

Monday 15 November 2021 – Morning

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

J250/01 Paper 1 (Foundation Tier)

Time allowed: 1 hour 10 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

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Candidate number

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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.

2
SECTION A

Answer **all** the questions.

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

Write your answer to each question in the box provided.

1 Which term describes a microscope with a higher resolution than a light microscope?

- A** Digital microscope
- B** Electron microscope
- C** Neutron microscope
- D** Proton microscope

Your answer

[1]

2 The model represents a polymer found inside human cells.



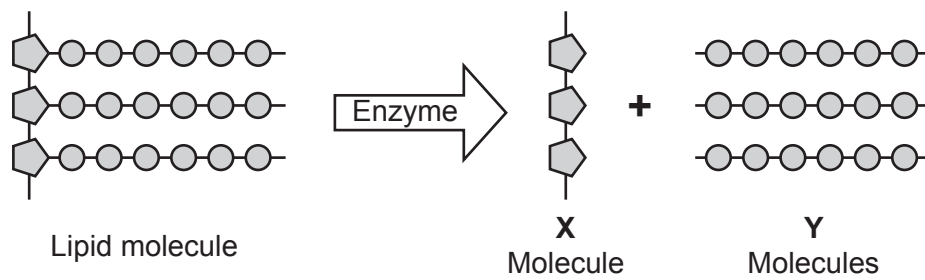
What is the name of this polymer?

- A** ATP
- B** Carbohydrate
- C** DNA
- D** Protein

Your answer

[1]

- 3 The diagram represents the digestion of lipids by an enzyme.



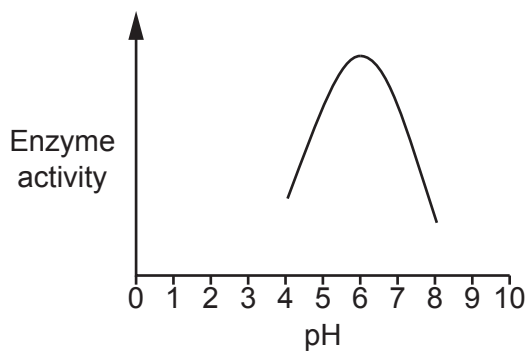
What names describe the **X** and **Y** molecules?

- A Glucose and amino acids
- B Glucose and fatty acids
- C Glycerol and amino acids
- D Glycerol and fatty acids

Your answer

[1]

- 4 The graph shows the effect of pH on the activity of an enzyme.



What is the optimum pH of this enzyme?

- A pH2
- B pH4
- C pH6
- D pH8

Your answer

[1]

5 Which hormone is involved in sperm production?

- A Insulin
- B Oestrogen
- C Progesterone
- D Testosterone

Your answer

[1]

6 The table shows information about five different contraceptive methods.

Method	How it works	Number of unexpected pregnancies per 1000 women using the method
IUD	releases copper which stops sperm entering uterus	8
male condom	stops sperm entering vagina	180
patch	releases chemical into body	90
pill	contains chemical that stops ovulation	90
sterilisation	stops egg reaching uterus	5

Which **two** non-hormonal contraceptive methods are the most effective?

- A Male condom and IUD
- B Male condom and sterilisation
- C Patch and pill
- D Sterilisation and IUD

Your answer

[1]

