

**GCSE (9–1) Biology A (Gateway Science)**  
**J247/03 Paper 3 (Higher Tier)**

**H**

Sample Question Paper

**Date – Morning/Afternoon**

Time allowed: 1 hour 45 minutes

**You may use:**

- a scientific or graphical calculator
- a ruler



First name

Last name

Centre  
number

Candidate  
number

**INSTRUCTIONS**

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**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 **28** pages.

**SECTION A**

Answer **all** the questions.

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

- 1** The image shows plant shoots growing towards sunlight.



What is this an example of?

- A** negative gravitropism
- B** negative phototropism
- C** positive gravitropism
- D** positive phototropism

Your answer

**[1]**

- 2** In DNA, which base does T (thymine) pair with?

- A** T
- B** C
- C** G
- D** A

Your answer

**[1]**

3

3 Which molecule is **not** a polymer?

- A DNA
- B lipid
- C protein
- D starch

Your answer

[1]

4 Insulin is a protein made of 51 amino acids.

How many bases are in the length of DNA coding for insulin?

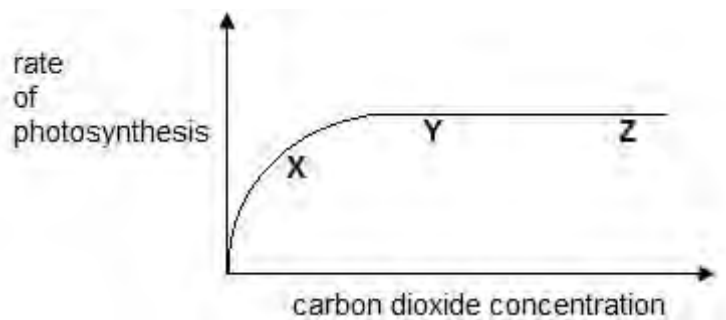
- A 51
- B 102
- C 153
- D 204

Your answer

[1]

SPECIMEN

- 5 The graph shows the effect of carbon dioxide concentration on the rate of photosynthesis.



Where on the graph is carbon dioxide a limiting factor?

- A X only
- B X and Y
- C Z only
- D Y and Z

Your answer

[1]

- 6 Which hormone is used to ripen fruit?

- A adrenaline
- B auxin
- C ethene
- D gibberellin

Your answer

[1]

7 Which reduces heat transfer from the skin?

- A shivering
- B sweating
- C vasoconstriction
- D vasodilation

Your answer

[1]

8 Which does **not** contain DNA?

- A cell membrane
- B chromosome
- C nucleus
- D plasmid

Your answer

[1]

9 Which part of the brain automatically controls heart rate and breathing rate?

- A cerebellum
- B cerebrum
- C hypothalamus
- D medulla

Your answer

[1]

10 Look at the table. Which row describes active transport?

	only occurs across a membrane	can move substances from a low to high concentration	uses ATP	only moves substances from high to low concentration
<b>A</b>			✓	✓
<b>B</b>	✓	✓	✓	
<b>C</b>	✓	✓		
<b>D</b>	✓		✓	✓

Your answer

[1]

11 If ADH levels rise, how will this affect urine?

- A higher concentration of urea
- B higher volume
- C lower concentration of sodium chloride
- D more dilute

Your answer

[1]

12 Which eye defect can be overcome by using spectacles containing concave lenses?

- A colour blindness
- B eye ball too short
- C long sight
- D short sight

Your answer

[1]

13 Which hormone is used to increase metabolic rate?

- A insulin
- B luteinising hormone
- C testosterone
- D thyroxine

Your answer

[1]

14 The inverse square law in relation to light intensity ( $i$ ) and distance ( $d$ ) from the light source is shown by:

- A  $i \propto d^2$
- B  $i \propto 1/d^2$
- C  $i^2 \propto 1/d$
- D  $i^2 \propto d$

Your answer

[1]

15 The diameter of a human egg cell is  $120\mu\text{m}$ .  
What is the diameter in mm?  
 $1\mu\text{m} = 1 \times 10^{-3}\text{mm}$ .

