**Plant Cells and Water**

**Technical & Teaching Notes**

### Related sheets

### Plant roots; About water; Moving water through plants; Plant leaves and water; Water and plant structure

### ****Introduction and context****

Cells are basic building blocks from which living organisms are made. You can see them through a microscope. Each plant cell has a cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts. There are different types of cells.

Groups of similar plant cells form tissue and work together to do a particular job, for example, root hair tissue (enables water and dissolved minerals to get into a plant) and xylem (tubes that carry water around a plant). Groups of different tissues make up an organ, again working together to do a particular job. A leaf and a plant root are examples. The next stage in ‘building’ a plant is for organs to work together as an organ system to do a necessary job, for example, a reproductive system and a leaf canopy. All living organisms (plants and animals) consist of a number of organ systems.

### To understand how water gets into and travels through plants students need to know something about cells, tissues and organs in plants.

### ****Possible barriers to learning****

### **The following are misconceptions that some students may have and which may be a hindrance to further learning:**

* The nucleus of a cell is like the nucleus of an atom
* Living things are made of cells, which are as small as atoms
* Microbes, cells and particles are much the same
* Fertilisers are plant food

### Plants get their food from the soil

### Links to National curriculum for science in England at key stage 3

### **In biology** pupils should be taught about cells and organisation, and nutrition and digestion which include:

* the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts
* the role of diffusion in the movement of materials in and between cells
* plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots

### **In chemistry** pupils should be taught about the particulate nature of matter, and pure and impure substances. This includes:

* the properties of the different states of matter (solid, liquid and gas) in terms of the particle model
* mixtures, including dissolving
* diffusion in terms of the particle model

### ****Safety Notes****

### **No hazardous materials are used.**

### **Cutting potatoes into sticks requires a sharp knife and so normal care and supervision should be provided.**

### ****Apparatus****

### ****Activity 2: Investigating potato sticks****

### **Each student or pair will need:**

### 2 screw cap jars, each of which is about two-thirds full when 200 cm3 of water is poured in

### 4 freshly cut potato sticks, each about 5 cm x 1 cm x 1 cm (students could cut these themselves, but it may be safer and quicker if these are cut by a teacher or technician)

### A cool place to leave the experiments overnight (a fridge would be ideal, but is not essential)

### ****Activity 3: Water and cell membranes****

### **Each group of students will need:**

### **4 x 10 cm lengths of Visking tubing**

### **thread to tie the ends of the Visking tubing**

### **small funnel (to make it easier to fill the Visking ‘cells’**

### **4 x 100 cm3 beakers (or similar sized glass jars)**

* **100 cm3 of about** 0.5 mol dm-3 sugar solution (17 g in 100 cm3 of solution)

### Suppliers

### **Visking tubing can be obtained from Philip Harris **(****<http://www.philipharris.co.uk/products/b8a90475_visking-tubing-30m>****)****

### Teaching Notes

**Part 1: Plant cells**

**The diagram shows interconnecting cells in a plant root. There are two types: epidermal cells and root hairs cells**

**Answers**

**1. A Cell wall, B Cell membrane, C Nucleus, D Vacuole, E Cytoplasm**

**2. A root hair cell has a protrusion which provide a greater surface area for the absorption of water.**

**3. In the cytoplasm.**

4. About 44 000 times

**Activity 2: Investigating potato sticks**

This is a simple demonstration of the uptake of water by osmosis.

Before being placed in the jars the potato sticks will be quite form and not easy to bend. Students might be asked to measure their dimensions. They could also record their masses.

The dimensions of those immersed in water overnight will have increased slightly and their mass increased also (make sure potato sticks are dabbed dry with absorbent paper being weighing them). The potato sticks will be even harder to bend than before they were out in the water overnight.

The dimensions of those immersed in salty water overnight will decreased increased slightly and their mass increased also (make sure potato sticks are dabbed dry with absorbent paper being weighing them. They bend easily.

The explanation is that when potato sticks are placed in water they take up (absorb) some of it (this is the process of osmosis - diffusion of water molecules into potato cells).

When placed in salty water, water moved from the potato cells into the surrounding salt solution. Again, osmosis is happening, but on the opposite direction.

Water moves from regions of low concentration (dilute solutions) to regions of high concentration.

**Activity 3: Water and cell membranes**

This activity uses Visking tubing to model the cell membrane in plant cells.

|  |  |
| --- | --- |
| Set-up | Observations |
| A | No observable change |
| B | ‘Cell’ swells up |
| C | ‘Cell’ shrinks and wrinkles |
| D | No observable change |

### ****Answers****

### **1. The idea is to show that water particles (molecules) move so that the concentration of sugar particles (also molecules) is the same either side of the membrane.**

### **2. Water particle diffuse through the membrane. In fact, sugar particles also diffuse, but the rate is much slower because they are significantly larger.**

### **3. Osmosis is the term used for the diffusion of water through a membrane. In osmosis, water moves from pure water (or a dilute aqueous solution) through the membrane to a solution that has a higher concentration of solute.**