Natural Chemical Changes and Common Everyday Reactions:

A Lesson to Support Science 10

by
Ted View

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These lessons were developed by the following team of teachers, Elders, and cultural advisors: Yvonne Chamakese, David Hlady, Anna-Leah King, Duane Johnson, Marcia Klein, Lana Lorensen, Sally Milne, Joseph Naytowhow, Lamarr Oksasikewiyin, Stuart Prosper, Ron Ray, Ted View, John Wright, and Laura Wasacase. Support was provided by Dean Elliott from the Ministry of Education, and Margaret Pillay from the Saskatchewan Professional Development Unit.

All resources used in these lessons are available through the Stewart Resources Centre: http://www.stf.sk.ca/services/stewart_resources_centre/online_catalogue_unit_plans/index.html

Information regarding the protocol when inviting Elders into the classroom can be found in the document: *Elders in the Classroom* by Anna-Leah King (attached as Appendix A). Further information can be found in the Saskatchewan Learning document: *Aboriginal Elders and Community Workers in Schools*.

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Overview

These lessons and lab incorporate objectives from the unit entitled Physical Science: Chemical Reactions (CR) in the *Science 10 Curriculum Guide*. These activities are intended to be employed in conjunction with a lesson, or as part of a lesson, but it is not suggested that this set of activities exist as a stand-alone component.

These activities look at chemical change in a First Nations and Métis context. A lab is included, but the lab is not intended as a substitute for a chemical change lab - it can act as a supplement to the usual lab. The resource material attached to the lesson is the spoken contribution of Sally Milne, an Elder from the La Ronge area. It was obtained by interview on March 16, 2007 in Saskatoon. Teachers may wish to invite an Elder from their area to provide background information as a replacement for the material included here, or in addition to this material (see Appendix A - Elders in the Classroom).

Foundational Objectives

CR1 Observe common chemical reactions in your world.

Source: This and other objectives are found in the following document: Saskatchewan Learning. (2005). *Science 10 curriculum guide*. Regina: Saskatchewan Learning.

Timeframe

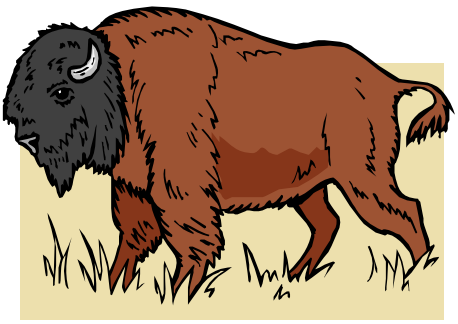
2-3 hours.

Resources

All necessary resource material is included. "From the Brains to the Tail," an excerpt from the book *Buffalo Hunt* by Russell Freedman, published by Scholastic and Holiday House, 1988, pp. 36-44, can be used as an introductory activity.

Digital Resource

- www.royalsaskmuseum.ca/research/building/bison_hide.shtml



Natural Chemical Changes and Common Everyday Reactions

Foundational Objectives

CR1 Observe common chemical reactions in your world.

Key Understandings

- Chemical change occurs every day, and in a variety of contexts.
- Chemical change can be discussed using First Nations and Métis ways of knowing.
- Chemical reactions result in chemical change.

Essential Questions

1. What common reactions do we encounter every day in our experience?
2. What clues help distinguish chemical changes from physical changes?
3. What evidence indicates that an exothermic reaction has occurred? An endothermic reaction?
4. Describe indicators that reveal chemical reactions have occurred.

Learning Objectives (LO)

Students will be able to:

CR1 LO2 Observe and describe chemical reactions that are important in everyday life.

CR1 LO3 Perform activities to investigate exothermic and endothermic chemical reactions.

CR1 LO4 Identify indicators that provide evidence that a chemical reaction has likely taken place.

Assessment Evidence

- Student discussion
- Group sharing
- Lab

Notes to the Teacher

Examples of chemical changes need not be restricted to modern examples. A look into any cultural group in any period of time can provide examples of chemical changes that have been employed effectively. The First Nations people of Saskatchewan, in this case, the Northern Cree, provide a range of examples of chemical changes that teachers can use to bring the First Nations perspective into the classroom.

The following activities include an introductory activity based on a story of the buffalo hunt, a discussion activity, and a lab based on the knowledge of La Range area Elder, Sally Milne. The activities aim to promote discussion on chemical change and draw upon students' previous knowledge on physical change. The lab is not intended as a substitute for a chemical change lab, but can act to supplement the lab.

