



Concept:

After the basic series and parallel circuits have been presented in 5F20.50, further exploration can be made using the above hybrid circuits. For example, Board #2, configures two series circuits in parallel with one another with an equivalent resistance of $R_{eq} = \left(\frac{1}{2R} + \frac{1}{2R}\right)^{-1} = R$. Recall that for the pure series and parallel circuits of four similar bulbs, that the equivalent resistances were $R/4$ and $4R$, respectively. So, the hybrid Board #2 shown above has an intermediate brightness. Once Kirchoff's Laws of charge and energy conservation have been presented, Boards #1 and #3 can be analyzed and students can be questioned about the relative bulb brightness within each of these circuits. They can also be queried about the results of removing various individual bulbs.

Procedure:

1. Describe the arrangement of the circuits on each board for the class.
2. Ask the class what they think will happen when you flip the switches.
3. Turn on the power to each board and discuss what you see and how that relates to voltages, currents and resistances for various sections of the boards.
4. Repeat steps 2-3 after removing various bulbs from the boards.
5. Discuss additional situations where students in class may have come into contact with series and parallel circuits outside the classroom.

Equipment:

1. Board #1 with (3) 120V 60W Light Bulbs
2. Board #2 with (4) 120V 60W Light Bulbs
3. Board #3 with (3) 120V 60W Light Bulbs
4. Safety gloves (not shown)