OCR
Oxford Cambridge and RSA

H

Friday 06 November 2020 – Morning

GCSE Biology A (Gateway Biology)

J247/03 Paper 1 (Higher 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

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 **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 **32** pages.

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

© OCR 2020 [601/8589/2]
DC (CJ/CB) 189804/8
OCR is an exempt Charity

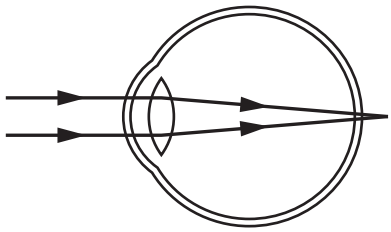
SECTION A

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 Look at the diagram showing an eye defect.



What is the defect and which lens could be used to correct it?

A Long-sightedness, corrected with a concave lens

B Long-sightedness, corrected with a convex lens

C Short-sightedness, corrected with a concave lens

D Short-sightedness, corrected with a convex lens

Your answer ☐ **[1]**

2 Anaesthetics used during operations slow down breathing and heart rate.

Which part of the brain do anaesthetics act on to do this?

A Cerebrum

B Cerebellum

C Medulla

D Pituitary

Your answer ☐ **[1]**

© OCR 2020

3 Which row shows the correct direction of blood flow through a double circulatory system?

A left side of heart → body organs → right side of heart → lungs

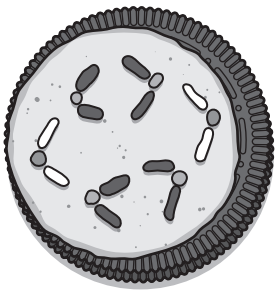
B left side of heart → lungs → right side of heart → body organs

C right side of heart → body organs → lungs → left side of heart

D right side of heart → lungs → body → left side of heart

Your answer ☐ **[1]**

4 A student models the process of mitosis using cookies and sprinkles.



Mitosis is part of the cell cycle.

Which process in the cell cycle has the student modelled?

A Cell division

B Chromosome movement

C DNA replication

D Growth of cell

Your answer ☐ **[1]**

5 How is sugar transported around a plant?

A Upwards in phloem

B Upwards in xylem

C Upwards and downwards in phloem

D Upwards and downwards in xylem

Your answer ☐ **[1]**

© OCR 2020

6 The resolution of an electron microscope is 0.1 nanometres.

The resolution of the eye is 100 micrometres.

How many times greater is the resolution of the electron microscope than the eye?

(1 micrometre = 1000 nanometres)

A 1000

B 10 000

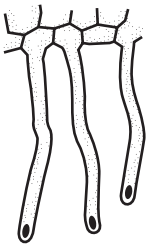
C 100 000

D 1 000 000

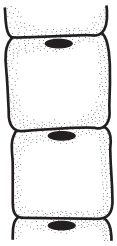
Your answer ☐ **[1]**

7 Which diagram shows cells that swell, creating an opening during daylight conditions?

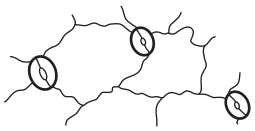
A



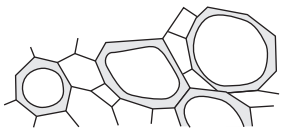
B



C



D



Your answer ☐ **[1]**

© OCR 2020

8 In a sample of DNA, 23% of the bases are cytosine.

What percentage of the bases are adenine?

A 23%

B 27%

C 46%

D 54%

Your answer ☐ **[1]**

9 Arsenic is a toxin that stops respiration in cells.

What other cell process would be stopped because of arsenic?

A Active transport

B Diffusion

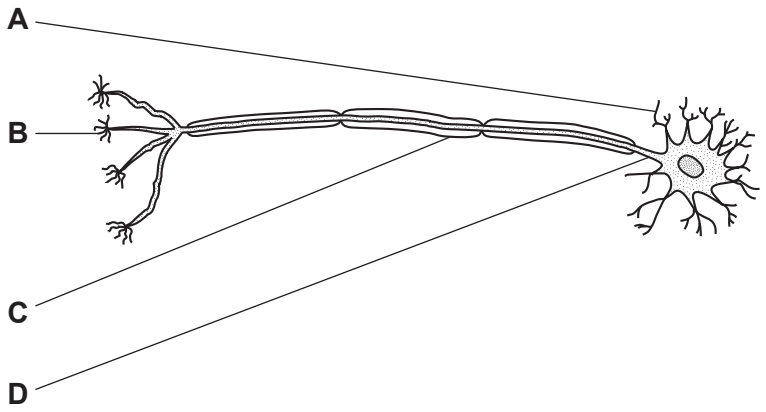
C Osmosis

D Transpiration

Your answer ☐ **[1]**

10 A motor neurone is usually stimulated by a relay neurone.

Which part of the motor neurone is first stimulated by a relay neurone?



Your answer ☐ **[1]**

© OCR 2020

11 In people with multiple sclerosis their immune cells stop working as they should. HSCT is a treatment for multiple sclerosis which destroys all the immune cells.

Once the immune cells are destroyed, cells from a patient's bone marrow can replace the immune cells.

What type of cell is used to replace the destroyed immune cells?

A Neurone cell

B Red blood cell

C Stem cell

D White blood cell

Your answer ☐ **[1]**

12 A side effect of some antibiotics is to inhibit the release of thyroxine into the blood.

What will these antibiotics do to levels of TSH and TRH?

A Both decrease

B Both increase

C Both stay the same

D TSH increases and TRH decreases

Your answer ☐ **[1]**

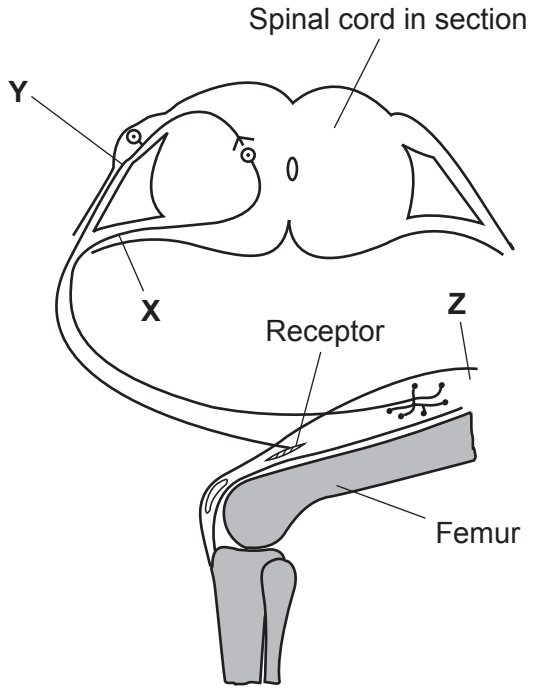
13 Which row in the table represents the eye when a person is in a dark room?

	Front view of iris and pupil	**Circular iris muscles**
A		contracted
B		relaxed
C		relaxed
D		contracted

Your answer ☐ **[1]**

© OCR 2020

14 The diagram shows a reflex arc.



A patient needs treatment for a leg injury.

An anaesthetic is injected to block nerve impulses to prevent pain but still allow movement of the leg.

Where was the anaesthetic injected in this patient?

A At **X**

B At **Y**

C At **Z**

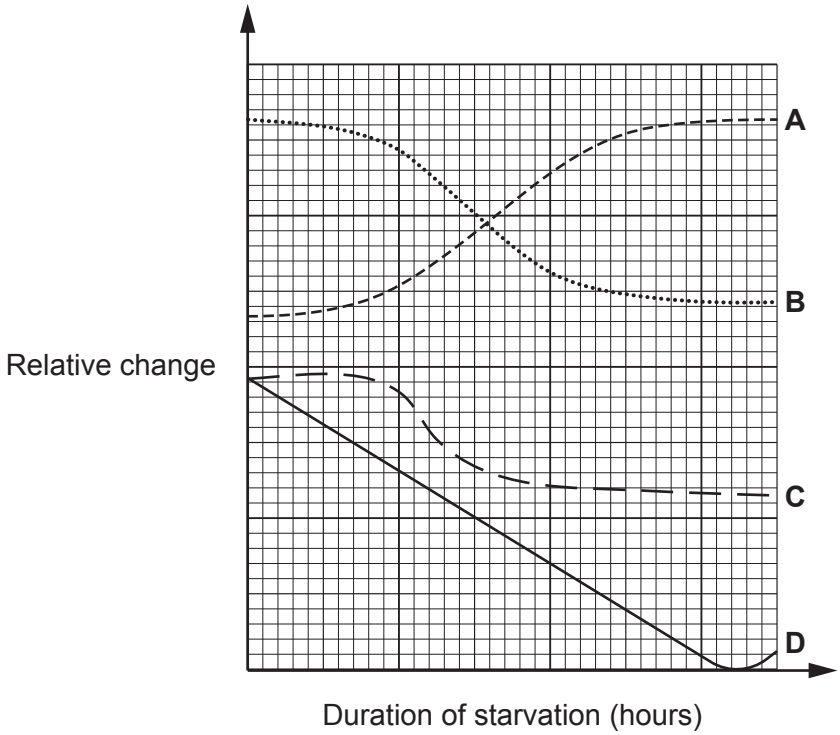
D At **X**, **Y** and **Z**

Your answer ☐ **[1]**

© OCR 2020

15 Short-term starvation affects the levels of blood glucose, liver glycogen and the hormones insulin and glucagon.

Which line on the graph represents the level of glucagon in the blood during short-term starvation?



Your answer ☐ **[1]**

© OCR 2020

SECTION B

Answer **all** the questions.

16 Some students investigate the effect of the surface area : volume ratio on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes that have been stained blue using a pH indicator solution. The indicator will turn red in acidic conditions.

They put different sized cubes into 3 different test tubes of hydrochloric acid and time how long it takes for the cubes to completely change to red.

Fig. 16.1 shows the apparatus they use.

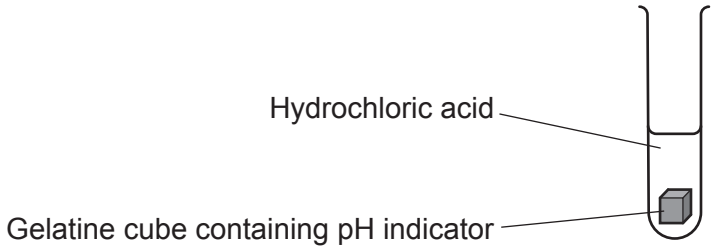


Fig. 16.1

The table shows the students' results.

Length of each side of the cube (mm)	surface area : volume ratio	Time to completely change colour (seconds)
2	.....	32
4	3 : 2	61
6	1 : 1	170

(a) **(i)** Calculate the surface area : volume ratio for the cube with sides of 2 mm.

surface area : volume ratio = ... **[2]**

(ii) What conclusion can be made about the effect of surface area : volume ratio on the rate of diffusion?

