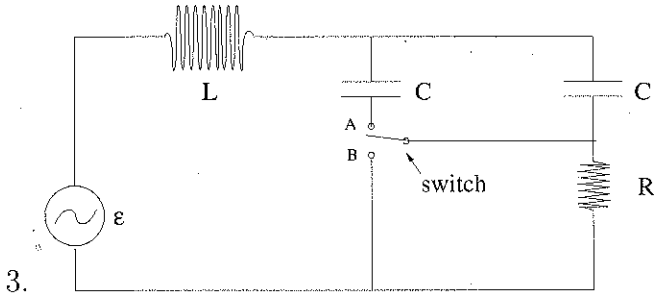

Figure 1: An AC circuit.

Complex Impedances

(a) Consider the circuit above. The switch can be set in any of three positions, A, B or open (unconnected). The source supplies a voltage $\varepsilon(\omega) = \varepsilon_0 e^{i\omega t}$.

When the switch is connected to A, find the frequency ω that maximizes the current through the resistor R. (5 pts)

(b) If we then flip the switch to the B position, what is the average power dissipation in the circuit (ignoring transient effects).

C) We now open the switch to the middle position. Find the value of the resistor R that will drop the amplitude of the current to 1/2 the value you found in part a), at the same frequency ω you found in part a). (5 pts)

(D) Suppose that the inductor, of inductance L, is constructed from a solenoid with N turns over a length ℓ, whose axis of symmetry lies on the $\hat{x}$ axis.

Express the cross sectional area of the solenoid in terms of the inductance L, the number of turns N, the length ℓ and any fundamental constants.