Exploring Earthquakes

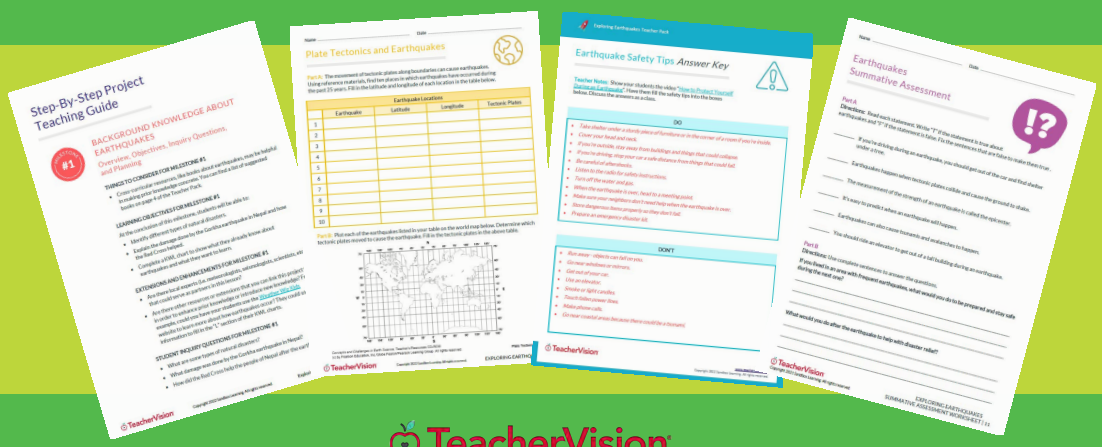
Build an Earthquake-Proof House

Science Project-Based Learning Grades 6–8

Explore Plate Tectonics

Apply Research and Design

Build an Earthquake-Proof House



TeacherVision

Lesson Plan:
Exploring Earthquakes

ABOUT THIS PROJECT-BASED LESSON

This project-based learning unit is designed to teach and reinforce the concepts in a grades 6-8 Science unit on Earthquakes and can be used in conjunction with existing curriculum materials.

The project is divided into 5 Milestones; each Milestone includes a self-contained student project activity. Done in sequence, the Milestones connect to enable students to produce a comprehensive capstone activity.

The minimum suggested duration for completing this project is 5 class periods. However, it is completely flexible and can be lengthened or shortened as necessary, based on available class time and interest level.

HOW TO USE THIS TEACHING GUIDE

Each Milestone for this project-based learning unit includes detailed daily activities presented in step-by-step order, with teaching notes, instructional guidance, and page references to resources and materials included in the Teacher Pack and Student Pack.

Daily activities are organized for you as follows:

- **Prepare (Bell-ringer/opener activity)**

  Use these short opening activities at the beginning of class.

- **Present (Lecture/model)**

  Use this portion of the lesson to deliver new subject material and project information, and to model any instructions or activity required for Produce or Participate elements.

- **Produce (Student project work)**

  Use this portion of the lesson to allow students to work independently or in small groups on activities and other project elements.

- **Participate (Student/group share)**

  Use this portion of the lesson to allow students to share out any project, research, or presentation materials.

- **Practice (Homework/assessment/independent)**

  Use this optional portion of the lesson, if desired, to give students homework activities.

Step-By-Step Project Teaching Guide

BACKGROUND KNOWLEDGE ABOUT EARTHQUAKES

Overview, Objectives, Inquiry Questions, and Planning

THINGS TO CONSIDER FOR MILESTONE #1

- Cross-curricular resources, like books about earthquakes, may be helpful in making prior knowledge concrete. You can find a list of suggested books on page 4 of the Teacher Pack.

LEARNING OBJECTIVES FOR MILESTONE #1

At the conclusion of this milestone, students will be able to:

- Identify different types of natural disasters.
- Explain the damage done by the Gorkha earthquake in Nepal and how the Red Cross helped.
- Complete a KWL chart to show what they already know about earthquakes and what they want to learn.

EXTENSIONS AND ENHANCEMENTS FOR MILESTONE #1

- Are there local experts (i.e. meteorologists, seismologists, scientists, etc.) that could serve as partners in this lesson?
- Are there other resources or extensions that you can link this project to in order to enhance prior knowledge or introduce new knowledge? For example, could you have your students use the Weather Wiz Kids website to learn more about how earthquakes occur? They could use the information to fill in the "L" section of their KWL charts.

