

Above & Below

Build the inside of the Earth, then the mountains on top of it

AHS Worldwide | Earth Science | Upper Elementary | Unit 1 Project

WHAT YOU WILL TURN IN: After Step 4, upload one photo of your play dough Earth, cut open, with all four layers flagged. After Step 8, upload one video, two to three minutes long, explaining both of your models. Nothing else gets turned in.

Your Challenge

You are going to build the Earth twice.

First you build what is under the ground: a play dough Earth with four layers, which you cut open with dental floss so you can see inside it. Then you build what happens on top of the ground: two towel plates crashing together to raise a mountain range, the way the Indian Plate raises the Himalayas.

At the end you hold up both models and explain the whole thing on video.

The Two Models You Will Build

- Model 1, Steps 1–4: a play dough Earth, cut in half, with the inner core, outer core, mantle, and crust all showing.
- Model 2, Steps 5–7: two cloth plates pushed together to build a mountain range, designed and tested by you.

Your Models Must

- Show all four layers of the Earth, wrapped around each other in the right order.
- Include a crust that is as thin as you can possibly make it.
- Be cut open in one clean pass, with a labeled flag standing in every layer.
- Use two real, named plates for the crash on top: the Indian Plate and the Eurasian Plate.
- Be tested twice, with two different materials, and measured both times.
- Include at least one honest statement about something your model cannot show correctly.

What You Need

Cost: about \$0 if you already have play dough and towels at home. If you make salt dough instead, the recipe is below and it costs pennies.

Gather Before You Begin

- A printed Above & Below worksheet
- Play dough in 4 different colors, about a fist-sized lump in total
- 1 piece of dental floss, about as long as your arm
- 1 plate to cut on

- 4 toothpicks and 4 small pieces of paper, for labels
- 2 towels, plus one other piece of cloth to compare against
- A pencil, a ruler, and colored pencils or crayons
- A phone or camera, for one photo and one video

Helpful but Not Required

- A tray or cookie tin, if you want to move your models without wrecking them
- Food coloring, if you are making salt dough from scratch

NO PLAY DOUGH? Mix 2 cups flour, 1 cup salt, and about 1 cup water until it is smooth like clay. Split it into 4 lumps and stir a different food coloring into each one. It cuts even better than play dough.

SAFETY: A grown-up helps with the floss cut in Step 4. Pull the floss straight down through the dough, on a plate, with your fingers well out of the way. Do not eat the dough, because salt dough has a great deal of salt in it. Wash your hands when you finish building.

How Long This Takes

Eight steps, about 15 to 20 minutes each. Steps 1 through 4 build the inside of the Earth. Steps 5 through 7 build what happens on top. Step 8 is the video. Do one step each day during this unit.

THE ONE IDEA THAT TIES IT TOGETHER: The thick mantle inside the Earth moves, very slowly, and it never stops. The crust on top is cracked into pieces called plates, and those plates ride on that moving mantle. That is why the ground on top can crash together and build mountains. You build the inside first, so that the outside makes sense.

Step 1 — Guess What Is Inside

Estimated Time to Complete: 20 minutes

What You're Working On

Making your best guess about the inside of the Earth, before anybody tells you the answer.

Materials & Resources

- Your Step 1 worksheet page
- A pencil

Instructions

1. The big empty circle on your worksheet page is the Earth, cut in half.
2. Draw what you think is inside it. Do not look anything up. Guess.
3. Label your guess: how many layers, which one is hottest, which one is biggest.
4. Now read the four facts about the four real layers.

5. Answer the plan question: which layer will need the most dough, and which the least?

GUESS BEFORE YOU READ: Most people guess the core is the biggest part of the Earth. It is not. Think about which layer is thickest, not which one sounds most important.

Think Deeper: Why would a scientist write down a guess they expect to be wrong?

How This Builds Your Project: You wrote your prediction down where you cannot quietly change it later. In Step 4 you cut your model open and find out how close you were.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
The guess	Layers drawn and labeled, before reading the facts	Drawn but not labeled	Nothing drawn
The four layers	All four named correctly	Two or three named	Fewer than two named
The dough plan	Both plan questions answered	One answered	Neither answered

Step 2 — Build the Core and the Mantle

Estimated Time to Complete: 20 minutes

What You're Working On

Building the inside of the Earth, from the middle outward.

