OCR
Oxford Cambridge and RSA

Friday 10 May 2024 – Morning

GCSE (9–1) Combined Science A (Gateway Science)

J250/01 Biology (Foundation Tier)

Time allowed: 1 hour 10 minutes

F

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 **60**.
- 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 **20** pages.

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

Section A

You should spend a **maximum** of **20 minutes** on this section.

Write your answer to each question in the box provided.

1 A student prepares a microscope slide to view colourless plant cells.

Which type of substance is used to colour the cells?

A Acid

B Hormone

C Lipid

D Stain

Your answer ☐ **[1]**

2 The total magnification of an image viewed using a light microscope is calculated using a formula.

What is the correct formula for total magnification?

A Total magnification = eyepiece lens magnification **×** objective lens magnification

B Total magnification = eyepiece lens magnification **–** objective lens magnification

C Total magnification = eyepiece lens magnification **+** objective lens magnification

D Total magnification = eyepiece lens magnification **÷** objective lens magnification

Your answer ☐ **[1]**

3 Plasmids are small rings of genetic material.

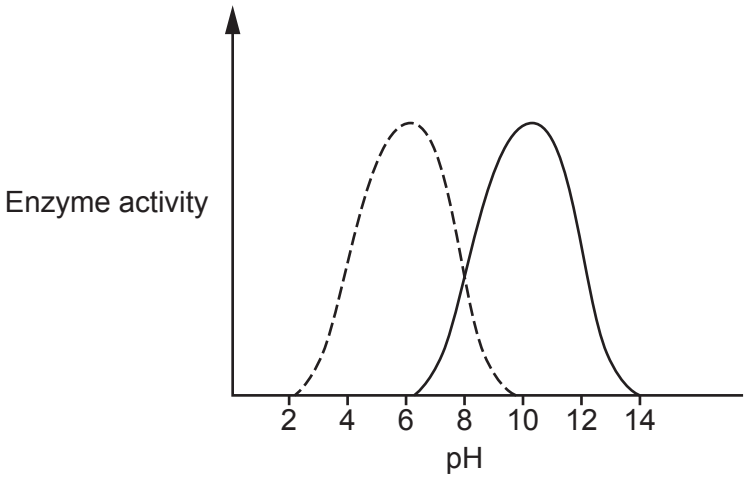
Which row describes where plasmids are found?

	Where they are found	**Type of cell**
A	cytoplasm	eukaryotic
B	cytoplasm	prokaryotic
C	nucleus	eukaryotic
D	nucleus	prokaryotic

Your answer ☐ **[1]**

4 The graph shows the effect of pH on the activity of two enzymes.

Identify the pH where both enzymes are active.



A pH 4

B pH 6

C pH 8

D pH 10

Your answer ☐ **[1]**

5 The model represents a molecule found inside human cells.

Which of these describes this model?

A Monomer and a double helix

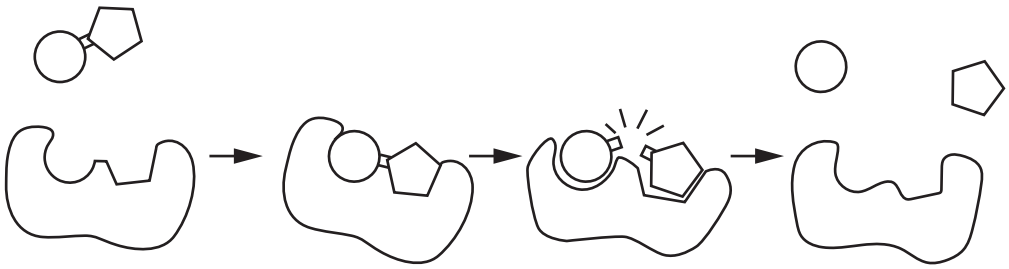
B Monomer and a double twist

C Polymer and a double helix

D Polymer and a double twist

Your answer ☐ **[1]**

6 The diagrams show stages in the hypothesis used to explain the mechanism of enzyme action.



Which term describes this hypothesis?

