HW5 = KEY =

Welcome to the homework page test1. If this isn't you then please go back to the homework login page.

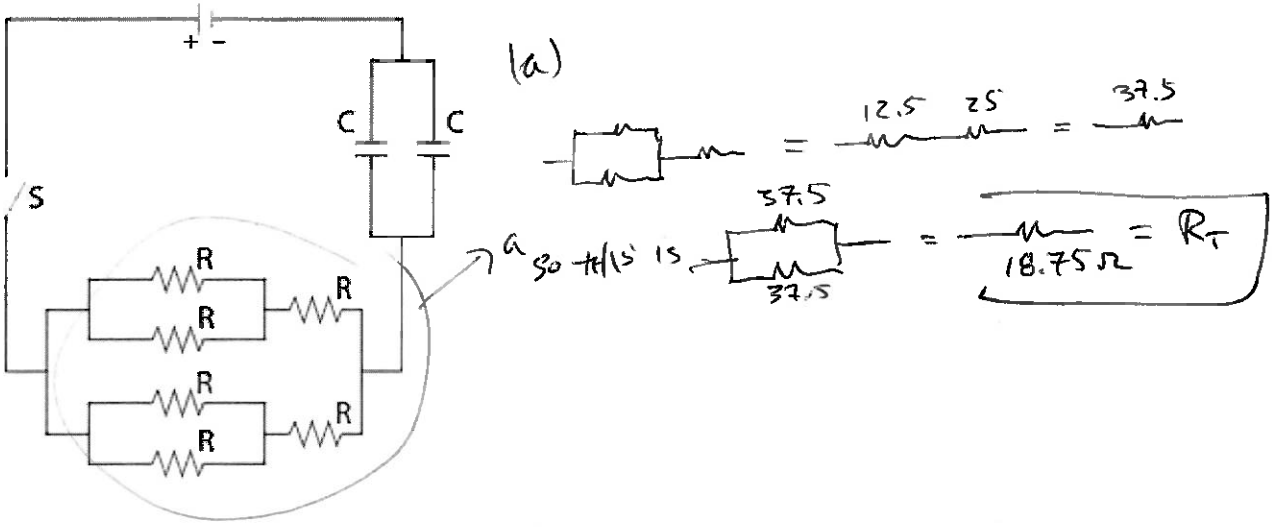
You may log out and return later if you wish without losing any saved data. You will have **TEN** attempts for each assigned problem. Every unsuccessful attempt will lower that part of the problem's value by 5%.

For example, if you get it right on the first try, then you will receive 100% for that problem. If you are twice incorrect and submit the correct on the third try, then you will receive a 90% for that part of the problem. You will not recieve any points for that part of the problem after 10 attempts.

You do not have to answer all the problems during a single session or in any particular order. To answer a problem simply type the numerical value in the box provided, check the box to the right of the part(s) you want to answer, and then click the submit button. You can freely log in and out of the homework page without losing any submitted information so feel free to take breaks if necessary.

LET'S BEGIN!

Problem #1



A circuit as shown is constructed from the resistance and capacitance values with R = 25.0Ω and C = 115μF where it is initially charged by a 11.0V battery. (a) compute the net resistance of all the resistors shown. (b) What is the time constant of the whole circuit?

(b) First find C_T: $C_T = 2C = 230\mu F$

(a) 18.75 Ω ✓ Answer part (a)

(b) 4.3 ms ✓ Answer part (b)

