Journey Through the Solar System **Answer Key**

projects.wwtambassadors.org/solar-system-explorer

You will explore an accurate online model of our solar system that is based on NASA imagery and other real data. The model displays the actual positions of the Sun, planets, a dwarf planet, and select moons and how they move with time. You will get to know different aspects of our solar system as you navigate through space, control time, and explore each object from up close and far away.

Time rate: By default, the model runs in real time. (If you watched Earth in the model for 24 hours, it would spin around once on its axis.) To avoid having to wait that long, you can increase the model's speed to up to 1 billion times real time.

Object size: By default, the objects are displayed at 25 times their actual size compared to the distances between them. You can change the display to show the true scale of the objects or make the objects appear even bigger.

1. **Open the Solar System Explorer.** projects.wwtambassadors.org/solar-system-explorer

2. **Get to know the controls.** Follow these steps and check them off as you go:

- ☐ Rotate to an **overhead view** of the solar system. (Left-click near the top of the window and drag the cursor downward.)
- ☐ **Zoom in** until you can see the Sun's bright and dark spots. (Click on the thumbnail of the Sun if you moved away from it earlier.)
- ☐ **Zoom out** so you can see the entire solar system again.
- ☐ **Speed up time** until you can see the planets moving around the Sun. (You might need to increase the speed to 10,000,000x before you start to see much happening!)
- ☐ Click NOW to **reset time** to the current time. (This will also reset the speed to "Real Time.")
- ☐ **Choose an object** to fly to. (Click one of the thumbnails on the left-hand side. Double-click to arrive immediately.)
- ☐ Make sure **realistic lighting** is turned on. (This shows how sunlight illuminates objects in the solar system.)
- ☐ Rotate around to the **daytime** (lit) side of your chosen object.
- ☐ Rotate around to the **nighttime** (unlit) side of the object.
- ☐ **Speed up time** again and watch how the object spins through day and night. Look at a few other objects in the same way.

  Do you think every planet and moon has a daytime and nighttime side? **YES** / **NO**
- ☐ Click on the blue "**TIPS**" button to read more suggestions.

3. **Scan the Pattern questions** on the next page and keep them in mind as you complete Step 4.

4. **Begin the Scavenger Hunt!** Using the interactive and everything you just practiced, find and identify as many of these objects as you can. You many need to **turn off realistic lighting** to observe features like ice cracks, bands, or spots. Keep track of your observations in the **Exploration Log**.

This object is known for its beautiful rings.

Saturn

This is the largest object in our solar system.

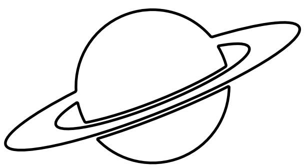
Sun

This planet has the longest year (meaning it takes the most time to orbit the Sun once).

Neptune

This planet spins on its side.

Uranus

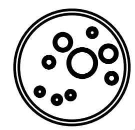


It has the longest day out of all the planets.
Hint: Increase time rate until you can observe each planet spinning. Which one needs the most speeding up to show any movement?

Venus

Look for a major geological feature on Earth (a mountain range, a river, a canyon, etc.).
Bonus: Can you identify the place you found?

(answers will vary)



This inner planet spins backward relative to almost all the other planets (which means you would see the Sun rise in the west and set in the east).

Venus

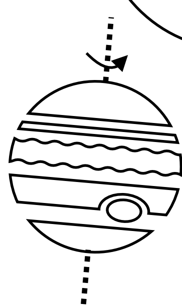
These planets have bands that make a 90-degree angle with the rotation axis of the planet.

Jupiter | Saturn

Uranus | Neptune

This object has a large red spot.

Jupiter



Even though this moon does not have a protective atmosphere, its surface is relatively smooth and has very few craters. Instead, many lines (ice cracks) crisscross over much of its surface.

Europa

This is the only moon that is larger than a planet.

Ganymede

5. **Did You Notice Any Patterns?** Some characteristics of objects in our solar system follow certain patterns if you look closely. You may have picked up on a few of them as you explored the interactive solar system.

Below are several **YES** / **NO** questions about possible patterns. Make a claim that describes the patterns you found (or state that there was no pattern). Provide evidence from your observations to support your claim. You may continue to consult the Solar System Explorer as you answer these questions.

a. What (if any) is the relationship between **a planet's distance from the Sun** and the **length of a year** (the orbital period) on that planet? Support your answer with evidence from your data and observations.

The farther away the planet is from the Sun, the longer its year.

The length of a year on a planet is the same as its orbital period. Exploration Log entries show that the planets' orbital periods are longer for planets that are farther from the Sun.

b. What (if any) is the relationship between **a planet's size** and the **length of its day** on that planet? Support your answer with evidence from your data and observations.

No pattern. Jupiter (largest) has the shortest day length. (You can notice rotation at 100x real time.)

Venus has the longest day length (100,000x real time), but it is not the smallest.

Mercury is the smallest and has a shorter day length (10,000x real time) than Venus.

c. What (if any) is the relationship between **an object's size** and **whether its structure is gaseous or not**? Support your answer with evidence from your data and observations.

In our solar system, the largest objects (Sun, gas/ice giants) are gaseous. Smaller objects have a rocky or icy structure. Exploration Log entries show that the five largest objects in size are all gaseous (based on characteristics listed in the interactive text). All rocky/icy objects in our solar system are smaller in size.

d. What (if any) is the relationship between **an object's structure** and **whether it has craters** visible on its exterior? Support your answer with evidence from your data and observations.

Gaseous object do not have craters. Most rocky and Icy objects have many craters. Objects without visible craters are the Sun, Jupiter, Saturn, Uranus, and Neptune—all gaseous, without a surface where craters could form. Mercury, Earth's Moon, Mars, Ganymede, and Callisto are rocky or icy and have a lot of craters. Venus, Earth, Io, and Europa are rocky and icy and have some craters. (Info for teachers: Venus and Earth have atmospheres that cause all but the largest meteors to burn up, so they have fewer craters. Io's volcanic and Europa's icy surface can actively re-form and smooth over old craters. The fuzzy image of Pluto in the interactive is pre-New Horizons. High-resolution New Horizons images show that parts of Pluto are heavily cratered.)

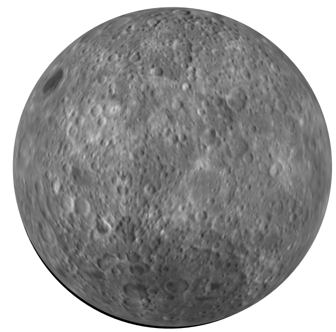
6. Challenge: If you finished everything and still have time, try these additional questions.

Turn OFF realistic lighting and **reset time to NOW!**

a. **Compare two sides of Earth's Moon**. The same side of the Moon always faces Earth. Navigate to the side of the Moon facing Earth and draw what you observe. Rotate to the side of the Moon facing away from Earth and draw what you observe.

Side of Moon facing Earth

Side of Moon facing away from Earth



b. What major difference did you notice between the side of the Moon facing Earth and the side of the Moon facing away from Earth?

The side of the Moon facing away from Earth is much more heavily cratered than the side of the Moon facing Earth, which is relatively smooth by comparison.

c. Astronomers learned in 1959 that the "far side" of the Moon looks very different than the near side. Since then, they have wondered ***why*** it looks so different. What are your ideas?

Answers will vary, but a strong answer will identify the proximity of the less-cratered side to Earth as a key reason. Since the same side of the Moon always faces Earth, it is common to think that the near side of the Moon has fewer craters because it is protected from meteor impacts by Earth. This would be an acceptable conjecture for this question.

*(For teachers: In reality, astronomers discovered recently that the Moon's near side has a **different composition** and a **thinner crust** than the far side, likely because of the additional heat radiated from Earth toward the Moon's near side early in the formation of both bodies. Meteors that struck the near side could actually pierce the thin crust, releasing lava that smoothed over the large, dark regions known as "mares.")*