OCR
Oxford Cambridge and RSA

# Friday 10 May 2024 – Morning

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

**J247/01** (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

**F**

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 page 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 **28** pages.

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

## Section A

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

Write your answer to each question in the box provided.

**1** Which structures are found in plant cells but **not** in animal cells?

**A** Chloroplasts

**B** Mitochondria

**C** Nuclei

**D** Ribosomes

Your answer ☐ **[1]**

**2** Which structures are found in prokaryotic cells but **not** in the eukaryotic cells of animals?

**A** Cell membranes

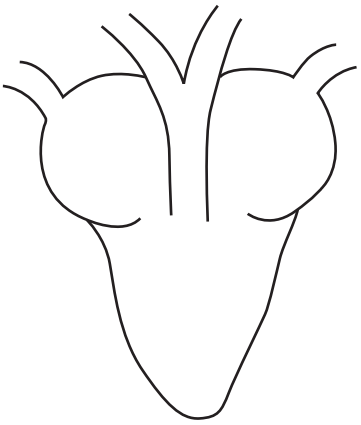
**B** Mitochondria

**C** Nuclei

**D** Plasmids

Your answer ☐ **[1]**

**3** The diagram shows the structure of a snake's heart.



Which sentence describes the structure of the snake's heart?

**A** It has one atrium and one ventricle.

**B** It has one atrium and two ventricles.

**C** It has two atria and one ventricle.

**D** It has two atria and two ventricles.

Your answer ☐ **[1]**

**4** Which two substances are the **products** of photosynthesis?

**A** Carbon dioxide and water

**B** Glucose and carbon dioxide

**C** Glucose and oxygen

**D** Oxygen and water

Your answer ☐ **[1]**

**5** Which word describes the loss of water vapour from the leaves of the plant?

**A** Circulation

**B** Respiration

**C** Translocation

**D** Transpiration

Your answer ☐ **[1]**

**6** Which sentence describes the effect of gravity on the roots and shoots of a plant?

**A** Both the roots and shoots grow downwards.

**B** Both the roots and shoots grow upwards.

**C** The roots grow downwards, and the shoots grow upwards.

**D** The roots grow upwards, and the shoots grow downwards.

Your answer ☐ **[1]**

**7** Which part of the eye controls the size of the pupil?

**A** Iris

**B** Lens

**C** Optic nerve

**D** Retina

Your answer ☐ **[1]**

**8** What is transported by red blood cells?

**A** Antibodies

**B** Glucose

**C** Hormones

**D** Oxygen

Your answer ☐ **[1]**

**9** Which blood vessel transports blood from the lungs to the heart?

**A** Aorta

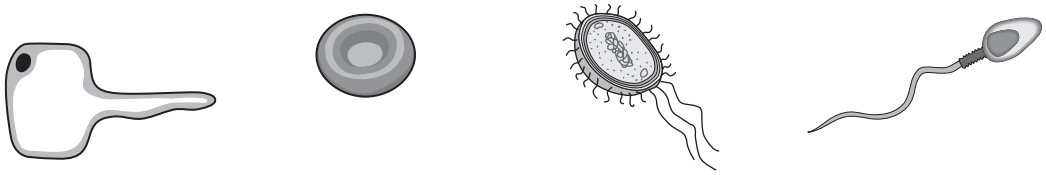
**B** Pulmonary artery

**C** Pulmonary vein

**D** Vena cava

Your answer ☐ **[1]**

**10** Which diagram shows a red blood cell?



**A** **B** **C** **D**

Your answer ☐ **[1]**

**11** Which reaction produces ethanol?

**A** Aerobic respiration in animal cells

**B** Aerobic respiration in yeast cells

**C** Anaerobic respiration in animal cells

**D** Anaerobic respiration in yeast cells

Your answer ☐ **[1]**

**12** A student investigates the rate of photosynthesis by counting the number of gas bubbles produced by a plant.

The table shows their results.

| **Number of gas bubbles** | | | |
|---|---|---|---|
| **Reading 1** | **Reading 2** | **Reading 3** | **Reading 4** |
| 26 | 29 | 26 | 27 |

What is the mean number of bubbles produced?

