9 How Trees Grow

KEYWORDS

chlorophyll
germinate
heartwood
photosynthesis
plumule
radicle
sap
sapling
sapwood

Both broadleaves and evergreens start life as a seed on the ground and they go through a life cycle like all plants. Different trees will grow and mature more slowly and some trees will live for centuries before they eventually die. Many trees grow to a great size; some redwood trees in the United States of America have archways through their trunks large enough to drive a car through.

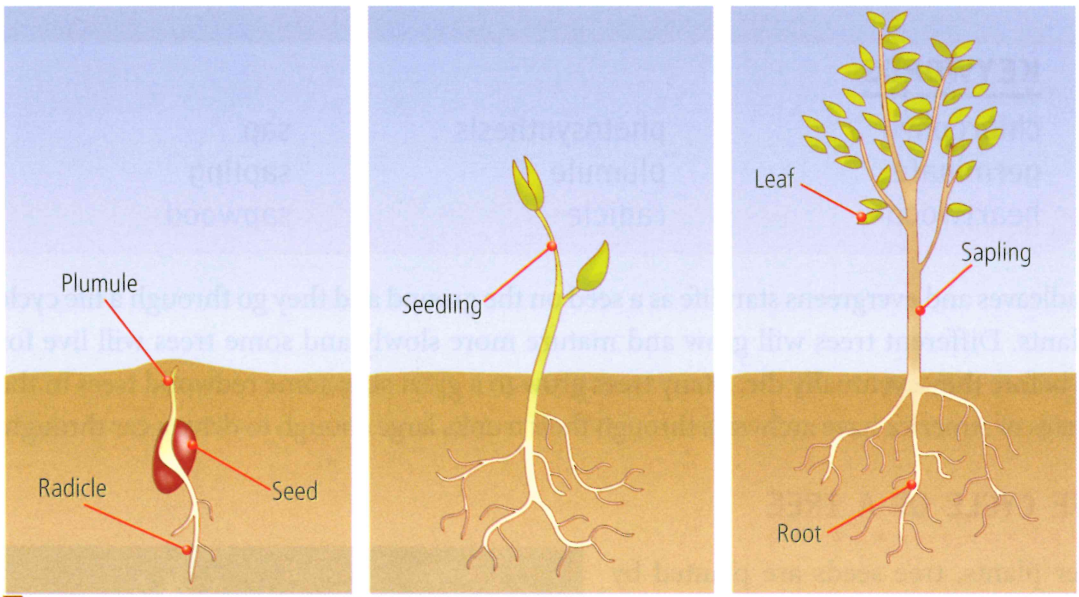
THE LIFE CYCLE OF A TREE

Like other plants, tree seeds are planted by many means. Some seeds simply drop from the tree to the ground, while the wind, animals and birds carry others. Seeds can be planted in pots or trays in a nursery. After a time the seed **germinates** and the shoot (plumule) that will form the stem makes its way to the heat of the earth's surface.

A car driving through a redwood tree

Stages of growth of the young tree

- The seed germinates with warmth
- The **plumule**, or shoot, begins to grow to the surface
- The **radicle**, or root, grows down into the soil
- The **seedling** gradually develops roots and leaves
- The seedling grows into a **sapling** as the tree begins to get strength



