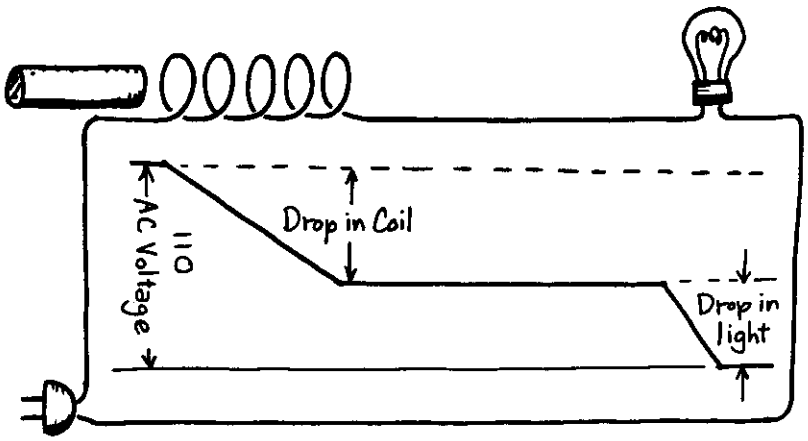
ANSWER: SHOVE IT IN

The answer is: b. The coil and the electric light bulb are in series. Therefore, the total voltage drop across the series circuit must be the voltage drop in the coil plus the voltage drop in the light—and this total must equal the 110 volts of potential difference supplied by the wall socket. So part of the 110 volt drop happens in the coil and the remaining part of the 110 volt drop is in the light. If there is a big voltage drop in the coil then there can only be a small voltage drop left for the light. A small voltage drop in the light makes it dim. What makes the voltage drop in the coil? Well, part of the coil voltage drop comes from resistance, but that is a small part because the coil is made of thick wire. The main cause of the voltage drop in the coil is the



changing magnetic field in the coil. The larger the change per second in the magnetic field, the larger the voltage across the coil. What determines the change in the magnetic field per second? Two things: HOW STRONG the maximum field is and HOW FAST it is changing. We cannot alter how fast the field is changing—that is set by the power company. The voltage provided by the power company fluctuates 60 times per second, so the current in the wire fluctuates 60 times per second and the current makes the magnetic field so the field also fluctuates 60 times per second.

But we can alter the STRENGTH of the magnetic field. How? By putting some iron in the coil. Because of the magnetic "domains" in the iron which align with the magnetic field in the coil, the iron makes a stronger magnetic field. That means there is more field to be changed each 1/60 of a second. That means more voltage in the coil. That means less voltage left for the light bulb, and THAT means a dimmer light. Some old stage light dimmers operated in just that way.

The voltage produced in the coil by the changing magnetic field is always in a direction so as to fight a change in the current. So a changing current fights its own change (called a "self-inductive reactance"). Some people think it is this resistance to change—"electric inertia"—that makes the magnetic field and coil dim the light. Not so. The current is alternating; repeatedly building up and dying down. While the "electric inertia" impedes the current in its build-up stage and so chokes the light, the same "electric inertia" drives current through the light in its dying-down stage and, therefore, force-feeds the light. These two effects, then, exactly cancel each other out.