**A** 25

**B** 26

**C** 27

**D** 28

Your answer ☐ **[1]**

**13** The diagram shows the order of bases in one strand of DNA.

| | | | | | | |
|---|---|---|---|---|---|---|
| T | C | A | G | G | A | C |

What is the base sequence of the complementary strand of DNA?

**A** A G T C C T G

**B** C T G A A G T

**C** G A C T T C G

**D** T C A G G A C

Your answer ☐ **[1]**

**14** Cellulose is a complex carbohydrate.

Which monomers is cellulose made from?

**A** Amino acids

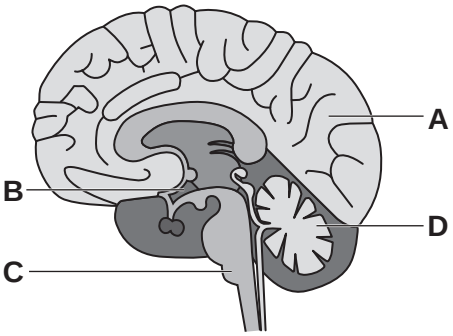
**B** Fatty acids

**C** Glycerol

**D** Simple sugars

Your answer ☐ **[1]**

**15** The diagram shows the structure of the human brain.




Which part of the brain is highly folded into two hemispheres and controls language and memory?

Your answer ☐ **[1]**

## Section B

**16** A light microscope is used to view a specimen.

**(a)** Draw lines to connect each **part of the microscope** to its **role** in viewing the specimen.

| Part of the microscope | Role |
|---|---|
| Stage | Moves the lenses up and down so the specimen can be seen clearly. |
| Objective lens | Makes the image bigger. |
| Focusing knob | Shines a light onto the specimen so that it can be seen. |
| Lamp | The part where the slide is placed. |

**[3]**

**(b)** A student uses a light microscope to look at pollen grains.

**(i)** The total magnification of the microscope is ×400.

The magnification of the eyepiece lens is ×10.

Calculate the magnification of the objective lens used by the student.

Magnification = ..... **[2]**

**(ii)** **Fig. 16.1** shows the image the student sees.

**Fig. 16.1**


The student was asked to produce a drawing of the pollen cells.

Describe to the student how a scientific drawing is produced.

.....

.....

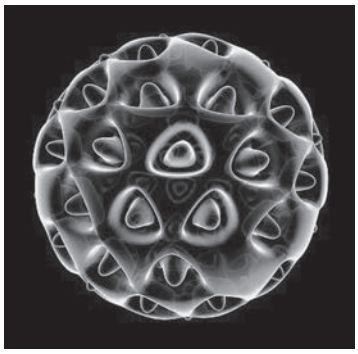
.....

.....

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

**(c)** **Fig. 16.2** shows an image of a pollen grain taken using an electron microscope.

**Fig. 16.2**



Give **two** reasons why the image shows more detail with the electron microscope than the image produced by the light microscope.

1 .....

.....

2 .....

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

**17** An athlete is running a 10 km race. They need to produce ATP in their cells during the race.

**(a)** Describe how cells make ATP.

In your answer include:

- the name of the process
- the substances that are used and made.

.....

.....

.....

.....

.....

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

**(b)** During the race, the athlete's body temperature increases.

Which of these responses will cool them down?

Tick (✓) **two** boxes.

| **Response** | |
|---|---|
| Hairs stand up | |
| Increases sweat production | |
| Shivering | |
| Vasoconstriction of blood vessels | |
| Vasodilation of blood vessels | |

**[2]**

**(c)** During the race, the athlete produces a substance that causes pain in their leg muscles.

Which substance causes this pain?

