Physics 4B
Fall 2022

ave. = 6.5
σ = 2.3

Name: Answer Key

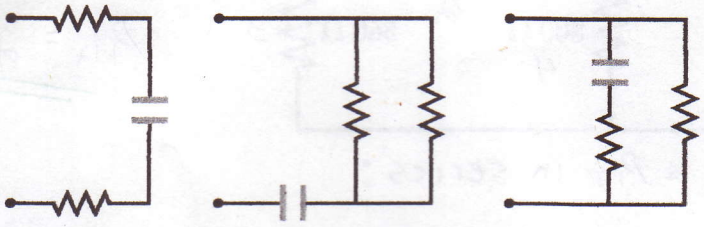
Lab (circle one): 8:00 am 11:15 am 2:30 pm

Quiz #6: Circuits

Problem 1 (1 point)
The figure below shows three sections of a circuit that are to be connected to a battery. The resistors are identical, as are the capacitors. Rank the sections according to the time required to reach 50% of its final charge, greatest first.

D

a) all tie
b) 1, 2 and 3 tie
c) 2 and 3 tie, 1
(d) 1, 3, 2
e) 2, 3, 1
f) none of the above



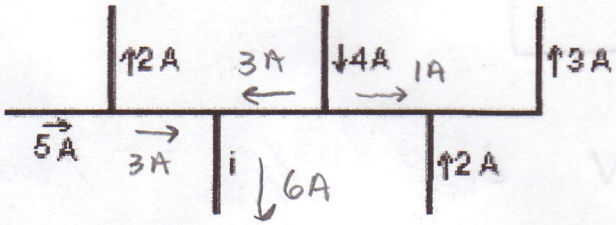
note: resistors are not in parallel

$\tau = (2R)C$ $\tau = (R/2)C$ $\tau = RC$

Problem 2 (1 point)
A portion of a circuit is shown, with the values of the currents given for some branches. What is the direction and value of the current *i*?

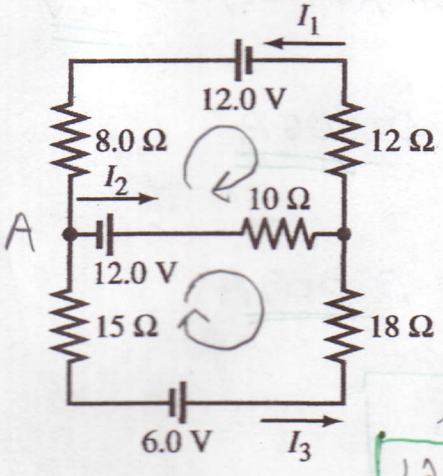
A

(a) ↓, 6A
b) ↑, 6A
c) ↓, 4A
d) ↑, 4A
e) ↓, 2A
f) none of the above



Problem 3 (3 points)
Use Kirchoff's rules to write three independent equations for the circuit shown below. (**Note**: you do not have to solve the equations.)

A



junction rule: $i_1 = i_2 + i_3$

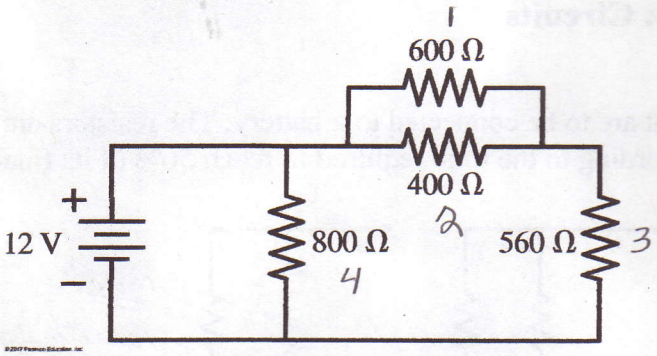
all loops start at A and go CW:

top loop:
$I_1(8.0\Omega) - 12.0V + I_1(12\Omega) + I_2(10\Omega) - 12V = 0$

bottom loop:
$12V - I_2(10\Omega) + I_3(18\Omega) - 6.0V + I_3(15\Omega) = 0$

outside loop:
$I_1(8.0\Omega) - 12.0V + I_1(12\Omega) + I_3(18\Omega) - 6.0V + I_3(15\Omega) = 0$

Problem 4 (5 points)
Find the current through and the potential difference across each of the four resistors shown in the figure below.



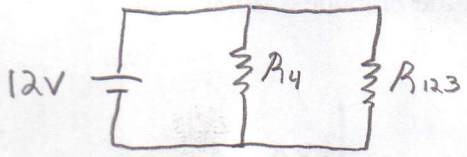
R_1 & R_2 in parallel:

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{600\Omega} + \frac{1}{400\Omega}$$

$$R_{12} = 240\Omega$$

R_{12} & R_3 in series:

$$R_{123} = R_{12} + R_3 = 240\Omega + 560\Omega = 800\Omega$$



$V_4 = 12V \quad i_4 = V_4/R_4 = 12V/800\Omega = 0.015A$

$V_{123} = 12V \quad i_{123} = V_{123}/R_{123} = 12V/800\Omega = 0.015A$

$i_3 = i_{123} = 0.015A \quad V_3 = i_3 R_3 = (0.015A)(560\Omega) = 8.4V$

$i_{12} = i_{123} = 0.015A \quad V_{12} = i_{12} R_{12} = (0.015A)(240\Omega) = 3.6V$

$V_1 = V_{12} = 3.6V \quad i_1 = V_1/R_1 = \frac{3.6V}{600\Omega} = 0.006A$

$V_2 = V_{12} = 3.6V \quad i_2 = V_2/R_2 = \frac{3.6V}{400\Omega} = 0.009A$

600Ω	V = 3.6V	i = 0.006A
400Ω	V = 3.6V	i = 0.009A
560Ω	V = 8.4V	i = 0.015A
800Ω	V = 12V	i = 0.015A