

# Answers to end-of-chapter questions

## Chapter 3: Movement in and out of cells

- 1 a Osmosis. Water is at a high water potential (dilute solution) in the soil, at a lower water potential (concentrated solution) inside the root cells. It moves through the partially permeable cell membrane, down its water potential gradient.
- b Neither. In this case, all the molecules in the saliva move as one, like water flowing in a river. Both diffusion and osmosis involve the random, individual movement of molecules or ions.
- c Diffusion. The ink particles move randomly, bumping into each other and into the water particles, gradually spreading throughout the water.
- d Diffusion. The carbon dioxide particles move randomly, and some will 'bump into' a stoma in the underside of the plant leaf. There is a low concentration of carbon dioxide inside the leaf, because the plant uses it up very quickly in photosynthesis. The carbon dioxide diffuses down its concentration gradient, from the air into the leaf.
- 2 a The sugar solution as a whole does not do anything. We need to think about the individual particles in the sugar solution – the water molecules and the sugar molecules. Both of these move about randomly. The water molecules can get through the tiny holes in the tubing, but the sugar molecules are too big. What will happen is that the water molecules will move randomly back and forth through the holes. Because there are more of them in the water than in the sugar solution, their net movement will be *into* the tubing. So the corrected sentence could be:  
If Visking tubing containing a sugar solution is put into a beaker of water, water will move from the water into the sugar solution, by osmosis.
- b It is true that plant cells do not burst in pure water, but this is because the cell wall is strong enough to prevent this happening. The cell wall is fully permeable, and cannot stop water molecules going through it. So the corrected sentence could be:  
Plant cells do not burst in pure water because, although water enters the cell by osmosis, the strong wall prevents the cell from bursting.
- c It is true that water will move out of a plant cell by osmosis, if the cell is placed in a concentrated sugar solution. However, the cell wall is not partially permeable – it is fully permeable. So the corrected sentence could be:  
When a plant cell is placed in a concentrated sugar solution, water moves out of the cell by osmosis, through the partially permeable cell membrane.
- d Plasmolysis is the result of placing a plant cell in a concentrated sugar solution. So much water moves out of the cell by osmosis that the contents shrink, and the cell membrane pulls away from the cell wall. As animal cells do not have a cell wall, they cannot undergo plasmolysis. So the corrected sentence could be either:  
Animal cells shrink when placed in a concentrated sugar solution.  
OR  
Plant cells plasmolyse in a concentrated sugar solution.
- 3 a Diffusion is a result of the random movement of molecules or ions. At higher temperatures, these have more kinetic energy and move faster, so diffusion happens faster.
- b During daylight, plants photosynthesise. They produce oxygen in their leaves, so the oxygen concentration inside the leaf is higher than the oxygen concentration in the air outside.

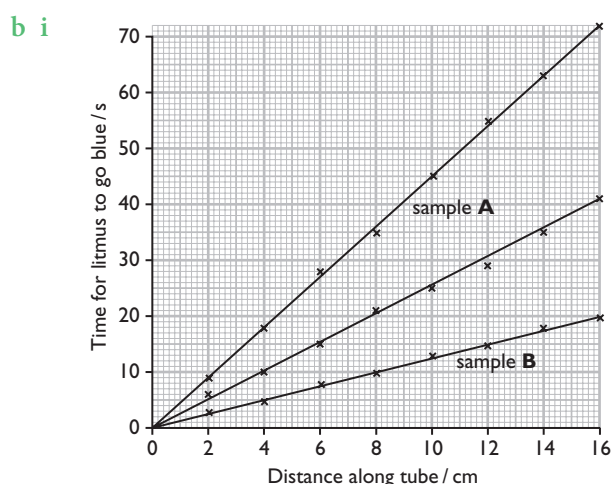
Oxygen therefore diffuses down its concentration gradient, from the leaf and into the air.

c Visking tubing is a partially permeable membrane. It has tiny, molecule-sized holes in it. Water molecules are even smaller than the holes, so they can pass through. Sugar molecules are much bigger than the holes, so they cannot pass through.

d When it is placed in pure water, an animal cell absorbs water by osmosis. This is because there is a higher water potential outside the cell than inside it. The extra water makes the cell swell, until it bursts.

e Plant cells are held in shape by their full vacuoles, which push outwards against the strong cell wall, producing a very firm structure. A plant cell like this is said to be turgid. Turgid cells pressing against each other make plant tissues strong and firm. When the cells are not full of water, they are no longer turgid, and their contents do not press outwards on the cell wall. The cells, and the tissues in the leaves that they make up, become soft and floppy. This is why the plant wilts.

4 a the movement of molecules / ions, down a concentration gradient / from a high concentration to a low concentration as a result of their random movement [2]



all points correctly plotted;  
lose one mark for any incorrect point  
neat best fit line drawn;

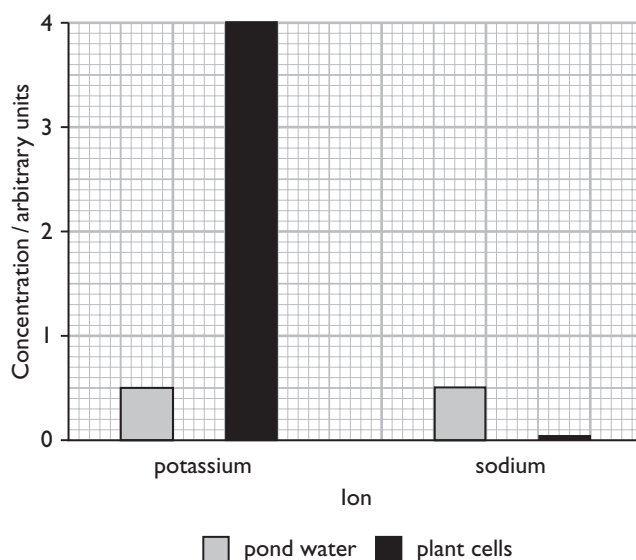
[3]

ii ammonium hydroxide is alkaline; [1]

iii A; [1]

iv C's concentration was between A and B; specific evidence quoted to support this statement, e.g. it took less time for it to travel 10 cm than A and more time than B; [2]

5 a more potassium in the plant cells than in the water;  
more sodium in the water than in the plant cells;  
use of comparative figures;



[3]

b active transport;  
if diffusion then concentrations in the cells and the water would be the same. [2]

c cells are using energy;  
from respiration;  
to, move potassium ions into the cell / move sodium ions out of the cell;  
against their concentration gradients;  
reference to transport proteins; [max 4]