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Tuesday 14 May 2019 – 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 may 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 may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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 consists of **32** pages.

SECTION A

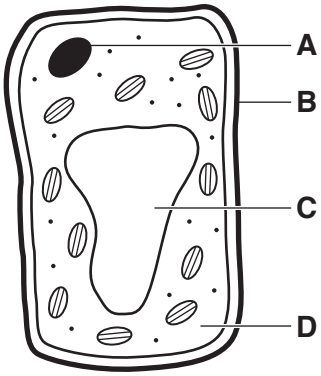
Answer **all** the questions.

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

Write your answer to each question in the box provided.

1 The diagram shows a plant cell observed using a light microscope.

Which label is pointing to a structure that contains genetic material?



Your answer ☐ **[1]**

2 How many different bases are in DNA?

A 2

B 4

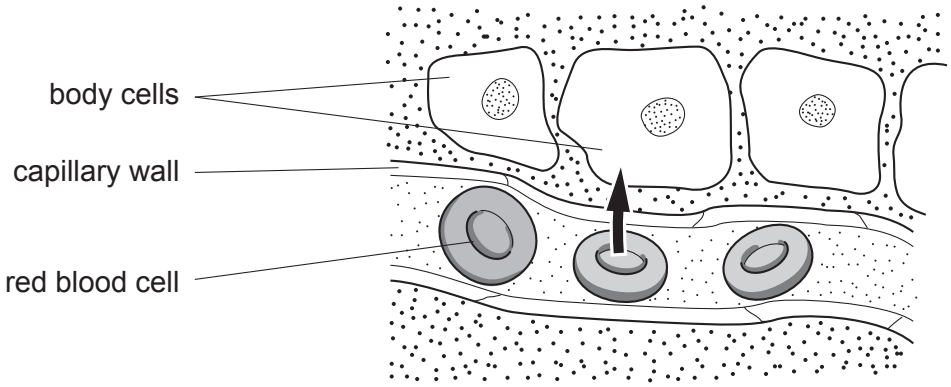
C 23

D 46

Your answer ☐ **[1]**

3 The diagram shows the direction of **oxygen** transfer from red blood cells to body cells.

What process does the arrow show?



A Active transport

B Diffusion

C Osmosis

D Transpiration

Your answer ☐ **[1]**

4 Which part of the eye does not function correctly in colour blindness?

A Cornea

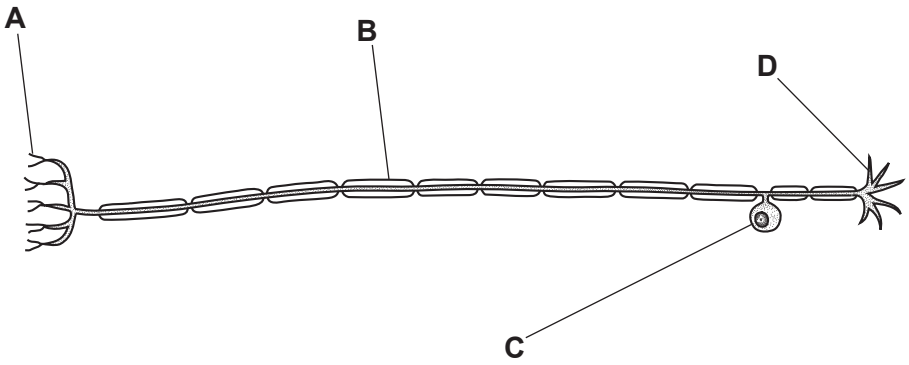
B Iris

C Lens

D Retina

Your answer ☐ **[1]**

5 Which label is pointing to the myelin sheath in a motor neurone?



Your answer ☐ **[1]**

6 What is the name of the gap between two neurones?

A Axon

B Dendrite

C Lumen

D Synapse

Your answer ☐ **[1]**

7 Light travels through different parts to reach the back of the eye.

Which structure does light pass through first when it enters the eye?

