



EARTH-MOON-SUN SYSTEM

VOL. 7

Developed with **Laura Beres**
Grades 6-8
Time: 60+ minutes



STEAM CONNECTIONS

Science: Students will analyze the relationships between the sun, moon, and Earth to determine the moon phase and if an eclipse will happen.

Technology: An orrery is considered to be a piece of technology and is used to model the sun, moon, and Earth.

Engineering: Students will assemble a paper orrery to use in modeling different lunar events.

Art: Students will create a model of the sun, moon and Earth.

Math: Students will use calendars and dates to help predict moon phases.

NOTES FOR TEACHERS:

Part 1: Introduction to content (slideshow with content).

Part 2: Develop a model and use it to demonstrate lunar events.

OBJECTIVE *Students will...*

Be able to construct and use a model of the Earth, sun, and moon in order to describe the phases of the moon and eclipses.

LEARNING STANDARDS

MS-ESS1.A — Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.

MS-ESS1.B — The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.

ESSENTIAL QUESTIONS

What causes the different phases of the moon? What is the relationship between the position of the sun, earth and moon?
What causes an eclipse?

MODIFICATIONS:



For a fun, in-person activity: Use 8 chocolate sandwich cookies per student to model the moon phases. Students will twist open the cookie and use the inside frosting to create the shape of the moon on the dark background of the cookie. Plastic knives make this easier, but are not required.

For more advanced students, a 3D model could be created instead of the paper model. Materials could be things like LEGO® pieces, modeling clay, styrofoam balls, and dowels.



COMMON MISCONCEPTIONS:

- Phases of the moon are caused by a shadow from the Earth.
- Different countries see different phases of the moon on the same day.
- The moon goes around the earth in a single day.
- The moon makes light the same way as the sun.
- Lunar and solar eclipses occur every month somewhere on Earth.

EXTENSION QUESTIONS:

- What role does the sun play in the entire solar system?
- How does the moon impact tides?
- How do seasons occur?

MATERIALS NEEDED:

- Orrery printed on cardstock, 1 per student
- Brads, 3 per student (9701168)
- Scissors (9729183)
- Coloring supplies (9705757 or 9705758)
- Single hole punch (9701185)
- Printed materials for students

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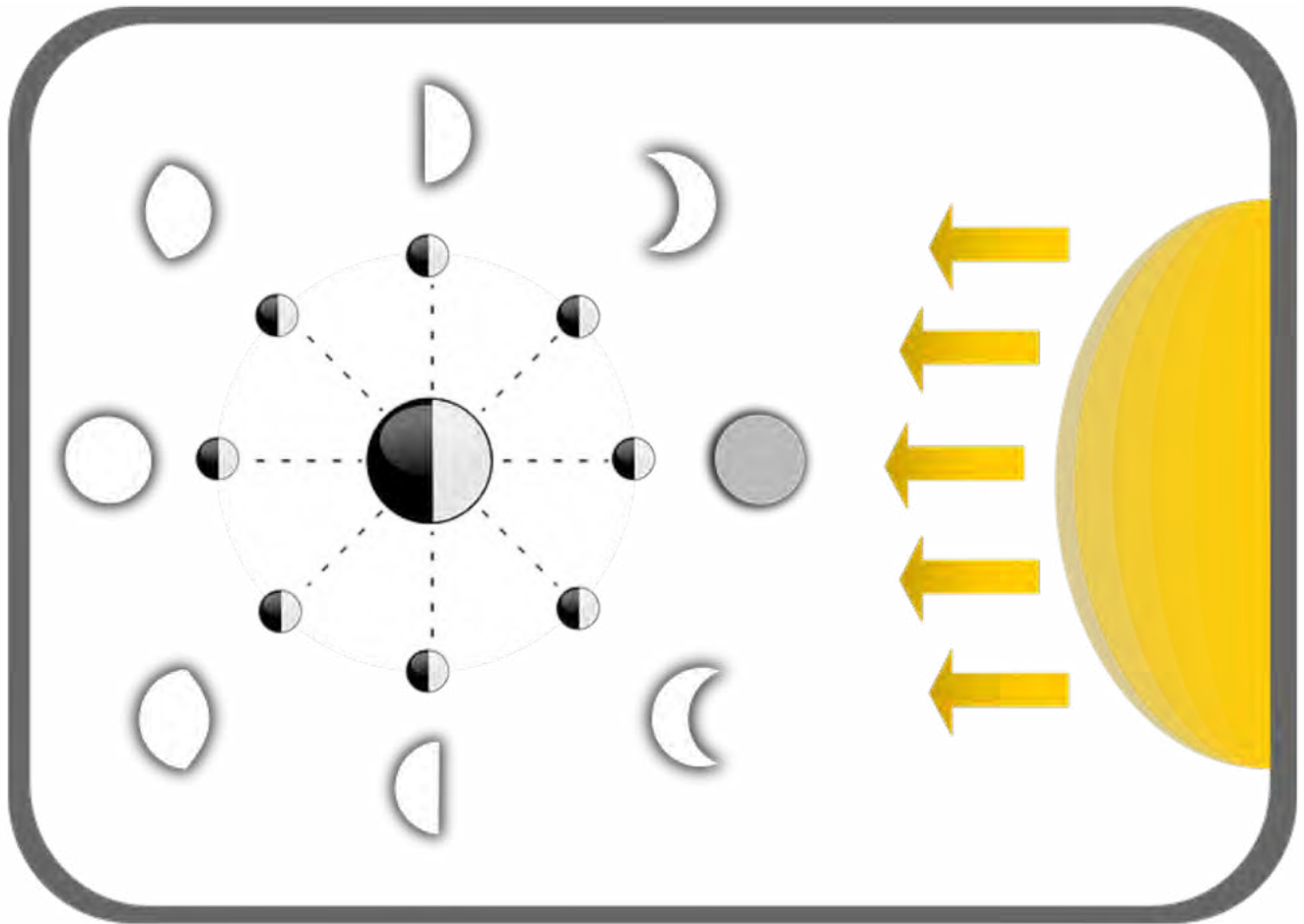
WORKSHEET 1