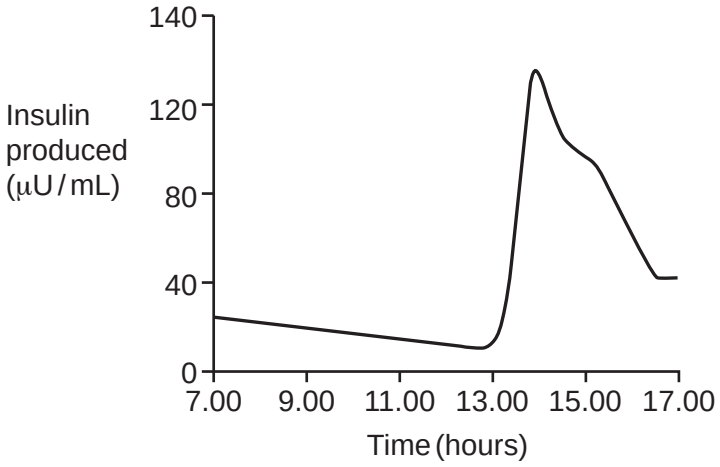
Put a (ring) around the correct answer.

**amino acid** **fatty acid** **hydrochloric acid** **lactic acid**

**[1]**

**(d)** After the race, the athlete eats some food.

The graph shows the athlete's insulin production after the race.




**(i)** Estimate what time the athlete ate the food.

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

**(ii)** Explain why eating food affects the athlete's insulin levels.

.....

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

**(e)** Draw a line to connect the boxes that describe the urine produced by the athlete after the race.

Draw only **one** line.

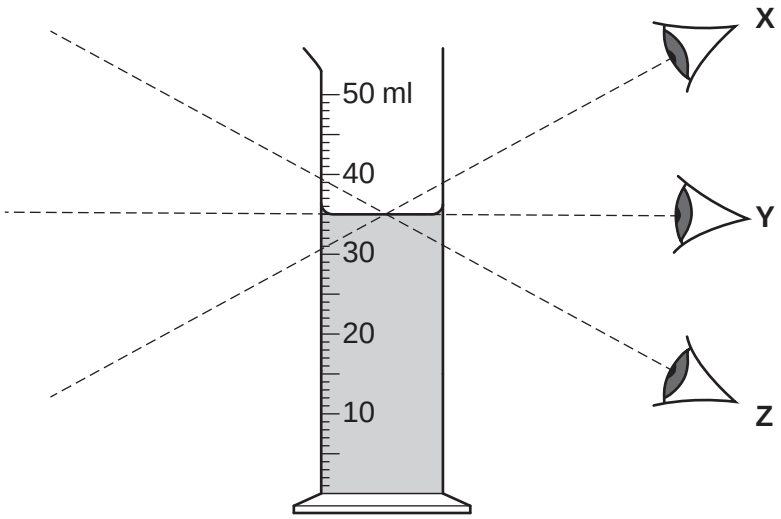
| | |
|---|---|
| High volume | Very concentrated urine |
| Low volume | Dilute urine |

**[1]**

**(f)** A student records some data on the volume of urine produced by different athletes after the race.

Each athlete's urine is collected in a different measuring cylinder.

The diagram shows three eye positions where the student could view the level of the urine to measure the volume produced by a particular athlete.




Complete these sentences.

Put a (ring) around each correct option.

The student should always view the level of liquid from position **X** / **Y** / **Z**.

Viewing the liquid from different positions for the different athletes would introduce

**sampling** / **random** / **systematic** error into the measurement.

**[2]**

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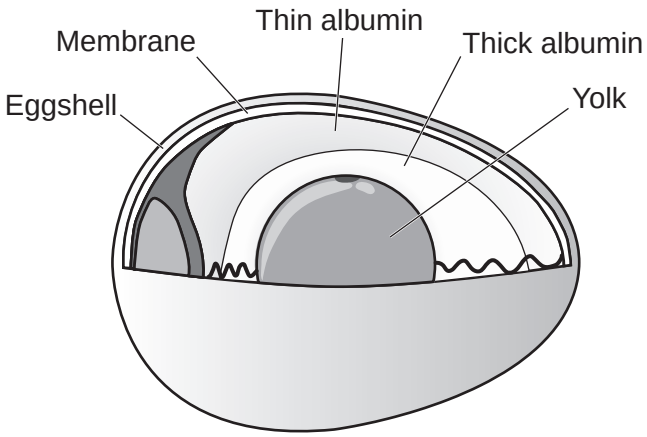
**18** The diagram shows a hen's egg.