A Cornea

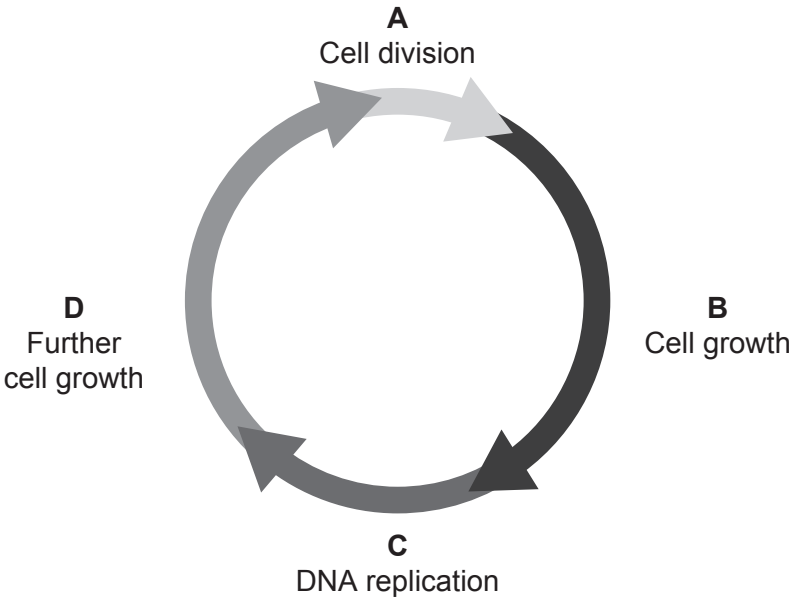
B Lens

C Pupil

D Retina

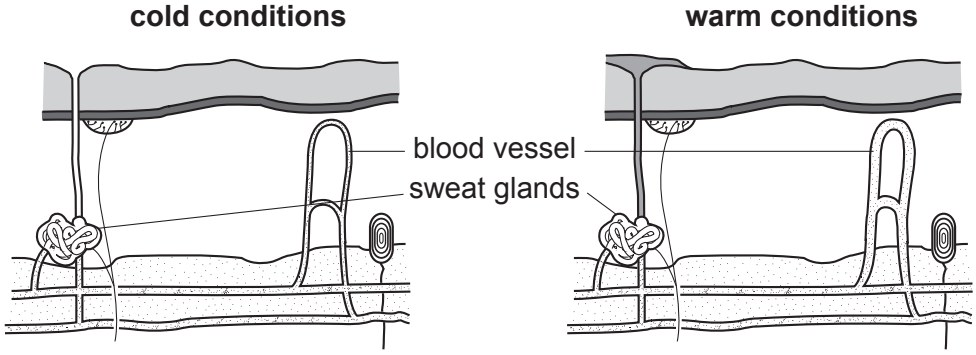
Your answer ☐ **[1]**

8 During which phase of the cell cycle does mitosis happen?



Your answer ☐ **[1]**

9 The diagrams show changes in the skin as a person moves from cold to warm conditions.



Which processes happen in the skin as a result of the change from cold to warm conditions?

A Blood vessels widen and sweat is released.

B Blood vessels narrow and sweat is released.

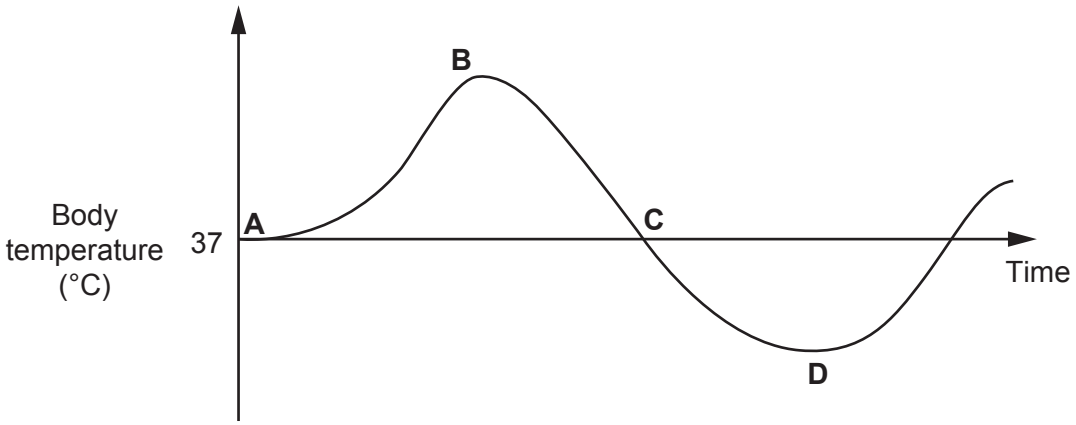
C Blood vessels widen and sweat production stops.

D Blood vessels narrow and sweat production stops.

Your answer ☐ **[1]**

10 The graph shows changes to body temperature during temperature regulation.

Which letter on the graph shows when shivering is occurring?



Your answer ☐ **[1]**

11 Which part of the brain controls the heartbeat and breathing?

A Cerebrum

B Hypothalamus

C Medulla

D Pituitary

Your answer ☐ **[1]**

12 When the enzyme lipase is mixed with a lipid which of the following will increase in concentration?

A Amino acids

B Fatty acids and glycerol

C Glucose and fructose

D Starch

Your answer ☐ **[1]**

13 A cube of potato is used to investigate the effect of surface area on osmosis.

The cube is 3 × 3 × 3 cm.

