 135 | 12 |
| **F** | dark | 149 | 138 | 11 |

**(i)** Which set of results are more **precise**, light or dark? .....

Explain your answer.

.....

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

**(ii)** The mean change in mass for plants in the dark is 11.3 g.

Calculate the mean change in mass for the plants in the **light** (plants **A** to **C**).

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

Mean change in mass for **light** = ..... g **[3]**

**(iii)** Write down **one** conclusion about the effect light has on the transpiration rate seen in the table.

.....

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

**(d)** The student has investigated the effect of light on transpiration rate.

The student decides to develop their investigation to find the effect of **air movement** on transpiration rate.

Suggest **one** piece of apparatus they could use to change the movement of the air.

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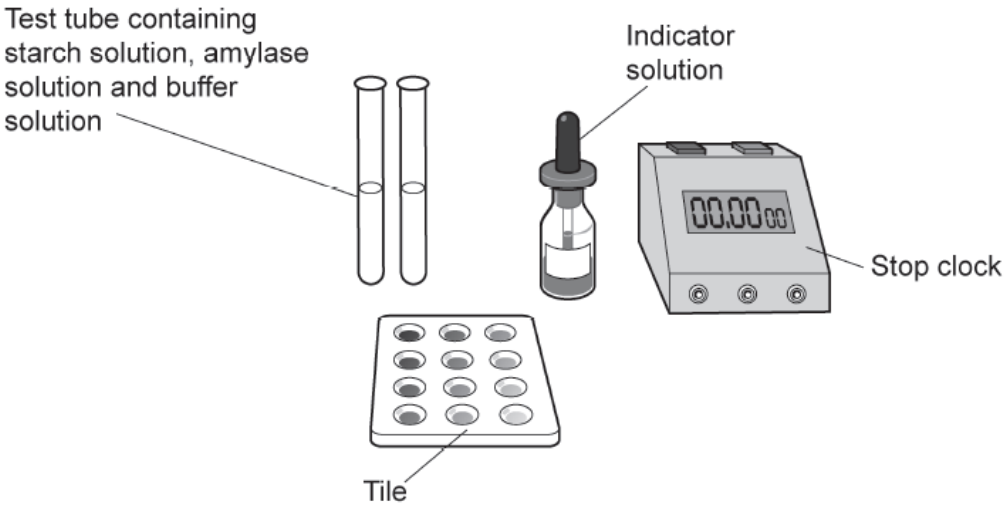
..... **[1]**

**11.** Nov 2020/Paper_J250/01/No.14

A student investigates the effect of pH on the activity of the enzyme amylase on starch.

To change the pH of the amylase, the student uses a chemical called a buffer.

The diagram shows equipment used in their investigation.




This is the method the student uses:

1. Add a single drop of indicator solution to each compartment in the tile.
2. Use **one** syringe to add 2 $cm^3$ amylase solution, 1 $cm^3$ pH 3 buffer solution and 2 $cm^3$ starch solution to the test tube.
3. Start the stop clock.
4. Every **20 seconds** transfer a drop of the mixture in the test tube to the indicator in the tile and record the colour change of the indicator.
5. Stop the stop clock when the indicator in the tile stays orange.
6. Repeat the method using buffers of **different** pH.

**(a)** Identify the **independent** and **dependent** variable in this investigation.

Independent variable .....

.....

Dependent variable .....

.....

**[2]**

**(b)** The indicator solution changes colour when starch is present.

**(i)** What is the name of this indicator solution?

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

**(ii)** What colour will the indicator solution change to when starch is present?

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

**(c)** To improve their investigation the student could repeat each pH to identify anomalies.

Suggest **two other** improvements the student could make to their investigation.

For each improvement write down **one** reason why it is needed.

Improvement 1 .....

Reason .....

.....

.....

Improvement 2 .....

Reason .....

.....

.....

**[4]**

**(d)*** The table shows the student's results.

| pH of buffer solution | Time when indicator stays orange (seconds) |
|---|---|
| 3 | Indicator still changes colour after 600 |
| 5 | 360 |
| 7 | 60 |
| 9 | 340 |
| 11 | Indicator still changes colour after 600 |

Explain the pattern in the results.

Include ideas about the mechanism of enzymes in your answer.

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

**12.** Nov 2020/Paper_J250/01/No.15

Stem cells are found in both animals and plants.

**(a) (i)** **Fig. 15.1** shows the area where stem cells can be found in a plant.

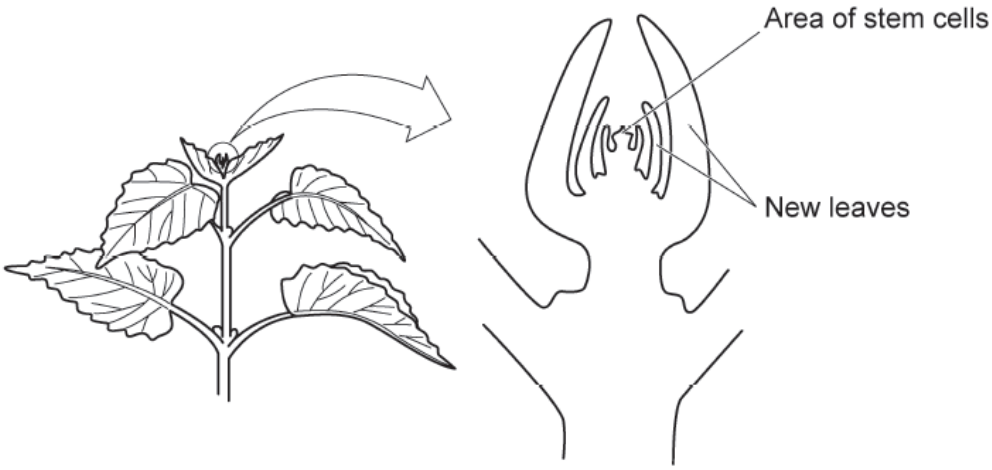



**Fig. 15.1**

What is the name of the area where stem cells are found?

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

**(ii)** Describe the difference between embryonic and adult stem cells in animals.

.....

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

**(b)** A group of people were asked if they were in favour of using embryonic stem cells for medical research.

The pie chart in **Fig. 15.2** shows the results.

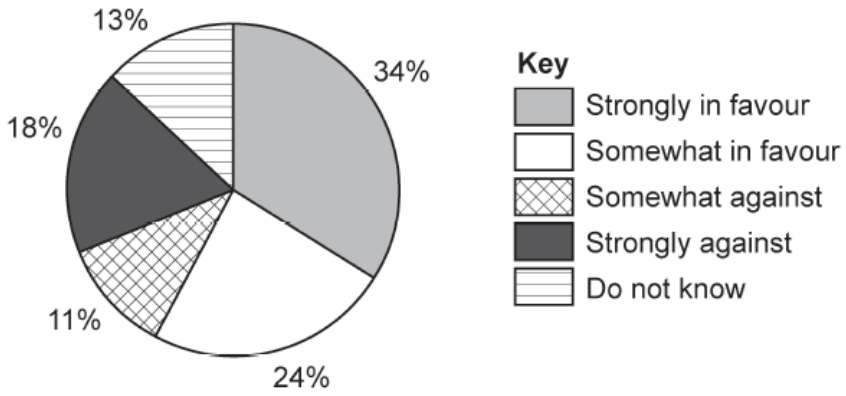



**Fig. 15.2**

**(i)** There were **254** people in the survey.

Calculate the **total** number of people who were **against** the use of embryonic stem cells.

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

Number of people against = ..... **[3]**

**(ii)** Suggest **two** reasons why some people may object to the use of embryonic stem cells.

1 .....

.....

2 .....

.....

**[2]**

**13.** Nov 2020/Paper_J250/02/No.3

Look at the table.

| | Clots blood | Makes antibodies | Transports oxygen |
|---|---|---|---|
| **A** | white blood cells | platelets | red blood cells |
| **B** | platelets | white blood cells | red blood cells |
| **C** | red blood cells | white blood cells | white blood cells |
| **D** | platelets | red blood cells | white blood cells |