A chick can develop inside the egg.




**(a)** The developing chick gets most of its nutrition from the egg yolk.

A student tests the yolk for **protein**.

The tables show:

- reagents that could be used to test the yolk
- possible colours of reagents if there is a positive test.

Identify the reagent the student should use and the colour that this reagent will go if protein is present.

Tick (✓) **two** boxes.

| **Reagent** | |
|---|---|
| Benedict's | |
| Biuret | |
| Iodine solution | |

| **Colour** | |
|---|---|
| Blue-black | |
| Purple | |
| Red | |

**[2]**

**(b)** The hen's egg is covered in an eggshell that lets gases through.

Why is it important that the eggshell lets gases through?

.....

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

**(c)** As a chick develops, it makes new cells.

These are the stages of the cell cycle. They are **not** in the correct order.

**A** Movement of the chromosomes

**B** Cell division

**C** Cell growth

**D** DNA replication

**E** More cell growth

Write the letters in the boxes to show the correct order of the stages in one cell cycle.
Two have been done for you.

| | | | | |
|---|---|---|---|---|
| **C** | | **E** | | |

**[2]**

**(d)** The size of a large hen's egg is approximately 40 mm.
The size of a bee's egg is 0.4 mm

How many orders of magnitude are there between the hen's egg and the bee's egg?

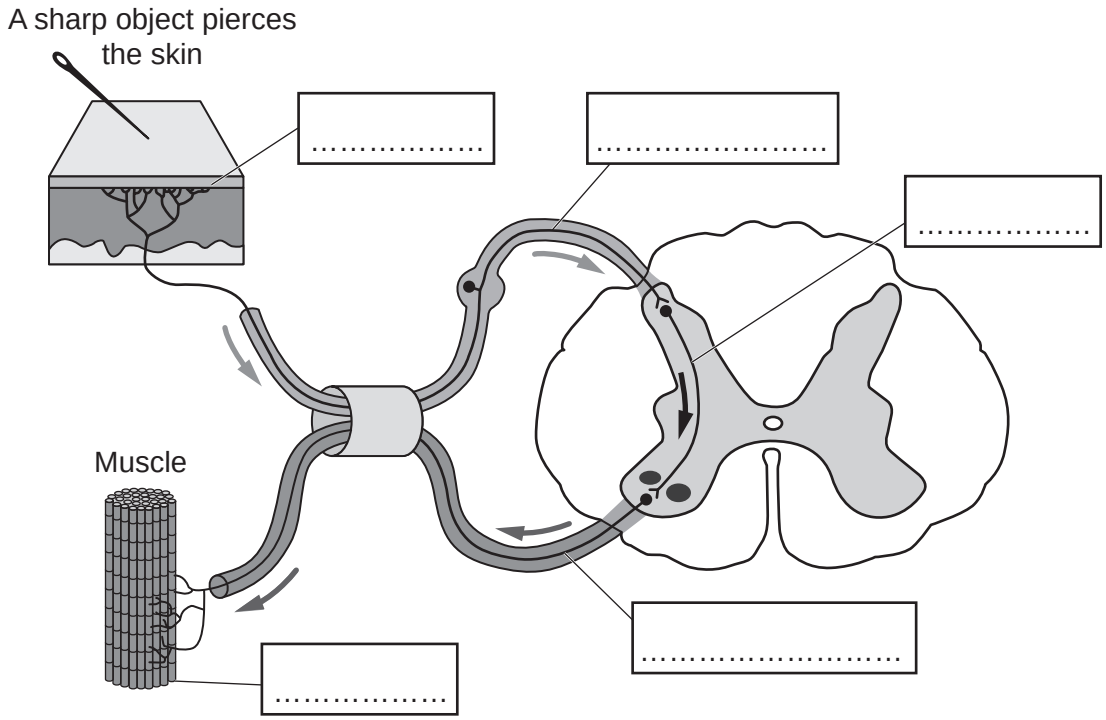
Orders of magnitude = ..... **[1]**

**19** The diagram shows the sequence of events that occurs during a reflex arc.

**(a)** Complete the reflex arc diagram.

Use the words from the list.

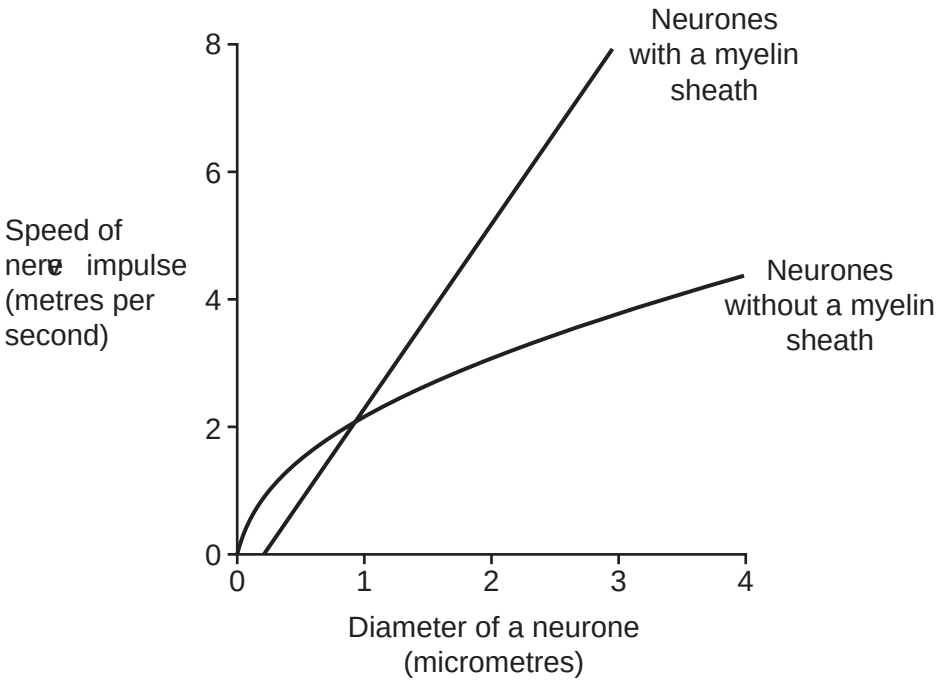
| | | | |
|---|---|---|---|
| **effector** | **motor neurone** | **receptor** | **relay neurone** |
| **sensory neurone** | **stimulus** | **synapse** | |




**[5]**

**(b)** Neurones can be divided into two types depending on whether they have a myelin sheath.

The graph shows the relationship between the speed of nerve impulses and the diameter of neurones, for both types of neurones.




Complete the sentences using the information from the graph.

Use numbers or words from the list.

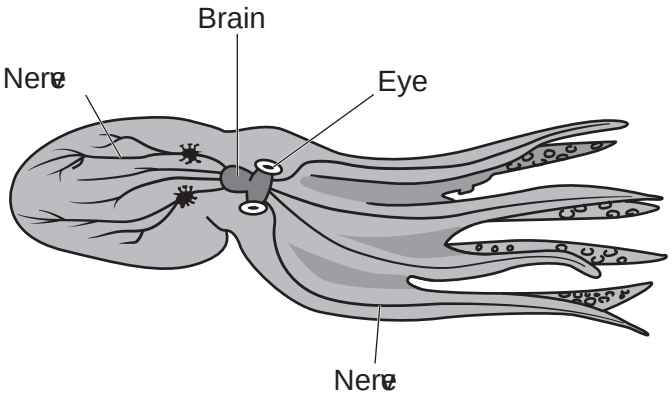
| | | | | |
|---|---|---|---|---|
| **1.0** | **4.0** | **8.0** | **faster** | **identical** |
| **negative** | **positive** | **slower** | | |

For both types of neurones there is a ..... correlation between the diameter of the neurone and the speed of nerve impulses.

