Name: _____ **Date:** _____ **Period:** _____

AP Physics C
Magnetic HO40

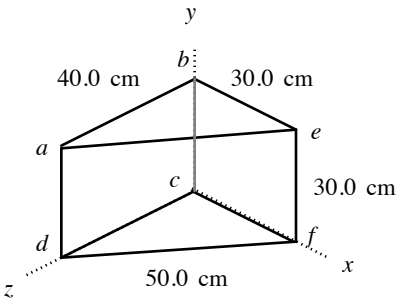
1.) A particle with a mass of 1.81 x 10^{-3} kg and a charge of 1.22 x 10^{-8} C has at a given instant a velocity $\boldsymbol{v}$ = (3.00 x 10^{5} m/s)**j**. What are the magnitude and direction of the particle's acceleration produced by a uniform magnetic field $\boldsymbol{B}$ = -(0.815 T) **i**? (UP 28-2)

2.) A particle with a charge of –2.48 x 10^{-8} C is moving with instantaneous velocity $\boldsymbol{v}$ = (-3.85 x 10^{4} m/s)**i** + (4.19 x 10^{4} m/s)**j**. What is the force exerted on this particle by a magnetic field a.) $\boldsymbol{B}$ = (1.40 T) **i**? b.) $\boldsymbol{B}$ = (1.40 T) **k**? (UP 28-3)

3.) An electron experiences a magnetic force of magnitude 4.60 x 10^{-15} N when moving at an angle of 40.0° with respect to a magnetic field of magnitude 3.50 x 10^{-3} T. Find the speed of the electron. (UP 28-5)

4.) A circular area with a radius of 0.374 m lies in the *xy*-plane. What is the magnetic flux through this circle due to a uniform magnetic field B = 1.16 T a.) in the +*z*-direction? b.) in the +*y*-direction? (UP 28-11)

5.)



The magnetic field *B* in a certain region is 0.385 T, and its direction is that of the +*x*-axis as in the figure to the left. (UP 28-8)

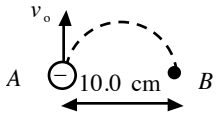
a.) What is the magnetic flux across surface *abcd*?
b.) What is the magnetic flux across surface *befc*?
c.) What is the magnetic flux across surface *aefd*?
d.) What is the net flux through all five surfaces?

6.) A charged particle with q = 4.80 x 10^{-19} C travels in a circular orbit with radius R = 0.468 m due to the force exerted on it by a magnetic field with magnitude B = 1.65 T and perpendicular to the orbit. (UP 28-14)

a.) What is the magnitude of the linear momentum $\boldsymbol{p}$ of the particle?

b.) What it the magnitude of the angular momentum $\boldsymbol{L}$ of the particle?

7.)



An electron at point *A* in the figure to the left has a speed v_o of 2.94 x 10^{6} m/s. Find the magnitude and direction of the magnetic field that will cause the electron to follow the semicircular path from *A* to *B*. (UP 28-15)

8.) Repeat Problem 7 for the case in which the particle is a proton rather than an electron. (UP 28-16)

9.) A singly charged ion of lithium has a mass of 1.16 x 10^{-26} kg. It is accelerated through a potential difference of 450 V and then enters a magnetic field with magnitude 0.723 T perpendicular to the path of the ion. What is the radius of the ion's path in the magnetic field? (UP 28-18)

10.) An electron in the beam of a TV picture tube is accelerated by a potential difference of 20,000 V. Then it passes through a region of transverse magnetic field, where it moves in a circular arc with radius 0.13 m. What is the magnitude of the field? (UP 28-19)

11.) An electron that is moving through a uniform magnetic field has a velocity $\boldsymbol{v}$ = (40 km/s)**i** + (35 km/s)**j** when it experiences a force $\boldsymbol{F}$ = -(4.2 fN)**i** + (4.8 fN)**j** due to a magnetic field. If B_x = 0,calculate the magnetic field $\boldsymbol{B}$. (f = femto = 10^{-15}) (HR 29-7P)

Name: _____ **Date:** _____ **Period:** _____

AP Physics C
Magnetic HO41

1.) A horizontal rod 0.200 m long carries current. There is a uniform magnetic field with magnitude 0.087 T and direction perpendicular to the rod. Find the current if the magnetic force on the rod is 0.22 N. (28-25)

