Physics II
Exam 3 Review

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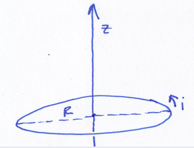
Outline

Problems

Problem 1

Consider a conductive ring with current i and radius R:



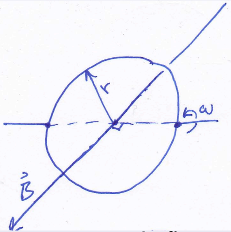
A Find B as a function of z

B if $R = \_\_$, $B = \_\_$ and $z = \_\_$, find i

C if there is an uniform external magnetic field B_{ext}, crossing the ring with $\theta = \_\_$, find the magnitude of B_{ext}

Problem 2

Consider a rotating ring with angular frequency, ω:



A Find an expression for the area, magnetic flux, and the magnitude/amplitude of the induced emf, ε in the ring.

B Sketch a plot of the magnitude/amplitude of the induced emf.

C Find the magnitude/amplitude of the current, given the resistance, $R(t) = 2\pi\sqrt{t}\alpha$, where α is a resistivity rate.

D Sketch a plot of the magnitude/amplitude of the current.

Multiple Choice

Chapter 28: Magnetic Fields

Question 1

A magnetic field exerts a force on a charged particle:

A Always

B Never

C If the particle is moving across the field lines

D If the particle is moving along the field lines

E If the particle is at rest

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D If the particle is moving along the field lines

E If the particle is at rest

Answer: C

Question 2

The direction of the magnetic field in a certain region of space is determined by firing a test charge into the region with its velocity in various directions in different trials. The field direction is:

A One of the directions of the velocity when the magnetic force is zero

B The direction of the velocity when the magnetic force is a maximum

C The direction of the magnetic force

D Perpendicular to the velocity when the magnetic force is zero

E None of the above

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B The direction of the velocity when the magnetic force is a maximum

C The direction of the magnetic force

D Perpendicular to the velocity when the magnetic force is zero

E None of the above

Answer: A

Question 3

A beam of electrons is sent horizontally down the axis of a tube to strike a fluorescent screen at the end of the tube. On the way, the electrons encounter a magnetic field directed horizontally rightward. The spot on the screen will therefore be deflected:

A Upward

B Downward

C To the right as seen from the electron source

D To the left as seen from the electron source

E Not at all

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C To the right as seen from the electron source

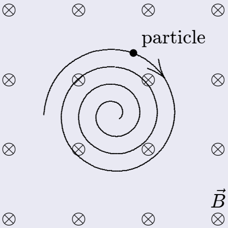
D To the left as seen from the electron source

E Not at all

Answer: C

Question 4

A uniform magnetic field is directed into the page. A charged particle, moving in the plane of the page, follows a clockwise spiral of decreasing radius as shown. A reasonable explanation is:



A The charge is positive and slowing down

B The charge is negative and slowing down

C The charge is positive and speeding up

D The charge is negative and speeding up

E None of the above

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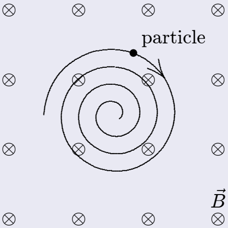


A The charge is positive and slowing down

B The charge is negative and slowing down

C The charge is positive and speeding up

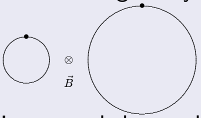
D The charge is negative and speeding up

E None of the above

Answer: B

Question 5

An electron and a proton each travel with equal speeds around circular orbits in the same uniform magnetic field, as shown in the diagram (not to scale). The field is into the page on the diagram. Because the electron is less massive than the proton and because the electron is negatively charged and the proton is positively charged:



A The electron travels clockwise around the smaller circle and the proton travels counterclockwise around the larger circle

B The electron travels counterclockwise around the smaller circle and the proton travels clockwise around the larger circle

C The electron travels clockwise around the larger circle and the proton travels counterclockwise around the smaller circle

D The electron travels counterclockwise around the larger circle and the proton travels clockwise around the smaller circle

E The electron travels counterclockwise around the smaller circle and the proton travels counterclockwise around the larger circle

Question 5

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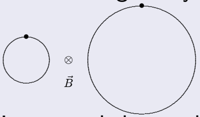