These activities are intended to be employed in conjunction with a lesson, or as part of a lesson, but it is not suggested that this set of activities exist as a stand-alone component.

Lesson Plan

1. Introduce the lesson by discussing the Key Understandings and Essential Questions with students, and by providing an overview of the activity. If the resource is available, complete the introductory activity. The introductory activity could also be completed using a variety of other resources (see resource list).

2. Provide students with the information shared by Sally Milne, a Cree Elder from the La Ronge area – *Historical Background on Common Reactions Experienced by the Northern Cree Nation*. If students are not aware of the issues of protocol surrounding the sharing of knowledge by First Nations and Métis people, explain to them that offering tobacco to the Elder is the protocol to access knowledge. (For more information, see Appendix A – Elders in the Classroom.)

3. Ask the class to work in groups on the discussion questions and the parallel activity, and to share these with the large group.

4. Prepare and complete the lab.

Introductory Activity – From the Brains to the Tail

This activity is suggested to provide background for students to help them frame the context for the lab and the discussion on hide tanning that follows. This may also be used an as extension activity. "From the Brains to the Tail" is a descriptive outline of the traditional buffalo hunt, and a very brief explanation of the tanning process. The story's strength remains in its ability to provide a background against which the tanning of hides can be explored as a type of chemical change.

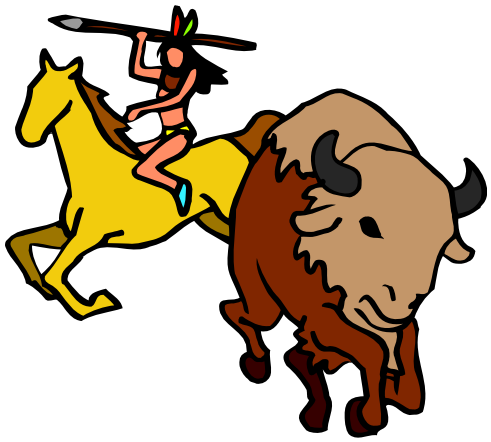
"From the Brains to the Tail" is an excerpt from the book *Buffalo Hunt* by Russell Freedman (available from the Stewart Resources Centre of the Saskatchewan Teachers' Federation).

The following questions will help centre students around the scientific concept of chemical and physical change, while scaffolding a background framework for the lab and the activities to follow.

Instructions for the Student

Please read the excerpt "From the Brains to the Tail" (pp. 36-44) from the book *Buffalo Hunt* by Russell Freedman. After you have completed your reading, answer the following questions:

1. In the excerpt, describe three chemical changes that took place.
2. In the excerpt, describe three physical changes that took place.
3. Is the making of pemmican a physical or a chemical change? What properties allowed pemmican to last so long without spoiling?
4. In what ways were buffalo chips useful? What types of reactions describe the burning of buffalo chips?
5. In the story, which chemical changes were useful? Which changes were undesirable?
6. In the story, which physical changes were useful? Which changes were undesirable?
7. From what you read in the story, and using the information you have learned so far, explain why you think the buffalo hunt is sustainable or unsustainable?



Answer Key of Possible Responses

1. In the excerpt, describe three chemical changes that took place.
    - Any example of food preparation – roasting, cooking, etc.
    - Spoilage of food
    - Smoking meat
    - Hides were cured
    - The act of digestion
    - Production of glue, fat, and soap from hooves

2. In the excerpt, describe three physical changes that took place.
    - Buffalo hair twisted into rope
    - Horns were hollowed out to be used as cups and ladles
    - Bones were shaped into tools
    - Tail was used for a fly swatter
    - Choice meats were sliced
    - Sinew dried and used for bowstring

3. Is the making of pemmican a physical or a chemical change? What properties allowed pemmican to last so long without spoiling?
    - Making of pemmican involves both physical and chemical changes:
        i. The physical change:
            1. aspect of drying the meat, pounding the meat
            2. the evaporation of water
        ii. The chemical change:
            1. denaturation of the protein