Materials & Resources

- Play dough in 3 of your 4 colors
- Your Step 2 worksheet page

Instructions

1. Roll a marble-sized ball. That is the inner core: solid metal, and the hottest part of the Earth.
2. Wrap it all the way around in a second color. That is the outer core: liquid metal.
3. Wrap both cores in a thick third color, the mantle. Use more dough here than both cores together, because the mantle is most of the Earth.
4. Roll the whole thing smooth, with no inner colors peeking through.
5. Write down which layer used the most dough, and whether that matched your plan.

WRAP, DO NOT STACK: Wrap each layer around the one before it, like a snowball. Do not flatten the colors and stack them like a sandwich, or your cut in Step 4 will show no rings at all.

Think Deeper: The mantle is the thickest layer by far. Why does that matter for what happens on the surface?

How This Builds Your Project: You now have hot metal in the middle and thick rock around it, in the right order. Step 3 adds the thin part you actually live on.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
Layer order	Inner core, outer core, mantle, in the right order	Order mixed up	Layers not separate
The mantle	Thickest layer, more dough than both cores	About the same as the cores	Thinner than the cores
The ball	Round and smooth, no inner colors showing	Lumpy, or colors peeking through	Not a ball

Step 3 — Add the Crust, as Thin as You Can

Estimated Time to Complete: 20 minutes

What You're Working On

Adding the thin outside layer, and finding out why you cannot make it thin enough.

Materials & Resources

- Your ball from Step 2
- Your fourth color of dough
- Your Step 3 worksheet page

Instructions

1. Flatten your fourth color as thin as you can, then thinner, until it almost tears.
2. Wrap it around the whole ball. That is the crust, the part you walk on.
3. Read this: if the Earth were the size of an apple, the crust would be thinner than the apple skin.
4. Answer this: compared to the real Earth, is your crust too thick, too thin, or just right?
5. Write one sentence saying why you could not get it thin enough, then put the ball somewhere safe. Do not cut it open yet.

TOO THICK IS THE RIGHT ANSWER: Your crust will be about ten times too thick, and you lose no points for that. Dough will not roll that thin. What matters is knowing it is too thick, and being able to say why.

Think Deeper: If your model gets the crust wrong on purpose, is it still a good model? Why?

How This Builds Your Project: You have four layers in the right order, plus one honest thing your model gets wrong. Step 4 is the reveal.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
The crust	Thin sheet wrapped all the way around	Thick or patchy	Missing
The apple check	Says too thick, and gives a reason	Answers with no reason	Not answered
The model	Four layers, smooth, and put away safely	Three layers	Fewer than three layers

Step 4 — Cut It Open

Estimated Time to Complete: 20 minutes

What You're Working On

Cutting your Earth in half and checking your guess against what is really inside.

Materials & Resources

- Your finished ball
- Dental floss and a plate
- 4 toothpick flags
- A grown-up to help with the cut
- A camera or phone

Instructions

1. Before you cut, circle the one thing on your Step 1 guess you are surest about.
2. Put the ball on a plate, and ask a grown-up to help with the cut.
3. Hold the floss tight, press it straight down through the middle, and pull it through.
4. Open the halves and put a toothpick flag in each layer: inner core, outer core, mantle, crust.
5. Write one thing your guess got right and one surprise. Then photograph it with all four flags showing, and upload the photo.

THIS IS YOUR FIRST UPLOAD: Cut slowly and straight down. If the dough squishes instead of cutting, chill it in the fridge first. Stand any fallen flags back up before you take the photograph.

Think Deeper: Your guess and your model are both drawings of something nobody has ever seen. How do scientists know what is really down there?

How This Builds Your Project: What you are looking at is a cross-section: a slice straight through the middle. The whole second half of this project happens on that thin outside ring.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
The cut	One clean cut, all four rings showing	Cut off-center	Not cut
The labels	All four layers flagged correctly	Two or three correct	Fewer than two correct
The photo	Uploaded, flags readable, right answer and surprise written down	Photo blurry, or nothing written	No photo uploaded

Step 5 — Label What Is Happening Above

Estimated Time to Complete: 5 minutes

What You're Working On

Connecting the moving mantle you just built to the mountains you can actually see.

