OCR
Oxford Cambridge and RSA

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

Date – Morning/Afternoon
Time allowed: 1 hour 45 minutes

Version 2

You may use:
• a scientific or graphical calculator
• a ruler

SPECIMEN

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 **24** pages.

SECTION A

Answer **all** the questions.

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

1   Plant shoots grow towards sunlight.

Which term describes this behaviour?

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 A

B C

C G

D T

Your answer [ ]   **[1]**

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]

5   The graph shows the effect of carbon dioxide concentration on the rate of photosynthesis.
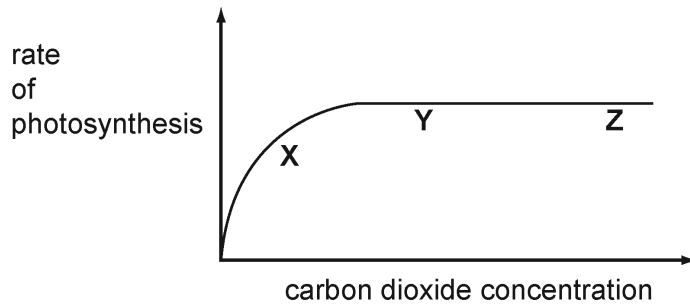
Where on the graph is carbon dioxide a limiting factor?

A   **X** only

B   **X** and **Y**

C   **Y** and **Z**

D   **Z** only

Your answer [ ]   **[1]**

6   Which hormone is used to ripen fruit?

A   Adrenaline

B   Auxin

C   Ethene

D   Gibberellin

Your answer [ ]   **[1]**

7 Which response 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	Uses ATP	Only moves substances from	
			low to high concentration	high to low concentration
A		✓		✓
B	✓	✓	✓	
C	✓		✓	
D	✓	✓		✓

Your answer ☐ **[1]**

11 How will an increase in ADH levels 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 µm.

What is the diameter in mm?

- 1 µm = 1×10^{-3} mm.

A 1.2×10^{-1}

B 1.2×10^{-2}

C 1.2×10^{-3}

D 1.2×10^{-4}

Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

16 The fat in milk is broken down by the enzyme lipase.
A group of students investigate the effect of temperature on this breakdown of fat.

In their investigation they use an indicator called phenolphthalein.
Phenolphthalein is pink in alkali conditions but colourless in pH values below 8.

Step 1 One student puts 5 drops of phenolphthalein and 5 ml of full fat milk into a test tube.

Step 2 She adds 1 ml of lipase and stirs the mixture.

Step 3 She measures the time for the pink indicator colour to disappear.

The other students repeat these three steps but at different temperatures.
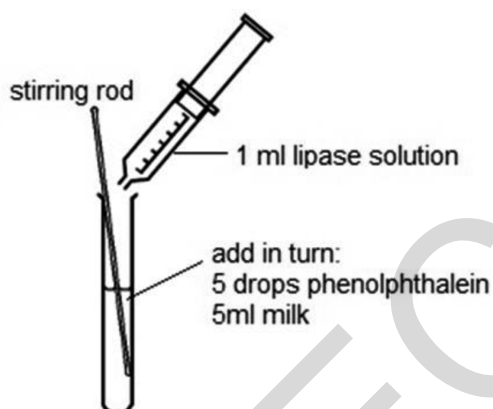
Table 16.1 shows the results of the group.

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

Table 16.1

(a) The pH falls as the fat in milk breaks down.

Explain why.

