

GCSE Biology A (Gateway)

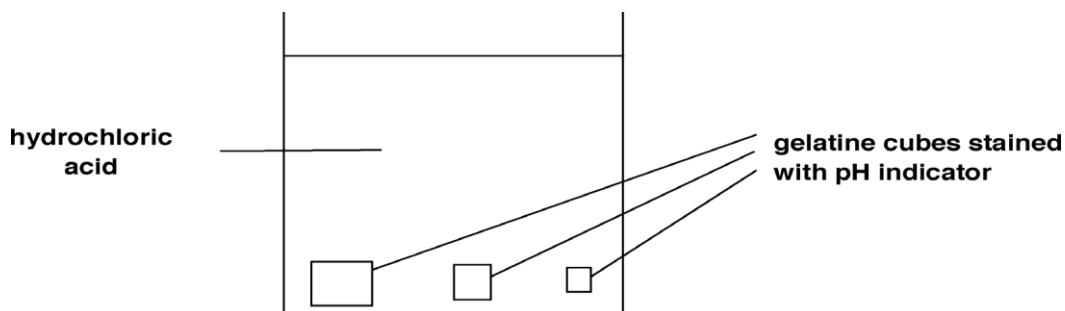
J247/03 B1-B3 and B7 Higher (Higher Tier)

Question Set 7

1

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.



The table shows their results.

Length of one side of cube (cm)	surface area: volume ratio	Time to completely change colour (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.

$$SA = 6(1 \times 1) = 6 \text{ cm}^2 \quad SA : V$$

$$V = 1 \times 1 \times 1 = 1 \text{ cm}^3 \quad \underline{\underline{6 : 1}}$$

[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 one side of cube (cm)	Rate of colour change (s ⁻¹)
1	7.6×10^{-3}
2	3.0×10^{-5}
3	1.5×10^{-5}

Use $\frac{1}{\text{time}}$ for these

[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.

As size increases the rate of diffusion decreases because of increased diffusion distance. For large organisms it would take too long for substances to diffuse in and out. [2]

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

Spheres are an improvement because animal cells tend to be round shapes, not cubes. Students used cubes because they are easier to cut and prepare. [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.

They have haemoglobin to carry oxygen.

[5]

Total Marks for Question Set 7: 12

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