2.) A wire along the *x*-axis carries a current of 7.00 A in the positive direction. Calculate the force (expressed in terms of unit vectors) on a 1.00 cm section of the wire exerted by these magnetic fields: (28-27)

a.) $\mathbf{B} = -(0.65\text{ T})\mathbf{j}$ b.) $\mathbf{B} = +(0.56\text{ T})\mathbf{k}$ c.) $\mathbf{B} = -(0.31\text{ T})\mathbf{i}$ d.) $\mathbf{B} = +(0.74\text{ T})\mathbf{j} - (0.36\text{ T})\mathbf{k}$

3.) A straight vertical wire carries a current of 8.00 A upward in a region where the magnetic field has magnitude $B = 6.72$ T and is horizontal. What are the magnitude and direction of the magnetic force on a 1.00 cm section of the wire if the magnetic field direction is (28-28)

a.) east? b.) south? c.) 30.0° south of west? d.) 60.0° north of east

4.) A circular coil of wire 6.5 cm in diameter has 12 turns and carries a current of 2.7 A. The coil is in a region where the magnetic field is 0.56 T. (28-29)

a.) What is the maximum torque on the coil? b.) In what position is the magnitude of the torque one-half of the value found in part (a)?

5.) A 5.0 cm x 12 cm rectangular coil with 600 turns carries a current of 0.0613 A. What is the maximum torque on the coil if it is in a uniform magnetic field with magnitude 0.267 T (28-30)

6.) A particle carries a charge of 4.97 nC. When it moves with a velocity of $\mathbf{v_1}$ that has a magnitude of 3.57×10^4 m/s and is at 45.0° from the *x*-axis in the *xy*-plane, a uniform magnetic field exerts a force $\mathbf{F_1}$ along the $-z$-axis. When it moves with a velocity of $\mathbf{v_2}$ that has a magnitude of 1.62×10^4 m/s and is along the $+z$-axis, there is a force $\mathbf{F_2}$ of magnitude 4.00×10^{-5} N exerted along the $+x$-axis. What are the magnitude and direction of the magnetic field?. (28-41)

7.) A particle with a charge 35 nC has a velocity $v = 5.89 \times 10^5$ m/s in the $-x$-direction It is moving in a uniform magnetic field with components $B_x = +.202$ T, $B_y = -0.522$ T, and $B_z = +0.322$ T. What are the components of the force exerted on the particle by the magnetic field? (28-42)

8.) A wire 0.150 m long lies along the y-axis and carries a current of 8.00 A in the +y-direction. The magnetic field is uniform and has components $B_x = +.107$ T, $B_y = -1.13$ T, and $B_z = +0.538$ T. (28-52)

a.) Find the components of force on the wire. b.) What is the magnitude and direction of the total force?

9.) An electron is accelerated from rest by a potential difference of 350 V. It then enters a uniform magnetic field of magnitude 200 mT with its velocity perpendicular to the field. Calculate

a.) the speed of the electron. b.) the radius of its path in the magnetic field. (HR 29-19E)

10.) A wire 1.80 m long carries a current of 13.0 A and makes an angle of 35.0° with a uniform magnetic field B = 1.50 T. Calculate the magnetic force on the wire. (HR 29-47E)

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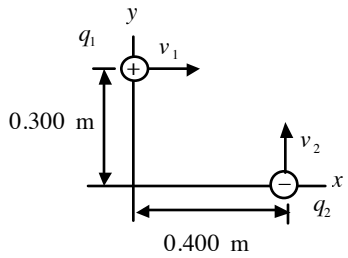
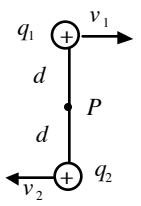
AP Physics C
Magnetic HO42

1.) 

A pair of point charges, $q_1 = +5.00\ \mu C$ and $q_2 = -3.00\ \mu C$, are moving in a reference frame as shown in the figure to the left. At this instant, what are the magnitude and direction of the net magnetic field produced at the origin? Take $v_1 = 6.00 \times 10^5$ m/s and $v_2 = 8.00 \times 10^5$ m/s. (29-3)

2.) 

