Physics 158 Written Homework 1
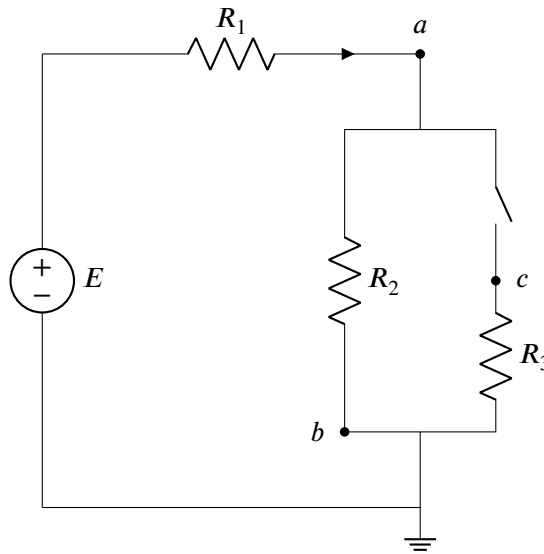
Problem 1

Difficulty: ★☆☆
If the switch is open,

    a) Find all currents and potentials at the labelled points.

If the switch is then closed,

    b) Find all currents and potentials at the labelled points.
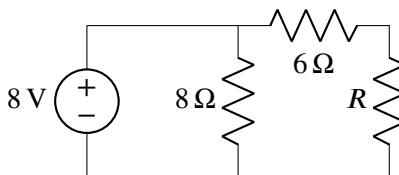
$E = 12\,\text{V}, R_1 = 7\,\Omega, R_2 = 4\,\Omega, R_3 = 10\,\Omega$
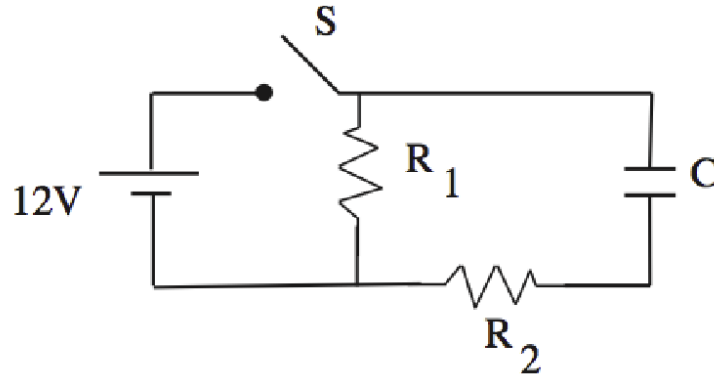

Problem 2

Difficulty: ★☆☆
If the total power dissipated in the circuit is 15W, what is the value of R?

Problem 3

Difficulty: ★★☆

The circuit below has the switch S is opened for a long time. $R_1 = 2\,\Omega$, $R_2 = 4\,\Omega$, $C = 2\,F$


a) The switch S is now closed. Find all currents just after the switch is closed.

b) Find all currents after the switch has been closed for a very long time.

c) After the switch was closed for a very long time it is opened again find the current through R_2 as a function of time.

Problem 4

Difficulty: ★★☆

Using their newfound knowledge of LR circuits, a Phys 158 student came up with a clever idea for a prank. They want to design an alarm clock that will continue to ring for 10 seconds after the battery is removed. The alarm clock can be thought of as a $1\,k\Omega$ resistor which requires at least 1 Watt to operate. They designed the following circuit to achieve this.
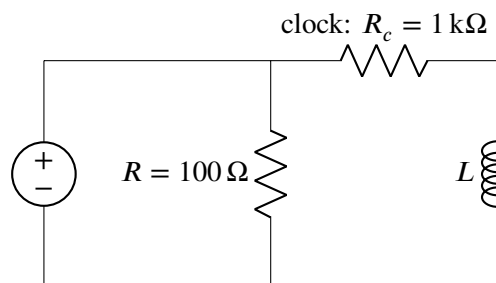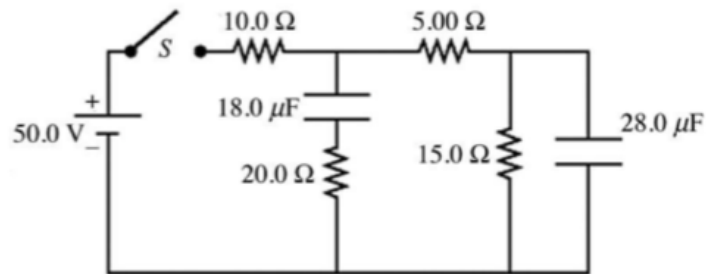

a) What value should the battery be such that the power supplied to the alarm clock does not exceed 3 Watts?

b) What value of inductor should they use so that the alarm clock remains on for 10 seconds after the battery is disconnected?

Problem 5

Difficulty: ★★☆

The circuit shown below initially has no charge on the capacitors and the switch S is originally open.

a) Just after closing the switch S, find all the currents.

b) After the switch has been closed for a very long time, find all the currents.

c) After the switch S has been closed for a very long time, find the potential difference across the 28.0 μF capacitor.

Problem 6

Difficulty: ★★☆

The circuit below has been open for a very long time and then the switch is closed at $t = 0$.
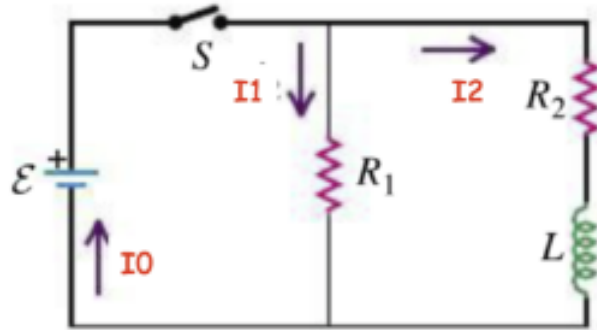
a) Find all of the currents at $t = 0^+$.

b) Find all of the currents after a very long time.

c) Find all of the currents as a function of time