

**GCSE Biology A (Gateway)**

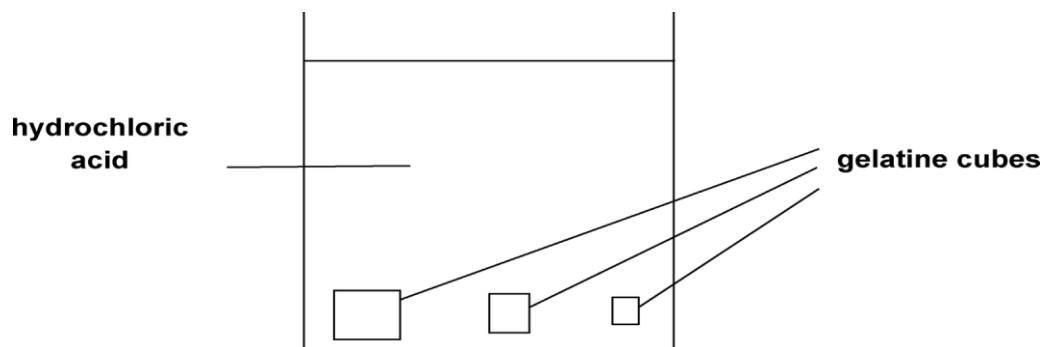
**J247/01 B1-B3 and B7 Foundation (Foundation Tier)**

**Question Set 9**

1

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

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.



The table shows their results.

length of 1 side of cube (cm)	surface <u>area</u> : volume ratio	time to completely change colour in seconds
1	6:1	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.

$$SA = 6 \times 1 \times 1 = 6 \text{ cm}^2$$

$$V = 1 \times 1 \times 1 = 1 \text{ cm}^3$$

6:1

Answer = ..... 6:1 ..... [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 <u>colour</u> change (s <sup>-1</sup> )
1	$7.6 \times 10^{-3}$
2	$3.0 \times 10^{-3}$
3	$1.5 \times 10^{-3}$

[2]

Rate of colour change =  $1/\text{time}$

$$1/132 = \underline{\underline{7.6 \times 10^{-3}}} \quad 1/328 = \underline{\underline{3.0 \times 10^{-3}}}$$

$$1/673 = \underline{\underline{1.5 \times 10^{-3}}}$$

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

Explain why most single celled organisms do **not** need a transport system (e.g. the circulatory system of multi-cellular organisms).

[2]

The smaller blocks changed colour faster. This is the same for most single celled organisms as they are smaller and have a larger surface area to volume ratio. This is why diffusion alone is sufficient.

- (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.

[5]

Red blood cells are well adapted for uptake and transport of oxygen. This is down to their small size so they can easily travel through capillaries. They have a biconcave disc shape so have a large surface area to volume ratio. Finally they don't have a nucleus so have more room for oxygen carrying haemoglobin.

**Total Marks for Question Set 9: 10**

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