Review: Quiz 1 and The Water Model

Session 1f of Basic Electricity
A Fairfield University E-Course
Powered by LearnLinc

Basic Electricity

Two Sections

- Electron Flow and Resistance
  - 5 on-line sessions
  - Lab
- Inductance and Capacitance
  - 5 on-line sessions
  - Lab

Mastery Test, Part 1

Basic Electricity (Continued)

- Text: "Electricity One-Seven," Harry Mileaf, Prentice-Hall, 1996, ISBN 0-13-889585-6 (Covers several Modules and more)
- References:
  - "Digital Mini Test: Principles of Electricity Lessons One and Two," SNET Home Study Coordinator, (203) 771-5400
  - Electronics Tutorial (Thanks to Alex Pounds at alex_tb@hotmail.com)
  - Electronics Tutorial (Thanks to Mark Sokos at sokos@desupernet.net)

Section 1:
Electron Flow and Resistance

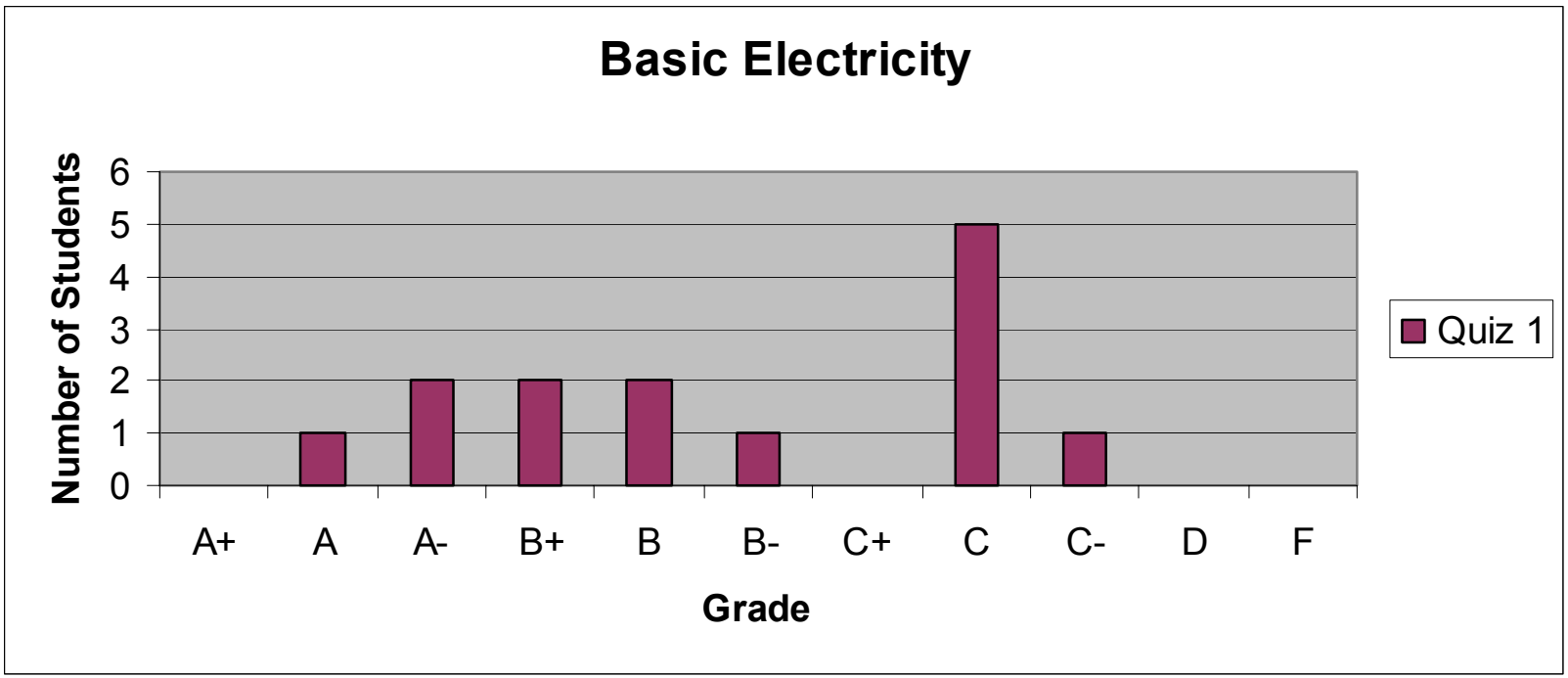
- 0BJECTIVES: This section introduces five basic electrical concepts as well as the underlying atomic structure of electrical materials.
  - Conductance(G),
  - Resistance (R),
  - Current (I),
  - Power (P), and
  - Electromotive force (E) or voltage (V).