A Active site

B Denaturing

C Enzyme specificity

D Lock and key

Your answer ☐ **[1]**

7 The table shows information about transport of substances.

Which row describes active transport?

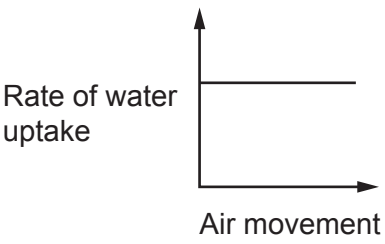
	Movement across a cell membrane	Movement down a concentration gradient	Requires energy
A	yes	yes	no
B	no	yes	no
C	yes	no	yes
D	no	no	yes

Your answer ☐ **[1]**

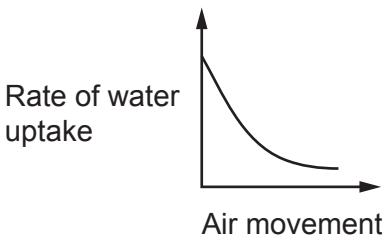
8 The graphs show how the rate of water uptake in plants can change.

Which graph shows the correct effect of **increased** air movement on the rate of water uptake?

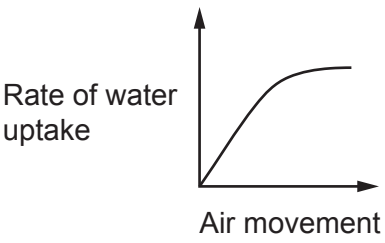
A



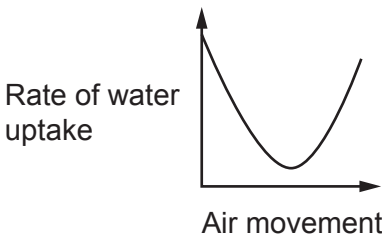
B



C



D



Your answer ☐ **[1]**

9 The table shows some information about insulin in the body.

Which row shows the correct information about insulin?

	Organ that produces insulin	Type of signal	Target organ
A	liver	chemical	pancreas
B	liver	electrical	pancreas
C	pancreas	chemical	liver
D	pancreas	electrical	liver

Your answer ☐ **[1]**

10 The length of a bacteria cell is 5.3 μm.

What is the length of this cell in **mm**?

(1 mm = 1000 μm)

A 5.3×10^{-6}

B 5.3×10^{-3}

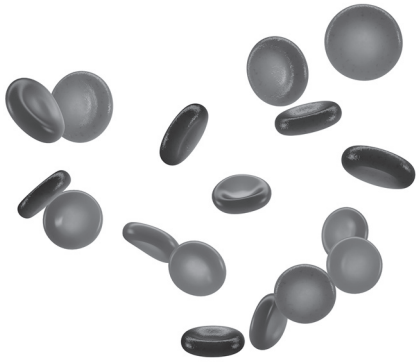
C 5.3×10^{3}

D 5.3×10^{6}

Your answer ☐ **[1]**

Section B

11 The diagram shows drawings of red blood cells.



(a) Complete the sentences about red blood cells.
Use words from the list.

biconcave	**chlorophyll**	**haemoglobin**	**helix**
nitrogen	**oxygen**	**water**	

Red blood cells are adapted to transport ..... around the body.

One adaptation is the red pigment ..... found inside the cells.

Another adaptation is their ..... shape.