- A  $1.2 \times 10^{-1}$
- B  $1.2 \times 10^{-2}$
- C  $1.2 \times 10^{-3}$
- D  $1.2 \times 10^{-4}$

Your answer

[1]

## SECTION B

Answer **all** the questions.

- 16** A group of students investigate the effect of temperature on the breakdown of the fat in milk by the enzyme lipase.

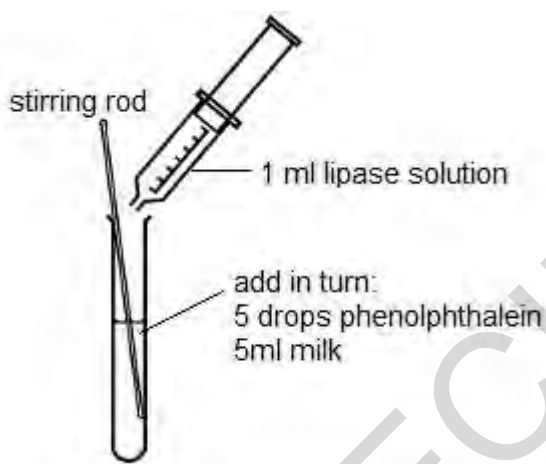
In their investigation they use an indicator called phenolphthalein.

Phenolphthalein is pink in alkali conditions but becomes colourless when the pH falls below pH 8.

A student puts 5 drops of phenolphthalein and 5 ml of full fat milk in to a test tube.

She adds 1 ml of lipase, stirs the mixture and times how long it takes to lose the pink colour.

Other students repeat this but at different temperatures.



The table shows the group's results.

Temperature (°C)	Time for pink colour to disappear (s)
20	480
40	240
60	270
80	960

- (a) Explain why the pH falls when lipase breaks down the fat in milk.

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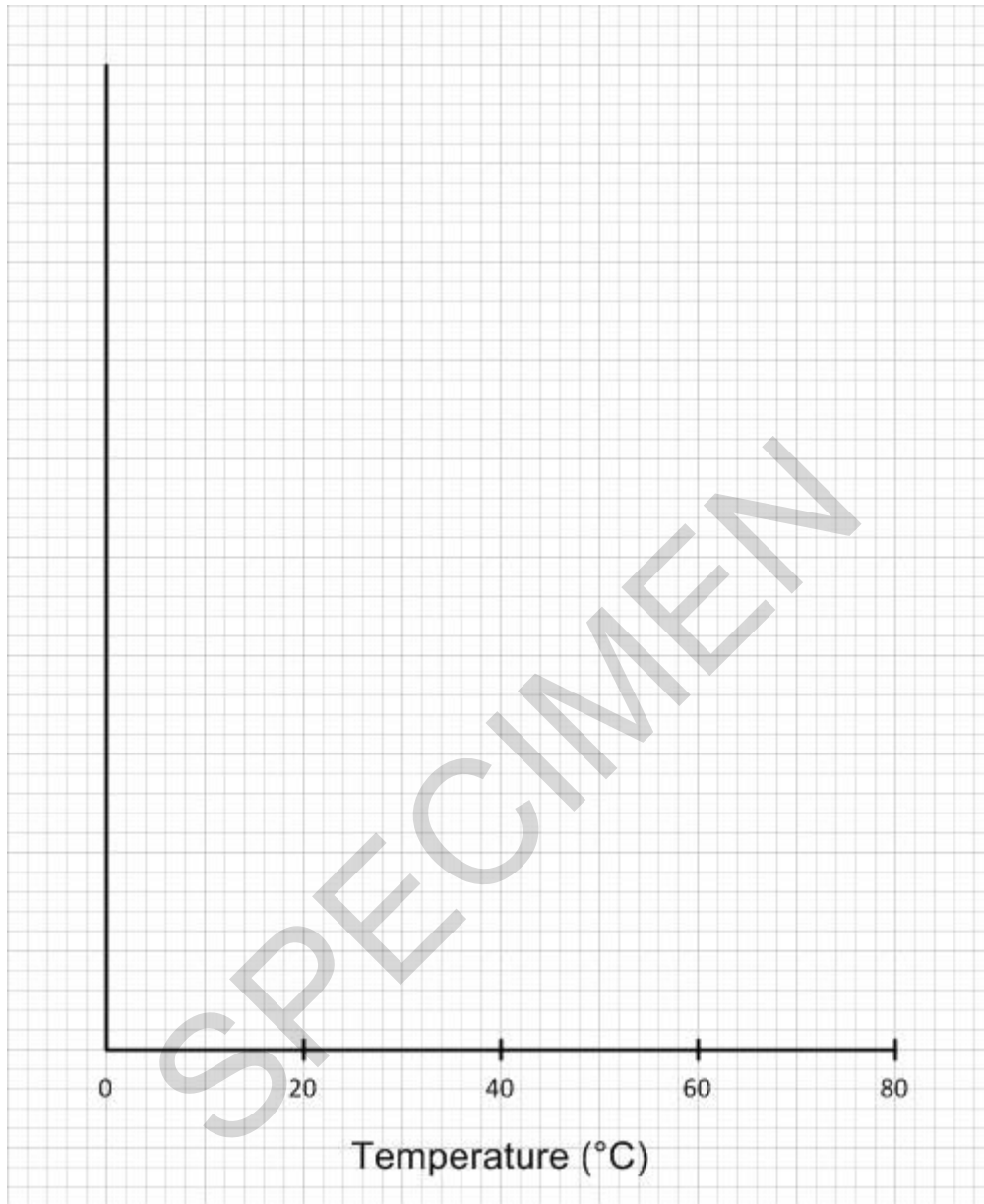
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[2]



