



CHANGING EARTH

K-12 Educator's Guide



CHANGING EARTH



HOW ARE WE A PART OF OUR CHANGING EARTH?

Since its formation, the Earth has undergone dramatic changes. The powerful forces behind these changes are present today and will continue to transform the planet in the future, regardless of human existence.

HOW DO WE COPE WITH THESE FORCES AS WE TRY TO SUSTAIN OUR EXISTENCE ON EARTH?

WHAT HAPPENS WHEN WE TRY TO CONTROL THESE FORCES IN ORDER TO LIVE WHERE WE CHOOSE?

CAN WE SEE HOW THE EARTH WILL CHANGE IN OUR LIFETIME AND IN FUTURE GENERATIONS?

The “Changing Earth” exhibit invites you and your students to consider these questions and find answers.

EARTH IS AN ACTIVE PLANET—
VOLCANOES ERUPT, RIVERS
FLOOD, AND THUNDERSTORMS
SWEEP THROUGH THE SKIES.
CHANGE MADE LIFE POSSIBLE.
CHANGE BRINGS DISASTER.
AND LIFE ON EARTH CHANGES
THE PLANET, TOO.
WE CAN INVENT WAYS TO LIVE
WITH CHANGE WHEN WE KNOW
WHY IT HAPPENS. WE CAN ALSO
FIGURE OUT HOW TO TACKLE
CHANGES THAT AFFECT OUR FUTURE.
EARTH IS CHANGING.
IT ALWAYS HAS.
WHAT'S OUR ROLE?