STUDENT INQUIRY QUESTIONS FOR MILESTONE #1

- What are some types of natural disasters?
- What damage was done by the Gorkha earthquake in Nepal?
- How did the Red Cross help the people of Nepal after the earthquake?

- What do you already know about earthquakes?
- What is one thing you want to learn about earthquakes? Why do you want to learn that?

ASSESSMENT FOR MILESTONE #1

- **Formative Assessment for Individual Activity**: Check each student's "KWL Chart" on page 3 of the Student Pack.
- **Formative Assessment for Group Activity:** Have each group share one thing they all knew about earthquakes and one thing they would all like to learn.
- **Summative Assessment:** Have the students complete the response printable on page 4 of the Student Pack for the Inquiry Question, "What is one thing you want to learn about earthquakes? Why do you want to learn that?"

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Project Activities for Milestone #1: Background Knowledge About Earthquakes

PREPARE (Bell-ringer/opener activity)

Have the students turn and talk about types of natural disasters. Call on students to share their answers. Tell the students that there's nothing we can do to stop these natural disasters, but we can be prepared for them and learn ways to stay safe. Tell the students that in this unit, they'll learn about earthquakes.

PRESENT (Lecture/model)

Show students this video on the disaster recovery efforts undertaken by the International Federation of the Red Cross in the aftermath of the Gorkha earthquake in Nepal in 2015. Discuss the destruction caused by the earthquake and how the Red Cross helped.

PARTICIPATE (student/group share, group activity)

Distribute the "Earthquakes K-W-L Chart" on page 3 of the Student Pack and have the students write about what they already know about earthquakes and what they would like to learn about them in the "K" and "W" sections of the organizer.

Put the students into groups of 3 or 4. Have the students share the ideas on their K-W-L charts. They can add new ideas that their group members share to their own organizers.

Formative Assessment: Have each group share one thing they all knew about earthquakes and one thing they would all like to learn.

PRACTICE (Homework/independent work/extensions)

Give each student the writing response template on page 4 of the Student Pack and ask them to write an answer to the inquiry question for this Milestone: "What is one thing you want to learn about earthquakes? Why do you want to learn that?"

ASSESSMENT

Formative Assessment for Individual Activity: Check each student's "KWL Chart" on page 3 of the Student Pack.

Formative Assessment for Group Activity: Have each group share one thing they all knew about earthquakes and one thing they would all like to learn.

Summative Assessment: Have the students complete the response printable on page 4 of the Student Pack for the Inquiry Question, "What is one thing you want to learn about earthquakes? Why do you want to learn that?"

EARTHQUAKE RESEARCH

Overview, Objectives, Inquiry Questions, and Planning

THINGS TO CONSIDER FOR MILESTONE #2

- If your students haven't done a lot of research, you can use the "How to Do Good Research" printable on page 5 of the Student Pack to review good research skills.

LEARNING OBJECTIVES FOR MILESTONE #2

At the conclusion of this milestone, students will be able to:

- Match earthquakes with their magnitudes.
- Research an earthquake to learn important facts about it.
- Compare and contrast earthquake information.

EXTENSIONS AND ENHANCEMENTS FOR MILESTONE #2

- Could you have your students identify the locations of some of the strongest earthquakes on a map? Give them the "Plate Tectonics and Earthquakes" printable on page 6 of the Student Pack and have them complete the activities.

STUDENT INQUIRY QUESTIONS FOR MILESTONE #2

- What were some of the strongest earthquakes' magnitudes?
- How can I research an earthquake to learn important information about it?
- What is one way the earthquake you researched is like the Gorkha earthquake? What is one way the two earthquakes are different?

ASSESSMENT FOR MILESTONE #2

- **Formative Assessment for Individual Activity**: Check each student's "Earthquake Magnitude Matching" printable on page 7 of the Student Pack. Use the "Earthquake Magnitude Matching Answer Key" on page 5 of the Teacher Pack to check the answers.
- **Formative Assessment for Group Activity:** Have the students share the most interesting facts they learned about the earthquakes they researched.
- **Summative Assessment:** Have the students complete the response printable on page 9 of the Student Pack for the Inquiry Question, "What is one way the earthquake you researched is like the Gorkha earthquake? What is one way the two earthquakes are different?"

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Project Activities for Milestone #2: Earthquake Research

PREPARE (Bell-ringer/opener activity)

Give the students the "Earthquake Magnitude Matching" printable on page 7 of the Student Pack. Allow them to use the Australian Geographic website to learn about the strongest earthquakes in history and to match them with their magnitudes. Use the "Earthquake Magnitude Matching Answer Key" on page 5 of the Teacher Pack to check their answers. Tell the students that the Gorkha earthquake in the Milestone 1 video isn't even on this top 10 list, but it still caused significant damage.