Submit

(D)(CON'T) THIS

$t = RC = 18.75 \times (230 \times 10^{-6})$

$= 0.0043$ SEC

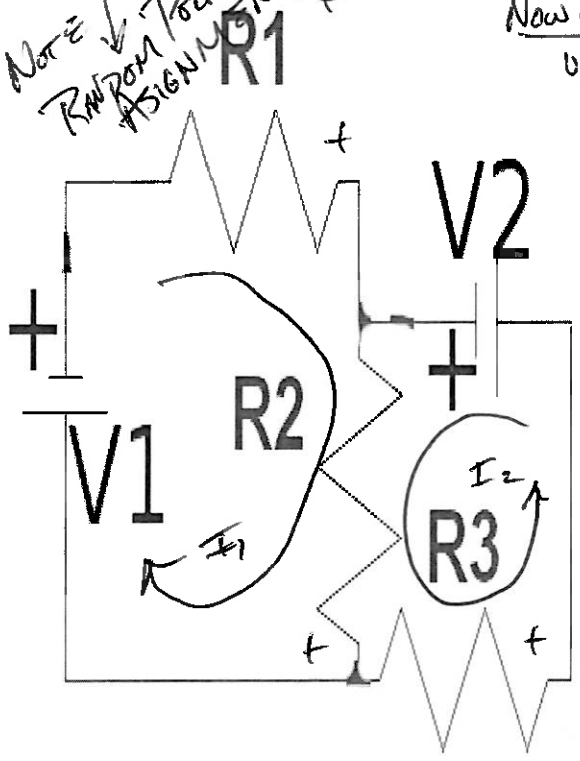
$\Rightarrow 4.3$ ms

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #2



NOTE: RANDOM POLARITY ASSIGNMENTS

LOOP (AWS. SO

LOOP 1: $-V_1 - V_{R1} - V_{R2} = 0$

LOOP 2: $-V_2 - V_{R2} - V_{R3} = 0$

NOW CHART THE VOLTS:

USING OHMS LAW CONVENTION

I → + V=IR

V_{R1}	$-R_1 I_1$
V_{R2}	$-R_2(I_1+I_2)$
V_{R3}	$-R_3 I_2$

NOW THAT CHART IS DONE & LOOPS ARE DONE SHUT OFF BRAIN & DO SLAVISH ALGEBRA!

$V_1 = R_1 I_1 + R_2(I_1+I_2) = (R_1+R_2)I_1 + R_2 I_2$

$V_2 = R_2(I_1+I_2) + R_3 I_2 = R_2 I_1 + (R_2+R_3) I_2$

PUT #S IN. $12 = 206\, I_1 + 75\, I_2$

$6 = 75\, I_1 + 105\, I_2$

$\begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \frac{1}{16005}\begin{bmatrix} 105 & -75 \\ -75 & 206 \end{bmatrix}\begin{pmatrix} 12 \\ 6 \end{pmatrix} = \begin{pmatrix} 0.0506 \\ 0.021 \end{pmatrix}$

SO $I_1 = 0.0506$ A

$I_2 = 0.021$ A

For V1 = 12 Volts and V2 = 6 Volts and given R1=131.0Ω , R2=75.0Ω and R3=30.0Ω , find the total power dissipated and the separate currents in the resistors.

(a) 50.6 mA to right in R1 ✓ Answer part (a)

(b) 71.6 mA down in R2 ✓ Answer part (b)

(c) 21 mA to right in R3 ✓ Answer part (c)

(d) 733 mW total power of circuit ✓ Answer part (d)

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(d) JUST SUM POWER DISSIPATED IN EACH RESISTOR

$P = \sum I^2 R = (.0506)^2 \cdot 131 + (.0716)^2 75 + (0.021)^2 30$

$= 0.3354 + 0.3845 + 0.0132 =$ 0.7331 WATTS

$I_1 + I_2 = 0.0716$

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

There have been no attempts to answer part (c)

There have been no attempts to answer part (d)

NOTE: CAN ALSO DO THIS LOOKING AT POWER PRODUCED BY BATTERIES

$P = \sum VI = V_1 I_1 + V_2 I_2$

$= 12(0.0506) + 6(.021) = 0.733$ WATTS

= SAME AS MUST BE THE CASE...

Problem #3

A BIT MESSY, BUT COMPLEXITY IS SKIN DEEP!!

LOOP 1: $20 - V_{40} - V_{100} = 0$

LOOP 2: $180 + 20 - V_{40} - V_{10} = 0$

LOOP 3: $40 + 180 - V_{35} - V_{10} = 0$

CHART THE VOLTAGES:

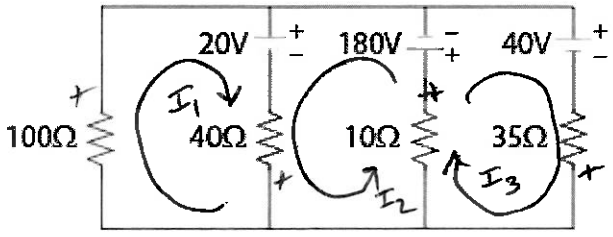
$V_{100} = -100 I_1$ $V_{40} = -40(I_1 + I_2)$ $V_{10} = -10(I_2 + I_3)$ $V_{35} = -35 I_3$

PLUG IN & TUNE BRAIN OUT! ALGEBRA TIME!!

