5.28

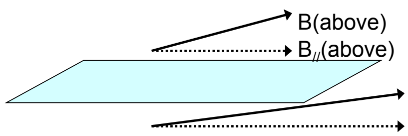
When you are done with p. 1:
Choose all of the following statements that are implied if $\oiint \vec{B} \cdot d\vec{a} = 0$ for any/all closed surfaces

(I) $\vec{\nabla} \cdot \vec{B} = 0$
(II) $B^{//}_{above} = B^{//}_{below}$
(III) $B^{\perp}_{above} = B^{\perp}_{below}$

A) (I) only
B) (II) only
C) (III) only
D) (I) and (II) only
E) (I) and (III) only

6.11

I have a boundary sheet, and would like to learn about the change (or continuity!) of B(parallel) across the boundary.



Am I going to need to know about

A) $\nabla \times B$
B) $\nabla \bullet B$
C) ???

5.28 b

In general, which of the following are continuous as you move past a boundary?

A) **A** B) Not all of **A**, just A_{perp}

C) Not all of **A**, just $A_{//}$

D) Nothing is guaranteed to be continuous regarding **A**

5.30

The leading term in the vector potential multipole expansion involves $\oint d\vec{\mathbf{l}}'$

What is the magnitude of this integral?

A) R

B) 2π R

C) 0

D) Something entirely different/it depends!

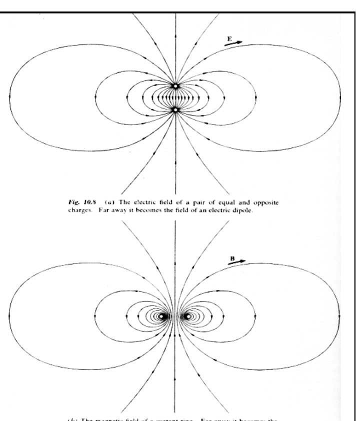
This is the formula for an ideal magnetic dipole:

$$\vec{\mathbf{B}} = \frac{c}{r^3}(2\cos\theta\,\hat{r} + \sin\theta\,\hat{\theta})$$

What is different in a sketch of a *real* (physical) magnetic dipole (like, a small current loop)?

E-field around electric dipole

B-field around magnetic dipole (current loop)



From Purcell,
Electricity and Magnetism

5.29

The formula from Griffiths for a magnetic dipole at the origin is:

$$\vec{\mathbf{A}}(\vec{r}) = \frac{\mu_0}{4\pi}\frac{\hat{m}\times\hat{r}}{r^2}$$

Is this the *exact* vector potential for a flat ring of current with **m**=I**a**, or is it approximate?

A) It's exact

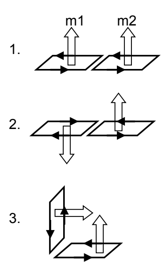
B) It's exact if |r| > radius of the ring

C) It's approximate, valid for large r

D) It's approximate, valid for small r

MD12-5

Two magnetic dipoles **m**1 and **m**2 are oriented in three different ways.



Which ways produce a dipole field at large distances?

A) None of these

B) All three

C) 1 only

D) 1 and 2 only

E) 1 and 3 only

MD12-7

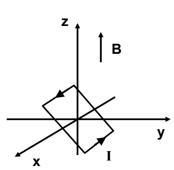
The force on a segment of wire L is $\vec{F} = I\,\vec{L}\times\vec{B}$

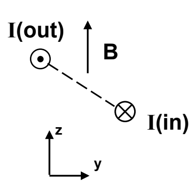
A current-carrying wire loop is in a constant magnetic field **B** = B **z_hat** as shown.

What is the direction of the torque on the loop?

A) Zero B) +x C) +y D) +z

E) None of these



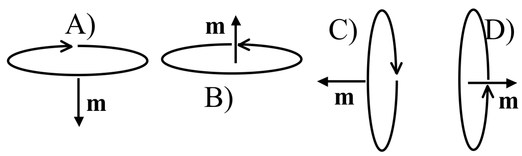


6.1

Griffiths argues that the torque *on* a magnetic dipole in a B field is:

$$\vec{\tau} = \vec{\mathbf{m}} \times \vec{\mathbf{B}}$$

How will a small current loop line up if the B field points uniformly up the page?



6.2

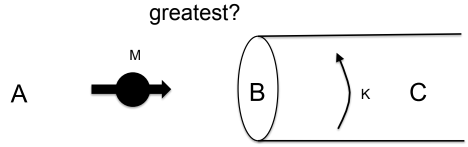
Griffiths argues that the force *on* a magnetic dipole in a B field is: $\vec{\mathbf{F}} = \vec{\nabla}(\vec{\mathbf{m}} \bullet \vec{\mathbf{B}})$

If the dipole **m** points in the z direction, what can you say about **B** if I tell you the force is in the x direction?

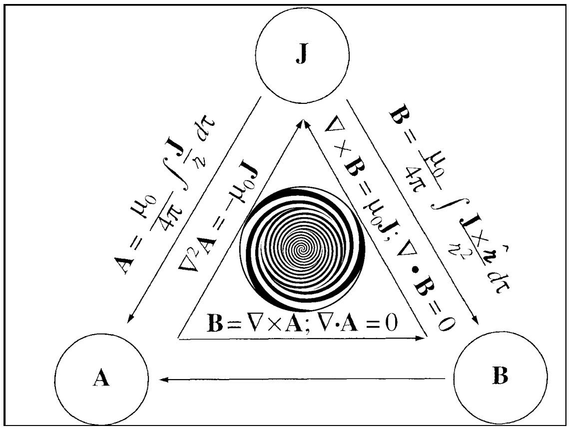
A) **B** simply points in the x direction
B) Bz must depend on x
C) Bz must depend on z
D) Bx must depend on x
E) Bx must depend on z

6.2x

Suppose I place a small dipole M at various locations near the end of a large solenoid. At which point is the magnitude of the force on the dipole greatest?



D) Not enough information to answer
E) There is no net force on a dipole


J
A
B
$\mathbf{A} = \frac{\mu_0}{4\pi}\int \frac{\mathbf{J}}{r}\, d\tau$
$\mathbf{B} = \frac{\mu_0}{4\pi}\int \frac{\mathbf{J}\times\hat{\mathbf{r}}}{r^2}\, d\tau$
$\nabla^2\mathbf{A} = -\mu_0\mathbf{J}$
$\nabla\times\mathbf{B} = \mu_0\mathbf{J};\ \nabla\cdot\mathbf{B} = 0$
$\mathbf{B} = \nabla\times\mathbf{A};\ \nabla\cdot\mathbf{A} = 0$