Homework 2

1. Simplify this circuit to find the total power absorbed by all resistors.

   ![Circuit Diagram 1](image1)

2. Simplify this circuit to find what fraction of $V_s$ appears across the 180 ohm resistor as $V_o$.

   ![Circuit Diagram 2](image2)

3. You have a current sensor that has an internal resistance of 10Ω. It can handle a maximum current of 1A, but you want to measure currents up to 100A. What value of $R_s$ would allow this? What is the maximum power it may have to absorb. (By the way, this is often done and $R_s$ is called a “shunt”.)

   ![Circuit Diagram 3](image3)
4. You have a voltage sensor that measures up to 10V, but you need to measure the voltage between a wire and ground that can reach up to 1000V (1KV). The sensor has an internal resistance of 1000Ω. What value of Rm would you use? What is the maximum power it may have to absorb? (Again, this is often done. Rm is referred to as a “multiplier”.)

5. You need to reduce the 1000V in the problem above to 100V for a lab experiment. What circuit would you use and with what values? Whatever circuit you use may not absorb more than 1 watt.

6. In the lab, you have more problems. The experiment calls for a 520 ohm resistor in some part of the circuit, but all you have are boxes of 470 and 100 ohm resistors. How can you make a 520 ohm resistor with a combination of these values?

7. Below is a schematic of a circuit someone else designed. The designer got sick before finishing his design (It happens!). How many watts does R4 absorb? Resistors come in sizes able to absorb 1/8, 1/4, and 1/2 watt. What size would you use? The next day they tell you Vs is now 5V. Can you tell them how much R4 has to absorb without doing all the nodal analysis again? How much must it absorb? Can you use the same size resistor (in wattage) as before? If not, what size?
8. This is the circuit model of an actual transistor amplifier (really!). The gain of the amplifier is $\frac{V_o}{V_s}$. What is the gain of the amplifier? Note the direction of $I_b$ and the dependent current source.

9. What is $V_c$ in this circuit?

10. What is $V_o$?
11. This is the model for a circuit using a FET. What is $V_o$ in terms of $V_s$?

12. What is $V_o$?