PRESENT (Lecture/model)

Tell the students that they are going to research an earthquake to learn more about where these natural disasters usually occur and how much damage they can do. Model filling out the "Earthquake Research" printable on page 8 with information about the Gorkha earthquake in Nepal. Show the students how to use books and websites, like Wikipedia, Science Direct, and Britannica to gather facts about the Gorkha earthquake. You can show them the "Sample Earthquake Research" printable on page 6 of the Teacher Pack as an example.

PARTICIPATE (Student/group share, group activity)

Have the students use the "Wikipedia Lists of Earthquakes" to choose an earthquake to research.

As the students select their earthquake, give them the "Earthquake Research" printable on page 8 of the Student Pack. You may want to have each student research a different earthquake. Have them use the books you gathered about earthquakes and the Internet to fill in the information on the chart.

As the students finish their research, have them meet with a partner. They should share the facts they found and look for ways the two earthquakes were the same and different.

Formative Assessment: Have the students share the most interesting facts they learned about the earthquakes they researched.

PRACTICE (Homework/independent work/extensions)

Give each student the writing response template on page 9 of the Student Pack and ask them to write an answer to the inquiry question for this Milestone: "What is one way the earthquake you researched is like the Gorkha earthquake? What is one way the two earthquakes are different?" (You may want to display the "Sample Earthquake Research" printable and allow the students to use their own research chart to answer this question.)

ASSESSMENT

Formative Assessment for Individual Activity: Check each student's "Earthquake Magnitude Matching" printable on page 7 of the Student Pack. Use the "Earthquake Magnitude Matching Answer Key" on page 5 of the Teacher Pack to check the answers.

Formative Assessment for Group Activity: Have the students share the most interesting facts they learned about the earthquakes they researched.

Summative Assessment: Have the students complete the response printable on page 9 of the Student Pack for the Inquiry Question, "What is one way the earthquake you researched is like the Gorkha earthquake? What is one way the two earthquakes are different?"

DESIGNING EARTHQUAKE-PROOF HOUSES

Overview, Objectives, Inquiry Questions, and Planning

THINGS TO CONSIDER FOR MILESTONE #3

- Your students will need cardboard boxes, playing cards, and other materials for the "Practice" activity and to build their model houses. You can find a complete list of materials on page 3 of the Teacher Pack.

LEARNING OBJECTIVES FOR MILESTONE #3

At the conclusion of this milestone, students will be able to:

- Conduct experiments to determine how building materials and locations impact a building's damage-level during an earthquake.
- Explain how scientists are designing earthquake-proof buildings.
- Apply what they learned in the experiments and video to design their own earthquake-proof houses.
- Explain whether or not the house they live in would survive an earthquake.

EXTENSIONS AND ENHANCEMENTS FOR MILESTONE #3

- Could you have your students play the "Stop Disasters" game to learn about how to prepare a city for an earthquake? They will construct buildings, like hospitals, and build strong structures to try to keep the earthquake from causing too much damage. Have the students select "Earthquake" on the first screen.

STUDENT INQUIRY QUESTIONS FOR MILESTONE #3

- What building materials and locations are the best to help a building survive an earthquake?
- How are scientists designing earthquake-proof buildings?
- How can you design your own earthquake-proof house?
- Do you think the house you live in would survive an earthquake? Why or why not?

ASSESSMENT FOR MILESTONE #3

- **Formative Assessment for Individual Activity**: Check each student's "Earthquake-Proof House Planner" printable on page 12 of the Student Pack.

- **Formative Assessment for Group Activity:** Talk with each student about their design plans and the materials they will use to make their models.
- **Summative Assessment:** Have the students complete the response printable on page 14 of the Student Pack for the Inquiry Question, "Do you think the house you live in would survive an earthquake? Why or why not?"
- **Summative Assessment:** Have the students complete the "Earthquakes Quick Quiz" on page 7 of the Teacher Pack. Use the "Earthquakes Quick Quiz Answer Key" on page 8 of the Teacher Pack to correct the quizzes prior to starting Milestone #4.

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Project Activities for Milestone #3: Designing Earthquake-Proof Houses

PREPARE (Bell-ringer/opener activity)

Give the students the "Earthquake!" printable on page 10 of the Student Pack. Read about the San Francisco earthquake together. Have the students work with a partner to try the experiments and see the effects of an earthquake.