Volume 7: Gr. 6-8

Name: _____ Period: _____ Date: _____

Earth, Moon, and Sun

Label the following image based on the class notes:



Sarah and Jimmy love Halloween. They can't wait to dress up in scary costumes and tell ghost stories. What they want the most is a full moon on the night of October 31. They remember having a full moon on July 4 because it wasn't totally dark for the fireworks. Using what you know about the length of the moon phase cycle, will there be a full moon on October 31? Explain your answer. _____

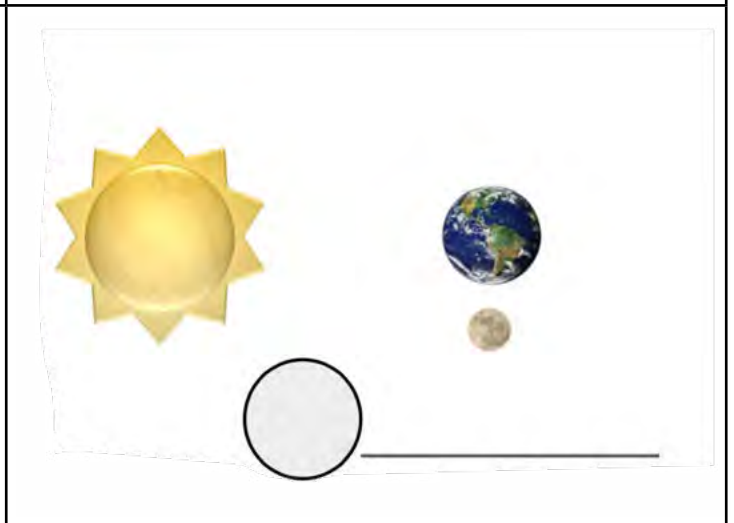
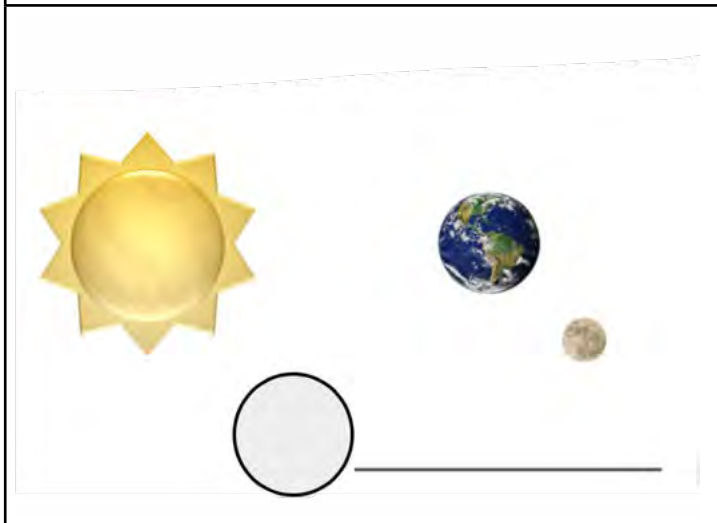
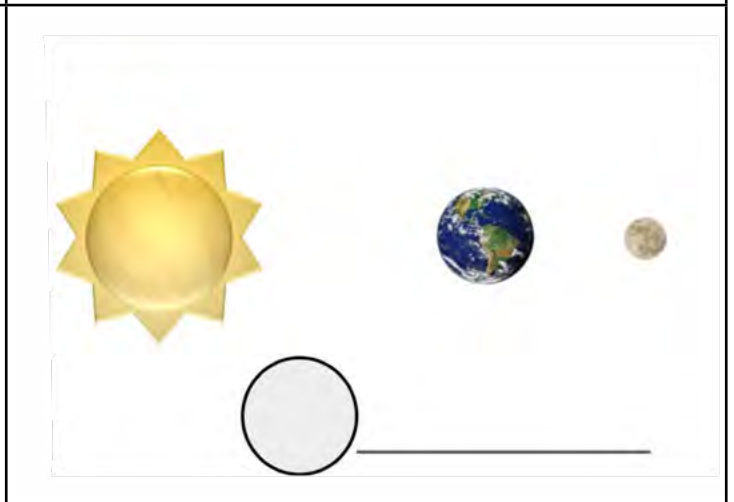
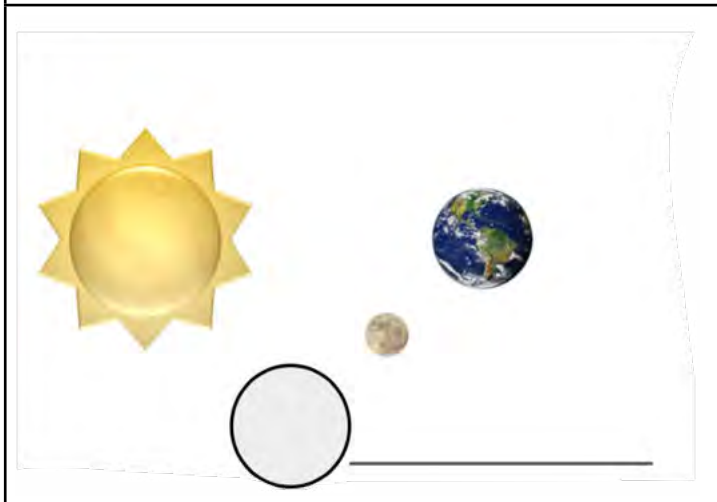
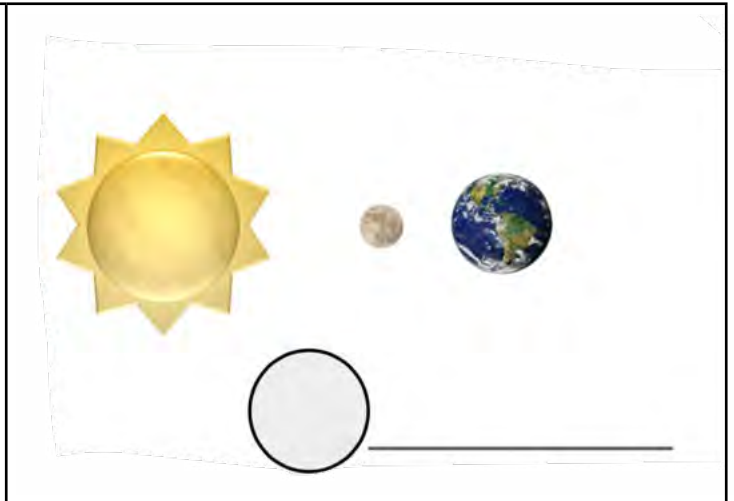
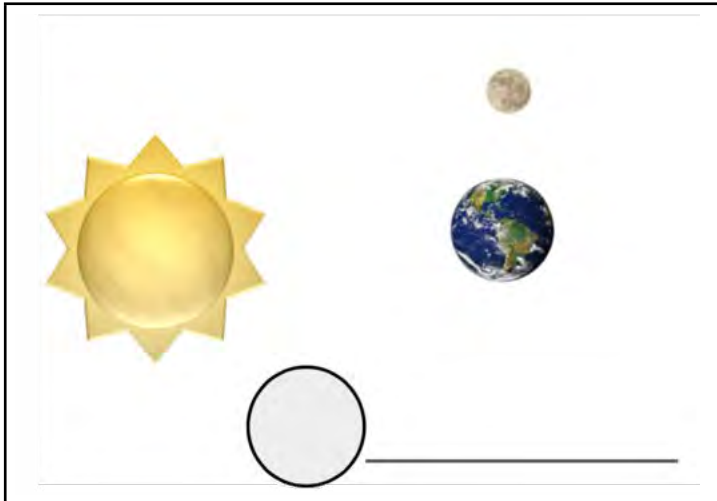
steamworks handout