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.... **[2]**

(b) Plot a graph of the results from **Table 16.1** and draw a line of best fit.
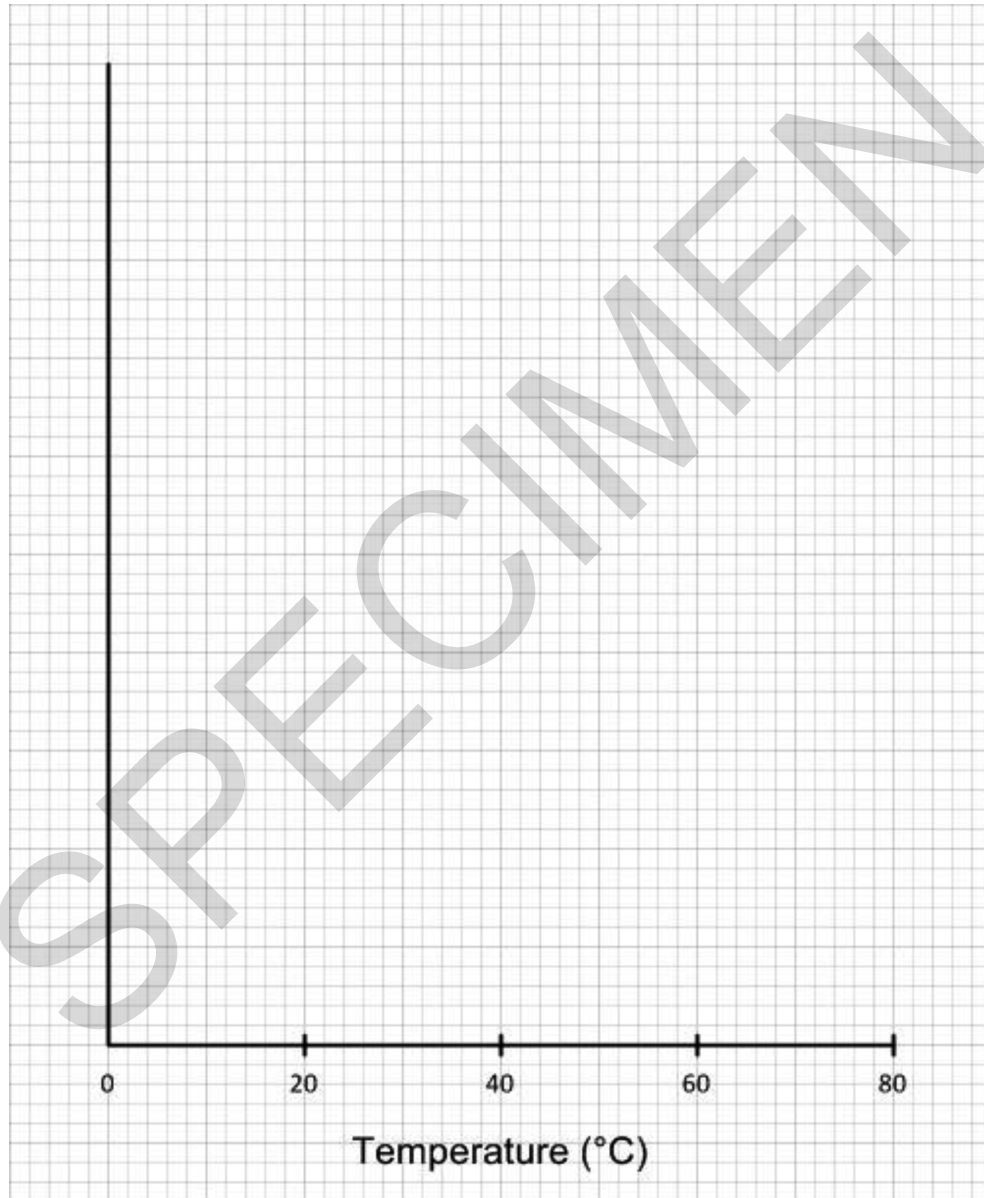
[5]

(c) Explain why the results at **20 °C** and **40 °C** are different.

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.... **[3]**

(d) Explain why the results at **40 °C** and **80 °C** are different.

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.... **[3]**

(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** modifications that the students could make to their method to find a more accurate value for the optimum temperature.

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.... **[2]**

(f) The students rounded each time they measured to the nearest 10 seconds.

They rounded the times 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 a more accurate measurement.

1 ....

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2 ....