PRESENT (Lecture/model)

Tell the students that the "Prepare" activity showed them how different types of buildings and different types of land affect the damage done by an earthquake. Explain that in this milestone they will build a house for themselves that will stand up well to earthquakes. Give them "The Future of Earthquake-Proof Buildings" printable on page 11 of the Student Pack. Show them the video "The Future of Earthquake-Proof Buildings". Have them take notes about three different ways architects are keeping buildings safe from earthquakes.

PARTICIPATE (Student/group share, group activity)

Give the students the "Earthquake-Proof House Planner" on page 12 of the Student Pack. Show them all the supplies they will have available to create a model of their house. Have them use what they learned in the experiments and in the video to answer the questions. Then, give them the "Earthquake-Proof House Design" printable on page 13 of the Student Pack to sketch their house and label the materials they will use for each part. Tell them they will build the model of their house in Milestone 4.

Formative Assessment: Talk with each student about their design plans and the materials they will use to make their models.

PRACTICE (Homework/independent work/extensions)

Give each student the writing response template on page 14 of the Student Pack and ask them to write an answer to the inquiry question for this Milestone: "Do you think the house you live in would survive an earthquake? Why or why not?"

ASSESSMENT

Formative Assessment for Individual Activity: Check each student's "Earthquake-Proof House Planner" printable on page 12 of the Student Pack.

Formative Assessment for Group Activity: Talk with each student about their design plans and the materials they will use to make their models.

Summative Assessment: Have the students complete the response printable on page 14 of the Student Pack for the Inquiry Question, "Do you think the house you live in would survive an earthquake? Why or why not?"

Summative Assessment: Have the students complete the "Earthquakes Quick Quiz" on page 7 of the Teacher Pack. Use the "Earthquakes Quick Quiz Answer Key" on page 8 of the Teacher Pack to correct the quizzes prior to starting Milestone #4.

EARTHQUAKE-PROOF HOUSE MODELS

Overview, Objectives, Inquiry Questions, and Planning

THINGS TO CONSIDER FOR MILESTONE #4

- Your students will need some art supplies to make their projects in this milestone. Look on page 4 of the Teacher Pack for a full list of suggested materials.

LEARNING OBJECTIVES FOR MILESTONE #4

At the conclusion of this milestone, students will be able to:

- Explain ways to stay safe during an emergency at school.
- Explain how to stay safe during an earthquake.
- Build a model of their earthquake-proof house.

EXTENSIONS AND ENHANCEMENTS FOR MILESTONE #4

- Could you have the students participate in disaster relief by playing "Fidgets to the Rescue"? Have them choose "Earthquake" as the natural disaster. Then, they should try to get emergency supplies to the places affected by the earthquake.

STUDENT INQUIRY QUESTIONS FOR MILESTONE #4

- How would you stay safe during an emergency at school?
- How can you build an earthquake-proof house?
- How would you stay safe during an earthquake? Tell at least 3 things you would do.

ASSESSMENT FOR MILESTONE #4

- **Formative Assessment for Individual Activity**: Check each student's "Earthquake Safety Tips" printable on page 15 of the Student Pack. Use the "Earthquake Safety Tips Answer Key" on page 9 of the Teacher Pack to check their answers.
- **Formative Assessment for Group Activity:** Meet with the students and discuss their plans for the project.
- **Summative Assessment:** Have the students complete the response printable on page 16 of the Student Pack for the Inquiry Question, "How would you stay safe during an earthquake? Tell at least 3 things you would do."

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Project Activities for Milestone #4: Earthquake-Proof House Models

PREPARE (Bell-ringer/opener activity)

Have the students turn and talk about the question: "Where are the emergency exits and meeting points for the school? In the event of a disaster, how would you get out of the building?" Call on students to share their answers, and review emergency protocols.

PRESENT (Lecture/model)

Tell the students that today they're going to learn how to stay safe during an earthquake. Give them the "Earthquake Safety Tips" printable on page 15 of the Student Pack. Show them the video "How to Protect Yourself During an Earthquake". Have them list the things you should and shouldn't do during an earthquake as they watch the video. Use the "Earthquake Safety Tips Answer Key" on page 9 of the Teacher Pack to discuss the answers.

PARTICIPATE (Student/group share, group activity)

The students should build their earthquake-proof house models. Allow them to use the supplies you've gathered. Remind them to use their ideas from the "Earthquake-Proof House Design" printable to build their models.

Formative Assessment: Meet with the students and discuss their plans for the project.