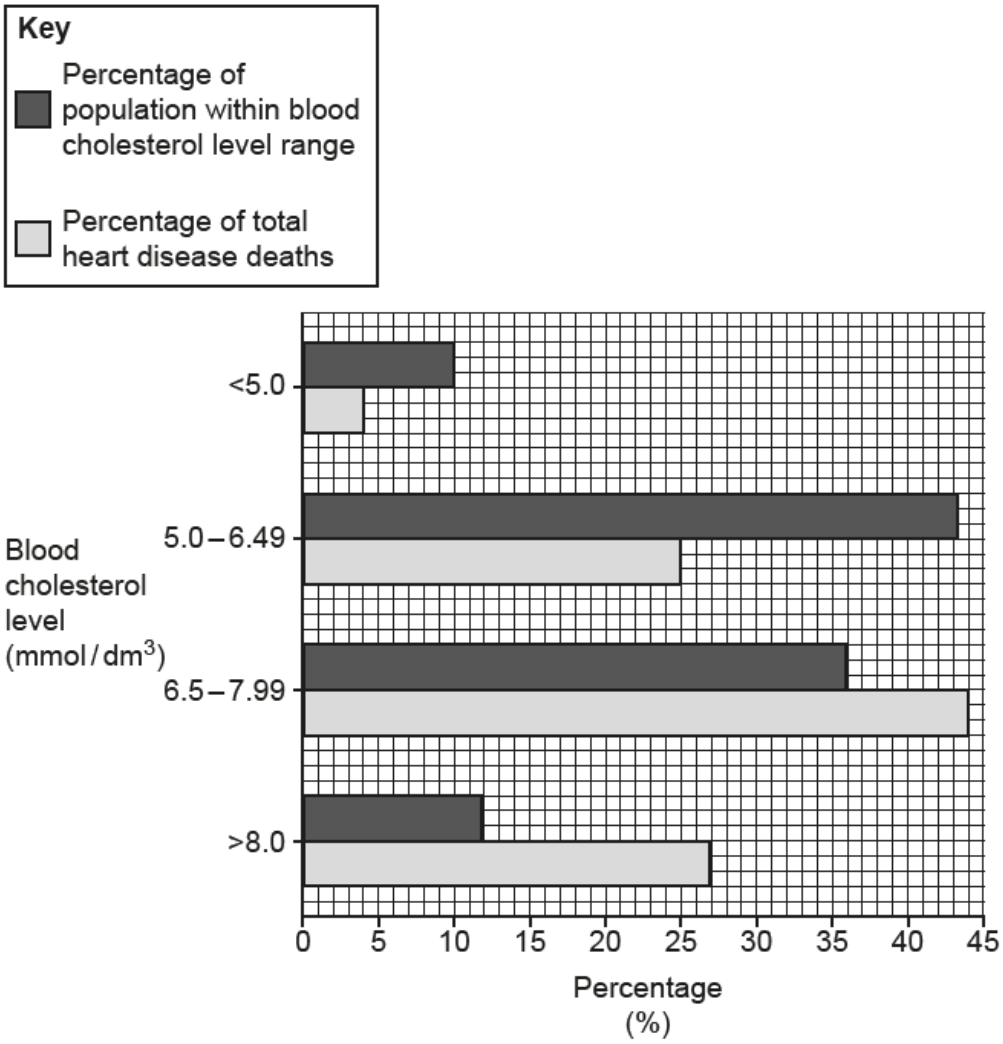
Which row in the table shows the correct function of the different parts of the blood?

Your answer ☐ **[1]**

**14.** Nov 2020/Paper_J250/02/No.15

Scientists studied a population of men. They grouped the men by their blood cholesterol levels.

The chart shows the percentage of the population in each blood cholesterol level group. It also shows the men in each group that died from heart disease as a percentage of the whole population that died from heart disease.




**(a) (i)** What conclusions can be made from the data in the chart?

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.....

.....

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

**(ii)** Calculate the ratio for percentage of total heart disease deaths for blood cholesterol $<5.0\,mmol/dm^3$ compared to those $5.0\,mmol/dm^3$ or greater.

Ratio = ..... **[2]**

**(iii)** Health experts encourage people to lower their blood cholesterol to $5.0\,mmol/dm^3$ or less.

Analyse evidence in the chart to justify the reason for this.

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

**(b) (i)** Hormone replacement therapy (HRT) involves giving oestrogen to women.

A group of scientists did a double-blind study of 643 women given either HRT or a placebo.

The study followed-up these women after five years. It showed reduced build-up of cholesterol in the arteries of women given HRT.

The scientists made this conclusion:

| |
|---|
| Women on HRT may be at **less** risk from heart disease. |

Explain why HRT could reduce the risk of heart disease.

.....

.....

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

**(ii)** The reduced build-up of cholesterol observed during the study might not be large enough to have an impact on a person's risk from heart disease.

What change could be made to the study to gain enough evidence to support the conclusion?

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

**15.** Nov 2021/Paper_J250/07/No.2

Which row describes the correct direction of blood flow through the **left** side of the heart?

**A** pulmonary artery → atrium → ventricle → vena cava

**B** pulmonary artery → ventricle → atrium → aorta

**C** pulmonary vein → ventricle → atrium → vena cava

**D** pulmonary vein → atrium → ventricle → aorta

Your answer ☐ **[1]**

**16.** Nov 2021/Paper_J250/07/No.7

Which process allows oxygen to enter blood cells from the alveoli down a concentration gradient?

**A** Active transport

**B** Diffusion

**C** Evaporation

**D** Osmosis

Your answer ☐ **[1]**

**17.** Nov 2021/Paper_J250/07/No.8

A student investigates movement of water into cells using potato chips.

They place a potato chip with a mass of 5 g in pure water. After 20 minutes the potato chip has increased in mass to 5.3 g.

Calculate the percentage change in mass.