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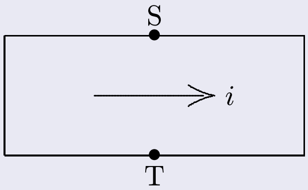
Answer: A

Question 6

The current is from left to right in the conductor shown. The magnetic field is into the page and point S is at a higher potential than point T. The charge carriers are:



A Positive

B Negative

C Neutral

D Absent

E Moving near the speed of light

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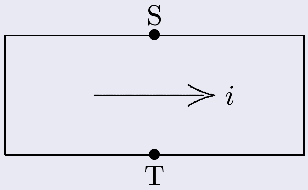

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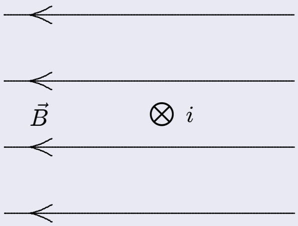
Answer: A

Question 7

The figure shows a uniform magnetic field $\vec{B}$ directed to the left and a wire carrying a current into the page. The magnetic force acting on the wire is:



A Toward the top of the page

B Toward the bottom of the page

C Toward the left

D Toward the right

E Zero

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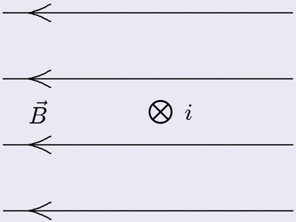
The figure shows a uniform magnetic field $\vec{B}$ directed to the left and a wire carrying a current into the page. The magnetic force acting on the wire is:



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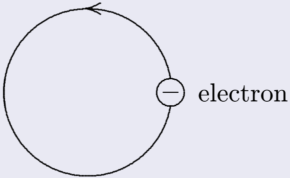
E Zero

Answer: A

Chapter 29: Magnetic Fields due to Currents

Question 1

Electrons are going around a circle in a counterclockwise direction as shown. At the center of the circle they produce a magnetic field that is:



A Into the page

B Out of the page

C To the left

D To the right

E Zero

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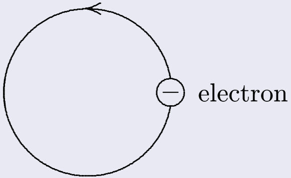

A Into the page

B Out of the page

C To the left

D To the right

E Zero

Answer: A

Question 2

Lines of the magnetic field produced by a long straight wire carrying a current are:

A In the direction of the current

B Opposite to the direction of the current

C Radially outward from the wire

D Radially inward toward the wire

E Circles that are concentric with the wire

Question 2

Lines of the magnetic field produced by a long straight wire carrying a current are:

A In the direction of the current

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C Radially outward from the wire

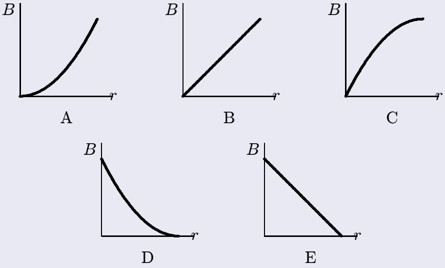
D Radially inward toward the wire

E Circles that are concentric with the wire

Answer: E

Question 3

Which graph correctly gives the magnitude of the magnetic field outside an infinitely long straight current-carrying wire as a function of the distance r from the wire?



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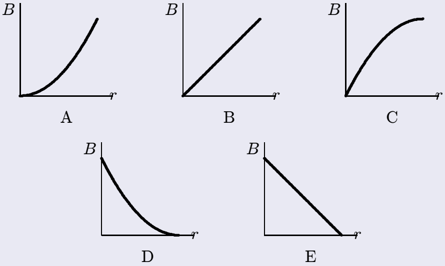

Answer: D

Question 4

Two long parallel straight wires carry equal currents in opposite directions. At a point midway between the wires, the magnetic field they produce is:

A Zero

B Non-zero and along a line connecting the wires

C Non-zero and parallel to the wires

D Non-zero and perpendicular to the plane of the two wires

E None of the above

Question 4

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C Non-zero and parallel to the wires

D Non-zero and perpendicular to the plane of the two wires

E None of the above

Answer: D

Question 5

A constant current is sent through a helical coil. The coil:

A Tends to get shorter

B Tends to get longer

C Tends to rotate about its axis

D Produces zero magnetic field at its center

E None of the above

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Answer: A

Question 6

A square loop of current-carrying wire with edge length a is in the xy plane, the origin being at its center. Along which of the following lines can a charge move without experiencing a magnetic force?