At a diameter of ..... micrometres, the speed of nerve impulses are the same in both types of neurone.

Above that diameter, the speed is ..... in the neurones with a myelin sheath. **[3]**

**(c)** The diagram shows the nervous system of the octopus.




**(i)** Both the octopus and humans have a central nervous system (CNS).

Give **one** similarity and **one** difference between the octopus CNS and the human CNS.

Similarity .....

.....

Difference .....

.....

**[2]**

**(ii)** In both the octopus and the human nervous systems, the eyes are close to the brain.

Suggest **one** advantage of this arrangement.

.....

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

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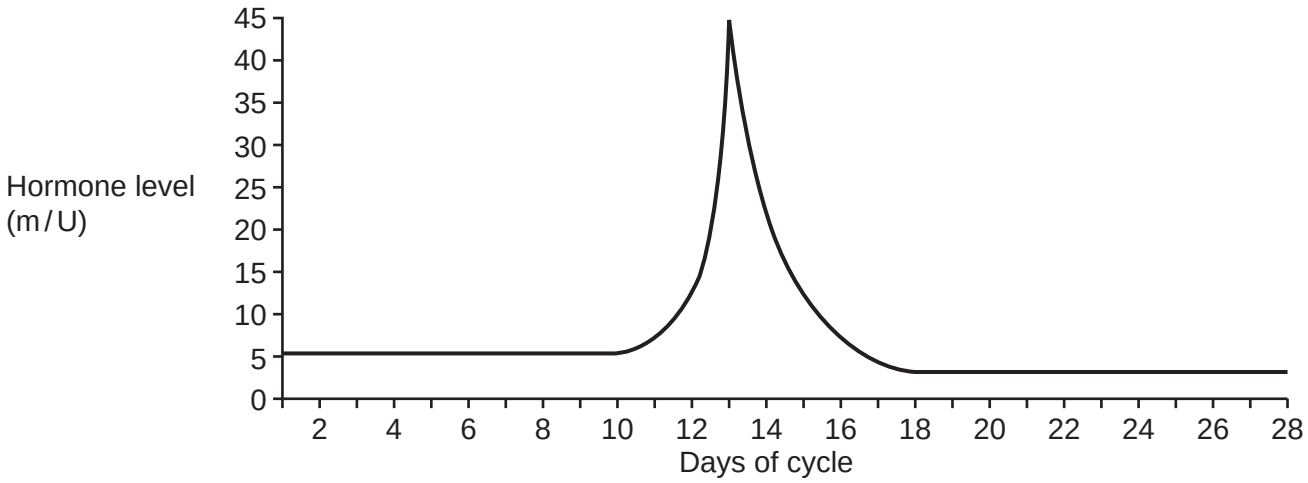
**20**

**(a)*** A female is trying to get pregnant.

To help improve her chances of pregnancy her doctor tells her:

- to monitor her level of a hormone that causes ovulation
- most sperm only survive 2 days in the female uterus, although some sperm can survive up to 5 days
- eggs only survive in the body for 24 hours after ovulation unless they are fertilised.

The graph shows the female's hormone level during a typical menstrual cycle.



Explain when, during the female's menstrual cycle:

- having sex could **possibly** result in pregnancy
- having sex is **most likely** to result in pregnancy.

Use the information provided by the doctor, the graph and your scientific knowledge.

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

**(b)** The table lists some of the different contraceptives available to males and females.

For each method of contraception, tick (✓) **all** the boxes that describe how that method works.

| Method of contraception | Hormonal | Non-hormonal | Stops sperm entering the uterus | Stops ova (eggs) being released |
|---|---|---|---|---|
| **Condom** | | | | |
| **Diaphragm** | | | | |
| **IUD** | | | | |
| **Combined pill** | | | | |

**[4]**

**21** Some people have a condition called varicose veins in their legs.

The veins swell up because the valves are not working properly.

**(a)** What is the role of the valves in veins?

.....