The stages in the growth of a tree

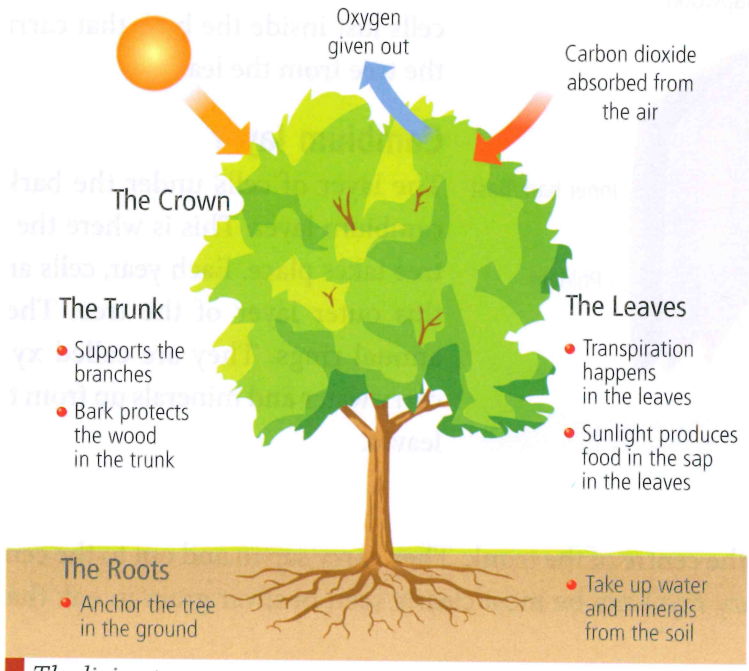
The young tree

As the young tree grows, leaves begin to use the energy from the sun to change sap into foo does this using a substance in the leaves called **chlorophyll**. This process is ca **photosynthesis**.

The roots anchor the tree to the ground. They also take up water and nutrients from the The outer layer of cells in the trunk acts like a pipeline to carry the sap from the roots tc leaves.

The upward movement of sap is made possible by the evaporation of moisture from the le (**transpiration**), which draws moisture up from the roots. The process is aided by capil **action**, which makes liquids stick to the sides of the thin walled cells.

Food is produced in the leaves by photosynthesis using the energy from the sun. This travels down from the leaves to feed the tree.



The living tree

THE PARTS OF THE TREE

Bark

The tough fibres of the bark protect the tree like a skin. The bark protects the tree from damage by the weather, animals, insects and fungi. It also helps to keep moisture in the tree.

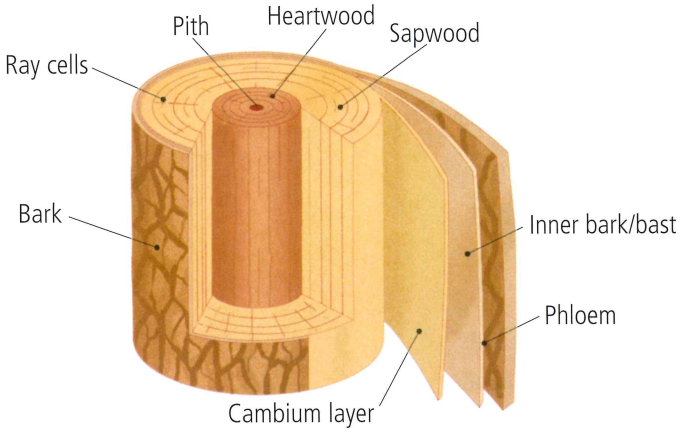
Sapwood

As the tree grows, layers of cells are added to the **sapwood**. The sapwood is the lighter-coloured wood in the trunk. Cells in the sapwood carry nutrients up and down the tree. Sapwood is the softer wood in the tree and it is less durable.

Heartwood

The **heartwood** is found in the centre of the tree and it is usually darker in colour than the outer layers. The heartwood gives the tree support and is the oldest wood of the tree. The wood from it is more durable and it is resistant to fungal and insect attacks.

Heartwood and sapwood softwood log



Parts of the trunk

Bast (phloem)

Bast is the inner layer of the bark. It is a laye cells just inside the bark that carries food dc the tree from the leaves.

Cambium layer

The layer of cells under the bark is called cambium layer. This is where the growth of tree takes place. Each year, cells are added o this outer layer of the tree. These cells fc annual rings. They are called **xylem cells** carry water and minerals up from the roots to leaves.