What is the surface area to volume ratio of the cube?

A 1 : 2

B 2 : 1

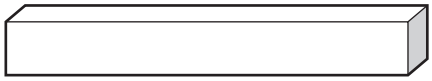
C 6 : 1

D 1 : 6

Your answer ☐ **[1]**

14 An experiment is carried out to find the concentration of potato tissue.

Four chips are cut from a potato.



At the start, each chip is 50 mm long, 10 mm wide and 10 mm high.

Each chip is put in a different sucrose solution **A**, **B**, **C** and **D**.

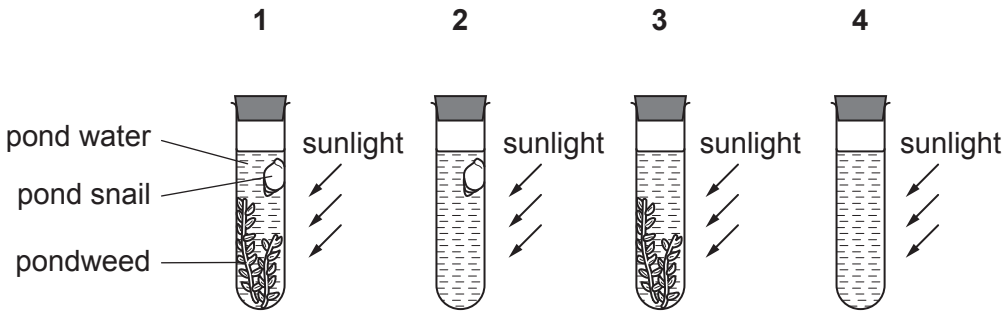
The volumes of the chips are calculated after 1 hour.

Sucrose solution	Volume of chip (mm^3)
A	50
B	500
C	5000
D	50 000

Which sucrose solution has the same concentration as the potato tissue?

Your answer ☐ **[1]**

15 Pond snails and pondweed are living in water in sealed test tubes.



Carbon dioxide dissolves in water and forms an acid.

In which test tube would the water become most acidic?

A 1

B 2

C 3

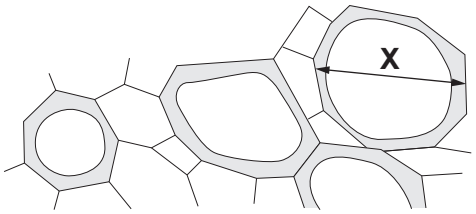
D 4

Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

16 The diagram shows cells that are important in the process of **transpiration** in plants.



(a) The diameter of cell **X** has been magnified 500×.

Calculate the actual diameter of cell **X**.

Use the equation: actual diameter = measured size ÷ magnification

Diameter = ... mm **[2]**

(b) What is the name of plant cell **X**?

Tick (✓) **one** box.

Phloem cell ☐

Root hair cell ☐

Xylem cell ☐

[1]

(c) State **two** ways that cell **X** is adapted to its function in a plant.

1 .....

2 .....

[2]

(d) Light microscopes let us see objects as small as 0.2 micrometres.

The diameter of cells similar to cell **X**, can vary between 0.008 mm and 0.5 mm.
(1 mm = 1000 micrometres)

Is it possible to see all these types of cells using a light microscope?

Explain your answer.

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

(e) State why electron microscopy has increased our knowledge of sub-cellular structures.

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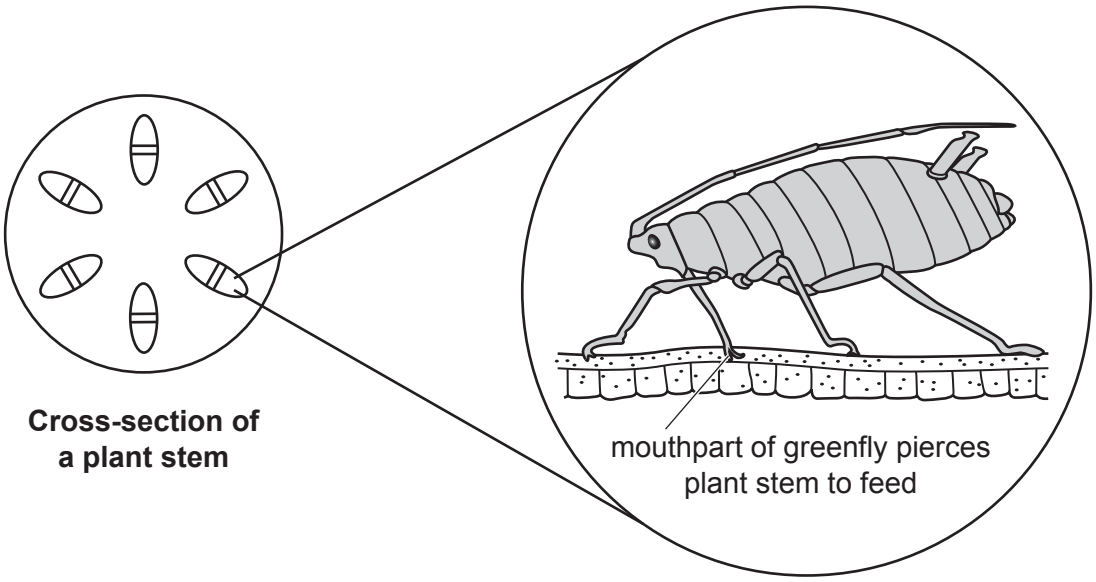
..... **[1]**

