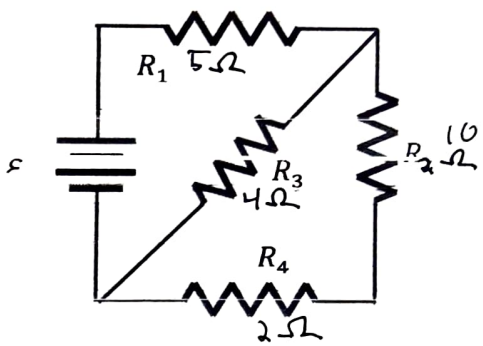
Section	Group	Name	Signature
Grade			
		Jacob Harkins	Jacob Harkins

After this activity you should know: • *Solve circuits in which not all the resistors are in series or parallel*

1. Four resistors are connected to the 20 Volt EMF. The resistances are $R_1 = 5\Omega$, $R_2 = 10\Omega$, $R_3 = 4\Omega$ and $R_4 = 2\Omega$.

   a. Determine the equivalent resistance of the circuit. Redraw the resistances at each step.



Series: R_1 R_{234}

Parallel: R_2 R_{34} =

$$R_{234} = \left(\frac{1}{4} + \frac{1}{12}\right)^{-1} = 3\ \Omega$$

$$R_{1234} = 5 + 3 = 8\ \Omega$$

   b. Determine the current and voltage drops across each resistor. Fill in the table below.

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

	R_1	R_2	R_3	R_4	R_{234}		
R	5Ω	10Ω	4Ω	2Ω	10 Ω		
I	2.5 A	0.63 A	1.87 A	0.63 A	2.5 A		
ΔV_R	−12.5 V	−6.25	−7.5	−1.25	−7.5		

c. The battery in the circuit has total useful chemical potential energy of 20,000 Joules. How long will the battery last in this circuit?

$P = 20V \cdot 2.5A = 50W$

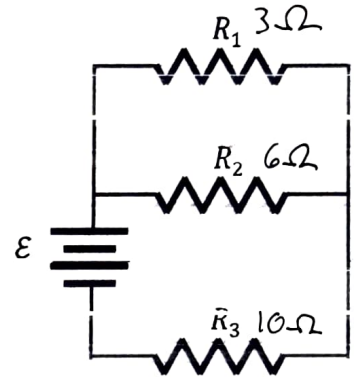
$20000 = P\Delta t$ $\quad \Delta t = 400s$

2. Three resistors are connected to an EMF with $R_1 = 3\Omega$, $R_2 = 6\Omega$ and $R_3 = 10\Omega$. The current through R_1 is $10A$.

a. Determine the equivalent resistance of the circuit.

$10 + \left(\frac{1}{3} + \frac{1}{6}\right)^{-1} = 12\Omega$

$I = 10A$



b. Determine the EMF and the current through R_3. Show work. You may (but do not have) to set up a table to help organize your calculation.

$V_1 = V_2 = I_1R_1 = 30V$

$I_2 = \frac{30V}{6} = 5A$

$I_3 = 15A = I_1 + I_2$

$V_3 = 150V$

$V_{123} = 180V$

3. Three resistors with $R_1 > R_2 > R_3$ are connected to an EMF.

a. The three resistors are connected in series to the EMF. Which resistor dissipates the most power? Explain your answer. *Hint: rewrite the power dissipation in terms of R and think about what is the same for series resistors.*

$P_{diss} = I\Delta V = I^2R$

R_1 dissipates the most since and I is the same for all of them. $P = RI^2$

b. The three resistors are connected in parallel to the EMF. Which resistor dissipates the most power? Explain your answer.

R_3 since $P = RI^2$ and current will flow linearly proportionately to the other R, I^2 is going to be bigger