Unit 10
Living Technologies

Overview

Today, when we think of technology we probably think of the vast array of electrical, electronic and digital technologies that surround us. In BC there are a number of First Nations organizations and Indigenous-run businesses, such as the First Nations Technology Council, that work to ensure that modern technologies are available equitably to First Nations.

However, this unit looks at ancient technologies that were essential for living over millennia and which are in many cases still alive today.

At its core, technology is the application of scientific knowledge and principles to design tools and processes that sustain and enhance life. Over thousands of years, First Peoples have used their scientific knowledge to develop myriad sophisticated technologies based on the plant, animal and mineral resources available to them both locally and through trade.

Naturally, the diversity of the province's First Peoples, and the topography, climate and ecosystems of their lands, means that a great diversity of technologies developed using available materials.

The activities in this unit encourage students to explore some of these technologies, and discover the scientific principles and knowledge that First Peoples applied when developing and using them.

Guiding Questions

- How have First Peoples applied scientific knowledge to design?
- How have First Peoples applied their knowledge of the land to design technologies that ensure a sustainable lifestyle?
- How have First People used their understanding of sound to create musical instruments?

Relevant BC Learning Standards for Senior Secondary Science

Course	Key Content Standards	Key Curricular Competencies
Science 10	• Practical applications and implications of chemical processes, including First Peoples knowledge • Potential and kinetic energy • Transformation of energy	Questioning and predicting: • Make observation aimed at identifying their own questions, including increasingly abstract ones, about the natural world. Planning and conducting: • Collaboratively and individually plan, select and use appropriate investigation methods, including field work and lab experiments, to collect reliable data. Processing and analyzing data and information: • Experience and interpret the local environment • Apply First Peoples perspectives and knowledge, other ways of knowing and local knowledge as sources of information • Use knowledge of scientific concepts to draw conclusions that are consistent with evidence Evaluating • Consider social, ethical, and environmental implications of the findings from their own and others' investigations Applying and innovating • Contribute to finding solutions to problems at a local and/or global level through inquiry Communicating: • Express and reflect on a variety of experiences, perspectives, and worldviews thorough place.
Chemistry 11	• Organic compounds • Applicatins of organic chemistry • Local and other chemical processes	
Physics 11	• Simple machines and mechanical advantage • Applications of simple machines by First Peoples • Characteristics of sound: pitch, volume, frequency, harmonics and beat • Resonance and frequency of sound	
Physics 12	• First Peoples knowledge and applications of forces in traditional technologies	

Cross-curricular Connections

Applied Design, Skills and Technologies 10

Key Curricular Competency: Evaluate the influences of land, natural resources, and culture on the development and use of tools and technologies

Culinary Arts 10; Food Studies 10

- First Peoples food protocols, including land stewardship, harvesting/gathering, food preparation and/or preservation, ways of celebrating, and cultural ownership

Textiles 10

- First Peoples traditional and current textile knowledge and practice

Woodwork 10

- Importance of woodwork in historical and current cultural contexts of First Nations, Métis, or Inuit communities, and other cultural contexts

BC First Peoples 12

- Impact of historical exchanges of ideas, practices, and materials among local B.C. First Peoples and with non-indigenous peoples

Resources

For further information on these resources, see the annotations in the Bibliography, beginning on page 273.

Suggested Resources

- Models and replicas of traditional First Peoples technologies. Check with your District Aboriginal Education department.
- Amaron, Beryl. *More Than Useable Tools: Towards an Appreciation of Nłeʔkepmx Fibre Technology as a Significant Expression of Culture*. UNBC Masters Thesis 2000. https://core.ac.uk/download/pdf/84873663.pdf
- Peacock, Sandra L. "From Complex to Simple: Balsamroot, Inulin, and the Chemistry of Traditional Interior Salish Pit-Cooking Technology." *Botany* v. 86, 2008. Pp 116-208. Online at https://bit.ly/2WtySyP
- *How to Make a Traditional Coast Salish Drum: Jorge Lewis Drum Maker*. Phil Ives, 2012. 20:58 min. https://youtu.be/3uzmBCZUx0w

Additional Resources

- Nisga'a Nation. *From Time Before Memory*. SD 92 (Nisga'a), 1996.
- Olsen, Sylvia. *Working With Wool*. Sono Nis, 2010.
- Stewart, Hilary. *Indian Fishing*. Douglas & McIntyre, 1977. Reprinted 2018, Quadra Recreation Society.

