

Transport in plants

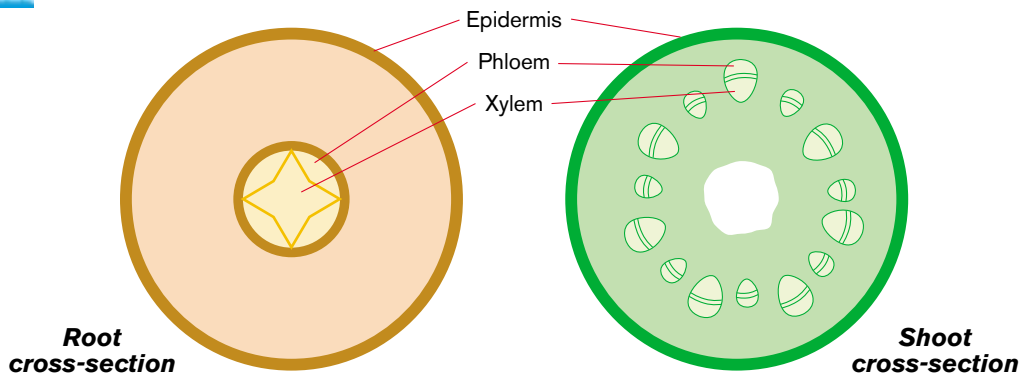


Key facts

- ◆ Water is absorbed through root hair cells by osmosis.
- ◆ Mineral salts are absorbed through root hair cells by active transport.
- ◆ Flowering plants have separate transport systems for water and nutrients.
- ◆ Xylem tissue transports water and minerals from the roots to the stem and leaves.
- ◆ Phloem tissue carries sugars from the leaves to the rest of the plant, including the growing regions and the storage organs.



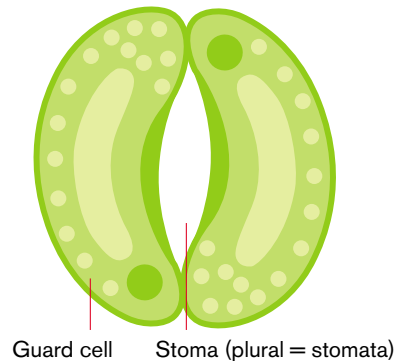
Diagrams to remember



Important ideas

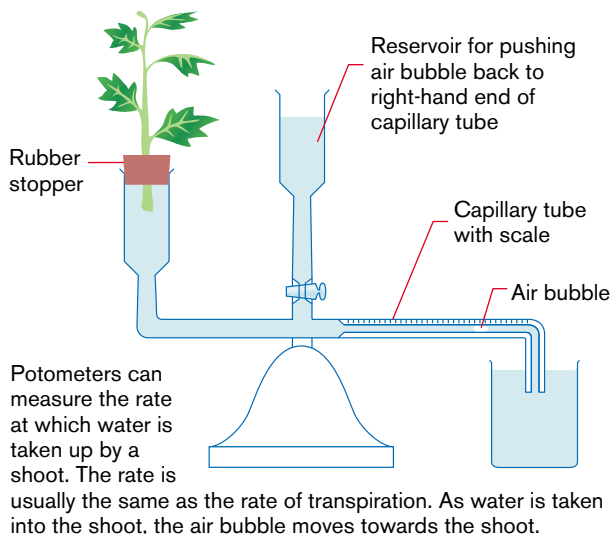
Stomata

- ◆ Plants need stomata to obtain carbon dioxide from the atmosphere.
- ◆ Because of this, transpiration occurs mainly through stomata.
- ◆ The size of the stomata is controlled by guard cells which surround them.
- ◆ If plants lose water faster than it is replaced by the roots, the stomata can be closed to prevent wilting.



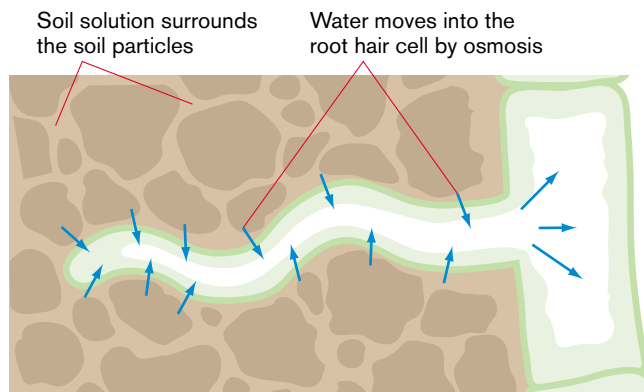
Transpiration

- ◆ The loss of water vapour from plant shoots is called transpiration.
- ◆ Transpiration is more rapid in hot, dry and windy conditions.
- ◆ Most plants have a waxy layer on their leaves which stops them losing too much water.
- ◆ Plants living in dry conditions have a thicker layer of wax.



