5 Diffusion may be defined as the net movement of particles from a region of their .....1..... concentration, to a region of their .....2..... concentration, where movement is .....3..... a concentration gradient.

Which words complete gaps 1, 2 and 3?

	1	2	3
A	higher	lower	down
B	higher	lower	up
C	lower	higher	down
D	lower	higher	up

1 A student investigated the effect of concentration on diffusion.

The student used pieces of agar which contained universal indicator. Universal indicator is green in substances with a neutral pH and red in substances with an acidic pH.

The student placed the pieces of agar into different concentrations of hydrochloric acid solution and measured the time taken for the acid to diffuse to the centre of each piece of agar. At the start of the investigation the agar was green.

The student used this method:

Step 1 Label four test-tubes **0.4**, **0.6**, **0.8**, **1.0**.

Table 1.1 shows the volumes of 1.0 mol per dm^3 hydrochloric acid solution and distilled water used to make the different concentrations of hydrochloric acid solution.

Table 1.1

concentration of hydrochloric acid solution / mol per dm^3	volume of 1.0 mol per dm^3 hydrochloric acid solution / cm^3	volume of distilled water / cm^3
0.4	4	6
0.6	6	4
0.8	8	2
1.0	10	0

Step 2 Use a 10 cm^3 syringe to put the volumes of 1.0 mol per dm^3 hydrochloric acid solution shown in Table 1.1 into the test-tubes labelled **0.4**, **0.6**, **0.8**, **1.0**.

Step 3 Use the 10 cm^3 syringe to put the volumes of distilled water shown in Table 1.1 into the test-tubes labelled **0.4**, **0.6**, **0.8**, **1.0**.

Step 4 A block of agar which measures approximately 1 cm × 2 cm × 2 cm is provided. Use the knife to cut the agar block into four pieces.

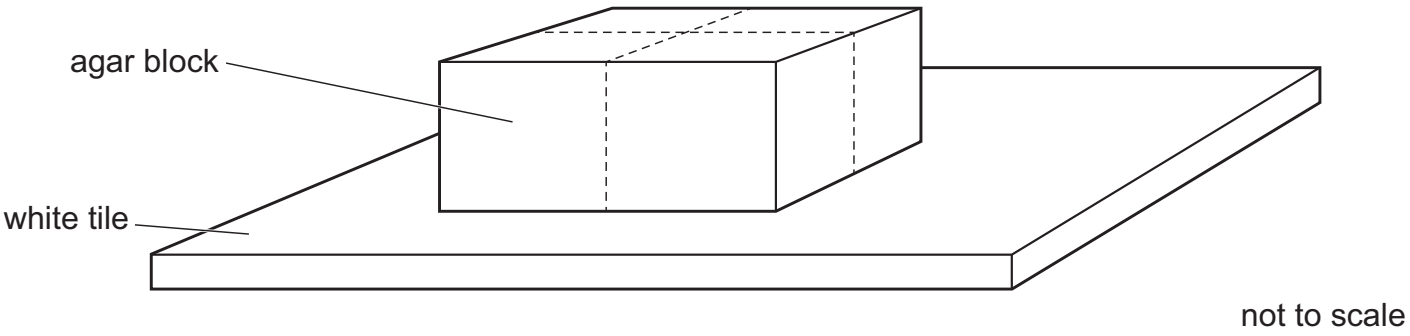

Fig. 1.1

Step 5 Place all the test-tubes into a warm water-bath.

Step 6 Put **one** agar piece into each of the test-tubes and immediately start the stop-clock. Observe the colour of the agar pieces as they change from green to red.

The student recorded the time taken for each piece of agar to become completely red.

The stop-clocks from step 6 are shown in Fig. 1.2.