- Stewart, Hilary. *Stone, Bone, Antler and Shell. Artifacts of the Northwest Coast*. Douglas & McIntyre, 1996.
- Stewart, Hilary. *Cedar: Tree of Life to the Northwest Coast Indians*. Douglas & McIntyre, 1984.
- Tepper, Leslie H. *Earth Line and Morning Star. Nlaka'pamux Clothing Traditions*. Canadian Museum of Civilization, 1994.
- Turner, Nancy J. *Plant Technology of First Peoples in British Columbia*. Royal British Columbia Museum Handbook series. UBC Press, 1998.
- Turner, Nancy J., Marianne Boelscher Ignace, and Ronald Ignace. "Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia." *Ecological Applications* 10.5 (2000): 1275-287. Available online at http://bit.ly/2cVwEOM

Blackline Masters

10-1 Traditional Technologies for Living
10-2 Frequency of Sounds Lab
10-3 First Peoples Technologies for Living
10-4 Digging Stick Technology
10-5 Pit Cooking Balsamroot

Outline of Activities

10.1 First Peoples Technologies: An Introduction
10.2 The Sounds of Drums
10.3 The Physics of Living Technologies
10.4 The Chemistry of Balsamroot
10.5 Topics for Inquiry

Suggested Activities

Note: There are more activities here than most teachers will incorporate into their units. It is not expected that you will use all of the activities, or follow the sequence as it is described. These activities are intended to be adapted to fit the needs of your students and classroom, as well as inspire ways that you can respectfully include relevant Indigenous knowledge and perspectives in your course.

Activity 10.1
First Peoples Technologies: An Introduction

a. Begin the unit by showing or demonstrating a unique technology that is or has been used by First Peoples in your region. Pose questions that asks students to think about how First Peoples understood and applied scientific ideas to this technology.
   - Where possible, choose an example of technology that will grab students' interest. Ideally they will be able to experience the technology through a real life example or model. This may involve a field trip to a cultural centre, museum or other locale. If that is not possible, have pictures and diagrams to illustrate the technology.
   - Technologies could include one of the following:
     - Traditional drum (How would you know what materials to use to get a good sound?)
     - Monumental pole/totem pole (In the past, how was the tree felled and transported? How was the pole raised?)
     - Longhouse or big house (How did people make planks in the past? How did they raise the house posts?)
     - Pit house (How were they designed for stability (not collapse)? How did their design include thermal properties to keep them livable through the winter?)
     - Spindle whorl (What principals of physics are used?)
     - Bow and arrow (What are the best materials to use? How do you make sure it shoots accurately?)
     - Animal traps (How are physics and animal behaviour understood and applied?)
     - Tasting food that has been processed using traditional methods, such as oolichan grease, pemmican, dried salmon, dried berry cakes (What processes were used to preserve the food?)
     - Canoes (Why were certain materials used? How was the canoe designed for its purpose?)

- clothing and footwear made of tanned hides (How do you make an animal skin soft and waterproof?)
- basketry (How do you know what plants to use? How do you prepare the plants for weaving into baskets so they won't break?)

- After students have had a chance to experience or observe the example of First Peoples technology, discuss what students know or can infer from it. The questions you ask will depend on what the technology is, but here are some samples:
  - What problem or need was it designed for?
  - How essential was it to the lives of the people who used it?
  - How did it make use of locally available resources?
  - How did it contribute to sustainability or food security?
  - What traditional ecological knowledge is necessary to make and use it?
  - What scientific principles are used in technology?
  - How does it use simple machines?

b. You may want to use Blackline Master 10-1, page 266, *Traditional Technologies*, to help introduce the topic of First Peoples Technologies.


Blackline Master 10-1, page 266, *Traditional Technologies*

- Ask students to suggest or predict what each of the technologies are, and what they were used for in the past.
- The items shown are: 1. fire drill 2. digging stick 3. adze 4. tweezers 5. spindle whorl 6. arrow or spear head 7. pole, poling canoe (or canoe)
- Use some of the questions in part a. above to discuss these technologies.

Activity 10.2
The Sounds of Drums

Students investigate First People's understandings of the properties of sound through an exploration of the construction of drums and other instruments such as rattles.

a. Sounds of the Land


Land-based activity

Sound Walk

This activity gets students outside and into their local environment. It allows them to relate place to learning. It helps students to understand how important land is to First Peoples and that understanding and land go together.

- Take students on a Sound Walk in one or more areas around the school to observe the sounds they hear. Ideally you will pass through an urban or developed area and a field or forest so students can experience different soundscapes.
- If it it isn't possible to go on a walk, ask students to reflect on sounds they hear around their home, on their way to school, or other notable soundscaspes they may have experienced.
- Using the video *Sounds of BC* (https://youtu.be/k0aErt4UPXQ) have

students listen to a variety of natural sounds from around BC. You can have them just listen to the sounds first to see how many they can identify.