Section 1 Schedule:

Session a – 03/04	Atoms, Charge and Current	Text 1.1 – 1.39
03/06 & 03/08 were Math Tutorials	Conductivity (G), Electric Fields and Electromotive Force (EMF)	Text 1.40 – 1.68
Session b – 03/11	Resistance (R), Conductance (G), Ohms Law (Ω) & Power (Watts)	Text 2.1 – 2.52
Session c – 03/13 (lab - 03/16, sat.)	Resistors in Series and Parallel and Working with Equations	Text 2.53 – 2.98
Session d – 03/18	Series / Parallel Simplification Voltage and Current Dividers	2.99 – 2.115
Session e – 03/20	Kirchoff, Thevenin & Norton	2.116 – 2.133
Session f – 03/25	**Review (Discuss Quiz_1)**	**1.42, 1.63, 2.5, 2.129 Sokos**

Quiz_1 Results

- The class had a B- average – Nice Job.
- Some of you should spend a little extra time on Chapters 1 and 2.



Quiz True/False

1. Batteries provide AC power. Only DC _F_
2. A Larger resistor allows less current (for the same voltage). _T_
3. The symbol for a resistor usually indicates its power rating. _F_
4. Copper is a good conductor. _T_
5. DC Current flows from the positive battery terminal to the negative terminal. _T_
6. Electrons flow from the positive battery terminal to the negative terminal. _F_
7. Kirchoff's law describes the relationship between voltage and current in a resistor. Ohm's Law _F_
8. Color bands are used to mark the value of a resistor because numbers would be too small to read. The numbers may be blocked. _F_
9. In a series circuit with two equal resistors they both dissipate the same power. _T_
10. A battery rated at 55 amp-hours will work for 55 hours before running down. It also depends on the current drain. _F_

Quiz Multiple Choice

1. To get a higher voltage, batteries should be connected
   a. Negative to negative in series
   b. Negative to negative in parallel
   c. Positive to negative in series
   d. Positive to negative in parallel
2. To supply more current, batteries should be connected
   a. Negative to negative in series
   b. Negative to negative in parallel
   c. Positive to negative in series
   d. Positive to negative in parallel
3. What value of resistor would you put in parallel with a 12kΩ resistor to get a resistance of 4kΩ?
   a. 4kΩ
   b. 6kΩ
   c. 8kΩ
   d. 12kΩ

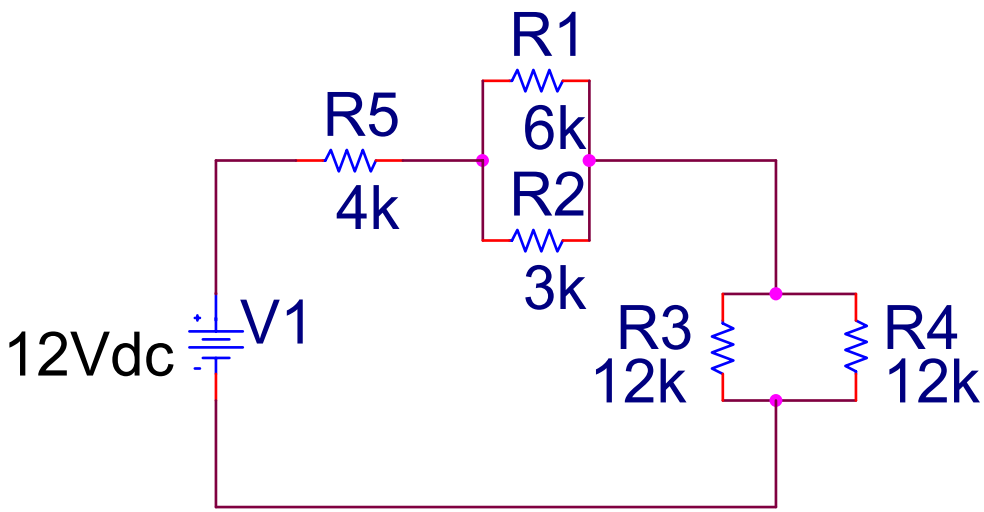
Quiz Multiple Choice (cont.)

