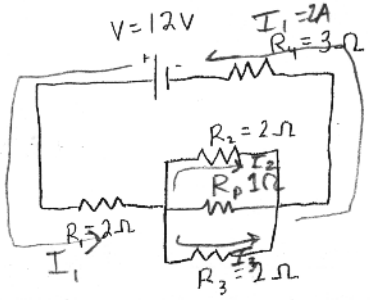
AP1 Circuit Practice

1)



$R_{eq} = 6\Omega$

$I = \frac{\Delta V}{R_{eq}} = \frac{12}{6} = 2A$

a) What is the current through each resistor?

$I_1 = 2A$ (R_1, R_4)

$I_2 = 1A$ (R_2)

$I_3 = 1A$ (R_3)

b) What is the power dissipated in each resistor?

$P_1 = I_1^2 R_1 = 8W$ $P_4 = I_1^2 R_4 = 12W$

$P_2 = I_2^2 R_2 = 2W$

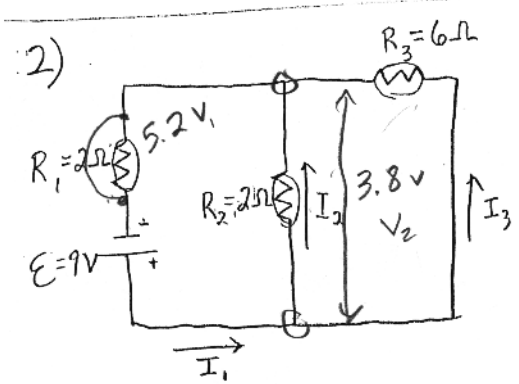
$P_3 = I_3^2 R_3 = 2W$

c) What is the power the battery supplies? Explain.

$P = I_1 \Delta V = 24W$

Notice the power input equals output

2)



a) Find each current.

$I_1 = \frac{\Delta V}{R_{eq}} = \frac{9V}{3.5\Omega} = 2.6A$

$I_2 = \frac{V_2}{R_2} = \frac{3.8}{2} = 1.9A$

$I_3 = I_1 - I_2 = 0.7A$

b) If the resistors are lightbulbs, rank them in order from brightest to dimmest.

Power = brightness

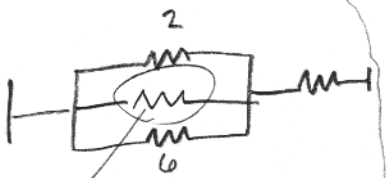
$P_1 = I_1^2 R_1 = 13.52W$

$P_2 = I_2^2 R_2 = 7.22W$

$P_3 = I_3^2 R_3 = 2.94W$

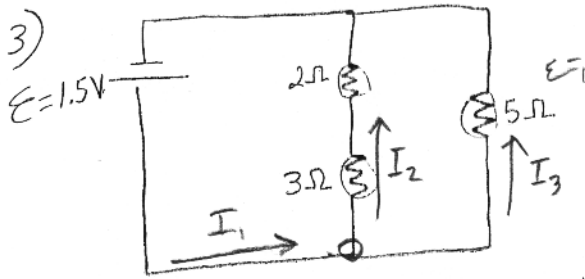
R_1, R_2, R_3

$R_{eq} = \frac{7}{2}\Omega$

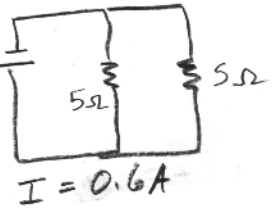


$\frac{3}{2}\Omega + 2\Omega = \frac{7}{2}\Omega$

3)



$\frac{1}{5} + \frac{1}{5} = \frac{2}{5} = R_p = \frac{5}{2} = 2.5\Omega$



a) Find the potential drop across the 2Ω resistor.

$I_2 = 0.3A$

$V = I_2 2\Omega = 0.6V$

b) If the 2Ω resistor burns out, what is the current in the 5Ω resistor? Why did it go down?

$I = \frac{\Delta V}{5\Omega} = 0.3A$

c) What would be the effect on the remaining lightbulbs? (3Ω, 5Ω after 2Ω burns out)

The 3Ω turns off!

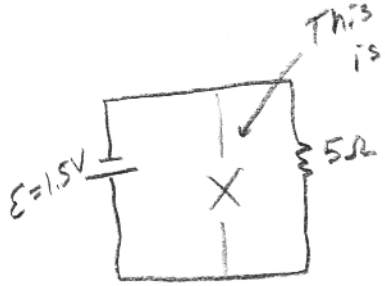
The 5Ω stays on

d) What would be the advantage of wiring circuits in parallel?