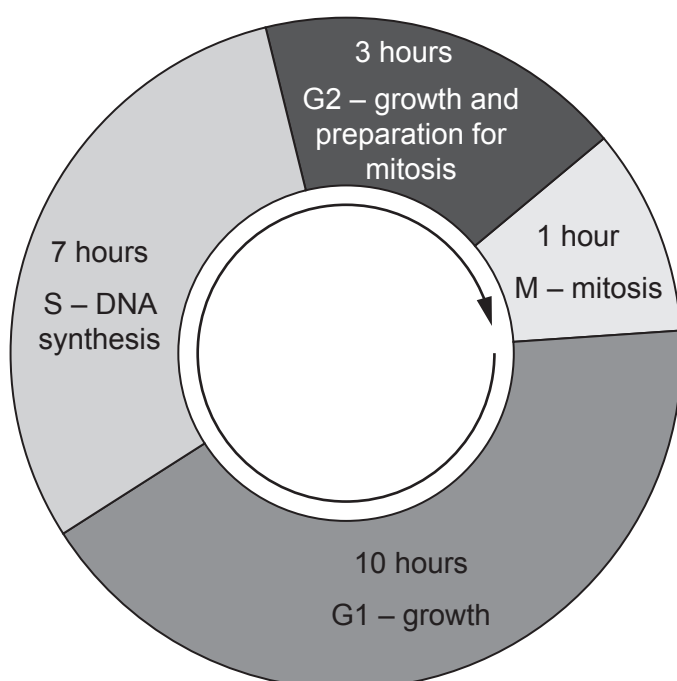
7 Which process allows substances to enter cells against a concentration gradient?

- A Active transport
- B Diffusion
- C Mitosis
- D Osmosis

Your answer

[1]

8 The diagram represents the cell cycle showing the hours spent in each part of the cycle.



The total time for the cell cycle is 21 hours.

What is the total time spent in cell division for this cell?

- A 1
- B 3
- C 4
- D 11

Your answer

[1]

- 9 A student uses a light microscope to observe onion cells.

They magnify the cells $400\times$. The magnification of the eyepiece is $20\times$.

What is the magnification of the objective lens?

- A $20\times$
- B $200\times$
- C $420\times$
- D $8000\times$

Your answer

[1]

- 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]

SECTION B

Answer **all** the questions.

- 11 (a)** It is important that our body maintains a constant internal environment.

Complete these sentences about maintaining a constant internal environment.

You can use each word once, more than once or not at all.

carbon dioxide embryonic hydrogen insulin

metabolic oestrogen oxygen testosterone

The body needs a constant internal environment so that reactions take place at an appropriate rate.

The body needs to maintain levels so that aerobic respiration can take place.

Blood sugar levels are controlled by the hormone

[3]

- (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. 11.1** shows the reflex arc involved with a response when a person touches a hot pan.

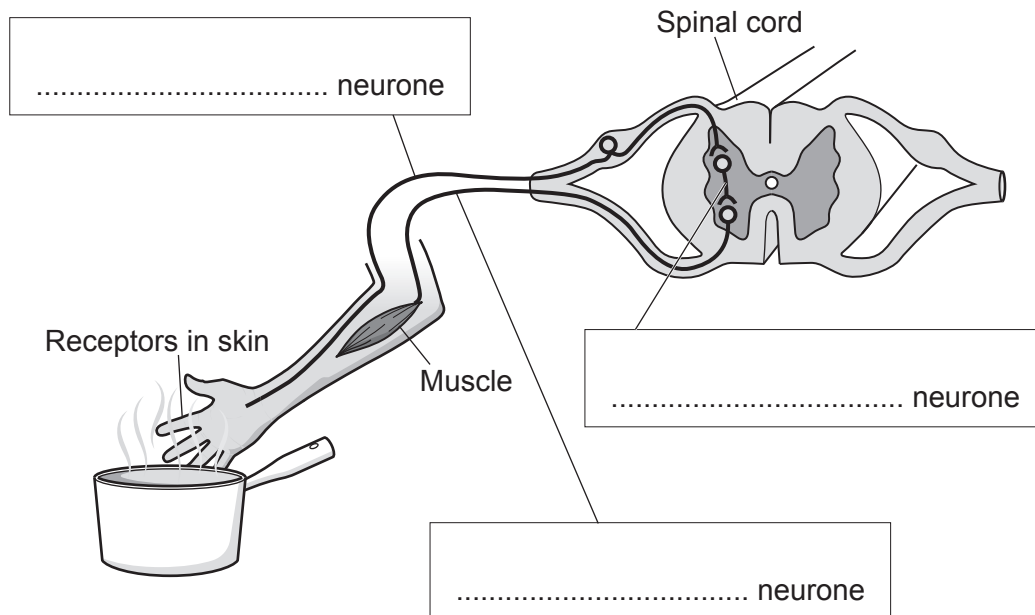


Fig. 11.1

- (i) Complete the **three** boxes in **Fig. 11.1** to label the neurones involved in the response. [3]
- (ii) Draw **two** arrows on **Fig. 11.1** to show the direction the nerve impulse travels along each neurone in the arm. [1]
- (iii) Explain how the reflex arc prevents too much damage from the hot pan.

