# Electrical Engineering 40/40I/41I

# Midterm 1 - Fall 1995

**Professors S. Schwarz (40) and R.M. White (40I/41I)**

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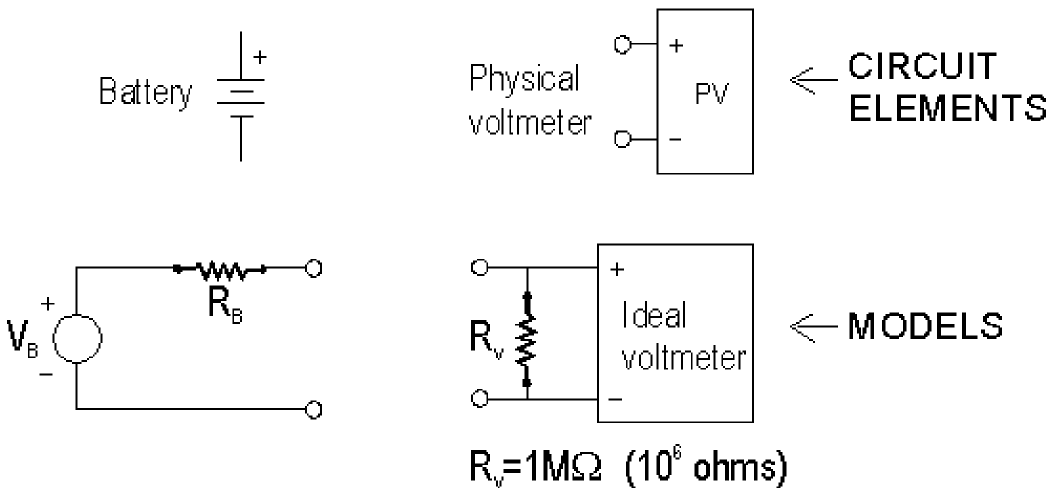
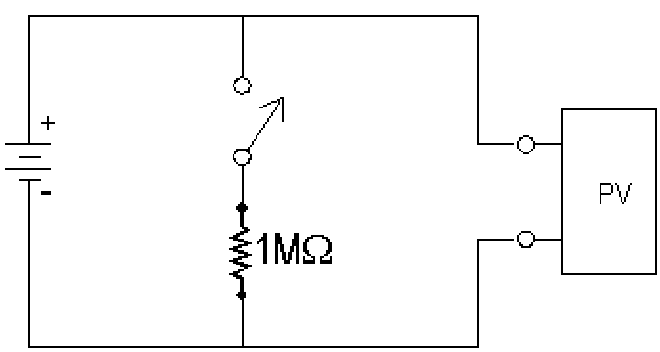
**Problem 1: [25%]**

Circuit models for a battery and a physical voltmeter are shown below:




A circuit is constructed as shown below:




When the switch is open (not connected) the physical voltmeter reads 8 volts. When the switch is closed (connected) the physical voltmeter reads 6 volts. Rind $R_B$ and $V_B$.

$R_B$ = ____________ohms
$V_B$ = ____________volts

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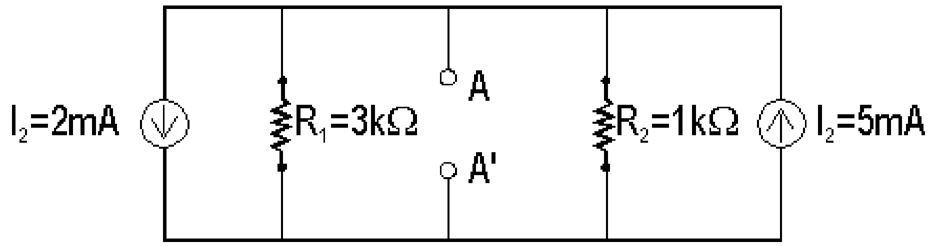
**Problem 2: [25%]**



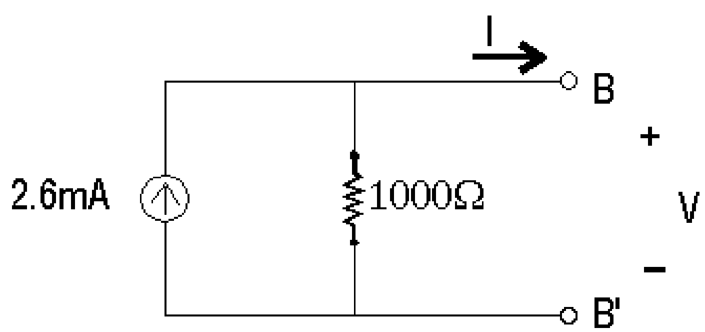

A two-terminal subcircuit is shown with terminals A and A'. Find its Th&#233 venin equivalent, making your method clear. (Label the terminals AA' in your equivalent circuit)