.... **[2]**

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TURN OVER FOR THE NEXT QUESTION

17   A student investigates how light intensity affects the rate of photosynthesis in pondweed.

The diagram shows how he sets up his investigation.
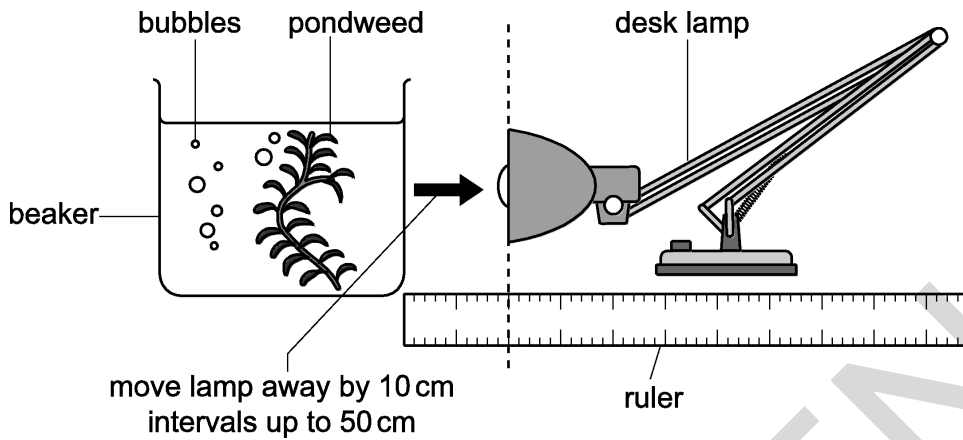
- He places the lamp at distances of 10, 30, 50, 70 and 90 cm from the beaker.

- At each distance, he measures how much gas is given off from the pondweed in 1 minute.

(a) (i)   The student 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)   The student'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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.... **[1]**

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

number of
bubbles in 10
seconds

distance between lamp
and beaker
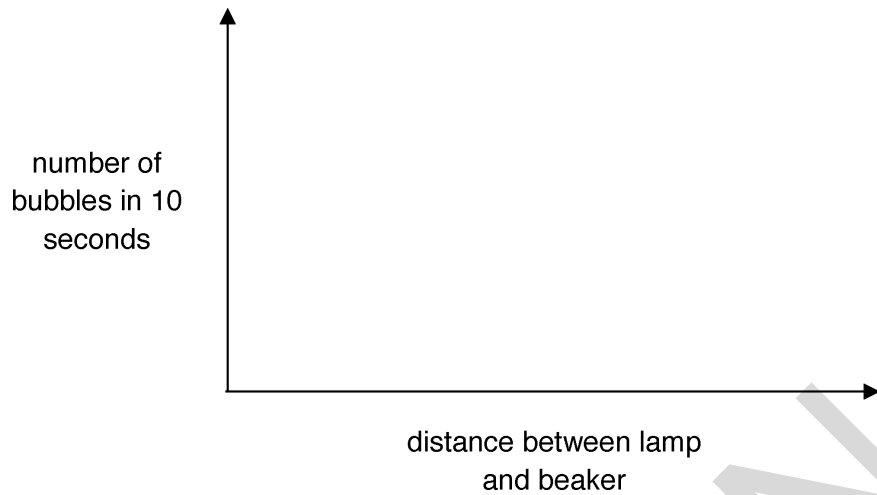
[2]

