Adapted to STEMAZing ECE Format by
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A Penny for Your Moon & A Quarter for Your Earth

<u>NOTE: Children should always be given ample time to experiment, notice, and wonder before they are provided an explanation.</u>

Always engage children with our two favorite questions:

What do you notice? What do you wonder?

Resist the urge to answer any questions children have while exploring. Instead, respond back with questions to children and let them make sense of the world. Sample questions you might use: What do you think? Do you notice any patterns? What could we change? Can we test something else? What can we try next? If children ask a testable question, which they could answer by doing an experiment, talk through with them how they might design a test to help answer their question. As much as possible and within reason, let them test their questions by trying the experiments they propose.

Learning Objectives

Children will…

- demonstrate the motion of the Moon's rotation.
- demonstrate that the Moon keeps the same face toward Earth.

Key Question

Does the Moon rotate or turn on its axis?

Vocabulary (See **What the heck? Explanation of Science** at the end for definitions.)

Moon	Rotation	Revolution
Earth	Orbit	Tidal Lock

Materials for Each Child

Penny	Quarter

Notice and Wonder Developmentally Appropriate Practice

1. Ask the children if they have ever seen the full moon.
2. Ask children if they think they have seen every side of the Moon.
3. Discuss – does the moon turn? Do we get to see every side of it?
4. Hand each child one penny and one quarter.

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5. Tell students we will be creating a model of Earth and the Moon.
6. Which object is Earth? (Quarter) Which object is the Moon? (Penny)
7. What do you notice?
8. Move the penny around the quarter, but keep Lincoln's nose facing the quarter, so the people on Earth can always see Lincoln's nose.
9. What do you notice?
10. Did the Moon make a complete rotation on its axis?
    - Was Lincoln ever upside down?
11. Did the Moon make a complete orbit (revolution) around the Earth?
12. Which way is Lincoln facing on the penny when you complete one orbit around Earth? How does this compare to when you started?

What it looks like from above:

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. Original setup: Nose-to-nose</td><td>2. Moving penny counter-clockwise (making sure Lincoln's nose is always pointing at Washington)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>3. Keep moving penny to this position.</td><td>4. Then, move it around another quarter turn.</td></tr>
<tr><td colspan="2">  </td></tr>
<tr><td colspan="2">5. Last move, Lincoln back to his original position (still facing Washington).</td></tr>
</table>

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Children should notice…

- we do not get to see the far side of the Moon from Earth.
- the Moon's rotation and orbit occur in the same time period (1 month) slower compared to Earth's 24-hour rotation.
- after one complete revolution, the penny moon is facing the same direction as when it started.

Extensions for Additional Learning

As always, ask the children throughout the experiment what they notice and what they wonder. If their wonder questions are testable, as much as possible and within reason, let them test their questions by trying new experiments.

See below for examples of what they might wonder and experiments they might do to test their wonderings.

- I wonder why the moon looks so big?
- I wonder why the moon lights up?
- I wonder what it would look like if we had more than one moon?
- I wonder how long it takes the moon to complete a revolution? A rotation?
- I wonder what would happen if Earth was in a tidal lock around the Sun?
    - Let them try it or look it up on the internet or discuss it!

#STEMAZingPictureBook Recommendation:

Earth! My First 4.54 Billion Years by Stacy McAnulty

Moon! Earth's Best Friend by Stacy McAnulty

Connections to the activity:

Conduct demonstration with an Earth globe and Moon ball (plastic ball with a face drawn on one side).

#STEMAZingVideo Recommendation:

Tidal Locking: Why Do We Only See One Side of the Moon
http://bit.ly/MinuteEarthTidalLock

Differentiating Developmentally Appropriate Practice

Younger children can mimic what the teacher does in a group first so they can master how to move and turn the penny.

References

https://www.lpi.usra.edu/education/workshops/unknownMoon/Tuesday/PennyMoonQuarterEarth.pdf

SAFETY CONCERNS

Please supervise children with coins due to choking hazards.

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AZ Early Learning Standards

Science Standard - Strand 1: Inquiry & Application - Concept 1: Exploration, Observation & Hypotheses
The child observes, explore, and interacts with materials, others, and the environment.

Science Standard - Strand 1: Inquiry & Application - Concept 2: Investigation
The child researches their own predictions and the ideas of others through active exploration and experimentation.

A Penny for Your Moon & A Quarter for Your Earth

What the heck? Explanation of the Science (Vocabulary in bold.)

Earth is the planet on which we live, the world. It is the third planet from the Sun. It is the only planet known to have life on it, and it is thought to have formed 4.5 billion years ago, 71% of the Earth's surface is covered by water. **Moon** is the large round object that circles the Earth and shines at night by reflecting light from the sun.

The Moon's **revolution** period, or orbital period, is the time it takes to complete one revolution around Earth. Moons revolution period is 27.3 days and it is identical to the Moon's **rotation** period. It takes the Moon 27.3 days to spin once on its axis. Compare this to Earth which takes 365¼ days (one year) to make a revolution around the Sun and 24 hours (1 day) to make one rotation on its axis.

Because of this, we only see the front side of the Moon. This wasn't so at first. Over time, the Moon became **tidally locked** with the Earth—just as the Moon exerts tidal forces on the Earth, our planet also exerts tides on the Moon, slowing down its rotation until it matched its revolution. The Moon also has two different periods of revolution, depending on your frame of reference. The Moon takes 27.3 days to orbit the Earth exactly 360 degrees, or with respect to the stars (a "sidereal" month). Because the Earth is moving around the Sun, while the Moon orbits the Earth, there is a different period for Moon phases (such as new moon to new moon)—it takes the Moon 29.5 days to complete a lunar phase cycle (a "synodic" month).

Reference

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