This print-out should have 13 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

Please notice that for your homework to be considered towards your grade, it needs to be submitted one hour before the corresponding recitation starts. Work submitted after this time, but before the DUE DATE on top of this page, will be accepted but not graded.

PLEASE REMEMBER THAT YOU MUST CARRY OUT YOUR CALCULATIONS TO AT LEAST THREE SIGNIFICANT FIGURES. YOUR ANSWER MUST BE WITHIN ONE PERCENT OF THE CORRECT RESULT TO BE MARKED AS CORRECT BY THE SERVER.

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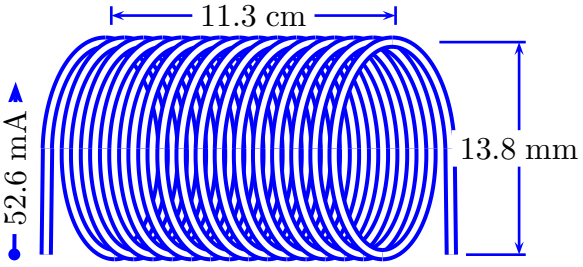
001 (part 1 of 3) 4 points

A 52.6 mA current is carried by a uniformly wound air-core solenoid with 656 turns as shown in the figure below.

The permeability of free space is 1.25664×10^{-6} N/A^2.



Compute the magnetic field inside the solenoid. Answer in units of T.

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002 (part 2 of 3) 4 points

Compute the magnetic flux through each turn. Answer in units of Wb.

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003 (part 3 of 3) 3 points

Compute the inductance of the solenoid. Answer in units of mH.

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004 (part 1 of 2) 4 points

A solenoid has 110 turns of wire uniformly wrapped around an air-filled core, which has a diameter of 9 mm and a length of 13.5 cm.

The permeability of free space is 1.25664×10^{-6} N/A^2.

Calculate the self-inductance of the solenoid. Answer in units of H.

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005 (part 2 of 2) 4 points

The core is replaced with a soft iron rod that has the same dimensions, but a magnetic permeability of $800\,\mu_0$.

What is the new inductance? Answer in units of H.

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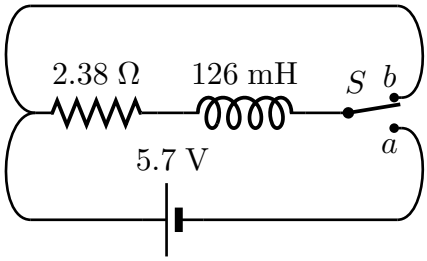
006 (part 1 of 3) 4 points

An inductor and a resistor are connected with a double pole switch to a battery as shown in the figure.

The switch has been in position b for a long period of time.



If the switch is thrown from position b to position a (connecting the battery), how much time elapses before the current reaches 113 mA? Answer in units of ms.

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007 (part 2 of 3) 4 points

What is the maximum current in the inductor a long time after the switch is in position a? Answer in units of A.

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008 (part 3 of 3) 3 points

The switch has brushes within it so that the switch can be thrown from a to b without internal sparking. Now the switch is smoothly thrown from a to b, shorting the inductor and resistor.

How much time elapses before the current falls to 154 mA? Answer in units of ms.

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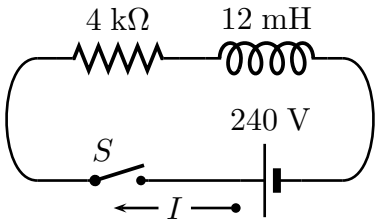
009 (part 1 of 1) 4 points

At times prior to $t = 0$, the switch is open.

The switch is closed at $t = 0$.



When $I = 22$ mA, what is the potential difference across the inductor? Answer in units of V.

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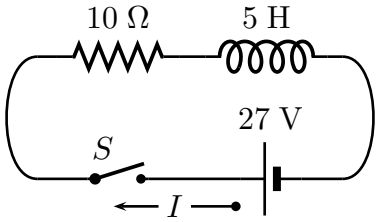
010 (part 1 of 4) 4 points

The switch in the circuit shown is closed at time $t = 0$.



At what rate is energy being dissipated as Joule heat in the resistor after an elapsed time equal to the time constant of the circuit? Answer in units of W.

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011 (part 2 of 4) 4 points

Calculate the rate at which energy is being stored in the inductor at this time. Answer in units of W.

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012 (part 3 of 4) 4 points

What is the total energy stored in the inductor at this time? Answer in units of J.

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013 (part 4 of 4) 4 points

How long a time does it take the current to reach 79 percent of its maximum value? Answer in units of s.