4. Which of the following is a variant of Ohm's law?
   a. I=V*R
   b. P=I*V
   c. V=I/R
   d. R=V/I

5. A resistor is marked red violet orange it's value is:
   a. 3700
   b. 27000
   c. 37000
   d. 2700

DC Circuit Analysis

1. For the following circuit:

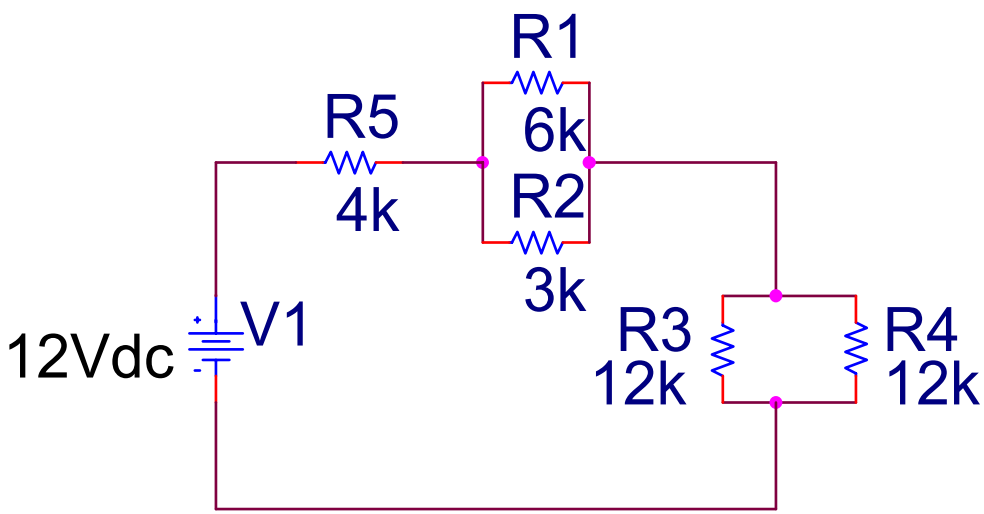


   a. Draw the "reduced equivalent circuit

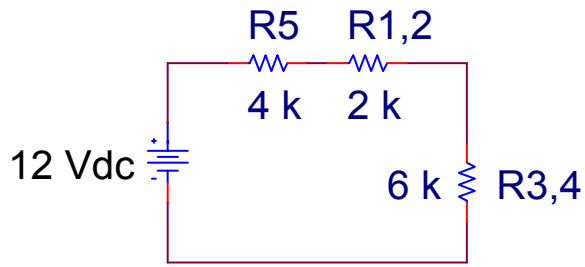
   b. What is the battery current?

DC Circuit Analysis

1. For the following circuit:



First replace the parallel resistors with their equivalent resistors.



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DC Circuit Analysis

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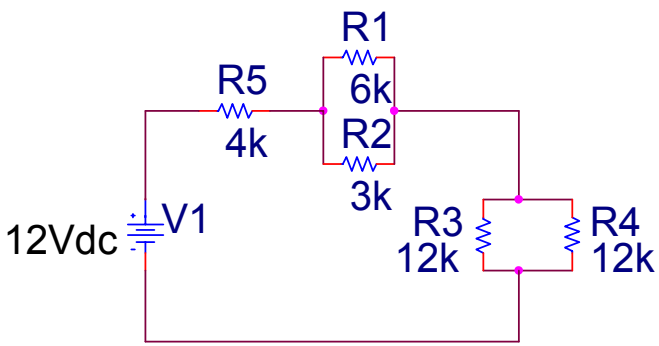
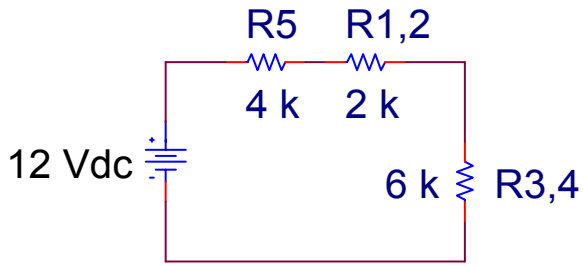
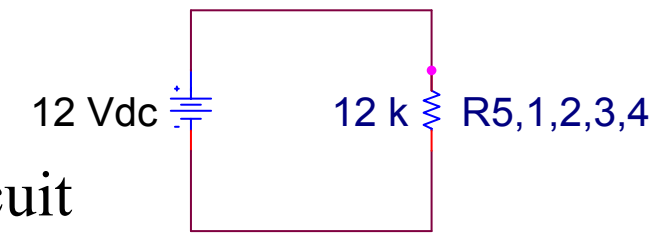