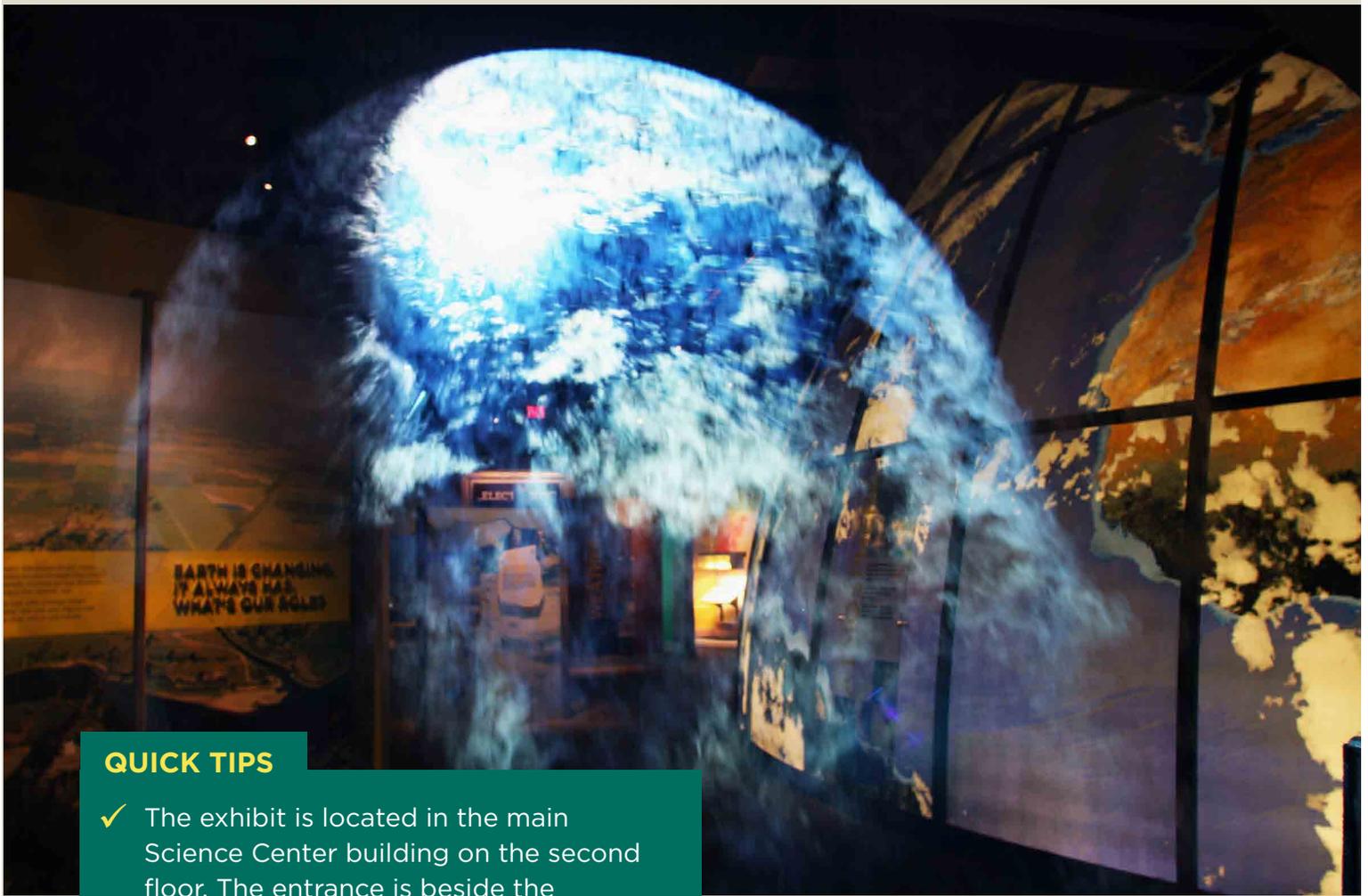


DURING YOUR VISIT, STUDENTS WILL:

- *Explore* how people are intertwined in Earth changes.
- *Investigate* the forces that change Earth and the new tools/approaches used to study Earth changes.
- *Discuss* the implications and choices people make and innovative approaches for a successful future.

AFTER YOUR VISIT, STUDENTS WILL:

- *Feel* personally connected to changes on Earth.
- *Wonder* about how local Earth events are part of a larger global system.
- Want to make Earth-friendly choices in everyday life.



QUICK TIPS

- ✓ The exhibit is located in the main Science Center building on the second floor. The entrance is beside the pendulum staircase. Elevator access is via the main elevators located at the front of the building. Use the ramps in the Benjamin Franklin National Memorial to make your way around to the entrance.
- ✓ The learning experience is greatest when students engage with the hands-on devices and multimedia presentations located throughout the exhibit. For logistical reasons, however, you might recommend that students spread out in small groups in order to enable everyone to see and hear the presentations.
- ✓ On average, most groups will spend about 40-50 minutes in the exhibit, if interacting with all of the devices.

WHAT TO EXPECT

As the exhibit's name implies, the focus is on the changing nature of Earth. The exhibit features Earth Science concepts for hands-on exploration in a "u-shaped" gallery.

The exhibition is organized into three sections: AIR, WATER, and LAND.

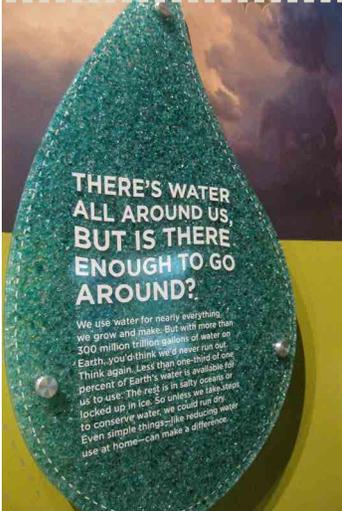
AIR = ATMOSPHERE + WEATHER

In the AIR section, the focus is on the atmosphere and the events that occur within it. Students can calculate their carbon footprint and find ways to reduce carbon emissions. After exploring the history of The Franklin Institute's weather station, they can step in front of a green screen and go "on air" as they deliver their own local weather forecasts.



WATER = OCEANS + RIVERS

In the WATER section, oceans and rivers connect with each other and with the land around them. The stream table has returned! This classic device enables students to see the impact of water flow on a terrain. Students can add barriers to change the flow and discover the effect.



