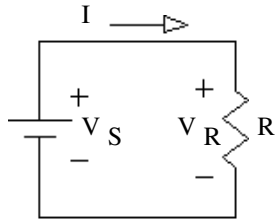
# ECE 1250 homework # 2

The following problems on your own paper. Since you have the answers, you must show your work to get credit.

1. Consider the figure below. For each of the cases below, find the missing value.




a) $I := 0.01 \cdot A$ $V_R := 4 \cdot V$ $R = ?$

b) $I := 50 \cdot mA$ $R := 560 \cdot \Omega$ $V_R = ?$

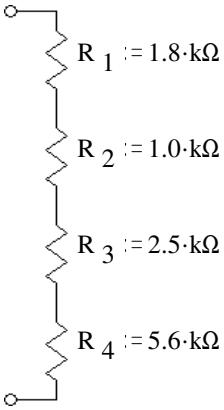
c) $V_R := 12 \cdot V$ $R := 1.5 \cdot k\Omega$ $I = ?$

2. Power and Ohm's law. Same circuit as above. For each of the cases below, find the missing values.

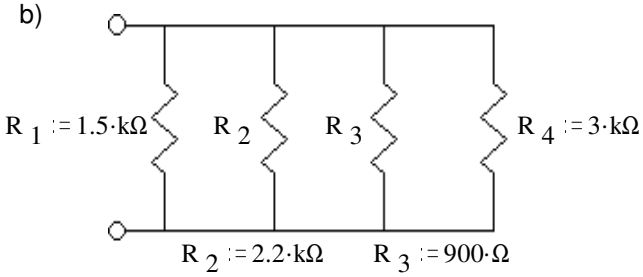
| | | | | | | |
|---|---|---|---|---|---|---|
| a) | $I := 5 \cdot mA$ | $R := 2 \cdot k\Omega$ | $V_R = ?$ | $P_R = ?$ | | |
| b) | $V_R := 25 \cdot V$ | $R := 100 \cdot \Omega$ | $I = ?$ | $P_R = ?$ | | |
| c) | $V_R := 20 \cdot V$ | $I := 0.01 \cdot A$ | $R = ?$ | $P_R = ?$ | | |
| d) | $P_R := 900 \cdot W$ | $V_R := 120 \cdot V$ | $I = ?$ | $R = ?$ | Toaster | |
| e) | $P_R := 1500 \cdot W$ | $R := 9.6 \cdot \Omega$ | $I = ?$ | $V_S = ?$ | Hair drier | Ignore the fact that these run on AC |
| f) | $P_R := 2500 \cdot W$ | $I := 10.5 \cdot A$ | $R = ?$ | $V_S = ?$ | Electric oven | |

3. Find the equivalent resistance of each of these networks, i.e. what would an ohmmeter read if hooked to the terminals.

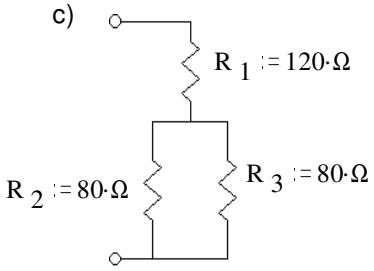
a)



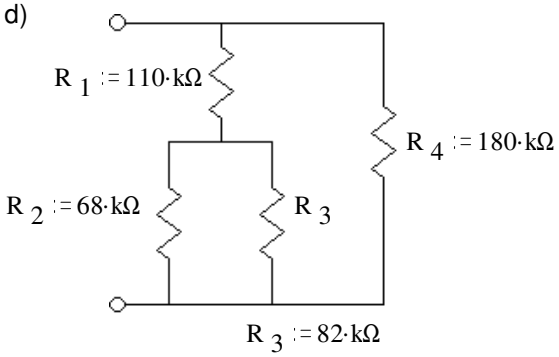

b)



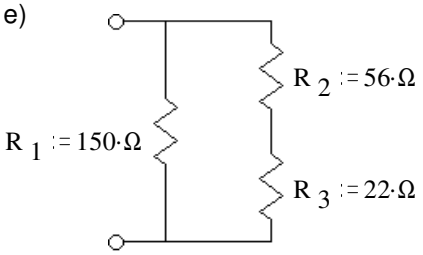

c)




d)



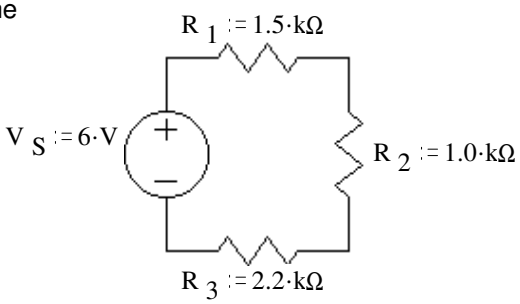

e)



# ECE 1250 homework # 2 p.2

4. a) Use the voltage divider concept to find the voltage across each of the resistors in the circuit at right.

