

## Moon Phases Optional 3E (Optional)

How does the moon contribute to storm severity?

**Performance Expectations**  
HS-ESS1-7

**Investigative Phenomenon**  
Hurricane Sandy created historic flooding in New York City on a high spring tide.

**Time**  
7 days

When students are considering what conditions might make storms worse in the future, it is important that they know what types of differences can influence storm severity with or without climate change. In this sequence, students investigate the relationship between moon phases and tides to understand how spring high tides created additional flooding during Hurricane Sandy.

|           |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                            |
|-----------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engage    | What do students know about why we see moon phases from Earth?                      | The teacher learns what students know and care about related to the <b>phases of the moon</b> by having them observe and <b>look for patterns</b> in <b>moon phase</b> images, then use their initial ideas to create a <b>diagram model</b> that <b>explains</b> the patterns they observed.                                                                              |
| Explore 1 | Students observe models of moon phases                                              | Students explore <b>phases of the moon</b> by <b>making observations of a 3-D moon phases model</b> and a <b>moon phase simulator</b> to <b>look for patterns that might provide evidence for causality</b> of the <b>moon phases</b> . The teacher's role is to confer with students around their learning, but not offer formal explanations yet.                        |
| Explain 1 | Students explain phases of the moon                                                 | Students demonstrate their initial understanding of the moon phases by creating a <b>diagram model</b> of the <b>Earth-Sun-Moon system</b> that <b>explains</b> the <b>patterns observed</b> from the <b>moon phases</b> models. Students then read a text and watch a video about <b>moon phases</b> in order to <b>evaluate and refine</b> their initial diagram models. |
| Explore 2 | Students graph daily tides and look for connections to phases of the moon           | Students learn about the <b>moon phases and tides</b> by <b>graphing daily tides</b> and <b>looking for patterns</b> in the graph that can be connected to <b>patterns observed in phases of the moon</b> . The teacher's role is to confer with students around their learning, but not offer formal explanations yet.                                                    |
| Explain 2 | Students identify and explain the relationship between phases of the moon and tides | Students read a text and watch a video about <b>moon phase and tides</b> in order to <b>create a diagram model that explains</b> the connection between <b>patterns observed</b> in the <b>moon phases</b> and <b>patterns observed</b> in the <b>tides</b> .                                                                                                              |
| Elaborate | Students apply their learning about phases of the moon to eclipses                  | Students <b>test out their explanations</b> of <b>patterns observed</b> in the <b>phases of the moon</b> by applying their thinking to a new problem about <b>solar and lunar eclipses</b> . This task connects to prior learning and extends students' thinking.                                                                                                          |
| Evaluate  | This 3E has no Evaluate                                                             |                                                                                                                                                                                                                                                                                                                                                                            |

Science &amp; Engineering Practices

Disciplinary Core Ideas

Crosscutting Concepts

# Engage

*What do students know about why we see moon phases from Earth?*

The teacher learns what students know and care about related to the **phases of the moon** by having them observe and **look for patterns** in **moon phase** images, then use their initial ideas to create a **diagram model** that **explains** the patterns they observed.

## Preparation

### Student Grouping

- ☐ Independent
- ☐ Table Groups

### Routines

- ☐ Rumors

### Literacy Strategies

None

## Materials

### Handouts

- ☐ Unknown material with identifier: `ess.u5.l1.engage.h`

### Lab Supplies

None

### Other Resources

- ☐ Post-its
- ☐ Chart Paper

## Instructional Sequence

1. Provide students with the handout *Unknown material with identifier: `ess.u5.l1.engage.h`*.
2. Have students individually respond to the prompt on the page.
3. Use the Group learning routine Rumors to share the patterns they notice.

# Explore 1

## *Students observe models of moon phases*

Students explore **phases of the moon** by **making observations of a 3-D moon phases model** and a **moon phase simulator** to **look for patterns that might provide evidence for causality** of the **moon phases**. The teacher's role is to confer with students around their learning, but not offer formal explanations yet.