17 (a) The diagram shows a cross-section of a plant stem.

A greenfly feeds on the plant by piercing through to the tissue shown in the cross-section of a plant stem.



(i) What is the name of the tissue in the stem that the greenfly is trying to reach with its mouthpart?

Tick (✓) **one** box.

Phloem ☐

Root hair ☐

Xylem ☐

[1]

(ii) Explain why plants infested with greenfly have very poor growth.

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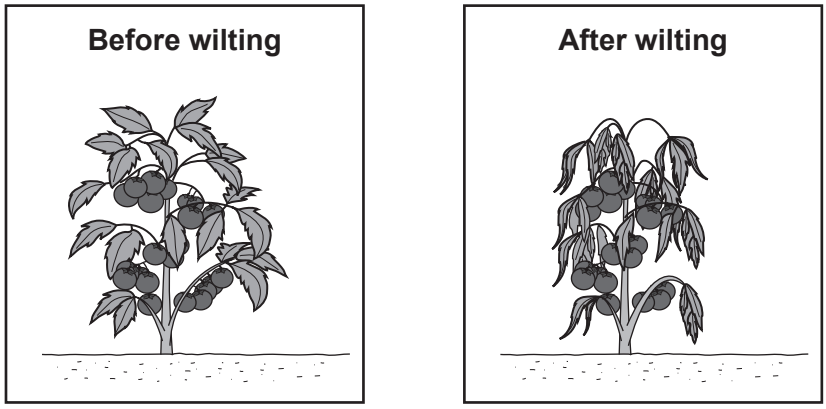
..... **[2]**

(b) A gardener carries out an experiment using two similar tomato plants. The tomato plants are grown in pots.

She puts one inside a glasshouse and one outside beside the glasshouse.

To decide which plant loses the most water, the gardener looks to see which plant wilts first.

The diagrams show a plant before and after it has wilted.



(i) On a windy day, the plant **outside** the glasshouse wilts first.

Explain why.

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

(ii) The gardener's results do not provide very accurate information about the effect of wind on water loss.

How could the gardener improve the design of her experiment?

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(c) Fifty years ago scientists experimenting on plants had to inject dyes to measure water flow.

Now they can use modern methods such as MRI and X-ray imaging.

Scientists are now developing new ideas on how water flows through a plant that are different from theories developed fifty years ago.

Explain why.

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

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18 (a) A scientist clones a cauliflower plant.

He uses small pieces of the cauliflower plant called explants.

This is the method the scientist uses to get the explants:

- Place the equipment in a beaker of bleach and swab the bench with 70% alcohol.
- Collect a small piece of cauliflower and place on a white tile.
- Use a scalpel to cut the piece of cauliflower lengthways into small 3–5 mm pieces called explants.
- Measure the mass of the explants.

(i) Suggest why the scientist uses a scalpel rather than a kitchen knife.

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

(ii) Write down **one** safety precaution that the scientist should take when using a scalpel.

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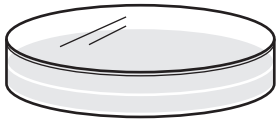
..... **[1]**

(iii) The explants are then prepared for cloning by placing on an agar jelly plate.

Agar jelly contains water, sugars and minerals.



Agar jelly plate

When the explants are placed on the agar jelly plate they have no roots or leaves.

Explain why the explants must be placed on the agar jelly plate.

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

(b) To grow the explants, the scientist places the agar jelly plate in a warm room near to a window.

(i) Explain why this will help the explants grow and develop into clones.

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

(ii) Using a heated cabinet with light bulbs inside the cabinet would improve this method.

Explain why.

