

Name _____

Date _____

Moon Motions

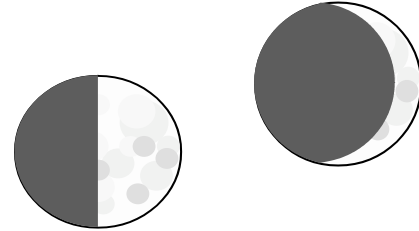
Part A

Overview:

Even though the moon does not appear to turn on its own axis from the Earth's point of view, it is indeed rotating as it revolves around the Earth. In the following activity, you will investigate the actual and apparent motions of the moon.

Materials:

- o Orbit of the Moon Sheet
- o Sun model (yellow ball)
- o Earth model (blue and black ball)
- o Moon model (white ball with black dot)
- o 3 Caps



Procedure:

1. Place the Sun, Moon and Earth models in a cap. This will stop them from rolling around while you work.
2. Lay the "Orbit of the Moon" sheet down on a flat surface.
3. Place the Sun model on the spot labeled "Sun".
4. Place the Earth model on the dot labeled "Earth". Be sure to place this model so that the **blue** side, representing daylight, **faces the Sun**.
5. Place the Moon model on top of position 1 on the sheet. Be sure that the black dot faces the Earth.
6. Move the Moon from position 1 to position 2, making sure that the **black dot continues to face the Earth**. To do this you will need to slightly turn or rotate the Moon model.
7. Move the Moon model from position 2 to position 3, making sure that the black dot continues to face the Earth. Again, you will need to rotate the Moon model.
8. Continue moving the Moon model from one position to the next along its orbital path around the Earth, until the Moon has completed its orbit around the Earth.
Throughout this exploration, make sure that the black dot on the Moon ALWAYS faces the Earth.

Questions:

1. This motion of the Moon around the Earth is called (rotation/revolution) _____
2. How many Earth days does it take for the Moon to make one complete revolution around the Earth? _____
3. How many degrees does the Moon move during one complete revolution around the Earth? _____
4. Calculate how many degrees the Moon moves *each Earth day*. _____
5. Calculate how many degrees the Moon moves in 1 hour. _____

Repeat the entire activity, moving the Moon around the Earth. Make sure that the dot on the Moon always faces the Earth as it revolves.

6. Does an observer on Earth ever see the back side of the Moon (side with no dot) at any point during the Moon's rotation? _____
7. To an observer on Earth, does the Moon *appear* to rotate? _____ Does the Moon *actually* rotate? _____
8. To an observer on Earth, in which direction does the Moon appear to move through the sky (east to west/west to east)? _____

Repeat the entire activity, moving the Moon around the Earth. Make sure that the dot on the Moon always faces the Earth as it revolves.

9. Did the dot on the Moon always face the sun? _____
10. Would an observer on the sun ever see the back of the Moon (side with no dot) at any point during the Moon's rotation? _____
11. To an observer on the Sun, does the Moon *appear* to Rotate? _____
12. From this activity you should be able to see that the Moon does not appear to rotate as it revolves around the Earth. For this to occur, the Moon must rotate (faster than/slower than/at exactly the same speed as) it revolves.

13. In other words, the Moon's rate of rotation is equal to its revolution. Therefore, how many Earth days does it take for the Moon to complete one rotation?

14. A day is defined as the amount of time it takes for a body to complete one rotation. A year is defined as the time it takes a body to complete one revolution. A day on the Moon is (shorter than/longer than/exactly as long as) one Moon year. _____ (HINT: Remember – the Moon's rate of rotation is equal to its revolution.)

Part B

Overview:

The phases of the moon are caused by the relative positions of the earth, sun, and moon. The moon goes around the earth, on average, in 27 days. The sun lights up the half of the moon facing the sun. When the sun and moon are on opposite sides of the earth, the moon appears "full" to us; a bright, round disk. When the moon is between the earth and the sun, it appears dark; a "new" moon. In between, the moon's illuminated surface appears to grow (wax) to full, then decreases (wanes) to the next new moon.

The edge of the shadow is always curved, giving the moon its familiar crescent shape. Because the "horns" of the moon at the ends of the crescent are always facing away from the setting or rising sun, they always point upward in the sky. It is fun to watch for paintings and pictures which show an "impossible moon" with the horns pointed downwards.