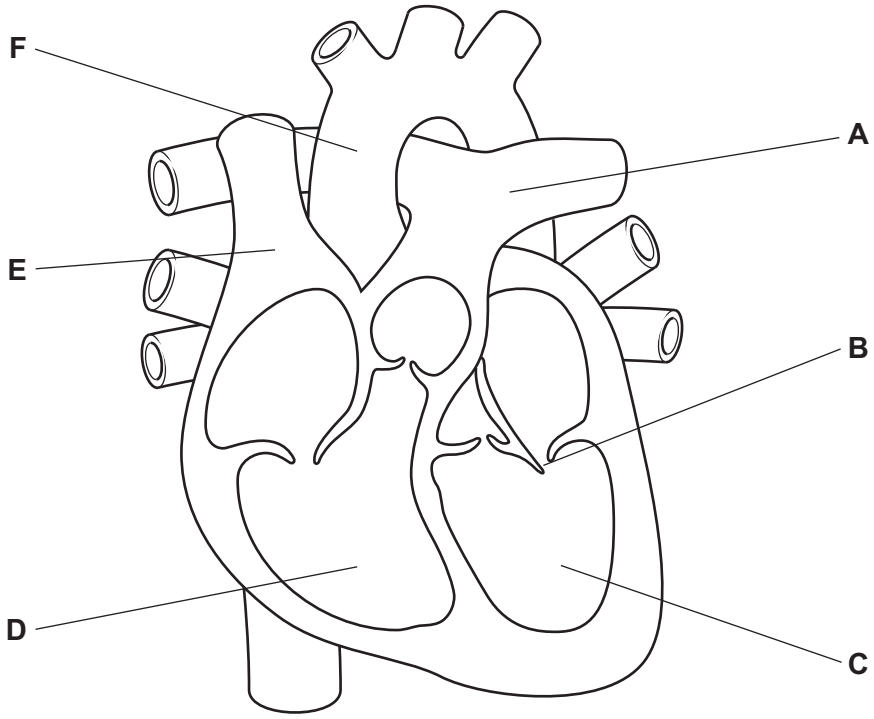
[3]

(b) Bone marrow cells inside human bones differentiate to form red blood cells.

What name describes cells that can differentiate?

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

(c) This diagram shows the human heart.



The table shows some information about the heart.

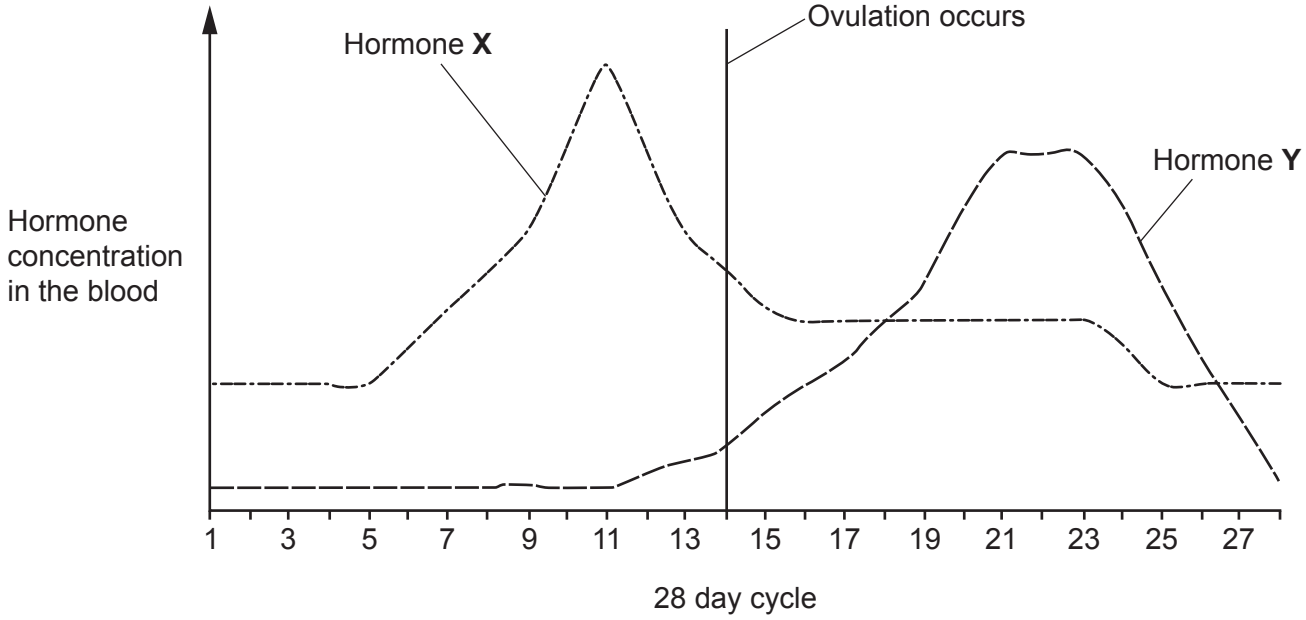
Use the diagram to complete the table.

