EL 110 - Introduction to Electricity and Electronics
Power, Parallel Lawnmowers & Resistors – In-class & Homework

POWER STUFF:

1. A washing machine is connected to 120 V. Its power is 840 W. Find its R, I.
   $R = V^2/P = 17.1\ \Omega$ $I = P/V = 7$ amps

2. Night light lamps are rated at 7 W, V = 120 V. Find R, I.
   Same equations: **$R = V^2/P = 2.06\text{k}\ \Omega$ $I = P/V = 58.3$ mA**

3. A 22 kΩ resistor has a power rating of 0.5 W, maximum. Find the maximum V, and I.
   $V_{max} = (P*R)^{0.5} = 105$ V $I_{max} = (P/R)^{0.5} = 4.77$ mA

4. The starter motor on a car draws 300 A, at 12 V. Find P, R.
   3600 W 40 mΩ = 0.04 Ω

5. Lightning strikes a tree, I = 12,000 A. $R_{tree} = 500\ \Omega$. Find P_{tree} , V_{tree} (voltage from top to bottom). **$P = I^2R = 72$ GW (that's 72,000 Megawatts!!). $V = IR = 6$ megavolts!!!**
   Morals of this story: don't stand under any tree during a thunderstorm, trees hit by lightning often have split trunks, from the sap turning into steam (exploding the trunk from inside). The lightning doesn't last very long, so the total ENERGY is not huge (like the POWER, which is huge).

6. A 3-volt flashlight bulb consumes 600 mW of power. What is its resistance? It's current?
   15 Ω, 200 mA

7. A British ichthyologist needs a tank heater to put out 250 W of heat to keep her guppies warm. The voltage is 220 V. Find the resistance, and the current. **194 Ω, 1.14 A (fishy answer)**

LAWNMOWER STUFF:

8. Moe can mow a certain lawn in 5 hours; Curly can mow the same lawn in 3 hours. How long does it take if they both mow the lawn at the same time? **1.875 hours**

9. Moe can mow a certain lawn in 5 hours; Curly can mow the same lawn in 3 hours. Larry helps also. How long does it take if all three stooges mow the lawn at the same time? (Larry can mow the same lawn in 6 hours). **1.43 hours**

10. Garden hose A can fill a swimming pool in 16 hours. Garden hose B can do it in 10 hours. If both garden hoses fill the pool together, how many hours does it take to fill the pool? **6.15 hrs.**

RESISTORS IN PARALLEL STUFF:

11. A 40 Ω resistor is connected in parallel with a 10 Ω resistor, across a 20 volt battery.
    a) How much current flows through each resistor? **0.5 A, 2 A respectively**
    b) How much total current does the battery supply? **2.5 A**
    c) What single resistor would cause the same current to flow from a 20 V battery? **8 Ω**
    d) Find the power dissipation of each resistor. **10 W, 40 W respectively**
    e) How much total power does the battery supply? **50 W**

12. A 60 Ω resistor, a 120 Ω resistor, and a 40 Ω resistor are in parallel across a 6 volt battery.
    a) How much current flows through each resistor? **100 mA, 50 mA, 150 mA respectively**
    b) How much total current does the battery supply? **300 mA**
    c) What single resistor would cause the same current to flow from a 6 V battery? **20 Ω**
    d) Find the power dissipation of each resistor. **0.6 W, 0.3 W, 0.9 W respectively**
    e) How much total power does the battery supply? **1.8 W**

13. Elwood P. Froon, a Ward College student, has two resistors soldered in parallel. One is clearly marked as (and known to be) a 100 Ω, 1% resistor. The other is unmarked. Elwood measures the parallel combination to be 75 Ω. What is the resistance of the unknown resistor?
    $Rx = ((1/75\Omega) - (1/100\Omega))^{-1} = 300\ \Omega$
    This is from (1/Rtotal) = (1/R1) + (1/R2), and we are solving for R2 = Rx.

14. Elwood's cousin, Betty Sue Freen, has three resistors soldered in parallel. One is clearly marked as (and known to be) a 1k Ω, 1% resistor, another is a 4k Ω, 1% resistor. The third resistor is unmarked. Betty Sue measures the parallel combination to be 500 Ω. What is the resistance of the unknown resistor?
    $Rx = ((1/500\ \Omega) - (1/1k\ \Omega) - (1/4k\ \Omega)^{-1} = 1333\ \Omega$
    This is from (1/Rtotal) = (1/R1) + (1/R2) + (1/R3), and we are solving for R3 = Rx.