### Preparation

#### Student Grouping

☐ Pairs

#### Routines

☐ Elbow Share + Domino Discover

#### Literacy Strategies

None

### Materials

#### Handouts

☐ Unknown material with identifier:  
ess.u5.l1.explore1.h

#### Lab Supplies

- ☐ Ball on stick with one side marked
- ☐ Lamp
- ☐ Someone other than the person holding the moon

#### Other Resources

### Instructional Sequence

1. Launch students into how the moon changes over time by providing them with the handout *Unknown material with identifier: ess.u5.l1.explore1.h* and their investigation supplies.
2. Support students as they enact their models. It works best if the room is as dark as possible.
3. Confer with students around their learning as they work in collaborative groups, but be sure to avoid offering formal explanations at this point.

4. After students have individually completed the See-Think-Wonder, use Elbow Exchange to help students articulate their ideas so far. Facilitate a whole-class share with Domino Share + Random Reporter.

# Explain 1

## *Students explain phases of the moon*

Students demonstrate their initial understanding of the moon phases by creating a **diagram model** of the **Earth-Sun-Moon system** that **explains** the **patterns observed** from the **moon phases** models. Students then read a text and watch a video about **moon phases** in order to **evaluate and refine** their initial diagram models.

## Preparation

### Student Grouping

- ☐ Pairs
- ☐ Groups of 3 for Think-Talk-Open Exchange

### Routines

- ☐ Think-Talk-Open Exchange

### Literacy Strategies

None

## Materials

### Handouts

- ☐ Unknown material with identifier: `ess.u5.l1.explain1.h`

### Lab Supplies

None

### Other Resources

- ☐ [Lunar Phases](#)

## Instructional Sequence

1. Launch students into moon phases by providing them with the handout *Unknown material with identifier: ess.u5.l1.explain1.h*. Have students use the text [Lunar Phases](#) to gain ideas.
2. Confer with students around their learning as they work in collaborative groups to explain moon phases.
3. After students have individually completed the See-Think-Wonder, use Elbow Exchange to help students articulate their ideas so far. Facilitate a whole-class share with Domino Share + Random Reporter.



## Explore 2

*Students graph daily tides and look for connections to phases of the moon*

Students learn about the **moon phases and tides** by **graphing daily tides** and **looking for patterns** in the graph that can be connected to **patterns observed** in **phases of the moon**. The teacher's role is to confer with students around their learning, but not offer formal explanations yet.

### Preparation

#### Student Grouping

☐ Pairs

#### Routines

☐ Domino Discover

#### Literacy Strategies

None

### Materials

#### Handouts

☐ Unknown material with identifier:  
ess.u5.l1.explore2.h

#### Lab Supplies

None

#### Other Resources

☐ [High and Low Tide Pictures](#)  
☐ [New York \(The Battery\), NY - Local Tide Times, Tide Chart | US Harbors](#)

### Instructional Sequence

5. Launch students into how the tides change over time by showing them the [High and Low Tide Pictures](#).
6. Providing students with the handout *Unknown material with identifier: ess.u5.l1.explore2.h* and have them work in tables to review the data.
7. Support students as they use data from [New York \(The Battery\), NY - Local Tide Times, Tide Chart | US Harbors](#) to record high tides over a two week period

8. Confer with students around their learning as they work in collaborative groups, but be sure to avoid offering formal explanations at this point.
9. After students have completed the graph and analysis questions, have students discuss their findings in groups. Facilitate a whole-class share with Domino Discover.



## Explain 2

*Students identify and explain the relationship between phases of the moon and tides*

Students read a text and watch a video about **moon phase and tides** in order to **create a diagram model that explains** the connection between **patterns observed** in the **moon phases** and **patterns observed** in the **tides**.

### Preparation

#### Student Grouping

☐ Triads

#### Routines

☐ Think-Talk-Open Exchange

#### Literacy Strategies

None

### Materials

#### Handouts

☐ Unknown material with identifier:  
ess.u5.l1.explain2.h

#### Lab Supplies

None

#### Other Resources

☐ [Tides](#)  
☐ [Watching the Tides](#)

### Instructional Sequence

4. Remind students that we are trying to figure out why Hurricane Sandy was so damaging. Provide students with the handout *Unknown material with identifier: ess.u5.l1.explain2.h*.
5. Show students the [Watching the Tides](#) .
6. Have students use the text [Tides](#) to gain information around the prompt: why was hurricane Sandy, which hit on a spring tide, so damaging?
7. Facilitate the group learning routine Think-Talk-Open Exchange to help students share their ideas. Have

students revise their responses after discussion.