Label letter	Name of part labelled	Description of part labelled
A	pulmonary artery	takes blood to the .....
B	.....	prevents backflow of blood in the heart
.....	vena cava	has a thin wall and a large ..... to transport blood at low pressure

[4]

(d) Hormones are transported in the blood.

The graph shows the changes that occur to female hormone concentrations in the blood during the menstrual cycle.



(i) Which day of the cycle does hormone **X** reach its peak?

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

(ii) Draw a line from each hormone to its correct name.

	insulin
Hormone **X**	oestrogen
Hormone **Y**	progesterone
	testosterone

[2]

12 Plants photosynthesise to produce food.

(a) Oxygen is a product of photosynthesis.

What are the **two** reactants in photosynthesis?

1 .....

2 .....

[2]

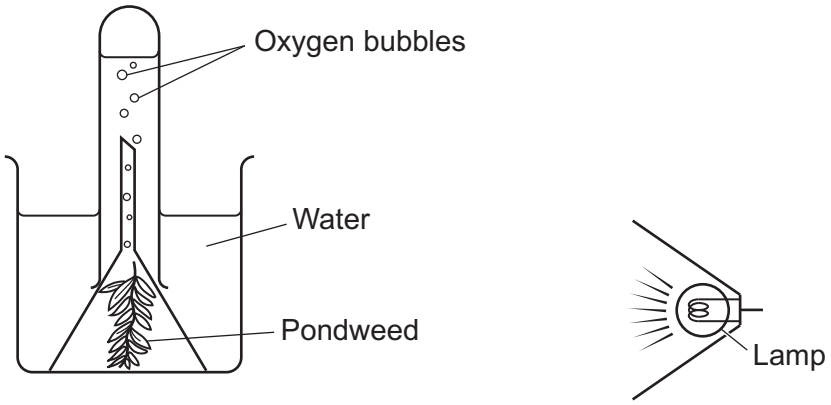
(b) Which statements about photosynthesis are **true** and which are **false**?

Tick (✓) **one** box in each row.

	True	False
Carbohydrates are produced in photosynthesis.		
Photosynthesis is an exothermic reaction.		
Photosynthesis is a two-stage process.		
Photosynthesis takes place in the mitochondria.		

[2]

(c) The diagram shows apparatus used to investigate photosynthesis.



The number of oxygen bubbles released each minute indicate the rate of photosynthesis.

(i) A student counts the number of oxygen bubbles released from the pondweed.

They count 23 bubbles in 3 minutes.

Calculate the rate of photosynthesis.

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

Rate = ... bubbles per minute **[2]**

(ii) The student develops their investigation to find the effect of light intensity on the rate of photosynthesis.

Describe how they should develop their investigation.

In your answer include:

- any additional apparatus they will need that is **not** shown in the diagram
- one variable they will need to control
- how they will change light intensity.

.....

.....

.....

