

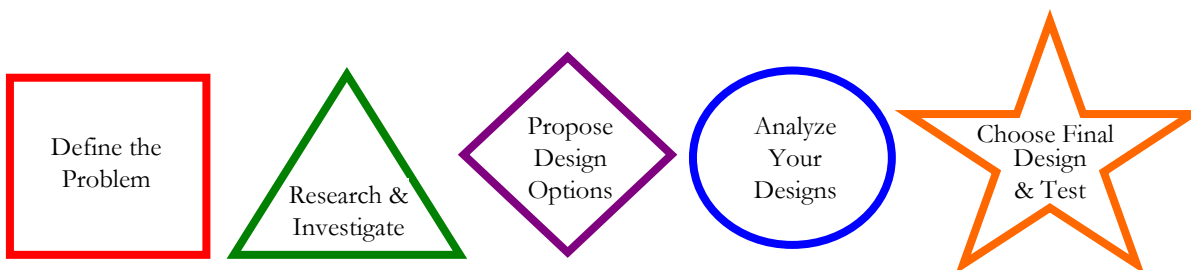
***Asteroid Impact***  
**Grades 6-8 Earth Science**

**Summary:**

*Asteroid Impact* is an 8-lesson, 450-550 minute long earth science curricular unit where student teams are posed with the scenario that an asteroid will impact earth. They must develop an engineering design solution that includes the location and size of underground caverns to save the people from the un-inhabitable earth surface for one year. Driven by this scenario, student teams (1) explore general and geological maps, (2) determine the area of their classroom to help determine the cavern size required, (3) learn about map scales, (4) test and classify rocks, (5) identify important and not-so-important rock properties for underground caverns, and (6) choose a final location and size. The team-based unit involves extensive critical thinking, data analysis and problem solving. The unit also reinforces a number of math, reading and writing 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. How Big? .....                       | 90                         |
| 3. Scaling the Map .....                | 45                         |
| 4. Possible Locations .....             | 45                         |
| 5. Rocks, Rocks, Rocks .....            | 135                        |
| 6. Ranking the Rocks .....              | 45                         |
| 7. Drum Roll Please! .....              | 45                         |
| 8. Testing the Caverns (Optional) ..... | 45                         |

**Educational Standards Aligned:**

Asteroid Impact is aligned with the following National 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.

National Council of Teachers of Mathematics Standards:

- Numbers and Operations: Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Numbers and Operations: Compute fluently and make reasonable estimates
- Geometry: Specify locations and describe spatial relationships using coordinate geometry and other representational systems
- Measurement: Understand measurable attributes of objects and the units, systems, and processes of measurement
- Measurement: Apply appropriate techniques, tools, and formulas to determine measurements
- Communication: Communicate their mathematical thinking coherently and clearly to peers, teachers and others

Accordingly, the Asteroid Impact unit is also aligned strongly with state science and math standards. For example, the unit is aligned with the following 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 different types and uses of earth materials, e.g., rocks, soil, minerals (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)
  - Evaluating the feasibility of predicting and controlling natural events, e.g., earthquakes, floods, landslides (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:**

- Presidents Memo
- CRFAO Briefing
- General Map
- Geology Map
- Student Worksheets

**Kit Materials:**

The following materials are included in the Asteroid Impact kit:

- Teacher's binder that includes (all in color): complete teacher's guide, blank student worksheets, answers to student worksheets, CRFAO Asteroid Briefing (literacy piece), General map, Geology map, President's memo.
- 8 laminated General Maps
- 8 laminated Geology Maps
- 24 inch by 36 inch classroom Alabraska map
- 8 numbered and labeled rock testing kits with the following components: container, dropper, steel plate, steel nail, glass tile, penny, quartz crystal, hand lens, obsidian, limestone, gneiss, basalt, sandstone, slate, pumice, granite
- Two extra samples of each rock type

The following items needed to complete Asteroid Impact are not provided (you will need one of each per team):

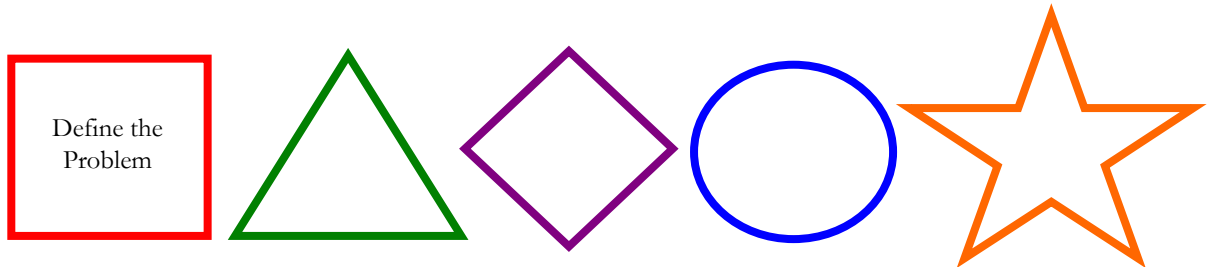
- cm-scale ruler
- scissors
- meter stick
- 250-ml beaker for water
- vinegar

**LESSON 1: WHAT'S THE PROBLEM?**

Lesson Time: 45 minutes

Summary: Lesson 1 introduces the Asteroid Impact unit. Students will read the President's memo to receive their 'marching orders'. Student teams are then formed and are given the student packet that includes worksheets and maps. Each team should become familiar with the maps and complete Worksheet One as a group.

Engineering Design Process Components:



Pre-Requisite Knowledge: Sixth grade reading level

Learning Objectives: Students will learn to:

1. Brainstorm, voice and write down potential solutions and questions
2. Read, understand and identify a problem
3. Hypothesize, through group discussion, what information might be required to solve the problem
4. understand general and geological maps - reading a legend and using a map scale to determine distances

Introduction/Motivation: Students are called by the President to design underground caverns to save people from an asteroid impact. The motivation is provided in the President's Memo.

Lesson Background & Concepts for Teacher: Basic information about asteroids (and additional web links) is provided in the CRFAO Briefing.

Materials List: President's Memo, What's the Problem? handout, General Map, Geology Map

Procedure:

- a) To grab the students attention, try watching the Discovery Channel DVD titled *Hyperspace* (contact AE for more info), or simulate the destruction caused by an asteroid by dropping a golf ball into a bucket of flour, or is possible, a bowling ball into a tub of sand.
- b) Divide your class into teams of students. Three to four students per team seems to be to work well; however, you may use smaller groups if you feel it is better for your class.  
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.
- c) 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.
- d) Read the President's Memo to the class, have a student read it to the class, or have each student read it to themselves. If the latter, please hand out a copy of the President's Memo to each student.
- e) Hand out the What's the Problem worksheet (one page), General Map and Geology Map to each

student. You may want to hand out the entire student workbook.

- f) Have each student team discuss and record answers to the questions in the What's the Problem worksheet. Have each team report their answers to the class if time permits. This "idea sharing" helps get the class involved.

TIP: Moderate this activity by having the teams report back after each question or at the end.

- g) Optional: As homework assign each student the task of measure the dimensions (length, width, and height) of his or her bedroom. This activity will help make lesson two go more smoothly.

Assessment: Grade What's the Problem worksheet; quiz students on the President's Memo. If assigned grade the homework assignment when it is turned in.

Lesson Extension Activities: Students should read the CRFAO briefing and:

- a. Look up one of the internet websites and write a report
- b. Construct a model of the solar system with an asteroid belt
- c. Write a paragraph about the importance of studying asteroids

Teacher Notes: