Concept Questions:

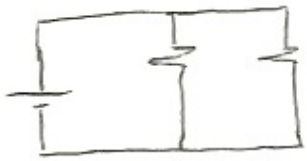
1. What are the properties of a series circuit and parallel circuit?

SERIES

- Current stays the same
- Voltage is divided amongst resistors

$R_{eq} = R_1 + R_2 + R_3 + \ldots$

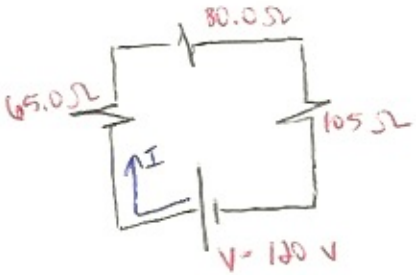
PARALLEL



- Current is divided
- Voltage stays the same

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

2. A cell phone (R = 65.0 Ω), an ipod (R = 80.0 Ω), and laptop (R = 105 Ω) are wired in a series circuit, connected to a 120.0 v power source.
   A. Which device receives the most voltage?
   B. Through which device does the most current flow?



A.) The voltage is divided amongst the resistors in a series. So the largest resistor will receive the most voltage.

Laptop: R = 105 Ω

B.) The current stays constant in a series. So they all get the same value.

Lab Technique:

3. What do the colored bands mean on a resistor? (Know how to use the resistor color chart)

They tell you the amount of resistance contained in each

First and Second Band	Third Band	Fourth Band
First and Second Digit	Number of Additional Zeros to add on to the end	The amount of uncertainty or error

4. What do you never do when measuring resistance?

NEVER connect the resistors to the battery

5. What does it mean if you see a 1. and no decimals after it on the multimeter display? What should you do?

Means that the meter is overloaded and you should move up to a higher setting.

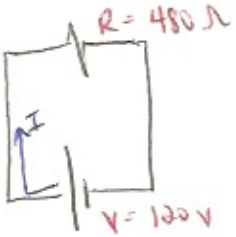
6. What happens if you have your leads reversed/backwards?

you get a negative sign.

7. What is different when you measure voltage vs current?

- When measuring voltage: Turn the meter to DC V. Make sure you have a complete circuit and place your leads around the device you want to measure.
- When measuring current: Turn the meter to DC A. Break the circuit by removing a wire and place your leads where the wire come from.

8. A light bulb has 480 Ω of resistance and is connected to a 120 v emf.
   A. What is the power emitted by the bulb?
   B. What is the current of the bulb?
   C. How many *protons* (even though we know it's the electrons that can travel) have traveled through this circuit in 20.0 seconds?



A.) * May want to solve for current first

$P = I \cdot V$ $\quad I = 0.25\ A$

$P = (0.25)(120)$

$\boxed{P = 30\ W}$

B.) $V = I \cdot R$

$I = \frac{V}{R}$

$I = \frac{120}{480}$

$\boxed{I = 0.25\ A}$

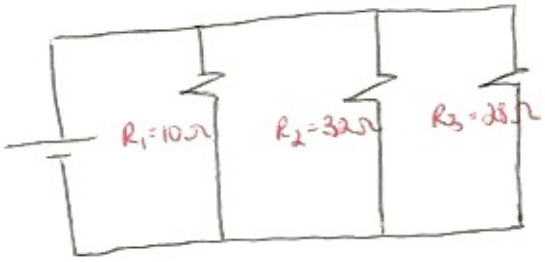
C.) $I = \frac{|\Delta q|}{\Delta t}$

$|\Delta q| = I \cdot \Delta t$

$|\Delta q| = (0.25)(20)$

$\boxed{|\Delta q| = 5.0\ C}$

9. Three resistors are connected together in a **parallel** circuit ($R_1 = 10.0\ \Omega$, $R_2 = 32.0\ \Omega$, and $R_3 = 28.0\ \Omega$). What is their equivalent resistance now?
   (Hint: It's not the same as if they were connected in a series)



$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_{eq}} = \left(\frac{1}{10}\right) + \left(\frac{1}{32}\right) + \left(\frac{1}{28}\right)$

