

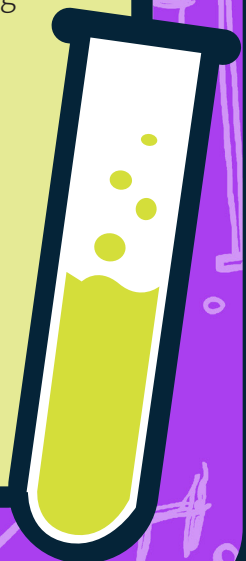
# UNLOCKING SCIENCE HANDSON!

## MAPPING THE MOON

One of the purposes that Genesis 1:14 gives for astronomical bodies is for time reckoning. This certainly is true of the moon in that it is the basis for the month. The synodic month is the 29.5-day cycle over which the moon's phases repeat. Another purpose of the moon is to provide light on the earth (Genesis 1:15; Jeremiah 31:35). In this exercise, we will observe the moon over two weeks, from new moon to full moon. During this time, you will see the moon's phases change dramatically as its position in the sky changes. You also will see the moon grow in brightness. When the moon is full, it will be bright enough to provide light for some outdoor activities not possible when the moon is not full. Until relatively modern times, the moon was very important in everyday life.

You can consult a calendar or an online resource like [mooncalc.org](http://mooncalc.org) and enter your location to find out when the next new moon will be and when the moonrise and moonset will be, as well as the altitude and azimuth. You ought to observe the moon about the same time each subsequent evening until the moon is no longer visible (about two weeks).

**Extra Family Fun:** Fill a pie pan with a thin layer of whipped cream and drop blueberries and grapes into the cream to make craters. Try different heights and angles to create your craters, and make sure you clean up by eating all of the fruit and cream.



# Building an Inclinometer

## Supplies

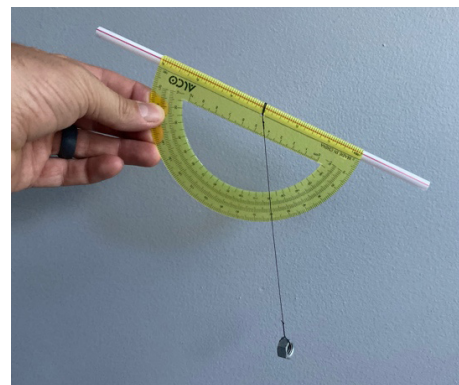
- Protractor
- Plastic straw
- Thread or light string
- Metal nut or washer
- Transparent tape
- Optional: Compass with azimuth/degree marks



**Figure 1: Supplies**

## Inclinometer Construction

- 1 Cut a piece of thread/string about 12 inches long.
- 2 Insert the thread/string through the hole at base of the protractor and tie it off. Making a simple over-hand knot may work to not pull through the hole.
- 3 Tie the nut/washer to the other end so that it hangs several inches below the curve of the protractor.
- 4 Tape the straw to the flat edge and on the opposite side of the knot so the string can swing freely.



**Figure 2: Completed Inclinometer**

## Using the Inclinometer to Find Elevation

- 1 To measure the angle of an object above the horizon, like the moon or a star, hold one end of the straw near your eye so you can see the moon or star.
- 2 Let the string hang freely.
- 3 When the object is aligned in the straw and the string is still, pinch the string and record the angle.
- 4 The angle you record will have to be converted since you are measuring the angle from  $90^\circ$ . Most protractors are marked with degrees from  $90^\circ$  in both directions, so find the difference (using absolute value subtraction) from 90. For example, if you read  $78^\circ$ , the angle above the horizon is  $12^\circ$  ( $90 - 78 = 12$ ). If the reading is  $134^\circ$ , the angle is  $44^\circ$  ( $134 - 90 = 44$ ).



**Figure 3: This reading indicates  $73^\circ$  and  $107^\circ$ , or an elevation of  $17^\circ$ .**

## Using the Compass to Find Azimuth

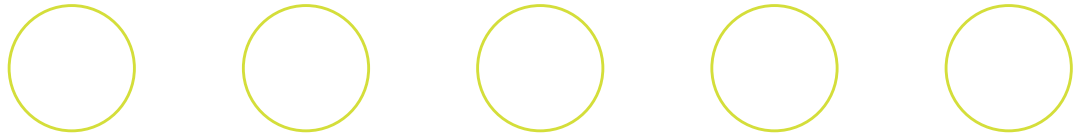
- 1 Orient your body in the direction of the moon and hold the compass level in front of you.
- 2 Rotate the azimuth ring so the 0° mark aligns with magnetic north.
- 3 Pick an object on the horizon that is directly below the moon and align the bearing arrow or sighting mark with the object.
- 4 Adjust the azimuth ring to align north to 0° and record the value at the bearing arrow to the nearest degree.