Turgor

- ◆ The water inside plant cells gives support for young plants.
- ◆ This is the main method of support for plant leaves.
- ◆ Plants wilt if the cells are short of water.
- ◆ When water moves into plant cells by osmosis it increases the pressure inside the cell.
- ◆ This pressure is called turgor pressure. It is turgor pressure that provides support.



As water enters the root hair cell, the concentration of water in that cell becomes greater than the concentration in the next cell, so water enters the next cell by osmosis.



Beware

- ◆ Plants do *not* have stomata to allow transpiration. The function of stomata is to allow gases into the leaf, particularly carbon dioxide for photosynthesis.
- ◆ Don't confuse the functions of xylem and phloem. Compose a mnemonic for the transport of water by xylem and sugar by phloem.
- ◆ High humidity *decreases* the rate of transpiration.
- ◆ To remember the factors that affect the rate of transpiration, think of the best weather for drying clothes.

States of matter and atomic structure

Key facts

Atoms

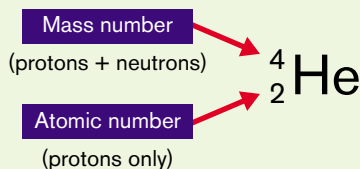
- ◆ All substances are made of **atoms**.
- ◆ There are about 100 different sorts of atoms.
- ◆ A substance that contains only one sort of atom is called an **element**.
- ◆ Atoms have a small central nucleus made up of **protons** and **neutrons** around which there are **electrons**.
- ◆ The number of electrons in an atom is equal to the number of protons in the nucleus.
- ◆ Atoms have no overall electrical charge.

Particle	Relative mass	Relative charge
Proton	1	+1
Neutron	1	0
Electron	Negligible	-1

Atomic number and mass number

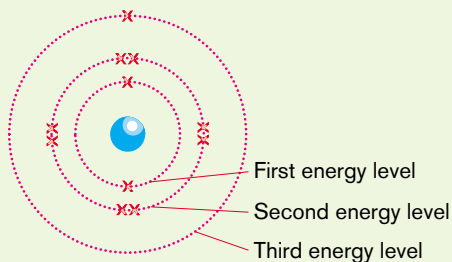
- ◆ All atoms of a particular element have the same number of protons.
- ◆ Atoms of different elements have different numbers of protons.
- ◆ The number of protons in an atom is called its **atomic number** (proton number).
- ◆ The total number of protons and neutrons in an atom is called its **mass number**.

- ◆ Atoms of the same element can have different numbers of neutrons; these atoms are called **isotopes** of that element.



Electrons

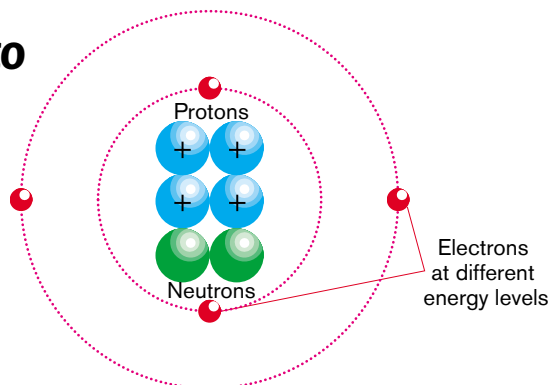
- ◆ Electrons occupy particular energy levels.
- ◆ Each electron in an atom is at a particular energy level.
- ◆ The electrons in an atom occupy the lowest available energy level.
- ◆ The arrangement of electrons in a sodium atom can be abbreviated to 2, 8, 1 which corresponds to the electrons in the first, second and third energy levels.



- ◆ You should be able to draw the above type of diagram for the first 20 elements in the periodic table.



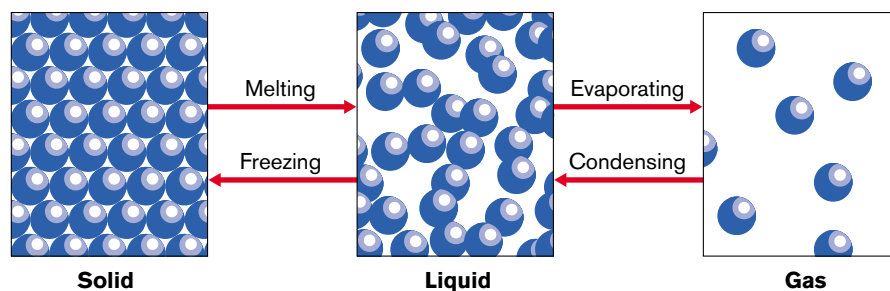
Diagram to remember



Important ideas

States of matter

- ◆ If energy is supplied to a solid, its *particles vibrate more violently*; they may separate from each other and become free to move — this is **melting**.
- ◆ The temperature at which a solid melts is called the melting point.
- ◆ Heating a liquid makes its *particles move around more quickly*.
- ◆ Particles that have enough energy may overcome attractive forces and escape from the liquid and become a gas — this is **evaporation**.
- ◆ When the temperature is higher, more particles have enough energy to escape so evaporation is faster.
- ◆ If the temperature is high enough, a liquid will **boil**.
- ◆ The temperature at which a liquid boils is called its boiling point.