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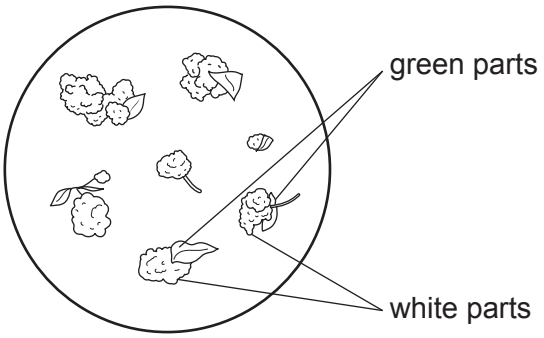
..... **[2]**

(iii) The scientist examines the agar jelly plate regularly.

Growth of the explants is visible in the plate within 10 days and parts of the explants are turning green.



What conclusion can be made about why the explants have parts that are turning green?

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

(c) The mass of the explants at the start was 15 g.

After 10 days the mass of the explants was 28 g.

Calculate the percentage increase in mass of the explants.

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

Percentage increase = ... % **[3]**

(d) The cells in cauliflower explants behave the same way as embryonic stem cells do in animals.

Explain why it is more difficult to clone adult animals than to clone cauliflowers.

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

19 Plant hormones are involved in controlling some processes in plants.

(a) Which processes in plants are controlled by plant hormones?

Tick (✓) **three** boxes.

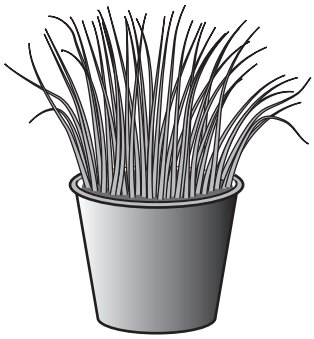
Flower opening	☐
Germination	☐
Photosynthesis	☐
Pollination	☐
Respiration	☐
Shedding of leaves	☐

[3]

(b) A child sets up an experiment to grow grass seeds in a plastic cup.

The grass seeds in cup **A** are grown directly under a window.
The grass seeds in cup **B** are grown by a window to the side.

Look at the results.

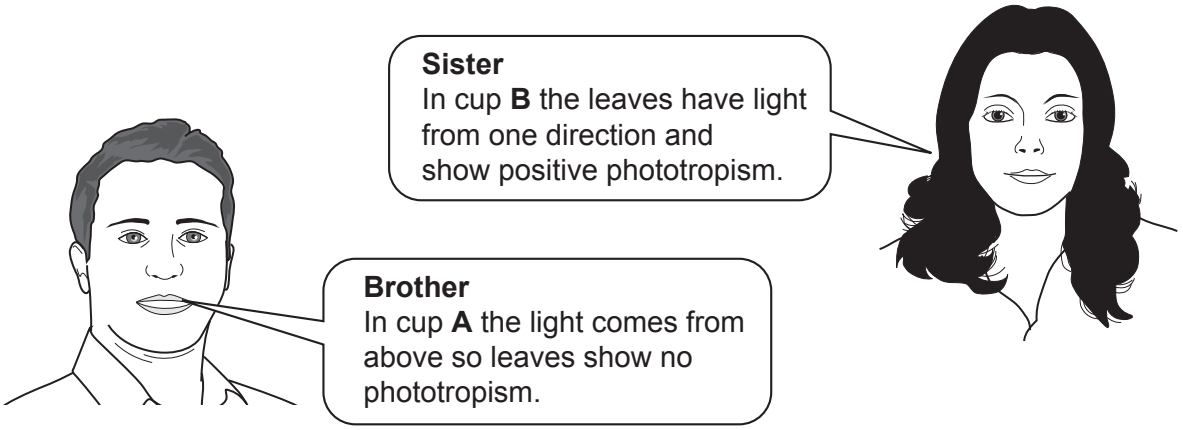


A
Grass seeds grown directly under a window

B
Grass seeds grown by a window to the side

The child's older brother and sister try to explain what has caused the results.

They make different conclusions.



(i) Explain why the sister has given the better conclusion.

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

(ii) Name the hormone that causes phototropism.

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

(c) (i) Different hormones control the human menstrual cycle.

Complete the sentences to describe how the menstrual cycle is controlled.

Use words from the list.

Each word can be used once, more than once, or not at all.

fetus **follicle** **FSH** **oestrogen** **progesterone**

The hormone released by the pituitary gland is called ..... .

This hormone acts on the ovary and causes the growth of a ..... .

The hormone that maintains the lining of the uterus is called ..... .

[3]

(ii) The table shows the concentration of oestrogen in the blood during the first 7 days of the menstrual cycle.

