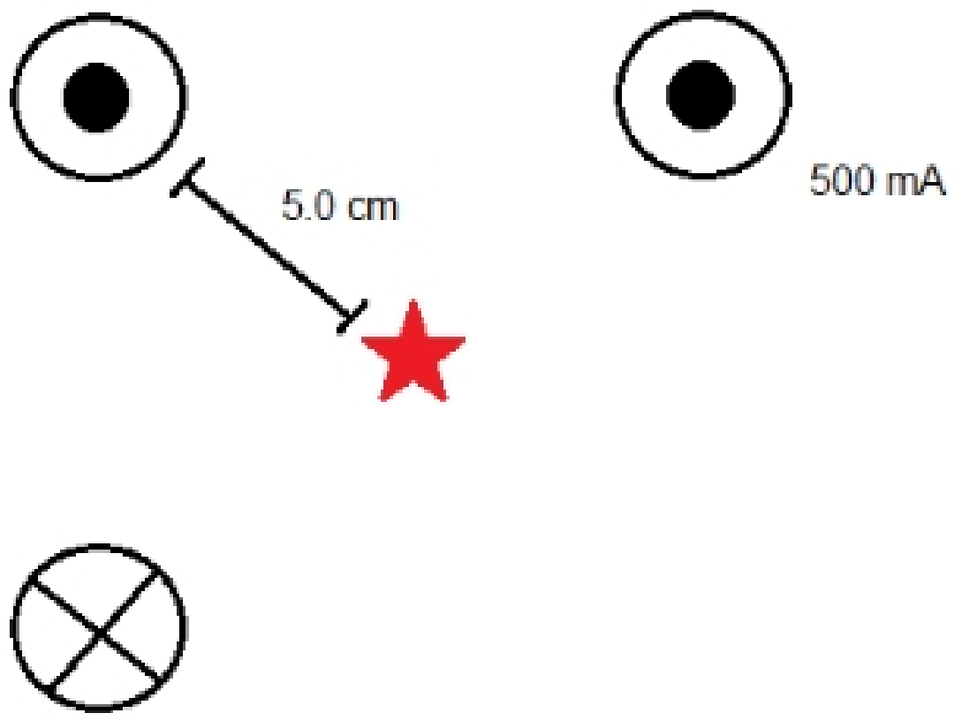
PHYSICS 235 Exam 2 Review Problems

Topics 9 and 10

(1) This Question corresponds to the below picture. What is magnetic field amplitude and direction at the point marked by the star? Each wire carries and current of 500 mA and is a distance of 5.0 cm from the point.



(2) How strong of a magnetic field would be needed to make a proton travel in a circle of 0.1 m radius if that proton is traveling at 10^4 m/s perpendicular to the magnetic field? What if it was an alpha particle (two protons and two neutrons) instead of just a proton?