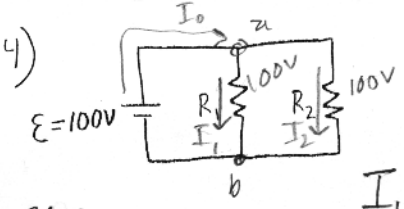
If one bulb goes out, the others on different paths can stay on.

e) What would be a disadvantage of wiring in parallel?

It uses more current, and more energy.



4)



$R_1 = 20\Omega$

$R_2 = 40\Omega$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{\frac{1}{20} + \frac{1}{40}}$

$R_{eq} = 13.3\Omega$

$I_0 = \frac{\mathcal{E}}{R_{eq}} = \frac{100V}{13.3} = 7.52A$

$P_1 = I_1^2 R_1 = 500W$ $\quad P_2 = I_2^2 R_2 = 250W$

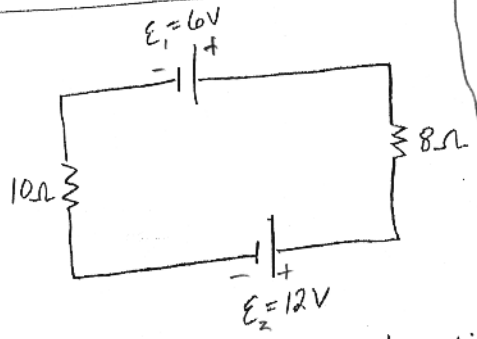
a) How much energy is dissipated in each resistor over 1min?

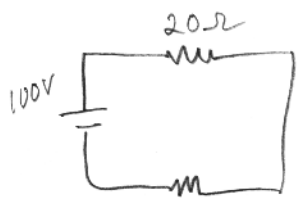
$I_1 = \frac{V_1}{R_1} = 5A$ $\quad I_2 = \frac{V_2}{R_2} = 2.5A$

b) Redraw the circuit with the resistors in series. What is the effect on the power of the resistors? $E = P \cdot t$

R_1 uses 30,000J per 1min

R_2 uses 15,000J per 1min





$R_{eq} = 60\Omega$

$I = 1.67A$

Power goes down!

5)

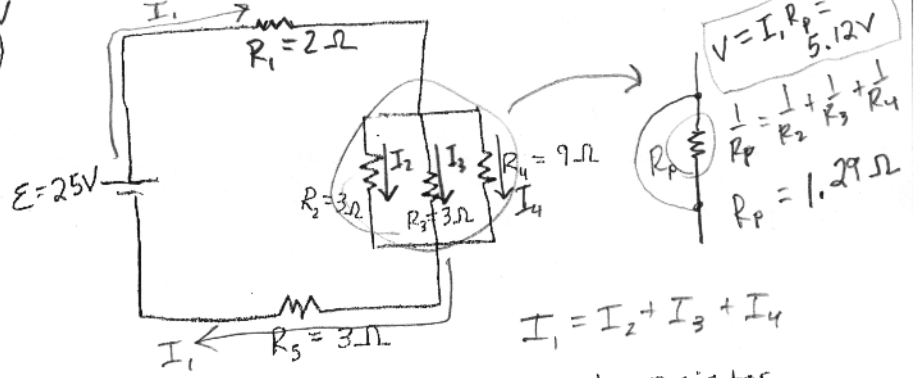
a) Find the current in the circuit.

$\mathcal{E}_2 - \mathcal{E}_1 = 6V$

$R_{eq} = R_1 + R_2 = 18\Omega$

$I = \frac{\mathcal{E}_{tot}}{R_{eq}} = \frac{6V}{18\Omega} = 0.33A$

6)



$I_1 = I_2 + I_3 + I_4$

a) Find the current through each resistor.

$R_{eq} = R_1 + R_p + R_5 = 6.29\Omega$

$I_1 = \frac{\mathcal{E}}{R_{eq}} = \frac{25V}{6.29\Omega} = 3.97A$ (R_1, R_5)

$I_2 = \frac{V}{R_2} = \frac{5.12V}{3\Omega} = 1.71A$

$I_4 = \frac{V}{R_4} = \frac{5.12V}{9\Omega} = 0.57A$

$I_3 = \frac{V}{R_3} = \frac{5.12V}{3\Omega} = 1.71A$

b) Find the power dissipated by each resistor.

$P_1 = I_1^2 R_1 = 31.5W$ $\quad P_4 = I_4^2 R_4 = 2.92W$

$P_2 = I_2^2 R_2 = 8.77W$ $\quad P_5 = I_1^2 R_5 = 47.28W$

$P_3 = I_3^2 R_3 = 8.77W$

c) How much power does the battery supply?

$P_b = I_1 \mathcal{E} = 99.25W$

-or-

Sum of resistors power loss!