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

**(b)** Varicose veins are more common in pregnant females.

During pregnancy, the baby can push on the main veins bringing blood back from the mother's legs.

Give **one** reason why this could lead to varicose veins in the legs.

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

**(c)** The data in **Table 21.1** shows the results from a study on varicose veins.

**Table 21.1**

| Age group | Number of people with varicose veins | Percentage of people with varicose veins who are male (%) |
|---|---|---|
| < 25 | 1256 | 46.0 |
| 25–29 | 2403 | 32.5 |
| 30–34 | 4304 | 26.5 |
| 35–39 | 5387 | 27.7 |
| 40–44 | 5630 | 29.6 |
| 45–49 | 5713 | 34.5 |
| 50–54 | 5297 | 37.9 |
| 55–59 | 4625 | 41.6 |
| 60–64 | 3400 | 46.1 |
| 65–69 | 2271 | 40.6 |
| 70+ | 3438 | 33.3 |

**(i)** Calculate the number of **males** in the study with varicose veins who were younger than 25 years old.

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

**(ii)** Which conclusions based on the data in **Table 21.1** are **true** and which are **false**?

Tick (✓) **one** box in each row.

| Conclusion | True | False |
|---|---|---|
| More females than males develop varicose veins. | | |
| Varicose veins are more common in people under the age of 25. | | |
| The age range 50–54 has the greatest number of cases of varicose veins. | | |
| There are more than double the number of people with varicose veins in the age range 55–59 compared to 65–69. | | |

**[2]**

**(d)** The results of the study were published in a peer review journal.

Give **one** reason why peer review is important.

.....

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

**22** A student investigates the effect of different concentrations of sugar solution on cubes of beetroot.

This is the method that they use:

**Step 1** Cut four cubes of beetroot tissue.

**Step 2** Place each beetroot cube in a test tube containing a different concentration of sugar solution.

**Step 3** Leave the beetroot cubes in the sugar solutions for 3 hours.

**Step 4** Remove the beetroot cubes from the sugar solutions.

**(a)** The student wants to calculate the percentage change in mass for each beetroot cube.

They want to use the method above to collect the data they need, but have missed some steps from the method.

Describe the **additional** steps needed in the method to find the data.

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.....

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.....

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

**(b)** State **two** variables that the student should control in this investigation.

1 .....

2 .....

**[2]**

**(c)** Describe how the student could find out if their data is both repeatable and reproducible.

Repeatable .....

.....

.....

Reproducible .....

.....

.....

**[3]**

**(d)** Two of the beetroot cubes increased in mass.

Explain why some of the beetroot cubes will increase in mass.

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.....

.....

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

**23** In 2013, scientists researched the use of stem cells to reverse hearing loss.
The scientists used 18 individual rodents for this research.

- They used a chemical to cause deafness in one ear of each rodent.
- They used stem cells to grow nerve cells in the lab.
- They transferred approximately 50 000 nerve cells into each rodent's ear.
- After 10 weeks they tested the rodents' hearing.

**(a)**

**(i)** What type of stem cell will the scientists have used?

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

**(ii)** Why will the scientists have used this type of stem cell?
Tick (✓) **one** box.

| | |
|---|---|
| Can differentiate into any type of cell | ☐ |
| Can differentiate into some types of cells | ☐ |
| Easy to collect | ☐ |

**[1]**

**(b)** Results from the research showed that the 18 rodents regained an average of 46% of their hearing.

**(i)** One of the scientists claims 'this research shows that our method will cure people who have a similar hearing problem'.

State **three** reasons why this scientist's claim is **incorrect**.

1 .....

.....

2 .....

.....

3 .....

.....

**[3]**

**(ii)** Suggest **one** way the scientists could extend their research.

.....

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

**(c)** The scientists discover that a different technique could one day be used to successfully treat 15% of the 10 million people who have hearing loss.

Calculate how many of the 10 million people with hearing loss could benefit from this technique.

Number of people = ..... million **[2]**

**END OF QUESTION PAPER**

## EXTRA ANSWER SPACE

If you need extra space use this lined page. You must write the question numbers clearly in the margin.