Time in days	Oestrogen (mg/100 cm^3 of blood)
1	20
2	20.5
3	25
4	27.5
5	30
6	32.5
7	34

Put a (ring) around the days below which show a steady increase in the concentration of oestrogen.

Days 1–4 **Days 2–5** **Days 3–6** **Days 4–7**

[1]

(d) The lining of the uterus is shed during menstruation.

New cells are needed to replace the lining of the uterus.

Describe the processes that occur to make these new cells.

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

20 (a) (i) Diabetes occurs when blood sugar levels are not controlled.

Which hormone reduces blood sugar levels?

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

(ii) Hormones are produced in endocrine glands.

Describe how hormones control different parts of the body.

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

(iii)* A glucose tolerance test can help identify if a person has diabetes.

The graphs show a glucose tolerance test in three people **A**, **B**, and **C**.

Key

– – – – Hormone that controls blood sugar levels

——— Glucose

'The Child with a Metabolic Condition', Chapter 31, www.nursekey.com, Nurse Key. Item removed due to third party copyright restrictions. Link to material: https://nursekey.com/wp-content/uploads/2016/08/F000310f031-003-9781437708240.jpg

One person is healthy and the other two people have different types of diabetes.

Explain the differences between the three graphs and describe how each person with diabetes could control their blood glucose levels.

Use information from the graphs in your answer.

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

(b) Diabetes can often result in high levels of glucose in the urine.

Which organ usually prevents glucose being lost from the blood when urine is made?

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

(c) Drugs can be used to treat one type of diabetes. One drug prevents an enzyme working properly.

Suggest how a drug can stop an enzyme working.

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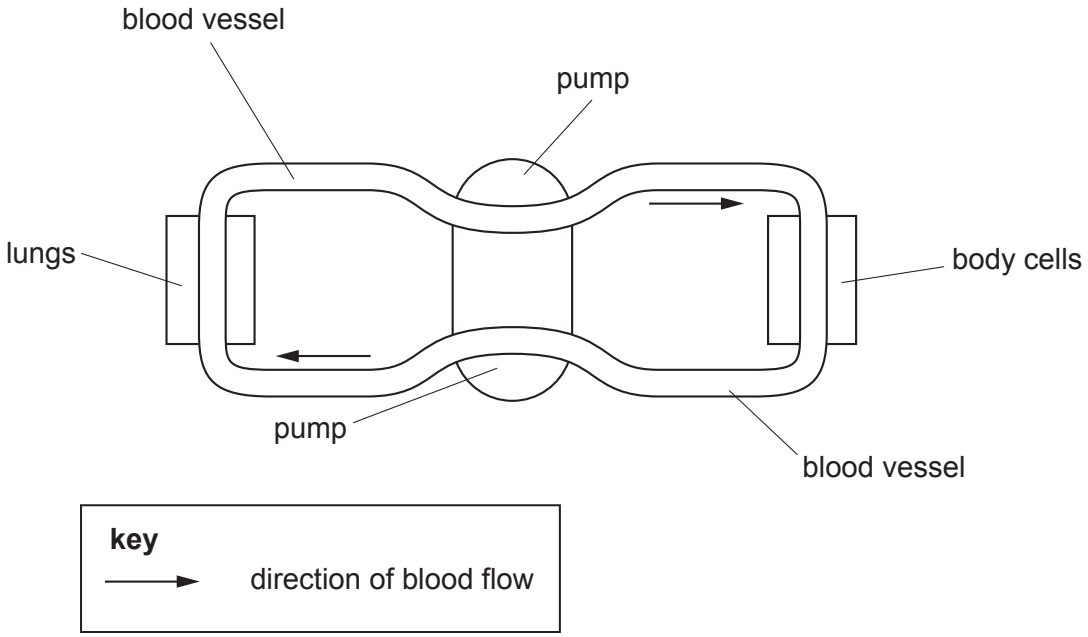
..... **[2]**

21 Look at the diagram. It represents the human circulatory system.



(a) Describe how the diagram shows that humans have a double circulatory system.

