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Automatic Windshield Wipers

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A caller on an automotive-themed radio program asked for help with a problem. It seems that when it rained her windshield wipers sometimes turned themselves on. How is this possible?

The wipers are supposed to work with a pretty simple circuit. A pair of wires connects the battery to the motor that sweeps the wipers. One of those wires has a switch in it. When you turn the wipers on you are closing this switch and allowing current to flow from the battery through the motor. Turning the wipers off opens this switch. Since air is a very poor conductor, the electrons can't get from one wire to another. So the motor stops turning.

Rain changes things. Clean water is not a good conductor, but water will never be clean by the time it gets under the hood of a car. Dirty water has plenty of ions and conducts electricity somewhat. Some water was getting into the switch through a cracked casing and "short circuiting" the switch by giving the electrons an alternate pathway from one wire to the other.

Demonstration: You can demonstrate this with a motor, a battery, three wires, and a beaker of salt water. Tape a straw to the motor as a "pretend" windshield wiper. Wire one terminal of the battery to one terminal of the motor. Leave one wire hanging off of the other battery terminal and another hanging off of the free motor terminal. The motor should turn when you touch the free ends of these wires together.

Just dipping the two ends of the wire into the salt water probably will not allow enough current to flow to turn the motor. Instead, you should strip at least 2 inches (5 centimeters) of insulation off the end of each wire and twist the bare ends together, but put a piece of tissue or paper towel in between the two wires so they don't directly touch each other. As long as the wires are dry the motor should still not turn. When the wires are dipped into the beaker, enough current should flow to spin the motor, though you may need to start the motor turning by hand. You'll end up with gunk on the wires, so expect to use a new pair for each demonstration. As with any demonstration, be sure to practice it yourself ahead of time.