- Ask students to share a sound from nature that is meaningful to them. If possible, students could create a sound recording or a short video demonstrating the sound and explaining why it is meaningful to them.
  - For an example see the short video Meaningful Sound, https://youtu.be/Fzz5P4U2DWw
  - Give students an opportunity to share their sounds with the class or other students.
  - Have students reflect on the sound they chose and what it means to them.

b. Drum: Heartbeats of Culture. Give students an opportunity to learn about the importance of drums to the local First Nations community, and to other Indigenous and non-Indigenous cultures.

Cross-Curricular Link
In Social Studies courses, student can connect the importance of First Peoples' cultural revival through drumming, storytelling, and singing.

- If possible, invite an Indigenous drummer to demonstrate and discuss the importance of drumming.
  - Students can prepare questions to ask, such as how drumming is used in the guest's culture, the materials used to make it, how they are made, how long a drum lasts, etc.
- Work with students to find out what types of drums have been traditionally used in your region. Most First Peoples make variations on the traditional form of a hide stretched over a wooden ring, but some use other shapes, and some use large box drums or planks.
  - Students can find images of different types of drums in Hilary Stewart's book *Cedar*. They can use the index to find references to drums.
  - Investigate how they are similar and different from drums in other parts of the province, country, or around the world.
  - If possible learn the word for drum and associated vocabulary such as drum stick or beater in the local First Nations language.
- Discuss what materials are used in these different drums. Ask, Why do you think these materials are chosen?

c. Ask students to identify the skills and scientific understandings that are required to build and use traditional drums.

- Students can view a video of contemporary drum maker Jorge Lewis of the Snuneymuxw (Nanaimo) First Nation demonstrating how to make a traditional drum.
  - See *How to Make a Traditional Coast Salish Drum: Jorge Lewis Drum Maker*. Phil Ives, 2012. 20:58 min. https://youtu.be/3uzmBCZUx0w
  - Discuss with students the ideas that Lewis explains about the personal energy that goes into the drum, starting about the 12:55 minute mark. For example, if you get impatient, those feelings go into the drum. He explains that the materials of the drum were once living beings animals

Video
How to Make a Traditional Coast Salish Drum: Jorge Lewis Drum Maker.

and trees, and as living entities, they have the ability to absorb personal energies.
    - Discuss how Lewis combines traditional and contemporary technologies to make the drum. For some of the modern tools used, students can suggest what types of tools might have been used in the past. (For example, the plastic bucket for soaking could have been a stream or lake, or a water-tight basket or box. Instead of the steel hammer and punch, drum makers may have used an awl or stone hammer and punch.)
    - Have students identify some of the skills that were significant for making the drum. (For example, the way the hide is soaked, the thickness of the hide used for the drum, which side of the hide is used for the drum, how to make the lace, how and where to punch the holes, how to string the lace; how to tighten the drum.)
    - Relate these skills to the scientific understandings required to successfully produce a drum. (For example, understanding how the hide will behave to make the best sound; how the stringing of the lace affects the tension of the drum head; how to treat the hide so it doesn't break or fall apart with use.)

Unit Links
See Unit 9, Hunting and Trapping for activities about tanning hides.

- Students can research the skills and knowledge required to gather and prepare the materials used to make a drum.
- Have students illustrate the steps involved in making and using drums, and indicate the types of skills and scientific knowledge required.

d. Making Sound Visible. Students can conduct a lab activity that demonstrates sound waves. Students build a model membrane covered in salt or sugar and use a bluetooth speaker to make the membrane vibrate.

Lab Activity

- There are a number of examples of this lab activity on the internet. One can be found at the Scientific American website. See "Making Sound Waves," https://bit.ly/2VOEXGy
- After conducting the activity, ask students to explain what was happening.
- Have students reflect on their understanding.

e. Sound variations. Pose the questions: How does one musical instrument make different sounds? What needs to change in order for the sound to be different?

- Students can work in groups to discuss different variables that would affect how a drum sounds. These include:
    - Size: Different size of drum makes different sounds. Have students predict which size drum would have the deepest pitch, or highest pitch and why.
    - Materials: Different hides make different sounds. Have student predict which hide would make the deepest, highest sounds and why.
    - Striking location. Where the drumstick meets drum makes different sounds

    - Striking pressure. The strength of the drumstick on the drum makes different volumes
    - Drumstick or beater construction. What materials is it made from? What shape is it?
  - Students can compare one or more drums to observe how these variables are demonstrated in each drum.
  - Students can design an activity to test some of these variables, if the materials are available.

f. Frequency of sound. Students measure the frequency of sound produced by different drums and different materials.