Materials:

- o “Orbit of the Moon” sheet
- o Sun model (yellow ball)
- o Earth model (blue and black ball)
- o Moon model (black and white ball)
- o 3 caps

Procedure:

1. Place each model in a cap.
2. Lay the “Orbit of the Moon” sheet down on a flat surface.
3. Place the Sun model on the spot labeled “Sun”.
4. Place the Earth model on the dot labeled “Earth”. Be sure to place this model so that the **blue** side, representing daylight, **faces the Sun**.
5. Place the Moon model on top of position 1 on the sheet. Be sure that the black side faces the Earth.
6. Keep the following rules in mind throughout this exploration:
 - o The white side of the Moon should always face the Sun. In order to achieve this, **you must not turn or rotate the moon**.
 - o For a portion of this activity, you will be asked to observe the Moon from the perspective of an observer on Earth. You will need to move out of your chair and crouch down to observe the Moon model at eye-level. See figures 1 and 2 below.
 - o When identifying the phases, be sure to note whether the Moon is waxing or waning, gibbous or crescent, full or new, or first or third quarter.



Figure 1

Position 1

7. Locate Diagram 1. Use a pencil to fill in the circle at Position 1, so it shows how the Moon model appears when viewed from above.
8. Locate Diagram 2. Fill in the circle at Position 1, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.

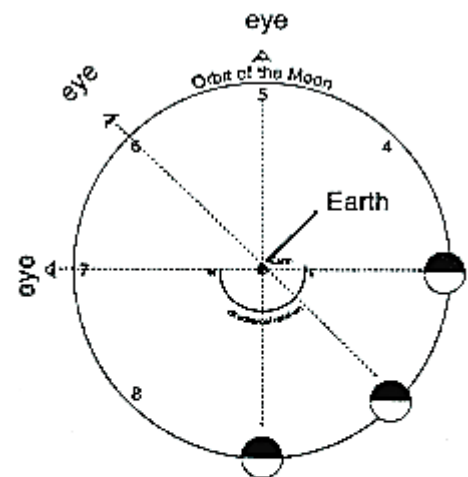


Figure 2

9. Locate Diagram 3. Fill in the circle at Position 1, so that it shows how the Earth model appears as viewed from the perspective of a person on the Moon. On the line below the circle, write the name of the phase of the Earth in this position.
10. What is the phase of the Moon in Position 1? _____
11. How many days will pass before this phase will be repeated? _____

Position 2

12. Locate Diagram 1. Use a pencil to fill in the circle at Position 2, so it shows how the Moon model appears when viewed from above.
13. Locate Diagram 2. Fill in the circle at Position 2, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.
14. The term used to describe the Moon as the lit portion **increases** is _____.
The term used to describe the Moon as the lit portion **decreases** is _____.
15. At Position 2, which side of the Moon is lit – the left or the right? _____
16. What is the phase of the Moon at Position 2? _____

Position 3

17. Locate Diagram 1. Use a pencil to fill in the circle at Position 3, so it shows how the Moon model appears when viewed from above.
18. Locate Diagram 2. Fill in the circle at Position 3, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.
19. Locate Diagram 3. Fill in the circle at Position 3, so that it shows how the Earth model appears as viewed from the perspective of a person on the Moon. On the line below the circle, write the name of the phase of the Earth in this position.
20. At Position 3, the Moon has now completed _____ percent of its orbit around the Earth.
21. What is the phase of the Moon in Position 3? _____

Position 4

22. Locate Diagram 1. Use a pencil to fill in the circle at Position 4, so it shows how the Moon model appears when viewed from above.
23. Locate Diagram 2. Fill in the circle at Position 4, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.
24. What is the phase of the Moon at Position 4? Be sure to note whether the Moon is waxing or waning. _____

Position 5

25. Locate Diagram 1. Use a pencil to fill in the circle at Position 5, so it shows how the Moon model appears when viewed from above.
26. Locate Diagram 2. Fill in the circle at Position 5, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.

