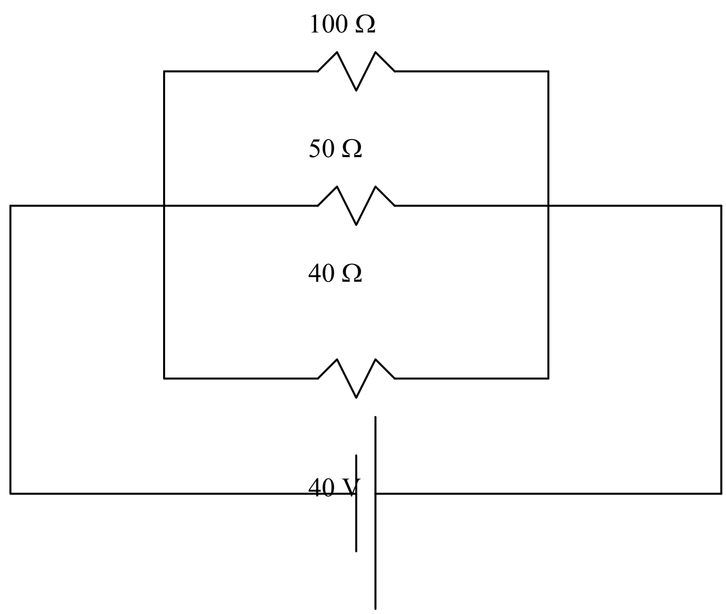
Phys Sc 430
Pretest 3.3 with solutions

1. Find the total resistance for the following:



$R = [100^{-1} + 50^{-1} + 40^{-1}]^{-1}$
$= 18\ \Omega$

2. Four identical resistors are hooked up ***in parallel***. If 3.0 A flows through one resistor, what is the total current?

$I_T = 3.0A(4) = 12\ A$

3. What resistor has to be attached *in parallel* to a 10. Ω resistor so that a 6.0 V battery produces 2.0 A of current?
For full marks, include a drawing!

$$\frac{1}{3} = \frac{1}{10} + \frac{1}{x}$$

Multiply through by the LCD = 30x:

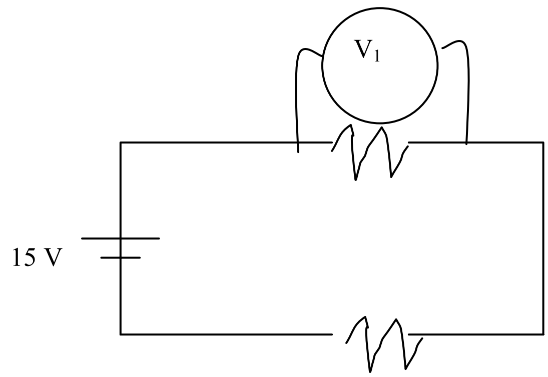
$$30x[\frac{1}{3} = \frac{1}{10} + \frac{1}{x}]$$

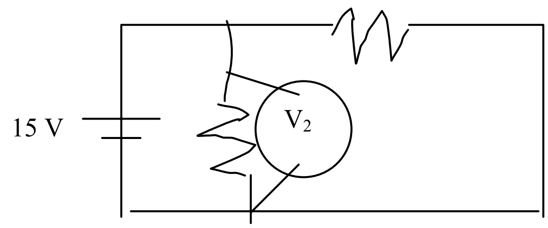
$10x = 3x + 30$
$7x = 30$

Hint for some flashbacks: In chemistry, you can't look for shells on a beach; women do not have to be annoyed by a period; even the religious cannot listen to a mass, but everyone can charge with plastic without spending money.

x = 4.3 Ω

4.





In the above circuits, all of the above resistors were ***identical.***

a. Find the reading of voltmeters V_1 and V_2.

V_1 = 15/2 = 7.5 V
V_2= 15 V (Voltage is constant in a parallel circuit.)

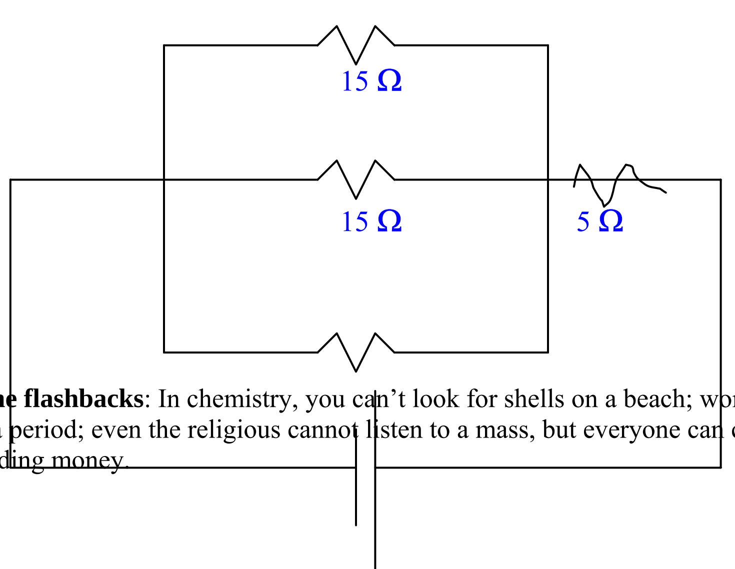
b. If the four resistors (in diagram for # 4) were replaced with identical light bulbs, which bulbs would be brighter?
Assume that each bulb has a resistance of 10 Ω.. Explain.