LAND = ABOVE + BENEATH

In the LAND section, the surface of the Earth awaits exploration. Find out what happens when the plates of the Earth's surface shift and collide. Monitor seismographs and see where the Earth is quaking. Try your hand at building quake-proof structure. Go underneath the surface and crawl through a magma chamber.



TRY THIS!

THIS SIMPLE ACTIVITY HELPS STUDENTS OBSERVE THE “GREENHOUSE EFFECT” WHEN AIR IS UNABLE TO CIRCULATE.

SUPPLIES:

- 2 small thermometers
- jar or other see-through container
- clock or watch
- sunlamp or access to a sunny area
- notepaper & pencil

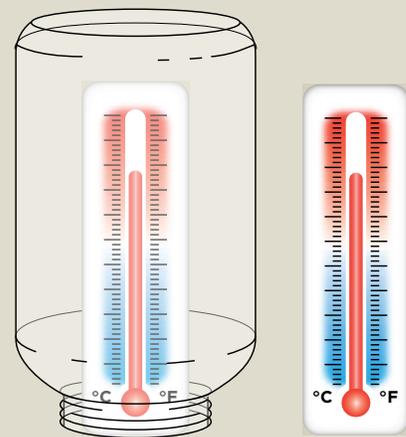
TO DO:

Have students work in small groups. Each group will need its own supplies.

Place thermometers a few inches apart under the sunlamp or in direct sunlight.

Wait three minutes so the thermometers will be giving accurate readings, and then record the temperature readings on both thermometers as well as the time.

Now place the jar over one of their thermometers, taking care that the jar does not cast a shadow over the uncovered one. If the thermometers are too large to remain horizontal inside the jars, it is fine to stand them against an inner side. Every minute, for ten minutes, record the readings of both thermometers.



TO NOTICE:

The air over the exposed thermometer is constantly changing as it circulates. As it gets warm, it is replaced by cooler air. Because the air in the jar cannot circulate to the rest of the room, this air stays in the sunlight and gets warmer and warmer. A similar trapping of heat happens in the Earth's atmosphere. Sunlight passes through the atmosphere and warms the Earth's surface. The heat radiating from the surface is trapped by greenhouse gases. Without an atmosphere, the Earth's temperature would average about 0 degrees Fahrenheit. This warming due to heat-trapping gases is called the "Greenhouse Effect." Both the atmosphere and the jar allow light to enter, but then trap that energy when it is converted to heat. They work differently, however, because the jar keeps in the heated air, while the greenhouse gases absorb radiated heat.

STREAM TABLE

A HIGHLIGHT OF THE “CHANGING EARTH” EXHIBIT IS THE HANDS-ON STREAM TABLE. STUDENTS WILL LEARN TO APPRECIATE BOTH THE POWER OF FLOWING WATER AND THE SUBTLE ELEGANCE OF THE PATTERNS IT CARVES.



Streams shape the landscape around them as they work to erode, transport, and deposit sediment. The stream table is a vivid demonstration of how those processes occur.

Gather your students around the table and ask them to make observations about what they notice. Ask them if they have ever been alongside a real stream. What do they remember about the stream’s edges? Did tree roots shape the stream’s course? Were there plants or larger rocks blocking its flow?

Encourage students to operate the table’s water taps to add water to the sandy landscape. (The table is on a four-percent inclined grade to help the water flow gently.) They should see twisty, winding pathways in the sediment.

As the water twists and turns along the table, it shapes landscape on a microscale representation of the real world. Watercourses appear and disappear, fine sediment is deposited and eroded, and obstacles are undercut and carried away.

TRY THIS!

MAKE YOUR OWN CLASSROOM BAROMETER AND USE IT TO OBSERVE CHANGES IN AIR PRESSURE WHICH SIGNAL CHANGES IN THE WEATHER.