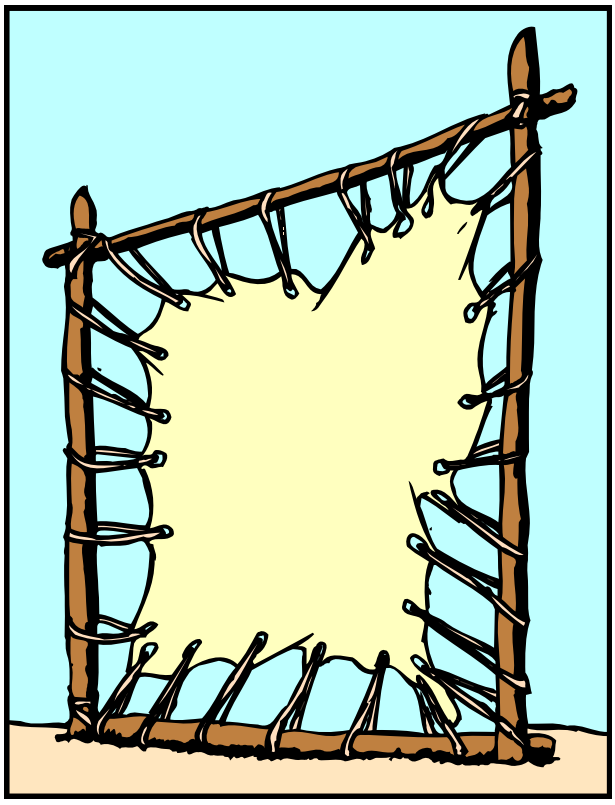
4. In what ways were buffalo chips useful? What types of reactions describe the burning of buffalo chips?
    - Used in combustion, as fuel for fire
    - Burning of buffalo chips - answer could be both physical and chemical reactions (physical - breaking buffalo chips into pieces to burn evenly; chemical - burning produces heat)

5. In the story, which chemical changes were useful? Which changes were undesirable?
    - Useful changes:
        i. Any example of food preparation – roasting, cooking, etc.
        ii. Smoking meat
        iii. Hides were cured
        iv. The act of digestion
        v. Production of glue, fat, and soap from hooves
        vi. Making fires

- Undesirable changes:
    i. Spoilage of food
    ii. Decomposition of the carcass
    iii. Burning the buffalo chips might provide warmth but the smell may be undesirable

6. In the story, which physical changes were useful? Which changes were undesirable?
    - Useful physical changes:
        i. Buffalo hair twisted into rope
        ii. Horns were hollowed out to be used as cups and ladles
        iii. Bones were shaped into tools
        iv. Tail was used for a fly swatter
        v. Choice meats were sliced
        vi. Sinew dried and used for bowstring
        vii. Pounding dried meat
    - Undesirable physical changes:
        i. Arrows used to kill the buffalo put holes into the buffalo hide and too many holes were considered undesirable
        ii. The freezing cold weather that affects the body

7. From what you read in the story, and using the information you have learned so far, explain why you think the buffalo hunt is sustainable or unsustainable?
    - Student answers will vary.



Historical Background on Common Reactions Experienced by the Northern Cree Nation

The following information is the spoken contribution of Sally Milne, a Cree Elder from the La Ronge area, obtained by interview on March 16, 2007 in Saskatoon.

Tanning Hides – An Example of Chemical and Physical Changes

A method of hide preparation, in this case a Northern Cree (La Ronge area) perspective, includes both physical and chemical changes. Hides can be tanned and prepared all year round.

The skin/hide is removed from the animal. During the first stages of preparation, holes are made along the edges, around the entire hide, about 10 cm apart. A frame holder is made from two living trees with a cross brace. The actual frame is made using four spruce poles lashed together to form a rectangle. The size of the frame depends on the size of the animal. The frame is then leaned against the frame holder. Ropes are laced through the holes of the hide to fasten it. The hide is stretched as tightly as possible and it is fleshed with a bone scraper (blood vessels are removed). The hide is allowed to dry.

The frame with the hide attached to it is flipped over, exposing the hair side. The hair is scraped off with a metal scraper. The hair along with the epidermis (white in colour) is completely removed. An experienced person can determine when the hide is reached by checking the texture with the tongue. If the scrapings are sticky, more needs to come off; if the scrapings flake, the hide has been reached. If the epidermis is not completely removed, water cannot pass through the hide and thus the final product will be as hard as cardboard.

After the hair and the epidermis are moved, the hide is cut away from the frame. Oil or melted lard is sprinkled onto the hide on the hair side and boiled brain, after it cools, is rubbed into the same side. The hide is folded up and left until it is ready (anywhere from two nights to as long as a week). A weight, such as a rock, is used to keep the hide properly folded.

The raw hide is then soaked for an entire morning. Water is squeezed through the hide by wringing out the water by hand or in a tourniquet fashion around the trunk of a tree (a pole is used as the lever of the tourniquet). The hide is pulled and stretched repeatedly to dry slowly over a long period of time. The drying process takes over three days. At this point, the hide feels beautifully soft and supple, like cloth.

The hide is draped over a pole and the flesh side is scraped again. When the hide is perfectly smooth, a piece of canvas is sewn to the base. The whole hide is shaped and rolled into a cylinder, flesh side in. This side will be protected by smoke and becomes the outer surface of the garment. The cylinder of hide with the canvas side down is placed like a chimney over a fire. The top edge of the cylinder is sewn shut to allow the smoke to circulate completely within the cylinder. The cylinder is suspended by ropes tied to a smoke frame. The proper type of wood is needed – pine and light golden stump wood are

used. This choice of wood produces little fire and a lot of smoke. The quality of stump wood is determined by its softness. Stump wood has a very low density.

The longer a hide is smoked, the darker it becomes. When the hide is smoked to the accepted degree, the stitches are removed.

Respecting the Cycle of Life

Within First Nations and Métis ways of being, protocols were followed that observed the offering of the animal's life to the people. A prayer and offering were made to the animal as a way of honouring its contribution to the well-being of the group through food, clothing, and household goods.

Possible Questions

1. From the article, find three examples of chemical changes.
2. From the article, give two examples of physical changes.
3. What clues give you the impression that the overall process involved in tanning hides procedures chemical changes?
4. Why are lard and the brain of animals needed for the tanning process?
5. Why is a light wood needed for the smoking process? What did the smoking process do to the hide? Is this an example of chemical change?

Parallel Experiences of Common Reactions

In the lives of the First Nations and Métis people hundreds of years ago, many of the activities involved both chemical and physical changes. The list below provided by Sally Milne, an Elder from the La Ronge area in northern Saskatchewan, reflects the lifestyle of the Northern Cree. Some of the practices of her people differ little from that of her ancestors.

From the list below, ask students to pick which activities were physical changes, which ones involved chemical changes, and how they know.

- Chokecherry processing
- Rose hip tea
- Labrador tea
- Saskatoon berry processing
- Smoking meat or fish
- Cooking bannock stew
- Cooking meat
- Tanning hide
- Canoe making

Activity

Brainstorm a list of parallel activities that take place in your life today. For example, while you may not make bannock stew, you may cook other foods. This is an example of chemical change.

Sally's List	Your List
Processing of chokecherries	
Rose hip tea	
Labrador tea	
Smoking meat, smoked fish	
Cooking bannock stew	
Cooking meat	
Tanning hide	
Canoe making	

Chemical Change Lab

Background

This lab focuses on chemical change in a First Nations context and specifically, on some of the physical and chemical changes experienced by the Northern Cree on the trap line. The types of plants and substances chosen for this lab reflect the daily uses of such materials.

Rose hips are structures that contain the ovary and the ovule in the wild rose plant. When dried and crushed, the rose hips were made into tea.

Mint, another traditional plant, was also crushed and made into tea. The oil inside the mint was extracted through the crushing process.

Fish were hung on an "A" frame to be smoked. Another method of preparation occurred during the first freezing in winter. Ten fish per pole were hung upside. Fish prepared this way were used for dog food.

(Sally Milne)

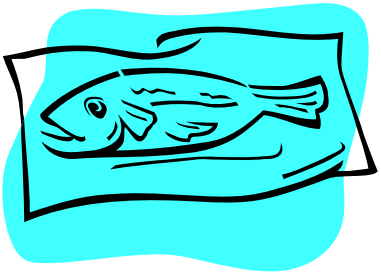
Purpose

- Identify indicators that provide evidence that a chemical reaction has likely taken place.
- Distinguish between a chemical and physical change of different substances.

Demonstration – Fish

The teacher will complete this demonstration to model the process to students. Two examples are provided for possible demonstration purposes. Students should record their observations on the sheet provided and answer the questions.

1. Obtain a sample of raw, uncooked fish and a sample of smoked fish.
2. The smoked fish will be store-bought, so the process used to smoke the fish may vary from the traditional method of preparation, but it can still illustrate changes for this lab.
3. Ask students to record and to observe the texture of each sample of fish, and to answer the questions.
4. Wash hands carefully with soap after handling the fish.



Questions:

- What did the uncooked sample look like?
- How was the sample of smoked fish different in texture and colour to the uncooked sample?
- From observation alone, can you tell if the change that the fish underwent in the smoking process is a chemical or a physical change?

Note: The teacher may find it useful to contact an Elder from the area to speak on the topic.

<u>Demonstration – Wood Chips</u>

(This demonstration could also be conducted by students.)

1. Place four wood chips into a 1,000 ml beaker.
2. In a fume hood, light the wood chips with a wood splint.
3. Observe the changes and record them in the table that follows.

Questions:

- Was this a physical or a chemical change? Why?
- What clues might indicate what type of change occurred?

Student Instructions

Materials Required

Each lab group will need:

1,000 ml beaker
5 test tubes
1 test tube rack
Goggles
1 test tube holder
1 rubber stopper
1 graduated cylinder
Hot plate
2 – 500 ml beakers
Wood splint and match
Tongs
Gloves

Substances Needed

Distilled water (500 ml)
Rose hips (4)
Mint (3 mint leaves)
Mortar and pestle
Wood chips (5)
Saskatoon berries

Procedure

- Select a student to collect the items listed in the materials section and to bring the materials to your work area.
- As you work through each station, record the changes and observations that you notice in the table provided.
- Complete the following experiments.

Experiment A – Rose Hips in Boiling Water

1. Bring a water bath to the boil.
2. Pour 50 ml of distilled water into a 500 ml beaker. Place this water-filled beaker into the water bath.
3. Using the mortar and pestle, crush 2 dried rose hips and place them into the distilled water and observe.
4. Fill in your observations in the table provided and answer the questions that follow.

Questions for Experiment A:

- What type of changes did you note as you boiled the water?
- What type of change occurred when you crushed the rose hips?
- Did the nature of the substance change? If so, what indicators (clues) did you notice?
- What type of change occurred when you placed the crushed rose hips into water?
- Did the nature of the substance change? If so, what indicators (clues) did you notice?

Experiment B – Rose Hips in Cold Water

1. Pour 50 ml of distilled water into a 500 ml beaker.
2. Using the mortar and pestle, crush 2 dried rose hips and place them into the distilled water and observe.
3. Fill in your observations in the table provided and answer the questions that follow.

Questions for Experiment B:

- Were there any significant differences in your observations compared to those you noted in Experiment A?
- Explain why or why not these may have or may have not occurred.

Experiment C – Mint Leaves

1. Bring a water bath to the boil.
2. Pour 50 ml of distilled water into a 500 ml beaker. Place this water-filled beaker into the water bath. Leave for 2 minutes.
3. Using the mortar and pestle, crush 3 mint leaves and place them into the distilled water and observe.
4. Fill in your observations in the table provided and answer the questions below.

Questions for Experiment C:

- What type of change occurred when you crushed the mint leaves?
- Did the nature of the substance change? If so, what indicators (clues) did you notice?
- Describe the mint after you mixed and heated it. How did it change?
- Was this a physical or a chemical change? Why?

After you have completed the lab, clean up your station and return items to the front bench.

Observation and Data Tables

Table 1 – Sample Descriptions and Observations

Samples	Before Reaction	After Reaction	Type of Reaction
Rose hips			
Water boiling			
Mint			
Wood chips			

Table 2 – Texture and Colour of Smoked and Uncooked Fish

Sample	Texture	Colour
Smoked fish		
Uncooked fish		

Analysis and Conclusion Questions

1. In which experiments do you think something new formed? Describe what the new substance looked like.

2. How do you know that a chemical change took place?

3. In which experiments did only physical changes take place? Explain.

4. Is the example below of the chokecherries an example of chemical or physical change, or both? Explain your answer.

Chokecherries were also gathered in large quantities. They were crushed whole and formed into patties for drying. Why did the native people prepare chokecherries in this apparently unpalatable way? In matters such as this, the Plains Indians acted from experience, not ignorance, although they were limited in the technologies available to them. If they lacked a technology to remove the pits on a large scale, they would have to eat the entire fruit, pits and all. What about the cyanide these pits contain? It is conceivable that crushing the berries and then drying them either allowed the cyanide to escape, or altered it so that it was safe to eat in considerable quantities.