The parallel circuit would have brighter bulbs. They would each receive 15V/10Ω = 1.5 A of current, whereas the series bulbs would only experience 7.5/10 Ω = 0.75 A of current.

5. Draw a circuit that would yield a total resistance of 10 Ω from the following four resistors:

15 **Ω**, 15 **Ω**, 15 **Ω**, 5 **Ω**

Assemble the three 15 Ω resistors in parallel, and then place them in series with the 5 Ω.



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15 Ω

6. **TRUE or FALSE?**

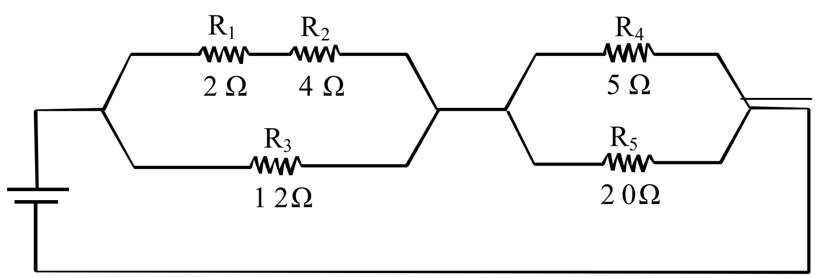
a. To explain why the voltage across two different resistors in parallel is the same, we need to point out that electrons have the same entrance and exit and thus the same potential difference___**TRUE**___

b. The current in a parallel branch will be constant only if the resistors are the same___**FALSE__(they mentioned one branch; not two branches)**

c. If the resistance of the wires is not ignored, one would calculate a lower total current for the circuit __**TRUE** _.

d. The total resistance for a series circuit is sometimes less than one of the individual series components.___ **FALSE_(it's always greater)**

7.



a. Find the total resistance of the above circuit.

$\mathbf{R_{P1} = [(2+4)^{-1} + 12^{-1}]^{-1} = 4\ \Omega}$
$\mathbf{R_{P2} = [(5)^{-1} + 20^{-1}]^{-1} = 4\ \Omega}$

$\mathbf{R_T = R_{P1} + R_{P2} = 4 + 4 = 8\ \Omega}$

b. Find the current flowing through R_4 if the total voltage is 12 V.

Since the resistances of the parallel components are the same, each component experiences 12 V/2 = 6 V, so R_4 will get 1.2 A. If the resistances were not the same, you would calculate the voltage, V_{p2}, by first getting the total current from V_T/R_T and then multiplying I_T by R_{p2}.

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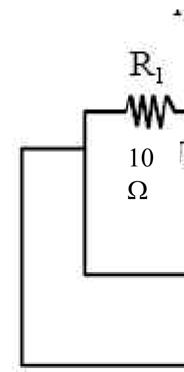
8. Find the potential difference at R_3, in other words, V_3, if the total current is 2.0 A. (refer to diagram below)

$V_T = I_T R_T$, so we need $R_T = [(10 + 2.5 + 2.5)^{-1} + 30^{-1}]^{-1} = 10\ \Omega$. Note that the resistance for the top branch = 15 Ω.

$V_T = 2\ A(10\ \Omega) = 20\ V$.

The current flowing through the top will be 20V/15 Ω = 1.33 A

$V_3 = IR_p = 1.33(2.5) = 3.3\ V$



9.

If a different battery was hooked up to this circuit and you measured 1.0 A at R_1, how much current would flow through R_2?

The top branch has half as much resistance as the bottom branch(15 vs 30 Ω) , so the bottom branch will receive only half as much current.

Answer = 1.0/2 = 0.5 A.

Now, of course, because you're dying to find out the long way of doing this:

Use the resistance of the top branch = **15 Ω.**

$V_{top} = Vp = IR_{top} = 1.0(15) = 15\ V$

Since this voltage also applies to the other parallel branch:

$V = I_2 R_2$

$15V = I_2(30\Omega)$

$I_2 = 0.5\ A$

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