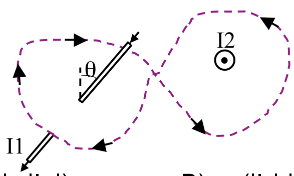
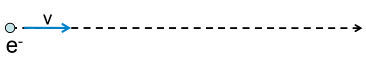
5.22

What is $\oint \vec{\mathbf{B}} \cdot d\vec{\mathbf{l}}$ around this purple (dashed) Amperian loop?



A) $\mu_0(|I_2|+|I_1|)$
B) $\mu_0(|I_2|-|I_1|)$
C) $\mu_0(|I_2|+|I_1|\sin\theta)$
D) $\mu_0(|I_2|-|I_1|\sin\theta)$
E) $\mu_0(|I_2|+|I_1|\cos\theta)$

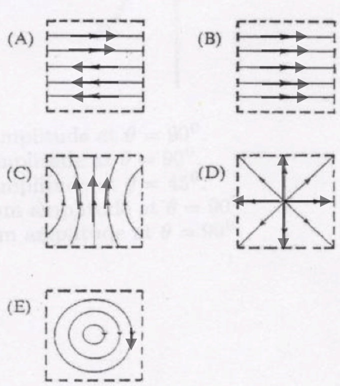
An electron is moving in a straight line with <u>constant</u> speed v. What approach would you choose to calculate the B-field generated by this electron?



A) Biot-Savart
B) Ampere's law
C) Either of the above.
D) Neither of the above.

5.18

Pick a sketch showing B field lines that *violate* one of Maxwell's equations within the region bounded by dashed lines.



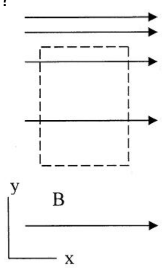
(What currents would be needed to generate the others?)

5.19 The magnetic field in a certain region is given by

$$\vec{B}(x,y) = C y \hat{x}$$

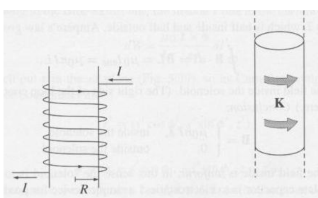
(C is a positive constant) Consider the imaginary loop shown. What can you say about the electric current passing through the loop?

A. must be zero
B. must be nonzero
C. Not enough info



5.20

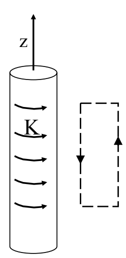
A solenoid has a total of N windings over a distance of L meters. We "idealize" by treating this as a surface current running around the surface.
What is K?



A) I B) NI C) I/L D) I N/L
E) Something else...

MD11-3

An infinite solenoid with surface current density K is oriented along the z-axis. Apply Ampere's Law to the rectangular imaginary loop in the yz plane shown. What does this tell you about Bz, the z-component of the **B**-field outside the solenoid?

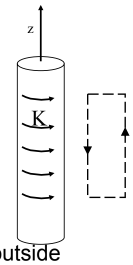


A) Bz is constant outside
B) Bz is zero outside
C) Bz is not constant outside
D) It tells you nothing about Bz

MD11-3

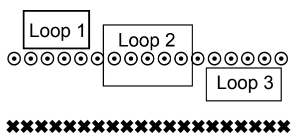
An infinite solenoid with surface current density K is oriented along the z-axis. Apply Ampere's Law to the rectangular imaginary loop in the yz plane shown.

We can safely assume that B(s→∞)=0. What does this tell you about the **B**-field outside the solenoid?



A) |B| is a small non-zero constant outside
B) |B| is zero outside
C) |B| is not constant outside
D) We still don't know anything about |B|

5.23



In the case of the infinite solenoid we used loop 1 to argue that the **B**-field outside is zero. Then we used loop 2 to find the **B**-field inside. What would loop 3 show?

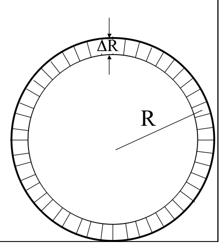
a) The **B**-field inside is zero
b) It does not tell us anything about the **B**-field
c) Something else

5.21
a

A thin toroid has (average) radius R and a total of N windings with current I.
We "idealize" this as a surface current running around the surface.
What is K, approximately?

A) I/R B) $I/(2\pi R)$
C) NI/R D) $NI/(2\pi R)$

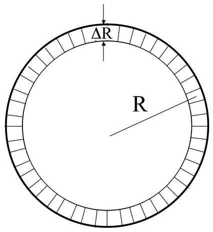
E) Something else



5.21b

What direction do you expect the B field to point?

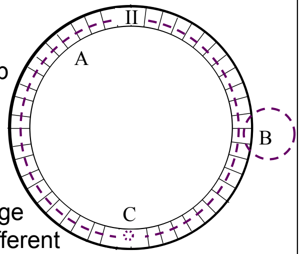
A) Azimuthally
B) Radially
C) In the z direction (perp. to page)
D) Loops around the rim
E) Mix of the above...



5.21 c

What Amperian loop would you draw to find B "inside" the Torus (region II)

A) Large "azimuthal" loop
B) Smallish loop from region II to outside (where B=0)
C) Small loop in region II
D) Like A, but perp to page
E) Something entirely different



5.21 d

Two long coaxial solenoids each carry current I but in opposite directions.

The inner solenoid (radius a) has n1 turns per unit length, and the outer one (radius b) has n2.

Find B (i) inside the solenoid, (ii) between them, and (iii) outside both.

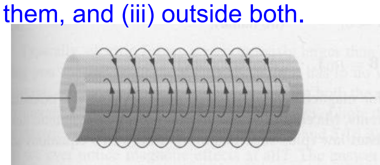


Figure 5.42

One of Maxwell's equations, $\nabla \times E = 0$ made it useful for us to define a scalar potential V, where $E = -\nabla V$

Similarly, another one of Maxwell's equations makes it useful for us to define the vector potential, **A.** Which one?

A) $\nabla \times E = 0$

$B)$ $\nabla \cdot E = \rho / \varepsilon_0$

$C)$ $\nabla \times B = \mu_0 J$

$D)$ $\nabla \cdot B = 0$

$E)$ something else!

$$\nabla \times \vec{\mathbf{E}} = 0 \rightarrow \boxed{\vec{\mathbf{E}} = -\nabla \mathrm{V}}$$

Can add a constant 'c' to V without changing **E** ("Gauge freedom"): ∇constant = 0,

$$\vec{\nabla} \cdot \vec{\mathbf{B}} = 0 \rightarrow \boxed{\vec{\mathbf{B}} = \vec{\nabla} \times \vec{\mathbf{A}}}$$

Can add any vector function '**a**' with ∇x**a**=0 to **A** without changing **B** ("Gauge freedom")

∇ x (**A**+**a**) = ∇ x **A** + ~~∇ x **a**~~ = ∇ x **A** = **B**

0