Ray cells

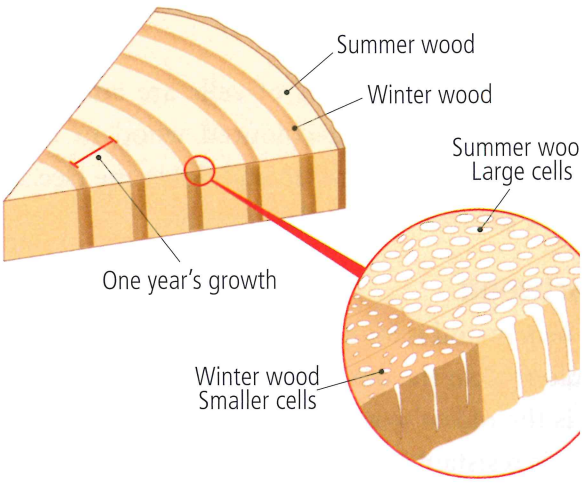
Ray cells radiate from the centre of the trunk. They carry sap in and out to the centre of the t The ray cells (medullary rays) can be most clearly seen in silver grain in oak that has been radially.

Pith

The pith is the centre of the trunk and is the remains of the young tree.

Annual rings

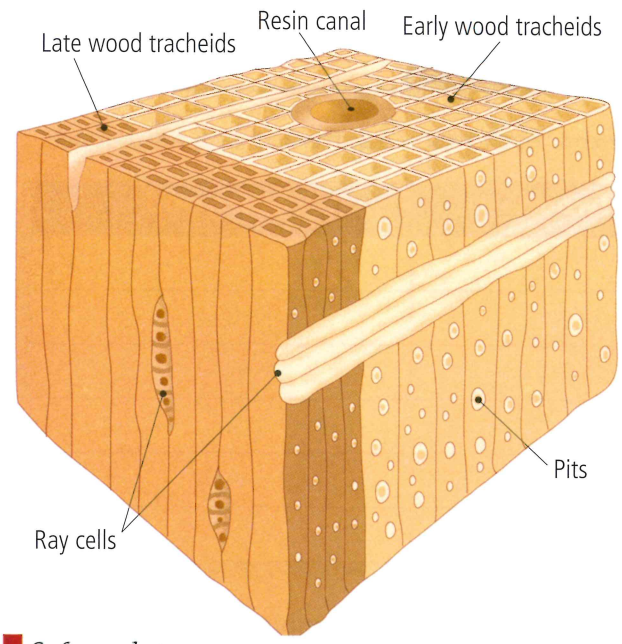
Trees in Ireland grow with the seasons because of Ireland's temperate climate. Each year a ring is added; during spring and summer the growth is rapid and the cells are wider than those during the winter season, which are smaller and more compact. The annual rings allow us to tell the age of the tree.



Annual rings

WOOD STRUCTURE

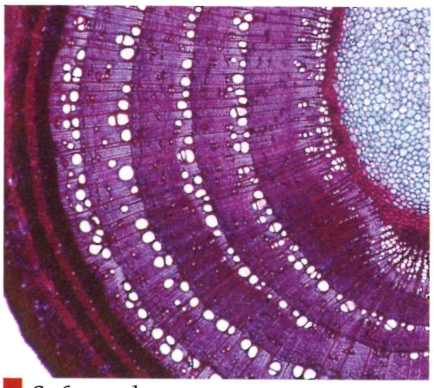
All wood is made up of cells like tubes, which are stuck together to form the structure of the tree. Softwoods have a slightly different structure to hardwoods.



Softwood structure

Softwoods

Softwood timber is made up mainly of cells called **tracheids** (which store food) with larger resin ducts and ray cells radiating out from the centre.

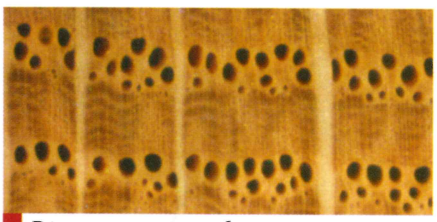


Softwood

Hardwoods

Hardwood timber is made up mainly of cells called fibres and vessels, or pores, which transport water and minerals. There are also ray cells that radiate out from the centre of the tree. These woods are grouped into two different categories.

