



Impact Study

Prep Time: 10 minutes

Grades: 6-8

Lesson Time: 50-60 minutes

Essential Questions:

- What kind of damage could Near-Earth Objects (NEOs) inflict on Earth?
- How does the size of NEOs affect the severity of damage?

Objectives:

- Model through an impact study how larger objects with more mass would cause more damage.
- Display that smaller objects would either burn up or not cause a lot of damage.

Standards:

- MS-ESS1-3- Analyze and interpret data to determine scale properties of objects in the solar system.
- MS-ESS3-2- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- RST.6-8.7 - Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

Teacher Prep:

- Materials (explore portion): 100-piece puzzle, live video projector (if available).
- Materials (explain portion): bins about the size of a shoe box, sand, water, small assorted objects, pen/pencil, ruler/tape measure, scale.
- Materials (elaborate portion): clay, play dough, etc. to build Earth protection models, pen/pencil, paper.

Teacher Notes/Background:

- 71% of the Earth's surface is covered with water.
- Only 3% of Earth's land area is inhabited by humans.
- Rocks smaller than 25 m would likely burn up as they enter the atmosphere.
- Larger would cause damage to local impact area.
- 1-2km would cause worldwide damage.
- Small asteroids can destroy a large city.

Impact Study

Engage (5 minutes)	<p>Turn and Talk:</p> <ul style="list-style-type: none"> • Students should discuss in groups the following questions: • How big do you think a meteorite would have to be to destroy a city? Cause a tsunami? Cause worldwide damage? • Do you think an impact from a meteorite could cause mass extinction? How would it do that? 	<p>Materials: N/A</p>
Explore (10 minutes)	<p>Puzzle Demonstration:</p> <ul style="list-style-type: none"> • Put together a 100-piece puzzle ahead of time (if time permits, students could put it together themselves) • Ask students how much of the Earth is covered in water. • Invite individual students to come remove a piece or multiple pieces of the puzzle and put them to the side. Do this until you have removed 29 pieces. • Show students what your puzzle looks like now. Explain that 71% of the Earth is covered with water, so what is the probability that a NEO would hit the land area? • Next, gather the 29 pieces that you removed together. Ask the students how much of the land surface they think humans inhabit. • Invite a student to come up and remove one piece of the group. Explain that only about 3% of the land surface of the Earth is inhabited by human impact (3% of 29 is .87 so explain that it is about 1 piece of the 29 pieces). • Explain that this model represents that the odds of a NEO hitting an area with human civilization is very slim. 	<p>Materials:</p> <ul style="list-style-type: none"> • 100 piece puzzle • Live video projector
Explain (20 minutes)	<p>Impact Study:</p> <ul style="list-style-type: none"> • Set up stations with 2 bins about the size of a shoe box. One should be filled half way with water, the other with sand. • Have student collect different sizes of rocks or small objects from outside or around the classroom. • Measure and weigh the objects before you begin conducting the experiment. • Drop the objects into the sand from the same height. Measure the crater that is created. Record the data. • Repeat this process for the water but observe how big the splash and ripples are. Record the data. • Drop the objects in both bins from different heights. How did this affect the craters/splashes? Record the data. • Students can repeat this process several times to collect different data sets. 	<p>Materials:</p> <ul style="list-style-type: none"> • Bins about the size of a shoe box • Sand • Water • Small assorted objects • Ruler or tape measure • Scale

Impact Study

Extensions and Enrichment:

- Try different types of materials to drop the NEOs in (gravel, dirt, flour, etc.) If a NEO hit different terrains on Earth would it have a different effect?
- Students can pick a known impact on Earth and do a study on what damage it caused, where it came from, what the rock was made of, etc. The link for that information is attached in the additional resources section.

Additional Resources:

- <https://www.nasa.gov/planetarydefense/faq>
- <https://cneos.jpl.nasa.gov/>