(Anna Leighton)

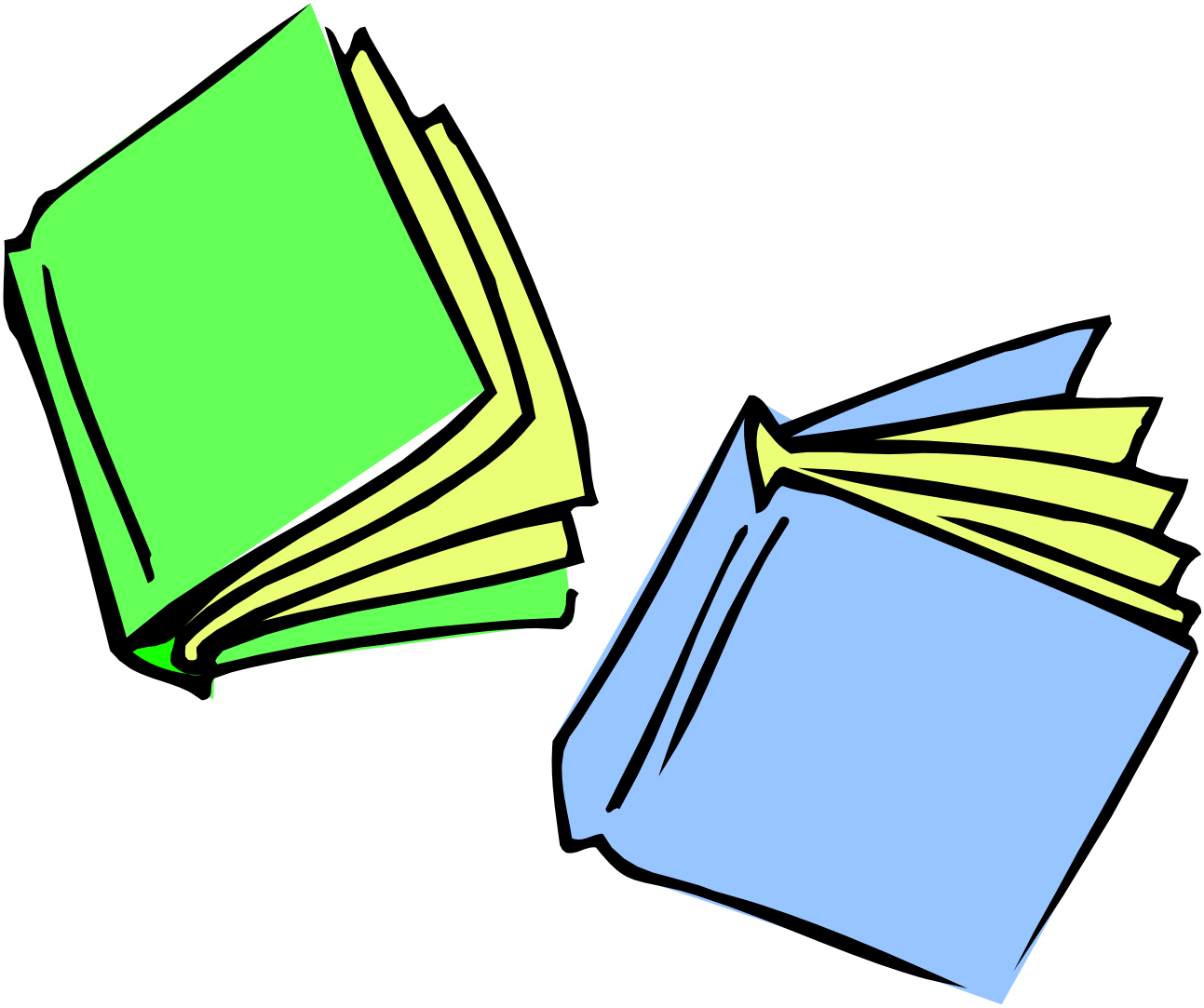
Bibliography

Freedman, R. (1988). *Buffalo hunt*. New York: Holiday House.

Leighton, A., & Hastings, D. (1993). *How to tan a moose hide using a traditional Saskatchewan Woods Cree smoke-tanning method*. La Ronge, SK: Curriculum Resource Unit.

