

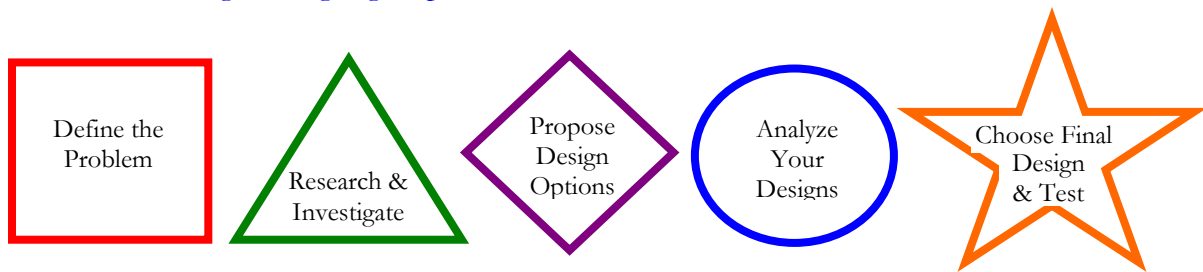
***Volcano Alert***  
**Grades 6-8 Earth Science**

**Summary:**

*Volcano Alert* is a 10-lesson, 500-600 minute long middle school earth science curricular unit. Motivated by the impending volcanic eruption of Mt. Gunnarupt, student teams are tasked with assessing the potential threat of a volcano to surrounding towns, and designing an early warning system and an evacuation plan for the thousands of people who live near Mt. Gunnarupt. Students will complete numerous hands-on, inquiry-based lessons to learn the requisite material: volcano types, volcano structure, lava composition and flow, volcanic reactions, gas pressure and topography. Student teams will build a model volcano, simulate volcanic explosions and lahar flows, and design a sensor network and evacuation plan. Unit lessons and activities are strongly aligned with national and state earth science, inquiry and technology standards.

**Engineering Design Process Components:**

Your students will use the five-component Engineering Design Process throughout this curriculum unit. The symbols below are shown throughout this guide and the student worksheets to highlight the design process component(s) of each lesson and activity. A helpful overview of the Engineering Design Process is provided at [www.AdventureEngineering.org/edp](http://www.AdventureEngineering.org/edp).



<b>Lessons</b>	<b>Time Required (min)</b>
1. What's the Problem?.....	45
2. Volcano Video and Questions .....	45
3. Ring of Fire .....	45
4. What Kind of Volcano? .....	45
5. Boom .....	45
6. Velocity and Viscosity .....	90
7. Build a Model Volcano.....	90
8. Hazard Analysis.....	45
9. Save the Townspeople!.....	45
10. Early Warning System Design.....	45

**Educational Standards Met:**

Volcano Alert is aligned with the following national and Colorado standards:

National Science Education Standards

- Unifying concepts and processes: evidence, models, and explanation; change, constancy and measurement
- Science as inquiry: identify questions that can be answered through scientific investigations; design and conduct a scientific investigation; use appropriate tools and techniques to gather, analyze, and interpret data; develop descriptions, explanations, and models using evidence; think critically and logically to make the relationships between evidence and explanations; recognize and analyze alternative explanations and

- predictions; use mathematics in all aspects of scientific inquiry
- Earth and space science: structure of the earth system, earth’s history
- Science and technology: abilities of technological design; understanding about science and technology
- Science in personal and social perspectives: populations, resources and environments; natural hazards; risks and benefits; science and technology in society
- History and nature of science: science as a human endeavor; nature of science.

Colorado Model Content Standards for Science

- 1: Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations
- 4.1: Students know and understand the composition of Earth, its history, and the natural processes that shape it
  - Describing natural processes that change Earth’s surface, e.g., mountain building, volcanic activity (grades k-4)
  - Recognizing that humans are affected by natural events, e.g., earthquakes, volcanoes, floods (grades k-4)
  - Explaining how minerals, rocks and soils form (grades 5-8)
  - Modeling natural processes that shape Earth’s surface, e.g., weathering, erosion, mountain building, volcanic activity (grades 5-8)
  - Explaining the distribution and causes of natural events, e.g., earthquakes, volcanoes, landslides (grades 5-8)
  - Describing the composition and structure of Earth’s interior (grades 9-12)
  - Using the theory of plate tectonics to explain the relationship among earthquakes, volcanoes, mid-ocean ridges and deep-sea trenches (grades 9-12)
  - Evaluating the feasibility of predicting and controlling natural events (grades 9-12)
- 5: Students know and understand interrelationships among science, technology, and human activity and how they affect the world.
- 6: Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines

**Student Handouts:**

✓ Student Worksheets .....	<b>Lesson:</b> (1-10)
✓ Memo .....	(1)
✓ News Skit (optional).....	(1)
✓ Ring of Fire Map .....	(3)
✓ Volcano Basics Briefing.....	(4)
✓ Mt. Gunnarupt Topography Map .....	(7)
✓ Mt. Gunnarupt Volcanic Hazards Map.....	(8)
✓ Hazard Analysis for Town B .....	(8)

**Materials List: (these materials are needed in addition to the materials provided in the Volcano Alert kit, 1 per group):**

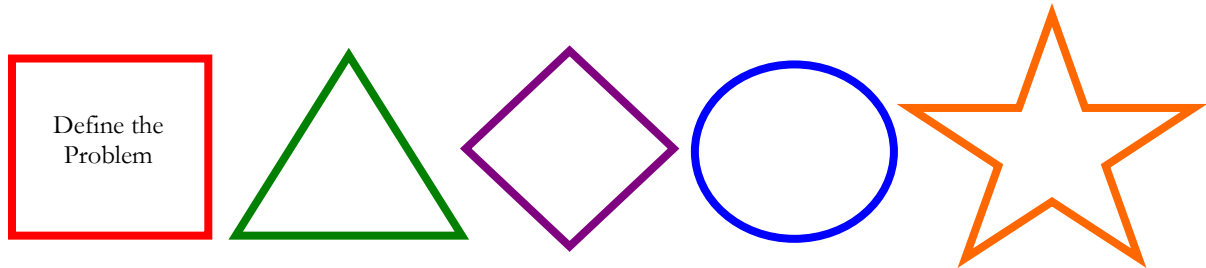
✓ Cutting tool (heavy duty scissors, razorblade, or box knife), Cardboard (2 medium-sized boxes per volcano), drywall joint compound.....	<b>Lesson:</b> (4)
✓ 1 pair goggles per person, paper towels .....	(5)
✓ calculators (optional), paper towels .....	(6)

## LESSON 1: What's the Problem?

Lesson Time: 45 minutes

Summary: Students will read the Urgent Memorandum to understand the engineering design problem they are being asked to tackle. Student teams are formed and team names are decided upon. Teams will then discuss and answer the questions provided in the **What's The Problem?** worksheet.

Engineering Design Process Components:



Pre-Requisite Knowledge: grade-level reading ability.

Learning Objectives:

Upon completion of this lesson, students will learn to:

1. read, understand and define a problem
2. hypothesize, through group discussion, about the important issues of this design problem.

Introduction/Motivation: The memorandum provides student teams (acting as engineering consulting firms) with their objective.

Lesson Background & Concepts for Teacher: Basic information about volcanoes and the potential damage lahar flows can cause is provided within the news skit.

Materials List: 3 handouts (Urgent Memorandum, What's the Problem?, News Skit-optional)

Procedure:

- a) Divide your class into teams of students and distribute the handouts. Three to four students per team works well; however, you may use smaller groups if you feel it is better for your class. We recommend that you provide all handouts to each student in a booklet.  
TIP: Encourage all students to get involved by assigning team roles. You might assign a discussion leader, time keeper for questions, and a scribe or recorder.
- b) Ask students to work as a group and come up with a name for their engineering team. You might want to give them a time limit to accomplish this.
- c) Read the Memo to the class, have a student read it to the class or have each student read it to themselves.
- d) Have each student team discuss and record answers to the **What's the Problem?** worksheet questions. Have each team report their answers to the class if time permits. This "idea sharing" helps get the class involved.

TIP: You might moderate this activity by having the teams report back after each question or give students a time limit per question. After the time limit, call on teams to give their answers to the entire class.

Assessment: Quiz students on the Urgent Memorandum and the information given in the News Skit and grade the “What’s the Problem?” worksheet.

Lesson Extension Activities:

1. Have the students think about how long it takes to evacuate all the people at school during a fire drill.
2. Have the students do an Internet search on Mount Rainier or Mount Hood, or for volcanic eruptions over the past 10 years.

Teacher Notes: