Soda Can Racer

Lesson Skill / Mathematical Concept: Measurement
Using timers and tape measures, students will select appropriate units of measurement to calculate distance traveled and speed.

Vocabulary:

- **Proton:** A subatomic particle that has a positive charge.
- **Electron:** A subatomic particle that has a negative charge.
- **Static Electricity**: Electricity that collects on the surface of something and can cause a mild shock if you touch it.

Estimated Time: *60 minutes*

Materials List
Each team of 3 to 4 students needs the following:

- Empty soda can
- 2-3 balloons
- Masking tape
- Tape measure or rulers
- OPTIONAL: Piece of wool (students may also rub balloons against hair to generate static electricity)
- Stop Watch (students may use timers on their phones or second hands on a clock/watch)
- OPTIONAL: Chart paper and markers for charting times

Goal: Students will use balloons and static electricity to propel an empty soda in a race against other students.

To see a video of a soda can race, you may go to: https://www.youtube.com/watch?v=tPmtwuWNTQc**.**

Steps

1. Ask students what they know about static electricity. If necessary you may prompt them by giving an example of how people experience static electricity on a daily basis (e.g. getting shocked after walking on carpet, static on clothes after they have been in the dryer, etc.).
2. Explain to students that static electricity occurs when electrons (which have a negative charge) are piled up in one object and then attracted to the protons (which have a positive charge) in another object.

3. Provide each team of 3 to 4 students with the materials.
4. Instruct students in each team to blow up 1 balloon and tie it off.
5. Students will generate static electricity by quickly rubbing the balloon with the piece of wool or against their hair for 15 to 20 seconds. (This will build up the electrons in the balloon.)
6. To propel the empty soda can, students will place the static charged balloon close to the can (without touch it). The can should start to roll towards the balloon, as the negatively charged electrons on the balloon are attracted to the positively charted protons in the can. Continue "pulling" the can by slowly moving the balloon away from the soda can.
7. Once students have gotten the hang of moving their soda cans, have your teams race against each other to see who can move their cans the fastest.
    a. Use the masking tape to create a starting line and finish line. 10 to 15 feet is a good distance, but you may choose any length based upon time and space available. Make sure that you take note of the distance, but do not tell the students.
    b. Using any procedure you wish, have the teams race against each other. Make sure to time each race (students may time themselves or you may time them) and record the times on chart paper.
    c. After you have finished the races, have students calculate the speed of their soda can racers (they may calculate the speed of each race they participated in or just their fastest race). To do this they will need to determine the length of the "race track." Encourage them to decide what unit of measurements will be most appropriate. If time is limited, you may tell them the length of the race track.
    d. To calculate the speed, instruct students to use the formula $\boldsymbol{S = \frac{D}{T}}$

       This equation tells us that the speed (S) is determined by dividing the distance (D) traveled by the time (T). For example, if the distance of the race is 10 feet and the time it takes to finish the race is 20 seconds, then the speed will be 0.5 feet per second (10 divided by 20). **See Calculating Speed Handout.**

Extensions and Modifications

Students may go a step further by trying to determine the speed in terms of feet per minute or miles per hour.

Students may test how different variables affect the power of the static electricity, e.g. the size of the balloon, length of the hair used to generate the static electricity, how long the balloon is rubbed against the hair, or if there is any difference between using hair or the piece of wool to generate the static electricity.

If you wish, you may provide the students with the distance of the track and the appropriate units of measurement.

There are other activities which can be done to demonstrate the power of static electricity. For example, if you place a statically charged balloon next to a slow trickle of water from a faucet, you can see the water “bend” from the pull of the static electricity.

Name: _____

Soda Can Racer
Speed Calculations

To calculate the speed (S) of your can you need to know the distance it traveled (D) and your race time (T). You will then calculate the speed (S) by using the following equation:

$$S = \frac{D}{T}$$

This equation tells us that we calculate speed by taking the distance (D) and dividing it by the time (T).

The speed will be expressed in terms of units of distance per unit of time. For example, if your soda can travels 10 feet in 5 seconds, divide the distance (10 feet) by the time (5 seconds) to get a speed of 2 feet per second.

Unit of distance are you using (Examples: Inches, feet, yards): _____

Unit of time are you using (Examples: seconds, minutes): _____

Use the table below to calculate and record your speed for each race:

Race	Distance	divided by	Time	equals	Speed
#1		**÷**		**=**	
#2		**÷**		**=**	
#3		**÷**		**=**	
#4		**÷**		**=**	
#5		**÷**		**=**	

Soda Can Activity Reflection Questions

1. What Math skills and concepts did you use in this activity?

2. If the distance of the race were 2,000 feet, what unit of measurement for time do you think you would probably you use and why?

3. Based upon what you observed in this activity, can you think of any ways that static electricity could be used in the real world?

4. What was the most challenging part of this activity?

5. Did your team have any disagreements? If so, how did you resolve them?