

On-level Physics

Electrostatics

This unit will allow each student to:

- a. gain a better understanding of interactions of charged particles and electric fields
- b. continue making proper scientific measurements and calculations
- c. define and properly use all vocabulary
- d. properly apply all terms and concepts in describing/explaining real world examples
- e. continue making and interpreting scientific graphs
- f. teach someone else the concepts discussed
- g. practice proper laboratory safety

This will be accomplished by each student that is able to:

recognize and relate SI and USCS units of charge, electrical potential energy, electric potential (voltage)

recognize charge, electrical potential energy, electric potential (voltage) by the units only

1. describe the effects of static electricity on matter
2. describe charging by friction, conduction, and induction/charge polarization
3. use an electroscope to detect the presence of charge; explain how the electroscope detects charge
4. explain the process of grounding
5. describe the two main purposes of a lightning rod (primary) preventing lightning and (secondary) redirecting lightning
6. apply the principle of conservation of charge to an object being charged
7. state Coulomb's law
8. compare and contrast gravitational forces to electrical forces
9. describe the behavior of electrons in conductors v. insulators
10. describe and sketch electric fields surrounding single charged particles as well as multiple charged particles
11. explain why the interior of a conducting sphere has zero electric field
12. describe how a charged particle can possess electrical potential energy
13. explain the relationship between electrical potential energy, charge, and electric potential
14. describe the purpose and operation of a capacitor
15. use a Van de Graaff generator to demonstrate the effects of an electric field
16. perform calculations using proper problem solving techniques to determine:
(a) electrical force (b) electric potential (aka: voltage)

Textbook Reference – Physics: Principles and Problems

Chapter 20: Static Electricity and Chapter 21: Electric Fields

Key Terms – *definitions are available at theteterszone.net*

charge, electrical force, **electrically polarized**, **electrostatics**, **grounding**, **conduction**, **conductor**, **electric field**, electroscope, induction, **insulator**, static electricity, Coulomb's law, capacitor, **electric potential**, **electrical potential energy**, voltage

Electrostatics and electric fields review Answer on a separate sheet of paper due prior to the 20Q on Day 5

- A. In terms of attraction and repulsion, how do negative particles affect negative particles? How do negatives affect positives?
- B. What happens to electrons in any charging process? What happens to protons in the same processes?
- C. Give an example of something charged by friction.
- D. Give an example of something charged by simple contact.
- E. Give an example of temporarily charging an object by induction.
- F. What occurs when we “ground” an object?
- G. What is an electrostatic discharge?
- H. What are two purposes of a lightning rod? Which is primary?
- I. How can you charge an object negatively by using a positively charged object?
- J. How does an electrically polarized object differ from an electrically charged object?
- K. Rub an inflated balloon against your hair and place it against a door. What does the balloon do? Explain how it does this.
- L. How does the magnitude of electrical force between a pair of charged objects change when the objects are moved twice as far apart? Three times as far apart?
- M. How many electrons are required to produce a charge of 1 C?
- N. How much energy is given to each coulomb of charge that flows through a 9 volt battery?
- O. If you put in 10 joules of work to push 1 coulomb of charge against an electric field, what will be its potential difference with respect to its starting position?
- P. What is the voltage at the location of a 0.0001 C charge that has an electric potential energy of 0.5 J?
- Q. Why is it safe to be in a car when it is struck by lightning? No, it’s not “grounding”.
- R. Sketch the electric field surrounding two electrons that are 2 cm apart. Where is the magnitude of the electric field the strongest?
- S. Describe how a charged particle would gain electrical potential energy.
- T. Compare and contrast electrical potential energy and electric potential.