

Physics 355 Circuit Puzzle Boxes: an optional activity

In this activity you explore several different electrical circuits. These circuits are constructed inside of "mystery" boxes so that you cannot see the wiring. The circuits' voltage source will be the electric outlets around the room. There are five identical light bulbs in each circuit which are mounted so that you can see and manipulate the bulbs on the outside of the boxes. You can *gently* twist the bulbs to loosen or tighten them in their sockets--loosening effectively removes the bulb from the circuit. The boxes are in lab one. Please treat them gently.

Your real task is to determine how the bulbs are electrically arranged in the circuit. In other words, you are to figure out the wiring by observing the behavior of the bulbs. Carefully draw and label your determination of how the five bulbs in each circuit are hooked together. In your drawings, try to avoid having wires that cross over one another as that tends to make your drawing confusing. Be sure you label which bulb is which (use the letters A-E) and include the voltage source in the diagram.

Before you begin your exploration, you will want to summarize what you know about circuits in general and the brightness of identical bulbs in parallel and in series.....

If a circuit path is broken, the circuit path is said to be "open" and current cannot flow. A bulb in an "open" circuit path will not light. In other words, if no current flows through the bulb, the bulb cannot light.

Identical bulbs with the same current through each burn equally bright.

Identical bulbs with different current through each, burn with different brightnesses. The higher the current through the bulb, the brighter the bulb. The lower the current through the bulb, the dimmer the bulb.

If one bulb in a series of bulbs burns out or is removed from the series, what happens to the other bulbs? Why?

If identical bulbs are in simple parallel with one another, the total current is split equally amongst the bulbs. What does this mean about the brightness of the bulbs?

Identical bulbs with the same voltage across each burn equally bright.

Identical bulbs with different voltages, burn with different brightnesses. The higher the voltage across the bulb, the brighter the bulb. The lower the voltage across the bulb, the dimmer the bulb.

If identical bulbs are in simple series with one another, equally share the total available voltage. What does this mean about the brightness of the bulbs?

If identical bulbs are in simple parallel with one another, each get the total available voltage. What does this mean about the brightness of the bulbs?

If one bulb in a simple parallel arrangement of bulbs burns out or is removed from the arrangement, what happens to the other bulbs? Why?

Some sample/example circuit diagrams on back.....

CIRCUIT DIAGRAM #1

CIRCUIT DIAGRAM #2

CIRCUIT DIAGRAM #3

CIRCUIT DIAGRAM #4

CIRCUIT DIAGRAM #5

CIRCUIT DIAGRAM #6

CIRCUIT DIAGRAM #7

CIRCUIT DIAGRAM #8

CIRCUIT DIAGRAM #9

CIRCUIT DIAGRAM #10

CIRCUIT DIAGRAM #11

CIRCUIT DIAGRAM #12