$20 = -40(I_1 + I_2) - 100 I_1$ → $1 = -2(I_1 + I_2) - 5I_1$

$200 = -40(I_1 + I_2) - 10(I_2 + I_3)$ ⇒ $1 = -7I_1 - 2I_2$

$220 = -35 I_3 - 10(I_2 + I_3)$ → $22 = -3.5 I_3 - I_2$



Determine (a) the current in the 10.0Ω resistor and (b) the unsigned difference in potential across the 100Ω resistor.

$I_2 + I_3$

THUS $I_1 = -\frac{1}{7} - \frac{2}{7} I_2$

$I_3 = -4.89 - 0.222 I_2$

PLUG THAT INTO MIDDLE EQN (LOOP 2) ⇒

$20 = -5I_2 - 4(-\frac{1}{7} - \frac{2}{7} I_2) + 4.89 + 0.222 I_2$

(a) 8 A ✓ Answer part (a)

(b) 100 V ✓ Answer part (b)

Submit

⇒ $20 - 5.46 = (-5 + \frac{8}{7} + 0.222) I_2$ ⇒ $I_2 = -4$ AMPS

$I_1 = \frac{-1}{7} + \frac{8}{7} = 1$ AMP

$I_3 \approx -4$ AMPS

b) $V_{100} = 100 \cdot I_1 = 100$ V

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

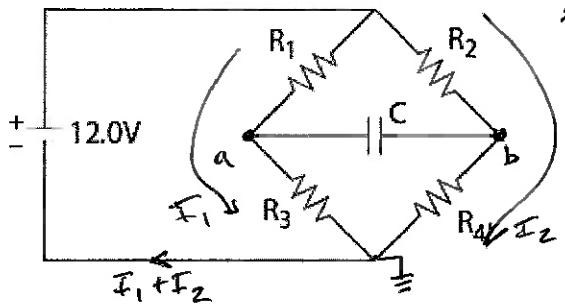
Problem #4

a) FINAL VOLTAGE SO THAT NO I FLOWS INTO C ⇒ LIKE C DISCONNECTED ⇒ LIKE $V_b - V_a$ W/ CAP REMOVED

SO NOTE IN THAT CASE $I_1 = \frac{12}{R_1+R_3} = 3\text{AMPS}$ $I_2 = \frac{12}{R_2+R_4} = 1.333\text{ AMPS}$

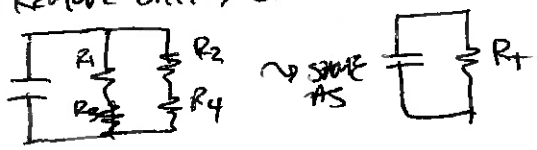
$\Rightarrow V_a = I_1 R_3 = 9\text{V}$ $V_b = I_2 R_4 = 2.667\text{ VOLTS}$

$V_{CAP} = V_a - V_b = 6.33\text{ V}$



For this problem take the battery to be 12.0V , R_1 = 1.00Ω, R_2 = 7.00Ω, R_3 = 3.00Ω, R_4 = 2.00Ω, and C = 5.00μF. (a) determine the final voltage of the capacitor (b) Suppose the battery is disconnected. How long would it take for the capacitor discharge to 2.4V?

b) REMOVE BATT ⇒ CIRCUIT LOOKS LIKE



(a) 6.33 V ✓ Answer part (a)

(b) 13.4 μs ✓ Answer part (b)

W/ $R_T = 2.77\Omega \Rightarrow$

$RC = (6\times10^{-6})(2.77)$

$RC = 1.385\times10^{-5}$

THEN DISCHARGE EQN:

$V = V_0 e^{-t/RC}$

$2.4 = 6.33\, e^{-t/1.38\times10^{-5}}$

$\Rightarrow t = 1.34\times10^{-5}\text{ SEC}$

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #5

$RC = 0.24$ sec

Given R = 24.0kΩ and C = 10.0μF. The capacitor is intially charged. The switch is closed. Compute the amount of time it takes the capacitor to only have 50% of its original charge? ⇒ 50% OF ORIGINAL VOLTAGE V_0