(b) Plot a graph of the results and draw a line of best fit.



[5]

- (c) Explain the difference between the results at 20°C and 40°C.

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- (d) Explain the difference between the results at 80°C and 40°C.

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- (e) (i) One student says that the results show that the optimum temperature for the lipase is 40°C.

The teacher says that she **cannot** say for certain that it is 40°C.

Explain why.

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..... [1]

- (ii) Give **two** reasons how the students could modify their method to find out the optimum temperature more accurately.

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..... [2]

- (f) The students rounded their times to the nearest 10 seconds.

They did this because they found it difficult to judge exactly when the pink colour had disappeared.

Describe and explain **two** ways the method could be improved to give more accurate measurements.

1 .....

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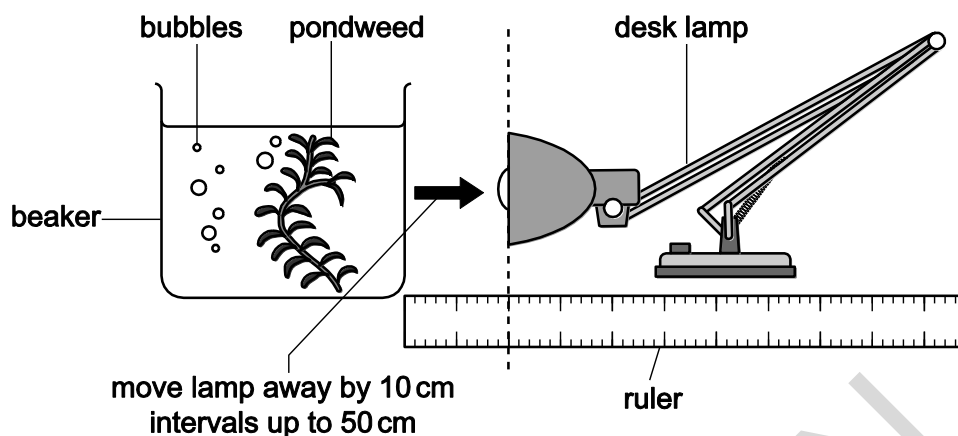
2 .....

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SPECIMEN

- 17 Puj investigates how light intensity affects the rate of photosynthesis in pondweed.