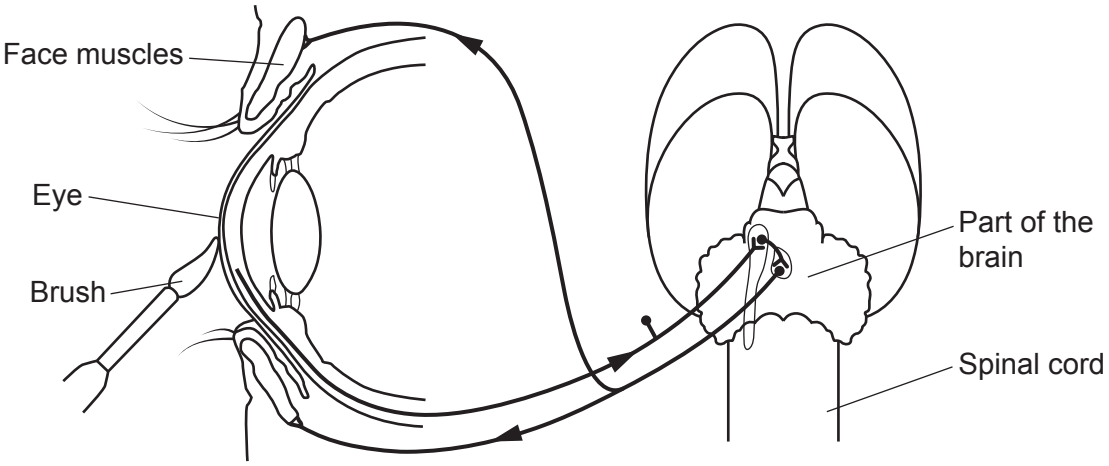
.....

.....

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

13

(a) Doctors can test your eye reflexes by touching the eye to make you blink.
The diagram shows the reflex arc involved in blinking.



Complete the sentences to describe the reflex arc.

Use the diagram.

The stimulus is the brush ..... the eye.

The stimulus is detected by ..... in the eye.

Nerve impulses are sent along the sensory neurone to the ..... .

The nerve impulses then pass along the motor neurone to the effectors which are the

..... .

[4]

(b) A study recorded the reaction time of people of different ages.

The table shows the mean reaction times for the different age groups.

Age group (years)	Mean reaction time (seconds)
25–34	0.185
35–44	0.210
45–54	0.225
55–64	0.230
65+	0.245

(i) Which age group had the fastest mean reaction time?

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

(ii) Calculate the **percentage increase** from the **25–34** age group's mean reaction time and the **65+** age group.

Give your answer to **3** significant figures.

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

(iii) When drivers are at the UK limit for blood alcohol content it increases their reaction time by 0.12 s.

A 25 year old drives at the UK limit.

Which age group has a mean reaction time closest to this 25 year old driver?

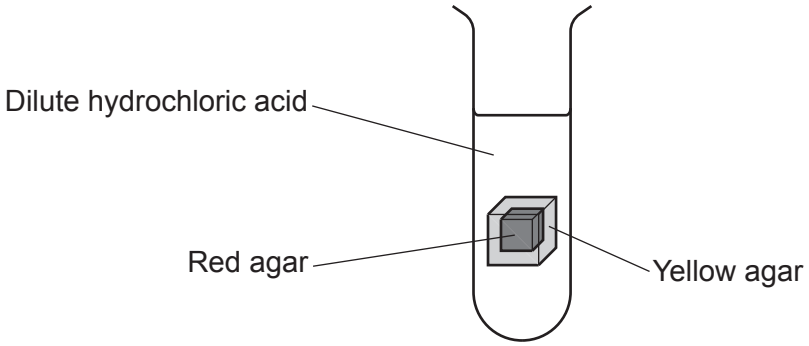
..... **[1]**

14 A student investigates diffusion. They use agar jelly stained red with a pH indicator.

This is the method they use:

- Cut the agar into cubes of different sizes.
- Place each agar cube into a different boiling tube.
- Add dilute hydrochloric acid to each boiling tube.
- Record the time taken for each agar cube to turn yellow.

The diagram shows one of their boiling tubes when the agar cube has started to turn yellow.



The table shows their results.

Agar cube	Surface area (cm^2)	Volume (cm^3)	Surface area to volume ratio	Time taken to turn yellow (seconds)
A	6	1	6 : 1	320
B	24	8	3 : 1	(122) 552
C	54	27	.....	833
D	96	64	1.5 : 1	1289

(a)

(i) Calculate the surface area to volume ratio of agar cube **C**.

