## Answer on Question \#61563-Physics-Other

The two strands of the DNA molecule are held together by electrostatic forces. There are four bases which make up the DNA molecule, thymine and adenine, cytosine, and guanine. In two of the bases, thymine and adenine, an oxide ion with a single negative charge from the thymine base is attracted to a hydrogen ion from the adenine ion. The distance between the two ions is 28.0 nm . Note that the oxide ion has a charge equivalent to a negative elementary charge and the hydrogen ion is equivalent to a positive elementary charge.
a) What is the strength of the electrostatic force between these two ions?
b) What is the direction of the force exerted on the oxide ion by the hydrogen ion? (Assume that the oxide ion is to the right of the hydrogen ion).
c) How many hydrogen ions would it take to equal the amount of charge contained in a lightning bolt, 25.0C?

## Solution

a)

$$
F=\frac{k q_{1} q_{2}}{r^{2}}=\frac{\left(8.99 \cdot 10^{9}\right)\left(6.02 \cdot 10^{-19}\right)\left(6.02 \cdot 10^{-19}\right)}{\left(2.8 \cdot 10^{-8}\right)^{2}}=4.16 \cdot 10^{-12} \mathrm{~N}
$$

b) To the left. The oxide ion is being held to the hydrogen ion which is to the left so the force is to the left. This is because the hydrogen ion has an electric field that pushes to the right (on the side of the oxide ion) but since the oxide has a negative charge, it moves in the opposite direction of where the magnetic field points. So although the field points to the right, the force is to the left.
c) One hydrogen ion has a charge of $1.6 \cdot 10^{-19}$ coulombs.

$$
N=\frac{25}{1.6 \cdot 10^{-19}}=1.5625 \cdot 10^{20} \text { hydrogen ions }
$$

