1 Some students investigated osmosis in raw potato sticks.

(a) Define the term *osmosis*.

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..... [3]

(b) The students measured the mass of four of the potato sticks using an electronic balance.

Fig. 4.1 shows an electronic balance.

Fig. 4.1

The students left each potato stick in one of four different liquids for 5 hours:

- distilled water
- 0.1 mol per dm^3 sodium chloride solution
- 0.5 mol per dm^3 sodium chloride solution
- 1.0 mol per dm^3 sodium chloride solution.

After 5 hours they measured the mass again and calculated the change in mass.

(i) Predict which of the liquids would cause the largest decrease in mass of a potato stick.

..... [1]

(ii) The students dried the potato sticks with paper towels before putting them on the electronic balance.

Suggest why.

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..... [1]

(c) After the experiment the students noticed that the potato stick with the lowest mass was soft and floppy.

Explain why the potato stick had become soft and floppy.

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..... [3]

(d) The students followed the same experimental procedure with boiled potato sticks and found no overall change in mass in any of the solutions.

Suggest why the mass of the boiled potato sticks remained the same.

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..... [2]

[Total: 10]

2 A student investigated the diffusion of substances through Visking tubing, an artificial membrane which has some of the properties of cell membranes.

The student made a bag of Visking tubing as shown in Fig. 4.1.

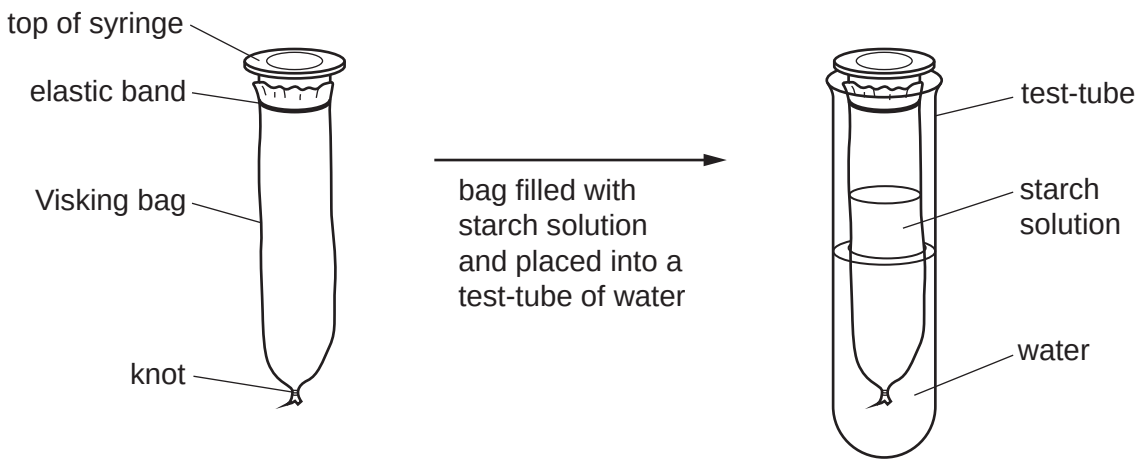

Fig. 4.1

The student added some iodine solution to the water in the test-tube.

After 30 minutes at room temperature, the contents of the Visking bag were stained blue-black, but the water outside remained a yellow colour.

(a) **(i)** Explain these results.

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..... [4]

(ii) State **three** factors that influence the movement of molecules through membranes.

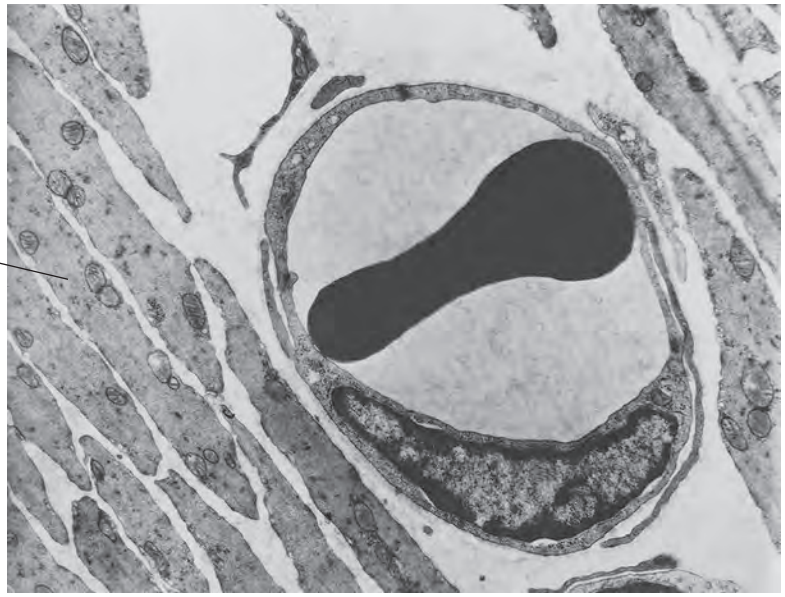
1 .....