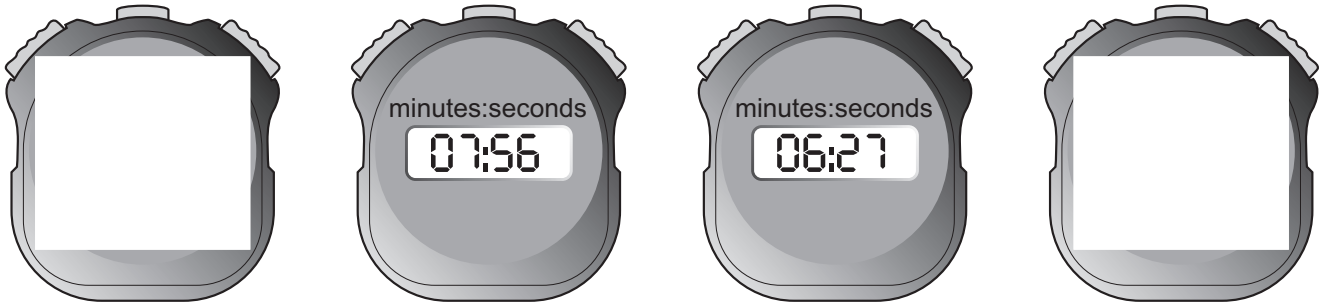

Fig. 1.2

(a) (i) Prepare a table to record the results of the investigation.

Convert the times on the stop-clocks shown in Fig. 1.2 to seconds and record these times in your table.

[4]

(ii) State a conclusion for the results.

.....

.....

..... [1]

(iii) State the independent and dependent variables in this investigation.

independent variable .....

.....

dependent variable .....

.....

[2]

(iv) Suggest **two** improvements to the method used for this investigation.

1 .....

.....

.....

2 .....

.....

.....

[2]

(v) Identify **two** hazards in this investigation.

.....

.....

..... [1]

(b) Plan an investigation to determine the effect of temperature on osmosis in potato plant tissue.

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..... [6]

[Total: 16]

1 Fig. 1.1 shows the movement of particles through an epithelial cell in the small intestine.

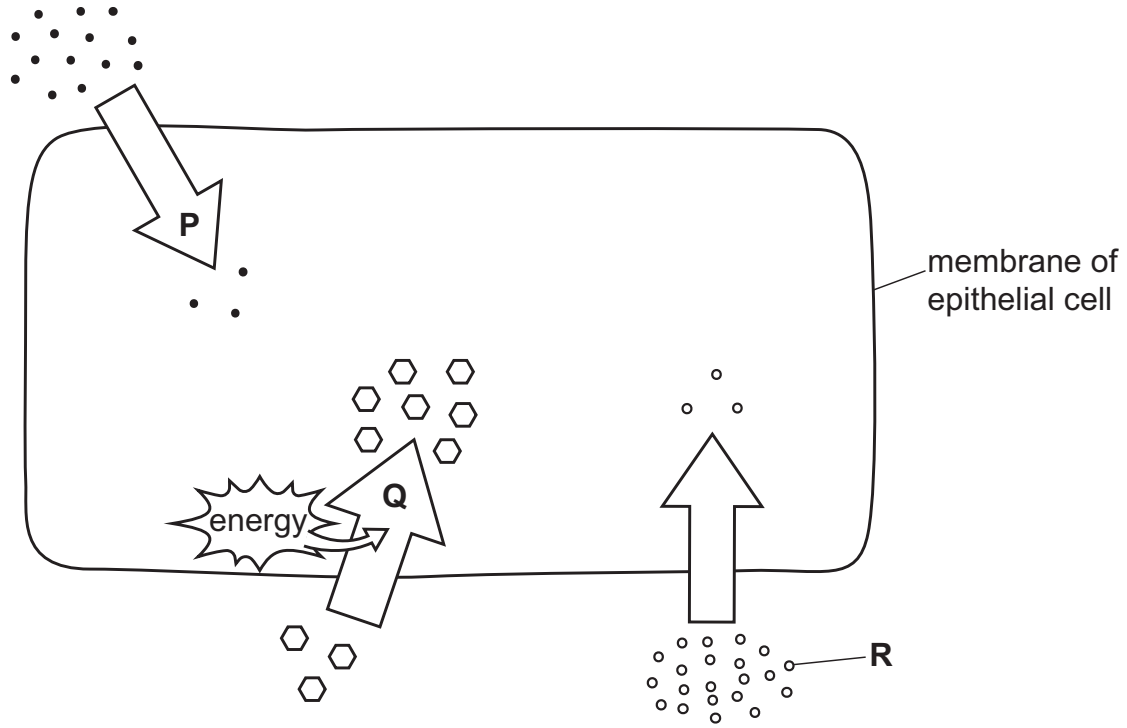

Fig. 1.1

(a) In Fig. 1.1, arrow **P** represents the diffusion of oxygen molecules.