.....

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

© OCR 2020

(iii) Emphysema causes some of the walls of alveoli in the lungs to break down. This produces a smaller number of larger air sacs.

Use the results to explain the effect of emphysema on oxygen diffusing into the blood.

.....

.....

.....

.....

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

(b) In a condition called sickle cell anaemia, the red blood cells can change shape. This reduces the amount of oxygen getting to cells in the body.

Fig. 16.2 shows a red blood cell and a sickled red blood cell.

Red blood cell **Sickled red blood cell**

Fig. 16.2

Explain why sickle cell anaemia reduces the amount of oxygen getting to cells in the body.

.....

.....

.....

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

(c) Red blood cells burst when they are placed in a solution with a much higher water potential than the red blood cells. This is called lysis.

Explain why lysis happens.

.....

.....

.....

.....

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

© OCR 2020

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

© OCR 2020

17 **Fig. 17.1** shows the mass of urea in the urine plotted against the BMI (Body Mass Index) for nine boys. BMI is a value often used to see if a person is a healthy mass for their height.

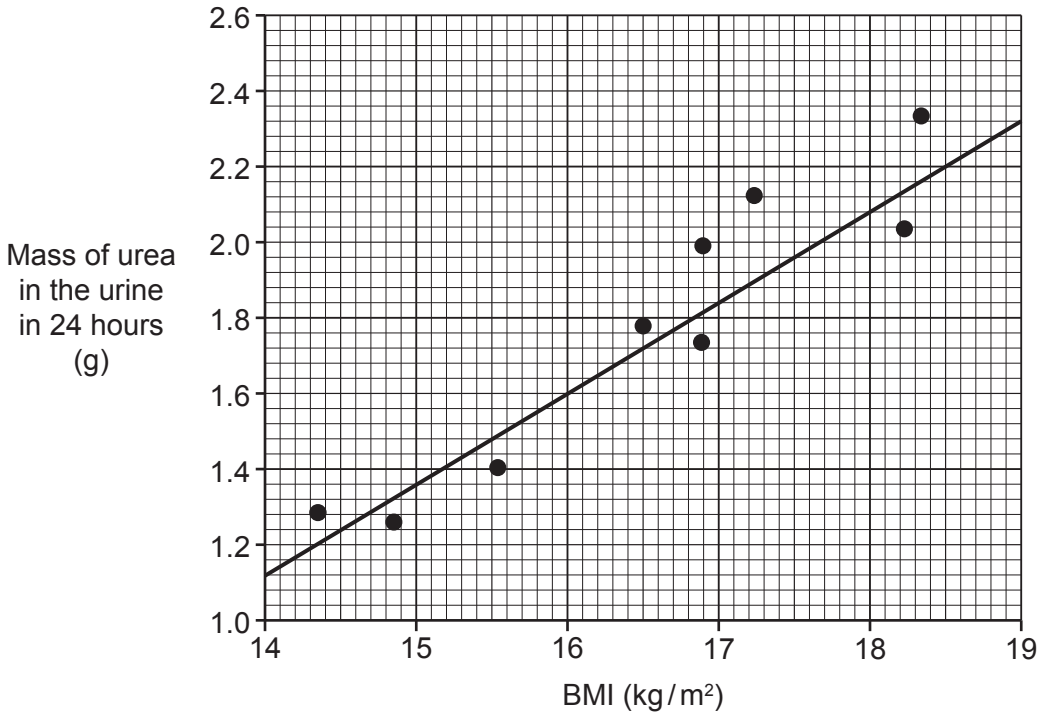


Fig. 17.1

(a) **(i)** What does the graph show about the relationship between BMI and the mass of urea in the urine?

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

(ii) A boy has a BMI of 16. He produces 1000 cm^3 of urine in 24 hours.

Calculate the concentration of urea in the boy's urine.

Concentration = ... g / cm^3 **[2]**

© OCR 2020

(iii) **Fig. 17.2** shows the mass of urea in the urine against the BMI for nine **different** boys.