**A** 5.7%

**B** 6.0%

**C** 94.3%

**D** 106%

Your answer ☐ **[1]**

**18.** Nov 2021/Paper_J250/07/No.11

Catalase is an enzyme found in potato. Catalase breaks down hydrogen peroxide to form water and oxygen.

A student investigates the activity of catalase.

This is the method they follow:
– Cut equal sized pieces of potato.
– Put one piece of potato into a conical flask.
– Add 50 $cm^3$ of dilute hydrogen peroxide.
– Collect the oxygen produced in 15 minutes using a measuring cylinder full of water.

**Fig. 11.1** shows the set-up of their investigation.

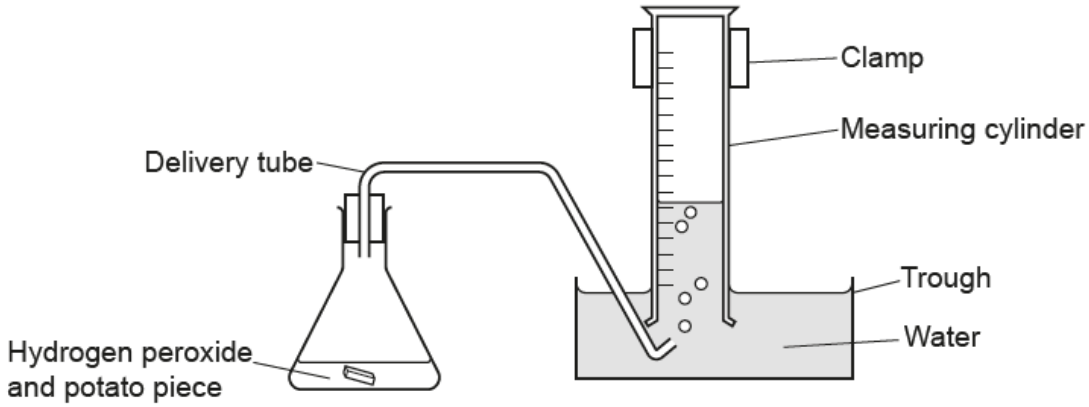


**Fig. 11.1**

The student then repeats the investigation, increasing the number of potato pieces each time.

**(a) (i)** Each time the student repeats the investigation they use 50 $cm^3$ of new dilute hydrogen peroxide.

Explain why they need to replace the dilute hydrogen peroxide.

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.....

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

**(ii)** Explain why the student does **not** need to replace the potato pieces already in the flask when repeating the investigation.

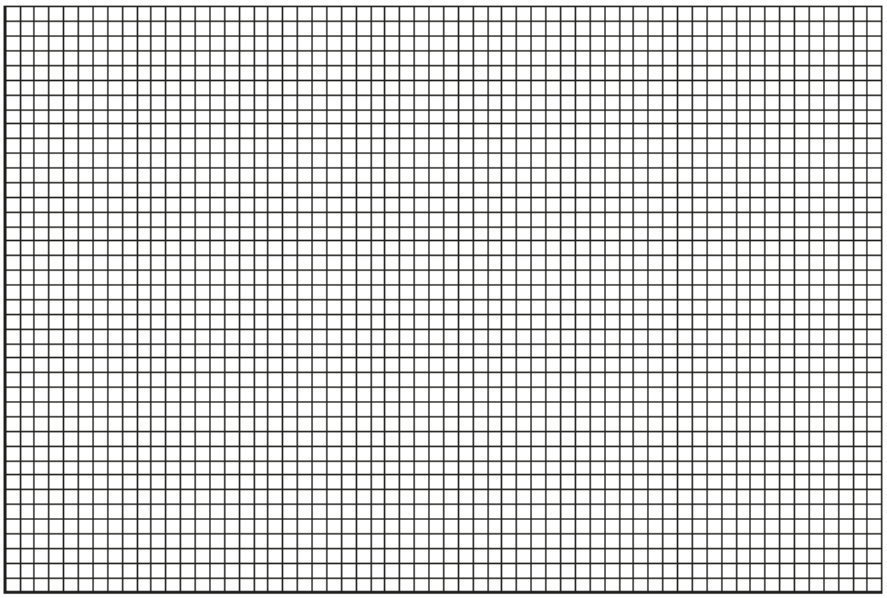
.....

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

**(b)** The table shows their results.

| Number of pieces of potato | Volume of oxygen collected in 15 minutes ($cm^3$) |
|---|---|
| 1 | 0.7 |
| 2 | 1.2 |
| 3 | 1.9 |
| 4 | |
| 5 | 3.2 |
| 6 | 3.8 |

**(i)** Plot a graph of the results and draw a line of best fit.



**[4]**

**(ii)** Use the graph to find the expected volume of oxygen produced when **4 pieces** of potato are used.

Volume of oxygen = ..... $cm^3$ **[1]**

**(iii)** Use the data in the **table** to calculate the rate of reaction when the student used **6 pieces** of potato.

Give your answer to **2** significant figures.