.....

.....

..... [2]

- (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 5 boys aged 12 years; they are given 150 cm³ of a caffeine-free drink.
- Group **B** contains 8 boys aged 15 years; they are given 150 cm³ of a caffeine drink.

Both groups are tested before and after taking the drink.

- (i) Identify **one** variable that has been controlled in this investigation.

..... [1]

(ii) Fig. 11.2 shows the results.

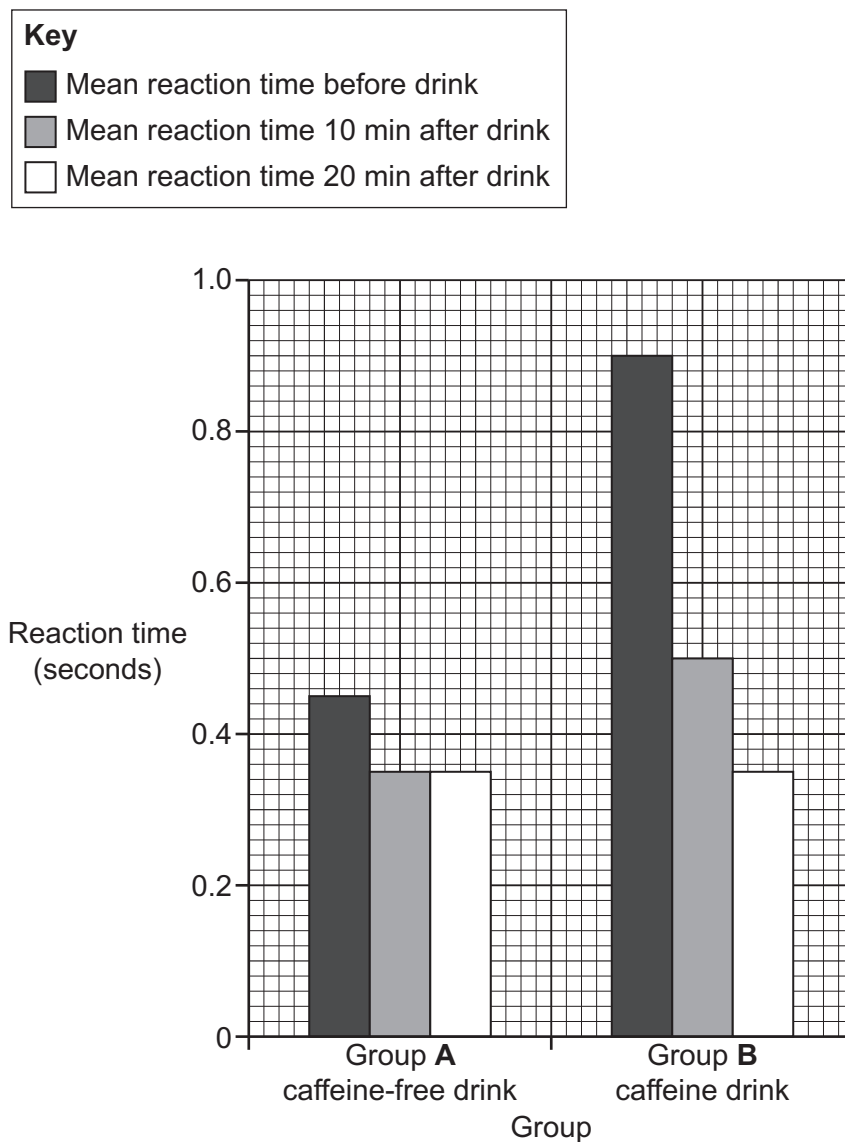


Fig. 11.2

Use data from **Fig. 11.2** to describe the effect of caffeine on reaction time.

