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5E Lesson Plan on Electrostatic Forces

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Overview

Introduction to 5E Lesson Plan

The 5E Lesson Plan is a teaching framework designed for a **week** long lesson comprised of **three** class periods at the **highschool level** . The Lesson will focus on electrostatic forces and interactions. Students will discover how 'every object in nature is either positive, neutral or negatively charged,' setting the foundation for deeper learning about charge interactions and electrostatic phenomena.

Day 1

ENGAGE: Sticky tape Demo

The Sticky Tape Experiment provides students with a hands-on opportunity to learn about electrostatic charges. By using simple materials like sticky tape, students can visualize and understand how objects can be positively, negatively, or neutrally charged. This experiment is a practical way to demonstrate fundamental concepts of physics, making abstract ideas more tangible and engaging for learners.

Experiment 1

What is going on here? Gravity?

1. Fold a small tab on a piece of tape and place it on a table as the base layer.

2. Place a second piece of tape on top, calling it the top layer.

3. Peel the top layer off and move it towards your hand slowly.

4. What do you Notice?

Experiment 2

Part 2

This experiment demonstrates how layers of tape interact when adhered and then separated.

1.First, a base layer of tape is placed on the table,

2. Followed by a middle layer

3.A top layer stacked on top of the middle piece.

4. Then middle and top layers are peeled off together from the base and then separated.

5. Move the sticky sides of each piece close then the non sticky sides, what do we notice?

Assessment

Prior Knowledge Assessment

Students will bring their knowledge that electricity is everywhere and that it is a fundamental force of nature.

They will also understand that 'objects only move when a force is applied to them' (N2L). This lesson builds on these foundational concepts by exploring the interactions of positive and negative charges and forces through hands-on activities and experiments, allowing students to connect prior knowledge to new learning about electrostatic forces.

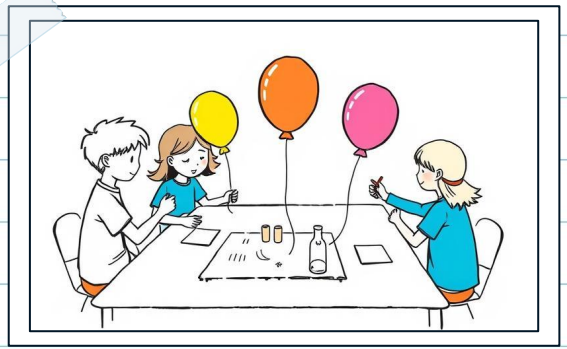
Standards

Next Generation Science Standards (HS-PS2-4)

Performance Expectations	Disciplinary Core Ideas	Crosscutting concepts
Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. 9th grade level of math would focus on descriptions and predictions	PS2.B: Types of Interactions. Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena HS-PS2-4: Motion and Stability: Forces and Interactions. Students will explore how these forces vary with distance and impact movement.	**Patterns** Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

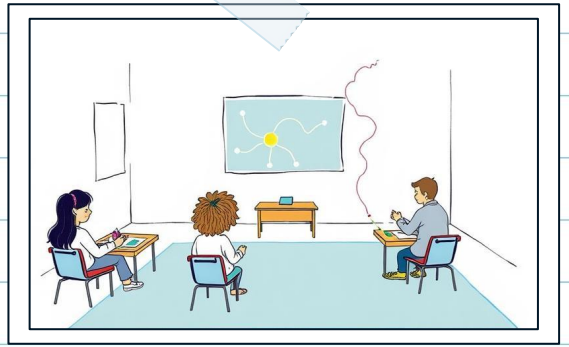
Day 1

EXPLORE: Conductors and Insulators and charges



Investigating Charge Interactions

Students will explore the difference between conductors and insulators using balloons and sheets of metal. They will observe how these materials interact with electrostatic fields, focusing on charge transfer and attraction or repulsion of objects.



Real-World Applications

Using carpet, hair, and charge sticks, students will impart a charge on surfaces and measure the electrostatic field with neutral or charged tape, enhancing their understanding of charge behavior in real-world contexts.

Day 2

EXPLAIN: Real world applications

Group Exploration

Students will go outside the classroom in groups to find 3 instances of electrostatic fields interacting or existing. They will observe and take notes on their findings.

3 instances of electrostatic interactions
Observation notes

Discussion

Returning to the classroom, students will discuss and explain what they think is occurring in each instance they observed. This encourages collaborative learning and critical thinking.

Group discussion notes

Partner Presentations

Each group will present their findings to a partner group. This allows for sharing of different observations and insights, enhancing understanding of electrostatic forces. As well as peer to peer learning and explanation.

Presentation to partner group
Feedback notes from partner group

Class Reflection

At the end of the class, groups will submit their notes. This reflection helps the teacher assess understanding and integrate the findings into further lessons.

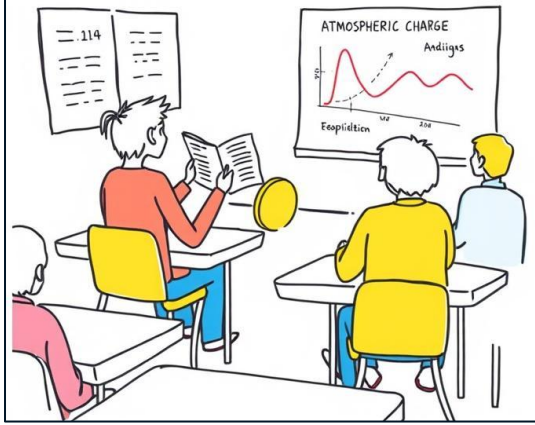
Submitted observation notes
Reflection on findings

Day 3

ELABORATE: Atmospheric Charge

Day 2 Activity Overview

- Students will read this article on atmospheric charge, which explains how different charges interact in the atmosphere, similar to the effects seen when rubbing carpet together.
- Each student will fill out a drawing template that illustrates the distribution of charges in the atmosphere and identifies where positive and negative charges are located and how clouds gain or lose charge.
- The teacher will provide the article, collect the completed drawing templates, and grade them, assisting students who require extra guidance on their graphics.



Day 3

Evaluate: Van der Graaf Experiment

Group Setup

Divide students into groups with a Van der Graaf generator assigned to each. Provide materials from previous lessons for their experiments.

Group assignments
Van der Graaf generators
Materials for investigation

Charge Identification

Students will experiment with materials used throughout the week to determine the charge on their Van der Graaf generator, discussing observations within groups.

Identification of charge
Group discussion notes

Individual Reflection

Each student writes a paragraph explaining how they determined the charge of the Van der Graaf generator, articulating their reasoning and evidence.

Individual reflection paragraphs

Teacher Facilitation

The teacher will facilitate discussions and assist groups struggling to identify the charge, ensuring understanding of concepts.

Thank you!