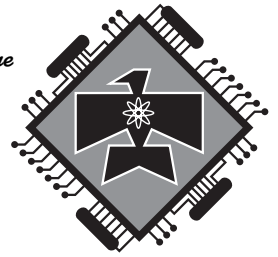




WOOD

Worksheet 13

A worksheet produced by the Native Access to Engineering Programme



What is wood?

According to the on line Merriam Webster Dictionary, wood is

- a: the hard fibrous substance ... that makes up the greater part of the stems, branches, and roots of trees or shrubs beneath the bark ...*
- b: wood suitable or prepared for some use*



Trees as a resource



For what purposes have your people traditionally used wood?

In the temperate regions of Turtle Island, trees are one of the Creator's greatest gifts. Trees plant their roots in Mother Earth. They provide shelter, medicine and food not only for humans but also for other plants and other animals. In the great forest stands of the west and central east, entire ecosystems and industries are supported by trees such as Sitka Spruce, Sugar Maple and Red Cedar. Trees and forests have been an incredibly valuable resource throughout history, primarily because of the many uses of wood. Wood can be used as an energy source and as a building material for an almost countless number of objects. It can also be used to make clothing, household goods and paper. Aboriginal peoples have used wood for all of these purposes.

If you come from a region with no trees, can you think of anything your people have used as a substitute for wood?



A clear cut area in a BC forest.

Over harvesting of trees has been a problem for thousands of years. In areas of Europe and the Middle East huge areas of forest were wiped out through the need to clear land for farming and over demand of wood based products. More recently, deforestation has been a huge issue in the rain forests of the Amazon basin. These forests have been burned to clear land for ranching and other farm practices. The Amazon burnings have drawn world wide attention and calls for action to protect the rain forests.

Do you know why?

While there are many examples of how trees and forests have been exploited poorly, they are actually a renewable resource which require proper and careful management.

*What is the difference between renewable and non-renewable resources?
Can you provide some examples of each?*

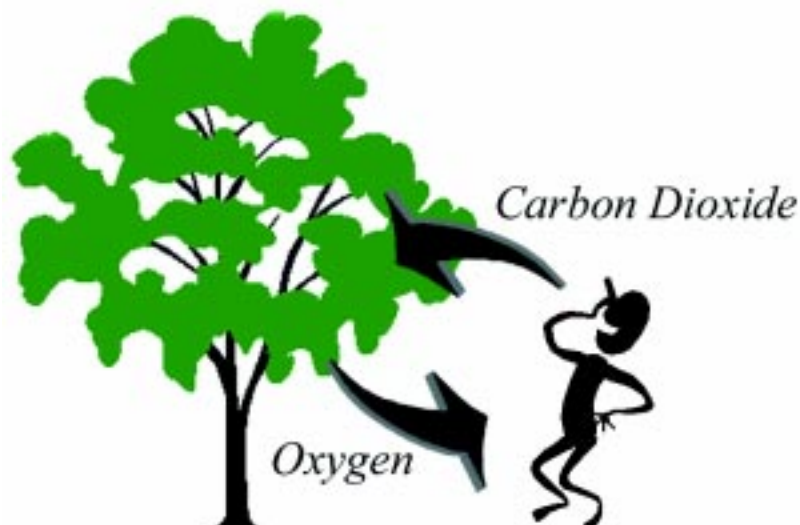


Respiration

While trees and animals are very different, they share some similarities in biology.

Because trees are living they breathe, but unlike humans and animals which take in oxygen and give off carbon dioxide, trees take in carbon dioxide and give off oxygen.

Why would the respiration of oxygen by trees and plants be important?



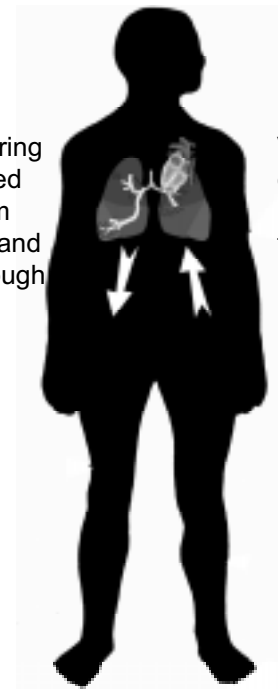
Vascular System

Trees, like people, also have a vascular system. In people a vascular system consists of the veins and arteries which allow blood to flow through our bodies. Blood delivers the nutrients and oxygen that our organs need to survive.

What do you think a tree's vascular system does?

