Electrostatics Worksheet Solutions

1. An object becomes charged when electrons are added to or removed from it so that it no longer has the same number of negative charges as positive charges.
   Some ways this can happen:
   - it is rubbed on an object with different affinity for electrons
   - it is touched with a charged object
   - it is charged by induction

2. When an object has the same number of negative charges as positive, it is said to have no net (overall) charge, as the negative and positive charges cancel out.

3. Negatively charged.

4.
   (a) It will be a quarter of the strength.
   (b) Positive.

5. $q_1 = -1.60\times10^{-19}$ C $\quad q_2 = +1.60\times10^{-19}$ C $\quad r = 5.3\times10^{-11}$ m

$$F = k\frac{q_1 q_2}{r^2} = 9\times10^9 \times \frac{1.60\times10^{-19}\times1.60\times10^{-19}}{\left(5.3\times10^{-11}\right)^2} = 8.208\times10^{-8}\ \text{N}$$

   The electrical force between the charges is 8.2×10^{-8} N attraction.

6. Charging by contact involves two objects touching, and electrons physically moving from one body to another.
   (diagram showing two objects touching, and indication of negative electrons being lost from one object to the other)

   Charging by induction involves bringing a charged object near (without touching) an uncharged object. The electrons in the uncharged object will move into another object (e.g. Earth) leaving the object charged.
   (see notes for diagram)

7. (Diagram shows a balloon-like shape with more negative than positive symbols within it, approaching some kind of pictorial representation of hair, containing equal numbers of negative and positive symbols. The negative symbols in the hair are represented retreating from the balloon, leaving the ends of the hair closest to the balloon positive. These positive ends will attract to the negative balloon.)

8. Charge is never created or destroyed; it simply moves from one object to another.

9. A good conductor allows lots of charge to flow, a good insulator allows none.

10. An arrangement of charges such that one end is negative and the other positive.