

Try This!

Model how an ocean of molten rock — magma — helped shape the Moon. Dense materials in the molten mixture sank, while the least dense materials floated to the top and cooled to form the light-colored areas we see on the Moon today.

Additional details and options are available online at <http://www.lpi.usra.edu/education/explore/marvelMoon/activities/familyNight/magmaOcean/>

Materials

- A clear area
- An (8 oz.) empty *clear plastic* water bottle with the label removed
- A handful of at least 5 the following items: *small* aquarium gravel, buttons, dried beans, marbles, sequins, small pieces of coffee stirrers, small pieces of a dry sponge, pony beads, lego pieces, wooden beads
- A clear plastic cup filled halfway with water
- A pitcher of water
- A funnel
- Towel for cleaning up spills

Procedure:

The early Moon was hot from its formation. Its rocks – at least the upper layer – were molten; they were liquid, just like the water.

1. Some materials float in water and others sink. Use the cup of water to test them, but first, make some predictions: which items will sink and which will float? Then test your predictions: add one piece of each type of item to the cup of water. Why did some items float and others sink?

Discuss with your family or friends: Which items could represent dense minerals on the Moon? Which items could represent the materials that floated to the top of the magma ocean?

2. There were different materials inside the early Moon's outer layers, and at first, they were all mixed together. Use the items you tested to make a model of the infant Moon's super-hot rock soup: choose two types of items – one that sinks and one that floats – to add to your bottle.

Use the funnel to fill the bottle half-full of water, then add a *small* handful of each to the bottle. Tighten the cap on the bottle, shake it, and watch carefully. Once everything has settled, note the order of the three different layers.

Discuss with your family or friends: What is on the very bottom? What is in the middle? Which items floated to the top?

Some minerals -- plagioclase feldspar—solidified and floated to the top of the Moon's magma ocean. These formed into rocks called anorthosites—the first rocks to form on the Moon, 4.5 billion years ago. Scientists are still looking inside lunar rocks for pieces of infant crust to learn more about how the early Moon cooled.

Websites for Further Exploration

Ways to
Get Involved

Connect to the Moon

<http://www.lpi.usra.edu/education/lprp/>

This site includes paths for inquisitive adults, students, and formal and informal educators to find online resources, information, and opportunities for involvement in lunar science and exploration.

Moon Zoo

<http://www.moonzoo.org/>

Moon Zoo uses about 70,000 high resolution images gathered by the Lunar Reconnaissance Orbiter. Citizen scientists are invited to categorize craters, boulders and more, including lava channels and even all sorts of different spacecraft sitting on the Moon's surface.

Moon Mappers

<http://cosmoquest.org/mappers/moon/>

Moon Mappers enlists the help of the public to perform the gargantuan task of mapping the sizes and positions of craters photographed on the Moon by Lunar Reconnaissance Orbiter.

Infant Moon: Moon Mix!

<http://www.lpi.usra.edu/education/explore/marvelMoon/activities/familyNight/magmaOcean/index.shtml>

This website contains an activity for children and background information about the lunar magma ocean at the bottom for adults.

Solar System Exploration: The Moon

<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Moon>

This website, suitable for ages 12 and up, offers information including headline news about the Moon, lunar missions, a gallery of images, facts and figures, and activities.

The Center for Lunar Science and Exploration

<http://www.lpi.usra.edu/nlsi/index.shtml>

This NLSI team site includes background science information, images, the traveling exhibits, high school research projects, and more.

Moon Poster: The Evolution of Our Moon

<http://www.lpi.usra.edu/education/moonPosters/Poster1/backb.pdf>

This is a description of the stages on lunar geologic evolution, written for teens to adults.

The Moon

http://www.lpi.usra.edu/science/kring/epo_web/moon/index.html

This website by David Kring includes detailed information about the Moon's surface features and history, for public adult audiences.

PSRD: Crystallizing the Lunar Magma Ocean

<http://www.psrdr.hawaii.edu/Aug11/LMO-crystallization.html>

This site contains detailed scientific articles written at a high level for public adult audiences.

Books for Further Exploration

Check out
Your Library

There are several sections to look for information about the Moon in your local library; you may want to start with these sections:

- 523.3 Moon / Astronomy
- 525 Earth and Moon
- 559.91 Lunar Geology

On the Moon

Anna Milbourne and Laura Fearn, Usborne Books, 2004, ISBN 0794506178

A book for children ages 4 to 8 that examines the Moon, its environment, and the astronauts who explored it.

The Moon

Elaine Landau, Children's Press, 2008, ISBN 0531125629

Readers age 9 to 12 can delve into lunar topics: the Moon's formation; interior; surface features; exploration; phases; myths; and relationship to Earth's tides.

Jump Into Science: Moon

Steve Tomecek, National Geographic Children's Books, 2005, ISBN 0792251237

Children go on a journey with a bug and a cat to discover the Moon's scientific history and concepts; written for children ages 9-12.

Earth and the Moon

Rebecca Stefoff, Benchmark Books, 2001, ISBN 0761412352

Easy-to-read text provides children ages 9 to 12 with an in-depth look at many lunar concepts: the Moon's formation; interior; surface features; exploration; and the cycles of day and night, seasons, months, and tides. The author briefly considers, "What If the Moon Didn't Exist?"

Earth And the Moon

Ron Miller, 21st Century, 2003, ISBN: 0761323589

Written for young teens, this book examines the theories of the Moon's formation, and the complex relationship between the Earth and Moon.

The Earth and the Moon

Linda Elkins-Tanton, Chelsea House, 2006, ISBN 0816051941

Written for young adults and adults, this book discusses Earth's size, orbit, mass, seasons and more as well as the evolution of the Moon.

The Moon and How to Observe It

Peter Grego, 2010, Springer, ISBN: 1852337486

A book for practical amateur astronomers who not only want to observe, but want to know the details of exactly what they are looking at. Includes observation guides, photos, and clear explanations of the Moon's geological evolution.

The Modern Moon: A Personal View

Charles Wood, 2003, Sky Publishing Corporation, ISBN: 0933346999

The perfect companion to lunar telescope viewing. Wood works his way across the lunar surface, identifying features of scientific importance and the people involved in unraveling their story.

The Once and Future Moon

Paul Spudis, 1998, Smithsonian Inst. Press. ISBN: 1560988479

A geologist discusses what our exploration of the Moon has taught us, and what we might do in the future to know and use the Moon better.