2 .....

3 .....

[3]

(b) Fig. 4.2 is an electron micrograph of a red blood cell within a capillary.



magnification ×6500

Fig. 4.2

(i) Molecules of carbon dioxide that are produced in muscle cells are transported to the blood.

Describe the pathway taken by these molecules of carbon dioxide.

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..... [3]

(ii) Explain how capillaries are adapted for their functions.

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..... [3]

(c) Mammals have a transport system for carbon dioxide. Plants absorb carbon dioxide from their surroundings to use in photosynthesis.

Explain how a molecule of carbon dioxide from the atmosphere reaches the site of photosynthesis in a leaf.

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..... [4]

[Total: 17]

3 Some plants can be grown in water using the technique of hydroponics. The roots are in water and supplied with the ions that they need at the concentrations that support maximum growth. Some ions can be absorbed both by diffusion and by active transport.

(a) (i) State **two** features of diffusion that do not apply to active transport.

1 .....

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2 .....

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[2]

(ii) Explain how roots are adapted to absorb ions.

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.....[2]

A group of students investigated the effect of soaking small onion bulbs in different concentrations of sodium chloride solution. They peeled off the outer papery leaves of the onion bulbs and divided the onions into 6 batches, each with 10 onions.

The onions were surface dried with paper towels and weighed. The mean mass of the onions in each batch was calculated. The onions were then left in sodium chloride solutions for three hours.

After three hours the students surface dried the onions and weighed them again. Their results are given in Table 2.1.

Table 2.1

concentration of sodium chloride solution / g dm^{-3}	mean mass of onions / g		percentage change in mass
	before soaking	after soaking for 3 hours	
0	147	173	+17.7
25	153	165	+7.8
50	176	172	–2.3
100	154	149	–3.2
150	149	142	–4.7
200	183	175	

(b) **(i)** Calculate the percentage change in mass of the onions that were in the most concentrated solution of sodium chloride. Show your working. Write your answer in Table 2.1.

[2]

(ii) Explain why the students calculated the percentage change in mass of the onions.

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.....[2]

(c) The students plotted a graph of the results as shown in Fig. 2.1.

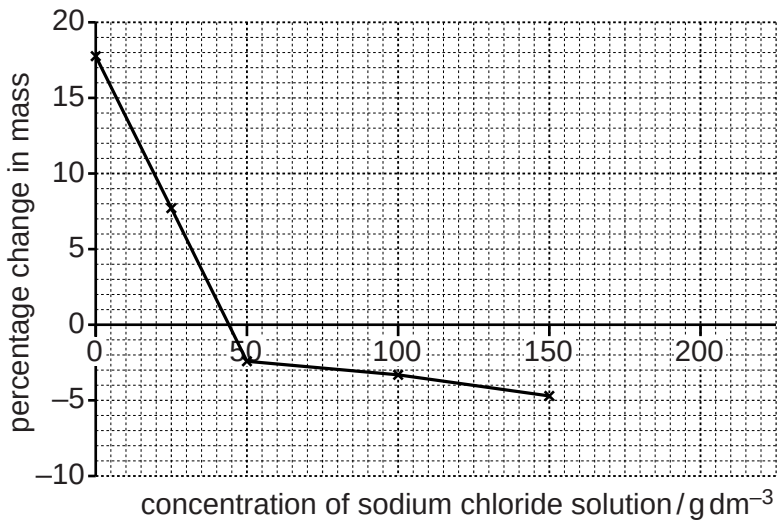

Fig. 2.1

(i) Complete the graph using your answer to **(b)(i)**. [1]

(ii) Use the graph in Fig. 2.1 to estimate the concentration of the sodium chloride solution that has the same water potential as the onions.

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(d) Using the term **water potential**, explain why the onions:

gained mass when soaked in dilute solutions of sodium chloride

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lost mass when soaked in concentrated solutions of sodium chloride.

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[4]

[Total: 15]

4 The pressure in the lungs of a student before and during the start of a volleyball match was recorded.

The results are shown in Fig. 2.1.