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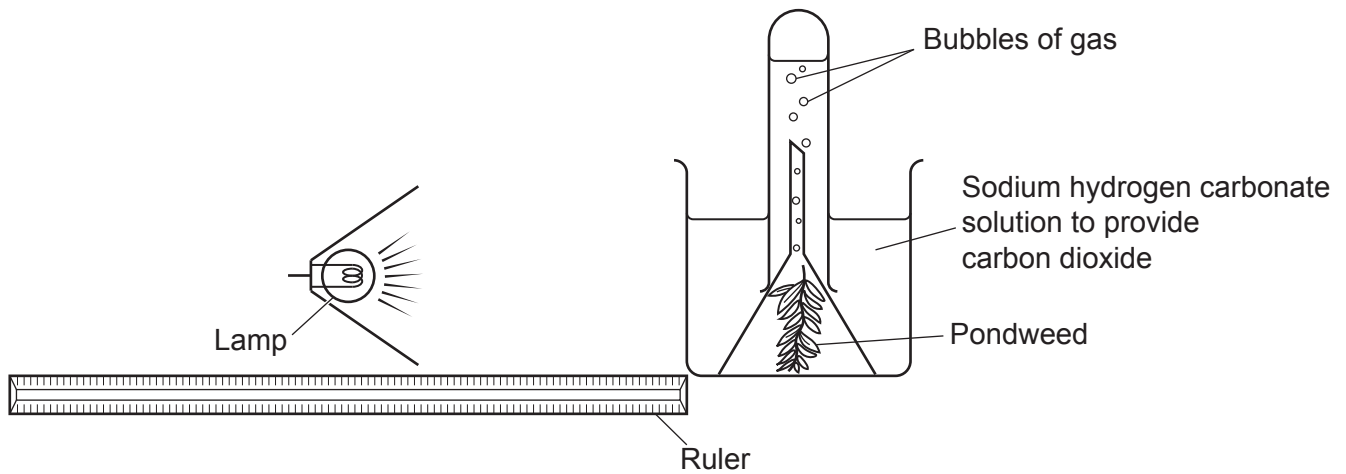
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..... [2]

12 A student investigates the rate of photosynthesis.

The diagram shows the apparatus they use.



(a) The bubbles of gas are made during photosynthesis.

Which is the main gas in the bubbles?

..... [1]

(b) The student counts the number of bubbles made by the pondweed for 5 minutes.

They repeat this three more times.

The table shows their results.

Attempt	Number of bubbles	Mean number of bubbles
1	19	
2	16	
3	6	
4	22	

(i) Calculate the mean number of bubbles.

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

Write your answer in the table.

[2]

- (ii) There is **one** anomaly in the results.

Identify the anomaly and suggest **one** reason **other** than human error that may have caused it.

Anomaly

Reason

.....

[2]

- *(c) Describe how the student could develop their investigation to show how light intensity affects the number of bubbles made.

In your answer include ideas about variables, what the student should measure and the expected results.

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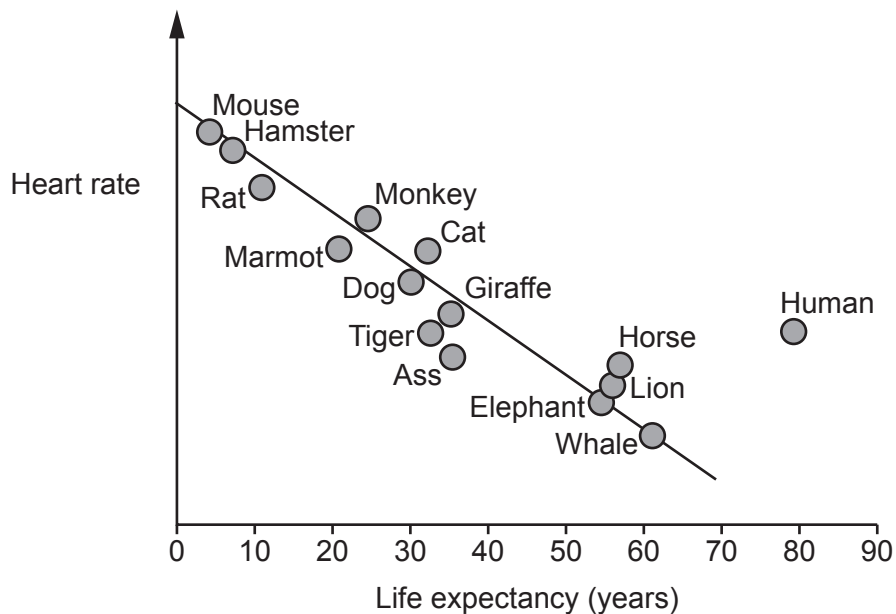
..... [6]

