Igneous Rocks

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Topic Investigating Igneous Rocks

Primary SOL ES.5 The student will investigate and understand the rock cycle as it relates to the origin and transformation of rock types and how to identify common rock types, based on mineral composition and textures. Key concepts include
a) igneous rocks.

Related SOL ES.1 The student will plan and conduct investigations in which
f) current applications are used to reinforce Earth science concepts.

Background Information

There are three main rock types. Each of these rock types forms in its own unique way. In this lesson, students will learn what makes igneous rocks unique. In its most basic definition, an igneous rock is one that has been completely melted and allowed to cool to form a new rock. What further breaks this rock type into smaller categories is the speed in which the rock cooled, if it formed on or below the surface of the Earth, and what it is that makes up the final igneous rock or its composition. Each of these characteristics tells a unique tale of rock formation.

Throughout this lesson, students will identify how igneous rocks form from the cooling of molten rock at or below Earth's surface. Emphasis will be placed on cooling location, cooling time, and the composition of the molten material and how these relate to the type of igneous rock that is formed.

Materials

- One-inch paper squares
- Set of igneous rock samples for each group:
  - Granite
  - Basalt
  - Pumice
  - Obsidian
  - Diorite
  - Andesite
  - Rhyolite
  - Scoria
  - Gabbro
  - Vesicular basalt
- Students' completed Rock Charts (from the "Three Types of Rocks" lesson)
- Igneous Rocks Activities handout (attached)
- Sample Classification Chart for Igneous Rocks (attached)

Vocabulary

andesitic, coarse-grained, composition, extrusive, felsic, fine-grained, intrusive, lava, mafic, magma, texture, vesicular

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Engage the class in an open discussion about rocks and how they think that they form. Once the topic of igneous rocks arises, complete a Know, Want to Know, and Learned (KWL) chart on the topic of igneous rocks. This will help to guide the students' learning on

this type of rock. (Make sure that all of the students complete their own so that each student's needs are met.)

2. Give each student group a set of igneous rock samples, and ask groups to categorize their rocks according to observable characteristics. Instruct groups to be prepared to discuss and defend their classification systems.
3. Allow groups to share their classification systems and defend their choices. Go over the origins of igneous rocks, and have students give some examples. Review the igneous rock information contained in their Rock Charts. Be sure to continue to fill out the KWL chart as you move through new information.
4. After students have defended their classification systems, instruct student groups to classify the igneous rock samples according to classification categories used by geologists—i.e., texture/grain size and composition/color.
5. Distribute copies of the attached Igneous Rocks Activities handout. Instruct students to complete Parts 1–4. Discuss these parts before having students complete Part 5.
6. Go over the assignment with the class, emphasizing key terms and concepts and adding additional notes to it to make a master Classification Chart for Igneous Rocks similar to the attached Sample Classification Chart for Igneous Rocks. Display this chart.
7. Conclude the study of igneous rocks with a lab activity in which students learn to identify unknown igneous rocks by their textures and mineral compositions, emphasizing the story-telling aspect (the origin) of each rock. Number the samples. Have students use Part 5 of the Igneous Rocks Activities handout to fill in information about the samples, allowing them to refer to the master Classification Chart for Igneous Rocks on display. Have students work individually or in small groups to identify the unknowns, using the textures and approximate compositions and the Sample Classification Chart for Igneous Rocks.
8. After all are finished, go over the rock identifications, and answer any questions to reinforce the story-telling aspect of igneous rocks.

Assessment

- **Questions**
  - See Igneous Rock Activities for questions
- **Journal/Writing Prompts**
  - Have students tell each igneous rock's story.
- **Other**
  - Once the students have finished the activity, have them fill in the last section of the KWL chart and have them share with the class. (i.e., What are the three things that you learned about igneous rocks?)

Extensions and Connections (for all students)

- Have students assume the persona of the rock they are describing and tell its story from its point of view.
- In preparation for a quiz or test on igneous rocks, have students review all of their work and refer to their Rock Charts once again.

- Have students complete a WebQuest or another kind of research project on a historically noteworthy volcanic eruption, detailing the types of igneous rocks that formed from the eruption.
- Have the students make a list of where they think they have seen igneous rocks in their daily lives and how they are used. What about the rock type allows them to be used for their particular applications? Why is there not a manmade equivalent for some of these items?

Strategies for Differentiation

- Use different types of candy (e.g., milk chocolate vs. chocolate with nuts vs. chocolate with rice) to demonstrate coarse-grained and fine-grained textures. *(CAUTION! Be aware of students with nut allergies.)*
- Have each student choose a favorite igneous rock, identify it, and explain in a written paragraph how and where it was formed.

Igneous Rocks Activities

Name: _____ **Date:** _____

Pre-Lesson Activity –

1.

KWL Chart

Igneous Rocks

K - know	W - want to know	L - learned

2. Gather in small groups within your classroom. Each group will be responsible for describing what could cause a rock to melt above and below the ground. Write each in a storyboard fashion, describing the steps taken in creating an igneous rock above and below the Earth's surface. Remember that there are no wrong answers in this exercise. At the bottom of your sheets of paper (as a group), make a list of man-made processes that could also create a molten rock.

Time	Number of Cutouts
30 sec.	
60 sec.	
90 sec.	

