

# Inquiry-based Learning in Three Parts through the Study of Rocks and Minerals



## ««« By Amanda Clapham

Amanda Clapham was a pre-service teacher at the University of Windsor when she wrote this article. Amanda was a recipient of the 2012 Don Galbraith Pre-service Teacher Award of Excellence with this submission.



*This information is recommended for use with the Ontario Curriculum, Grade 4: Understanding Matter and Energy, Rocks and Minerals*

Rocks and minerals are of great importance in the history of our Earth, although it unfortunately remains a concept that lacks lustre and enthusiasm for elementary students. Most students are able to comprehend the differences between rocks

and minerals and how formations occur over time however, the tangible relationships students can gain by interacting with various types of rocks and minerals and causation by rocks and minerals remains detached.

The following activities will span across approximately eight fifty-minute science periods each, allowing students to learn about rocks and minerals, causes and effects of mining and erosion and their societal and environmental implications, as well as the use and disposal of rocks and minerals through hands-on experiences and self-guided discovery. The purpose is for the learning to be student-directed through the setup of the materials and stations.

## ***Curriculum Expectations***

These activities are suitable for Grade 4 Science: Understanding Matter and Energy, Rocks and Minerals. They may also be modified into specific lessons as opposed to station setup. This increases the opportunity for differentiating instruction and meeting the needs of a variety of learners. This activity, when organized as stations, meets all requirements of the Ontario Curriculum Expectations in a three part inquiry-based learning strategy; minds on, action, and consolidation.

## ***Learning Goals***

Students will be able to classify and describe the properties of rocks and minerals using tangible equipment and materials. Students will also develop an understanding of the causes and effects of erosion and mining on society and the environment. Finally, students will investigate how rocks and minerals are used, recycled, and disposed of in everyday life.

## ***Success Criteria***

In order for students to be successful at each station of investigation, it is important that students follow instructions and share the roles and responsibilities outlined at each station. Some stations will require the use of technology to research information, as well as a variety of tools, materials, and equipment that will require use with care in order to practice proper safety procedures.

## Materials

- A collection of various rocks (sedimentary, metamorphic, igneous) and minerals
- Flashlights
- Construction paper
- Scratch tiles (clay works well)
- Watering cans
- Baking pans
- Mixture of soil, clay, and small rocks
- Chocolate chip cookies (see safety notes)
- Napkins/paper towel
- Tooth picks
- Computers
- Investigation Booklets (template attached)

## Safety Notes

As most schools are now nut-safe or nut-free, the cookies used should be labelled nut-free. If any students have allergies to other ingredients in the cookies, such as dairy, wheat, chocolate or soy, accommodations should be made for them if possible. However, cookies are not meant to be eaten. In addition, safety goggles should be worn while doing this activity.

## Pre-lesson Preparation

For these activities to progress effectively, the equipment must be organized, and well prepared in advance. Prior to initiating the activities in their entirety, the following steps must be taken in order for effective delivery:

1. Identify four specific areas in the classroom that can be used for stations (tables and chairs to accommodate five to six students)
2. Organize boxes at each station that hold the materials required for use at each station.
3. In advance, organize your class into four groups; try to include a variety of leveled learners in each group to ensure the successful execution of information at each station.
4. Prepare instruction sheets for each station so that you are not repeating yourself.
5. *Optional:* Prepare role lists (or assign students roles) and expectations at each station for students to follow while participating in each station

## Stations

### Activity #1: Investigate Rocks and Minerals

At this station, students will be equipped with information on the three different types of rocks; sedimentary, metamorphic, and igneous, as well as various minerals. Students will perform a variety of tests on these rocks and minerals and record their results in their investigations booklets. Students will draw the rock, record its name, and characterize it (colour, size, texture). Two tests will be performed on the rocks – hardness and lustre. Hardness will be accomplished by taking the rock and scratching it across the clay tile; a fine line with heavy pressure classifies the rock as hard (granite), and a broad, intense line with pressure will classify the rock as soft (talc). Two of each rock and mineral must be classified, tested and results recorded in the booklet. (Curriculum Expectations met: 2.1, 2.2, 2.3, 2.6, 3.1, 3.2, 3.3, 3.4.)



