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Lessons in electric circuits

Polka Dot Images/Polka Dot/Getty Images An open electrical circuit means that there is a break in the continuity of the circuit. Circuits that are complete are considered closed. When a break occurs in the wiring of a vehicle's circuit it can be difficult to find because of the number of wires used in the electrical system. While time consuming, using an Ohmmeter allows you to trace open electrical circuits on a car. The job becomes easier if a wiring diagram is available as this will show the color codes for the OEM wiring and which accessory is attached to the wire. Disconnect the cable from the negative (-) post on the battery using a socket wrench to loosen the lock nut on the terminal and pulling the cable off. Wait 20 minutes for the stored charge in the vehicle's electrical system to dissipate before continuing. Start at one end of the fuse box, using the fuse diagram in the car's manual or the diagram that is affixed to the fuse box cover; identify the first wire coming out of the fuse box. Put a small label on the wire that is marked with the wire's identity (e.g. headlights). Connect the two probes to the Ohmmeter and turn the meter on. Make sure the meter reads 0.00 with the probes not touching. Touch the probes and the meter should read between 0.00 and 0.03. Touch a probe to each end of a short piece of wire simultaneously. Note the reading on the meter. Turn the dial on the meter, slowly, through the various levels of resistance ranges until the lowest range is found that still gives a reading. The higher range of resistance will be at the top of the dial, or for meters with a needle gauge, the higher range is to the right side of the meter. Scrape a spot of insulation off the first wire to be tested (Spot #1) to reveal the inner copper core as close to the fuse box as possible. Scrape another spot of insulation off 8-inches away from that (Spot #2). Place a probe tip on each spot simultaneously. If the meter gives a reading higher than 0.03 then there is no break in the wire between those two points. Remove the probes. Wrap Spot #1 with a piece of electrician's tape to reseal the insulation. Scrape the insulation off the wire 8-inches away from the Spot #2. Touch the probes to the wire and take a reading. Continue working down the wire in this manner until the meter does not return a reading. The space between the probes (where there is no reading) contains the break in the wire that is causing the open circuit. Reseal the insulation on the spots no longer being used in the test. Label the wire every two feet so it is easier to keep track of which wire has already been tested. Trace and test each wire coming from the fuse box. When you load a battery into an electronic device, you're not simply unleashing the electricity and sending it to do a task. Negatively charged electrons wish to travel to the positive portion of the battery -- and if they have to rev up your personal electric shaver along the way to get there, they'll do it. On a very simple level, it's much like water flowing down a stream and being forced to turn a water wheel to get from point A to point B.Whether you are using a battery, a fuelcell or a solarcell to produce electricity, three things are always the same:The source of electricity must have two terminals: a positive terminal and a negative terminal.The source of electricity (whether it is a generator, battery or something else) will want to push electrons out of its negative terminal at a certain voltage. For example, one AA battery typically wants to push electrons out at 1.5 volts.The electrons will need to flow from the negative terminal to the positive terminal through a copper wire or some other conductor. When there is a path that goes from the negative to the positive terminal, you have a circuit, and electrons can flow through the wire.You can attach any type of load, such as a light bulb or motor, in the middle of the circuit. The source of electricity will power the load, and the load will perform whatever task it's designed to carry out, from spinning a shaft to generating light.Electrical circuits can get quite complex, but basically you always have the source of electricity (such as a battery), a load and two wires to carry electricity between the two. Electrons move from the source, through the load and back to the source.Moving electrons have energy. As the electrons move from one point to another, they can do work. In an incandescent light bulb, for example, the energy of the electrons is used to create heat, and the heat in turn creates light. In an electric motor, the energy in the electrons creates a magnetic field, and this field can interact with other magnets (through magnetic attraction and repulsion) to create motion. Because motors are so important to everyday activities and because they are, in essence, a generator working in reverse, we'll examine them more closely in the next section. Early investigations of static electricity go back hundreds of years. Static electricity is a transfer of electrons produced by friction, like when you rub a balloon across a sweater. A spark or very brief flow of current can occur when charged objects come into contact, but there is no continuous flow of current. In the absence of a continuous current, there is no useful application of electricity.The invention of the battery -- which could produce a continuous flow of current -- made possible the development of the first electric circuits. Alessandro Volta invented the first battery, the voltaic pile, in 1800. The very first circuits used a battery