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

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.... **[2]**

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

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.... **[3]**

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

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....**[2]**

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

The diagram shows how she sets up her experiment.
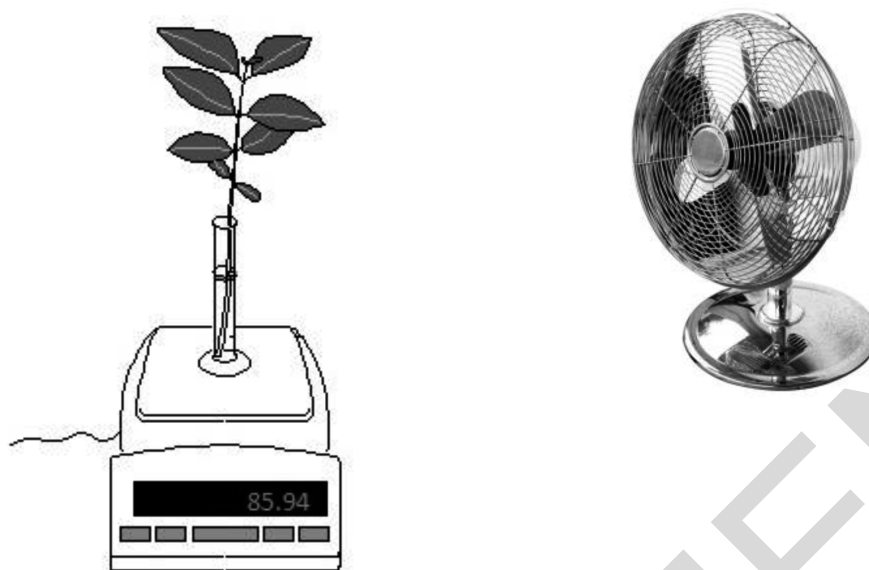
1. She measures the rate of transpiration by measuring the loss in mass over 3 hours.

2. She does this first with the fan switched off.

3. She repeats this but with the fan switched on.

4. She keeps all other environmental conditions the same.

These are her results.

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

(a) Explain the difference in her results.

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.... **[2]**

(b) The student 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]**

Turn over

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	Is myelin sheath present?	Diameter ($\times 10^{-3}$ mm)	Speed of impulse (m/s)
A	yes	13–20	80–120
B	yes	6–12	33–75
C	yes	5–8	4–24
D	yes	1–5	3–15
E	no	0.2–1.5	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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.... **[2]**

20   A student investigates how different concentrations of sucrose solutions affect 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.

| 1.0 M solution | 0.5 M solution | 0.0 M solution |
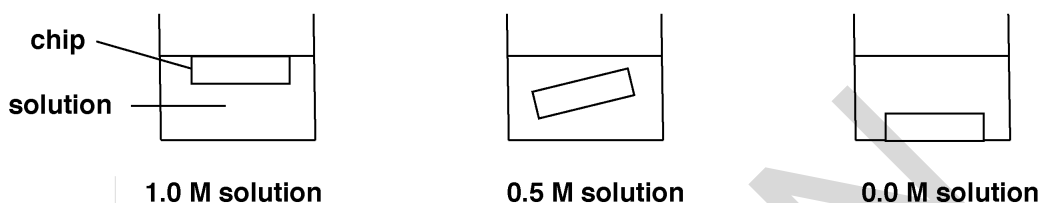
These are the results.

Concentration of sucrose solution	Length of potato chip	
	Start (cm)	After two hours (cm)
1.0 M	5.0	4.5
0.5 M	5.0	5.0
0.0 M	5.0	5.5

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

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.... **[2]**

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

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.... **[2]**

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

Answer = ... % [2]

(ii) In experiments like this, what is the advantage of calculating percentage change, rather than 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. However, it does **not** measure the total change to the chips.

Explain why.

