Physics 24 Problem Set 2

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due Monday, January 23

Please make your work neat, clear, and easy to follow. It is hard to grade sloppy work accurately. Generally, make a clear diagram, and label quantities. Derive symbolic answers, and then plug in numbers after a symbolic answer is available.

1. Purcell 4.15

2. Purcell 4.20
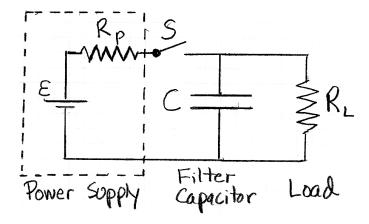
3. Purcell 4.21

4. Purcell 4.25

5. Purcell 4.32

Figure 1: For use in Problem 6.

6. The circuit in Fig. 1 is meant to represent the power supply in an electric device connected to a filter capacitor C and a load in the device of resistance R_L. The load might be your computer or television. For the following, it is a good idea to reason out the conditions for $t = 0$ and as $t \to \infty$ prior to solving a differential equation; then adapt your solution to the differential equation to satisfty the initial and final solutions.

    (a) First, imagine that for times $t < 0$ the switch S is open, there is no charge on the capacitor, and the load is drawing no current. At time $t = 0$ the switch is closed; find the voltage across the capacitor C and the current through the load R_L as a function of time for $t \geq 0$.

    (b) Second, imagine that for times $t < 0$ the switch S is closed, and there is voltage across the capacitor C and the load R_L is drawing current. At time $t = 0$ the switch is opened; find the voltage across the capacitor C and the current through the load R_L as a function of time for $t \geq 0$.