PEANUTS and SPACE FOUNDATION

Rocket Dog

OBJECTIVES

Students will:

- Read *Snoopy, First Beagle on the Moon!* and *Shoot for the Moon, Snoopy!* to give students some background knowledge.
- Describe how a rocket must overcome drag and the forces of gravity to get outside the Earth's atmosphere.
- Explain that thrust is the force created by a rocket.
- Explain some challenges that engineers face in getting a rocket to overcome the forces of gravity as it heads into space.

SUGGESTED GRADE LEVELS

K – 5

SUBJECT AREAS

Science, Math, Language Arts, and Speaking/Listening

TIMELINE

45 – 60 minutes

NEXT GENERATION SCIENCE STANDARDS

- K-PS2-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
- K-PS2-2: Analyze data to determine if a design solution works as intended to change the speed or direction of an object.
- 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

21st CENTURY ESSENTIAL SKILLS

Critical Thinking/Problem Solving, Collaboration and Teamwork, Communication, Information Literacy, Flexibility, Leadership, Initiative, Social Skills, Organizing Concepts, Predicting Patterns, Constructing Explanations, Obtaining/Evaluating/Communicating Ideas

PEANUTS

SPACE FOUNDATION

PEANUTS and SPACE FOUNDATION

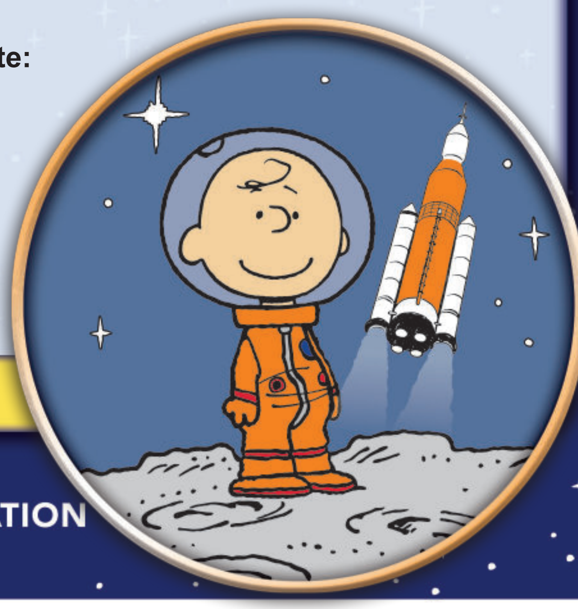
Rocket Dog

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. Meanwhile, the Command Module was named Charlie Brown, Snoopy's loyal owner.
- These books are a united effort between NASA and Simon & Schuster to generate interest in space among today's younger children.
- "Few classroom topics generate as much excitement as rockets. The scientific, technological, engineering and mathematical foundations of rocketry provide exciting classroom opportunities for authentic hands-on, minds-on experimentation (Dunbar, 2012)."
- What is a rocket scientist? When people think about jobs at NASA, certain careers come to mind first. Astronaut is almost always near the top of the list, often followed by the fabled "rocket scientist." The job title is almost mythical — the gold standard for a challenging occupation. To put a task in perspective, a common expression is "Well, it's not rocket science." But, at NASA, it is. Rockets have always been a big part of what NASA does, and someone has to make them fly. But what is a rocket scientist? The truth is, a lot of them are actually engineers — men and women who take the raw science of Newtonian physics and apply it to design vehicles to launch things into space. As NASA research engineer Tom Benson put it, "Call them what you want, scientist or engineer. People who work on rockets have to eventually build an efficiently working piece of machinery that has many complex physical and chemical phenomena present that must be fully understood. The success of the rocket depends on the knowledge and experience of the builder."
- For more background info visit NASA's Rocketry Website: https://www.nasa.gov/pdf/265386main_Adventures_In_Rocket_Science.pdf

VOCABULARY

Gravity, Force, Speed, Atmosphere, Drag, Thrust, Weight, Lift, Rocket, Earth, Moon



PEANUTS

SPACE FOUNDATION

PEANUTS and SPACE FOUNDATION

Rocket Dog

MATERIALS

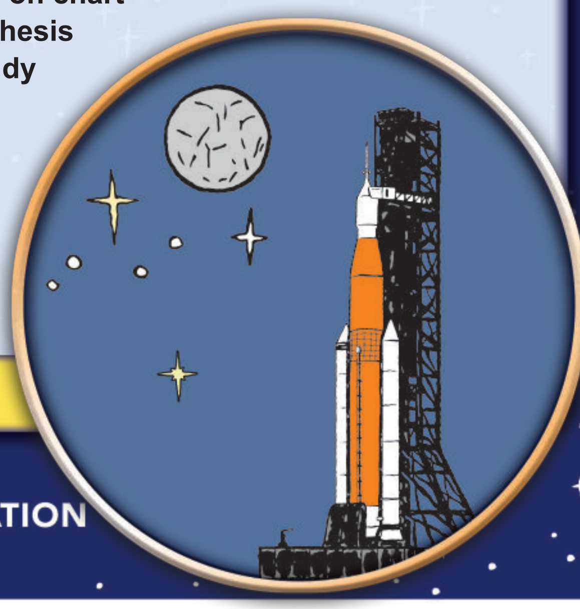
Per Group

- 1 track for cars (or thin surface)
- 1 butcher paper cut into 4-foot lengths
- 3-4 foam noodles cut into 3-inch lengths (cardboard toilet paper rolls can be used)
- 4 equally sized stackable blocks (2” x 4”)
- Data collection sheet
- 1 stopwatch
- 1 toy car (Hot Wheels, Matchbox, etc.)
- 1 cup of sand
- Measuring tape (for extension)

LESSON PROCEDURES

Teacher’s note: Set up experiment stations prior to the start of the lesson.

