Class: Grade 9 Science

Lesson Title: Electrostatics Kinulation – Law of Attraction & Inducing Charges

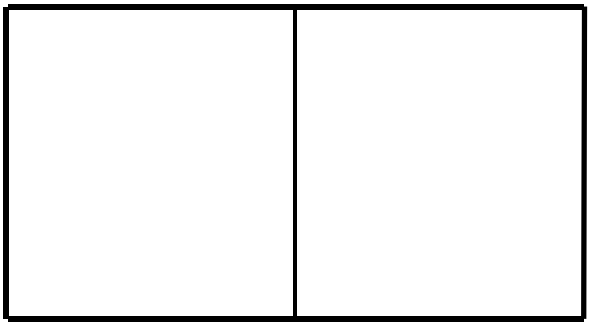
Class Size: **24**
Time: **60 mins**

Curriculum Outcomes:
308-14 Identify properties of static electrical charges: like charges repel, unlike charges attract, induced charges.

Learning Objectives:
1. Students will further develop their understanding of electrostatics and the law of attraction.
2. Students will understand the concept of how to induce neutral charged object.

Materials:
- Tape
- Music
- Sticky notes with positive/negative signs

Preparation beforehand:
- Tape a designated area on the floor for students to stand in when they are acting as charged particles.



- Have a playlist of music ready to play for each activity so students can move around and dance during the interaction

Introduction:
- Introduce the topic. Possible prompt questions include:
  - What is an atom? Are atoms charged? What are the different parts of an atom?
  - Do charges make objects act a certain way?

- Explain what a kinulation is (broken up into kinesthetic and simulation). Tell them that these are used to help students learn difficult concepts that are otherwise difficult to picture. It allows students to become part of the demonstration, and therefore easier to remember and learn. Ask students if they would like to try one.

Activity #1 – Like and Unlike Charges:
1. Ask students to stand in the large rectangle taped on the floor. They can ignore the center line for now.

2. Explain that for this activity that all of the students are individual objects that are going to have a specific charge.
   a. When the music starts playing they can begin to act like the charge that they are in that environment.

3. You can write somewhere where all students can see "Males (+), Females (+)"
    a. Tell the students to act how they think their charge would act with the other charges around them
    b. Start the music and let it play for 10-15 seconds
    c. Ask students what they were all trying to do in this scenario. Were you trying to get closer to the other charges or get away from them?

4. Next, write "Males (+), Females (-)" and let the music play once again to see how the students react.
    a. Was this situation different than the first? How was it different?
    b. Did you feel a repulsion or an attraction to the other charges?

5. Next, write "Males (-), Females (-)" and let the music play.
    a. How was this situation different? The same?
    b. Does it matter if you're both negative or both positive? Does the same thing occur?

6. Finally, write "Males (-), Females (+)" and play some music.
    a. Is there a difference? Who were you attracted to or repelled by?

7. Ask students what they can conclude about like and unlike charges after this activity? This is the law of attraction—like charges repel and unlike charges attract.

Activity #2 – Induced Charges:

1. Ask students how does an object become negatively or positively charged? We know there are protons, neutrons and electrons in an atom, but how does an atom attain a charge?

2. What does it mean if an object is neutral?
    a. Are all 3 of the subatomic particles able to move?
    b. What happens if an object gains electrons? Loses electrons?

3. Does anyone know anything about induced charges?
    a. Tell students they are going to learn about them now through a kinulation.

4. Split the class in half and have the two groups stand on either side of the rectangle with the middle line separating them.
    a. Each group of students is representing one neutral object.
    b. Hand out sticky notes with positive and negative signs on them, try to have equal positives and negatives on each side of the taped line.
    c. Tell students that when the music starts they are going to simulate a "rubbing" motion to pretend they are creating friction (What occurs when there is friction? Is there a transfer of charges? Which charges move?")
    d. The teacher will be the one moving negative charges around to the opposite side by guiding students over while the music is playing.

5. Once you stop the music, ask students what occurred? Did the object's charge change on either side?
    a. Did you gain or lose negative charges?
    b. Did any positive charges move?
    c. If an object is negatively charged, what can you say about the amount of protons and electrons?
    d. If an object is positively charged, what can you say?
    e. What are examples of good conductors?

Activity #3 – Induction by Separation:

1. Ask for 10 volunteers to keep their charge. The remaining students are going to be given one positive charge and one negative charge to represent they're neutral (they can have a sticky note on each hand)
    a. The students that keep their charge need to stand around the border of the taped square.

2. For this activity, the charged particles on the outside will stand still during the music and the neutral particles inside the taped area will be floating around.

3. When the neutral particles are floating around, if they are near a negative charge who's standing on the outside, they can reach their positive sticky note towards them and their negative sticky note away (charges shifting)
    a. They are never physically touching, just near each other.
    b. Ask students if they are giving away charge here.

4. Play the music and let the neutral particles float around while changing their arm positions based on the charges on their hands and the ones around them.
    a. If they understood what to do, have the students switch roles and repeat the activity.

Conclusion – Possible wrap-up questions:

1. Can you think of any real life examples where charge induction occurs? What about induction by separation?
2. What happens when you rub a balloon against your head?
3. What happens when you clean off a TV screen and the next day there is a lot of dust on it?