GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.

TEACHER GUIDE

OUR SOLAR SYSTEM

GRADES 6-8

COMMON MISCONCEPTIONS

- **There are many stars in our solar system.**
  Our solar system only consists of one star, the Sun. The Sun is the largest thing in the solar system and all other objects are held in orbit around the Sun due to gravity. The Sun consists of 99.8% of the mass in our solar system and is roughly 109 times the diameter of Earth. The Sun is mostly made of hydrogen and helium and reaches temperatures in its core of more than 27 million degrees Fahrenheit due to nuclear reactions. Although the Sun is one of more than 100 billion stars in the Milky Way, it is the only one found within our solar system.

- **There is no gravity is space.**
  Students may think that because an atmosphere does not exist in space, that gravity does not exist. However, gravity is the attractive force by which a planet or other body draws objects toward its center. Anything that has mass, such as planets and other objects in space, also has gravity. The larger an object's mass, the more gravitational pull it has on another object. Since the mass of the Sun is so large compared to the planets, its force of gravity keeps all of the planets in orbit around it.

- **All planets have rocky surfaces.**
  Planets in our solar system can be divided into two main groups—terrestrial and gas giants. The terrestrial planets (Mercury, Venus, Earth and Mars) have compact, rocky surfaces, and are located closest to the Sun. The gas giants (Jupiter, Saturn, Uranus, and Neptune) are large planets composed mostly of gases, such as hydrogen and helium, with a relatively small, rocky core.

STARS

Stars are born within clouds of dust scattered throughout most galaxies. These clouds begin to collapse under their own gravitational attraction. As the cloud collapses, the material at the center begins to heat up. This is the very beginning of what will one day become a star. This hot core continues to gather dust and gas and the star is fueled by nuclear fusion of hydrogen to form helium. There is an outflow of energy that keeps the star from collapsing under its own weight and is the energy by which it shines. The life of a star is often dependent on its size and will end once all the hydrogen has been fused. In general, the larger the star, the shorter its life, although most live for billions of years.

ASTEROIDS, COMETS, AND METEOROIDS

An asteroid is a small rocky object that orbits the Sun. Asteroids are smaller than a planet, but larger than the pebble-size objects called meteoroids. Sometimes one asteroid can smash into another, causing small pieces to break off. Those pieces are called meteoroids. Meteoroids can also come from comets. Comets orbit the Sun like asteroids, but are made of ice and dust instead of rock.

A meteor is what happens when a meteoroid burns up upon entering Earth's atmosphere. The meteoroid vaporizes as it enters Earth's atmosphere causing a streak of light in the sky. Sometimes a meteor is called a shooting star due to its appearance, but a meteor is not actually a star. If a meteoroid does not vaporize completely in the atmosphere, it can land on Earth's surface and is then called a meteorite.

MOONS

Just like planets orbiting the Sun, there are more than 200 moons in our solar system that orbit other celestial objects. Large planets have a strong enough gravitational pull to hold a moon in its orbit. This is known as a natural satellite. However, sometimes even a large asteroid can hold a small moon in orbit.

Moons come in many shapes and sizes. Most are airless but a few have atmospheres and even hidden oceans. Saturn and Jupiter have the most moons but even smaller worlds like Pluto can have five moons in orbit. Earth has only one moon that acts as a stabilizing force and helps to make it a more pleasant place for life.

TEACHER TIPS

Asking students to share a question that has not been shared yet helps to push student thinking around the phenomenon. Often students will come up with a similar set of questions, so asking them to think longer and deeper about what they are observing will help build their ability to ask questions. Students may also struggle with the mathematical calculations and process when first presented with the task. Allowing students to work in groups helps build their ability to collaborate and communicate through discourse in order to figure out the best way to apply mathematical concepts and processes to solve the problem. If students are presented with the algebraic expressions needed to solve the problem, they miss out on the sensemaking that will help them when they are faced with different but similar problems in the future.

ABOUT THIS LESSON

This lesson was created by the National Science Teaching Association (NSTA) to pair with the Generation Genius video and support *NGSS*.

They have requested we provide the following background with this lesson:

The Next Generation Science Standards (NGSS) are the national standards on how students learn science, and they are based on contemporary research presented in *A Framework for K–12 Science Education (the Framework).* The shift in science teaching and learning required by the Framework is summarized in this infographic: A New Vision for Science Education.

At the start of each Generation Genius lesson, students are presented with a phenomenon, then they try to explain it. Students will notice they have gaps in their knowledge and ask questions, which motivates them to build ownership of science ideas they need in order to explain how or why the phenomenon occurred. The way students build ownership

of science and engineering ideas is through active engagement in the science and engineering practices (SEPs). This process of sensemaking, or doing science to figure out how the world works, is one of the major shifts the *Framework* encourages.

To engage in the SEPs, students should be part of a learning community that allows them to share their ideas, evaluate competing ideas, give and receive critiques, and reach consensus. Students can start by sharing ideas with a partner, then with a small group, and finally, with the whole class. This strategy creates opportunities for all students to be heard, build confidence, and have something to contribute to whole-class discussions. Each Generation Genius lesson provides conversational supports to facilitate such productive student discussions to contribute to sensemaking.

Excited to continue your shift toward the new vision for science education? Check out the Generation Genius Teacher Guide page on the NSTA website for resources and strategies to engage every student in your classroom in **doing** science.