(i) Describe what is meant by the term diffusion.

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..... [2]

(ii) State the type of energy needed for diffusion.

..... [1]

(b) Carbon dioxide molecules also move by diffusion.

(i) State the name of the process in human cells that produces carbon dioxide.

..... [1]

(ii) On Fig. 1.1, draw an arrow to show the direction of diffusion of carbon dioxide molecules. [1]

(c) In Fig. 1.1, arrow **Q** represents another type of particle movement.

Identify the type of particle movement represented by arrow **Q**.

Explain your answer.

type of movement .....

explanation .....

.....

.....

[3]

(d) In Fig. 1.1, particle **R** moves from the lumen of the small intestine into the epithelial cell.

Suggest why particle **R cannot** be starch.

.....

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.....

..... [2]

(e) Fig. 1.2 is a photomicrograph of red onion cells.

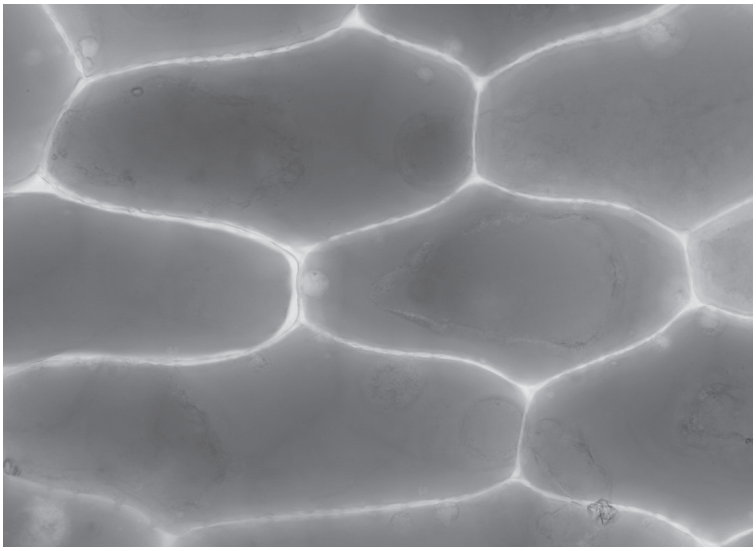

Fig. 1.2

Fig. 1.3 is a photomicrograph of the same red onion cells after being immersed in a salt solution.

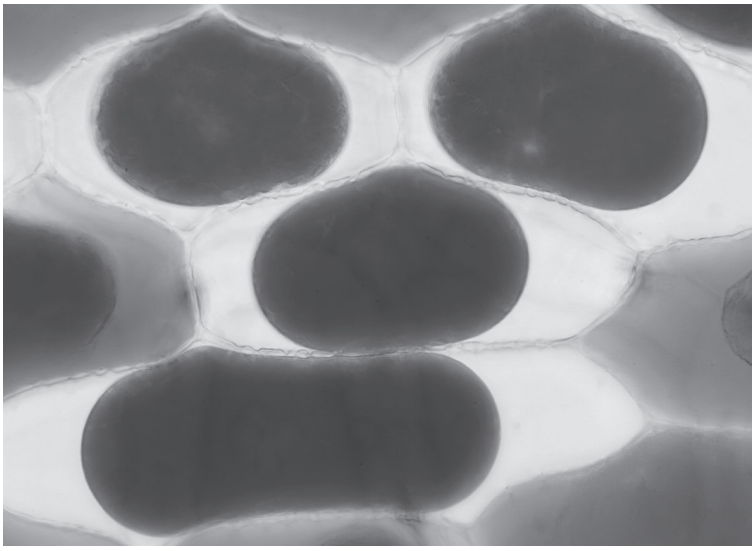

Fig. 1.3

Using Fig. 1.2 and Fig. 1.3, describe **and** explain the difference in appearance of the cells before and after immersion in salt solution.

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..... [6]

[Total: 16]