**Please write step by step solutions.**

**Not just the answers only.**

**Question 1**

A toroid of mean radius **24** cm and circular cross section of radius **2.5** cm is wound with a superconducting wire of length 1000 m that carries a current of **360** A.

(a) What is the number of turns on the coil?



(b) What is the magnetic field at the mean radius?

T 

(c) Assuming that *B* is constant over the area of the coil, calculate the magnetic energy density *u*m and the total energy *U*m stored in the toroid.  
*u*m =

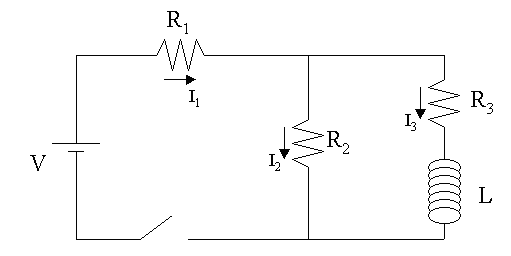
J/m3 

*U*m =

kJ 

**Question 2**

Three resistors (*R1* = 120 Ohms, *R2* = 330 Ohms, and *R3* = 240 Ohms) and an ideal inductor (*L* = 1.6 mH) are connected to a battery (*V* = 9 V) through a switch as shown in the figure below.

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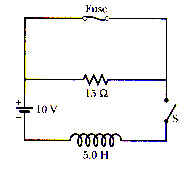
The switch has been open for a long time before it is closed at t = 0. At what

time *t0*, does the current through the inductor (*I3*) reach a value that is 63% of

its maximum value?

*t0* = s 

**Question 3**



**Figure 31-93**

In Fig. 31-93, the component in the upper branch is an ideal 2.8 **A** fuse. It has zero resistance as long as the current through it remains less than 2.8 **A**. If the current reaches 2.8 **A** it 'blows' and thereafter has infinite resistance. Switch S is closed at time t = 0 . Use the numerical values : E=14 **V**, L=5.1 **H**.

When does the fuse blow ?

s 

**Question 4**

If the current through an inductor were doubled, the energy stored in the inductor would be

1. quadrupled.
2. quartered.
3. doubled.
4. the same.
5. halved.



**Question 5**

The current in a coil with a self-inductance of 1 mH is **2.3** A at *t* = 0, when the coil is shorted through a resistor. The total resistance of the coil plus the resistor is **15.0** capital omega.

(a) Find the current after 0.5 ms.

A 

(b) Find the current after 10 ms.

A 

**Question 6**

The current in an *RL* circuit is zero at time *t* = 0 and increases to half its final value in **3.8** s.

(a) What is the time constant of this circuit?

s 

(b) If the total resistance is **8** capital omega, what is the self-inductance?

H 

**Question 7**

A solenoid of **1900** turns, area **11** cm2, and length **30** cm carries a current of **4.0** A.

(a) Calculate the magnetic energy stored in the solenoid from 1/2 *LI* 2.

J 

(b) Divide your answer in part (a) by the volume of the solenoid to find the magnetic energy per unit volume in the solenoid.

J/m3 

(c) Find *B* in the solenoid.

T 

(d) Compute the magnetic energy density from *u*m = *B*2/2mu or micro0.

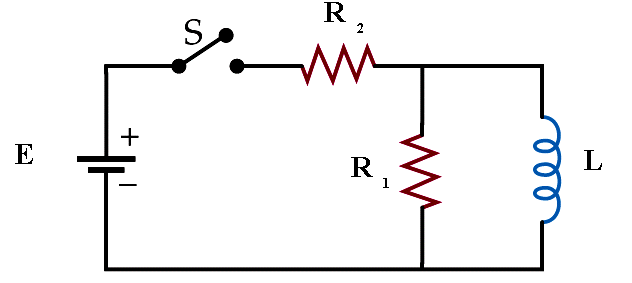
J/m3 

Compare your answer with your result for part (b).

1. smaller than (b)
2. same as (b)
3. greater than (b)



**Question 8**



Given the circuit shown in the figure, assume that the switch S has been closed for a long time so that steady currents exist in the inductor, and that the inductor has negligible resistance. Assume L=**3 H**, the larger resistance R1=**99 capital omega**, the smaller resistance R2=**15 capital omega**and the emf large epsilon=**10 V**.   
Find the battery current.

A 

The current in the larger resistor

A 

The current in the inductor.

A 