

Phys 2B Summer 2022

Quiz 4 Practice

Question 1:

A solenoid in a magnetic imaging machine has 1300 loops/meter and carries a current of 490 A. What is the approximate magnetic field inside the solenoid?

- (a) 0.064 T
- (b) 0.22 T
- (c) 0.80 T
- (d) 1.5 T
- (e) 2.7 T

Question 2:

A circular loop of wire with area 1.3 m^2 lies on the ground, perfectly horizontal, so that its axis of rotation is vertical. The Earth's magnetic field in this region has horizontal component $B_H = 45 \mu\text{T}$ north and vertical component $B_V = 35 \mu\text{T}$ down, so its total magnitude is about $B = 57 \mu\text{T}$. If the wire loop carries a 2.0 A current, clockwise when viewed from above, what is its orientation energy with respect to the Earth's magnetic field?

- (a) 0
- (b) $-120 \mu\text{J}$
- (c) $-91 \mu\text{J}$
- (d) $+91 \mu\text{J}$
- (e) $+120 \mu\text{J}$

Question 3:

A certain ion is known based on its chemistry to have a charge of $+2e$. In order to measure its mass, it is sent into a magnetic field of strength 0.20 T at a velocity of $44,000\text{ m/s}$, perpendicular to the field. If the ion moves in a circle of radius 0.14 m , what is its mass?

- (a) $1.8 \times 10^{-30}\text{ kg}$
- (b) $1.7 \times 10^{-27}\text{ kg}$
- (c) $3.4 \times 10^{-27}\text{ kg}$
- (d) $1.0 \times 10^{-25}\text{ kg}$
- (e) $2.0 \times 10^{-25}\text{ kg}$

Question 4:

An electron has a velocity vector $\vec{v} = (v_x, v_y, v_z) = (1.0, 1.0, 0.0)\text{ m/s}$. It is in a magnetic field $\vec{B} = (1.5\text{ T})\hat{x}$. What is the magnetic force vector produced by the field acting on the electron?

- (a) $\vec{F} = (-2.4 \times 10^{-19}\hat{z})\text{ N}$
- (b) $\vec{F} = (2.4 \times 10^{-19}\hat{x} + 2.4 \times 10^{-19}\hat{y})\text{ N}$
- (c) $\vec{F} = (3.4 \times 10^{-19}\hat{x})\text{ N}$
- (d) $\vec{F} = (2.4 \times 10^{-19}\hat{z})\text{ N}$
- (e) $\vec{F} = (3.4 \times 10^{-19}\hat{z})\text{ N}$

Question 5:

A loop of wire lies in the x - y plane. There is a constant magnetic field of strength 4.0 T pointing in the positive x direction. The loop of wire begins to rotate around the y axis with constant angular frequency 160 rad/s. If the loop is a circle of radius 1.2 m, what is the maximum induced emf?

- (a) 0.11 V
- (b) 9.5 V
- (c) 39 V
- (d) 770 V
- (e) 2900 V

Question 6:

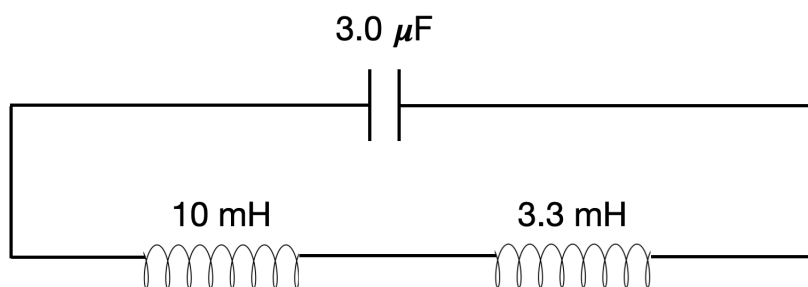
A cylindrical wire of radius 5.6 mm carries a uniformly distributed current. The total current is 85 A, and the drift velocity of electrons in the current is 4.5×10^{-3} m/s. What is the magnetic force felt by an electron 2.2 mm from the center of the wire due to the magnetic field produced by the current in the wire, if it is traveling at the drift velocity?

Hint: It may be less confusing to calculate things for a positive charge moving in the same direction as the conventional current, than for an electron moving in the opposite direction of the conventional current. The result will be the same anyway.

- (a) 0
- (b) 8.6×10^{-25} N toward the center of the wire
- (c) 8.6×10^{-25} N toward the surface of the wire
- (d) 5.6×10^{-24} N toward the center of the wire
- (e) 5.6×10^{-24} N toward the surface of the wire

Question 7:

What is the angular frequency of the LC circuit shown below?



- (a) $7.4 \times 10^{-9}\ \text{rad/s}$
- (b) $2.0 \times 10^{-4}\ \text{rad/s}$
- (c) $4.4 \times 10^3\ \text{rad/s}$
- (d) $5.0 \times 10^3\ \text{rad/s}$
- (e) $1.2 \times 10^4\ \text{rad/s}$

Question 8:

An LC circuit has a current of 97 A at the same time that the capacitor has a charge of 18 mC . If the capacitance is $45\text{ }\mu\text{F}$ and the circuit stores 4.0 J of total energy, what is the inductance?

- (a) $2.6\text{ }\mu\text{H}$
- (b) $85\text{ }\mu\text{H}$
- (c) $770\text{ }\mu\text{H}$
- (d) 4.1 mH
- (e) 8.2 mH

Question 9:

An LC circuit consists of a 44 pH inductor and 86 nF capacitor. If the maximum charge on the capacitor is 220 nC and this occurs at time $t = 0\text{ s}$, what is the absolute value of the current flowing through the circuit at $t = 2.9\text{ s}$?

- (a) 3.9 A
- (b) 9.1 A
- (c) 36 A
- (d) 110 A
- (e) 330 A

Question 10:

A power company needs to send an alternating current at potential 6.0 kV into a transformer in order to transmit the current across the grid at 500 kV. Which of the following transformers would modify the voltage as desired?

- (a) 1200 loops in the primary coil, and 18 in the secondary.
- (b) 62,500 loops in the primary coil, and 9 in the secondary.
- (c) 120 loops in the primary coil, and 10,000 in the secondary.
- (d) 24 loops in the primary coil, and 500 in the secondary.
- (e) 36 loops in the primary coil, and 25,000 in the secondary.