UNIVERSITY OF CALIFORNIA AT BERKELEY
College of Engineering
Dept. of Electrical Engineering and Computer Sciences

EECS 40 **Fall 2003**

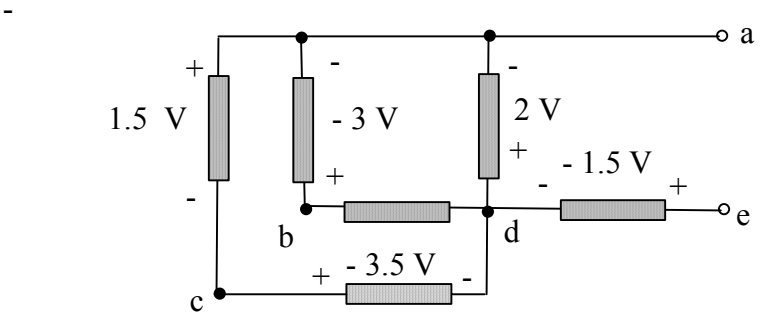
Homework Assignment #1
Due at 11 AM in 240 Cory on Friday, 9/5/03
* Be sure to put your name and section number on your paper

Problem 1: Digital representation of a voltage signal
Some audio systems are advertised to use 18-bit analog-to-digital conversion. If the maximum possible value of the microphone output voltage is 250 μV and this voltage can be either + or – with respect to ground, what is the voltage resolution of the system? Assume that one bit is used to encode whether the voltage is positive or negative.

Problem 2: Current and voltage

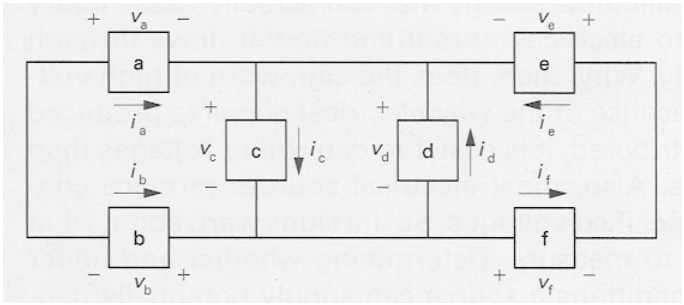
a) Suppose a 32 μA current flows (in the +*x* direction) in a semiconductor sample of cross-sectional area 10 μm^2.
(i) What is the average number of electrons per second that flow past a fixed reference cross section that is perpendicular to the direction of flow?
(ii) What is the current density at a fixed reference cross section that is perpendicular to the direction of flow?

b) Consider the following electric circuit:



(i) What is v_{ae} in Volts?
(ii) What is v_{bd} in Volts?

Problem 3: Power
(Problem 1.28 in the textbook)

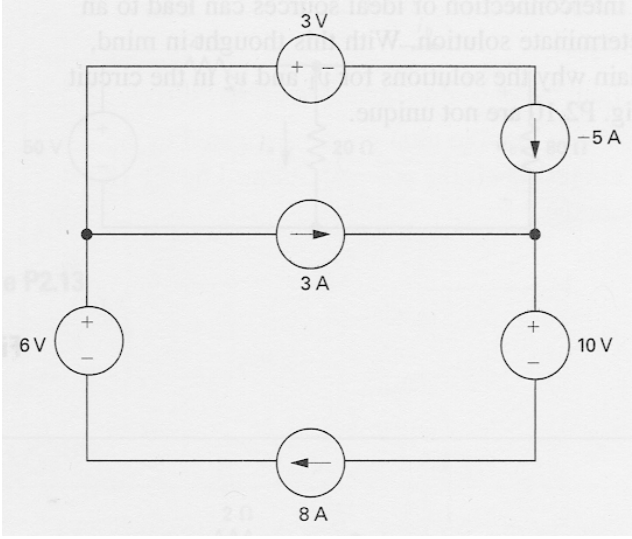


a) In the circuit shown, identify which elements have the voltage and current reference polarities defined using the passive sign convention.

b) The numerical values of the currents and voltages for each element are given below. How much total power is absorbed, and how much is delivered in this circuit?

ELEMENT	VOLTAGE (V)	CURRENT (A)
a	−8	7
b	−2	−7
c	10	15
d	10	5
e	−6	3
f	−4	3

Problem 4: Voltage and current sources
(Problem 2.7 in the textbook)
If the interconnection shown below is valid, find the total power developed in the circuit. If the interconnection is not valid, explain why.



Problem 5: Resistor circuit
(Problem 2.14 in the textbook)
The currents i_1 and i_2 in the circuit shown below are 20 A and 15 A, respectively.

- **a)** Find the power supplied by each voltage source.
- **b)** Show that the total power supplied (by the sources) equals the total power dissipated in the resistors.