Materials & Resources

- Your cut-open Earth
- Your Step 5 worksheet pages
- A pencil

What It Looks Like Above the Crust

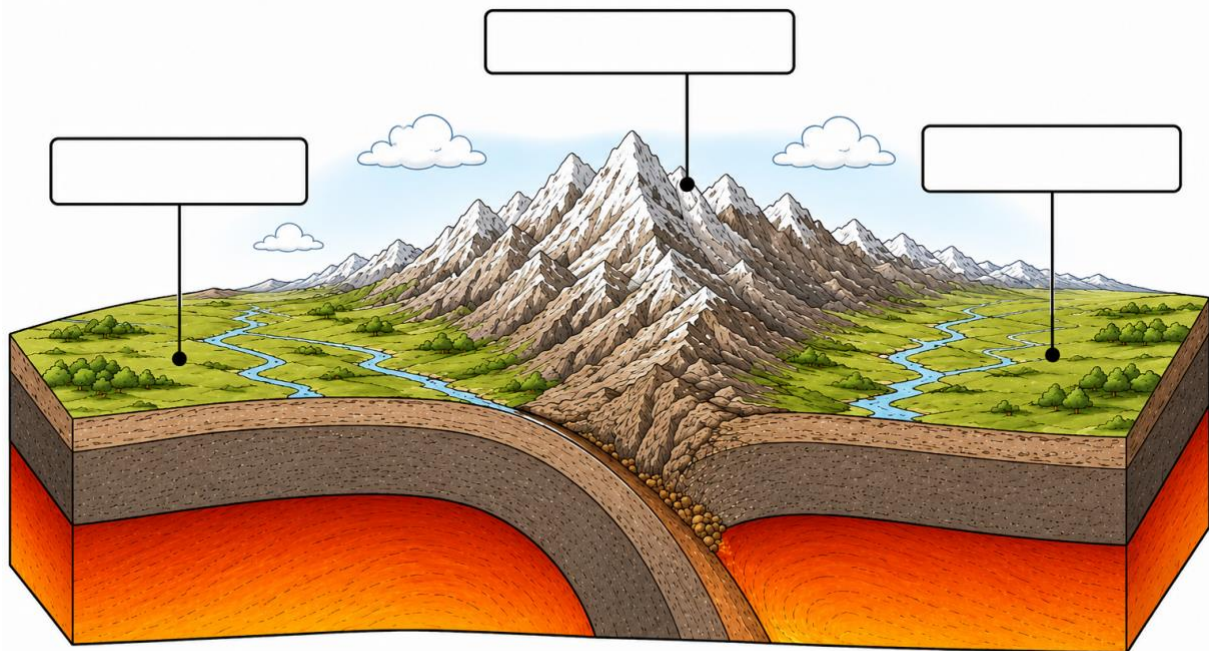


Figure 1 — The same crash, seen from the side. Label the three boxes on your worksheet copy, then add your arrows.

Instructions

1. Read the six facts about your plate on the worksheet.
2. Hold your cut-open Earth so you can see the mantle. It moves, slowly, like thick soup.
3. On the picture, write Indian Plate in the left box and Eurasian Plate in the right box.
4. Write Himalayas in the box pointing at the peaks. Mount Everest is in there.
5. Draw one arrow on each plate, in the direction it is moving.

START UNDERNEATH: The mountains are the last thing that happens, not the first. Draw the mantle arrows, then the plate arrows, and only then look at the peaks.

Think Deeper: Nothing pushes the plates from the side. So what is moving them?

How This Builds Your Project: Steps 1 to 4 built the inside of the Earth. This picture is the outside, and your arrows are the reason it looks the way it does.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
The three labels	Both plates and the mountains named correctly	One label wrong or missing	Boxes left empty
The arrows	Plate arrows face each other, mantle arrows curl underneath	Only one set of arrows drawn	No arrows
The boundary	Convergent circled, and both questions answered	Circled, questions left blank	Missing

Step 6 — Design Your Mountain Model

Estimated Time to Complete: 10 minutes

What You're Working On

Planning a model of two plates crashing, before you build it.