Beware

- ◆ Remember the difference between atomic number and mass number. Compose a mnemonic to help you.
- ◆ Don't mix up the way in which particles move:
 - particles in solids vibrate
 - particles in liquids move around fairly slowly at room temperature
 - particles in gases move around quickly at room temperature

Using waves



Key facts

Visible spectrum

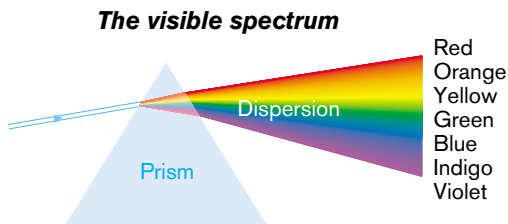
- ◆ The visible spectrum is produced on passing white light through a prism because white light is made up of many different colours.
- ◆ Different colours of light are refracted by different amounts; red is refracted least and violet light most.

Sound and ultrasound

- ◆ Sounds are produced when objects vibrate.
- ◆ The greater the size (amplitude) of vibrations, the louder the sound.
- ◆ The higher the frequency of a sound, the higher its pitch.
- ◆ Ultrasonic waves have a frequency higher than the upper limit of the hearing range for humans.



Diagrams to remember



Highest frequency

Shortest wavelength



The electromagnetic spectrum



Important ideas

Effects of electromagnetic radiation on living tissues

- ◆ Microwaves are absorbed by the water in cells, which might be damaged or killed by the heat released.
- ◆ Infrared radiation is absorbed by skin and is felt as heat.
- ◆ Ultraviolet radiation can pass through skin to deeper tissues.
- ◆ X-radiation and gamma radiation mostly pass through soft tissues, but some can be absorbed by the cells.
- ◆ High doses of ultraviolet radiation, X-radiation and gamma radiation can kill normal cells.
- ◆ Lower doses of these types of ionising radiation can cause normal cells to become cancerous.

Uses of electromagnetic waves

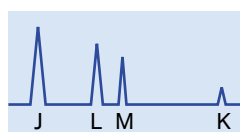
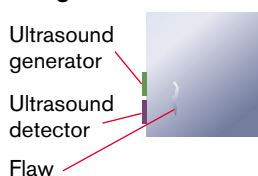
Type of radiation Uses

Radio waves	<ul style="list-style-type: none"> to transmit radio and TV programmes between different points on the Earth's surface
Microwaves	<ul style="list-style-type: none"> to send information to and from satellites for cooking, since these wavelengths are strongly absorbed by water molecules
Infrared	<ul style="list-style-type: none"> in grills, toasters and radiant heaters in optical fibre communication for the remote control of TV sets and VCRs
Visible light	<ul style="list-style-type: none"> illumination
Ultraviolet	<ul style="list-style-type: none"> in sun beds in fluorescent lamps and security coding
X-rays	<ul style="list-style-type: none"> to produce shadow pictures of materials that X-rays do not easily pass through, including bones and metals
Gamma rays	<ul style="list-style-type: none"> to kill harmful bacteria in food to sterilise surgical instruments to kill cancer cells

Ultrasound

- ◆ Ultrasound is used for scanning internal structures in medicine and industry.
- ◆ The ultrasonic waves are partly reflected when they meet a boundary between two different media.
- ◆ The time taken for the reflections of ultrasonic pulses to reach a detector (usually placed near to the source) is a measure of how far away such a boundary is.
- ◆ Ultrasonic waves can clean delicate mechanisms without having to disassemble them — the pulses dislodge dust particles.

Using ultrasound to detect flaws in a metal block



A pulse is sent from the generator through the block. The oscilloscope trace shows the time at which ultrasound reaches the detector.

- J = ultrasound going straight from generator to detector
- L = ultrasound reflected from left side of flaw
- M = ultrasound reflected from right side of flaw
- K = ultrasound reflected from right side of block



Beware

- ◆ Don't confuse wavelength and frequency of these different electromagnetic waves — the longer the wavelength, the lower the frequency.