PHASES OF THE MOON (Materials: 8 small styrofoam balls, black marker, cardboard, play dough)

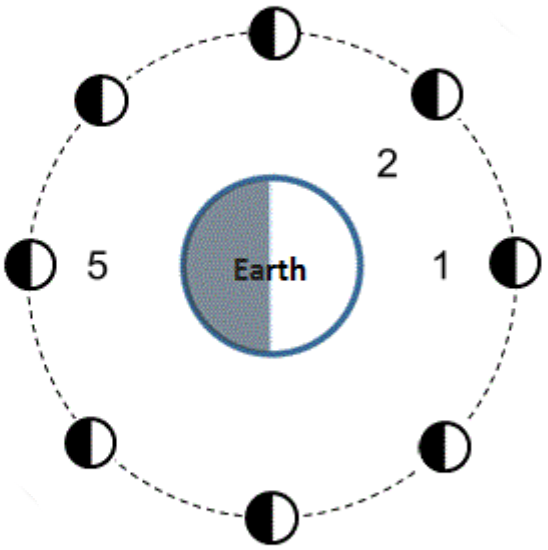
Realize a model of the phases of the Moon:

- color in black half of each ball, they represent the Moon illuminated by the Sun
- place the balls around the hole in the cardboard representing the orbit
- be sure the illuminated face is always in the same direction as in the figure below
- now put your head in the hole and… look at the Moon from the Earth!

a) how does the Moon appear when seen from the Earth in different positions?
b) take a picture of each phase (as seen from the Earth) then:
   - order the pictures and name each phase
   - identify the East and West in each phase

When you look at the Moon during a quarter, do you see a quarter or a half of it illuminated? Why?
How can you distinguish the First and Last quarters? First on the west, Last on the east
How can you distinguish waxing and waning phases? Waxing on the west, waning on the east

1 New Moon
2 Waxing crescent
3 First quarter
4 Waxing gibbous
5 Full Moon
6 Waning gibbous
7 Last quarter
8 Waning crescent



1. Let's think about the time, as you know the Moon's revolution takes about 28 days (27 d 7 h 43 min)

a) how much time passes between the four main phases? About 1 week
b) if today is a Full Moon, what will we see next week? Last quarter
c) look at the ephemeris* of the Moon in July 2022, you can see the time of moonrise and moonset. Which phases can you observe during the night and during the day?

New Moon, waxing crescent, and waning gibbous occur during the day. Full Moon, waxing gibbous, and waning gibbous occur during the night.

Ephemeris: a table that gives astronomical information, e.g. data, time of moonrise, and moonset

DARK SIDE OF THE MOON (Materials: a small ball with two colors)

It is said that the Moon always turns the same face to Earth. In other words, from Earth, we can only see the same half of the Moon, while we never see the backside. In your opinion, is it true?

Probably, most of the students know this fact (however they can't explain why)

Realize a model of the Moon rotating around the Earth using the two-color ball to simulate the Moon so you can easily distinguish the two halves (the two faces of the Moon). Put another ball to represent the Earth and draw the orbit (approximately).

1. Move the Moon around the Earth (revolution) without rotating the Moon on itself:
   a) what happens if the Moon were fixed on its axis while moving along the orbit?
   b) can we see both sides of the Moon from Earth?

We can observe the whole Moon, in different positions along the orbit we see the different sides

2. Now move the Moon around the Earth (Moon's revolution) and simultaneously rotate it (Moon's rotation)
   a) what happens now?

We can still observe the whole Moon, the dark side fact seems to be false

3. Let's change our investigation. Simulate the "dark side" hypothesis, so move the Moon around the Earth in a way that makes it true that from Earth we always observe the same face.
   a) can you do it? This means the hypothesis can be true
   b) how can you do it? Once the Moon completed the revolution, how many rotations have been done?

Yes, we can simulate the "dark side" hypothesis if the rotation has the same period of the revolution. The Moon completes one rotation at the same time as the revolution.

That's the stuff! The dark side is indeed a true fact because the rotation and the revolution of the Moon take the same amount of time: approximately 28 days.

Take photos and videos to show and tell your discoveries!