A $x = 0,\ y = \frac{a}{2}$

B $x = \frac{a}{2},\ y = \frac{a}{2}$

C $x = \frac{a}{2},\ y = 0$

D $x = 0,\ y = 0$

E $x = 0,\ z = 0$

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D $x = 0,\ y = 0$

E $x = 0,\ z = 0$

Answer: D

Question 7

The magnetic field B inside a long ideal solenoid is independent of:

A the current

B the core material

C the spacing of the windings

D the cross-sectional area of the solenoid

E the direction of the current

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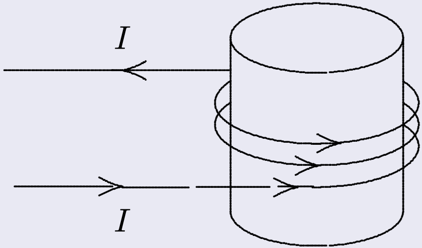
Answer: D

Question 8

Magnetic field lines inside the solenoid shown are:



A clockwise circles as one looks down the axis from the top of the page

B counterclockwise circles as one looks down the axis from the top of the page

C toward the top of the page

D toward the bottom of the page

E in no direction since $B = 0$

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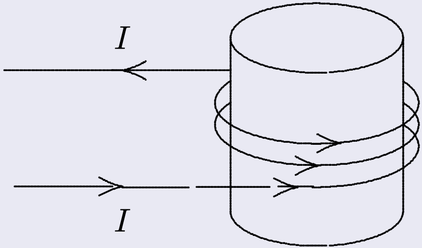

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C toward the top of the page

D toward the bottom of the page

E in no direction since $B = 0$

Answer: C

Chapter 30: Induction and Inductance

Question 1

If the magnetic flux through a certain region is changing with time:

A Energy must be dissipated as heat

B An electric field must exist at the boundary

C A current must flow around the boundary

D An emf must exist around the boundary

E A magnetic field must exist at the boundary

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A Energy must be dissipated as heat

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D An emf must exist around the boundary

E A magnetic field must exist at the boundary

Answer: D

Question 2

A square loop of wire lies in the plane of the page. A decreasing magnetic field is directed into the page. The induced current in the loop is:

A Counterclockwise

B Clockwise

C Zero

D Up the left edge and from right to left along the top edge

E Through the middle of the page

Question 2

A square loop of wire lies in the plane of the page. A decreasing magnetic field is directed into the page. The induced current in the loop is:

A Counterclockwise

B Clockwise

C Zero

D Up the left edge and from right to left along the top edge

E Through the middle of the page

Answer: B

Question 3

A circular loop of wire rotates about a diameter in a magnetic field that is perpendicular to the axis of rotation. Looking in the direction of the field at the loop the induced current is:

- A Always clockwise
- B Always counterclockwise
- C Clockwise in the lower half of the loop and counterclockwise in the upper half
- D Clockwise in the upper half of the loop and counterclockwise in the lower half
- E Sometimes clockwise and sometimes counterclockwise

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C Clockwise in the lower half of the loop and counterclockwise in the upper half

D Clockwise in the upper half of the loop and counterclockwise in the lower half

E Sometimes clockwise and sometimes counterclockwise

Answer: E

Question 4

If the potential difference across a resistor is doubled:

A only the current is doubled

B only the current is halved

C only the resistance is doubled

D only the resistance is halved

E both the current and resistance are doubled

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B only the current is halved

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D only the resistance is halved

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Answer: A

Question 5

A magnet moves inside a coil. Consider the following factors:

I Strength of the magnet

II Number of turns in the coil

III Speed at which the magnet moves

Which can affect the emf induced in the coil?

A I only

B II only

C III only

D I and II only

E I, II, III

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III Speed at which the magnet moves

Which can affect the emf induced in the coil?

A I only

B II only

C III only

D I and II only

E I, II, III

Answer: E