**Activity #2: Life cycle of an Aluminum Can**

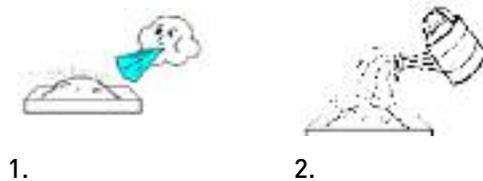
Using the computers, students will investigate the process of recycling by looking at the life cycle of an aluminum can. Students will research what happens at each step from purchase, to use, to disposal, and last – recycling to reproduction. Based on their investigative research, students will work in pairs to create and design story books (approximately five to eight pages) identifying the steps to which aluminum cans are reduced, reused, and recycled. These books will be for the purpose of reading and sharing with the younger primary students in the school. (Curriculum Expectations met: 2.4, 2.6.)

**Activity #3: Erosion**

As a group, students will investigate two different forms of erosion – wind and water. At first, students will collaborate ideas about what wind and water erosion are, and the effects of each.

As a first experiment, students will experiment with wind erosion. By taking a small baking pan, each student will pile a sufficient amount of the soil, clay, and rock mixture to form a small mound in the centre of the baking pan. Students will gently blow at the mound and record their observations. Students should notice that as they blow, the force of the wind created gently moves the soil and clay around the mound and in some cases makes it fall down the sides of the mound, bringing other pieces with it. Observations will be recorded in thorough detail in the investigation booklet.

The subsequent experience will require the same mound of mixture to be spread out to evenly cover the bottom of the baking pan. One end of the pan must then be propped up onto two large books to create an incline. Using the watering can, students will slowly and consistently pour water onto the mixture at the raised end of the pan. Students should notice that the water carries small bits of soil and clay down the pan, leaving revealed or carrying with it, the larger pieces of bare rock. It will be evident that there is less mixture located at the raised end of the pan. Observations must be recorded. (Curriculum Expectations met: 1.1, 2.6.)

**Station #4: Mining**

At this station, as a group or independently, students will read an article about Larry Gibson and how the acres of land surrounding his property have been destroyed by the invasive coal mining companies. It is the job of the students at this station to investigate the costs and benefits of mining on society and the environment. Once they have recorded these pros and cons, students must come up with a way to keep mining as a job market for locals, but also to prevent the amount of land being destroyed.

As an experiment, students will be given a napkin, a few tooth picks and a chocolate chip cookie (Harder cookies work best, or those with rainbow chips. Avoid chewy cookies.). The purpose is to use the toothpicks and mine for the chocolate chips while trying to destroy as little of the surrounding land as possible. Students will observe that it is very

difficult to preserve the land (dough) in order to successfully mine the rocks and minerals (chocolate chips). Students will generate ideas for how they can preserve or help rebuild the land after mining occurs. (1.1, 1.2, 2.1, 2.5)

From:  
<http://sallysbakingaddiction.com>



© Dana Rothstein |  
Dreamstime Stock Photos

### ***Assessment and Evaluation***

As these activities are hands-on and student guided, the majority of the assessment should be done using anecdotal notes about each student's participation at the stations, and their ability to share materials and roles. Another method of evaluation could be done using rating scales both on student participation, as well as the information they obtain at each section and how they present that information. At the completion of all stations, students may be evaluated in formal unit test evaluations to consolidate knowledge.

### ***Notes***

Tracking the progress of all students at each station is essential to ensure that chaos does not commence at the beginning of the subsequent periods. It is also necessary to keep the students informed about the time constraints on each period and to manage working time effectively. The duration of each activity should last approximately two class periods over an eight period time. The remaining two science periods should be used to consolidate the learning as a class and in small groups in preparation for the close of the unit.

### ***References***

Ministry of Education, 2007 *The Ontario Curriculum Elementary Grades 1 to 8 Science and Technology*.

