

Electricity Program of Study Content Assessment: Explanations for Static Electricity Items

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Explanations for Items on the Content Assessment about Static Electricity

Question 1:

When we talk about charging objects and the flow of electricity we are talking about the movement of charged particles, called *electrons*. Electrons have a negative charge.

The objects that are easy to charge (balloons, feathers, corks, and combs) do not conduct electricity. We call objects that do not conduct electricity *insulators*. Insulators are materials in which electrons are not free to move around. Since the electric charge is not free to move around, charges can be added and accumulated in that material. Objects made of plastic or glass are examples of insulators.

Objects or materials that conduct electricity well are called *conductors*. In conductors, the electrons are free to move through the material. This is the reason that they are not easy to charge. Charges do not accumulate in the material because they easily flow out of the material. Metals and (some) liquids have the right structure for electric charges to move around easily.

Question 2:

Balloons are made of rubber, an insulator, which allows them to collect a charge. One of the simplest ways of charging a balloon is to rub it with wool. Electrons are transferred by friction when one material rubs against the other.

Simply touching a balloon to an electric outlet will not cause electrons to be moved to or from the balloon. Charge will not collect on a balloon after placing it in an electric circuit because charge will not flow in the circuit to conduct electricity. The balloon, being an insulator, prevents the circuit from having a complete path because electricity cannot flow through an insulator.

Question 3

Rubbing a glass rod with silk creates friction between the two objects and causes electrons to move from the silk to the glass rod. The silk will not cause the glass rod to become magnetized because magnetism is a property of metals, not glass. Glass does not have the correct structure to become magnetic.

Question 4

If two balloons move away from each other we can think of them as *repelling*. We can rule out the idea that they are magnetic because magnets are specially structured metals (balloons are made of rubber). So, we can assume that there is something going on with the charge carried by each of the balloons. One of the properties of charges is that opposite charges attract and like charges repel. These balloons are repelling each other so they must both hold the same type of charge. They could be both positively charged or negatively charged; we can't tell from this observation.

Question 5

Opposite charges attract. Rods that have different/opposite charges will attract. Rods aren't charged unless they have an excess of one type of charge. The rods in answer choice a) are oppositely charged. The two neutral rods (each rod has the same number of positive and

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negative charges) are not attracted to each other. This is because the force from similar charges repelling each other balances out the force from opposite charges attracting each other.

In the case of the positively charged rod placed near the neutral rod, there is an attraction between them. Because there are more positive charges than negative charges in one rod, the force of attraction between those positive charges and the negative charges in the other rod is greater than the repulsive force. The same is true of the rod that is negatively charged – it also will attract a neutral rod. However, the force between these pairs of rods is less than the force between the two oppositely charged rods.

Question 6

Often when two materials are rubbed against one another friction causes negative particles (electrons) to be transferred from one material to the other. Materials differ in the ease with which they allow electrons to be transferred. To figure out which object gives up its electrons we need to know what types of material the objects are made of. For now, all we can say is that negative particles might move from the block to the cloth or vice versa. The positive particles (protons) are bound up in the structure of the atoms that make up the material. In ordinary situations, they do not move between materials.