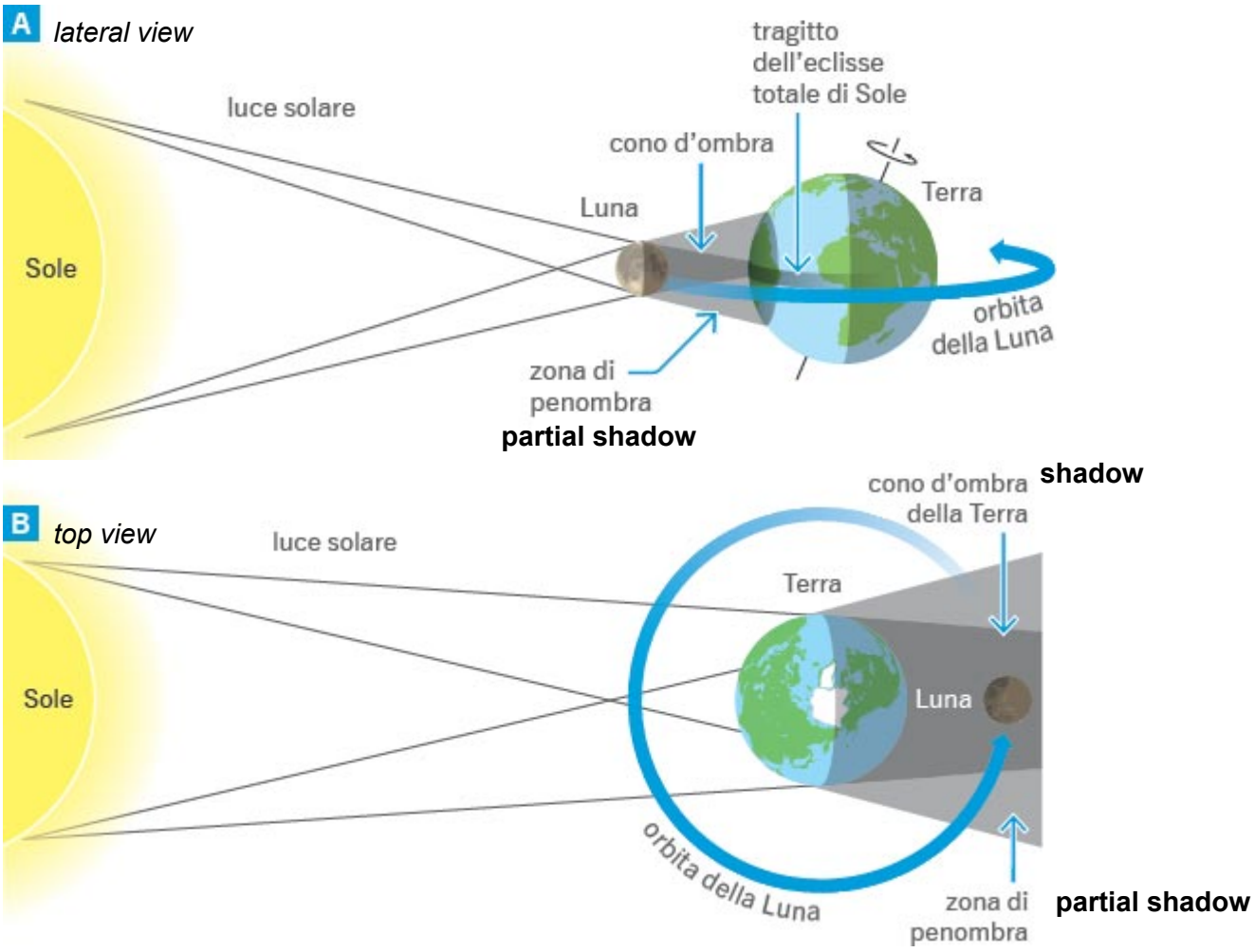
ECLIPSES (Materials: light source, small and large spherical objects, wood ring, play dough)

In the Earth-Moon-Sun system, the alignment of three celestial objects is known as syzygy.
There are two alternative configurations:

- Moon in conjunction (configuration S - **M** - E)
- Moon in opposition (configuration S - E - **M**)

Realize a model to represent these configurations and prove that different configurations are not possible.
Different configurations are not syzygial (see Moon's phases)

When the Moon is in conjunction or in opposition, the shadow produced causes the event known as an eclipse. There are Lunar eclipses and Solar Eclipses. Look at the figures, understand the event, and replicate it with your model, then complete the table below.



	Who obscures who?	Where is the Moon?	When can we see the event? During the night or day?
Lunar eclipse	E obscures the M	M in opposition	Night
Solar eclipse - total eclipse - partial eclipse > annular eclipse	M obscures the S	M in conjunction … … and apogee	Day

Take photos and videos to show the events of the eclipses with your model.
What we can see from the Earth?