Rate of reaction = ..... $cm^3$ / min **[3]**

**(c)** The reaction is exothermic.

Suggest how the student could improve their investigation to control the temperature.

.....

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

**19.** Nov 2021/Paper_J250/07/No.14

**(a)** The diagrams show a healthy heart valve and a damaged heart valve.

| | Open | Closed |
|---|---|---|
| **Healthy heart valve** |  |  |
| **Damaged heart valve** |  |  |

A patient with a damaged heart valve may have these symptoms:

- shortness of breath
- feeling lightheaded, dizzy or faint.

Use the diagrams to explain why the damaged heart valve may cause these symptoms.

.....

.....

.....

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

**(b)** Adult stem cells can be used to grow new heart valves for the patient.

**(i)** The adult stem cells used are taken from the patient's own body.

Describe the function of stem cells inside the human body.

.....

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

**(ii)** Stem cells could also be taken from a human embryo.

Suggest **two** advantages of using the patient's own adult stem cells rather than embryonic stem cells.

1 .....

.....

2 .....

.....

**[2]**

**20.** Nov 2021/Paper_J250/07/No.15

**(a)** The body maintains a constant internal environment in different ways.

One example is maintaining body temperature.

Explain why it is important to maintain body temperature.

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.....

.....

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

**(b)** The nervous system helps the body maintain a constant internal environment. It also allows a person to respond to external stimuli.

A person touches a hot pan. **Fig. 15.1** shows the reflex arc involved with a response when a person touches a hot pan.

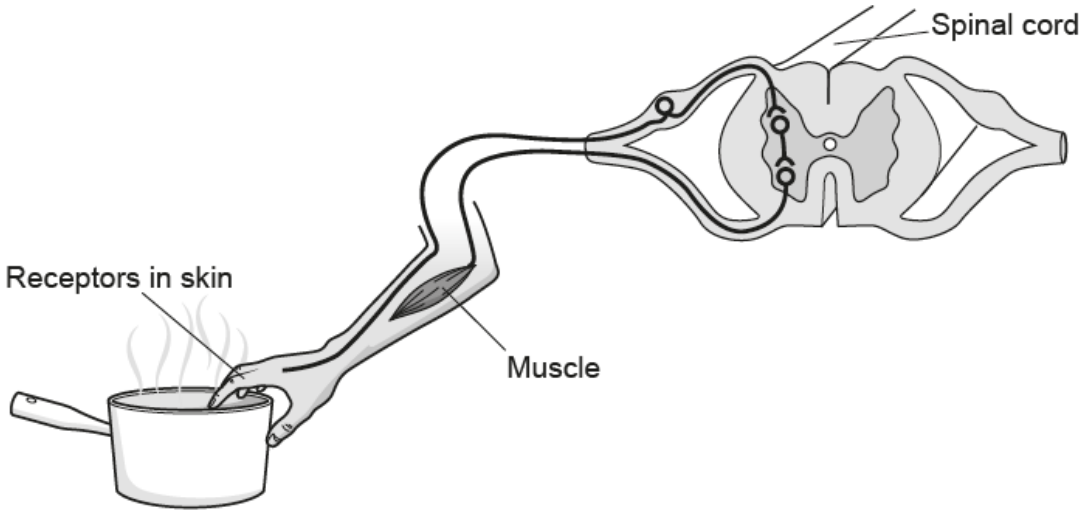


**Fig. 15.1**

Use **Fig. 15.1** to explain how the nervous system coordinates a response to touching the hot pan.

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.....

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

**(c)** Caffeine is a chemical found in coffee and cola drinks.

A scientist investigates the effect of caffeine on reaction times.

They test two groups:

- Group **A** contains 2 boys aged 15 years; they are given 150 $cm^3$ of a caffeine-free drink.
- Group **B** contains 2 boys aged 15 years; they are given 150 $cm^3$ of a caffeine drink.

Both groups are tested before and after taking the drink.

**(i)** Suggest **one** reason why their method produces results that may **not** be reproducible.

.....