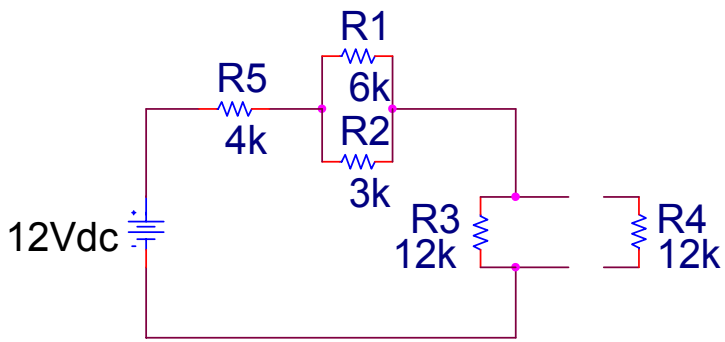
Now add the series resistors to get to only one equivalent resistor.



a. Draw the "reduced equivalent circuit
b. What is the battery current? $I = 12v/12k\Omega = 1$ mA
c. What is the voltage across resistor R1? $V = 1mA*2k\Omega = 2v$
d. What is the current through R3? $I = 0.5*I_b = 0.5$ mA

Thevenin

2. Now treat resistor R4 as the "load" resistor. Find the Thevenin equivalent circuit.



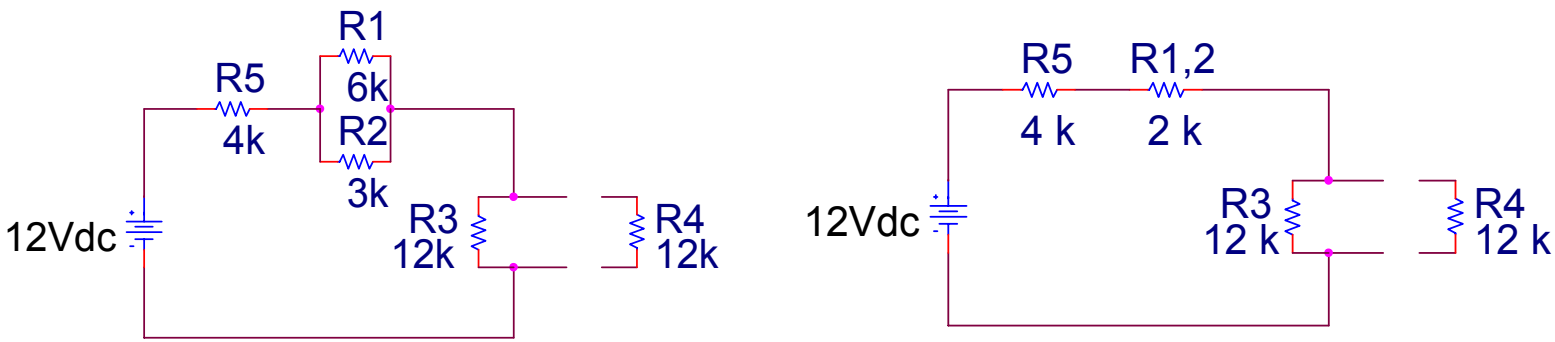
We are trying to find a simple circuit with one battery and one resistor in series that will behave the same as this circuit when we re-attach R4.

There are two steps

1. Find the voltage when the load is not attached
2. Find the value of the resistance to place in series with that voltage
3. Both of these are easier if we first reduce the circuit (no R4)

Thevenin (Cont.)

2. Now treat resistor R4 as the "load" resistor and find the Thevenin equivalent circuit.

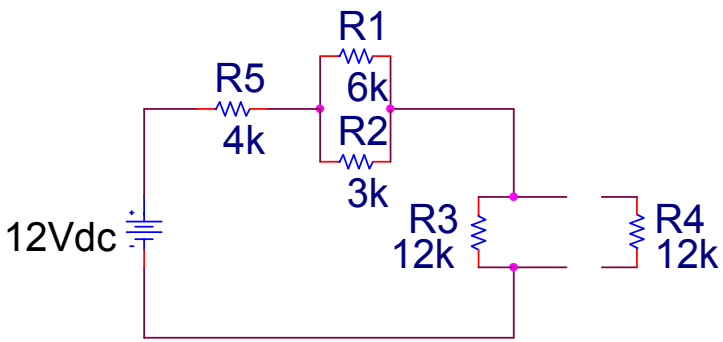


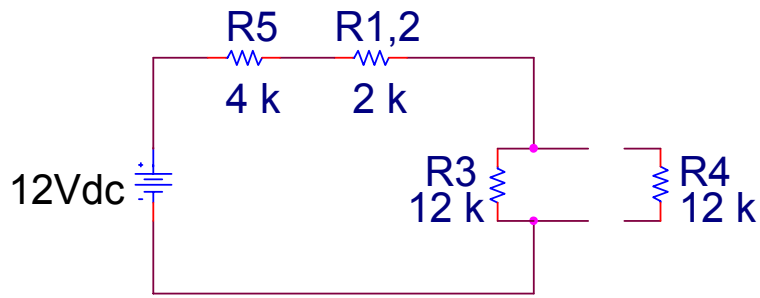
The "open circuit" voltage (no R4) is the Thevenin voltage.

$V_{R3} = V_{TH} = 12V*12k/(4k+2k+12k) = 12*12/18 = 12*2/3 = 8V$

Thevenin (Cont.)

2. Now treat resistor R4 as the "load" resistor and find the Thevenin equivalent circuit.

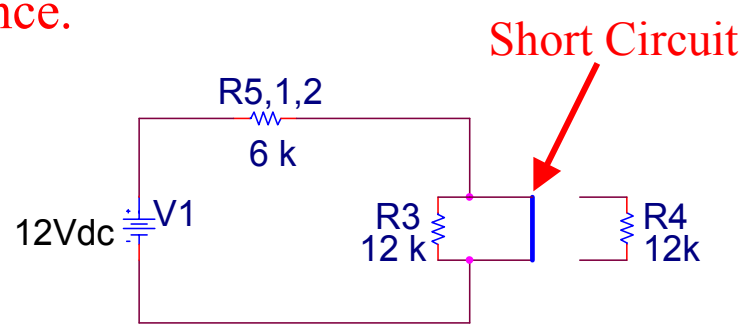




Now we need to find the Thevenin resistance.
There are two ways to do this.
The first is to "short out" output terminals and find the current that flows through the shorting element.

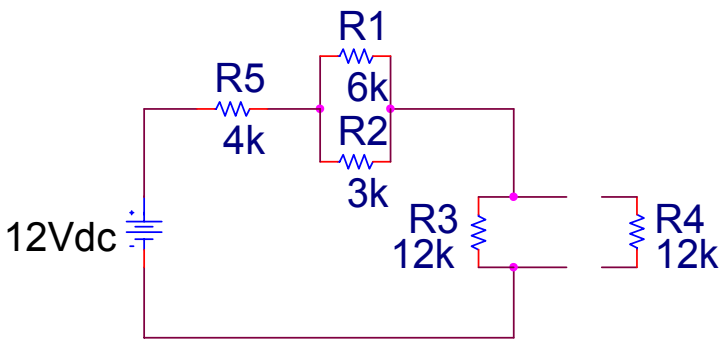
$I_{SC} = 12V/6k\Omega = 2$ mA, and

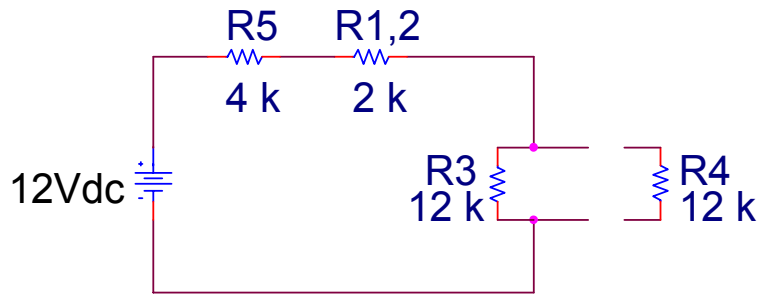
$R_{TH} = V_{TH} / I_{SC} = 8V / 2$ mA $= 4k\Omega$