Royal Saskatchewan Museum. (2007). *Building exhibits: First Nations Gallery: Making the bison hide tipi*. Retrieved January 3, 2008, from www.royalsaskmuseum.ca/research/building/bison_hide.shtml

Saskatchewan Learning. (2005). *Science 10 curriculum guide*. Regina, SK: Saskatchewan Learning.



APPENDIX A

Elders in the Classroom

by
Anna-Leah King

It is the Elders' responsibility to guard sacred knowledge and to maintain the ceremonial oral tradition of knowledge transmission. In Saskatchewan, the territory is home to four First Nations, namely Cree, Saulteaux, Dene, and Oceti Sakowin - Dakota/Nakoda/Lakota.

Source: Office of the Treaty Commissioner. (2002). *Teaching treaties in the classroom: Participants manual*. Saskatoon, SK: Office of the Treaty Commissioner.

All of these First Nations have a home here and it is entirely appropriate to represent any or all of these First Nations when approaching curriculum content. The Elders bring with them traditional knowledge and perspective passed down from generation to generation through the oral tradition. The reference to Elders' wisdom has lately been termed "Indigenous knowledge" or "traditional knowledge." Their traditional knowledge and wisdom will give insight to teachers willing to reshape curriculum and validating First Nations content and perspective.

Inviting the Elders

Protocol

The Elders would expect to be approached in the traditional way, respecting traditional protocol. They are given a small offering of tobacco in exchange for their commitment to invest their time and energy into the work at hand. They can be asked to lead the gatherings with prayer and ceremony. First Nations gatherings always begin with prayer and ceremony. It is entirely appropriate to ask this of them. It may not be what you are familiar with, but you will soon realize the benefits of respecting First Nations protocol and ceremonial practice. The Elders may want to begin with a smudge on the first gathering and offer prayer for the task at hand and the team that has been brought together. The Elders are well aware that any given group put together is there to learn from one another and so blessings towards this endeavour are prayed for. Sometimes, depending on the size of the project, a pipe ceremony may be requested. Each Elder may have a slightly different approach to opening and closing ceremony. Some may speak for a while. Others will ask you to share so they can become more familiar with everyone. Simply inviting them with an offering of tobacco and asking that they open and close the gatherings is enough. The Elder will take it from there.

Elder Expectation

When you invite Elders, it is important that you are clear on what you expect from them. If you are asking them to contribute with their knowledge, wisdom, and guidance, then say so. They may not all be familiar with education and what teachers and curriculum writers are trying to do, so explaining what curricula is and what is needed of them is essential to a good working relationship. You want them to contribute First Nations and Métis content and perspective. The Elders need to feel confident that they will be of assistance. Let them know that you see their role as wisdom keepers and they need to draw upon their personal experience, cultural knowledge, and teachings to contribute to the process. The Elders will share what is acceptable and give caution for what they view as sacred knowledge that is only to be shared in the context of ceremony.

Elders need time to think before they answer. Do not be impatient and feel they are not answering soon enough, as they will answer your questions in time. Some Elders are reflective, philosophical thinkers. They will review holistically what you have asked of them. A concept that you think is simple and straightforward has many different dimensions to a First Nations speaker, and they must put the concept into the context of the whole and analyze the dimension of its interrelatedness. Sometimes they translate what you are saying to themselves in their language. They think things out in their mother tongue first and then find the words of closest approximation in English. Not all words and concepts are readily translatable. That is why letting the Elder know what is expected of them beforehand is important because it gives them time to think it over and to find some area of common ground.

Elder Care

Elders do not expect anything but it would be nice to assign one person to see to their needs. Offer them a comfortable seat and debrief them on the expectations for the gathering. Introduce them to everyone and generally make them feel welcome. See to it that they have water, juice, coffee, or tea. It is good to have a snack for them at coffee break. Invite them to pray over the food before you eat. Allow them to be first in line for lunch or let them know you will serve them. This is an example of First Nations protocol. These are small things, but kind gestures go a long way with Elders. They appreciate when younger people make efforts to lighten their load. These gestures make the Elder feel welcome and cared for in a respectful way.

Gifts

It is appropriate to have a small gift for the Elders. If they are paid for their time, this would be considered the gift. Some give a small gift in addition to the honorarium, such as a basket of teas or jams.

- Further information can be found in the document: *Aboriginal Elders and Community Workers in the Classroom*, available from the First Nations and Métis Branch of the Ministry of Education.