WORKSHEET 2

Volume 7: Gr. 6-8

Name: _____ Period: _____ Date: _____

With the following diagrams, create the sun-moon-earth relationship with your orrery. In the blank circle, draw the moon phase as it would be seen from earth. Write the name of the moon phase on the line provided.



Which two phases are not represented? _____ and _____

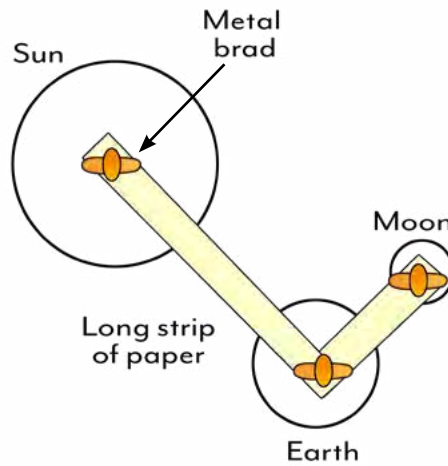
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ORRERY TEMPLATE

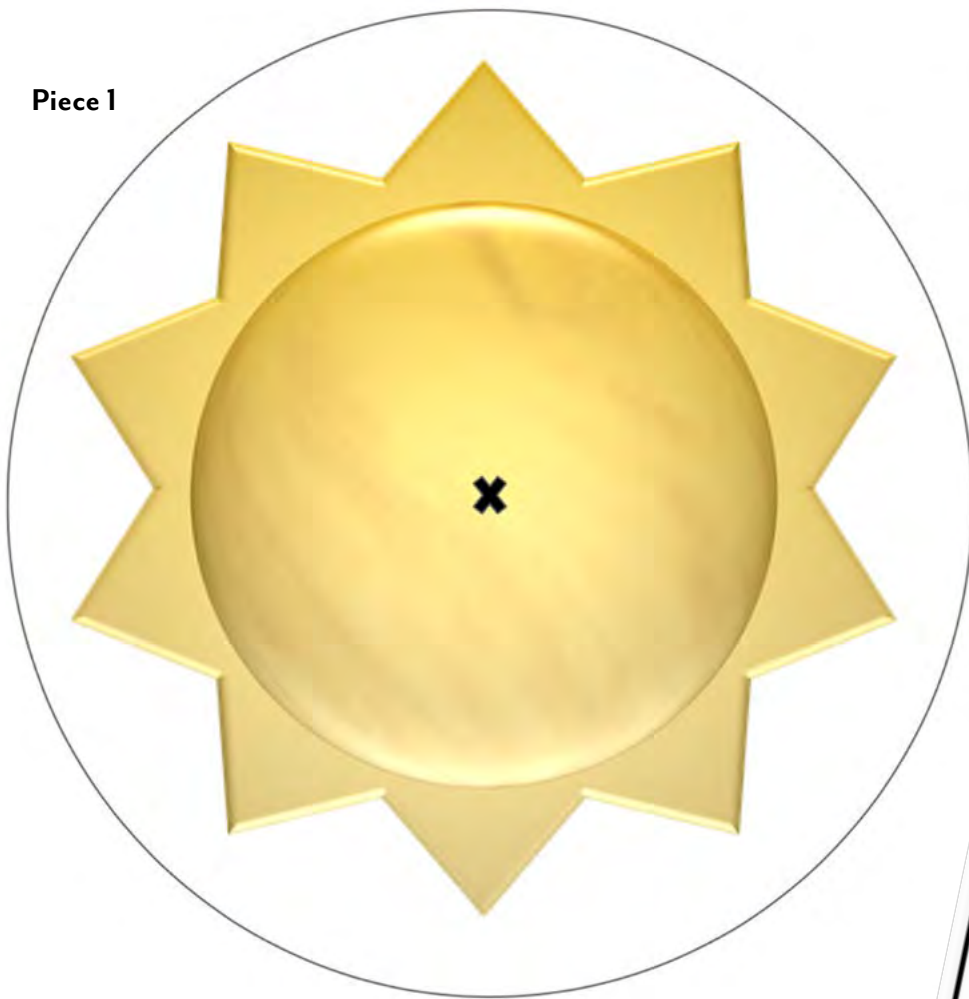
Volume 7: Gr. 6-8

Orrery Instructions:

1. Carefully cut the shapes from the template.
There should be four pieces.
2. Color the Sun, Earth, and Moon.
3. Use the hole punch to make holes in the pieces where they are marked by an X. There will be five holes.
4. Assemble the pieces using two brads.