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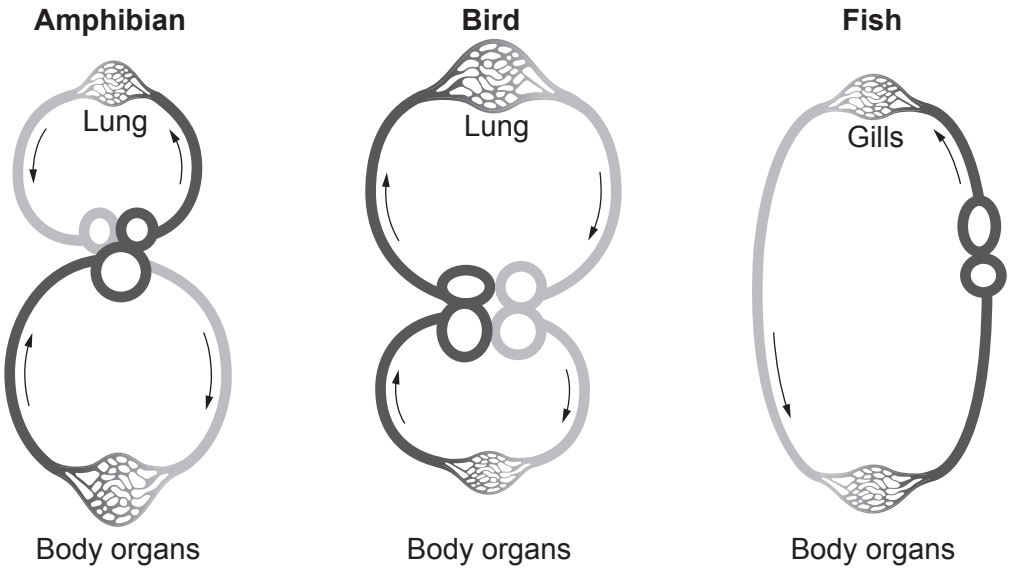
..... **[2]**

(b) Look at the diagrams of the circulation systems in an amphibian, bird and fish.



Which of these has a circulatory system most similar to humans?

Tick (✓) **one** box.

Amphibian ☐

Bird ☐

Fish ☐

Explain your choice.

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

(c) Scientists investigate how exercise affects blood flow to different organs in the body.

This is their method.

- Ask a healthy person to sit in a room at 20 °C
- Measure the blood flow to different organs in the person's body
- Repeat this with the person exercising at a constant speed on a treadmill in the same room.

The table shows the scientists' results.

Organ	Rate of blood flow (ml per minute)	
	Sitting	**Doing exercise**
Brain	750	750
Heart muscle	250	1000
Muscles	1200	22 000
Skin	500	600
Other organs	3100	650
Total	**5800**	**25 000**

(i) By how many times has the **total** blood flow increased by doing exercise?

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

Number of times the total blood flow has increased = ... **[2]**

(ii) The table shows that blood flow to other organs has decreased by nearly 5 times when a person is **doing exercise**.

The blood flow to the muscles has increased by more than eighteen times.

Explain these changes to blood flow rate.

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

22 Yeast cells can respire anaerobically.

(a) Complete the word equation for **anaerobic** respiration in yeast.

glucose ⟶ ..... + ... **[1]**

(b) Write down **two** ways in which anaerobic respiration in yeast cells is different from anaerobic respiration in human muscle cells.

1 .....

.....

2 .....

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

(c) Date fruits contain three different sugars, fructose, glucose and sucrose.

Different strains of yeast can ferment different sugars to produce a fermented product.

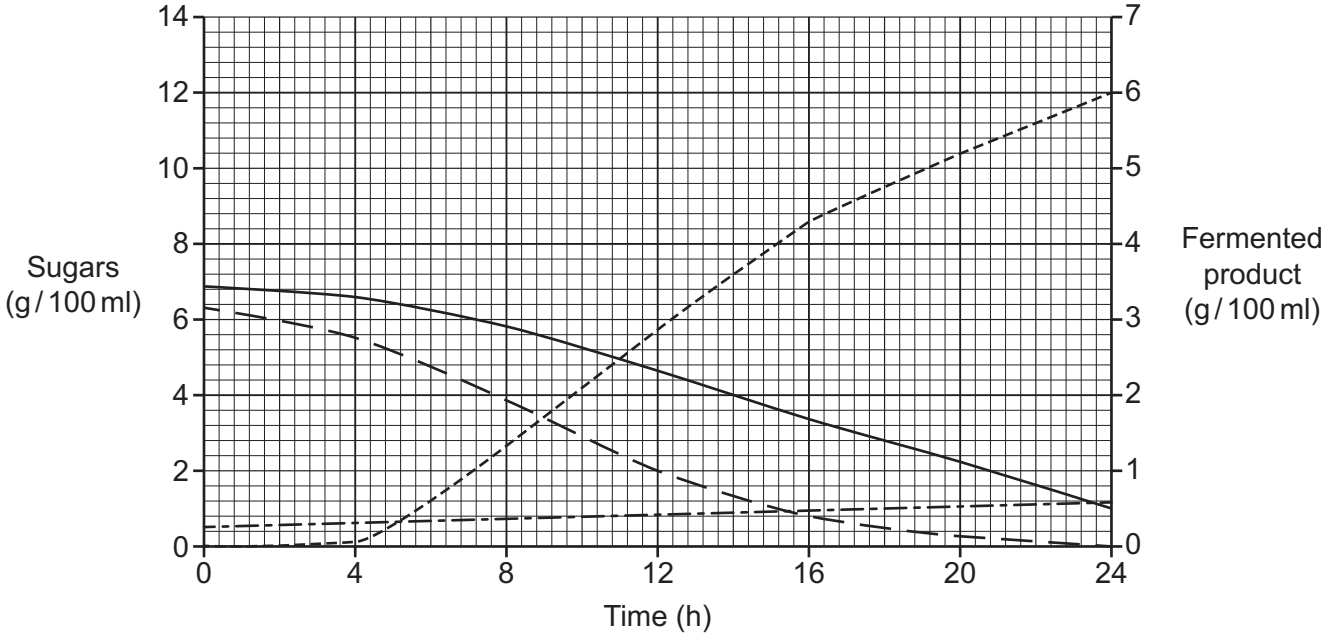
Scientists investigate how two different strains of yeast, **A** and **B**, ferment sugars inside date fruits.

