

**CONCEPT** Scientists established three laws of electrical charges based on experiments. The three laws are opposite charges attract each other, like charges repel each other and charged objects attract neutral objects.

## BACKGROUND

Electrostatics was invented by the French physicist Charles- Augustin de Coulomb. Best known for the formation of Coulomb's law.

**There are two (2) types of electric charge:** Positive charge and Negative charge.

**By scientist definition:**

A rubber rod rubbed with wool is charged negative. (electrons move from wool to rubber)

A glass rod rubbed with silk is charged positive. (electrons move from glass to silk)

An object is electrically neutral if the same amounts of negative and positive charge are found on the object, net charge is zero.

The fundamental units of charge is the Coulomb.

Electric charge is quantized.

A proton has a positive charge.  $+1.6 \times 10^{-19}$  Coulombs

An electron has a negative charge.  $-1.6 \times 10^{-19}$  Coulombs

**Calculate the electrostatic force using the formula:**

$$F = K(q_1 \times q_2)/D^2$$

Where K is coulombs constant, equal to  $9 \times 10^9 \text{ Nm}^2/\text{C}^2$ .

The unit for K is Newtons square meters per square coulombs.

## EXAMPLES

Rubbing a balloon on your head and making your hair stand up.

Walking across carpet in socks and receiving a shock from a doorknob.

Having clothes come out of the dryer and sticking to each other.



*Make sure it measures up*

## APPLICATION

A major problem from static electricity is its potential to cause damage to equipment or explosions. Computers or sensitive electronics can be damaged by a static electric spark. When using gasoline, you must protect against sparks that may ignite the fuel. Machines are plagued with problems from static electricity. Control or elimination of static electricity is usually done by grounding or draining off the electrical charges, as well as using caution.

**ELECTRIC EQUIPMENT SHOCKS:** A static electricity spark can damage the internal electronics of a computer. Technicians who work on the inside of computers should have a special pad on the floor and use a grounded strap on their wrist that will suck any charges from their bodies. You should touch something metal to ground out any electrical charges you have before you touch the computer.

**GASOLINE EXPLOSIONS:** People who fill a gasoline container at the pump are advised to use caution to avoid static sparks. When you slide out of your car, touch something metal to get rid of any excess charges. It is also recommended to place the container on the ground when filling it. When many gallons of gasoline are transferred from a truck into the underground tank at a filling station, there is friction caused by the gasoline flow. Also, since the fuel is very flammable, a single spark caused by static electricity could cause an explosion.

**DUST EXPLOSIONS:** Fine dust in a grain elevator can be ignited by a static electric spark, creating an explosion in the storage facility. Coal dust explosions have been seen in coal mines, as have explosions in wood-working facilities.

Safety precautions have been legislated for these industries to dilute or prevent the dust, as well as to eliminate static electricity sparks.



## REAL WORLD CONNECTIONS

**ONE MAIN USE IS IN PRINTING TECHNOLOGY SUCH AS:** xerox machines, laser printers and ink jet printers

Static electric charges attract the ink or toner to the paper.

**ADDITIONAL USES INCLUDE:** powder coat paint sprayer systems, air filtering systems, pollution control in smokestacks and dust removal. Smoke precipitators and electrostatic air cleaning are based upon static electricity.



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