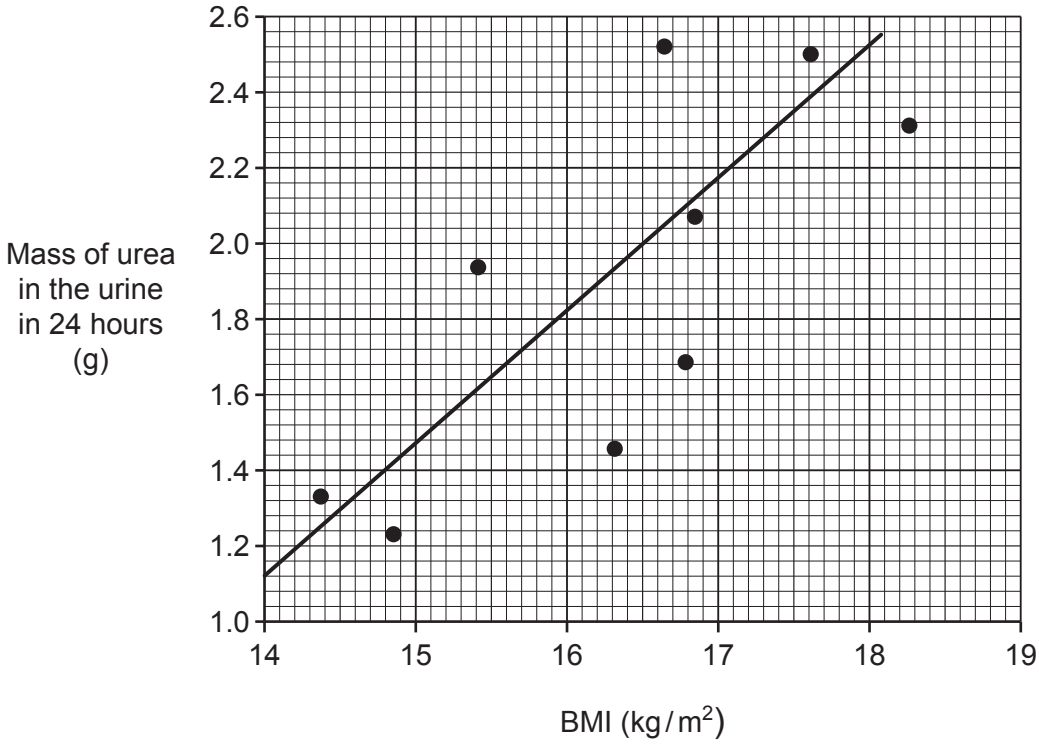


Fig. 17.2

Give **two** differences in the relationship between BMI and the mass of urea in the urine shown in **Fig. 17.1** and **Fig. 17.2**.

1 .....

.....

2 .....

.....

[2]

© OCR 2020

(b) The kidney filters the blood. The fluid produced by filtering the blood passes through kidney tubules.

Each kidney tubule contains a number of different parts.

Put a number (**1** to **5**) in the boxes to show the order of the parts that the liquid passes through.

The first one has been done for you.

Bowman's capsule	**1**
Collecting duct	
Proximal convoluted tubule	
Loop of Henlé	
Second coiled region	

[3]

© OCR 2020

BLANK PAGE

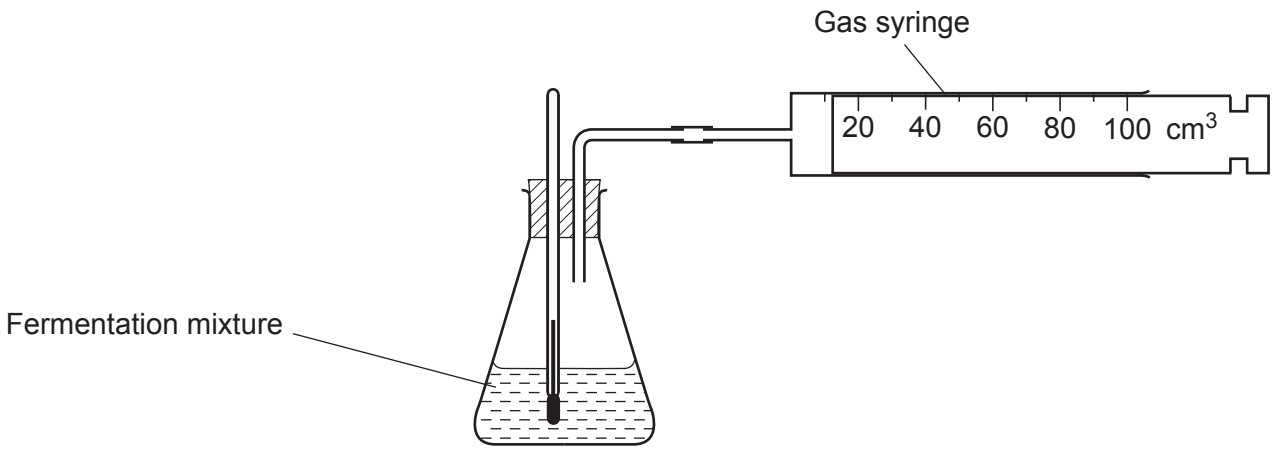
PLEASE DO NOT WRITE ON THIS PAGE

© OCR 2020

18 Fermentation involves enzymes that break down sugar releasing carbon dioxide gas.

The volume of carbon dioxide released can be used to measure how fast these enzymes are working.

A student investigates if fermentation works faster at 25 °C or 30 °C.
She measures the volume of carbon dioxide released in 10 minutes.
The diagram shows the apparatus she uses.



(a) The student could have measured the volume of carbon dioxide by collecting the gas over water in a measuring cylinder.

Why is it better to use a gas syringe?

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

(b) The student's results are shown in the table.

Temperature (°C)	**Volume of carbon dioxide gas (cm^3) released in 10 minutes**		
	Trial 1	**Trial 2**	**Trial 3**
25	23	25	22
30	34	27	33

(i) Calculate the **mean** rate of gas produced at **25 °C** in cm^3/minute.

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

Mean rate of gas produced at 25 °C = ... cm^3/minute **[3]**

© OCR 2020

(ii) The rate of gas produced at 30 °C is greater than at 25 °C.

Use ideas about enzymes to explain why.

.....

.....

.....

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

(c) Phenols are chemicals that inhibit enzymes during fermentation.

They bind to amino acids on enzyme molecules.

Suggest how phenols inhibit enzymes.

.....

.....