Thevenin (Cont.)

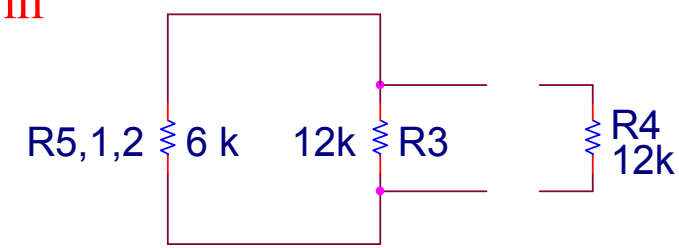
2. Now treat resistor R4 as the "load" resistor and find the Thevenin equivalent circuit.





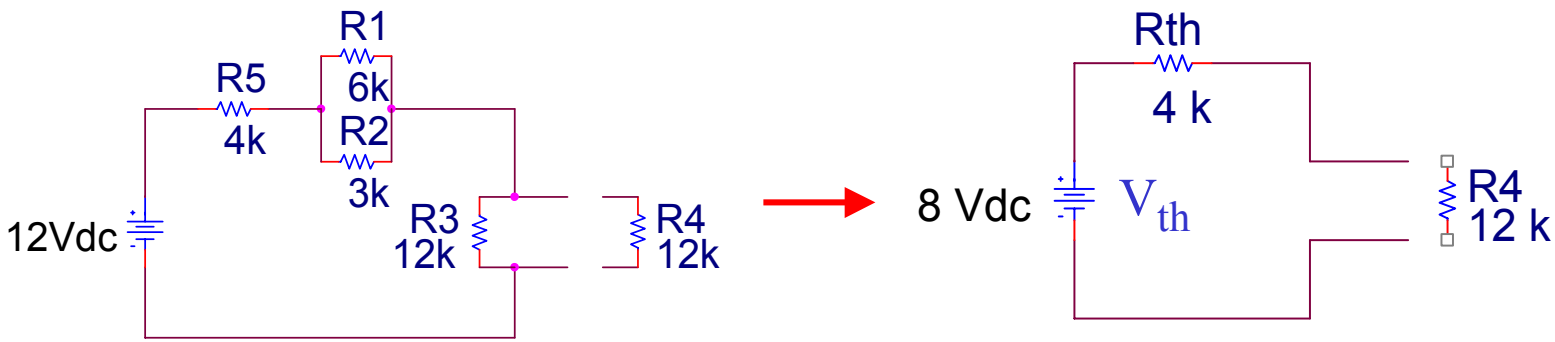
The second method for finding the Thevenin resistance is to set the voltage to zero and find the equivalent resistance "looking in" from the output terminals.

$R_{TH} = 6k\Omega \parallel 12k\Omega$ so $R_{TH} = 4k\ \Omega$



Thevenin (Cont.)

2. Now treat resistor R4 as the “load” resistor and find the Thevenin equivalent circuit.



We now have the Thevenin equivalent circuit.

Section 2 Schedule

Session 2a – 03/27	Alternating Current & Sine Waves	Text 3.1 – 3.41
Vector Math – 04/01	Sine Waves, Magnitude, Phase and Vectors	Text 4.1 – 4.24
Session 2b – 04/03	Inductors and Circuits	Text 3.42 – 3.75
Session 2c – 04/08	Transformers	Text 3.76 – 3.100
Session 2d – 04/10 (lab - 04/13, Sat.)	Capacitors	Text 3.101 – 3.135
Session 2e – 04/15	More Capacitors	Text 3.135 – 3.148
Session 2f – 04/22	Review (Discuss Quiz_2)	