27. Locate Diagram 3. Fill in the circle at Position 5, so that it shows how the Earth model appears as viewed from the perspective of a person on the Moon. On the line below the circle, write the name of the phase of the Earth in this position.
28. At Position 5, the Moon has now completed _____ percent of its orbit around the Earth.
29. What is the phase of the Moon in Position 5? _____

Position 6

30. Locate Diagram 1. Use a pencil to fill in the circle at Position 6, so it shows how the Moon model appears when viewed from above.
31. Locate Diagram 2. Fill in the circle at Position 6, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.
32. As the Moon moves from Position 5 to Position 6, does the lit portion appear to increase or decrease? _____
33. What is the term used to describe your answer to question 32? _____
34. What is the phase of the Moon in Position 6? _____

Position 7

35. Locate Diagram 1. Use a pencil to fill in the circle at Position 7, so it shows how the Moon model appears when viewed from above.
36. Locate Diagram 2. Fill in the circle at Position 7, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.
37. Locate Diagram 3. Fill in the circle at Position 7, so that it shows how the Earth model appears as viewed from the perspective of a person on the Moon. On the line below the circle, write the name of the phase of the Earth in this position.
38. At Position 7, the Moon has now completed _____ percent of its orbit around the Earth.
39. What is the phase of the Moon in Position 7? _____

Position 8

40. Locate Diagram 1. Use a pencil to fill in the circle at Position 8, so it shows how the Moon model appears when viewed from above.
41. Locate Diagram 2. Fill in the circle at Position 8, so that it shows how the Moon model appears when viewed from the perspective of a person on Earth. On the line below the circle, write the name of the phase of the moon in this position.
42. What is the phase of the Moon at Position 8? _____

Position 1 (at completion of orbit)

43. What is the phase of the Moon when it has returned to Position 1? _____

44. In your own words, explain how the Moon appears to go through a cycle of phases. _____

Diagram 1

The Moon in Orbit As Viewed From Above

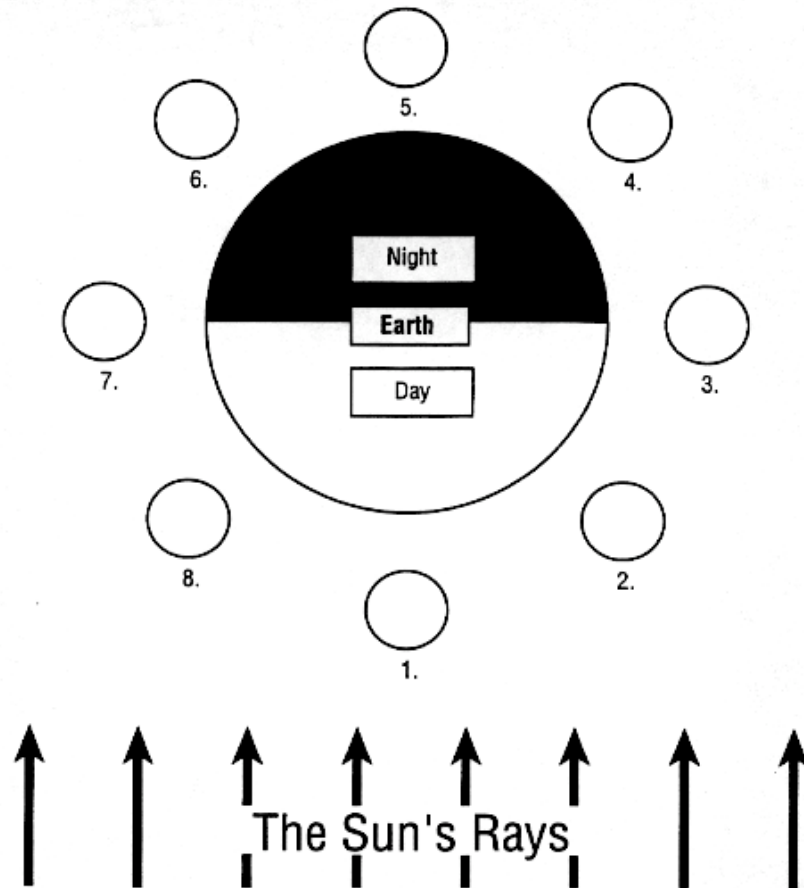
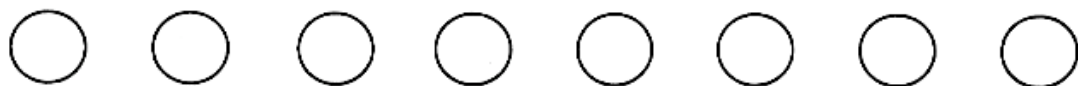


Diagram 2

The Moon Viewed From the Earth



1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____

Diagram 3

The Earth Viewed From the Moon



1. _____ 3. _____ 5. _____ 7. _____