- 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?

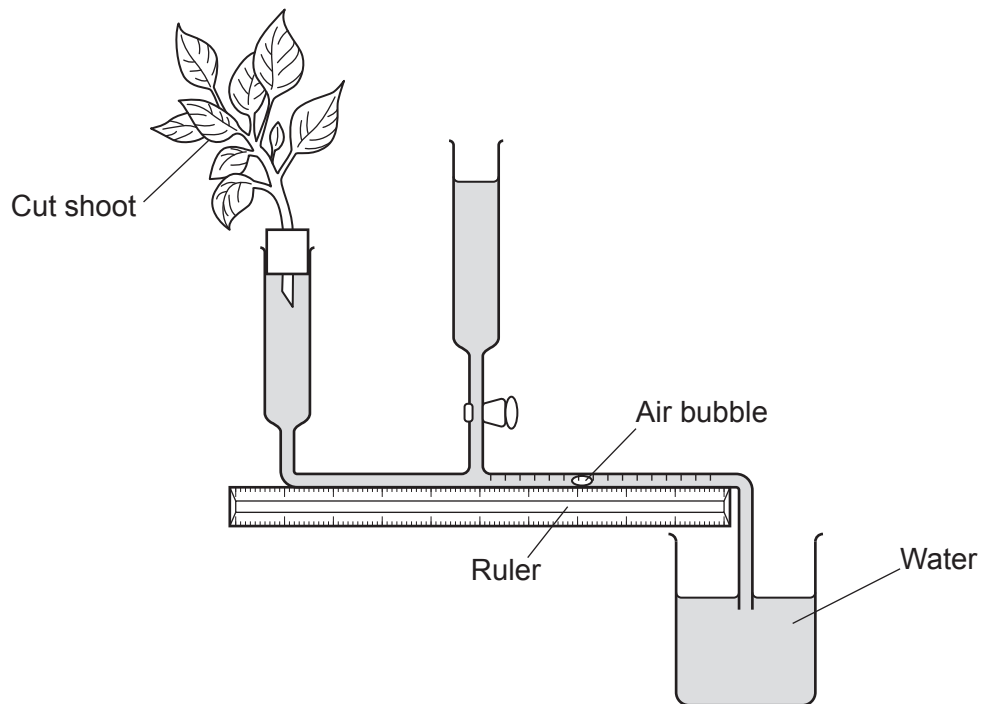
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 [1]

13
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14 A student investigates the environmental factors that affect water uptake by plants.

The diagram shows the apparatus they use.



(a) (i) What is the name of the apparatus shown in the diagram?

Put a ring around the correct answer.

gas syringe funnel potometer water bath

[1]

(ii) Describe how the student would use the air bubble to measure water uptake.

.....

 [2]

(iii) Write down **two** environmental factors that **increase** the rate of water uptake by plants.

1
 2 [2]

- (b) When they set up the apparatus, the student cut the shoot under water.

Suggest why.

.....
 [1]

- (c) (i) Most of the water taken in by the plant is lost in transpiration.

Complete the table to compare the processes of **transpiration** and **translocation**.

	Transpiration	Translocation
Substances transported	water and	water and sugar
Vessels used for transport	xylem	
Direction water moves in vessels		

[4]

- (ii) Water is transported in xylem vessels.

