Static Electricity

Physical Science | Lesson Guide

4th Grade

Photo Description

A large blue balloon floats above a dark surface covered with colorful confetti pieces. Water droplets cling to the bottom of the balloon, creating small beads that seem ready to fall. The scattered confetti below shows many different colors like red, yellow, green, and white circles.

Scientific Phenomena

This image demonstrates static electricity and water adhesion as the anchoring phenomenon. The balloon likely became charged through friction (rubbing), which allows it to attract small water molecules and hold them against gravity. The water droplets form due to condensation from the air or transfer from nearby surfaces, and they stick to the balloon because of electrostatic attraction and surface tension forces.

Core Science Concepts

1. Static Electricity: When objects are rubbed together, they can gain or lose electrons, creating an electrical charge that attracts other materials
2. Adhesion: Water molecules can stick to other surfaces due to attractive forces between different types of molecules
3. Surface Tension: Water molecules stick together strongly, forming droplets with rounded shapes
4. Gravity vs. Other Forces: While gravity pulls the water droplets down, electrical and adhesive forces can be strong enough to hold them up

Pedagogical Tip:

Have students make predictions about what will happen to the water droplets before conducting balloon experiments. This activates prior knowledge and creates investment in the outcome.

UDL Suggestions:

Provide multiple ways for students to demonstrate their understanding: drawing force diagrams, acting out molecular movement, or creating digital presentations about static electricity in everyday life.

Zoom In / Zoom Out

1. Zoom In: At the molecular level, electrons are moving between the balloon material and whatever rubbed against it. Water molecules (H ,O) have a slightly positive and negative side, making them attracted to charged surfaces like tiny magnets.

2. Zoom Out: This same static electricity phenomenon occurs in nature during thunderstorms when ice particles in clouds rub together, building up massive electrical charges that eventually become lightning.

Discussion Questions

1. What do you think would happen if we touched the balloon with our finger? (Bloom's: Predict | DOK: 2)

2. How might the size of the water droplets change if we waited longer? (Bloom's: Analyze | DOK: 3)

3. What other materials besides water might stick to a charged balloon? (Bloom's: Apply | DOK: 2)

4. Why do you think some droplets are larger than others? (Bloom's: Evaluate | DOK: 3)

Potential Student Misconceptions

1. Misconception: "The balloon is magnetic." Reality: The balloon has an electrical charge, not a magnetic field. Static electricity and magnetism are different forces.

2. Misconception: "Water always falls down immediately." Reality: Other forces like electrical attraction can temporarily overcome gravity, allowing water to stick to surfaces.

3. Misconception: "Only metal objects can be charged." Reality: Many materials including rubber, plastic, and fabric can gain static electrical charges through friction.

NGSS Connections

- Performance Expectation: 5-PS1-3 Make observations and measurements to identify materials based on their properties
- Disciplinary Core Ideas: PS1.A Structure and Properties of Matter, PS1.B Chemical Reactions
- Crosscutting Concepts: Patterns, Cause and Effect
- Science Practices: Planning and Carrying Out Investigations, Analyzing and Interpreting Data

Science Vocabulary

* Static Electricity: A build-up of electrical charge on the surface of objects that can attract other materials
* Adhesion: The force that makes different materials stick together
* Friction: The rubbing force between two surfaces that can create heat or electrical charge
* Condensation: When water vapor in the air turns into liquid water droplets
* Surface Tension: The force that makes water form rounded droplets and stick together

External Resources

Children's Books:
- Balloons and Static Electricity by David Dreier
- The Magic School Bus and the Electric Field Trip by Joanna Cole
- Static Electricity by David Dreier

YouTube Videos:
- "Static Electricity for Kids" - Simple experiments showing how balloons can pick up paper, bend water, and stick to walls (https://www.youtube.com/watch?v=yc2-363MIQs)
- "Bill Nye Static Electricity" - Educational segment explaining electron movement and static charge buildup through fun demonstrations (https://www.youtube.com/watch?v=LQWwSkiMGgM)