SUPPLIES:

- glass or beaker with straight sides
- ruler (12 inch)
- tape
- one foot of clear plastic tubing
- chewing gum
- water

TO DO:

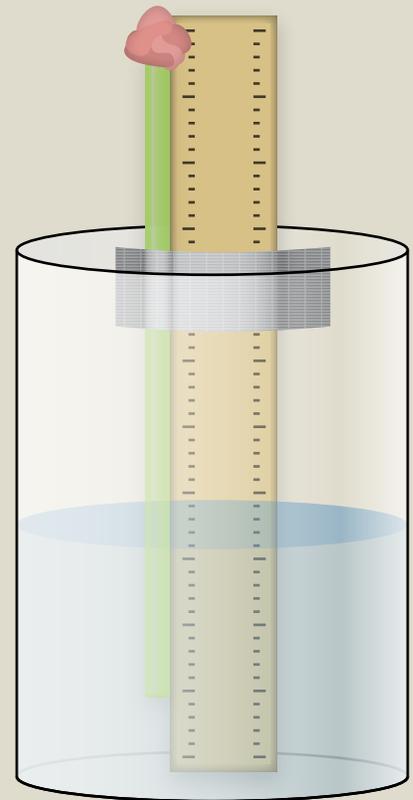
Begin by standing the ruler in the glass and holding it against the side. Tape the ruler to the inside of the glass. Make sure that the numbers on the ruler are visible.

Stand the plastic tube against the ruler in the glass. Make sure that the tube is not touching the bottom of the glass by positioning the tube up a half inch on the ruler. Secure the tube by taping it to the ruler.

Chew the gum so that it is soft. While you're chewing, fill the glass about half way with water. Use the plastic tube like a straw and draw some water half way up the tube. Use your tongue to trap the water in the tube. Quickly move the gum onto the top of the tube to seal it.

Make a mark on the ruler to record where the water level is in the tube. Each time you notice a change in the water level, make another mark. You'll notice, over time, that the water level rises and falls. Pay attention to the change in weather as the water level changes.

The water in the tube rises and falls because of air pressure exerted on the water in the glass. As the air presses down (increased atmospheric pressure) on the water in the glass, more water is pushed into the tube, causing the water level to rise. When the air pressure decreases on the water in the glass, some of the water will move down out of the tube, causing the water level to fall. The change in barometric pressure will help you to forecast the weather. Decreasing air pressure often indicates the approach of a low pressure area, which often brings clouds and precipitation. Increasing air pressure often means that a high pressure area is approaching, bringing with it clearing or fair weather.



Curricular Standards

An exploration of the “Changing Earth” exhibit can help students achieve learning objectives as called for by the national standards.

Next Generation Science Standards

K: Weather & Climate

2: Earth’s Systems: Processes that Shape the Earth

3: Weather & Climate

4: Energy

4: Earth’s Systems: Processes that Shape the Earth

5: Earth’s Systems

MS: History of Earth

MS: Earth’s Systems

MS: Weather & Climate

MS: Human Impacts

HS: History of Earth

HS: Earth’s Systems

HS: Weather & Climate

HS: Human Sustainability

National Science Education Standards

K-4 A: Science as Inquiry

K-4 B: Physical Science

K-4 D: Earth & Space Science

K-4 F: Science in Personal & Social Perspectives

5-8 A: Science as Inquiry

5-8 B: Physical Science

5-8 D: Earth & Space Science

5-8 F: Science in Personal & Social Perspectives

9-12 A: Science as Inquiry

9-12 D: Earth & Space Science

9-12 E: Science & Technology

9-12 F: Science in Personal & Social Perspectives

Benchmarks for Science Literacy

4. The Physical Setting

4b. The Earth

4c. Processes that Shape the Earth

Common Core English Language Arts

K-5: Reading Informational Text

6-12: Literacy in Science & Technical Subjects

Common Core Mathematics

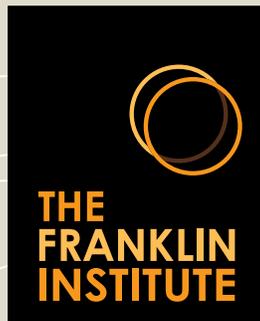
K-12: Measurement & Data

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