Electrostatics

HS-PS2-4. **Use mathematical representations of Coulomb's Law to describe and predict the electrostatic forces between objects.** [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of electric fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]

HS-PS2-6. **Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*** [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material.]

Learning Targets:

I CAN…

- **LT33 - Identify the charge on each subatomic particle.**
- **LT34 - Compare and contrast conductors and insulators.**
- **LT35 - Identify electrons as the subatomic particles that move in a conductor and predict how electrostatic forces cause them to move in conductors.**
- **LT36 – Apply the principle of the conservation of charge to determine charge distributions.**
- **LT37 - Predict attraction and repulsion between charged and neutral objects and the processes that cause them.**
- **LT38 - Use proportional reasoning to predict changes in electrostatic forces based on changes in charges and/or separation distance.**
- **LT39 - Make calculations using Coulomb's Law.**

LT33 examples:
A. Using the language of electric charge and force, describe why electrons "hang around" the nuclei of atoms.

B. What's the particle in an atom that has no electric charge?

LT34 examples:
C. Materials in which electric charge can move easily are called ____________________.

D. What are some examples of materials in which electric charge *cannot* move easily?

LT35 & LT36 examples:
E. How do positive charges behave in the presence of other positive charges?

F. While playing with your niece, your rub a balloon on your head and "stick" it to the wall. (Your niece is amazed!) Assuming the balloon acquires a negative charge, your hair would acquire a positive charge. What happened to your hair to make it positively charged?

G. An electroscope is charged by contact with a negatively charged balloon. Draw a sketch of the electroscope and at least six electrons on the electroscope both when the balloon is still nearby *and* when the balloon is moved far away from the electroscope.

LT37 examples:

H. A negatively charged balloon is brought near a pile of neutral confetti (small bits of paper). When the balloon is brought close, the confetti is attracted to the balloon. Explain why this attraction exists between a charged object (balloon) and a neutral object (confetti).

LT38 examples:

I. By what factor would the electrostatic force change if the distance between two charges quadruples?

J. By what factor would the electrostatic force change if one of the charges triples and the other doubles?

K. By what factor would the electrostatic force change if the distance between 2 charges is reduced to 1/9?

LT39 examples:

L. Calculate the electric force between two electrons that are 1E-10 m apart.

M. Calculate the electric force between a +2.5 nC charge and a -7.5 nC charge that are 0.05 meters apart.

N. Calculate the electric force between a -2.5μC charge and a +7.5μC charge that are 0.05 meters apart.

O. Calculate the distance between two equal -8.5μC charges if the electrostatic repulsion of one on the other is 5.0 N.