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.... **[1]**

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

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.... **[1]**

21 The graph in **Fig. 21.1** shows how the level of progesterone changes during the menstrual cycle.
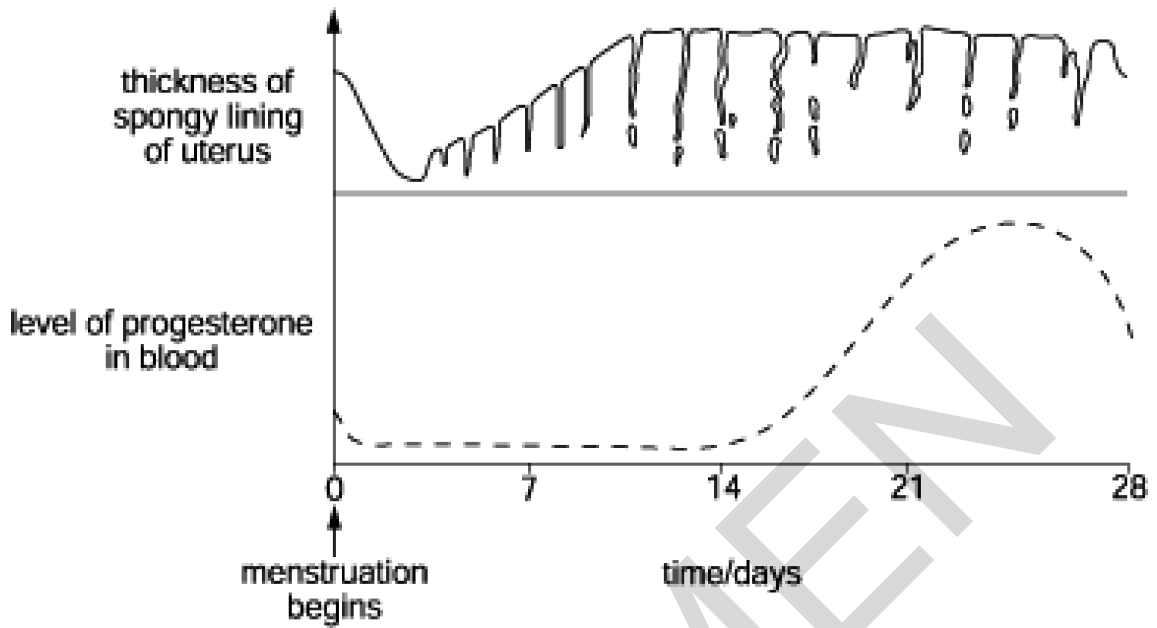
Fig. 21.1

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

(b)* Endometriosis is a condition where the cells that normally line the uterus (womb) can move to other parts of the body.

During the menstrual cycle the cells that have moved can react in the normal way to the hormones controlling menstruation.
This can cause a number of problems including fatigue and pain.

Explain what happens to the cells that have moved and how doctors could treat the condition using sex hormones.

Use the information from the graph in **Fig. 21.1** and your own knowledge.

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.. **[6]**

22 Some students investigate how the rate of diffusion in animal cells is affected by the surface area : volume ratio.

1. They use three different sized gelatine cubes stained blue with pH indicator.

2. They put the cubes into a beaker of hydrochloric acid.

3. They measure the time for each cube to completely change colour.

hydrochloric acid

gelatine cubes stained with pH indicator
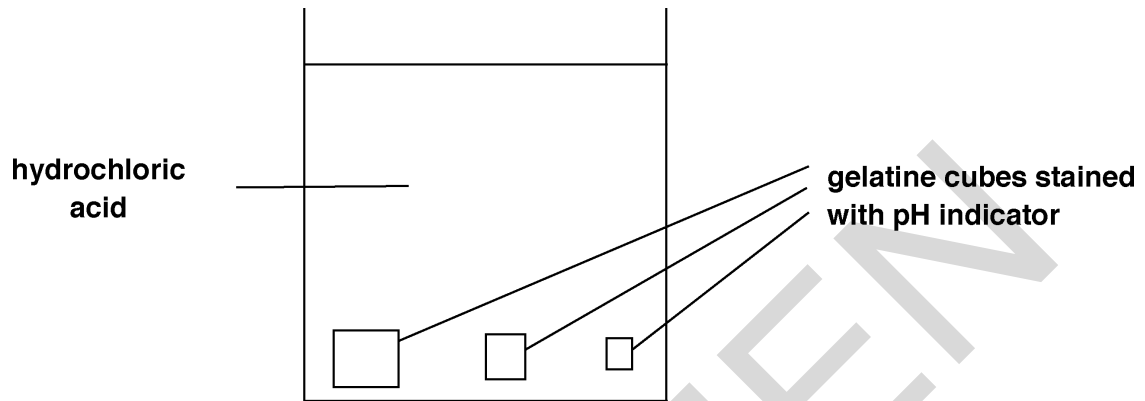
The table shows their results.

Length of one side of cube (cm)	surface area : volume ratio	Time to completely change colour (seconds)
1	....	132
2	3:1	328
3	2:1	673

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

answer = ... **[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 one 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