Look at their results.

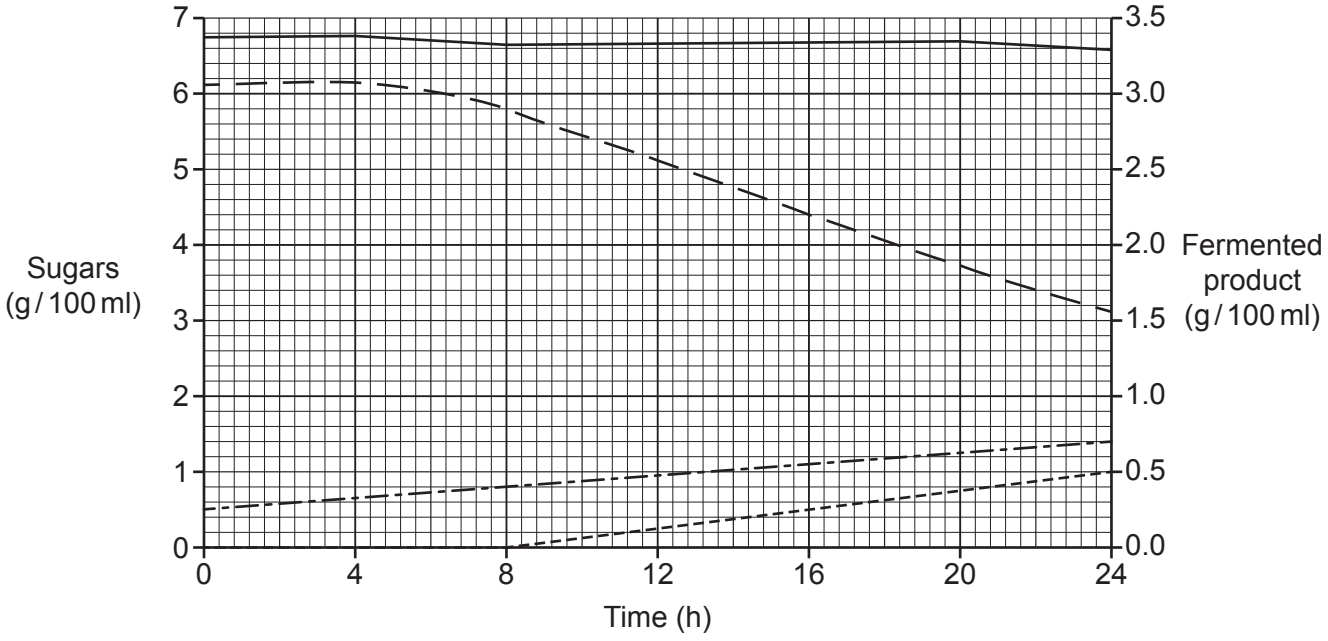
Key

——— fructose — — glucose - - — - - sucrose ------ fermented product

Yeast A



Yeast B



(i) Which sugar is **not** fermented by either strain of yeast?

Tick (✓) **one** box.

Fructose ☐

Glucose ☐

Sucrose ☐

[1]

(ii) After 24 hours, how many times higher is the fermented product yield of yeast **A** compared to yeast **B**?

Number of times higher = ... **[2]**

(iii) Which sugar would increase fermentation the **most** if added to either yeast **A** or yeast **B**?

Tick (✓) **one** box.

Fructose ☐

Glucose ☐

Sucrose ☐

[1]

(iv) Fermented dates are used to supply both fructose and fermented product.

Explain why it would be best to use yeast **B** to ferment dates to supply both fructose and fermented product.

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

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).