

CALCULATING THE ECLIPSE WITH RATIOS

A solar eclipse is a mesmerizing event that occurs when the Moon passes in between the Earth and the Sun in its orbit, causing the Sun to cast a shadow of the Moon onto the Earth.

On Earth, the Moon and the Sun take up almost the same amount of space in the sky, so that during a total solar eclipse the Moon can almost completely "block out" the Sun. This is special to Earth - on other planets in our solar system, the moon(s) may be too small in the sky to fully block out the Sun or too big and block out the corona (the Sun's atmosphere) as well.



An image of the 2017 total solar eclipse. Credit: Rémi Boucher

In this activity, we will use ratios to calculate the relative sizes of a moon and the Sun in the sky for Earth, Mars, and Jupiter. All measurements given are average values provided by the Canadian Space Agency and NASA.

Earth

Measurements:

* Moon diameter: 3476 km

Moon distance from Earth: 384,400 km

* Sun diameter: 1,400,000 km

* Sun distance from Earth: 150,000,000 km

a) What is the ratio of the Moon's distance from Earth to its diameter?

b) What is the ratio of the Sun's distance from Earth to its diameter?

c) Why does the Moon fully "block out" the Sun during a solar eclipse from Earth?



Mars

Mars has two moons: Phobos ("fear") and Deimos ("panic"). Let's see what a solar eclipse looks like on Mars when Phobos passes between Mars and the Sun.

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* Phobos diameter: 22 km

* Phobos distance from Mars: 6000 km

★ Sun diameter: 1,400,000 km

★ Sun distance from Mars: 227,939,200 km

a) What is the ratio of Phobos's distance from Mars to its diameter?

b) What is the ratio of the Sun's distance from Mars to its diameter?

c) Which is bigger in the sky, Phobos or the Sun? What would a solar eclipse look like on Mars?

d) Take it further: What would Phobos' diameter need to be to appear as the same size as the Sun in the sky from Mars?



Jupiter

According to NASA, Jupiter has 95 moons that we know about so far! Jupiter's largest moon is Ganymede. Let's see what a solar eclipse looks like on Jupiter when Ganymede passes between Jupiter and the Sun.

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Ganymede diameter: 5262 km

* Ganymede distance from Jupiter: 1,070,000 km

* Sun diameter: 1,400,000 km

★ Sun distance from Jupiter: 778,600,000 km

a) What is the ratio of Ganymede's distance from Jupiter to its diameter?

b) What is the ratio of the Sun's distance from Jupiter to its diameter?

c) Which is bigger in the sky, Ganymede or the Sun? What would a solar eclipse look like on Jupiter?

d) Take it further: What would Ganymede's diameter need to be to appear as the same size as the Sun in the sky from Jupiter?