



Human Biology

HBI3T/Q12/task

Unit 3T AS Investigative Skills Assignment Task Sheet

The effect of surface area and volume of cells on the absorption of substances

Introduction

Cells vary in size. This means that different cells have different surface areas and different volumes. The relationship between surface area and volume affects the rate at which cells exchange substances through their plasma membrane (cell surface membrane).

In this investigation, blocks of gelatine will be used as model cells. You are going to investigate the rate of absorption of hydrochloric acid by model cells of different sizes.

The gelatine contains an indicator dye. The dye is dark blue-green in alkaline conditions, and it turns orange in acid conditions.

Gelatine melts quite easily so you should handle the blocks as little as possible.

Materials

You are provided with

- a piece of gelatine containing an indicator dye stained dark blue-green
- ruler marked in millimetres
- cutting surface
- scalpel or sharp knife
- dilute hydrochloric acid
- test tubes
- test tube rack
- bung
- timer

You may ask your teacher for any other apparatus you require.

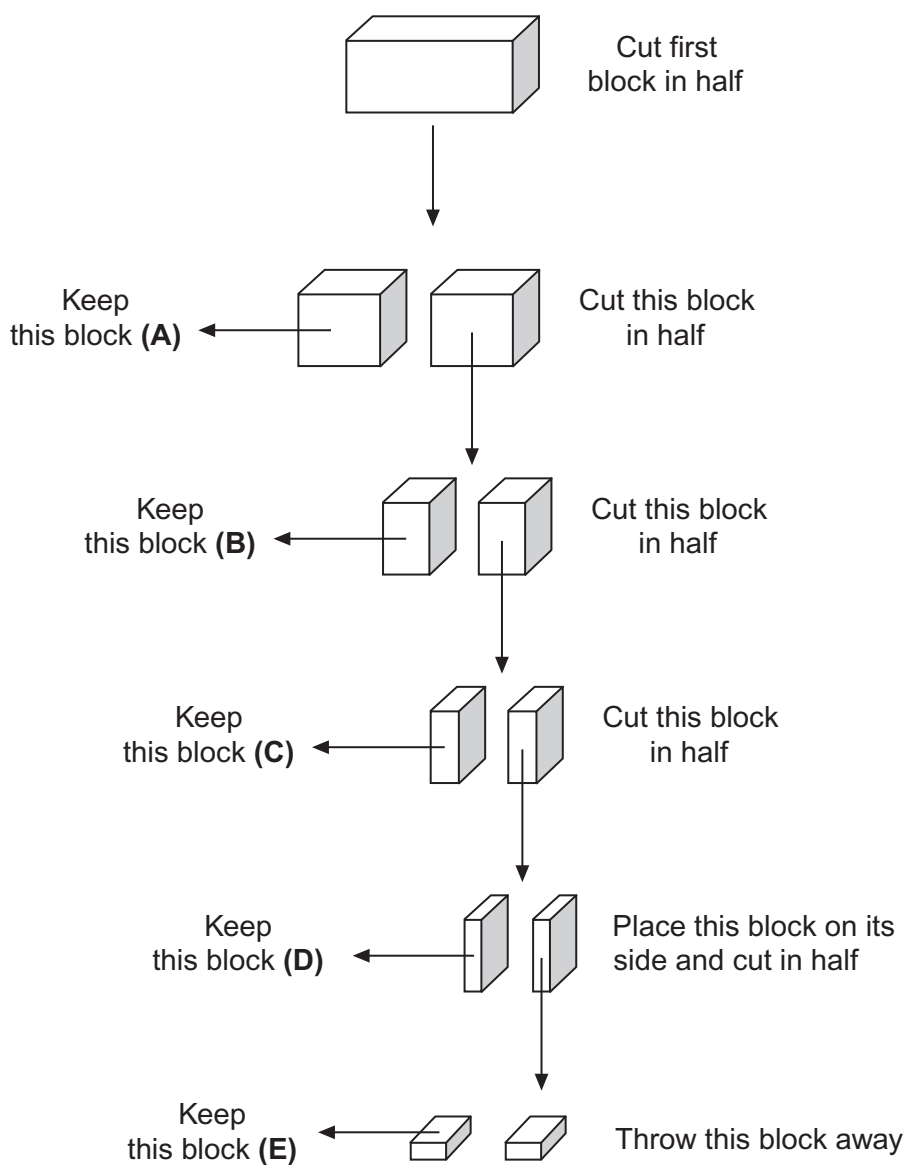
Outline method

Read these instructions carefully before you start your investigation.

1. Place the gelatine flat on the cutting surface.
2. Use the scalpel to cut out a 10 mm × 20 mm block. Keep the blade vertical when making each cut.

- Cut this gelatine block five times into smaller blocks as shown in **Figure 1**. Keep the blade vertical when making each cut.

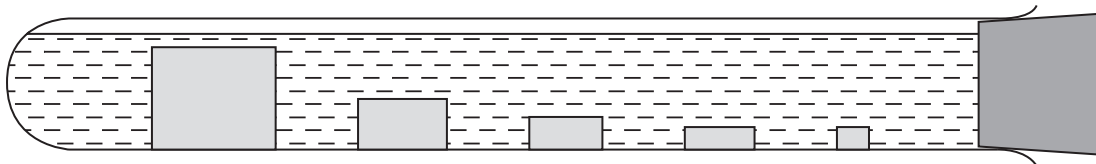
Figure 1



- Pour dilute hydrochloric acid into a test tube until it is about 15 mm from the top.
- Carefully drop block **A** into the test tube, followed by block **B**, then block **C**, then block **D**, then block **E**.
Immediately close the tube with the bung and start the timer.

6. Put the tube on its side and spread the blocks out along the length of the tube as shown in **Figure 2**. Try to make sure they do not touch each other.

Figure 2



7. Leave the tube on its side. Every few seconds rotate it gently to move the liquid.
8. Watch the colour of the blocks. Record the time taken for each block to change colour to orange. Note that the large block may take more than 45 minutes to change colour.

You will need to decide for yourself

- when each block has turned orange
- whether to record the time for each block to change colour in whole minutes or in seconds.

ISA HBI3T/Q12 Candidate Results Sheet: Stage 1

The effect of surface area and volume of cells on the absorption of substances

Centre Number

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Candidate Number

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Candidate Name

Record your data in a table in the space below.

(3 marks)

Hand in this sheet at the end of each practical session.

The surface area divided by volume for each cube has been calculated for you. You should include this information in your table of results.

Block	Surface area divided by volume
A	0.6
B	0.8
C	1.2
D	2.0
E	2.2

ISA HBI3T/Q12 Candidate Results Sheet: Stage 2

The effect of surface area and volume of cells on the absorption of substances

Centre Number

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Candidate Number

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Candidate Name

Use the space below to process your data.

Use the graph paper to plot a graph of your processed data.

(6 marks)

Hand in this sheet at the end of the practical session.

Hand in this sheet at the end of each practical session.