Lab Activity


Blackline Master 10-2, page 267, *Frequency of Sounds Lab*

  - Students can follow the directions for the lab using Blackline Master 10-2, page 267, *Frequency of Sounds Lab*.
  - Use the Lab4U Physics app to get frequency vs intensity and amplitude vs time graphs for each drum.
    - How do traditional First Peoples' drum making skills demonstrate an understanding of sound, vibration, pitch and volume?
    - What new questions do you have after doing this lab? If you could extend this lab what else would you like to find out with this equipment? What new hypothesis could be tested?

g. If possible and appropriate, students could participate in a drum-making activity where they make a drum of their own.

h. Other instruments. Students could research another instrument commonly used by BC First Nations, such as rattle, whistle, or flute.

Activity 10.3
The Physics of Living Technologies

Students can analyze a variety of ways that Indigenous technologies use principles of physics This activity provides some suggestions for topics that students can use to develop their own inquiries.

a. The technology of the digging stick. Introduce the topic with the example of a simple tool like the digging stick. The digging stick was an essential tool for many First Nations in the past. At first it seems to be a very simple tool, but its use involves a number of types of scientific knowledge to be successful.
   - Students can read about the digging stick on Blackline Master 10-3, page 270, *Digging Stick Technology*.

Blackline Master 10-3, page 270, *Digging Stick Technology*

b. Many technological devices utilized by First Peoples can be understood as "simple machines" (devices that change the direction or magnitude of a force). More complex devices may consist of 2 or more simple machines configured to carry out a task. The same type of simple machine could be used multiple times, or different types could be used in combination. Students can examine a variety of traditional technologies and analyse how they employ simple machines.
   - The six simple machines are:
     - Lever (fulcrum and lever arm)
     - Wedge
     - Inclined plane
     - The pulley
     - Wheel and axel
     - Screw
   - An engineering analysis of simple machines includes consideration of:
     - The purpose of the machine (to multiply force, or distance)
     - Force: effort (applied force) and output
     - Work: input and output
     - Power: input and output
     - Mechanical advantage
     - Efficiency
   - Students can select one of the technologies that interests them to analyse from the viewpoint of simple machines. Blackline Master 10-4, page 271, *The Physics of Living*, gives some suggestions. The topics included on the Blackline Master are:
     - Transportation Technologies
     - Technologies for Food Sustainability
     - Technologies for the Household and Community
   - Students can build and test a working model of the technology, where possible, or illustrate the uses of simple machines through diagrams.

Blackline Master 10-4, page 271, *The Physics of Living*

Resources

Stewart, Hilary. *Cedar: Tree of Life to the Northwest Coast Indians*.

Stewart, Hilary. *Indian Fishing*.

Stewart, Hilary. *Stone, Bone, Antler and Shell. Artifacts of the Northwest Coast*.

Turner, Nancy J. *Plant Technology of First Peoples in British Columbia*

c. First Peoples Architecture. Architecture is important for its material function (e.g. safe housing) and for the cultural life of a community. Various architectural forms prevalent in BC can be understood as addressing different climactic conditions, geography, topography, and cultural and spiritual needs.

- Architecture – Designs and Construction Technologies. Consider design features that are appropriate to the local climate
  - Consider ways that the design contributes to and supports community life and cultural practices
- Longhouse. Investigate construction techniques that utilize simple machines for moving and hoisting logs
  - Lever/Fulcrum
  - Wedge
  - Torque – using cables to pull, and people and poles to push, generating torque to erect house posts and totem poles
  - Static equilibrium – techniques to ensure the stability and integrity of structures – poles, beams, ropes, tongue and groove connectors
- Pit house.
  - Investigate engineering design features that contribute to strength e.g. dome shape, stability of the design
  - Investigate design features that are appropriate to local climate (thermal properties in winter vs summer)
  - Consider ways that the design contributes to and supports community life and cultural practices
- Contemporary Indigenous Architecture
  - Investigate the work and philosophies of Indigenous architects such as those represented here: https://tinyurl.com/fnesc79.

Activity 10.4
The Chemistry of Balsamroot

An import food for many First Nations of the BC Interior is balsamroot. Depending on how it is processed, the root can be used as food or as medicine. Students investigate the sophisticated traditional and scientific knowledge required to produce two different products. They will find out how pit-cooking causes chemical changes.