Write your answer in the table.

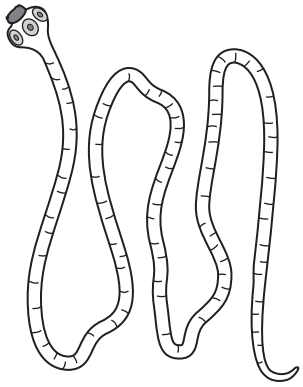
[2]

(ii) The student has two results for their agar cube **B** experiment. The result for their first attempt was 122 seconds.

Suggest why the student repeated the experiment to obtain a second result.

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

(b)* Tapeworms live in the digestive system of a host animal.



- They feed by absorbing nutrients directly from their animal host.
- The nutrients diffuse across the outer surface of the tapeworm to all the cells in their body.
- The tapeworm has a surface area to volume ratio similar to agar cube **A**.

Explain why having a surface area to volume ratio similar to agar cube **A** is an advantage to the tapeworm.

Use data from the table.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

15 **Fig. 15.1** and **Fig. 15.2** show two different transport vessels in plants.

Fig. 15.1

Xylem vessels

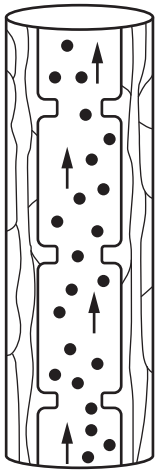


Fig. 15.2

Phloem vessels

(a) The arrows show direction of movement inside the vessels.

Give **two** reasons why **Fig. 15.2** shows phloem vessels.

1 .....

.....

2 .....

.....

[2]

(b) Compare the type of substances transported in xylem and phloem vessels.

.....

.....

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

(c) Explain how the transport of substances through **xylem** changes on a warm day compared with a cold day.

.....

.....

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

16 A teacher investigates the effect of different enzymes on starch. They want to find out if the enzyme breaks down the starch into sugar.

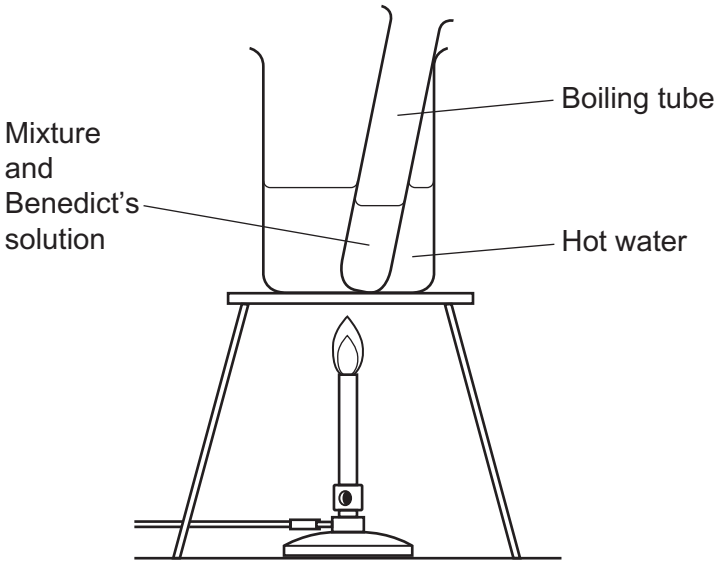
This is the method they use:

- Add 1 cm^3 of an enzyme to 5 cm^3 of starch solution in a boiling tube.
- Leave the mixture for 5 minutes.
- Add Benedict's solution to the mixture.
- Place the boiling tube in a hot water bath.
- Record the colour of the Benedict's solution after heating.

Benedict's solution is a blue solution that, when heated, forms a coloured precipitate if sugar is present.

Fig. 16.1 shows how the teacher tested for the presence of sugar in the mixture.

Fig. 16.1



(a) The teacher repeats the method with different enzymes.

(i) Identify the dependent variable in this investigation.

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

(ii) Suggest **one** hazard in this investigation and the precaution the teacher should take.

