

## ACTIVITY 4

# DAYTIME MOON

Grades :  
**4 and  
higher**

Level of preparation:  
**intermediate**

Student groupings:  
**small groups**

Length:  
**30-45 minutes**

Location of activity:  
**at school**

## BRIEF DESCRIPTION

In this activity, students observe the Moon in the daytime and recreate its phase with a small ball.

## LEARNING GOALS

- Observe the Moon in the sky.
- Model the phase of the Moon visible in the sky.

## MATERIALS

- Several light-coloured balls (ideally one ball for each group of 3-4 students)
- Notebook
- Pencils

## INTRODUCTION

Few people realize that the Moon may be visible in the daytime. This activity allows students to observe the Moon in daylight and to recreate the Moon phase on a ball. Holding a small ball under the real Moon allows the ball to be lit by sunlight in the same way as the Moon. This makes it possible for students to realize that the “missing” part of the Moon is still there, but it’s hiding in the shadow. In addition, by analyzing the system in three dimensions, it’s possible to understand the alignment of the Earth, Moon and Sun to recreate this phase.

**For a visual explanation of the phases of the Moon, please watch the accompanying video:** <http://youtu.be/iF8k9ibNko8>.

## PREPARATION

- Find or buy the balls. White Styrofoam balls available in dollar stores are ideal for this activity as they show a good contrast between the lit and unlit parts.
- Plan your observation for a time when the Moon will be visible in the sky. Here are the two most interesting options:
  - During the week **before full moon**, the Moon will be visible **in the eastern sky in the afternoon**.
  - During the week **after full moon**, the Moon will be visible **in the western sky in the morning**.
- Most calendars have information about the phases of the Moon, but it is also possible to find it by searching online. The *Rio Tinto Alcan Planetarium* in Montreal offers a lunar calendar on their website: <http://espacepouurlavie.ca/en/phases-moon>
- On the day of the activity, make sure the sky is clear enough to see the Sun and Moon.

## METHOD

- Go outside with your students and have them form small groups. Make sure they bring something to write on and a pencil.
- Distribute a ball to each group and ask them to figure out how to place the ball in order to see the same pattern of light and shadow as on the real Moon in the sky, as in Figure 3.



Figure 3. Modelling the phase of the Moon in daylight with a ball

Start a **discussion with your students by asking them these questions** (answers are provided in italics):

- What happens to the missing part of the Moon? *It is simply not lit and therefore does not appear in the sky. The Moon is always a sphere.*
- Identify the part of the ball and the Moon where it is daytime (*facing the Sun*) and where it is dark (*unlit part*).
- View your model from above and draw your ball, the Sun and yourself. Then try to see the alignment of the three bodies in space: the Moon, the Sun and the Earth. *Both alignments are shown in Figure 4. It shows that the angle in a) is the same as the angle b).*

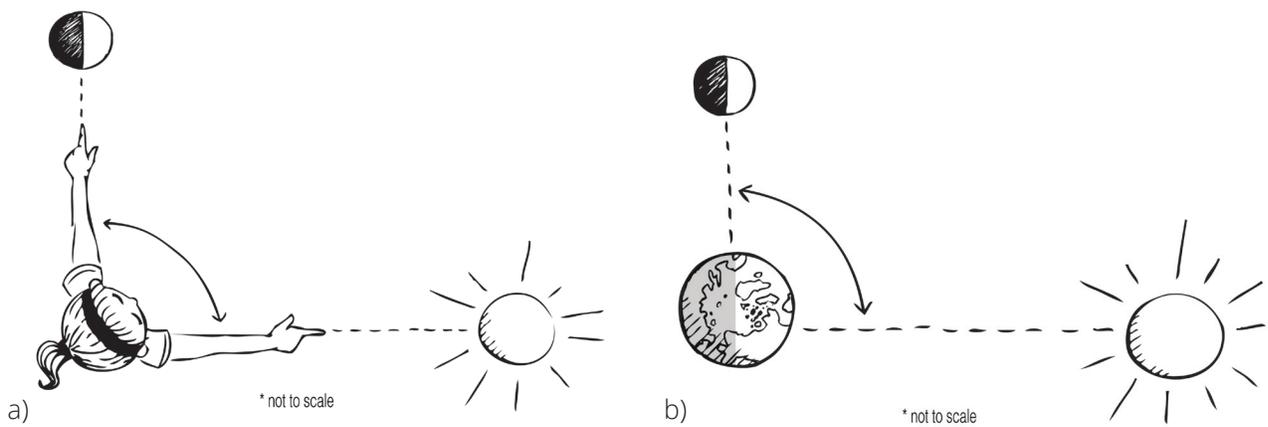


Figure 4. The angle formed by our arms pointing at the Sun and Moon in the sky is the same as the angle between the Sun, Earth and Moon with the Earth at the centre. In this case, we see that a quarter moon is formed when this angle is  $90^\circ$ . NOTE: the drawings are absolutely not to scale. They only serve to show the alignment and not distances. In fact, the Sun should be much farther to the right to light the Moon that way.

- Bonus Question: The symbol of a crescent moon and a star is very popular around the world and can be found on the flag of several countries. Is this configuration possible? *No, because the dark portion of the Moon is still present (the Moon is always a sphere) so it is impossible to see the stars through it. The stars are much farther away from us than the Moon. To view this alignment would require the unlit portion of the Moon to be transparent, which is impossible.*