# Elaborate

*Students apply their learning about phases of the moon to eclipses*

Students **test out their explanations** of **patterns observed** in the **phases of the moon** by applying their thinking to a new problem about **solar and lunar eclipses**. This task connects to prior learning and extends students' thinking.

## Preparation

### Student Grouping

☐ Table Groups

### Routines

☐ Read-Generate-Sort Solve

### Literacy Strategies

None

## Materials

### Handouts

☐ Unknown material with identifier: [ess.u5.l1.elaborate.h](#)

### Lab Supplies

None

### Other Resources

☐ [Eclipses](#)

## Instructional Sequence

1. Tell students that there is one final component of moon phases that is really cool, called eclipses.
2. Provide students with the handout *Unknown material with identifier: [ess.u5.l1.elaborate.h](#)* and the text [Eclipses](#).
3. Facilitate the group learning routine Read-Generate-Sort-Solve for students to understand what causes solar and lunar eclipses.

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# Evaluate

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*This 3E has no Evaluate*

## Preparation

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### Student Grouping

None

### Routines

None

### Literacy Strategies

None

## Materials

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### Handouts

None

### Lab Supplies

None

### Other Resources

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# Standards in Moon Phases Optional 3E (Optional)

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## Performance Expectations

HS-ESS1-7

Clarification Statement:

Assessment Boundary:

This PE, added by NYS, is not in the NGSS: Construct an explanation using evidence to support the claim that the phases of the moon, eclipses, tides and seasons change cyclically. [Clarification Statement: Emphasis of the explanation should include how the relative positions of the moon in its orbit, Earth, and the Sun cause different phases, types of eclipses or strength of tides. Examples of evidence could include various representations of relative positions of the Sun, Earth and moon.] [Assessment Boundary: Assessment does not include mathematical computations to support explanations but rather relies on conceptual modeling using diagrams to show how celestial bodies interact to create these cyclical changes.]

## Aspects of Three-Dimensional Learning

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### Science and Engineering Practices

### Disciplinary Core Ideas

### Crosscutting Concepts

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#### Constructing Explanations and Designing Solutions

- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. SEP6(2)

#### ESS1.B Earth and the Solar System

- Earth and celestial phenomena can be described by principles of relative motion and perspective. ESS1.B(3)NYS

#### Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. CCC1(1)
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## Assessment Matrix

|                                                          | Engage                                                  | Explore/Explain 1                                                                                                      | Explore/Explain 2                                                                                                      | Elaborate                                                  | Evaluate |
|----------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------|
| <b>Constructing Explanations and Designing Solutions</b> | Unknown material with identifier:<br>ess.u5.l1.engage.h | Unknown material with identifier:<br>ess.u5.l1.explore1.h<br>Unknown material with identifier:<br>ess.u5.l1.explain1.h | Unknown material with identifier:<br>ess.u5.l1.explore2.h<br>Unknown material with identifier:<br>ess.u5.l1.explain2.h | Unknown material with identifier:<br>ess.u5.l1.elaborate.h |          |
| <b>ESS1.B Earth and the Solar System</b>                 | Unknown material with identifier:<br>ess.u5.l1.engage.h | Unknown material with identifier:<br>ess.u5.l1.explore1.h<br>Unknown material with identifier:<br>ess.u5.l1.explain1.h | Unknown material with identifier:<br>ess.u5.l1.explore2.h<br>Unknown material with identifier:<br>ess.u5.l1.explain2.h | Unknown material with identifier:<br>ess.u5.l1.elaborate.h |          |
| <b>Patterns</b>                                          | Unknown material with identifier:<br>ess.u5.l1.engage.h | Unknown material with identifier:<br>ess.u5.l1.explore1.h<br>Unknown material with identifier:<br>ess.u5.l1.explain1.h | Unknown material with identifier:<br>ess.u5.l1.explore2.h<br>Unknown material with identifier:<br>ess.u5.l1.explain2.h | Unknown material with identifier:<br>ess.u5.l1.elaborate.h |          |

## Common Core State Standards Connections

|              | Engage | Explore/Explain 1        | Explore/Explain 2        | Elaborate | Evaluate |
|--------------|--------|--------------------------|--------------------------|-----------|----------|
| Mathematics  |        | MP.2<br>MP.4             | MP.2<br>MP.4             |           |          |
| ELA/Literacy |        | RST.9-10.1<br>RST.9-10.7 | RST.9-10.1<br>RST.9-10.7 |           |          |