Concepts
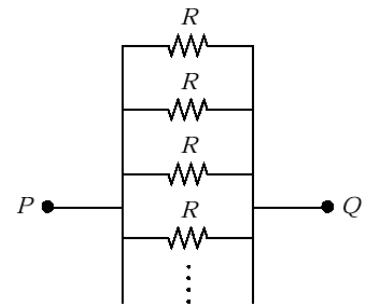
1. As more identical resistors R are added to the parallel circuit shown
   here, the total resistance between points P and Q
   a)   increases
   b)   remains the same
   c)   decreases.

2. The light bulbs in the circuit shown are identical. When the switch
   is closed,
   a)   both go out
   b)   the intensity of light bulb A increases
   c)   the intensity of light bulb A decreases
   d)   the intensity of light bulb B increases
   e)   the intensity of light bulb B decreases
   f)   some combination of a–e occurs
   g)   nothing changes.
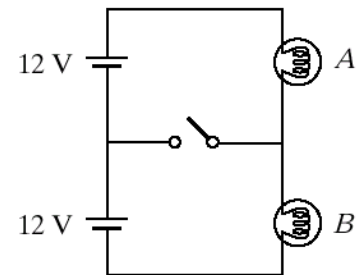
3. Two light bulbs A and B are connected in series to a constant voltage
   source. When a wire is connected across B as shown, bulb A:
   a)   burns more brightly
   b)   burns as brightly
   c)   burns more dimly
   d)   goes out.
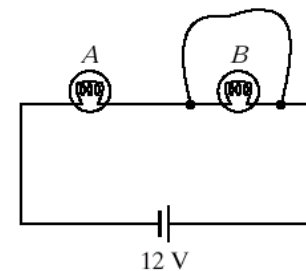
Short calculations

4. A standard AA battery can deliver about 2.0 watt-hours of energy.
a)   If a battery costs $1.00, what is the cost of operating a 100 W lamp for 8.0 hours using
        batteries?
b)   What is the cost if energy is provided at $0.20 per kWh (typical home electricity cost in
        Victoria)?

Tutorial question

5. The bulbs in the circuit at right are identical and the battery is ideal.
   a)   Consider the circuit as shown.
    i) Rank bulbs A, B and C in order of brightness. Explain (group
          discussion).
    ii) Rank the potential differences across the bulbs. Explain.
    iii)Write an equation that relates the potential difference across bulbs
          A and B to the battery voltage.
    iv)Is the potential difference across bulb A *greater than, less than,* or *equal to* one half the
          battery voltage? Explain (group discussion).
   b)   A student cuts the wire between bulbs A and C, as shown.
    i) Rank bulbs A, B and C in order of brightness. Explain (group
          discussion).
    ii) Rank the potential differences across the bulbs. Explain.
    iii)Write an equation that relates the potential differences across bulbs
          A and B to the battery voltage.
    iv)Is the potential difference across bulb A *greater than, less than,* or
          equal to one half the battery voltage? Explain (group discussion).
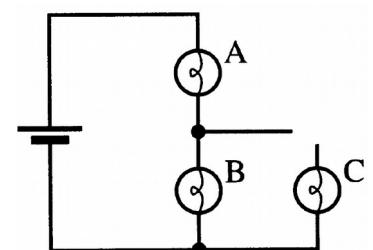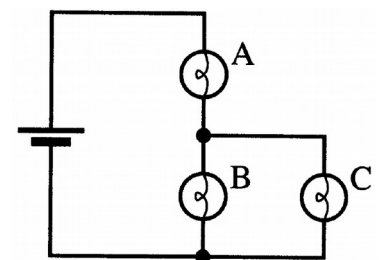
c) Consider the following discussion between two students regarding the change in the circuit when the wire in the circuit is cut:

Student 1: *"I think that bulb B will get brighter. Bulb B used to share the current with bulb C, but now it gets all the current. So bulb B will get brighter."*

Student 2: *"I don't think so. Now there aren't as many paths for the current, so the resistance in the circuit has increased. Since the resistance in the circuit has increased, the current in the circuit decreases. Bulb B will get dimmer."*

    i)   Is Student 1 correct? Why, or why not?
    ii)   Is Student 2 correct? Why, or why not?
    iii)   Use what you have learned about voltage to determine whether bulb B will *become brighter, become dimmer,* or *stay the same brightness* when the wire is cut. Explain (group discussion).

Answers
1. Decreases
2. Unchanged
3. Brighter.
4. (a) $400; (b) $0.16.
5. (a) (i) A brightest; B,C less but same; (ii) A highest; B,C less but same; (iii) $I = V/(1.5\,R)$ where R is resistance of one bulb. (iv) Greater.
(b) (i) A,B equal; C dark. (ii) A,B same; zero for C. (iii) $V_A = V_B = 0.5\,V$.
(c) (i) Student 1 is correct. (ii) Student 2 is incorrect. (iii) Brighter.