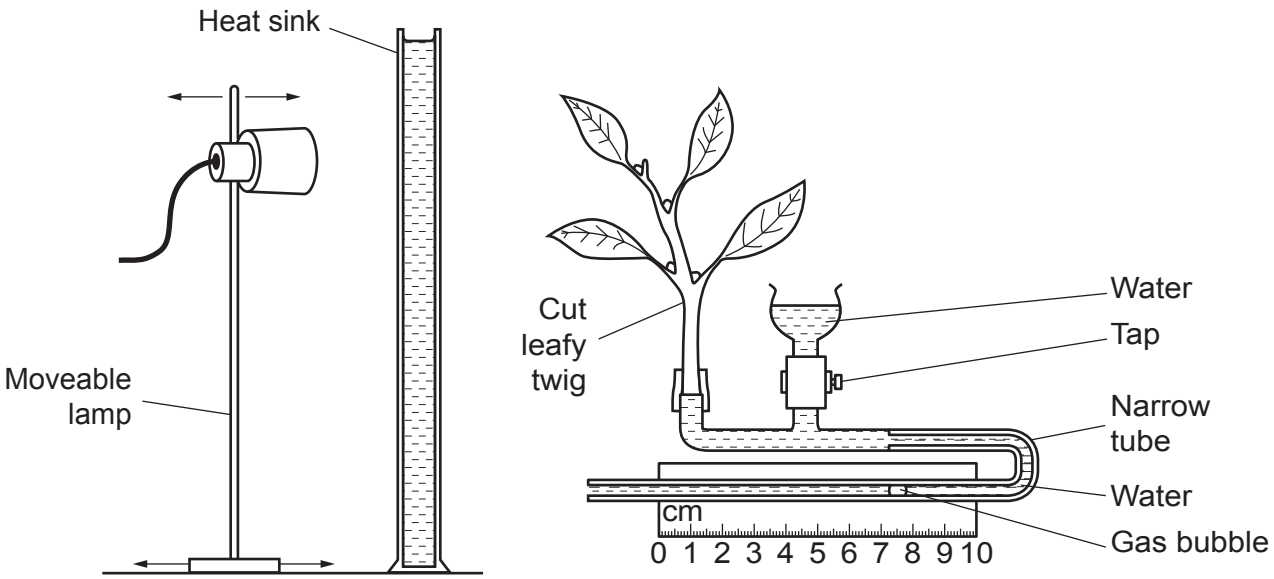
.....

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

© OCR 2020

19 The diagram shows a simple potometer.

The apparatus can be used to investigate the effect of light intensity on transpiration rates.



(a) **(i)** Describe what happens during transpiration.

.....

.....

.....

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

(ii) Describe how the apparatus can be used to investigate the effect of light on transpiration rates.

.....

.....

.....

.....

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

(iii) The heat sink is a transparent tube of cold water.

Explain why a heat sink is used in this experiment.

.....

.....

.....

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

© OCR 2020

(b) The table shows the results from using the potometer.

Distance of potometer from the light (cm)	Distance gas bubble moved in one minute (mm)		
	Trial 1	**Trial 2**	**Trial 3**
10	70	74	72
20	73	75	71
30	52	49	51
40	42	30	31
50	12	14	13

(i) The mean distance the gas bubble moved along the tube at 10 cm from the light was 72 mm.

The diameter of the narrow tube was 1 mm.

Calculate the volume of water taken up by the plant.

Use the equation: volume = $\pi r^2 l$
where r is the radius of the tube and l is the distance the bubble moves
$\pi = 3.14$

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

Volume of water = ... mm^3 / minute **[3]**

(ii) Identify the anomalous reading in their recorded results and suggest a possible reason for this.

.....

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

(iii) How should the scientists deal with this anomalous reading when they process the data?

.....

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

(iv) The scientists described their results for **20 cm** as 73 ± 2.
Explain why they did this.

.....

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

© OCR 2020

20 **(a)** Carolina horsenettle is a weed that grows in crop fields in the USA.

New horsenettle shoots develop from buds on roots in spring. The shoots die in the autumn but the roots remain alive under the ground.

Effective weed control involves stopping seed production and killing the root system.

Selective herbicides are used to control Carolina horsenettle.

The best time to apply selective herbicide is when the horsenettle is actively growing between the bud and flower stage.

(i) Describe how a selective herbicide works.

.....

.....

.....

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

(ii) **Fig. 20.1** and **Table 20.1** show information about four different herbicides **A**, **B**, **C** and **D**.