Piece 1



Piece 2



steamworks handout

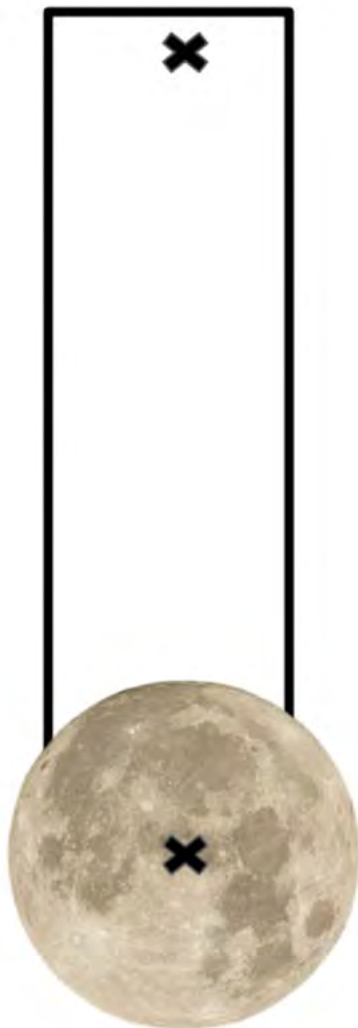
ORRERY TEMPLATE

Volume 7: Gr. 6-8

Piece 3



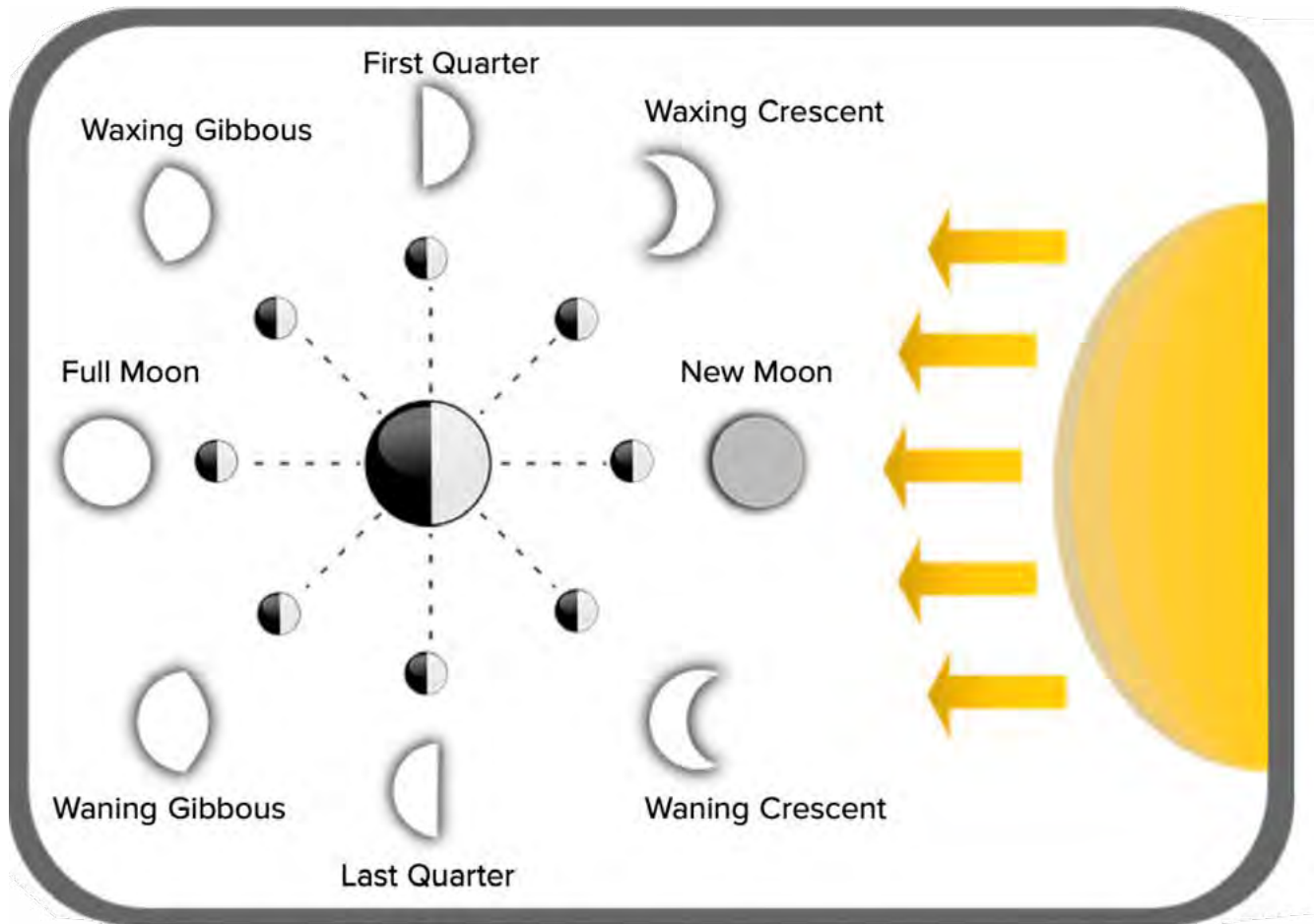
Piece 4



Name: _____ Period: _____ Date: _____

Earth, Moon, and Sun







Label the following image based on the class notes:



Sarah and Jimmy love Halloween. They can't wait to dress up in scary costumes and tell ghost stories. What they want the most is a full moon on the night of October 31. They remember having a full moon on July 4 because it wasn't totally dark for the fireworks. Using what you know about the length of the moon phase cycle, will there be a full moon on October 31? Explain your answer. **There are 119 days between July 4 and October 31. A full moon happens every 29.5 days. It is very likely that there will be a full moon because that is almost exactly 4 cycles.**

Name: _____ Period: _____ Date: _____

With the following diagrams, create the sun-moon-earth relationship with your orrery. In the blank circle, draw the moon phase as it would be seen from earth. Write the name of the moon phase on the line provided.

 <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; margin-right: 10px;"></div> <div>Third quarter</div> </div>	 <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; margin-right: 10px;"></div> <div>New Moon</div> </div>
 <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; margin-right: 10px;"></div> <div>Waxing Crescent</div> </div>	 <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; margin-right: 10px;"></div> <div>Full Moon</div> </div>
 <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; margin-right: 10px;"></div> <div>Waxing gibbous</div> </div>	 <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; margin-right: 10px;"></div> <div>First Quarter</div> </div>

