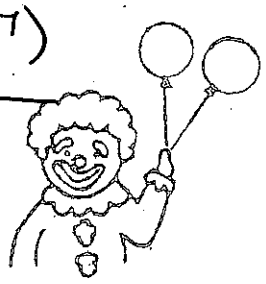
Exercise 1: When sugar is poured from the box into the sugar bowl, the rubbing of sugar grains creates a static electric charge that repels the grains, and causes sugar to go flying out in all directions. If each of two sugar grains acquires a charge of 3.0×10^{-11} C at a separation of 8.0×10^{-5} m, with what force will they repel each other?

$F = \frac{kq_1q_2}{d^2}$ $\quad F = \frac{(9.0\times10^{9})(3.0\times10^{-11})(3.0\times10^{-11})}{(8.0\times10^{-5}\,m)^2}$

Answer: 1.27×10^{-3} N or 0.00127 N

Exercise 2: Boppo the clown carries two mylar balloons that rub against a circus elephant, causing the balloons to separate. Each balloon acquires 2.0×10^{-7} C of charge. How large is the electric force between them when they are separated by a distance of 0.50 m?

$F = \frac{kq_1q_2}{d^2}$ $\quad F = \frac{(9\times10^{9})(2\times10^{-7})(2\times10^{-7})}{(.50m)^2}$



Answer: 1.44×10^{-3} N or 0.00144 N

Exercise 3: Inez uses hairspray on her hair each morning before going to school. The spray spreads out before reaching her hair partly because of the electrostatic charge on the hairspray droplets. If two drops of hairspray repel each other with a force of 9.0×10^{-9} N at a distance of 0.070 cm, what is the charge on each of the equally-charged drops of hairspray?

KHDbdcm

$F = \frac{kq_1q_2}{d^2}$ $\quad 9.0\times10^{-9}\,N = \frac{(9\times10^{9})(x)^2}{(.0007\,m)^2}$ $\quad .070\,cm \rightarrow m$ $\quad .0007\,m$

$(.0007)^2 \times 9\times10^{-9} = (9\times10^{9})(x^2)$

$\frac{4.41\times10^{-15}}{9\times10^{9}} = \frac{9\times10^{9}(x^2)}{9\times10^{9}}$

Answer: $\sqrt{4.9\times10^{-25}} = \sqrt{x^2}$

$7\times10^{-13}\,C = x$

Exercise 4: Bonnie is dusting the house and raises a cloud of dust particles as she wipes across a table. If two 4.0×10^{-14} C pieces of dust exert an electrostatic force of 2.0×10^{-12} N on each other, how far apart are the dust particles at that time?

$(d^2)\ 2.0\times10^{-12}N = \dfrac{(9\times10^9)(4\times10^{-14})(4\times10^{-14})}{d^2} \times d^2$

$d^2\dfrac{(2.0\times10^{-12}N)}{2.0\times10^{-12}} = \dfrac{1.44\times10^{-17}}{2.0\times10^{-12}}$

$\sqrt{d^2} = \sqrt{.0000072}$

$d = 2.68\times10^{-3}m$ or $.00268m$

Answer: _____

Exercise 5: Each of two hot-air balloons acquires a charge of 3.0×10^{-5} C on its surface as it travels through the air. How far apart are the balloons if the electrostatic force between them is 8.1×10^{-2} N?

$d^2 \times 8.1\times10^{-2}N = \dfrac{(9\times10^9)(3\times10^{-5})(3\times10^{-5})}{d^2} \times d^2$

$d^2\dfrac{(8.1\times10^{-2}N)}{8.1\times10^{-2}} = \dfrac{8.1}{8.1\times10^{-2}}$

$\sqrt{d^2} = \sqrt{100}$

$d = 10m$

Answer: _____

15-2 Electric Field

Vocabulary

Electric Field: An area of influence around a charged object. The magnitude of the field is proportional to the amount of electrical force exerted on a positive test charge placed at a given point in the field.

$$\textbf{electric field} = \frac{\textbf{electric force}}{\textbf{test charge}} \quad \text{or} \quad E = \frac{F}{q_0}$$

The SI unit of electric field is the **newton per coulomb (N/C).**

The electric field around a charged object is a vector and can be represented with electric field lines that point in the direction of the force exerted on a unit of positive charge. In other words, electric field lines point away from a positive charge and toward a negative charge, as shown in the diagram.