

Puffed Rice Fleas

Section FORCES & INTERACTIONS

Estimated Time ⌚ Setup: 5 minutes; Procedure: 5 minutes

OVERVIEW

Students will learn about the power of electric forces as a charged object is used to move other materials.

In this activity, students charge a balloon through building up static electricity. When they bring the charged balloon near a puffed rice cereal, they can see as the cereal is first attracted to – and then repelled – by the balloon. Students learn about the interplay between electron movement, forces, how they impact movement.

INQUIRY QUESTIONS

Getting Started:

🔍 What happens when a charged object is brought near another object?

Learning More:

🔍 How and why do atomic particles move?

Diving Deeper:

🔍 How does electric force explain the movement of objects?

CONTENT TOPICS

This activity covers the following content topics: atomic structure, protons, neutrons, electrons, electric force, static electricity, charges, attractive and repulsive forces

This activity can be extended to discuss: ions, intra/intermolecular forces, ionization, Coulomb's Law

NGSS CONNECTIONS

This activity can be used to achieve the following Performance Expectations of the Next Generation Science Standards:

🔗 **3-PS2-3:** Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

MATERIALS

For one setup:

- ✔ Plate
- ✔ Puffed rice cereal
- ✔ Balloon
- ✔ Charging cloths (e.g. wool, plastic wrap, carpet, etc.)

ACTIVITY NOTES

This activity is good for:

- ✔ Individuals
- ✔ Pairs
- ✔ Small groups
- ✔ Demonstrations

Safety Tips & Reminders:

- ⚠ Beware that if it is very humid, this activity will not work as static electricity wears off quickly in moist air.
- ⚠ There is no eating or drinking in the laboratory—even when we are working with normally edible materials.
- ⚠ This experiment uses a balloon. Check to see if any students have latex allergies or if there are any restrictions on using balloons in the classroom in advance.
- ⚠ Review the Safety First section in the Resource Guide for additional information.

Fun Fact #1

Static electricity occurs most often when the air is dry. This is because moist air conducts electricity, and charges that build up easily wear off.

EXPLAIN  continued

In this experiment, students rub a balloon against a cloth like wool, plastic wrap, or carpet. A balloon – which is made of nylon, latex, or rubber – tends to draw electrons from other objects. The charging cloth tends to give up electrons. When rubbed together, the cloth gives up electrons to the balloon and a negative charge builds up on the surface of the balloon.

When the balloon is brought near a neutral object, like puffed rice cereal, the electrons in the cereal repel away from the balloon and the protons in the cereal are attracted to the balloon. Electrons are more mobile and move easily in an atom. The electrons in each grain of cereal move farther away from the negatively charged balloon, but protons cannot move as much so they stay in the same place. This makes the attraction from the protons stronger than the repulsion from the electrons – which have been pushed away – giving the cereal a weak positive charge. The slightly positive cereal sticks to the balloon because of electric force.

However, overtime some of the extra negative charge from the balloon can jump from the balloon to the cereal. When this happens, the cereal becomes negatively charged. Since the cereal and the balloon now have the same charge, they repel one another, and the cereal jumps off the balloon.

Differentiation for Younger or More Advanced Students

You can differentiate this activity for students of different grade levels by focusing on the concepts outlined below.

GETTING STARTED

For younger students, emphasize the following concepts:

- An atom is the smallest building block of matter, and is made of protons, neutrons, and electrons.
- Forces can be either attractive (pulling) or repulsive (pushing).
- Something can have either a positive charge, a negative charge, or no charge (neutral).
- Opposite charges are attracted to each other and like charges repel each other.

DIVING DEEPER

For more advanced students, emphasize the following concepts:

- Protons, neutrons, and electrons have different charges and locations in an atom.
- Electrons can be transferred from one atom to another, or from one object to another.
- Some atoms/objects tend to give up electrons, while others tend to accept electrons.
- When charges build up on an object they create static electricity.

ELABORATE 

Elaborate on your students' new ideas and encourage them to apply them to different situations. The section below provides some alternative methods, modifications, and extensions for this activity.

- While a balloon works well for this experiment, other materials like a ruler, straw, comb, and more will work, too! Typically, insulators are good at holding a surface charge.
- Try using different materials around the room to charge the balloon. Which materials work best? Which do not work well? What factors might determine which materials most easily give away electrons and charge an object?
- Move the charged balloon toward different materials, such as small pieces of aluminum foil, rubber bands, salt, pepper, and more. Do these substances behave differently than the puffed rice. What factors might determine how strong the attraction will be?
- What happens if the balloon is placed near the cereal without charging it first? Why do you see these results?
- A fun extension is to charge a balloon, then bring it near a trickling faucet that has a steady (but small!) stream of water coming out. You will be able to see the water bend towards the balloon!
- Electric force can be used to power motion! Try charging a balloon and see if you can move a soda can, bubbles, another balloon, and more! Students can set up a race and run multiple trials to find the fastest way to move an object across the room.