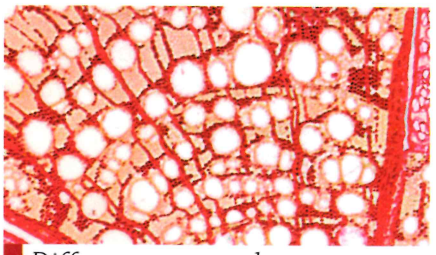
1 Ring porous woods: When the pores or vessels are grouped together into distinct rings.



Ring porous wood

2 Diffuse porous woods: When the pores or vessels are spread throughout the growth.

Hardwood



Diffuse porous wood

Exercises

1 Below is a list of native trees. Indicate whether each tree is a softwood or a hardwood.

Tree	Hardwood	Softwood
Ash		
Sitka spruce		
Larch		
Beech		
Oak		
Sycamore		

2 Describe the following: (a) chlorophyll, (b) photosynthesis, (c) transpiration.

3 Explain the function of the bark of a tree.

Exam Questions

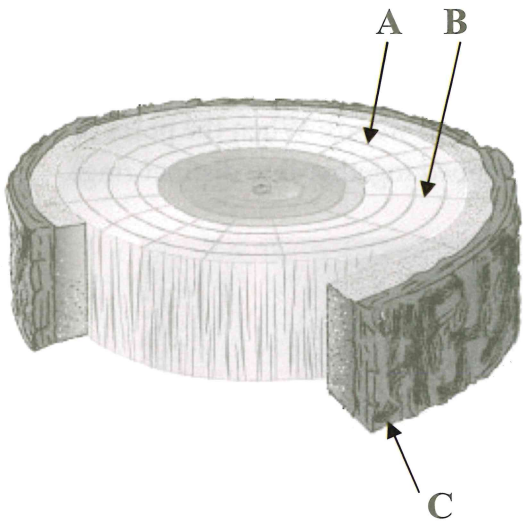
1 The diagram shows a cross section through the trunk of a tree.

(a) Name the parts of the cross section labelled A, B and C.

(b) In the diagram, the heartwood and sapwood areas are clearly shown. State two differences between the areas.

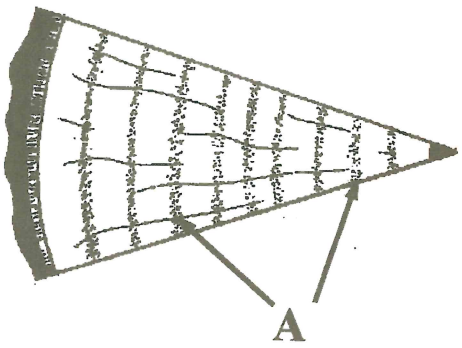
(c) Food generated through photosynthesis is transported through the tree trunk. Describe, using notes and neat freehand sketches, the process of photosynthesis.

(JC, HL, 2007)

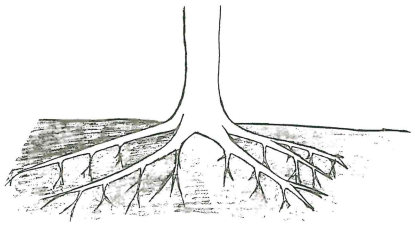


Exam Questions

2 A new annual ring is added to a tree each year. During what season of the year, spring or autumn, is the darkest part shown at A, of each ring added?
(JC, OL, 2002)



3 Name one function of the roots of a tree.
(JC, OL, 2007)



Web Links

www.100mile.com/bcforests/forestry/rings/index.html
http://forestry.about.com/od/dendrochronology/ss/tree_age.htm
www.geoffswoodwork.co.uk/timber%20growth.htm
www.idahoforests.org/blueprint.htm?OpenScript=12858
www.woodmagic.vt.edu/kids/
www.arborday.org/kids/carly/treevialpursuit/treevial_pursuit.cfm
www.arborday.org/
www.discoverscience.rutgers.edu/extras/trees/treephotos.html
www.oplin.org/tree/
www.british-trees.com/
www.nativewoodlandtrust.ie/
www.crann.ie/
www.woodlandsofireland.com/