Phys 132 - Fund Phys 2 - Homework 10
Monday, Feb 26, 2007

Name: Solutions

1. Two resistors, 42.0 and 64.0 Ohms, are connected in parallel to a voltage source. The current through the 64.0 Ohm resistor is 3.00 A. Determine the current in the other resistor.

A) 1.97 A
B) 3.00 A
C) 4.57 A
D) 7.57 A

$(3A)\frac{64}{42} = 4.57$

2. If a 9 V battery supplies 4.5 A when its terminals are short-circuited, what is the internal resistance of the battery?

A) 2 Ω
B) 0.5 Ω
C) 40.5 Ω
D) 18 Ω

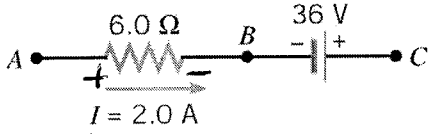
3. Chapter 20, Problem 68. A battery has an internal resistance of 0.012 Ω and an emf of 9.00 V. What is the maximum current that can be drawn from the battery without the terminal voltage dropping below 8.90 V? (Hint: Consider the internal resistance to be in series with an external resistance R. If V_R is 8.90 V, what is $V_{0.012}$? What current would cause that $V_{0.012}$?)

A) 750 A
B) 740 A
C) 250 A
D) 16 A
E) 8.3 A

$V_T = V_0 - IR_{int}$

$IR_{int} = V_0 - V_T = 0.1\,V \qquad I = \frac{0.1\,V}{0.012\,\Omega} = 8.3\,A$

A current of 2.0 A exists in the partial circuit shown in the drawing.



4. Chapter 20, Problem 74(a). What is the magnitude of the potential difference between the points A and B?

A) 12 V
B) 18 V
C) 48 V
D) 36 V
E) 24 V

$V = IR = (2.0A)(6.0\Omega) = 12\,V$

5. Chapter 20, Problem 74(b). What is the magnitude of the potential difference between points A and C?

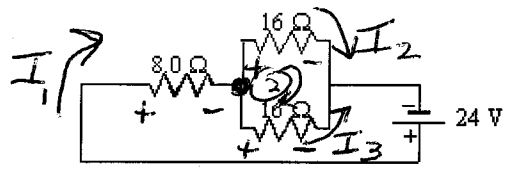
A) 12 V
B) 18 V
C) 48 V
D) 36 V
E) 24 V

From A→B: 12 V drop = −12 V

From B→C: 36 V rise = +36 V

Total From A→C = +24 V

6. Three resistors are connected in a circuit as shown. Using Kirchhoff's rules, determine the current in one of the 16-Ω resistors. **Show your work.**



A) 0.50 A
B) 0.75 A
C) 1.0 A
D) 1.3 A
E) 2.0 A

At the marked point:

$\Sigma I_{in} = \Sigma I_{out}$

$I_1 = I_2 + I_3$ (1)

Loop 1: Around the outside, clockwise, from the marked point:

$24 = 16 I_2 + 8 I_1$ (2)

Loop 2: Two 16Ω resistors, CW

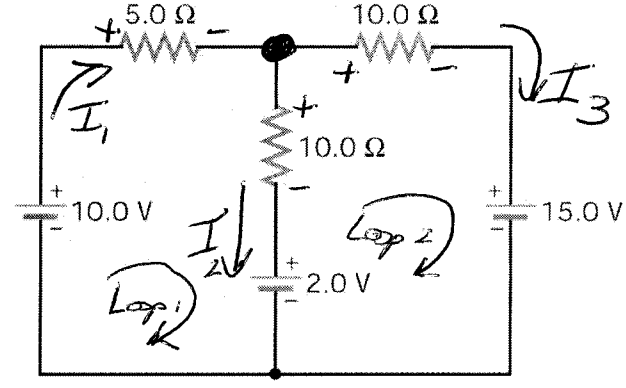
$16 I_3 = 16 I_2$ (3)

(3) $\rightarrow I_2 = I_3$ (1) $\rightarrow I_1 = 2 I_2$ (2) $\rightarrow 24 = 16 I_2 + 16 I_2 \rightarrow I_2 = 0.75\,A$

7. (8 points) Use Kirchoff's Laws to determine the voltage across the 5 ohm resistor. Which end of the resistor is at a higher potential?

Follow all of the steps in the Reasoning Strategy on page 599. Write each equation that comes from Kirchoff's Laws before solving.

Yes, the answer is given. To get credit, you have to write the three useful Kirchoff's Rules, then solve for the currents, then find V of the 5 ohm resistor.



A) 0.75 V, left side

Junction: $I_1 = I_2 + I_3$ (1)

Loop 1: $10 = 10 I_2 + 2 + 5 I_1$ (2)

Loop 2: $10 I_2 + 2 = 10 I_3 + 15$ (3)

Use (1) (2) $\rightarrow 10 = 10 I_2 + 2 + 5(I_2 + I_3) \rightarrow 8 = 15 I_2 + 5 I_3$ (4)

(3) $\rightarrow 10 I_2 = 10 I_3 + 13 \rightarrow I_2 = I_3 + 1.3$ (5)

Use (5) (4) $\rightarrow 8 = 15(I_3 + 1.3) + 5 I_3 \rightarrow -11.5 = 20 I_3 \rightarrow I_3 = -0.57\,A$

$I_2 = 0.725\,A$ $I_1 = 0.15\,A$ $V_{5\Omega} = IR = 0.15\,A \cdot 5\Omega = .75\,V$