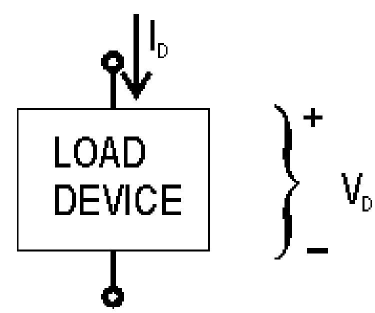
$R_{TH}$ = ____________ohms
$V_{TH}$ = ____________volts



**Problem 3: [25%]**

(a) Plot the I-V characteristic of the Norton equivalent circuit having terminals B-B' on the axes below:

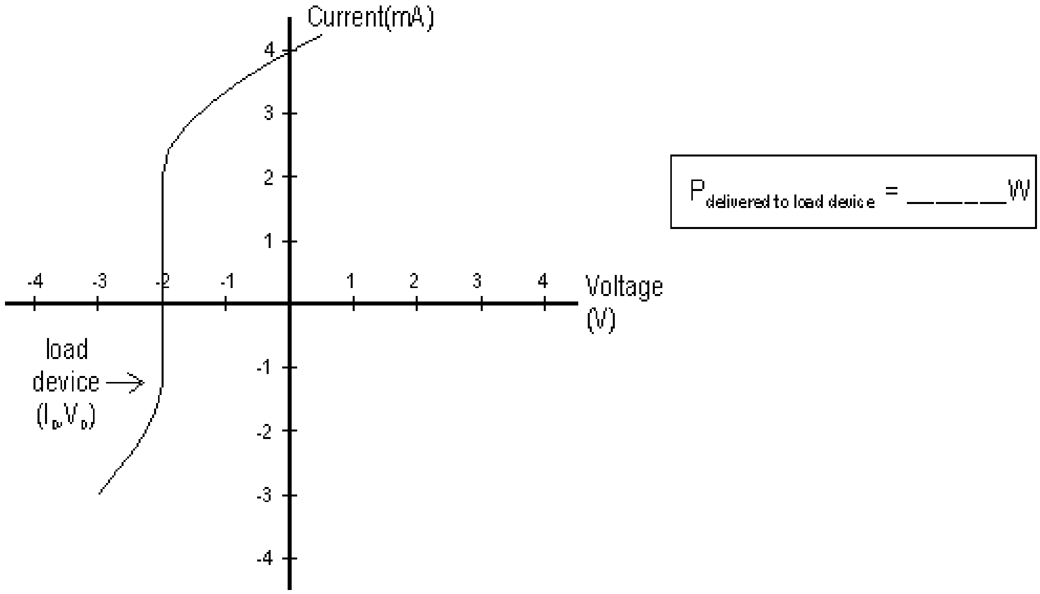



(b) The I-V characteristic of a load device is also plotted on these azes. If the load device is connected to terminals B-B',what current, ID, flows and what voltage, VD, appears across the load device?

$I_D$ = ____________mA
$V_D$ = ____________V

(c) Under the conditions of part (b), find the power delivered to the load device.

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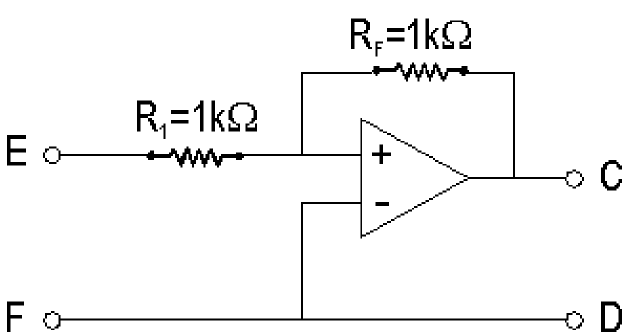
**Problem 4: [25%]**




In the above circuit the op-amp has an abnormally low voltage amplification; in fact, A=5. Its input resistance $R_i$=1MΩ and $R_O$=0. Output terminals C, D, are open-circuited.

(a) Re-draw the circuit with the full op-amp equivalent circuit inserted. (Do NOT use the ideal op-amp technique.)

(b) Find the input reisistance looking into terminals E, F. Use the full op-amp model. (Do NOT use the ideal op-amp technique.) Output terminals C, D are open-circuited.

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