Blackline Master 10-5, page 272, *Pit Cooking Balsamroot*

a. Introduce the topic of the chemistry of balsamroot by giving background to students, or have students read and discuss the article on Blackline Master 10-5, page 272, *Pit-Cooking Balsamroot*.

b. Provide students an opportunity to observe some of the characteristics of the balsamroot. If balsamroot grows in your area, you may be able to bring a sample into the class, or have students observe them in the field.
- Students can view a short amateur video See *Arrow Leaf Balsam Root* that shows the parts of the balsamroot. Healthy Family Variety Channel, 2018. 5.27 min. https://youtu.be/ASJ4WTENynM.
- Students can find botanical information at the online database E-Flora, https://tinyurl.com/fnesc67.
- Students can read a short article with pictures at ww.bcfoodhistory.ca. See "Cariboo Sunflowers," Mary Leah De Zwart, 2017. Linked at https://tinyurl.com/fnesc75.
- The balsamroot is discussed in a case study in this article: "Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia." by Turner et al. (*Ecological Applications* 2000). Available online at http://bit.ly/2cVwEOM

c. What is inulin? Inulin is a major component of balsamroot that makes the plant indigestible.

Background: Inulin is a polysaccharide made up of fructose chains. Many plants use it as a way of storying carbohydrates. As a dietary fibre it is indigestible to humans. It is considered a pre-biotic as it feeds some bacteria in the gut. It is consumed naturally in foods we eat, and sometimes used in supplements to aid digestive health and as a food additive.
- Have students research to find out the chemical structure and properties of inulin.
- Students can determine what is the chemical reason for inulin being indigestible to humans. (The type of chemical bond formed between the fructose molecules; a type of glyscosidic bond.)
- Students can work together to compile a list of common plants that contain inulin.

- Ask students to predict what chemical changes would need to take place when balsamroot is cooked to make it digestible. (For example, the chemical bonds need to be broken.)

d. Students investigate the traditional method of pit cooking balsamroot, and how the processes involved cause the chemical changes required to convert inulin to digestible sugars. As a primary resource students can use the scientific paper by Sandra L. Peacock, "Complex to Simple: Balsamroot, Inulin, and the Chemistry of Traditional Interior Salish Pit-Cooking Technology." Online at https://bit.ly/2WtySyP.

Sandra L. Peacock, "Complex to Simple: Balsamroot, Inulin, and the Chemistry of Traditional Interior Salish Pit-Cooking Technology." Online at https://bit.ly/2WtySyP

- Pages 118-120 of the document describe the traditional methods of pit-cooking balsamroot. One is a description from 1900 by ethnographer James Teit; the other is a more contemporary description by an Elder (page 120). Page 119 shows a diagram of an earth oven.
- Students can work in pairs or groups to analyze the descriptions and list or diagram the steps involved in preparing and processing the balsamroot.
  - Have students suggest or identify key parts of the process that might play a role in causing the chemical changes in the inulin.
- Have students the identify traditional knowledge and skills required to successfully produce edible foods from balsamroot in large quantities.
- If possible, have students develop experimental activities that model the slow cooking of inulin containing plants and test for chemical changes.

e. Student can also investigate the whole other chemistry when balsamroot is used as medicine. The roots and leaves have been shown to have antimicrobial qualities. However, they can be toxic if taken in large quantities.

- An interesting scientific investigation into the dual nature of the balsamroot was studied by Secewepemc scientist Kelly Bannister in her doctoral thesis.
  - Kelly Patricia Bannister. Chemistry Rooted in Cultural Knowledge: Unearthing the Links Between Antimicrobial Properties and Traditional Knowledge in Food and Medicinal Plant Resources of the Secwepemc (Shuswap) Aboriginal Nation. Doctoral thesis, UBC, 2000. Linked at https://bit.ly/2dyksEs.

Activity 10.75
Topics for Inquiry

There are many other areas of technology that can be investigated in science classes. Here are a few suggestions

a. Appropriate Clothing

The geography, climate and available resources dictated diverse materials and designs of clothing for BC First Peoples in the past. Each type of clothing required a unique set of skills and knowledge to provide appropriate clothing for daily life and also for ceremonial and spiritual needs.