Part 1: Crystals

You are simulating the growth of crystal grains in an igneous rock. Your goal is to arrange as many cutouts in a repeating pattern as possible within the given time period.

1. Compare the results of the three time periods. For each period of time, write a statement that compares the size of the crystal to the amount of time given to complete the task.

2. The particles of magma are free to move around because the magma is _____ (solid or liquid).

3. When a substance (mineral or rock) becomes solid, the particles _____ (are/are not) free to move around and form crystals.

Part 2: Cooling of the Pies

A baker cooks three pies in an oven. After the pies are done, he turns off the oven and starts to take the pies out of the oven. He takes the first pie out and puts it on the counter. As he is taking the second pie out, he burns his hand and drops the pie into a sink full of cold water. He leaves the third pie in the oven while he takes care of his hand.

1. Which pie will cool the fastest? Explain why.

2. Which pie will take the longest to cool? Explain why.

3. Igneous rocks form by the cooling of molten rock (magma or lava). What is the difference between magma and lava?

4. Apply the "pie story" to the different conditions in which molten rock cools to form igneous rocks. Try to think of a scenario for each pie.
   a. Counter pie

   b. Sink pie

   c. Oven pie

Part 3: Application

Now, let's think about real-life situations.

1. Where would molten rock take the longest time to cool and change to solid—on the Earth's surface, in the water, or in the Earth?

2. Considering your answer to question 1, what can you deduce about the size of the crystal grains formed in this situation?

3. Where would molten rock take the shortest time to cool and change to solid—on the Earth's surface, in the water, or in the Earth?

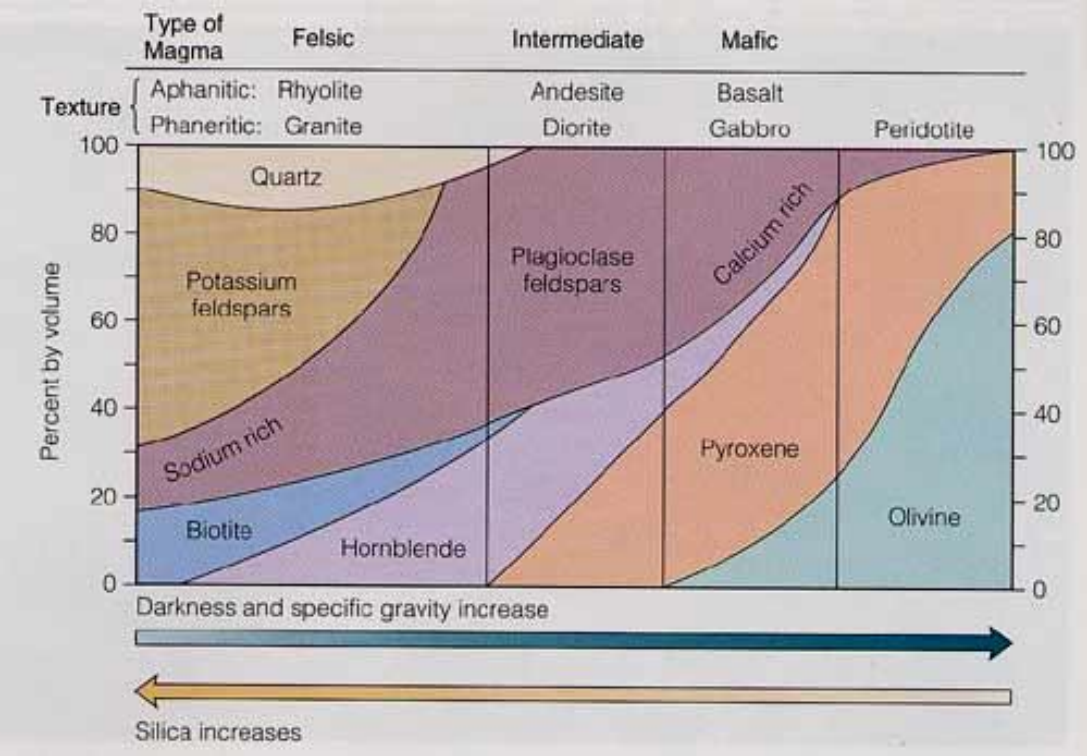
4. Considering your answer to question 3, what can you deduce about the size of the crystal grains formed in this situation?

5. Define the following terms:
   - Intrusive

   - Extrusive

6. Match these terms to the situations in questions 1 and 3.

Part 4: Composition



1. Using the graphic above, list the minerals that make up basalt.

2. What minerals are found in granite?

3. Copy the 0-100% scale on the left of the chart onto the edge of a piece of paper. Use your scale to read the percent of each mineral that is found in granite. List the percentages on the graphic above next to the mineral names.

4. What two types of plagioclase feldspars are shown on the diagram?

5. What type of magma creates granite and rhyolite?

6. What type of magma creates gabbro and basalt?

Part 5: Identification

Complete the following table, using the kit of rock samples.

Sample Number	Crystal Size Fine = F Coarse = C	Location Intrusive = I Extrusive = E	Color Light = L Dark = D	Magma Felsic = F Mafic = M	Rock Name
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sample Classification Chart for Igneous Rocks

Name: _____ **Date:** _____

Cooling	Textures	Mineral Composition		
		Mostly Light	50/50	Mostly Dark