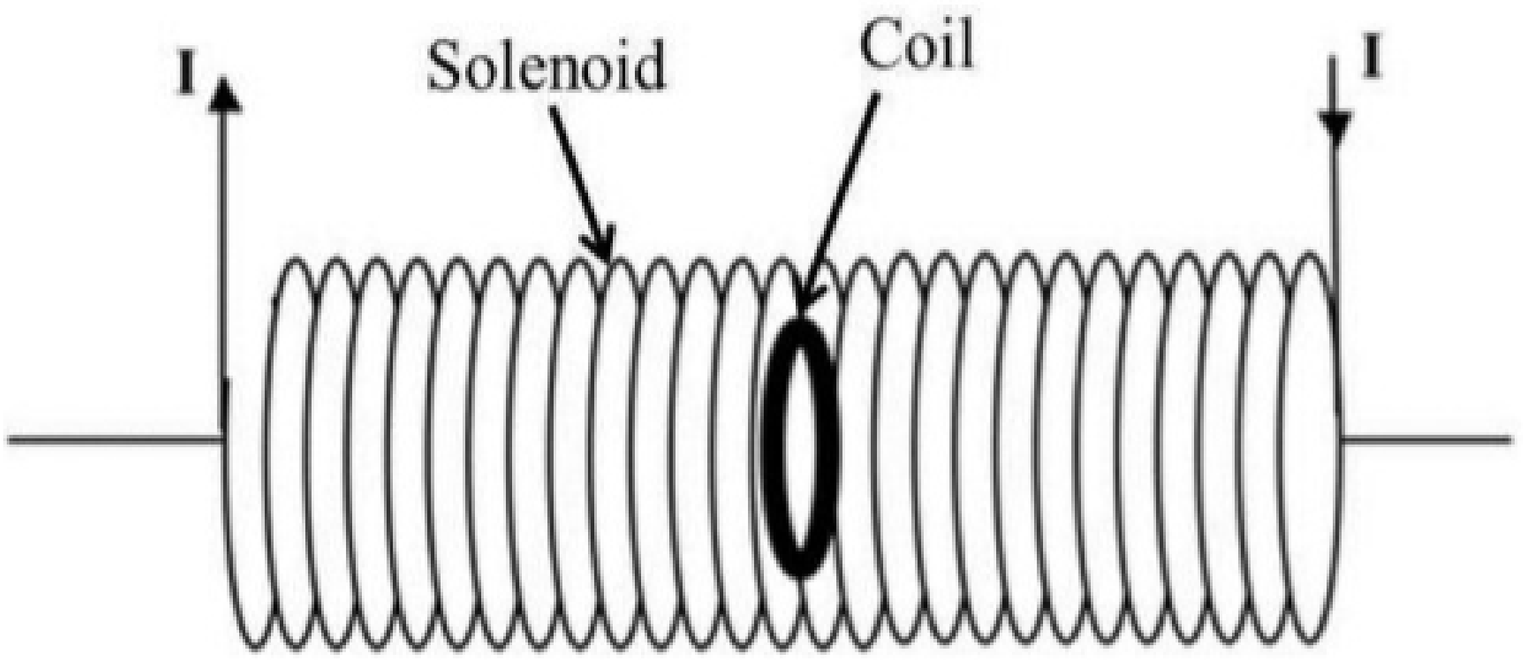
Topics 11 and 12

(3) The ^{14}N nuclei in a sample of tissue are relaxed to equilibrium in an external magnetic field $\vec{B} = 1.0\,\mathrm{T}\ \hat{\mathbf{z}}$. An additional field is then applied in the x direction so that the new field quickly becomes $\vec{B}_{new} = (2.0\mathrm{T})\hat{z} + B_x\hat{x}$. For what value of B_x will the angular frequency of oscillation of the ^{14}N nuclei be 40.00 MHz?

Nucleus	$\gamma / 2\pi$ (MHz/T)
^{1}H	42.576
^{3}He	32.434
^{7}Li	16.546
^{13}C	10.705
^{14}N	3.0766

A) 1.143T
B) 1.392T
C) 1.232T
D) 1.81T

(4) A 5.0 m long solenoid has a radius of 20 cm and 4000 turns/m. The current in the solenoid flows clockwise as viewed from the right and *decreases* at a rate of 3500 A/s. A small conducting coil of radius 10 cm containing 8 turns is placed in the center of the solenoid with its axis the same as the solenoid axis as shown. The resistance of the five-turn coil is 2 Ohms. Determine the current induced in the coil.



A) 2.21 A clockwise from the right
B) 3.42 A clockwise from the right
C) 2.21 A counterclockwise from the right
D) 4.42 A counterclockwise from the right

Topics 13 and 14

(5) For the AC generator shown, the rotating coil has a length of 10 cm and a width of 5 cm and contains 200 turns. The coil rotates in a uniform magnetic field B = 0.10 T. What is the angular speed for the rotating shaft if the generator is producing a peak EMF = 10 V?

A) 500 rad/s
B) 50 rad/s
C) 100 rad/s
D) 25 rad/s
E) 250 rad/s

(6) The amplitude of a wave is described by the equation:

$$y(x,t) = 3.0 \sin\left(\frac{x}{6.8*10^{-8}} + \frac{t}{2.3*10^{-16}} \right),$$

where x is in meters and t is in seconds. What type of wave is this most likely to be?

A) An electromagnetic wave travelling in the +x direction.
B) An electromagnetic wave travelling in the –x direction.
C) A sound wave travelling in the +x direction
D) A sound wave travelling in the –x direction
E) None of the above

Topics 15 and 16

(7) Imagine that you have a source of sound producing a total sound output power of 22 W. Your friend measures a sound intensity of 0.028 W/m 2. How far away from the source is your friend?

(8) A guitar string has a fundamental frequency of 30Hz. The string has a tension of 200 N and a length of 350mm. What is the total mass of the string?