Week 11, Session 2 Problems

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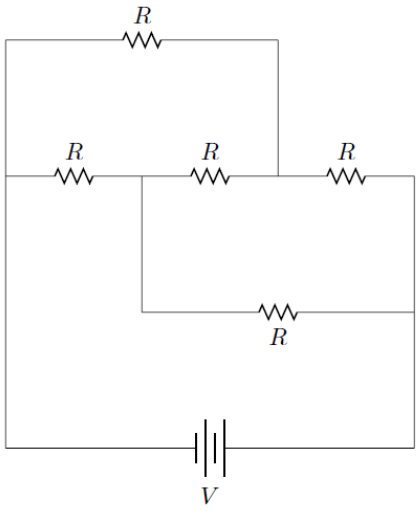
11/1

1 Circuits

1.1 Equivalent Resistance

Find the equivalent resistance of this circuit. Note that it cannot be decomposed into series and parallel.



(*Source: Dan and Vetri*)

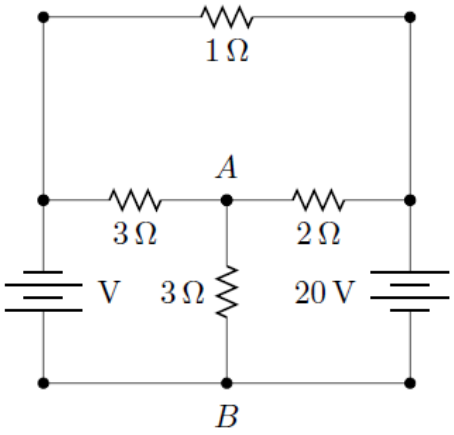
1.2 Kirchhoff Practice

Consider the circuit shown. Suppose the current form A to B is 3 A.

(a) Find the current through each resistor.

(b) Find the voltage V of the battery on the left.

(c) Find the power generated by each battery.



(*Source: http://physics.info/kirchhoff/practice.shtml*)

1.3 Capacitors in a Circuit

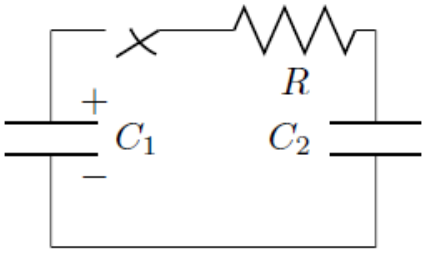
Consider the circuit shown below that contains capacitors C_1 and C_2 and resistor R. Initially the switch is open and the capacitor C_1 has charge Q_0. The switch is closed at $t = 0$.

(a) What is the initial current that flows through the resistor right after the switch is closed?

(b) After a very long time, what are the charges Q_1 and Q_2 on C_1 and C_2 respectively?

(c) What is the charge $Q_2(t)$ on C_2 as a function of time?

(d) How will $Q_2(t)$ be modified if a dielectric of constant ϵ is inserted in between the plates of capacitor C_2?



(*Source: Lanzara Fall 2013 Midterm 2*)

1.4

Consider a circuit where a battery leads into a resistor r, which then splits into parallel resistors r and R. If you wanted the power through the resistor R to stay constant even if the resistance R varies slightly, then what value of resistance r should you use for the two other resistors in the circuit?