- Students can investigate the types of materials that are used to make traditional clothing. The main categories are:
  - furs
  - skins and hides
  - woven fibre from plant materials, such as bark from cedar and other trees, reeds and grasses, stinging nettle.
  - hair such as mountain goat, woolly dogs
- Students can select on of the materials, or a particular type of traditional clothing from a specific area, and investigate the technologies, skills and knowledge that were required to produce them. They can consider questions such as:
  - What are important qualities of different animal skins?
  - What are the insulating properties of skin and furs?
  - What qualities of plant material are needed to make fibres?
  - How was clothing designed to deal with the local climate?
  - How was clothing made waterproof?
  - How did First Peoples make the best use of available materials?
  - How do you transform cedar bark into soft fibres for weaving?
  - How do you use a spindle whorl for spinning fibres?
- Some resources are:
  - Tepper, Leslie H. *Earth Line and Morning Star. Nlaka'pamux Clothing Traditions*. Canadian Museum of Civilization, 1994.
  - Nisga'a Nation. *From Time Before Memory*. SD 92 (Nisga'a). 1996. See Chapter Three: Am'ugithl Nisga'a: Nisga'a Clothing, pages 105-142.
  - Olsen, Sylvia. *Working With Wool*. Sono Nis. 2010.
  - Beryl Amaron, "More Than Useable Tools: Towards an Appreciation of Nłe?kepmx Fibre Technology as a Significant Expression of Culture" (UNBC Masters Thesis 2000). https://core.ac.uk/download/pdf/84873663.pdf
  - See Unit 2, Activity 2.6, The Story of the Salish Woolly Dog for additional resources.
  - See Unit 9, Hunting and Trapping, Activity 9.5, The Chemistry of

Tanning, for activities about preparing furs and skins.

b. Food Processing Activities

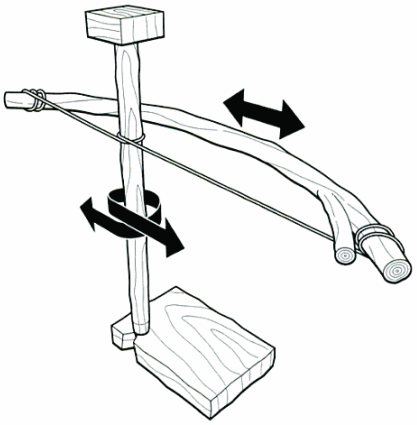
First Peoples processed many types of foods to store for winter supplies and for trade with other Nations. Each type of processing required a knowledge of the food itself and how it would respond to

- Oolichan grease. The oolichan (eulachon) was an extremely significant fish in the past, and still is today, although its numbers are greatly reduced. The small oil-rich fish is rendered it into one of the most prized foods and valuable trade goods, commonly known as grease.
  - Students can research the steps required to make oolichan grease, and infer the skills and knowledge required to make it successfully.
  - Some resources are:
    - Sinumwack: Bella Coola Oolichan Run. UBCIC, 1978. 19:59 min. https://youtu.be/sZYRl_4v2B4. This video shows a harvesting and processing camp in Bella Coola (Nuxalk) in 1978. It gives a good explanation of the process, and the reasons for the steps, as well as discussing ways that oolichan grease is made.
    - *Eulachon past and present*. Megan Felcity Moody. Masters Thesis, UBC, 2008. Linked at https://tinyurl.com/fnesc74. This thesis examines the oolichan (eulachon) in broad terms in communities along the coast, and with a specific focus on the Nuxalk First Nation. See pagers 76-80 for a discussion of the processes in making the grease.
    - "Making Eulachon Grease in Kemano." Living Landscapes, Royal BC Museum, 2006. Linked at https://tinyurl.com/fnesc73. This website is a photo gallery of an oolichan harvesting and processing camp in Kemano.
    - *T'Lina: The Rendering of Wealth*. Nimpkish Wind Productions, 1999. 50 min. This feature documentary by Kwakwaka'wakw filmmaker Barb Cranmer tellls of the traditional oolichan harvest and processing on Knight Inlet, and the depletion of the oolachon. It may be available from your Resource Centre or community library.
- Drying and Smoking. Many different methods of drying and smoking foods were used. Students can investigate the diverse types of scientific knowledge need to ensure that the meat, berries and other foods were dried properly and did not go bad over the winter.

Blackline Master 10-1

Traditional Technologies for Living

1.



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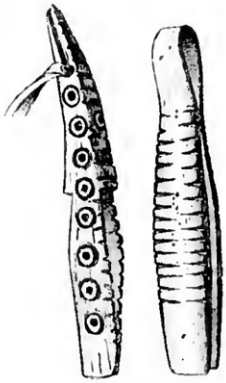

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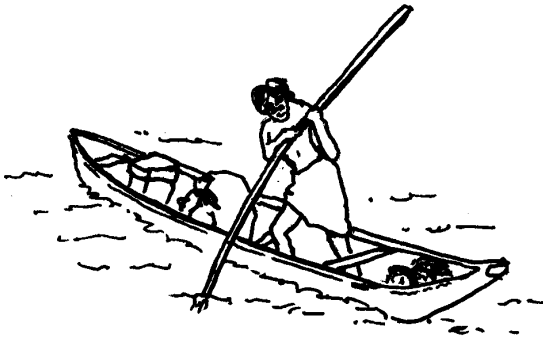


