

# Physics 158 Written Homework 1

## Problem 1

Difficulty: ★☆☆

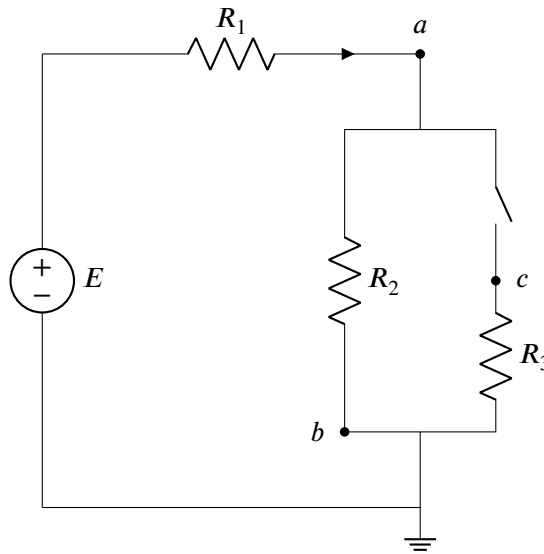
If the switch is open,

- 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.

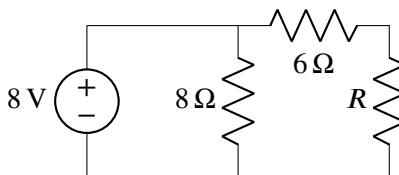
$$E = 12 \text{ V}, R_1 = 7 \Omega, R_2 = 4 \Omega, R_3 = 10 \Omega$$



## Problem 2

Difficulty: ★☆☆

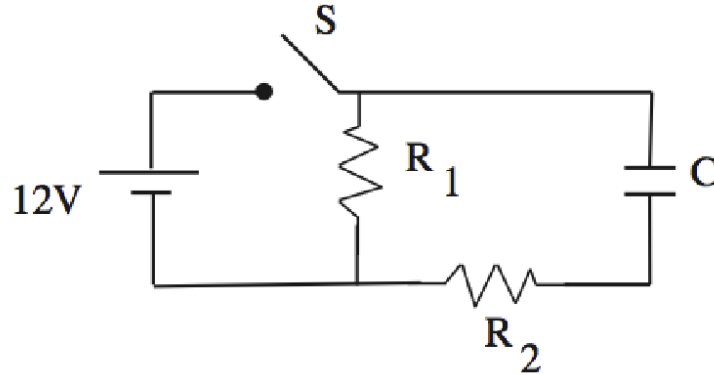
If the total power dissipated in the circuit is 15W, what is the value of  $R$ ?



### Problem 3

Difficulty: ★★☆☆

In the circuit shown below the switch has been open for a long time and there is no charge on the capacitor. Take  $R_1 = 2\ \Omega$ ,  $R_2 = 4\ \Omega$ ,  $C = 2\ \text{F}$ .

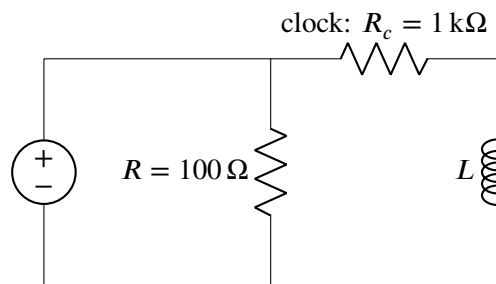


- The switch  $S$  is now closed. Find all currents just after the switch is closed.
- Find all currents after the switch has been closed for a very long time.
- After the switch has been closed for a very long time it is reopened. Calculate the current through  $R_2$  as a function of time.

### 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  $1\ \text{k}\Omega$  resistor which requires at least 1 Watt to operate. They designed the following circuit to achieve this.

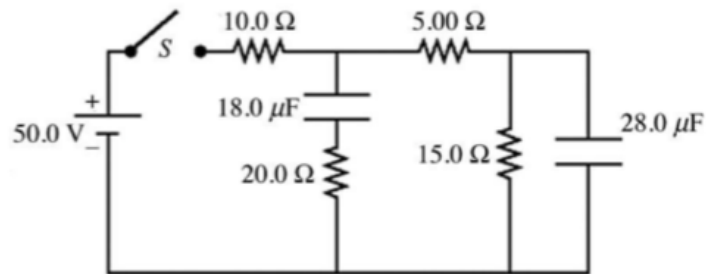


- What value should the battery be such that the power supplied to the alarm clock does not exceed 3 Watts?
- What value of inductor should they use so that the alarm clock remains on for 10 seconds after the battery is disconnected?

## Problem 5

Difficulty: ★★☆☆

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

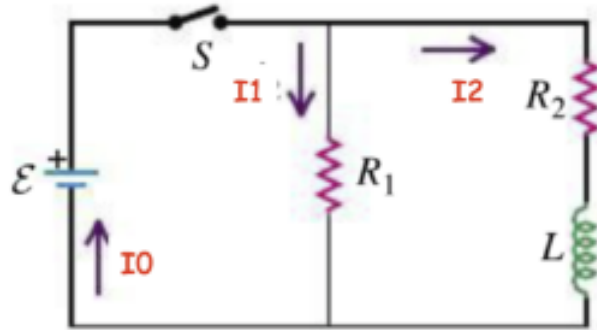


- Just after closing the switch  $S$ , find all the currents.
- After the switch has been closed for a very long time, find all the currents.
- After the switch  $S$  has been closed for a very long time, find the potential difference across the  $28.0 \mu\text{F}$  capacitor.

## Problem 6

Difficulty: ★★☆☆

The circuit below has been open for a very long time and then the switch is closed at  $t = 0$ .



- Find all of the currents at  $t = 0^+$ .
- Find all of the currents after a very long time.
- Find all of the currents as a function of time