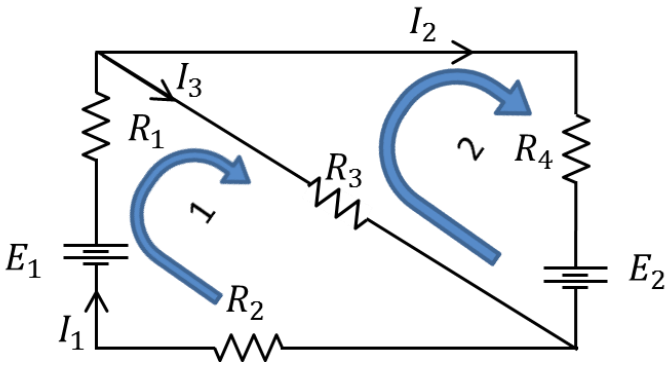
Name: _____ DISC: _____ Score: _____ / 20

Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

Q1	Q2	Q3	Q4
5	5	10	5

1. Consider the resistor network:



SERIES	$R_{eq} = R_1 + R_2$
PARALLEL	$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$
OHM'S LAW	$V = I\,R$
CONTINUITY OF CURRENT AT A JUNCTION	$I_3 = I_1 + I_2$

Useful Information

a. The table contains the values for the resistors and batteries. Now let's use this information to find the current I_1:

R_1	R_2	R_3	R_4	E_1	E_2
15 Ω	15 Ω	5 Ω	5 Ω	35 V	15 V

Loop 1 (1 pts):
Loop 2 (1 pts):
I_1 (3 pts):

i. Write the loop rule for loop 1:

ii. Write the loop rule for loop 2:

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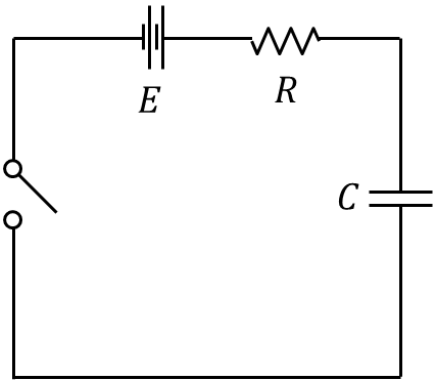
iii. Using your loop rules above, solve for I_1:

(Use the attached scratch paper, but put you answer in the box above.)

2. A simple RC circuit is shown below:



TIME CONSTANT	$\tau = RC$
R	$3\ \Omega$
C	$2\ \mu F$
E	$7\ V$
CAPACITANCE	$C = Q/V$
$Q(t) = Q_0\left(1 - e^{-\frac{t}{\tau}}\right)$	$Q(t) = Q_0\left(e^{-\frac{t}{\tau}}\right)$

Useful Information

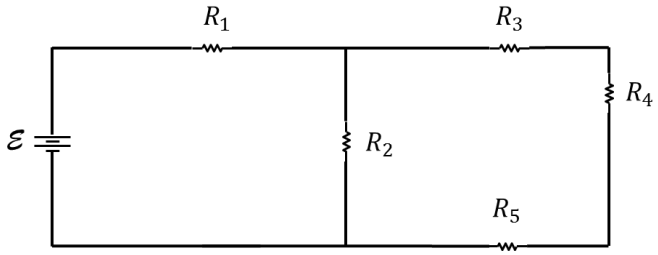
a. Initially the switch is open and the capacitor is uncharged. After the switch is closed, the capacitor starts charging. Sketch the current through the circuit as a function of time. Don't forget to correctly label your sketch.

Labels (1 pt):
Form (1 pt):

b. After the capacitor is fully charged, what is the maximum charge Q the capacitor will achieve?

Set-up (1 pt):
Algebra (1 pt):
Charge (1 pt):

3. Consider the resistor network:



SERIES	$R_{eq} = R_1 + R_2$
PARALLEL	$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$
OHM'S LAW	$V = I\,R$
CONTINUITY OF CURRENT AT A JUNCTION	$I_3 = I_1 + I_2$

Useful Information

a. Let all resistors have resistance $R = 3\,\Omega$ and $\varepsilon = 4\,V$. Find the effective resistances requested and calculate the current flowing through each:

Table (6 pts):

STEP	ACTION	RESULT	CURRENT
1	EFFECTIVE RESISTANCE $\mathrm{R}_{345} = R_{eq1}$:		
2	EFFECTIVE RESISTANCE $R_{2345} = R_{eq2}$:		
3	EFFECTIVE RESISTANCE $R_{12345} = R_{eq3}$:		

b. For each step in the above table, draw the effective circuit:

Step 1:

Step 2:

Step 3:

Step 1 (2 pts):
Step 2 (1 pts):
Step 3 (1 pts):

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