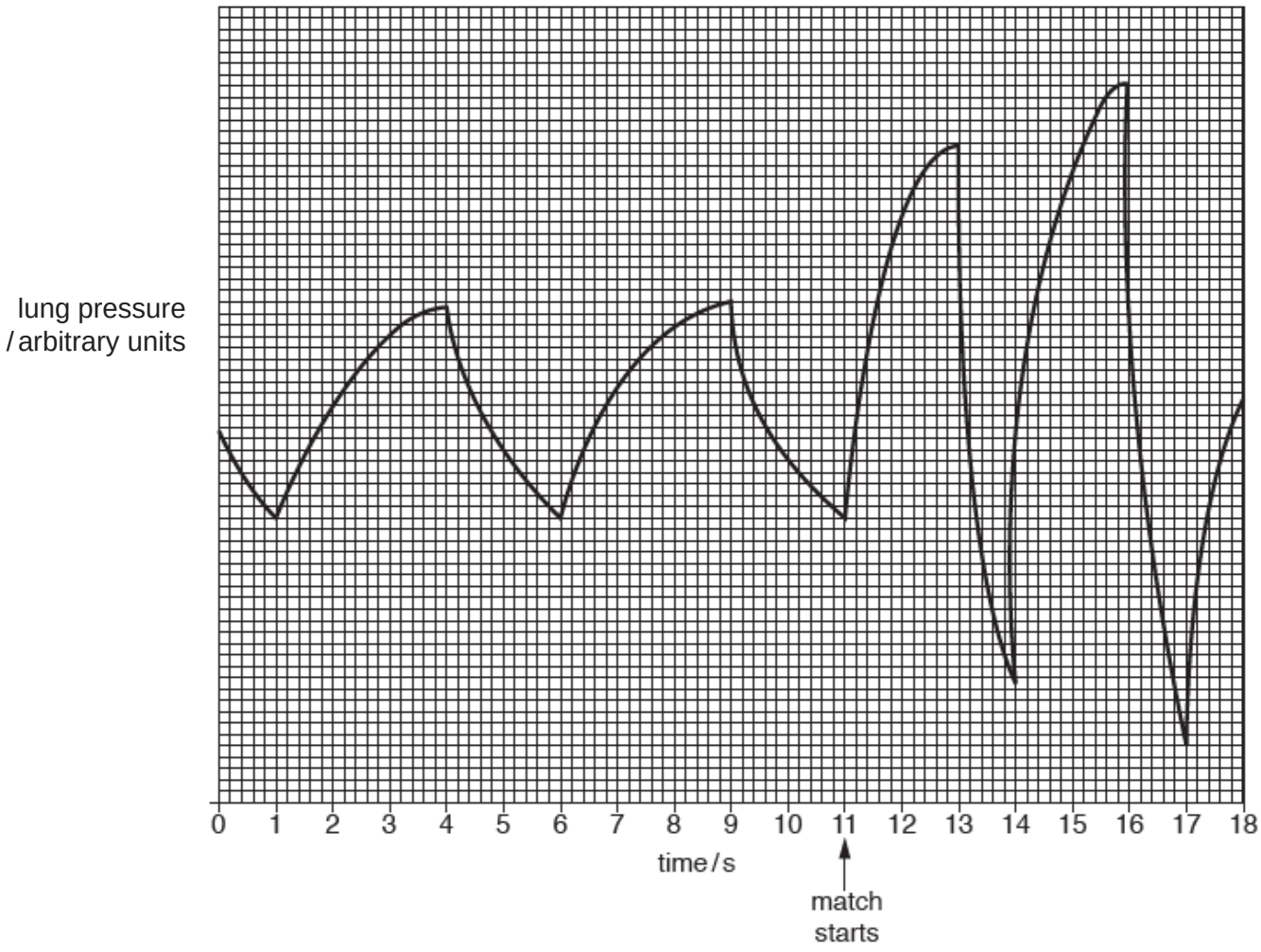

Fig. 2.1

(a) (i) Use the results in Fig. 2.1 to calculate the breathing rate before the start of the match. Express your answer to the nearest whole number.

Show your working.

.....breaths per minute
[2]

(ii) Use the results in Fig. 2.1 to describe how the pattern of breathing during the match is different from the pattern of breathing before the match starts.

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.....[3]

(b) Describe the process of inhalation.

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.....[4]

(c) Carbon dioxide is excreted from the body through the lungs.

(i) Explain why this process is termed *excretion*.

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.....[1]

(ii) Name the part of the blood in which most carbon dioxide is transported.

.....[1]

(iii) Describe the effect of increased carbon dioxide concentration on blood pH.

.....[1]

(d) Carbon dioxide moves from the blood capillaries into the alveoli by diffusion.

Explain why the rate of diffusion of carbon dioxide increases during exercise.

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[Total: 14]