Materials & Resources

- Your Step 6 worksheet page
- A pencil and a ruler
- Two towels, and one other kind of cloth

Instructions

1. Pick what your two plates will be: bath towels, hand cloths, dish towels.
2. Sketch your set-up on the worksheet: what sits on the table, and where your hands push.
3. Write down what you think will happen where the two plates meet.

4. Write down how tall you think your mountain will get, and what you will measure it with.
5. Set everything up on the table, and then stop. Do not push yet.

WRITE THE PREDICTION FIRST: A guess written down after the test is not a prediction. Fill in your prediction before your hands touch the plates.

Think Deeper: Why do scientists write down what they expect before they run a test?

How This Builds Your Project: Geologists design a test before they run it. That is the only way the result means anything afterward.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
Materials	Two plates chosen and written down	Chosen, but not written down	Not decided
The sketch	Plan drawn from the side, with push arrows	Drawn from above, or no arrows	No sketch
The prediction	Filled in before the test, with a measurement plan	Filled in, but no measurement plan	Left blank

Step 7 — Test Your Model

Estimated Time to Complete: 20 minutes

What You're Working On

Running your test twice, and comparing your model against the real thing.

Materials & Resources

- Your set-up from Step 6
- Your Step 7 worksheet page
- A ruler

Instructions

1. Push both plates together slowly, at the same speed, and watch where they meet.
2. Measure how tall your mountain got, and write it down.
3. Flatten it out, swap in your second material, and run the test again.
4. Write which material built the taller mountain, and why you think it won.
5. Compare your model to your labeled picture. Write one way it matches, and one way it does not.

SLOW AND EVEN: Push fast and the plates just slide over each other. Push slowly and evenly and the material folds upward, which is what the real rock does.

Think Deeper: Real mountains take millions of years to rise. Your model takes four seconds. What does that change about what your model can prove?

How This Builds Your Project: You now have a model of what is under the crust and a model of what sits on top of it. Step 8 is where you explain both.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
The test	Run twice, with two different materials	Run once	Not run
Measuring	Both mountains measured and written down	Only one measured	No measurements
The comparison	One match and one mismatch with the real picture	Only one of the two	Left blank

Step 8 — Explain Both Models on Video

Estimated Time to Complete: 20 minutes

What You're Working On

Explaining the whole project, inside and out, in your own words.

Materials & Resources

- Your cut-open Earth
- Your labeled picture
- Your mountain model
- A phone or camera

Instructions

1. Set all three where the camera can see them: the cut-open Earth, the picture, and the mountain model.
2. Name the four layers, from the middle out, pointing at each one.
3. Say what the mantle is doing, and what it carries on top of it.
4. Name your two plates, and show which way each one is moving, and what type of plate it is.
5. Show your mountain model, and say what a mountain is made of.
6. Say one thing your models get wrong on purpose.

THIS IS THE ONLY UPLOAD: Two to three minutes, with all three models in the shot. Hold the camera still, and watch it back once before you send it.

Think Deeper: If you had to teach this to a younger child using only one of your two models, which would you pick, and what would they miss?

How This Builds Your Project: This is the entire project in your own voice: what is inside the Earth, and what that does to the land on top of it.

Step Rubric

Dimension	Meets Expectations	Approaching	Beginning
Both models	Dough Earth and mountain model both shown	Only one shown	Neither shown
The explanation	All six things covered, in your own words	Four or five covered	Read straight off the page
The video	Two to three minutes, clear picture and sound	Very short, or hard to hear	Not uploaded

A Strong Video Includes

- All four layers named in the right order, with your finger on each one.
- The mantle described as moving, and as the thing that carries the plates.
- Both plates named, with the direction each one travels.
- Your mountain model pushed up while the camera is watching.
- One honest error: something your models cannot show correctly.

FOR THE GROWN-UP HELPING: You are needed twice. In Step 4, hold the plate steady and guide the floss straight down. In Step 7, read the measurements out loud while your student pushes. Everything else your student can do alone, including the video.