$\frac{1}{R_{eq}} = 0.166964$

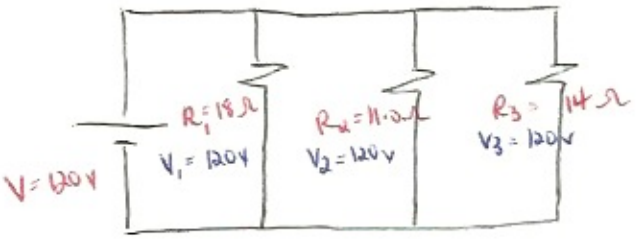
$\frac{1}{R_{eq}} = \frac{0.166964}{1}$

$0.166964 \cdot R_{eq} = 1$

$R_{eq} = \frac{1}{0.166964}$

$\boxed{R_{eq} = 5.99\ \Omega}$

10. Every morning, Sam plugs in his 18.0 Ω toaster, his 11.0 Ω electric hot plate, and 14.0 Ω coffeemaker in all at the same time. They form a parallel circuit connected to a 120.0 v source.
    A. Sketch the circuit.
    B. What is the current through each device?
    C. If the maximum amount of current flowing through the circuit is 15.0 A, can he have all three appliances plugged in at the same time?



* in a parallel circuit, all resistors have the same voltage.

B.) $R_1 = 18.0\ \Omega$

$V_1 = I_1 \cdot R_1$

$I_1 = \frac{V_1}{R_1} = \frac{120}{18}$

$\boxed{I_1 = 6.67\ A}$

$R_2 = 11.0\ \Omega$

$V_2 = I_2 \cdot R_2$

$I_2 = \frac{V_2}{R_2} = \frac{120}{11}$

$\boxed{I_2 = 10.9\ A}$

$R_3 = 14\ \Omega$

$V_3 = I_3 \cdot R_3$

$I_3 = \frac{V_3}{R_3} = \frac{120}{14}$

$\boxed{I_3 = 8.57\ A}$

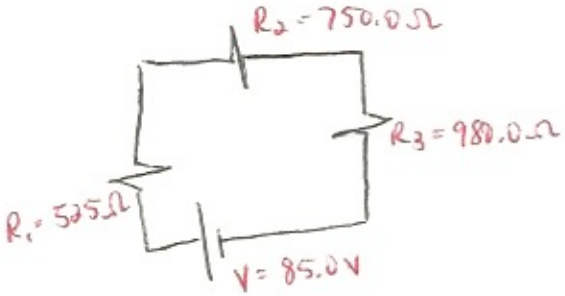
C.) Total Current

$I_{total} = I_1 + I_2 + I_3$

$I_{total} = 6.67 + 10.9 + 8.57$

$\boxed{I_{total} = 26.14\ A}$ too much for the circuit

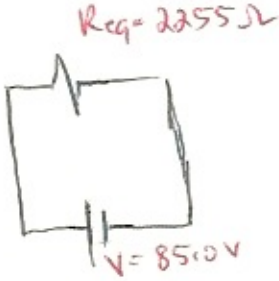
11. A circuit has 3 resistors ($R_1 = 525.0\ \Omega$, $R_2 = 750.0\ \Omega$, and $R_3 = 980.0\ \Omega$) connected in a series and connected to a voltage source of 85.0 v.
    A. Draw the circuit diagram for this circuit and find the equivalent resistance
    B. What is the current from the battery?
    C. How much voltage will each resistor receive?



