

Craters on the Earth and Moon

What's this activity about?

Big Questions:

- Why do the Moon and the Earth look so different?
- What processes on Earth erase the evidence of past impacts?
- How old are the craters on the Moon?

Big Activities:

Make craters on models of the Moon and Earth. Investigate the properties of Earth that hide past cratering events -- movement of the crust, erosion, water, and a protective atmosphere.

Participants:

From the club: A minimum of one person. With large groups, it is good to have at least two presenters.

Visitors: Cratering is appropriate for families, the general public, and school groups ages 8 and up. Up to 10 visitors at a time may comfortably participate.

Duration:

10 to 20 minutes

Topics Covered:

- How craters are formed
- How atmosphere protects Earth from small impacts
- Why natural processes erase the evidence of impact craters on Earth
- When most of the Moon craters were created



Where could I use this activity?

ACTIVITY	Star Party	Pre-Star Party – Outdoors	Pre-Star Party – Indoors	Girl Scouts / Youth Group Meeting	Classroom			Club Mtg	Public Presentation (Seated)	Gen Public Presentation (Interactive)
					K-4	5-8	9-12			
Craters on the Earth and Moon	√	√	√	√	√	√	√		√	

What do I need to do before I use this activity?

What materials from the ToolKit are needed for this activity?	What do I need to supply to run this activity that is not included in the kit?	Preparation and Set Up
Two plastic containers with tops Cocoa in a shaker jar Meteor image card Blue plastic circle Picture of the Moon Earth Banner	Flour Handful of regular rocks Newspapers if running activity inside	<ul style="list-style-type: none"> Put the newspaper down on the ground. Place one pan on newspaper. Fill the pan at least 1 inch deep with flour. Sprinkle lightly with cocoa mix. Create a second pan of flour in the same way, cover it and place it on the blue circle.

Background Information

Impacts

The Planetary and Space Science Center at the University of New Brunswick maintains the Earth Impact Database, a list of all known impact craters on Earth:
<http://www.unb.ca/passc/ImpactDatabase/>

Meteors don't actually "burn up" in the atmosphere. See an explanation by Phil Plait in Bad Astronomy here:

http://www.space.com/scienceastronomy/top5_myths_020903-5.html

Scales Represented by this Model

The Moon and Earth models are not to size scale. The Earth model shows the relative proportions of water (71%) to land area (29%) in order to illustrate the likelihood of impacts occurring in the water. The Earth has about four times the land area as the Moon. (150 million km² of land on Earth vs. the Moon's entire surface of 38 million km²)

If you would like to make an approximate scale model comparing the land area of the Earth and Moon, place the 1-meter Earth Banner on the ground and compare it to one of the containers (Moon). Have visitors observe which rocks hit the land area or place the equivalent of 4 pans, (2,300 cm² or 350 in²) of flour on the banner. You can use cake and pie pans or sturdy, clean take-out containers. There is about 4 times more land area on the Earth than on the entire Moon.

Detailed Activity Description

Craters on Earth and the Moon

Leader's Role	Participants' Role (Anticipated)
<p><u>To Do:</u> Point to the pan full of flour on the newspaper. Have regular rocks ready.</p> <p><u>To Say:</u> This represents a small area of the surface of the Moon, our closest neighbor. We have some mountains here, but what's missing from our Moonscape? Right – let's make some!</p> <p><u>To Say:</u> Small asteroids sometimes stray from the Asteroid Belt, but they weren't headed for the Moon on purpose -- they're rocks and don't have eyes!</p> <p>Let's take these rocks, representing the asteroids that bombarded the Moon early on, and drop them behind you to create craters, like this.</p> <p><u>To do:</u> Stand with your back to the pan and drop the rock behind you.</p> <p><u>To say:</u> Okay, now you try.</p> <p><u>To do:</u> Ask all visitors to stand on one side of the pan so no one gets hit by misfired rocks. Pass out a rock or two to each participant and let them try to drop one at a time.</p>	<p>Craters!</p> <p>Drop rocks into flour.</p>
<p><u>Presentation Tip:</u> Do not let participants throw the rocks up in the air. Dropping them reduces the chance of injury.</p>	



Leader's Role	Participants' Role (Anticipated)
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Misconception Tip:

One thing this model doesn't show is that you won't find the rock that made the crater sitting there at the bottom. They hit so hard that the energy blows them to bits!