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

**(ii)** **Fig. 15.2** shows the results.

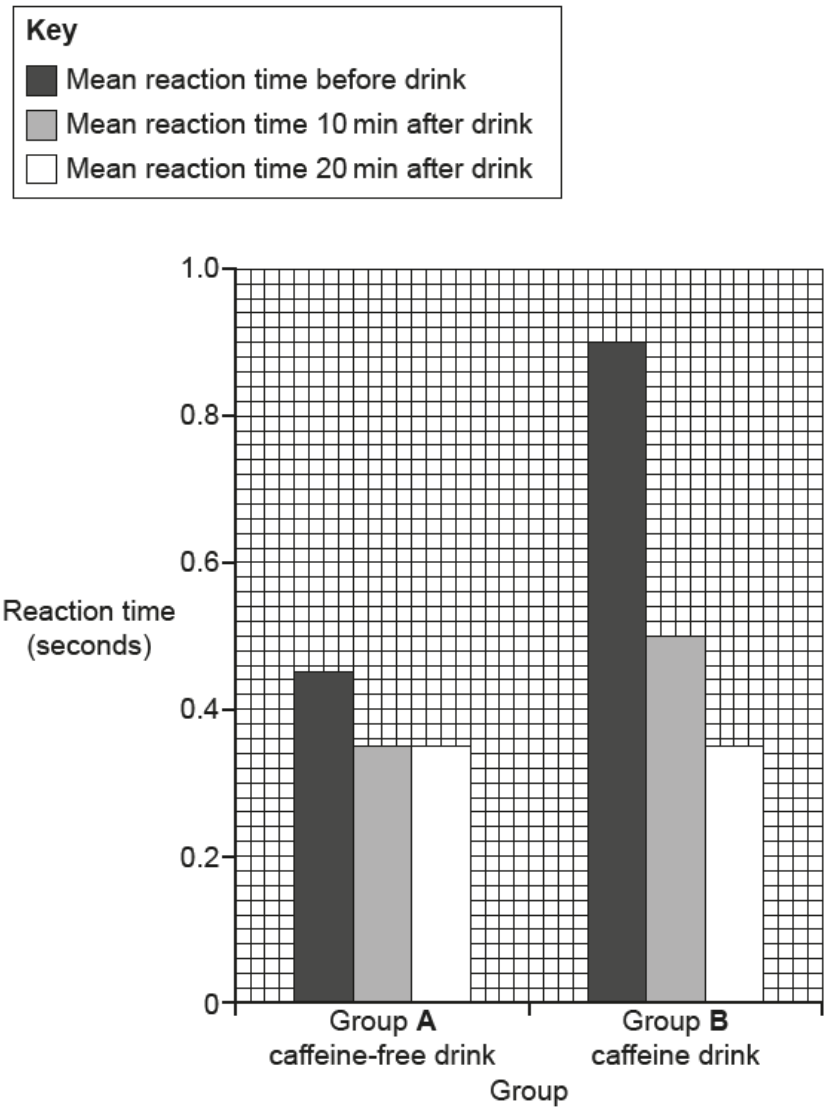



**Fig. 15.2**

Compare the data for group **A** with the data for group **B**.

.....

.....

.....

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

**21.** Nov 2021/Paper_J250/08/No.9

One method of surgical treatment for cardiovascular disease involves inserting a metal or plastic tube into the coronary artery.

How will this surgical treatment help to improve the condition of a patient who has cardiovascular disease?

**A** It increases blood flow to the lungs.

**B** It increases oxygen supply to the heart muscle.

**C** It prevents blood flow through the damaged artery.

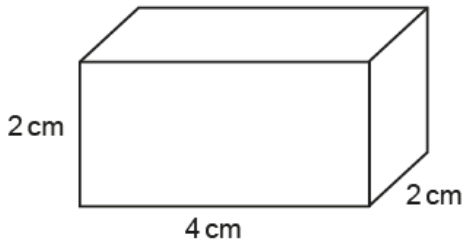
**D** It prevents oxygenated and deoxygenated blood mixing.

Your answer ☐ **[1]**

**22.** Nov 2020/Paper_J250/07/No.2

A student investigates the rate of diffusion using blocks of agar.

The diagram shows one of the blocks of agar they use.




The block has a surface area of 40 $cm^2$.

What is the surface area to volume ratio of this block of agar?

**A** 1 : 2

**B** 1 : 2.5

**C** 2 : 1

**D** 2.5 : 1

Your answer ☐ **[1]**

**23.** Nov 2020/Paper_J250/07/No.10

Which term describes the ability to see two points as separate points and not merged into one?

**A** Depth of field

**B** Magnification

**C** Power

**D** Resolution

Your answer ☐ **[1]**

**24.** Nov 2020/Paper_J250/07/No.11

Stem cells are found in both animals and plants.