Blackline Master 10-2

Frequency of Sounds Lab

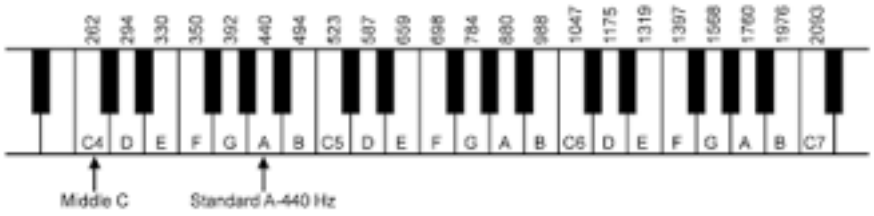
Please read over the lab and write your hypothesis in the space provided on this worksheet before starting the lab video.

Overview

This lab is an investigative lab in which you will verify how frequency is related to pitch and how different drum sizes and materials produce different sounds. You will also look at rattles and how their materials effect the sound that is produced.

Every sound has it source in a vibrating object. What vibrates depends on the object that is making the noise. Vibrating objects send energy through waves into the surrounding air. The human eardrum passes those vibrations through to the middle and inner ear where tiny hair cells change the vibrations into electrical signals that are sent to the brain. The brain tells you that you are hearing sound and what that sound is.

The human ear can detect sounds ranging from approximately 20 Hz to 200000 Hz. Below is a portion of a piano keyboard and the frequencies those keys produce.



What does it mean to say that one note is higher than another? What happens to a sound's frequency when you increase its pitch?

Objectives

- To experimentally determine how different sizes of drums and different materials of drums affect the frequency of sound produced by that drum.
- To experimentally determine how a rattle produces different frequency of sound and how the amplitude vs time graph for a rattle is different from that of a drum.

Materials

- Cell phone with Lab4Physics app using Sonometer
- 2 handmade drums with drumsticks
- 3 different handmade rattles.

Write your Hypothesis:
For this lab, write a hypothesis below. You may use the "If … then … because …" format.

Predict which drum material and size you think will have the highest and lowest pitches. Explain why you think so.

Procedure
1. Turn on Lab4Physics app on your cell phone. Go to tools and choose Sonometer.
2. Click "New measurement"
3. Press "Go" button
4. Beat one drum once with the drumstick
5. When recording stops three result options are presented. "Amplitude vs. Time", Frequency, and "Intensity vs Frequency". Click on Save Data.
6. Precisely name the data so as not to confuse it later.
7. Measure the diameter and thickness of the drum and record it in Table 1.
8. Record the type of material used to make the drum in Table 1.
9. Record the frequency of the drum in Table 1.
10. Repeat steps 2 – 9 for the other drum. Record your data in Table 1.
11. Repeat steps 2 - 7 and steps 8 - 9 for three different rattles. Record your data in Table 2.

Discussion Questions
1. What is producing the sound?
2. What diameter of drum tends to produce a higher pitch sound?
3. What diameter of drum tends to produce a lower pitch sound?
4. How are pitch and frequency related?
5. Why does the Sonometer app produce such a different amplitude vs time graph for the rattles than it did for the drums?
6. Evaluate your hypothesis. Make sure you use your results to refute or verify your hypothesis.

Conclusion
In one or two sentences, summarize the key findings of the lab.

Data Recording

Table 1: Drum size and composition compared to frequency of sound produced.

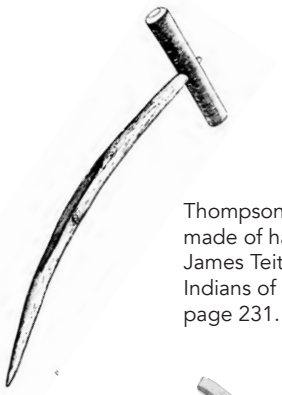
Drum Description			Peak Frequency:(Hz)
Diameter (cm)	Thickness (cm)	Material	

Table 2: Rattle composition compared to frequency of sound produced.

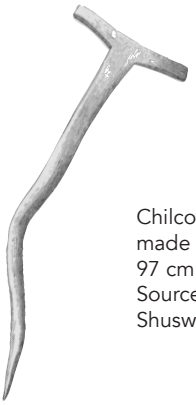
Rattle Description		Peak Frequency (Hz)
Outside Material:	Inside Material:	

Blackline Master 10-3

Digging Stick Technology



Thompson digging stick made of hardwood. Source: James Teit, The Thompson Indians of British Columbia, page 231.