The diagram shows how he sets up his investigation.



Puj places the lamp at distances 10 cm, 30 cm, 50 cm, 70 cm and 90 cm from the beaker.

At each distance he counts how many bubbles of oxygen gas the pondweed gives off in 1 minute.

- (a) (i) Puj counts the number of bubbles to get a measure of the amount of gas given off in photosynthesis.

Why is counting bubbles **not** an accurate way of measuring the amount of gas given off?

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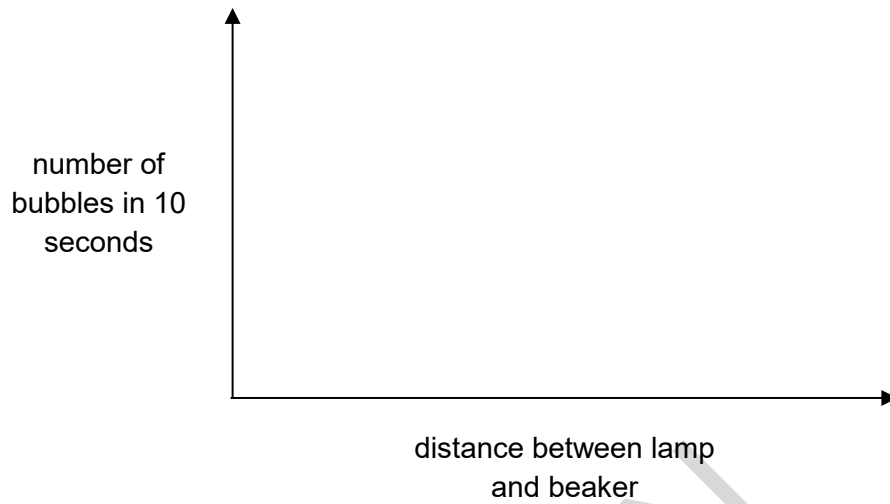
..... [2]

- (ii) Bob's teacher says that collecting the gas, for example in a gas syringe, would give a more accurate measurement.

Explain why.

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(b) (i) Sketch a line on the axes below to show the results you would expect.



[2]

(ii) Explain the shape of the graph. **Two** explanations are required.

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(c) (i) Describe how and where oxygen is produced in photosynthesis.

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- (ii) Explain why the amount of oxygen gas given off is **not** a true measure of the rate of photosynthesis.

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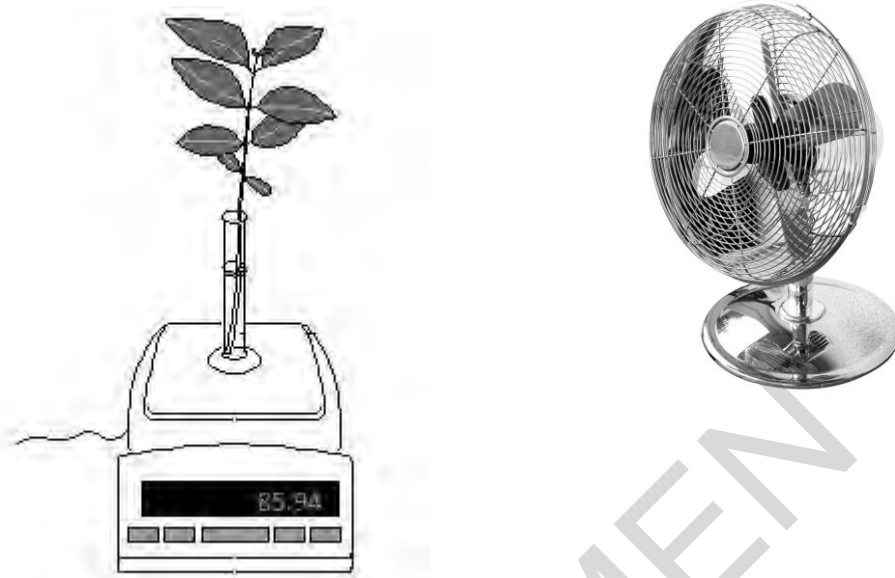
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SPECIMEN

18 Emma wants to investigate the effect of air movement on transpiration.

The diagram shows how she sets up her experiment.