PRACTICE (Homework/independent work/extensions)

Give each student the writing response template on page 16 of the Student Pack and ask them to write an answer to the inquiry question for this Milestone: "How would you stay safe during an earthquake? Tell at least 3 things you would do."

ASSESSMENT

Formative Assessment for Individual Activity: Check each student's "Earthquake Safety Tips" printable on page 15 of the Student Pack. Use the "Earthquake Safety Tips Answer Key" on page 9 of the Teacher Pack to check their answers.

Formative Assessment for Group Activity: Meet with the students and discuss their plans for the project.

Summative Assessment: Have the students complete the response printable on page 16 of the Student Pack for the Inquiry Question, "How would you stay safe during an earthquake? Tell at least 3 things you would do."

PROJECT PRESENTATIONS

Overview, Objectives, Inquiry Questions, and Planning

THINGS TO CONSIDER FOR MILESTONE #5

- You may want to collect the students' projects after their presentations so you can use the rubric to assess them. You will need their earthquake research, earthquake-proof house planning sheets, and earthquake-proof house models.

LEARNING OBJECTIVES FOR MILESTONE #5

At the conclusion of this milestone, students will be able to:

- Explain how earthquake relief efforts were carried out in Haiti.
- Present their projects to the class.
- Identify the best features for an earthquake-proof house.

EXTENSIONS AND ENHANCEMENTS FOR MILESTONE #5

- Could you invite other classes to listen to your students' presentations and learn about earthquakes? You could also record the presentations and share them on your website so family members can see them.

STUDENT INQUIRY QUESTIONS FOR MILESTONE #5

- How were earthquake relief efforts carried out in Haiti?
- Which features do you think are the best for making a house earthquake-proof? Why?

ASSESSMENT FOR MILESTONE #5

- **Formative Assessment for Individual Activity**: Check the students' "Earthquake Relief Efforts" printable on page 17 of the Student Pack. Use the "Earthquake Relief Efforts Answer Key" on page 10 of the Teacher Pack to check their answers.
- **Summative Assessment for Group Activity:** Use the "Exploring Earthquakes Project Rubric" on page 13 of the Teacher Pack to assess the students' projects and presentations.
- **Summative Assessment:** Have the students complete the response printable on page 18 of the Student Pack for the Inquiry Question, "Which features do you think are the best for making a house earthquake-proof? Why?"

- **Summative Assessment:** Give the students the "Earthquakes Summative Assessment" on page 11 of the Teacher Pack. Use the "Earthquakes Summative Assessment Answer Key" on page 12 of the Teacher Pack to correct the assessments.

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Project Activities for Milestone #5: Project Presentations

PREPARE (Bell-ringer/opener activity)

Give the students the "Earthquake Relief Efforts" printable on page 17 of the Student Pack. Show them the video "Haiti Desperate for Help After Deadly Earthquake". Have them answer the questions as they watch it. Use the "Earthquake Relief Efforts Answer Key" on page 10 of the Teacher Pack to check their answers.

PRESENT (Lecture/model)

Tell the students that they will be presenting their projects for the class. Tell them they should share the research they gathered about the earthquake and explain how their earthquake-proof house would stay safe during the earthquake.

PARTICIPATE (Student/group share, group activity)

Give the students a few minutes to prepare for their presentations.

Have the students share their projects one at a time.

Summative Assessment: Use the "Exploring Earthquakes Project Rubric" on page 13 of the Teacher Pack to assess the students' projects and presentations.

PRACTICE (Homework/independent work/extensions)

Give each student the writing response template on page 18 of the Student Pack and ask them to write an answer to the inquiry question for this Milestone: "Which features do you think are the best for making a house earthquake-proof? Why?"

ASSESSMENT

Formative Assessment for Individual Activity: Check the students' "Earthquake Relief Efforts" printable on page 17 of the Student Pack. Use the "Earthquake Relief Efforts Answer Key" on page 11 of the Teacher Pack to check their answers.

Summative Assessment for Group Activity: Use the "Exploring Earthquakes Project Rubric" on page 13 of the Teacher Pack to assess the students' projects and presentations.

Summative Assessment: Have the students complete the response printable on page 18 of the Student Pack for the Inquiry Question, "Which features do you think are the best for making a house earthquake-proof? Why?"

Summative Assessment: Give the students the "Earthquakes Summative Assessment" on page 11 of the Teacher Pack. Use the "Earthquakes Summative Assessment Answer Key" on page 12 of the Teacher Pack to correct the assessments.