and electrodes immersed in a container of water. The flow of current through the water produced hydrogen and oxygen.The first widespread application of electric circuits for practical use was for electric lighting. Shortly after Thomas Edison invented his incandescent light bulb, he sought practical applications for it by developing an entire power generation and distribution system. The first such system in the United States was the Pearl Street Station in downtown Manhattan. It provided a few square blocks of the city with electric power, primarily for illumination.One classification of circuits has to do with the nature of the current flow. The earliest circuits were battery-powered, which made in a steady, constant current that always flowed in the same direction. This is direct current, or DC. The use of DC continued through the time of the first electric power systems. A major problem with the DC system was that power stations could serve an area of only about a square mile because of power loss in the wires.In 1883, engineers proposed harnessing the tremendous hydroelectric power potential of Niagara Falls to supply the needs of Buffalo, N.Y. Although this power would ultimately go beyond Buffalo to New York City and even farther, there was an initial problem with distance. Buffalo was only 16 miles from Niagara Falls, but the idea was unworkable -- until Nikola Tesla made it possible, as we'll see on the next page. Video Playback Not Supported (DepositPhotos)Even if you never do your own electrical work, you need to know which breakers operate which electrical circuits.There are two surefire ways to determine which circuit breaker controls a particular electrical outlet in your home. One of them is to plug a radio into the outlet with the volume turned on high, then turn off each breaker at the electrical distribution box, one at a time, until the radio stops playing.Watch the video to see the Simple Solution! 1 From “World News Tonight” to “The View,” Here’s How to Contact Your Favorite ABC TV Shows 2 What Are Examples of Similes in Romeo and Juliet? 3 What's an S&P 500 Fund and How Do You Invest in One? 4 How Much Does a Boneless Chicken Breast Weigh? 5 What Common Items Weigh 1 Ounce? A dedicated electrical circuit is one that serves a single appliance or electrical fixture. It's required by the National Electrical Code for certain critical-use appliances and many fixed appliances. No other appliances, fixtures, lights, or outlets can be served by these dedicated circuits. They are most commonly required for appliances that have motors to ensure there is sufficient power for the start-up load and to run at peak performance. More importantly, dedicated circuits prevent the inconvenience of circuit overloads. When more than one appliance is served by a single circuit, there is the potential for these appliances to draw more power than the circuit is designed to handle. The result is a tripped circuit breaker or fuse. This is a fairly common occurrence in kitchens in older homes that were installed at a time when the National Electrical Code did not anticipate such a large number of appliances that would be featured in modern kitchens. Kitchens lean heavily on appliances with motors (mixers, garbage disposers, can openers) and appliances that heat (toasters, pizza ovens, electric grills). Both these types of appliances are notoriously heavy power users. If, for example, you are using a toaster and pizza oven on the same circuit, it's quite common to overload the circuit and trip the circuit breaker. This is especially common in an older kitchen with only one or two 15-amp circuits that are already powering the refrigerator and microwave oven. Modern kitchens, though, have been installed with at least four, and maybe as many as six or seven 20-amp circuits, and there is much less chance of overloading any individual circuit—especially since the major appliances will have their very own dedicated circuits that can't be used by other fixtures. The National Electrical Code requires that any appliance or device dedicated as critical-use be served by its own dedicated circuit to eliminate the chance of another appliance or device tripping the breaker and shutting down that critical fixture. These critical appliances include things like furnaces, water heaters, sump pumps, even refrigerators. If one of these breakers trips and you don't know it, you could end up with a flooded basement, a freezing house, no hot water, or a refrigerator full of rotten food. Here's a list of the typical appliances that require dedicated circuits. In addition to these, your local building authority may specify additional appliances or equipment that need a dedicated circuit. And the National Electrical Code, which is revised every three years, may also periodically add additional appliances to this list: Refrigerator Freezer Electric range (also cooktop, oven) Electric water heater Furnace (also heat pump) Washer (technically a designated circuit) Dryer Microwave Dishwasher Garbage disposal Sump pump Air conditioner (room and whole-house) Bathroom heater (including vent-fan heater units) Laundry room receptacles (outlets) Your home's electrical service panel (breaker box) should have labels indicating all dedicated circuits. If you see that any of the above appliances are doubled-up on a single breaker or that they're combined with other equipment, such as lighting or receptacles, talk to an electrician. This is a safety hazard in addition to a nuisance. Electrical circuits that are not up to code can also be a hindrance to selling your home.

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