**(a) (i)** **Fig. 11.1** shows the area where stem cells can be found in a plant.

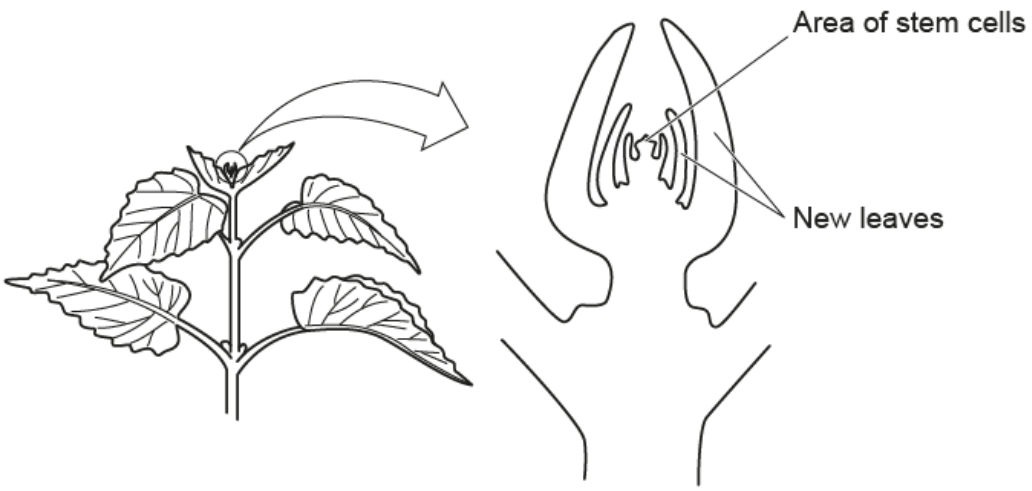



**Fig. 11.1**

What is the name of the area where stem cells are found?

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

**(ii)** Describe the difference between embryonic and adult stem cells in animals.

.....

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

**(b)** A group of people were asked if they were in favour of using embryonic stem cells for medical research.

The pie chart in **Fig. 11.2** shows the results.

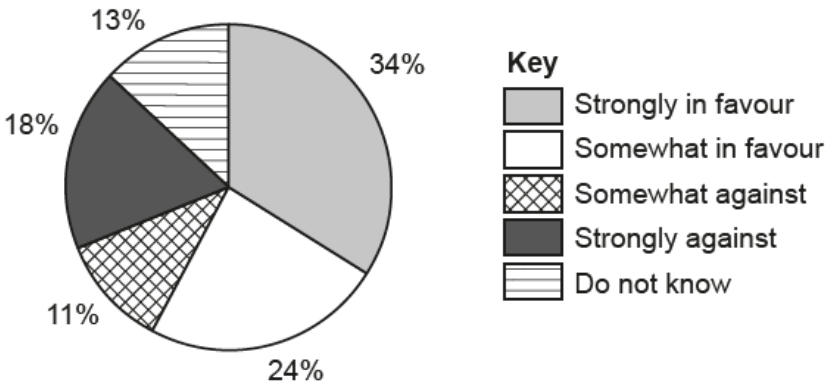



**Fig. 11.2**

**(i)** There were **254** people in the survey.

Calculate the **total** number of people who were **against** the use of embryonic stem cells.

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

Number of people against = ..... **[3]**

**(ii)** Suggest **two** reasons why some people may object to the use of embryonic stem cells.

1 .....

.....

2 .....

.....

**[2]**

**25.** Nov 2020/Paper_J250/07/No.13

**(a)** **Fig. 13.1** shows a red blood cell.

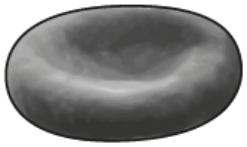


**Fig. 13.1**

**(i)** Explain **one** way red blood cells are adapted to transport oxygen around the body.

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

**(ii)** Which gas diffuses out of blood and into the lungs?

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

**(b)** **(i)** Complete these sentences about the human heart.

The wall of the human heart is made of a type of muscle called

..... muscle.

The muscle wall of the ventricle ..... to pump blood to the body.

**[2]**

**(ii)** **Fig. 13.2** shows two different blood vessels, **X** and **Y**, that are connected to the heart.

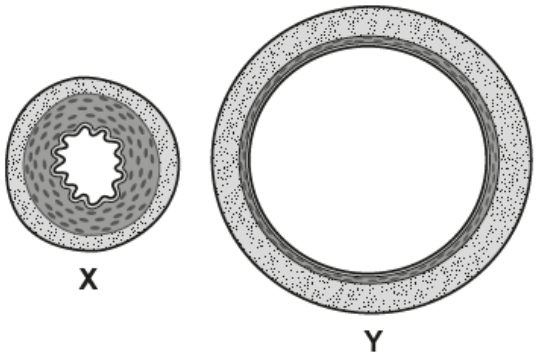


**Fig. 13.2**

Which blood vessel, **X** or **Y**, is most likely to be the vena cava?

Use **Fig. 13.2** to explain your answer.