** Use Earth, Moon, and Sun PDF or labeled diagram above to grade drawings.

Which two phases are not represented? **Waning Crescent** and **Waning Gibbous**



Earth,
Moon,
and Sun

Motion of the Moon

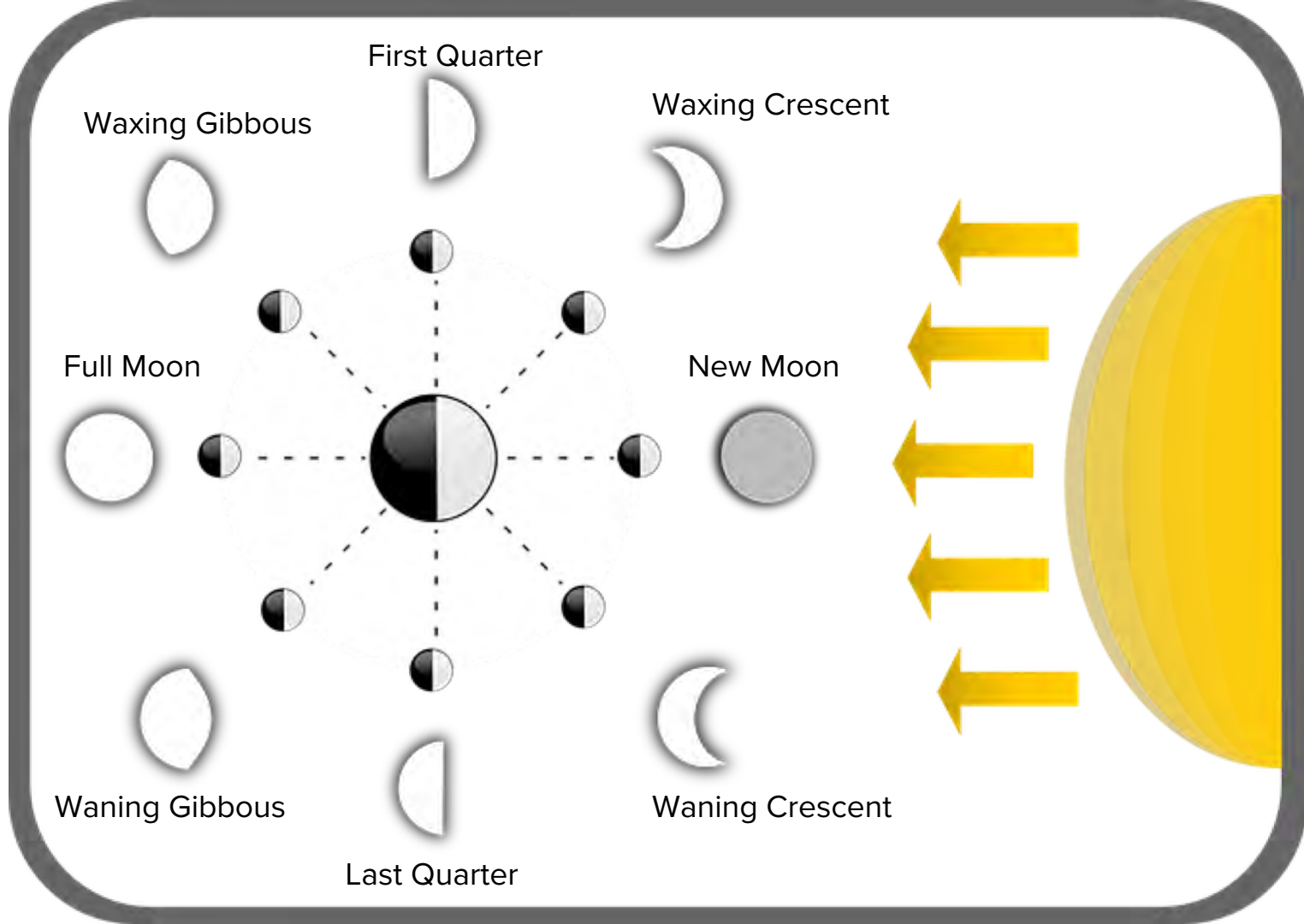


- Moon rotates (spins) on its axis as it revolves around (circles) the Earth
- The time it takes to rotate is the same as the time it takes to complete one full revolution
- Moon does not produce its own light — it reflects the light of the Sun

Phases of the Moon

- Complete lunar cycle takes 29.5 days
- “Waxing” refers to the amount of lit surface seen becoming larger
- “Waning” refers to the amount of lit surface seen becoming smaller





Lunar Eclipse

- Occurs when a full moon moves through the shadow cast by the Earth
- Also known as a blood moon
- This can only happen when the sun, moon, and Earth align just right, which is only 1–2 times per year



Solar Eclipse

- Occurs when the new moon passes directly between the Earth and Sun
- The shadow of the Moon falls on the Earth's surface
- There are 1–2 total solar eclipses per year and several more partial ones