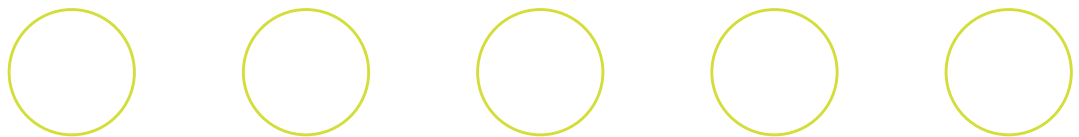
**Figure 4: This compass indicates an azimuth of 261°.**

## Activity: Mapping the Moon

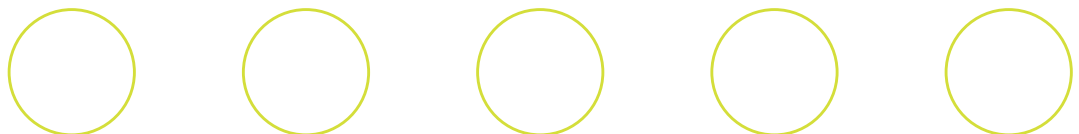
Observe the moon over half of a cycle of its phases and carefully sketch how it looks each night. Start on the night of the new moon and record the moon for 15 days. Make sure that you make your observation at the same time each night and from the same location. Use the inclinometer you made to find the altitude and a compass to find the azimuth. You can use the website [mooncalc.org](http://mooncalc.org), [timeanddate.com/moon](http://timeanddate.com/moon), or other online resources if you don't have a compass or to check your initial readings to make sure you are on the right track. You can also find the moon rise and moon set times on sites like these.



|          |  |  |  |  |
|----------|--|--|--|--|
| Date     |  |  |  |  |
| Time     |  |  |  |  |
| Moonrise |  |  |  |  |
| Moonset  |  |  |  |  |
| Altitude |  |  |  |  |
| Azimuth  |  |  |  |  |



|          |  |  |  |  |
|----------|--|--|--|--|
| Date     |  |  |  |  |
| Time     |  |  |  |  |
| Moonrise |  |  |  |  |
| Moonset  |  |  |  |  |
| Altitude |  |  |  |  |
| Azimuth  |  |  |  |  |



|          |  |  |  |  |
|----------|--|--|--|--|
| Date     |  |  |  |  |
| Time     |  |  |  |  |
| Moonrise |  |  |  |  |
| Moonset  |  |  |  |  |
| Altitude |  |  |  |  |
| Azimuth  |  |  |  |  |

## Analysis Questions and Discussion

Comparing the data in the table:

- 1 Which side of the moon was lit and which side was dark during your observations? *During the time from new moon to first quarter, the left side of the moon will be dark and the right side will get increasingly lighter.*
- 2 On which days was the moon in a crescent shape? *The first six or so days should be a crescent shape. This is called waxing crescent as the crescent is growing, or waxing.*
- 3 On which days was the moon in a gibbous shape? *The point from half to full moon are called a gibbous shape. This is a waxing gibbous because it is growing.*
- 4 How did the moon's position in the sky change each evening? Which way did the moon move? *Answers will vary, but the azimuth should increase from right to left, which is east to west facing the moon (from the Northern Hemisphere).*
- 5 Which evening was the moon highest in the sky? *Answers will vary, but it should be highest around the first quarter near day 7.*
- 6 Did you see any bright stars near the moon? Can you identify any of these as stars or planets? *The planets orbit in the same plane as the moon, so they will often appear close to the moon. You can identify them using computer programs or apps on a smartphone.*
- 7 Red Genesis 1:14–19. Is the moon mentioned in this passage? What is the purpose of the moon? *While the word moon does not appear, God calls it the lesser light to rule the night. Its purpose is to rule over the day and mark the passing of time and seasons, particularly the month.*
- 8 Use a concordance, Bible software, or online tool (like BlueLetterBible.org) to look up all of the places “moon” appears in the Bible. How many times does it occur? Which of these passages is the most interesting to you? *“Moon” appears 59 times in the ESV and has lots of interesting passages connected to it. Israel’s calendar was based on the moon’s cycles.*

**“And God made the two great lights—the greater light to rule the day and the lesser light to rule the night—and the stars.” Genesis 1:16 (ESV)**