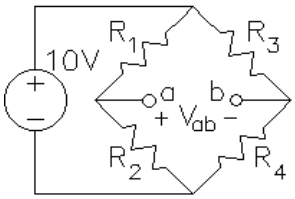
$V_{R1} = ?$ $V_{R2} = ?$ $V_{R3} = ?$




b) Confirm that the three resistor voltages add up to the source voltage, ie, confirm Kirchoff's voltage law.

c) Without recalculating anything, what would happen to all the resistor voltages if the source voltage were doubled? Tripled?

5. The circuit at right is known as a *wheatstone bridge*, or simply a *bridge*. It is a very common measurement circuit, used with strain gauges, thermisters, and other devices whose resistance changes in response to something that you'd like to measure. Let's assume the resistors in this circuit are 100W strain gauges. The resistance of these gauges changes slightly when you stretch or compress them. They are glued to a material (often steel) and are used to measure deformations of the material (called strain).




a) Before any deformation all R's are 100Ω. Find $V_{ab}$.

b) Due to deformation, $R_1$ and $R_4$ decrease by 1% and $R_2$ and $R_3$ increase by 1%. Find $V_{ab}$.

c) Due to a temperature change, the resistances of all the gauges increase by 5%. Find the % change in $V_{ab}$.

d) Why do you think the bridge circuit is used in this case?

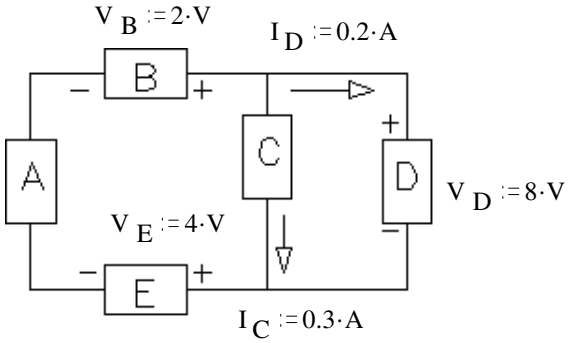
6. Refer to the circuit of problem 4.

a) how much power is dissipated by each resistor? $P_{R1} = ?$ $P_{R2} = ?$ $P_{R3} = ?$

b) Independently determine the power that the source is contributing to the circuit. $P_S = V_S \cdot I_S = ?$

c) Show that power is conserved (Σ answers to a = answer to b).

7. The circuit at right has five unknown components labeled A through E.




a) Which of the components are absorbing power from the circuit?

b) Which of the components are contributing power to the circuit?

c) Show that power is conserved.

**Answers**

1. a) $R := 400 \cdot \Omega$ b) $V_R := 28 \cdot V$ c) $I := 8 \cdot mA$
2. a) $V_R := 10 \cdot V$ $P_R := 50 \cdot mW$ b) $I := 0.25 \cdot A$ $P_R := 6.25 \cdot W$ c) $R := 2.0 \cdot k\Omega$ $P_R := 200 \cdot mW$
   d) $I := 7.5 \cdot A$ $R := 16 \cdot \Omega$ e) $I := 12.5 \cdot A$ $V_S := 120 \cdot V$ f) $R := 22.7 \cdot \Omega$ $V_S := 238 \cdot V$
3. a) $R_{eq} := 10.9 \cdot k\Omega$ b) $R_{eq} := 390 \cdot \Omega$ c) $R_{eq} := 160 \cdot \Omega$
   d) $R_{eq} := 81 \cdot k\Omega$ e) $R_{eq} := 51.3 \cdot \Omega$
4. a) $1.91 \cdot V$, $1.28 \cdot V$, $2.81 \cdot V$ b) $1.91 \cdot V + 1.28 \cdot V + 2.81 \cdot V = 6 \cdot V$ c) double, triple
5. a) $0 \cdot V$ b) $100 \cdot mV$ c) 0% change d) Reading won't be affected by temperature.
6. a) $2.44 \cdot mW$, $1.63 \cdot mW$, $3.59 \cdot mW$ b) $7.66 \cdot mW$ c) $P_S = P_{R1} + P_{R2} + P_{R3}$
7. a) C, D, E b) A, B c) $6 \cdot W = 6 \cdot W$

ECE 1250 homework # 2 p.2