PEANUTS and SPACE FOUNDATION
Fetch Snoopy!

OBJECTIVES
Students will:
- ✦ Read *Snoopy, First Beagle on the Moon!* and *Shoot for the Moon, Snoopy!* to give students some background knowledge.

SUGGESTED GRADE LEVELS
2nd – 5th

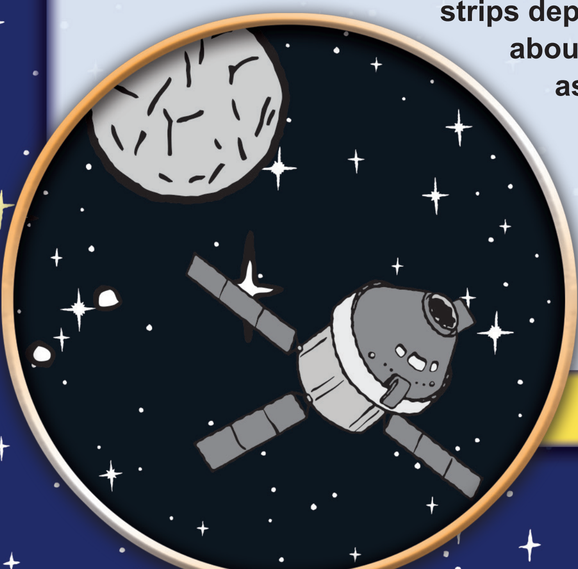
SUBJECT AREAS
Science, Math

TIMELINE
45 – 60 minutes

NEXT GENERATION SCIENCE STANDARDS
- ✦ 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- ✦ 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- ✦ 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- ✦ 5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

21st CENTURY ESSENTIAL SKILLS
Critical thinking/Problem solving, Organizing Concepts, Predicting Patterns, Obtaining/Evaluating/Communicating Ideas

BACKGROUND
- ✦ NASA has proudly shared an association with Charles M. Schulz and his American icon Snoopy since Apollo missions began in the 1960s. Schulz created comic strips depicting Snoopy on the Moon, capturing public excitement about America's achievements in space. In May 1969, Apollo 10 astronauts traveled to the Moon for a final trial run before the lunar landings took place on later missions. Because that mission required the lunar module to skim within 50,000 feet of the Moon's surface and "snoop around" to determine the landing site for Apollo 11, the crew named the lunar module Snoopy. The command module was named Charlie Brown, Snoopy's loyal owner.



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- These books are a united effort between Peanuts Worldwide, NASA and Simon & Schuster to generate interest in space among today's younger children. The character of Snoopy has been allowed to be reimagined for this special partnership and for the opportunity to head into outer space.
- Gravity is a constant force that's all around us. According to NASA, "Gravity is a force that governs motion throughout the universe. It holds us to the ground, and it keeps the moon in orbit around Earth and Earth in orbit around the sun. Many people mistakenly think that gravity does not exist in space. However, typical orbital altitudes for human spaceflight vary between 120 - 360 miles above Earth's surface. The gravitational field is still quite strong in these regions, since this is only about 1.8 percent the distance to the moon. Earth's gravitational field at about 250 miles above the surface is 88.8 percent of its strength at the surface. Therefore, orbiting spacecraft, like the space shuttle or space station, are kept in orbit around Earth by gravity."
- The Moon has a gravitational pull, but it's considerably less than Earth. According to NASA, "The condition of microgravity comes about whenever an object is in free fall. That is, it falls faster and faster, accelerating with exactly the acceleration due to gravity (1g). As soon as you drop something (like an apple) it is in a state of free fall. The same is true if you throw something; it immediately starts falling towards Earth. Objects inside [the ISS] appear to be floating and motionless, they are actually traveling at the same orbital speed as their spacecraft: 17,500 miles per hour (28,000 km per hour). Objects in a state of free fall or orbit are said to be weightless. The object's mass is the same, but it would register "0" on a scale. Weight varies depending on whether you are on Earth, the moon or in orbit. But your mass stays the same."

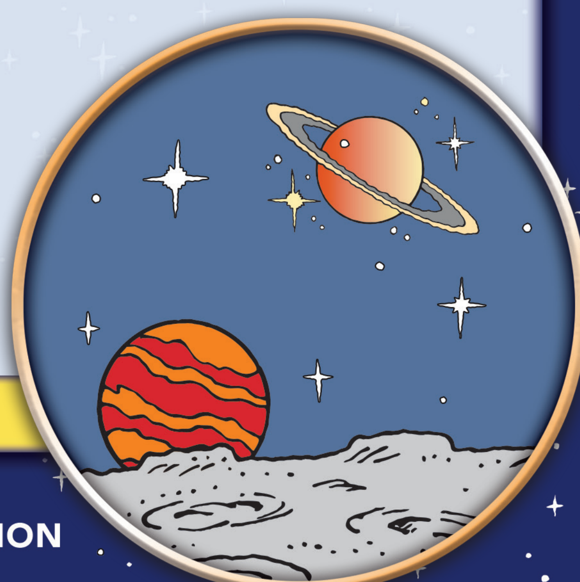
VOCABULARY

Gravity, microgravity, mass, weight, hypothesis

MATERIALS

For each group:

- Three balls of different mass but roughly the same size (i.e., ping-pong ball, golf ball, bouncy ball)
- Slingshot that can hold the balls
- Scale to weigh the balls
- Graphing sheet
- Red, black and blue pens
- 25-foot tape measure
- Open space (outdoors or indoors)



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LESSON PROCEDURES

1. *Read Snoopy, First Beagle on the Moon!* and *Shoot for the Moon, Snoopy!* to the entire class, to give students some background knowledge.
2. Discuss how gravity affects objects on Earth and compare gravity on Earth to that of the moon. Ask students, "Since the moon is $^1/_6$ of the Earth's gravitational pull, how does Snoopy practice for being in low or microgravity?" (*Shoot for the Moon, Snoopy!* pp. 12 - 17, "low gravity.")
3. Compare mass (amount of matter it contains) and weight (amount of gravity is pulling on that object). Ask students, "If we play fetch with Snoopy on the moon, will the weight of the ball affect how far it will go (distance)? What do you THINK will happen?"
4. Conduct an experiment using the scientific method. As a class, develop a hypothesis (educated guess) on how gravity will affect the distance of a ball thrown by varying its mass. It should look something like, "**IF** we increase the mass of a ball thrown on the moon, **THEN** the distance of the ball will be less than that of the lighter ball."
5. Divide the students into groups of three. Provide each group with the supplies needed for this experiment (except for the balls; each team gets three of varying mass). Before starting the experiment, have students record each ball's mass. As students measure the mass, you can stretch out the tape measure for students to calculate distance. It would be best to conduct this activity outside on a field, but in a classroom, gym or cafeteria works too.
6. Explain to students that scientists perform tests at least three times to get more accurate results. Record the distance after each "throw" for each ball. Ask students, "Why are we using a slingshot, and not our arms to throw the ball?" Answer: We are trying to keep the force constant (not changing) for most accurate results. The only variable (changing) will be the mass). Have students rotate roles of throwing, measuring distance and recording data.
7. Analyze data from the experiment. Have students graph their results. Ask students, "Which ball went the farthest? Shortest? Why do you think this happened?"
8. Conclude the experiment by addressing your hypothesis. Ask students, "Was our hypothesis correct? How do you know? What could we do differently to make our results better? If we were on the moon, which ball would be best to play fetch with Snoopy?" Explain to students that on the moon, objects would go farther and fall slower due to having much less gravity. Have students write a summary of the experiment.

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EXTENSIONS

- Perform the same experiment but change the size of the ball. Will you have the same results?
- Research gravitational pull on other planets. Would playing fetch with Snoopy differ on Mars than on Earth? Moon?

RESOURCES

Dunbar, B. (2015, May 13). What is Microgravity? Retrieved from https://www.nasa.gov/centers/glenn/shuttlestation/station/microgex.html

Garcia, M. (2018, July 9). NASA and Peanuts Celebrate Apollo 10's 50th Anniversary. Retrieved from https://www.nasa.gov/feature/nasa-and-peanuts-celebrate-apollo-10-s-50th-anniversary

Schultz, Charles M. (2019). Snoopy, First Beagle on the Moon! New York, NY: Simon & Schuster.

Schultz, Charles M. (2019). Shoot for the Moon, Snoopy! New York, NY: Simon & Schuster.

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Fetch, Snoopy!
Data Sheet

Directions: Complete the table using the data gathered from the experiment. Graph results.

Object	**Mass (g)**	**Distance #1 (m)**	**Distance #2 (m)**	**Distance #3 (m)**
Ball One				
Ball Two				
Ball Three				

Graph: Mass vs. Distance

Mass

Distance