

## Section 7.1: Properties of Electric Charge

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**A.** Each charged object attracts the pieces of paper differently because different objects accept different amounts of extra electrons. Therefore, they vary in their total charge. Objects with greater charge have a stronger attraction to the pieces of paper.

**B.** Some pieces of paper fall off the charged object after a short while because the charged object polarizes the nearby pieces of paper. The side of the paper attracted to the charged object has a charge opposite to that of the charged object. When the two are in contact, electrons move from the charged object to the paper, causing it to have a neutral charge. Without the attraction to the charged object, the pieces of paper fall away from the object.

**C.** Paper in contact with the charged conductor can take on some of the excess charge of the conductor. The conductor has enough charge to neutralize the opposite charge on the side of the paper next to the conductor and to place extra charge onto the paper. The paper thus acquires the same kind of charge as the conductor. The like charges repel each other, causing the paper to “jump” from the conductor.

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**1.** To determine the sign of the charge on an unknown object using a glass rod and a piece of silk, I would first rub the glass rod with the piece of silk, giving it a negative charge. Then I would place the silk close to the charged object. If the silk is pulled toward the object, then the object has a positive charge. If the silk is pushed away from the object, the object has a negative charge.

**2.** The electric force between two like charges is repulsive, and the electric force between unlike charges is attractive. The object that has a charge attracts unlike charges and repels like charges in the object with zero charge. Induced charge separation creates a slight charge on the ends of the object; because the unlike charge is closest to the inducing charge, the two objects are attracted to one another.

**3.** The negative charge on the balloons repels the electrons in the material on the wall, so that the electrons are repelled from the wall’s surface. This resulting positive charge in that area holds the negative charge on the balloons, causing the balloons to attach to the wall.

**4.** When the pellets of foam plastic touch the rod, the pellets become negatively charged. The negatively charged pellets are repelled by the negatively charged rod, causing the pellets to jump away from the rod. When they jump, they spark.

**5.** When two objects, such as a glass rod and a silk cloth, are rubbed together, protons cannot move from one object to the other. Protons cannot move from one object to another because they are tightly bound to the nucleus of the atom.

**6. (a)** The charge on my body and the charge on the carpet are equal and opposite. After walking across the carpet, my body now has an excess of electrons because the electrons moved from the carpet to me. Therefore, the charge on my body is negative, and the charge on the carpet is positive.

**(b)** Walking across a carpet on a cold, dry day illustrates charging by friction.

**7.** It is a good precaution to touch the metal casing before handling the memory chip because sparks from charge build-up on the student can damage the circuitry of the chip. Touching the casing acts as an electrical ground.

**8.** To give a neutral object a positive charge using only a negatively charged object, I would use the process of charging by induction. By bringing the negatively charged object near the neutral object, the object becomes polarized. Using a ground connection on the far side of the neutral object removes electrons, so that when the negatively charged object is pulled away, the formerly neutral object has a net positive charge.

**9. (a)** When a glass rod is rubbed with a wool rag, electrons move from the glass to the wool. The glass rod becomes negatively charged, and the wool rag becomes positively charged.

**(b)** When a plastic rod is rubbed with a silk scarf, electrons move from the scarf to the rod. The plastic rod becomes positively charged, and the silk scarf becomes negatively charged.

**(c)** When a platinum rod with a negative charge is touched with a similar rod with a positive charge, electrons move from the negatively charged rod to the other rod until the charge on one rod is balanced. One rod will become neutral. The charge of the other rod will have the same charge as the rod with the greater charge at the beginning.

**(d)** When a small metal rod touches a large positively charged metal sphere, electrons move from the rod to the sphere, balancing only some positive charge on the sphere. Both the metal rod and sphere are positively charged.

**10.** Friction between the father's skin and the wool sweater he is wearing gave a net charge to the father. When the student and his father shook hands, the charge transferred to the student.

**11. (a)** Clothes rubbing against each other in the dryer transfer electrons, so that some clothes have negative charge and others have positive charge. These unlike charges attract each other, causing the clothes to cling together.

**(b)** Compounds in a fabric softener sheet break into negative and positive ions, which interact with the charges on the clothes. This process easily removes the built-up charge.