$V(t) = V_0 e^{-t/RC}$

$\frac{V(t)}{V_0} = \frac{1}{2} = e^{-t/RC} = e^{-t/0.24}$

$\Rightarrow t = 0.1664$ sec

166.4 ms ✓ Answer the question

Submit

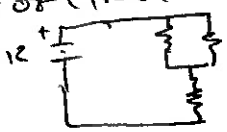
Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #6

a) 12V ACROSS $R_1 \Rightarrow I_1 = \frac{V}{R_1} = 12/6 = 2$ AMPS

d) REST OF CIRCUIT

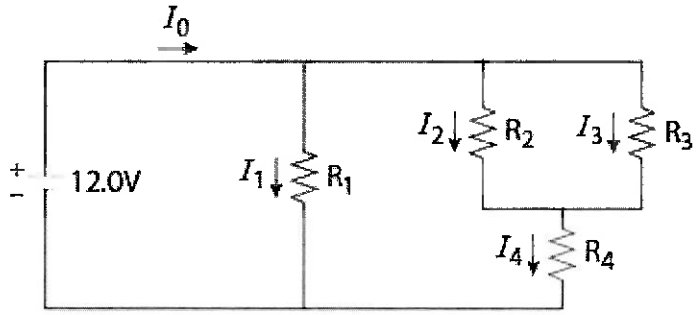


$R_T = 3.43\Omega$

$\Rightarrow I_{R_T} = \frac{12}{3.43} =$

$I_{R_T} = 3.5$ AMPS

$= I_4$!



Given resistance values of R_1 = 6.00Ω, R_2 = 5.00Ω, R_3 = 2.00Ω, and R_4 = 2.00Ω, compute (a) I_1, (b) I_2, (c) I_3, and (d) I_4.

b) SO IF $I_4 = 3.5$ WE CAN COMPUTE

$V_{R4} = I_4(2) = 7$ VOLTS

$\Rightarrow 12 - 7 = 5$ VOLTS ACROSS R_2 & R_3

(a) 2 A ✓ Answer part (a)

(b) 1 A ✓ Answer part (b) SO $I_2 = \frac{V_{R_2}}{R_2} = \frac{5}{5} = 1$

(c) 2.5 A ✓ Answer part (c) c) $I_3 = \frac{V_{R_2}}{R_3} = \frac{V_{R_3}}{R_3} = \frac{5}{2}$

(d) 3.5 A ✓ Answer part (d)

Submit

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

There have been no attempts to answer part (c)

There have been no attempts to answer part (d)

Problem #7

$V_C = 12(1 - e^{-t/RC})$

$V_C(1.15\times10^{-3}) = 5$

$\Rightarrow 5 = 12(1 - e^{\frac{-1.15\times10^{-3}}{RC}})$

$\Rightarrow e^{\frac{-1.15\times10^{-3}}{RC}} = 1 - 5/12$

A intially uncharged capacitor (10.0μF) is connected to a 12.0V battery. The wires have some resistance. If capacitor voltage is 5.00V after a time 1.15ms after being connected to the battery, compute the value of the resistance.

213 Ω ✓ Answer the question

$\Rightarrow -\frac{1.15\times10^{-3}}{RC} = \ln(1 - 5/12) = -0.54$

$\Rightarrow RC = 0.0021$ $\quad C = 10\times10^{-6}$

$\Rightarrow R = 213.3\,\Omega$

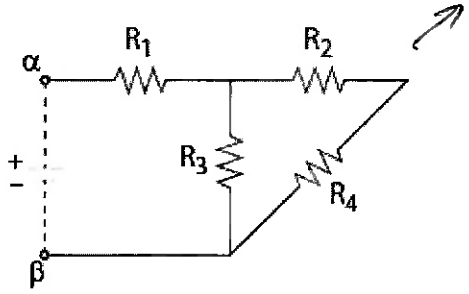
Submit

Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #8

$2.6\,\Omega$ ‖ $R_2 + R_4 = 8.5\,\Omega$ ~ $2.3\,\Omega$ + $1.99\,\Omega$ = $4.3\,\Omega$



(a) Determine the total resistance between the points α and β with $R_1 = 2.30\Omega$, $R_2 = 5.10\Omega$, $R_3 = 2.60\Omega$, and $R_4 = 3.40\Omega$. (b) If a 11.0V battery connected at those points α and β as shownn, then compute the magnitude of net current.

(a) 4.3 Ω ✓ Answer part (a)

(b) 2.56 A ✓ Answer part (b) $\quad \frac{V}{R_{tot}} = \frac{11}{4.3} = 2.56\,\text{Amps}$