Chilcotin digging stick made of caribou antler. 97 cm long. Source: James Teit, The Shuswap, page 513

Digging sticks were one of the most important tools in many First Nations communities in the past. They use a simple yet elegant technology.

The digging stick was an essential part of a woman's toolkit for many First Nations who harvested large amounts of roots and bulbs.

Digging sticks are usually made from hardwood, such as Pacific yew, oceanspray, saskatoon berry and crabapple. Sometimes in the past they were made from antlers of caribou, elk or deer.

In the Stl'atl'imx language the word for oceanspray, a hardwood plant, translates to mean "digging stick plant."

Many digging sticks, especially those used by interior First Nations, have a crossbar handle at the top. This could be antler, mountain goat horn or wood. Many sticks used on the coast had a rounded knob at the top.

Often wooden digging sticks were reversible. The handle had a hole drilled to accept one end. The sticks were sharpened at both ends If the bottom tip became dull during digging, the stick could be pulled out of the handle and reversed so there was a new sharp tip ready to dig.

The tips were not only sharpened. They were also fire hardened in hot coals. This made them last much longer.

The shape of the stick was important, too. If the wood did not have the proper curve, it could be shaped by bending it through a steaming process.

To use the digging stick, it is first pushed down into the soil, then pulled back. It might take one good pull, or pushing and pulling a number of times, to lift up a good clump of roots or bulbs.

Once the roots and bulbs have been exposed, the harvester can then pick those that are the best size for harvesting. The sod can then be put back in place, and the remaining plants can continue to grow. This ensures the plants are harvested sustainably.

Digging sticks were used for others purposes as well. They could be used for weeding areas were root plants were grown, excavating for house pits or pit ovens, and, on the coast, for digging clams.

Digging sticks were usually used by women. For a woman, they were very personal items. They were made specially for her, and matched her height and how she would use it.

The handles were often decorated with designs that had special meaning to her. When she died, her digging stick might be buried with her, or used to mark her grave.

Blackline Master 10-4

The Physics of Living

For thousands of years First Peoples of Canada developed many sophisticated technologies to sustain and enhance their lives. Here are some of the technologies that you can investigate.

Transportation Technologies

Canoes

- Consider various styles of canoe. Investigate advantages and disadvantages of each canoe design in light of the intended material and cultural purposes. For example, consider buoyancy and maneuverability (torques) needs in different conditions, such aslocation (e.g. ocean vs river vs lake) or use (e.g. transportation vs fishing vs food harvesting)

Paddles

- Analyze as a lever
- What are the advantages and purposes of different shapes of paddle?
- Investigate paddles in relation to force, work, energy, power

Poling (rather than paddling) canoes

- Analyze in terms of torques

Technologies for Food Sustainability

- These include technologies for hunting, fishing, and agriculture. They can be analyzed as simple machines such as wedges, and levers. Also analyze the forces of torque.
- Digging stick
- Fish hooks
- Fishing and hunting spears
- Fish club
- Bow and arrow

Technologies for the Household and Community

Analyze these tools and techniques as simple machines:

- Tools for woodworking
  - Hammer: hand and hafted maul – analyze as levers (mechanical advantage)
  - Wedge
  - Adzes and chisels
- Techniques for felling trees
- Techniques for splitting planks
- Technique for starting fires: Fire drill (torque and energy transformations)
- Spindle whorl for spinning fibres

Blackline Master 10-5

Pit-Cooking Balsamroot

The arrowleaf balsamroot (*Balsamorhiza sagittata*) is a plant in the sunflower family that grows abundantly in western North America.

All parts of the plant can be used. In the past, the leaves, stems, shoots and seeds were eaten or used as medicine. But the most important part was the taproot.

The root of the balsamroot is an important food source for many BC First Nations of the interior and in the Fraser Valley. In the past it was a staple food that provided nutrition and energy throughout the year. As well, it provides a useful medicine.

Using the taproot is labour intensive. It is not easy to dig, and has to be peeled, a difficult and time consuming job.

A main component of the taproot is the carbohydrate inulin. However, inulin is indigestible by humans. How could the root become a staple food source if most of it is indigestible?

Indigenous people perfected a cooking technology that converted the inulin to simple sugars, making the root not only taste better, but become digestible and provide available energy sources.

This technology is the earth oven or pit-cooking which involves a slow cooking period in an enclosed pit in the ground.

There are a number of essential conditions that need to be met to successfully produce the edible food.

These include:

- adequate temperature for a sustained period of time, provided by fire-heated rocks
- adequate moisture, provided by steam from water added at a specified point in the cooking process
- adequate acidity, provided by volatile organic acids emitted by moistened plants added to the pit