Emma measures the rate of transpiration by measuring the loss in mass over 3 hours.

She does this first with the fan switched off.

She then repeats this but with the fan switched on.

She keeps all other environmental conditions the same.

These are her results.

	Fan switched off	Fan switched on
Mass loss in 3 hour in g	37	144

(a) Explain the difference in her results.

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..... [2]

**(b)** Emma kept environmental conditions like light intensity and temperature the same.

**(i)** Why was it important to keep the light intensity the same?

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

**(ii)** Why was it important to keep the temperature the same?

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

SPECIMEN



19 A boy picks up a hot plate and quickly drops it.

This is a reflex action.

(a) Describe the sequence of events that happens in his nervous system during this reflex action.

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[5]

(b) The table shows information about different types of neurons.

Type of neurone	Diameter (x10 <sup>-3</sup> mm)	Is myelin sheath present?	Speed of impulse (m/s)
A	13-20	yes	80-120
B	6-12	yes	33-75
C	5-8	yes	4-24
D	1-5	yes	3-15
E	0.2-1.5	no	0.5-20

(i) Discuss the effect of diameter on the speed of impulse.

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[2]

- (ii) Explain how strong a conclusion, if any, you can make from the data about the effect of the myelin sheath on the speed of impulse.

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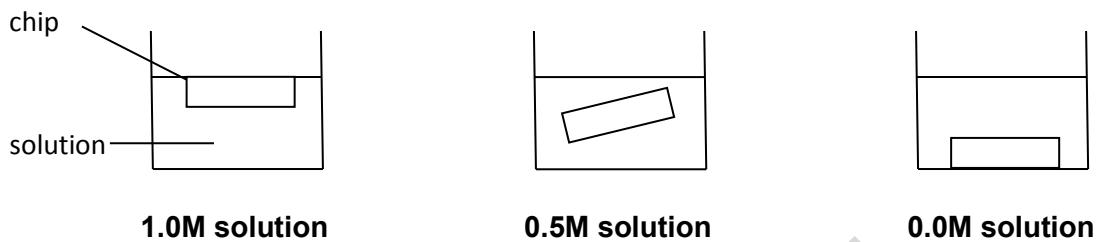
SPECIMEN

**20** An investigation is done to investigate osmosis in potatoes.

Three chips are cut from a potato.

Each chip is 5.0 cm long.

Each chip is left in a different concentration of sucrose solution for two hours.



These are the results after two hours:

chip in <b>1.0M solution</b>	4.5 cm
chip in <b>0.5M solution</b>	5.0 cm
chip in <b>0.0M solution</b>	5.5 cm

(a) Explain why the chip in the **0.0M solution** increased in length.

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..... [2]

(b) Explain why the chip in the **0.5M solution** stayed the same length.

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..... [2]

- (c) (i) Calculate the percentage change in length of the chip in the **1.0M solution**.

**answer** = .....% [2]

- (ii) In experiments like this, what is the advantage of calculating percentage change, not just the actual change?

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..... [1]

- (d) (i) Measuring the length of the chips is a quick and easy way to get results but it does **not** measure the total change to the chips.

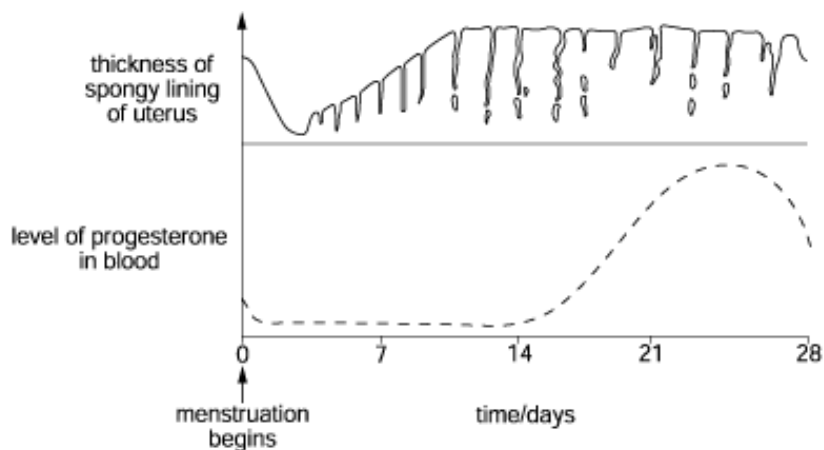
Explain why.