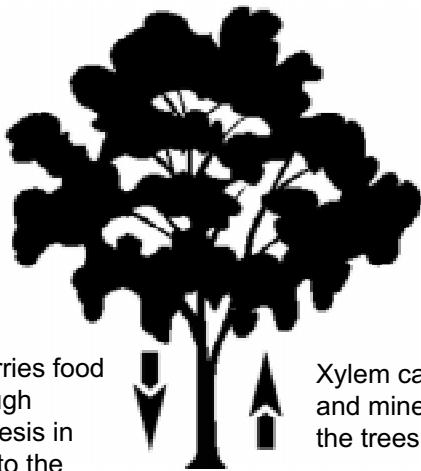
Arteries bring oxygenated blood from the heart and lungs through the body.

Veins return carbon dioxide laden blood to the lungs and heart.



A tree's vascular system also allows nutrients to flow throughout its body. The liquid, which is primarily water and dissolved minerals, is called sap.

*Later winter / early spring sap was and is very important to many of the nations in the east.
Do you know why?*



Phloem carries food made through photosynthesis in the leaves to the rest of the tree.

Xylem carries water and minerals up from the trees roots.

A tree's vascular system is made up of two types of vessels, one called phloem, the other called xylem. You may have learned about these in biology class.

It is the xylem which makes up most of the wood in a tree.

Plant Cells: Composite Materials

One of the places where animals and plants differ is in the construction of their cells. Unlike animal cells, plant cells are contained within a fairly rigid structure called the cell wall. The cell wall is very important because it helps plant cells to keep their shape. It consists of a combination of proteins and cellulose.

Cellulose is a polysaccharide, which literally translated means *many sugars*. Each polysaccharide is made up of a long chain of 3000 or more interconnected glucose molecules.

Where else have you heard about glucose?



Plant cell walls are rigid and strong...

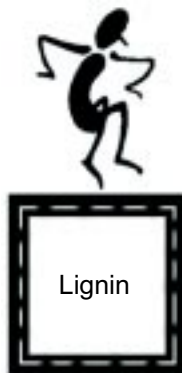


...animal cells are not.

The combination of cellulose and proteins is very strong. Together they create what engineers would call a composite material. A composite material is formed when two or more materials combine to produce something new which has improved properties (thermal, physical, chemical etc.). A composite material has two components, the fibres and the matrix. The fibres provide stiffness and strength while the matrix holds them together.

*In a cell wall, what is the fibre and what is the matrix?
Can you name any other composite materials?*

Secondary Cell Walls: Lignin



The secondary wall makes the cell even more rigid and strong.

All plant cells have cell walls. As the plant matures, the cell walls thicken and provide more support. In woody plants like trees, some of the cells – specifically those that make up the xylem – develop a secondary cell wall at maturity.

What do you suppose the effect of the secondary cell wall is?

Xylem consists of a number of different types of cells, each of which has a different role in helping it move liquid through the tree. Within the xylem, the sclerenchyma, tracheids and vessel elements contain a substance called lignin in their secondary cell walls. Lignin is an organic substance which makes cell walls very, very rigid and strong.

Properties of wood

About two thousand years ago, a tribe of Ojibway Indians lived on the shore of Thunder Bay in the vicinity of Sibley Peninsula and had for their Chief a very wise and much traveled man, of great birth. Golden Eagle, for that was the chieftain's name, at the time of this story, had reached the age of ninety years and was very close to death. Calling his son to his bedside, the old man took a deerskin bag from under the furs and, placing the bag in his son's hands, softly spoke this message: "Ti-Baki- Enane, my days are few. In this bag you will find many seeds that I have brought from a great distance. Take good care of them and, whenever a new child is born to my people, plant a seed in good earth for it. Soon, great trees will grow from the seeds and my people will build their homes from the wood. They will also build great ships and they will prosper."

Excerpt from *Legend of the Great White Pine*
www.schoolnet.ca/autochtone/kenora/pine-e.html

It is the properties (and availability) of wood which have made it so useful to people throughout the world for thousands of years. As you probably know from your own experience, wood can vary quite a lot depending on the type of tree from which it comes. Wood from maple trees has different uses than wood from cedars.



*Maple and cedar are examples of two different types of tree.
Do you know what these types are?
What do you already know about the properties of wood?*



In general, wood is relatively strong and light weight.

*Think of ways in which your ancestors used wood.
Why are strength and light-weight a good combination?*

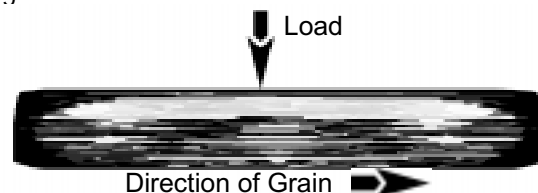
If you've ever looked at a piece of wood closely you'll see that it has a grain or texture from its fibres. The strength of wood is different depending on the orientation between the grain and the direction of loading.

In tension (or pulling) wood is about 50 times stronger when...

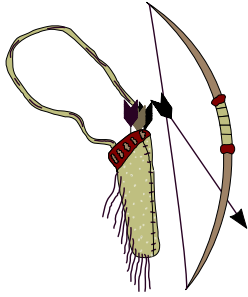
... a load is applied parallel to the grain ...