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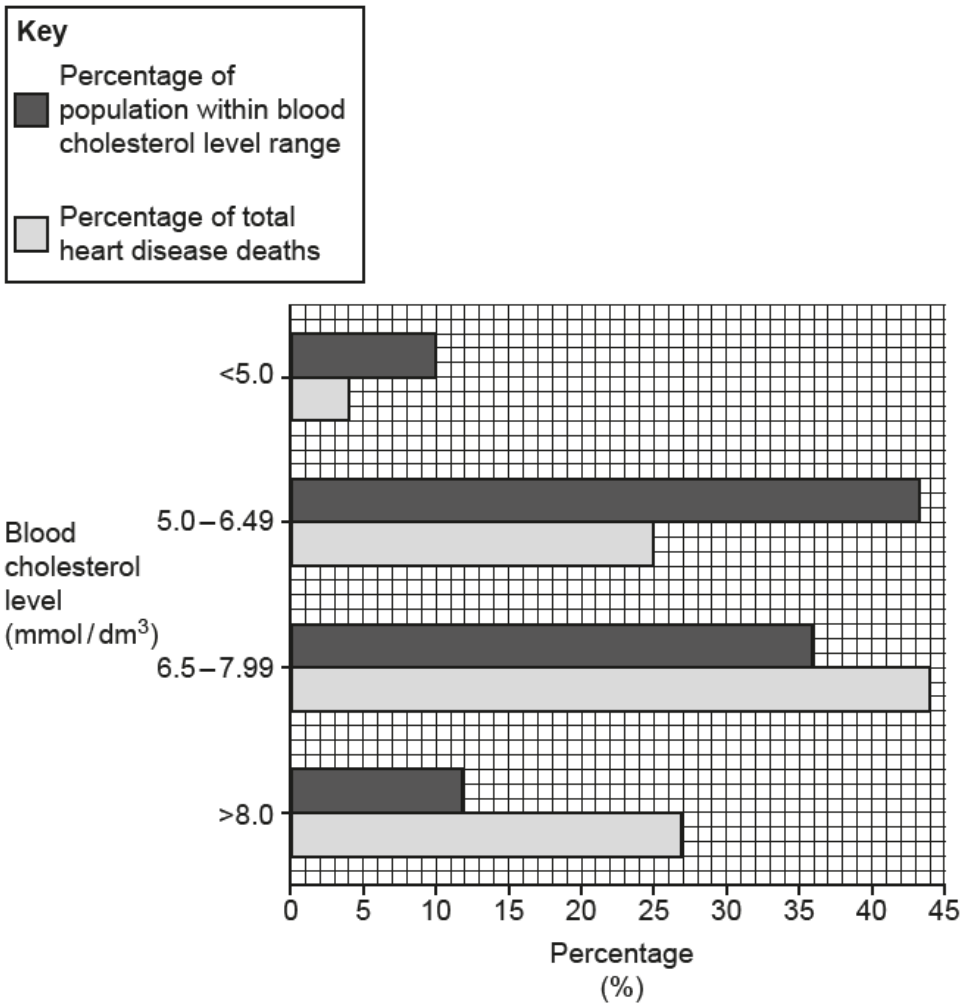
.....

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

**26.** Nov 2020/Paper_J250/08/No.11

Scientists studied a population of men. They grouped the men by their blood cholesterol levels.

The chart shows the percentage of the population in each blood cholesterol level group. It also shows the men in each group that died from heart disease as a percentage of the whole population that died from heart disease.




**(a) (i)** What conclusions can be made from the data in the chart?

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

**(ii)** Calculate the ratio for percentage of total heart disease deaths for blood cholesterol $<5.0\,mmol/dm^3$ compared to those $5.0\,mmol/dm^3$ or greater.

Ratio = ..... **[2]**

**(iii)** Health experts encourage people to lower their blood cholesterol to $5.0\,mmol/dm^3$ or less.

Analyse evidence in the chart to justify the reason for this.

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

**(b) (i)** Hormone replacement therapy (HRT) involves giving oestrogen to women.

A group of scientists did a double-blind study of 643 women given either HRT or a placebo.

The study followed-up these women after five years. It showed reduced build-up of cholesterol in the arteries of women given HRT.

The scientists made this conclusion:

| |
|---|
| Women on HRT may be at **less** risk from heart disease. |

Explain why HRT could reduce the risk of heart disease.

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

**(ii)** The reduced build-up of cholesterol observed during the study might not be large enough to have an impact on a person's risk from heart disease.

What change could be made to the study to gain enough evidence to support the conclusion?

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

**(iii)** Oestrogen is known to interfere with the cell cycle, increasing the rate of mitosis.

Suggest why HRT might increase the risk of breast cancer.

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

**(c)** Name **one** lifestyle change someone could make that could also **reduce** the risk of heart disease.

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