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- (ii) What could the students measure to see the total change to the chips?

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..... [1]

21 The graph shows how the level of progesterone changes during the menstrual cycle.



(a) (i) Draw another line on the lower graph to show how the level of oestrogen changes during the menstrual cycle. [2]

(ii) Describe how oestrogen and FSH interact during the menstrual cycle.

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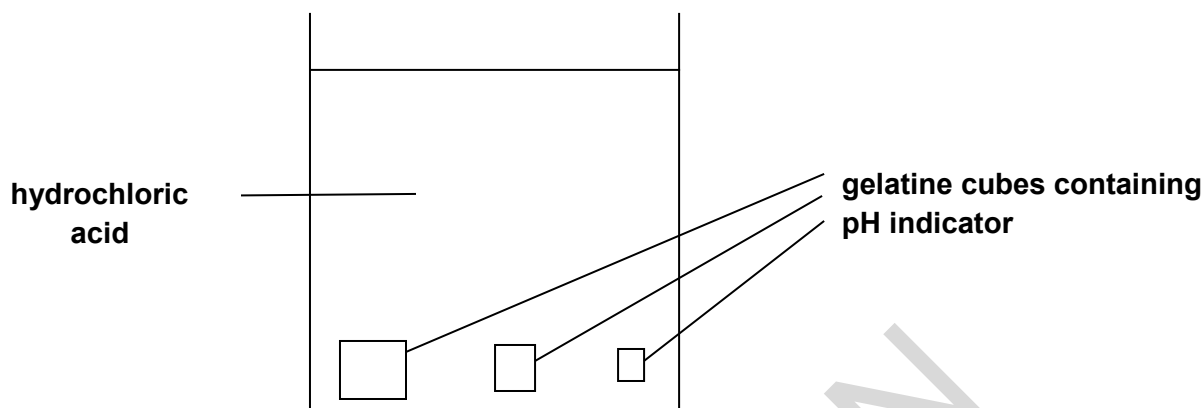
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- 22** Some students investigate the effect of the ratio of surface area:volume on the rate of diffusion in animal cells.

They use hydrochloric acid and gelatine cubes stained blue with pH indicator.

They put different sized cubes into a beaker of hydrochloric acid and time how long it takes for the cubes to completely change colour.



The table shows their results.

length of 1 side of cube (cm)	surface area:volume ratio ( $\text{cm}^{-1}$ )	time to completely change colour in seconds
1	.....	132
2	3	328
3	2	673

- (a) (i) Calculate the surface area:volume ratio for the cube with sides of 1 cm.

answer = .....  $\text{cm}^{-1}$

[1]

- (ii) Calculate the rate of colour change for each of the three cubes.

Write your answers in the table below.

Show your answers in standard form.

length of 1 side of cube (cm)	rate of colour change ( $s^{-1}$ )
1	.....
2	.....
3	.....

[2]

- (iii) Use the results and your calculations in parts (i) and (ii)

Explain why most large multi cellular organisms need transport systems, such as the blood system, but most single celled organisms do **not**.

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[2]

- (iv) Explain why using gelatine spheres instead of cubes might be more biologically accurate but suggest why the students used cubes instead.

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[2]



(b) Oxygen enters red blood cells by diffusion.

Describe and explain how red blood cells are adapted for the efficient uptake and transport of oxygen.

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**[5]**

**END OF QUESTION PAPER**

SPECIMEN