To Say:

Now it looks more like the Moon. Look, many rocks didn't hit the pan. That's all right. Most of the asteroids don't hit the Moon either, but go whizzing right by.

The Moon is our closest neighbor. If all of those things are hitting the Moon, don't you think some would be hitting the Earth too?

Is the Earth covered in craters like the Moon?

Why do you think that is?

Let's go to Earth and find out!

To do:

Go to the second model with blue plastic under the flour container.

To say:

This is a model of the Earth. It was hit with lots of space rocks long ago too. Let's make some craters! (Repeat same as before)
Look at where those rocks hit. Where did most of your rocks end up?

This represents the **ocean** that covers 70% of the Earth. If something hits deep water, it won't leave a permanent crater.




Sure

No

Erosion?

On the blue sheet

Leader's Role	Participants' Role (Anticipated)
<p><u>To say:</u> Does the Moon have oceans?</p> <p>What about the big meteorites that did hit on land? Why don't we see the craters left by those?</p> <p>That's right. Almost all of those craters we see on the Moon happened a long time ago, when the Solar System was a much wilder and more dangerous, place. So they've been around a while.</p> <p>Thanks to the water and air here on Earth, we have erosion. This slowly wears down and fills up craters over time. Something like this.</p>  <p><u>To do:</u> Blow on the flour to fill in some of the craters. Be sure to blow away from people and telescopes.</p> <p><u>To say:</u> There's another big reason we don't see them, and that's because of what a dynamic place our Earth is. The crust is moving all the time. We have earthquakes, volcanoes, and mountains forming.</p> <p>Here, do you want to make an earthquake? Shake the pan gently.</p> <p>What else? The Earth has an atmosphere. We're lucky because anything smaller than a house will explode in the atmosphere. Let's see how that works.</p>	<p>No!</p> <p>Erosion!</p> <p>Visitor shakes pan</p>

Leader's Role	Participants' Role (Anticipated)
<p><u>To do:</u> Put the meteor illustration on top of the pan.</p> <p><u>To say:</u> When asteroids collide with Earth, they hit the atmosphere first. The small ones are going faster than a bullet, around <i>25 miles per second!</i> The atmosphere slows them down really fast. Has anyone ever done a belly flop in a pool? When you hit the water, it feels really hard, almost like it's solid. Believe it or not, when a space rock hits our atmosphere, it's like it is slamming into a solid too. Most small rocks simply explode. Do you know what we see when that happens?</p> <p><u>To do:</u> Flip the sheet over to show meteors.</p> <p><u>To say:</u> When the atmosphere puts the breaks on these rocks so fast, they heat up and leave a trail of gas and vaporized rock. We see that streak as a meteor! Anything up to the size of a house will explode or vaporize in our atmosphere.</p> <p>So small rocks don't make impact craters at all.</p> <p>But of course really large asteroids aren't stopped by the atmosphere and do hit dry land sometimes. Did you know that there are over 170 impact craters on Earth that haven't been erased- yet? You can see the ones found in North America here.</p> <p><u>To do:</u> Show red dots on the Earth Banner</p>	<p>Meteors!</p>
<p>Presentation Tip: You might want to familiarize yourself with the impact craters nearest to you. You can find a list here: http://www.unb.ca/passc/ImpactDatabase/</p>	



Materials

What do I need to prepare?

- Put the newspaper down on the ground.
- Place one pan on newspaper.
- Fill the pan at least 1 inch deep with flour.
- Sprinkle lightly with cocoa mix.
- Create a second pan of flour in the same way, cover it and place it on the blue circle.

Where do I get additional materials?

1. Container: Use a 9" pie tin.
2. Blue fabric circle: plastic tablecloths can be found at dollar stores or party supply stores. Cut to a diameter of 18".
3. Flour and cocoa can be found at any grocery store.
4. Earth Banner: print your own 42" square banner. Find the original artwork here:

http://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=460