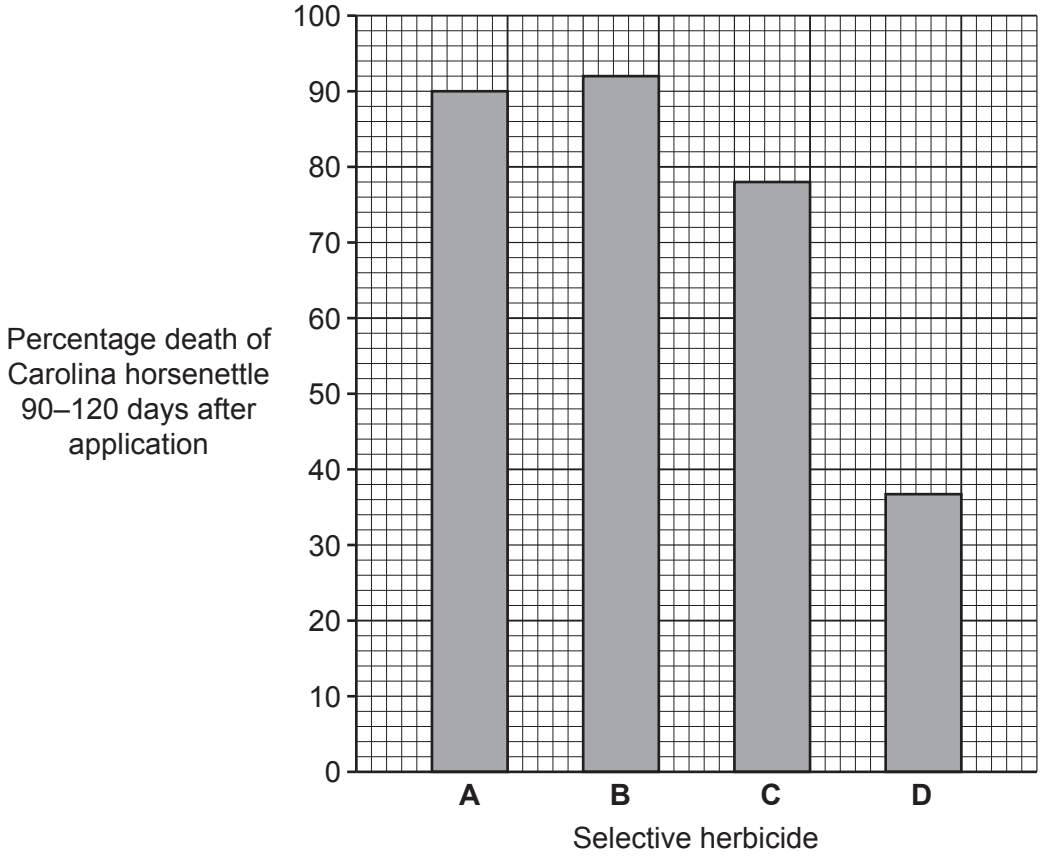


Fig. 20.1

© OCR 2020

Selective herbicide	A	B	C	D
Effect on Carolina horsenettle	prevents seeds and roots of plants growing	prevents seeds and roots of plants growing	prevents seeds and roots of plants growing	prevents shoot growth and fruiting but minimal damage to roots
What plants herbicide works on	Carolina horsenettle	Carolina horsenettle and several other broad-leaved plant species	Carolina horsenettle	Carolina horsenettle and most other broad-leaved plant species
Cost of herbicide	medium	high	medium	low

Table 20.1

Carolina horsenettle is growing in a field with a crop and other broad-leaved weeds.
Evaluate the information on selective herbicides **A**, **B**, **C** and **D**.

Which selective herbicide would be best to use and when it should be applied?
Explain your decision.

.....

.....

.....

.....

.....

.....

.....

.....

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

(b) **(i)** Describe **one** effect that gibberellin hormones have on plants.

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

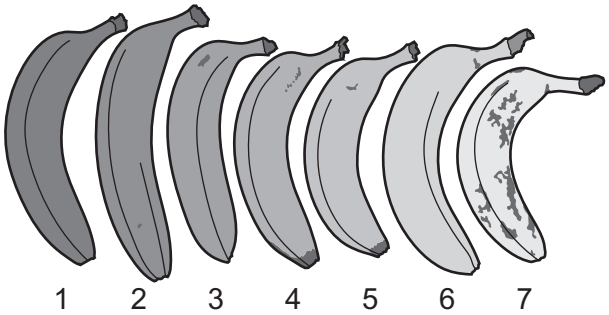
© OCR 2020

(ii) A student investigates ripening in bananas.

The student keeps bananas in different conditions. After 1 week he decides if each banana was **ripe** or **not ripe**.

The results were difficult to interpret so he planned to develop the experiment.

He found a picture that he thought he could use.



Explain how this could help develop his experiment.

.....

.....

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

© OCR 2020

(c) A process in cells is involved in producing a chemical that causes ripening of fruit. Look at **Fig. 20.2**.

