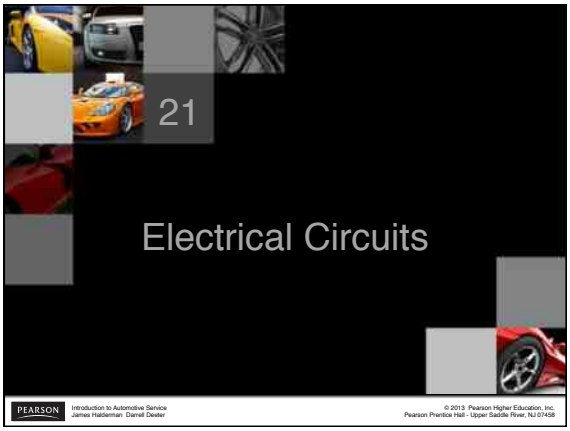
21
Electrical Circuits
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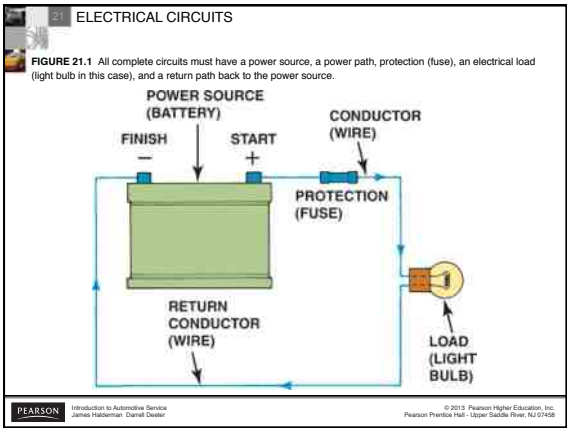
21 ELECTRICAL CIRCUITS
FIGURE 21.1 All complete circuits must have a power source, a power path, protection (fuse), an electrical load (light bulb in this case), and a return path back to the power source.
POWER SOURCE (BATTERY)
FINISH
START
CONDUCTOR (WIRE)
PROTECTION (FUSE)
RETURN CONDUCTOR (WIRE)
LOAD (LIGHT BULB)
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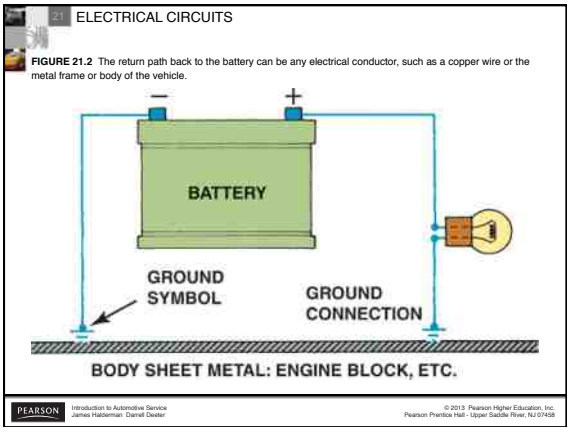
21 ELECTRICAL CIRCUITS
FIGURE 21.2 The return path back to the battery can be any electrical conductor, such as a copper wire or the metal frame or body of the vehicle.
BATTERY
GROUND SYMBOL
GROUND CONNECTION
BODY SHEET METAL: ENGINE BLOCK, ETC.
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FIGURE 21.3 An electrical switch opens the circuit and no current flows. The switch could also be on the return (ground) path wire.

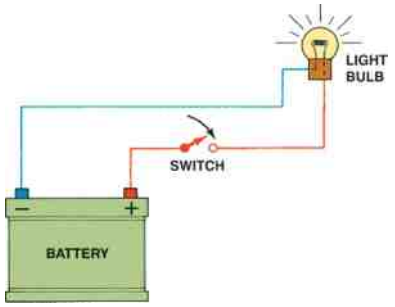

FIGURE 21.4 Examples of common causes of open circuits. Some of these causes are often difficult to find.

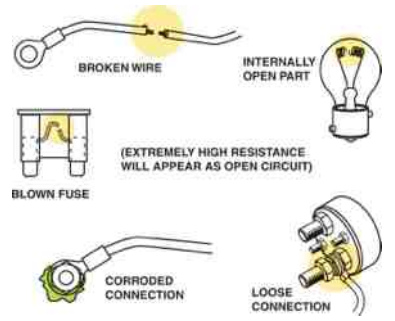

FIGURE 21.5 A short circuit permits electrical current to bypass some or all of the resistance in the circuit.

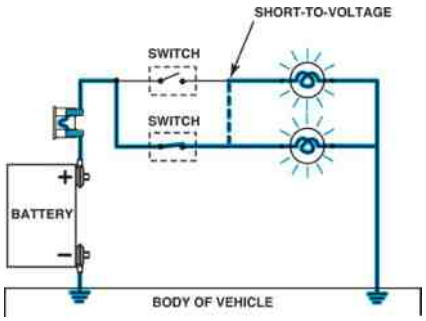

FIGURE 21.6 A fuse or circuit breaker opens the circuit to prevent possible overheating damage in the event of a short circuit.

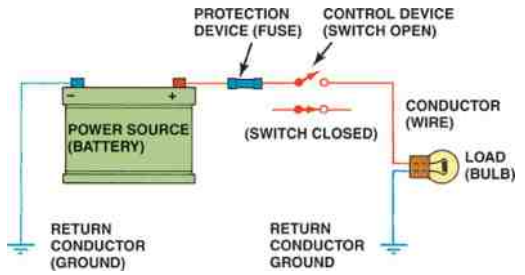

FIGURE 21.7 A short-to-ground affects the power side of the circuit. Current flows directly to the ground return, bypassing some or all of the electrical loads in the circuit. There is no current in the circuit past the short. A short-to-ground will also cause the fuse to blow.

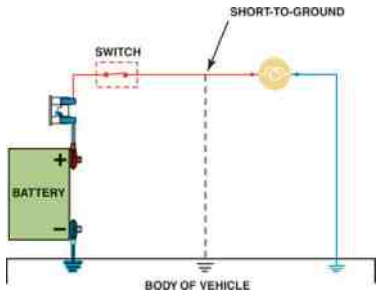

FIGURE 21.8 To calculate one unit of electricity when the other two are known, simply use your finger and cover the unit you do not know. For example, if both voltage (*E*) and resistance (*R*) are known, cover the letter *I* (amperes). Note that the letter *E* is above the letter *R*, so divide the resistor' s value into the voltage to determine the current in the circuit.

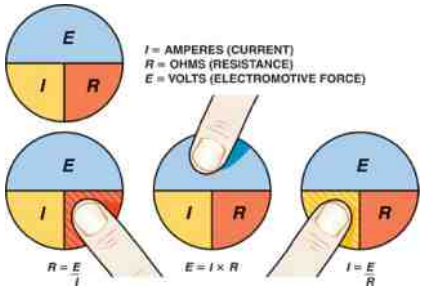

FIGURE 21.9 Electrical flow through a circuit is similar to water flowing over a waterwheel. The more the water (amperes in electricity), the greater the amount of work (waterwheel). The amount of water remains constant, yet the pressure (voltage in electricity) drops as the current flows through the circuit.