Write down **one** way xylem vessels are adapted to this function.

..... [1]

16
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- 15 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 cm³ of dilute hydrogen peroxide.
- Collect the oxygen produced in 15 minutes using a measuring cylinder full of water.

Fig. 15.1 shows the set-up of their investigation.

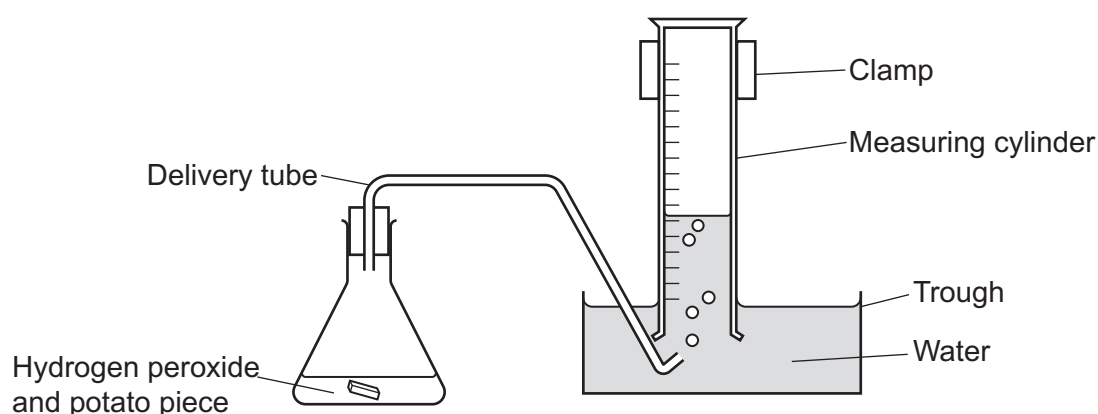


Fig. 15.1

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 cm³ of new dilute hydrogen peroxide.

Explain why they need to replace the dilute hydrogen peroxide.

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 [2]

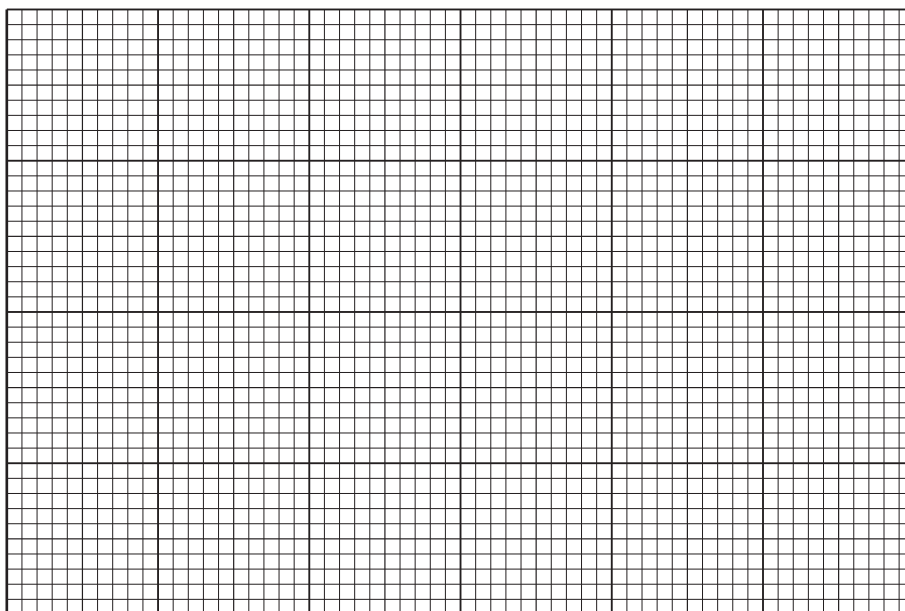
- (ii) Explain why the student does **not** need to replace the potato pieces already in the flask when repeating the investigation.

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 [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 = cm³ [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.

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..... [1]

END OF QUESTION PAPER

[illegible]

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