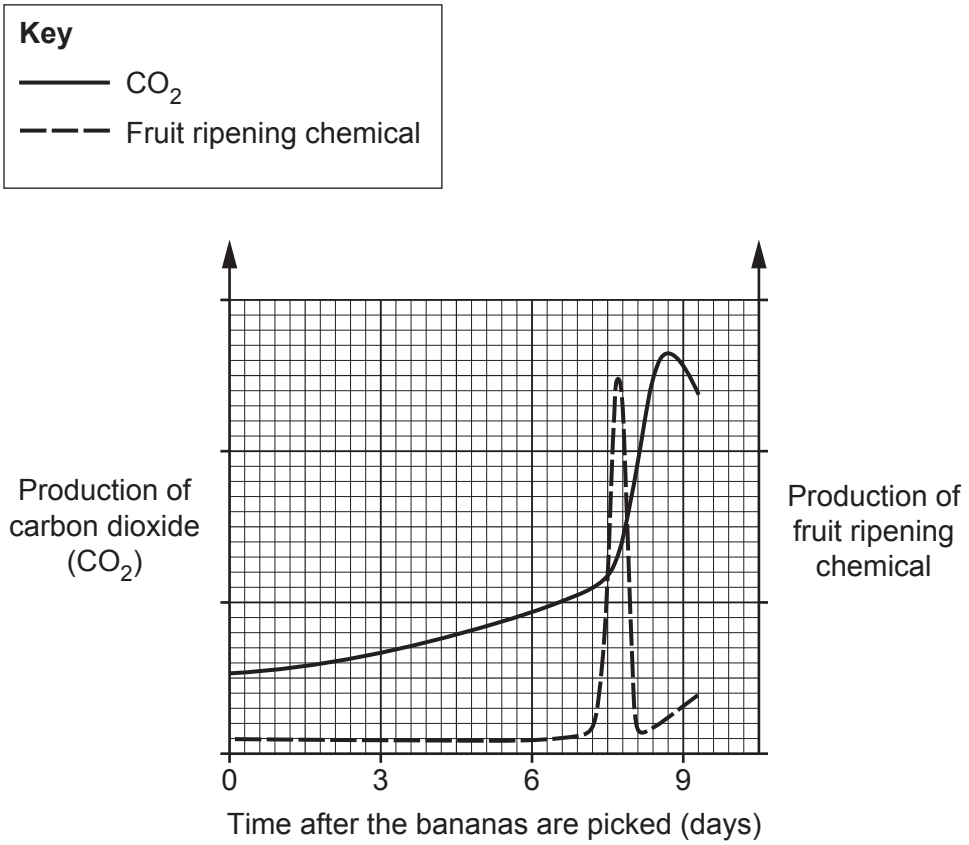


Fig. 20.2

Use evidence from **Fig. 20.2** to suggest what this process might be.

.....

.....

.....

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

© OCR 2020

21 This question is about coordination.

(a) Parts of the body, such as the fingers, are moved by the contraction of muscles.

In a voluntary movement the brain sends nerve impulses to muscle fibres along motor neurones.

Name the part of the brain that controls voluntary movement.

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

(b) A nerve to a muscle contains many motor neurones.

Fig. 21.1 shows two motor neurones supplying a muscle that moves the fingers. **Fig. 21.2** shows the force of contraction of the muscle when the neurones are stimulated separately or both together.

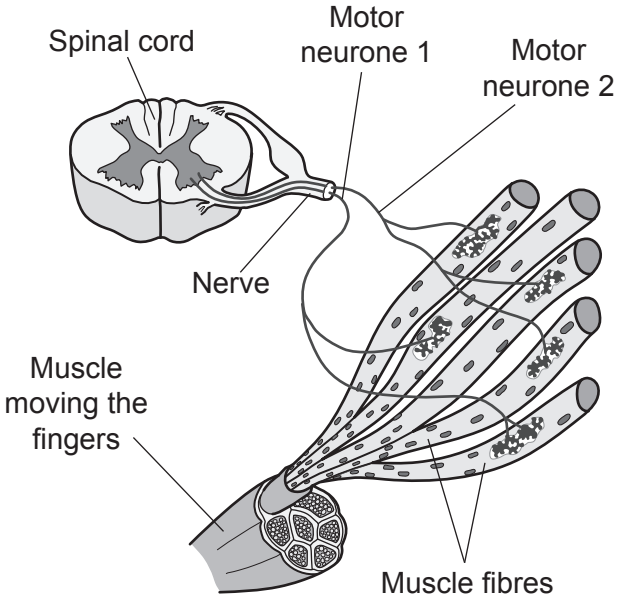


Fig. 21.1

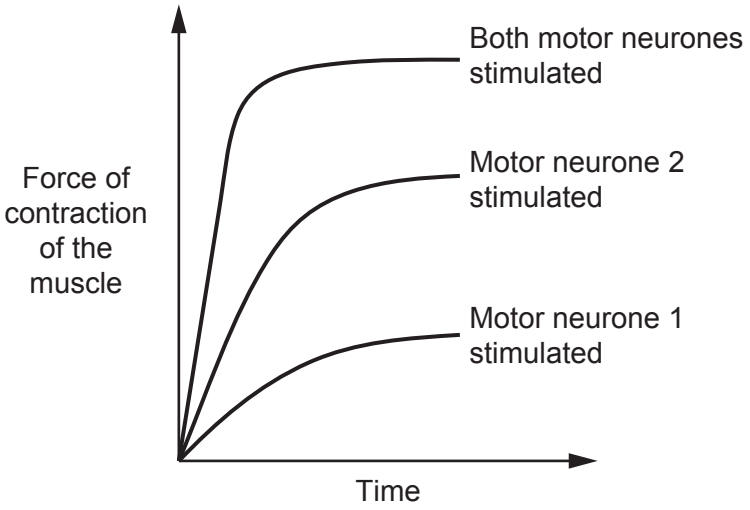


Fig. 21.2

© OCR 2020

(i) Suggest how the brain can finely control the force of contraction in the muscles controlling the fingers.

.....

.....

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

(ii) **Fig. 21.3** shows a motor neurone supplying a muscle that moves the leg.

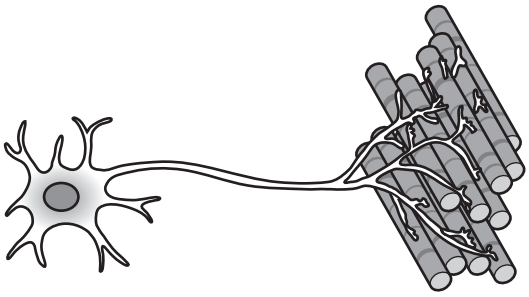


Fig. 21.3

Explain the reason for the difference in the neurone supplying this muscle compared to the neurones supplying the muscle that moves the fingers.

.....

.....

.....

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

© OCR 2020

***(c)** Dart players use their fingers to throw darts at a dart board.

Dart players **A** and **B** have different throwing styles. **Fig. 21.4** shows the throwing styles of the two players.

The release window is the area where the dart is released.

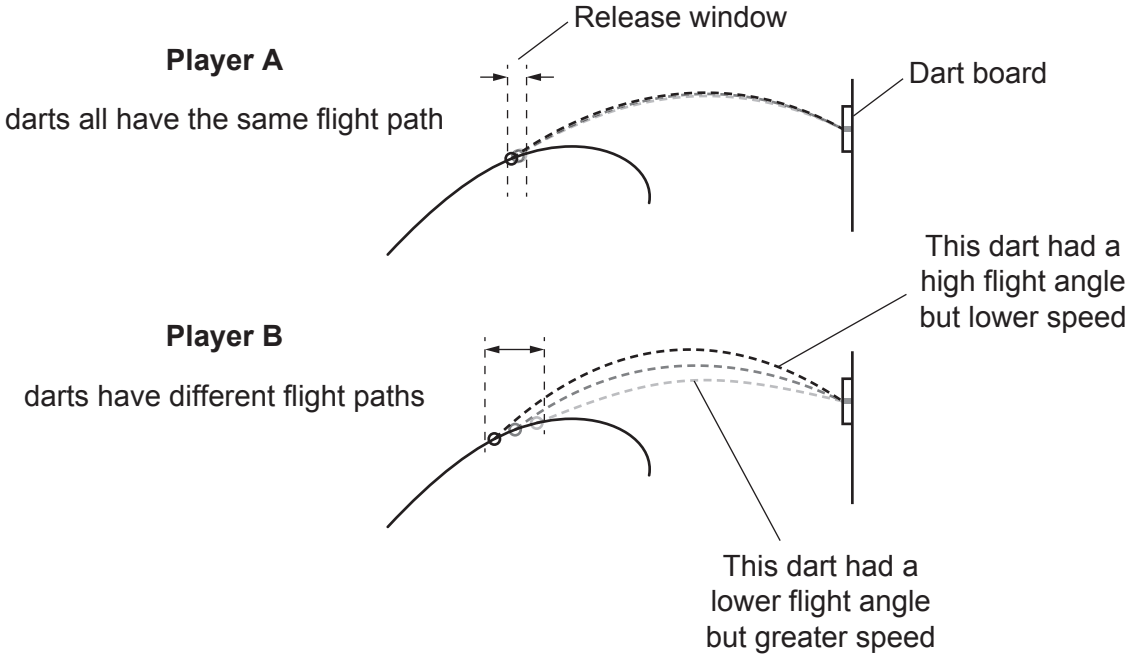


Fig. 21.4

© OCR 2020

To throw a dart accurately at the centre of a dart board involves coordination. The brain needs to coordinate the actions of sense organs and muscles.

Explain the function of the nervous system and muscles in the throwing of a dart at the centre of the dart board and why this process is more complicated in **Player B** than in **Player A**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

© OCR 2020

22 Protein synthesis takes place inside cells.

(a) Describe what happens during protein synthesis.

Use terms from the list in your answer.

amino acids **DNA** **mRNA** **transcription**

translation **ribosome**

.....

.....

.....

.....

.....

.....

.....

.....

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

(b) ADH is a protein hormone made up of amino acids.

(i) Complete the sentences to explain the link between amino acids and proteins.

Large molecules, like proteins, made of smaller molecules are called .....

The smaller molecules, or amino acids, are called ..... .

[2]

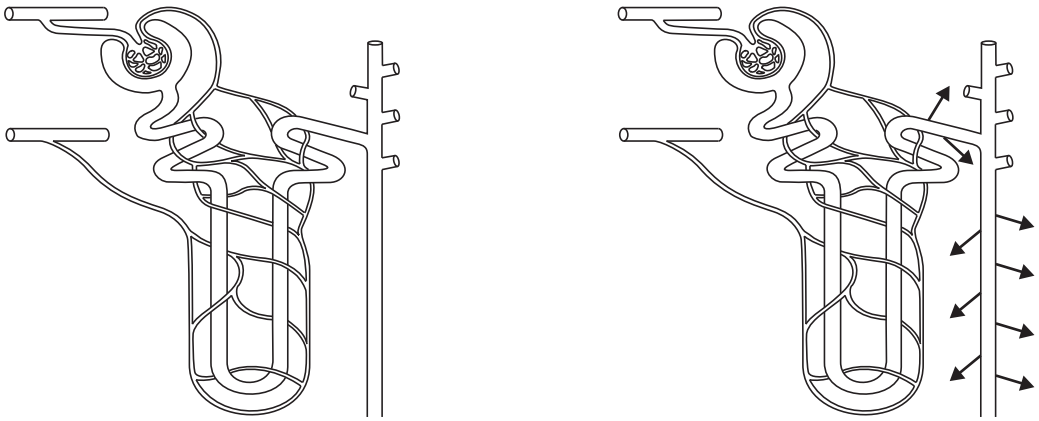
© OCR 2020

(ii) Alcohol inhibits ADH production.

Person **A** and **B** both drank one small 100 ml drink.
Only one of the drinks was high in alcohol.

Look at the diagram of a kidney tubule in person **A** and **B** after the drink.

Person A **Person B**



→ Movement of water

Explain how you can tell from the diagram that person **A**'s drink contained alcohol.

.....

.....

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

© OCR 2020

(iii) After the alcohol has been removed from person **A**'s body, control mechanisms will correct the excess loss of water caused by the alcohol.

Describe these control mechanisms.

.....

.....

.....

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

END OF QUESTION PAPER

© OCR 2020

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).

© OCR 2020

OCR
Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© OCR 2020