A.) $R_{eq} = R_1 + R_2 + R_3$

$R_{eq} = 525 + 750 + 980$

$\boxed{R_{eq} = 2255\ \Omega}$



B.) $V = I \cdot R$

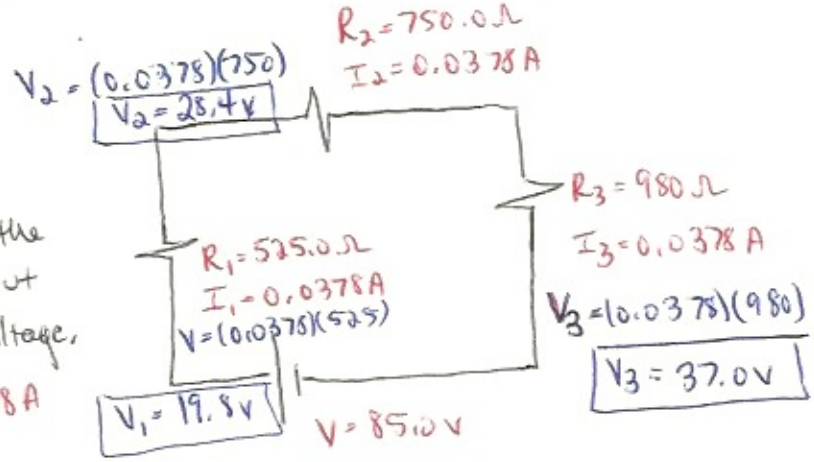
$I = \frac{V}{R} = \frac{85}{2255}$

$\boxed{I = 0.0378\ A}$

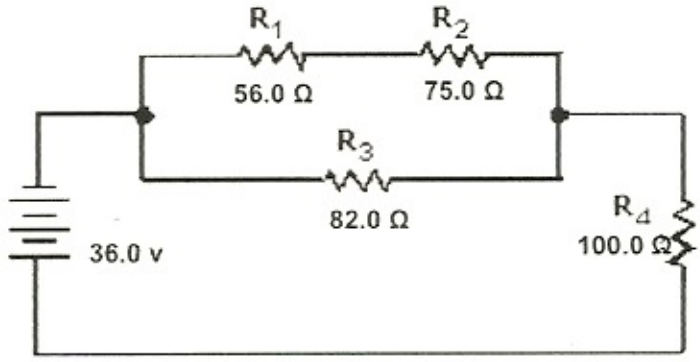
C.)

All devices receive the same current - but divide up the voltage.

$I = 0.0378\ A$

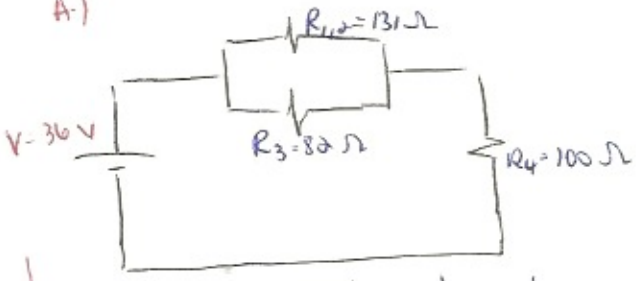


12. Find the following for the circuit shown below:
    A. The equivalent resistance
    B. The total current at the battery
    C. The current and voltage through each resistor.



$R_{1,2} = R_1 + R_2 = 56 + 75 = \boxed{131\ \Omega}$

A.)

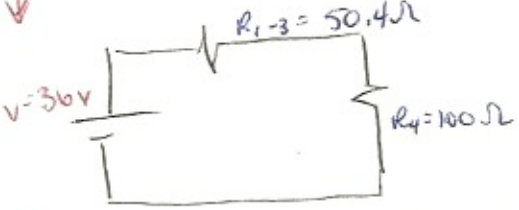


$\frac{1}{R_{1-3}} = \frac{1}{R_{1,2}} + \frac{1}{R_3} = \frac{1}{131} + \frac{1}{82}$

$\frac{1}{R_{1-3}} = 0.007634 + 0.012195$

$\frac{1}{R_{1-3}} = 0.019829$

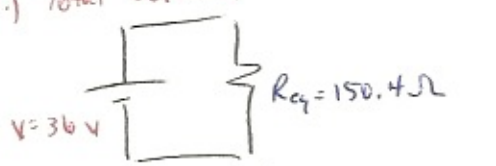
$R_{1-3} = \frac{1}{0.019829} = \boxed{50.4\ \Omega}$



$R_{eq} = R_{1-3} + R_4 = 50.4 + 100$

$R_{eq} = \boxed{150.4\ \Omega}$

B.) Total Current



$V = IR$

$I = \frac{V}{R} = \frac{36}{150.4}$

$\boxed{I = 0.239\ A}$