Hazard .....

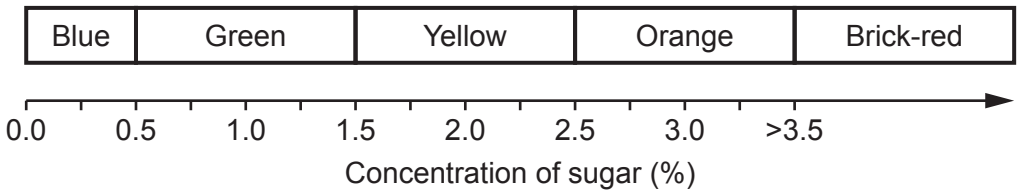
Precaution .....

.....

[1]

(b) **Fig. 16.2** is a chart that shows the colour of Benedict's solution after heating in different concentrations of sugar solution.

Fig. 16.2



The table shows the results recorded by the student.

Mixture of enzyme and starch	Colour of the Benedict's solution after heating	Sugar concentration in mixture (%)
A	brick-red	.....
B	blue	.....
C	orange	2.5 – 3.5
D	yellow	.....

(i) Complete the table. **[1]**

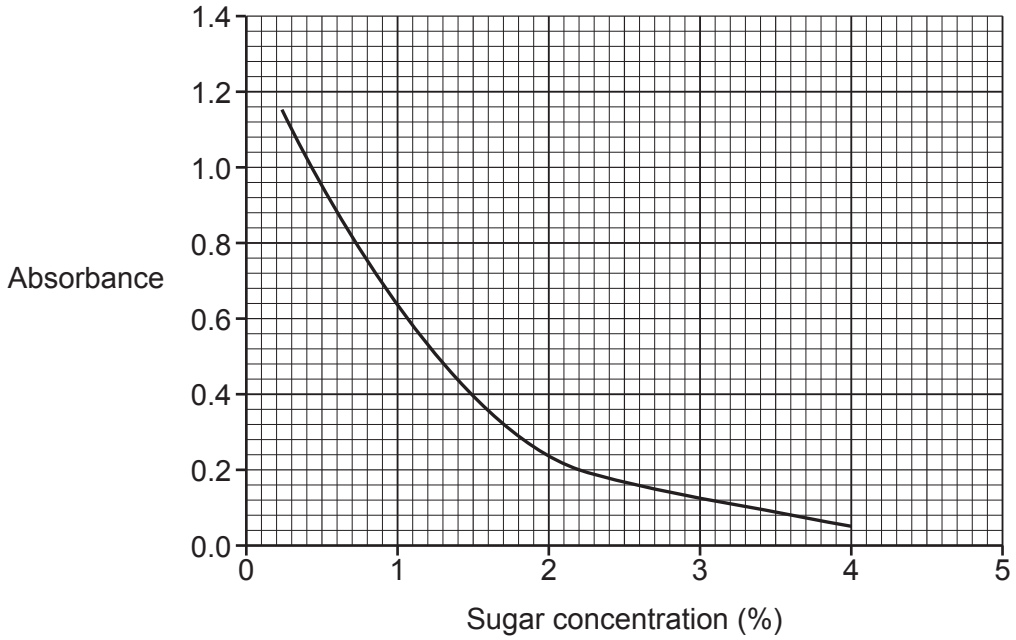
(ii) The concentration of sugar in mixture **C** stated in the table is **not** an accurate value.

How can the student tell that it is **not** an accurate value?

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

(c) The amount of light absorbed by different colours can be measured.

The graph compares absorbance with the percentage of sugar concentration.



(i) The teacher investigates the light absorbed by the different coloured mixtures.

They record an absorbance of 0.2 for mixture **C**.

Use the graph to find the sugar concentration of mixture **C**.

Sugar concentration = ... % **[1]**

(ii) The answer to **(i)** is outside the range stated in the results table.

Suggest how the student could improve their method to find out how **precise** their measurement is for mixture **C**.

.....

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

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.