

Shake It Up:

Engineering Dams for Earthquakes



🔥 **Grade Levels:** 5, 8, 9-12

- **5th grade**
Science 2.2.b
- **8th grade**
SEEd 8.4.5
- **9th-12th**
Earth Science 5.3.a

🔥 **Active Time:** 2 hours

🔥 **Wait Time:** 6+ hours

🔥 **Skills:**

Observing
Predicting
Experimenting
Formulating Models

Introduction

The water stored in Utah's reservoirs is an important resource, but what happens to it during an earthquake? In this activity, students will learn what is involved in designing and building seismically-safe dams. Next, they will test their knowledge by building a model dam and running it through a simulated earthquake.

Phase 1: What is a Dam?

In order to construct a model dam that can withstand an earthquake, it is important to learn: 1) why dams are built and 2) about the different types and parts of a dam. This activity teaches students how dams function from the point-of-view of engineers, operators, and scientists.

Time: 15 minutes

Materials: Computer and projector
What is a Dam presentation
How Dams Work presentation
Dam Design worksheet

Instructions:

- 🔥 Welcome students and introduce activity.
- 🔥 Ask students what they think a dam is.
- 🔥 Watch the What is a Dam presentation and discuss.
- 🔥 Pass out Dam Design worksheet.
- 🔥 Encourage students to take notes as they watch How a Dam Works presentation; then discuss what has been learned so far.

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Phase 2: Designing and Building a Dam

During this portion of the activity, students will use the knowledge gained in Phase 1 to construct the framework for a model dam.

- Time:** 1 Hour
- Materials:** Dam Design worksheet
Dam Design templates
Disposable aluminum foil roasting pans
Aluminum foil
Hot glue gun
Cardboard
Scissors
Plaster of paris
Paper cups
Spoons



Instructions:

- 💧 Divide students into groups of 3 to 5 individuals.
- 💧 Have each group design a dam using the Dam Design worksheet.
- 💧 Pass out aluminum foil roasting pans, scissors, strip of aluminum foil and cardboard.
- 💧 Using the hot glue, attach the strip of aluminum foil to the roasting pan. Pay particular attention to securing the foil to the bottom and sides of the pan.
- 💧 Have students create a framework for their model dams.
- 💧 Mix plaster of paris and put it into paper cups. (Limit the number of cups for each group. This will encourage students to use their resources wisely. For most groups, three (8 oz.) cups of plaster of paris should be enough.)
- 💧 Have students apply plaster of paris to the framework of their model dams.

Phase 3: Cure Time

In order for a model dam to work properly, it needs to dry and cure. Allow at least 6 hours for this to happen.

Special Note: *If you are working in a cold or humid environment, the model may take as long as 2 weeks to fully dry.*

- Time:** 6+ Hours
- Materials:** Oil-based Spray Paint

Instructions:

- 💧 Place the finished dams in a warm, dry location where they will be left undisturbed.
- 💧 Allow plaster of paris to cure for at least 6 hours.
- 💧 After curing and at least 1 hour before testing, spray model dams with a layer of oil-based spray paint. This will stop water from absorbing into the plaster and prevent the dams from leaking.

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Phase 4: Testing the Dam

While it's fun to build a model dam from scratch, it's even more exciting to see if the structure can survive a disaster. In this part of the activity, students will test their model dams to see if they can hold water. Next, they will see if their dams can withstand a simulated earthquake.

Time:	30 minutes
Materials:	Dam Observation worksheet Earthquake simulator Computer and projector Maintaining Dam Safety presentation

Instructions:

- Pass out the Dam Observation worksheet.
- Place a cured and waterproofed model dam on a flat surface.
- Pour 2 to 4 cups of water behind the model dam.
- Let the dam sit for about 5 minutes. Pay particular attention to the bottom and sides of the dam. Are there signs of seepage, leaking, or other indications of water moving through the dam?
- If the dam survives the initial water test, place it on an earthquake simulator and shake for 30 seconds.
- If the dam survives the earthquake test, return to a flat surface and make additional observations to determine if the dam is still watertight.
- After testing the dams, discuss the results. If one or more dams failed, try to identify when the failure occurred and have the students discuss why they thought it happened.
- Watch the Maintaining Dam Safety presentation to learn how dams are built to be seismically safe.
- End with a discussion about what has been learned. Take time to emphasizing the difference between actual risks versus perceived risks.

Additional Resources

For more information about dams and dam safety, check out the following links:

- Central Utah Water Conservancy District: <http://www.cuwcd.com/>
- US Bureau of Reclamation, Upper Stillwater Dam: <https://www.usbr.gov/projects/index.php?id=257>
- Association of Dam Safety, Kid Center: <https://damsafety.org/kids>
- National Dam Safety Program: <https://www.fema.gov/national-dam-safety-program>
- PBS Kids, Build a Dam: <http://pbskids.org/zoom/activities/sci/buildadam.html>
- TeachEngineering, Dam Forces: https://www.teachengineering.org/activities/view/cub_dams_lesson02_activity1