1. Assemble car-track lengths to 1 foot each. Lay one 4-foot length of butcher paper at the end of each track. Place 3 or 4 foam noodle sections (or 3 or 4 toilet paper tubes) on the butcher paper at the 3-foot mark (this will represent breaking through the Earth’s atmosphere). Stack one block under each track (the other blocks will be used later in the lesson).
2. Read *Snoopy, First Beagle on the Moon!* and *Shoot for the Moon, Snoopy!* for the entire class to establish some background knowledge.
3. Open *Shoot for the Moon, Snoopy!* to page 8. Discuss with your students that Snoopy will be traveling to the Moon and will have to overcome certain forces in order to break through the Earth’s atmosphere.
4. Show students a video clip of a rocket launch. At the end of the video, discuss with students the forces that affect the launching of the rocket (thrust, drag, gravity, weight, lift). Discuss how thrust and drag are opposing forces. Ask students, "How do thrust and drag affect the speed of an object?"
5. Introduce the word “hypothesis,” and display the word on chart paper or white board. Share with the class that a hypothesis is an idea or explanation that you then test through study and experimentation. Have students hypothesize how certain forces will affect the speed of the object (data collection sheet, section A). Have students formulate their hypothesis in an “If…, then…” format.



PEANUTS

SPACE FOUNDATION

PEANUTS and SPACE FOUNDATION

Rocket Dog

6. Introduce the experiment to students. Explain that students will be doing an activity that will help demonstrate how an object's speed will change with variations in the push and pull on the object.
7. Divide students into groups of three. Assign roles to students: data collector (will operate the stopwatch for each trial), data recorder (records data onto the data collection sheet), and pilot (operates the toy car).
8. Students will begin with one stacking block under the track. The pilot will release the toy car at the top of the track. The data collector will time how long it takes for the toy car to break through the Earth's atmosphere (run into the foam noodles or toilet paper rolls). The data recorder will record the time on the data collection sheet, section B.
9. Students will repeat this experiment using two blocks under the track, then three blocks under the track, and finally four blocks under the track.
10. Explain to students that the next section of the experiment will demonstrate drag (or pull) on an object. Have students rotate roles. Sprinkle a thin layer of sand on the butcher paper in the area between the end of the track and the Earth's atmosphere (paper rolls).
11. Students will begin with one stacking block under the track. The pilot will release the toy car at the top of the track. The data collector will time how long it takes for the toy car to break through the Earth's atmosphere (run into the paper rolls). The data recorder will record the time on the data collection sheet, section C.
12. Students will repeat this experiment using two blocks under the track, then three blocks under the track, and finally four blocks under the track.
13. Once all students have completed their experiments, have students compare their data. Specifically focus on how the speed of the toy car was affected by opposing forces.
14. Discuss results and important finding as a class. Explain how the force of gravity provided speed or thrust to the car. By raising the height of the track, you increase the cars' speed. Lead students to understand that the sand was an opposing force on the toy car and caused the speed to decrease. Discuss how the sand is representative of drag on a rocket. Have students write a conclusion statement in section D of the data collection sheet. Students can check to see if their hypothesis was correct. As a whole class, summarize how a force on an object can cause an object's speed to increase, while an opposing force can cause an object's speed to decrease.

PEANUTS

SPACE FOUNDATION

PEANUTS and SPACE FOUNDATION

Rocket Dog

EXTENSIONS

- Place measuring tape alongside butcher paper so that the measuring tape begins at the end of the track. Have students calculate the speed of each trial using the formula

$$speed = \frac{distance}{time}$$

- Have students create a graphic novel to illustrate the forces that affect rockets launching into space.
- Predict what would happen if more sand were added to the butcher paper. Discuss how this would be represented by excessive drag on a rocket. If there is not enough thrust to overcome the drag on a rocket, then the rocket would not be able to break out of the Earth's atmosphere.

RESOURCES

Dunbar, B. (2012, July 30). Rockets Educator Guide. Retrieved from https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Rockets.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

National Aeronautics and Space Administration. (n.d.). Retrieved from https://www.nasa.gov/pdf/265386main_Advantures_In_Rocket_Science.pdf

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

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

PEANUTS

SPACE FOUNDATION

Data Collection Sheet

Section A: Hypothesis

In the space below, hypothesize how certain forces will push or pull an object and how this will affect the speed of the object.

If____

then____

____

Section B: Experiment #1 (without sand)

Record the time it takes for the toy car to break through the Earth's atmosphere (paper rolls).

Number of Blocks	**Time (seconds)**
1	
2	
3	
4	

Section C: Experiment #2 (with sand)

Record the time it takes for the toy car to break through the Earth's atmosphere (paper rolls).

Number of Blocks	**Time (seconds)**
1	
2	
3	
4	

Section D: Conclusion

Based on your results from the experiments, fill in the blanks to complete the conclusion below.

A *push* on an object will cause the object's speed to ____________________.

A *pull* on an object will cause the object's speed to _____________________.