... than it is when the load is applied perpendicular to the grain.



Wood is also about 15 times stronger in tension than it is in compression which means it can withstand more force when it is being pulled than when it is being pushed.



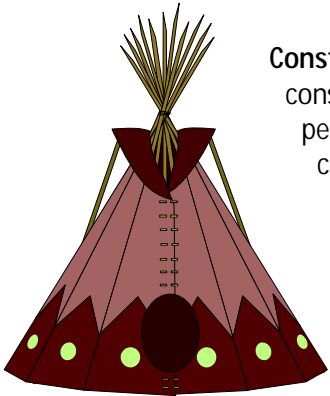
Since you know wood is stronger in tension than in compression, which way is a wooden bow most likely to break?

Can you think of anything which might decrease the strength of wood?

Depending on the type of wood, it can also be more or less decay resistant and impact resistant. Wood is a good insulator, both thermally and electrically. Wood also has desirable acoustic properties.

What applications would each of these properties have?

Uses of wood



Construction: It's strength, light weight and insulation properties make wood a highly desirable construction material. Canadian designed wood-frame homes are built all over the world. Aboriginal peoples traditionally used wood and other resources from trees to build housing. On the west coast, the Haida, Bella Coola, Salish and others used huge native Cedar to construct dwellings. Further east, the Iroquois Nations built longhouses from flexible saplings and elm bark. Wood was also used by the peoples of the Plains as the structural supports for buffalo skin tipis.

*Did your ancestors use wood for housing?
What kind of materials are used for housing in your community now?*

Transportation: Wood is also used extensively in transportation. Even today, much of the interior detailing in a Rolls Royce is made from highly polished wood veneer. Wood is and has been used in transportation, for the same reasons it is used in construction – it is lightweight, strong, attractive and relatively easy to acquire. The Cree make toboggans from tamarack or birch trees, soaking and working the wood so that it curves at the front end. Birch (as well as other types of wood) has also been used by Native peoples in different areas of the country to make canoes. Willow is one of the woods used throughout Turtle Island to construct baby carriers such as cradleboards.

What property of wood makes it a natural choice for boats?



Tool-making: Wood is used extensively in tools. Go to a hardware store, construction site or shop class and many of the tools you see will have wooden handles. Traditionally tools such as knives, spoons, spears and arrows have been made in whole or in part from wood.

Why would you want a handle on a knife? How about a shaft on an arrow?



Instruments: The acoustical properties of wood were harnessed by indigenous peoples all over the world for instruments used in ceremonies, long-distance communication and music making. Drums, rattles and flutes are some of the instruments made by Aboriginal peoples on Turtle Island.

What other instruments are made from wood?

The acoustic properties of wood depend on its density, strength and elasticity. Aboriginal people used wood from the trees such as the red willow, cedar and maple for making instruments.

Sports equipment: Hockey, baseball, tennis and cricket are all sports which use equipment made from wood.

What property of wood would you want for a cricket or baseball bat?

Aboriginal people have also used wood for sporting equipment and games. The handle and basket supports for lacrosse sticks are fashioned from wood, as is the spear used in the game of snow snake.

Other uses: There are many other uses of wood - both traditional and non-traditional. Think about how many ways wood is used in your community and how different your life, and that of your ancestors, would have been without it.



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Math Problems

1. Rain forest covers about 2% of the Earth, or 6% of its land mass. Rain forests are being destroyed at an alarming rate in a number of areas.

- a) The Amazon rain forest in Brazil is home to a number of indigenous peoples, including the Macuxi and Yanomami, who have lived there for many thousands of years. Their home is disappearing as wood is harvested for timber or burnt to clear land for farming, ranching, roads and hydro electric projects.

It is estimated the Brazilian rain forest originally covered 2,860,000 km². If it now covers 1,800,000 km², how much has been destroyed? What percentage had been destroyed?

- b) On the west coast of Vancouver Island the trees of Pacific Rim National Park are part of temperate rain forest. This tract of land and trees is home to a number of First Nations peoples, including the Tla-o-qui-aht and Ucluelet. Like the indigenous peoples of Brazil, these First Nations have been fighting to protect the forest, primarily from commercial harvesting.

If 66 acres of BC rain forest is cut down every second, how many square meters are cut in an hour?
2,471 acres = 10,000m²



2. Your community is practicing sustainable forestry and processing the wood you harvest at a newly opened saw mill. The saw mill's first big contract is to produce cut timber beams for the construction of log cabins in a tourist fishing camp also being run by people in your community.

The logs you receive at the mill are cut to 4m lengths in the bush. The contractor who is building the cabins needs square timber beams which measure 15cm x 15 cm x 4m. If the picture shows a cross section of the cut you use, what portion of each log will be sent to the wood chipper?