Positive point charges $q_1 = +4.00\ \mu C$ and $q_2 = +6.00\ \mu C$, are moving are moving relative to an observer at point *P*, as shown in the figure to the left. The distance d is 0.150 m. When the two charges are at the locations shown in the figure, what are the magnitude and direction of the net magnetic field they produce at point *P*. Take $v_1 = 7.50 \times 10^5$ m/s and $v_2 = 2.50 \times 10^5$ m/s. (29-4)

3.) A long straight wire lies along the *x*-axis and carries current $I = 8.00$ A in the *x*-direction. Find the magnetic field (magnitude and direction) produced at the following points by a 2.00 mm segment of the wire centered at the origin: (29-5)

a.) $x = 3.00$ m, $y = 0$, $z = 0$; b.) $x = 0$, $y = 3.00$ m, $z = 0$; c.) $x = 3.00$ m, $y = 3.00$ m, $z = 0$.

4.) You want to produce a magnetic field of magnitude 7.50×10^{-4} T at a distance of 0.050 m from a long, straight wire. (29-8)

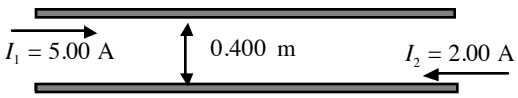
a.) What current is required to produce this field?

b.) With the current found in part (a.), what is the magnitude of the field at a distance of 0.100 m from the wire?

5.) Two bikers are reading a compass under an overhead transmission line that is 5.00 m above the ground and carries a current of 900 A in a horizontal direction from east to west. (29-11)

a.) Find the magnitude and direction of the magnetic field at a point on the ground directly under the conductor.

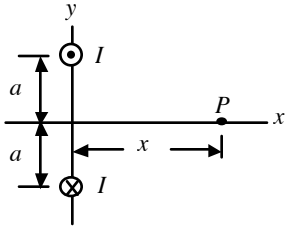
b.) One biker suggests that they walk 50 m away from the line to avoid inaccurate compass readings caused by the current. Find the magnitude and direction of the magnetic field at this point.

6.) 

Two long, parallel wires are separated by a distance of 0.400m. The currents I_1 and I_2 have the directions shown. (29-14)

a.) Calculate the magnitude of the force exerted on each by each wire on 0.200 m length of the other. Is the force attractive or repulsive?

b.) If each current is tripled, what is the magnitude of the force that each wire exerts on a 0.200 m length of the other.

7.) 

The figure to the left is an end view of two long, parallel wires perpendicular to the *x*-*y* plane. Each carries current $I = 9.00$ A, but in opposite directions. Suppose a third long, straight wire, parallel to the other two passes through point *P* and also carries a current $I = 9.00$ A. Let $a = 0.300$ m and $x = 0.400$ m. Find the direction and magnitude of the force per unit length on the third wire, (29-46)

a.) if the current in it is directed into the plane of the figure.

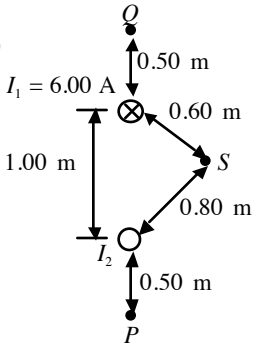
b.) if the current in it is directed out of the plane of the figure.

Name: _____ **Date:** _____ **Period:** _____

AP Physics C
Magnetic HO43

1.) A long, straight wire carries a current of 1.50 A. An electron is traveling in the vicinity of the wire. At the instant when the electron is 0.0800 m from the wire and traveling with a speed of 4.00 x 10^4 m/s parallel to the wire in the same direction as the current, what are the magnitude and direction of the force that the magnetic field of the current exerts on the electron? (29-43)

2.)



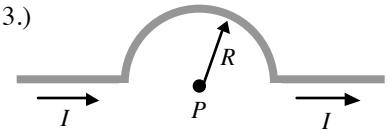
Two long, straight, parallel wires are 1.00 m apart. The upper wire carries a current I_1 of 6.00 A into the plane of the paper. (29-47)

a.) What must be the magnitude and direction of current I_2 for the net field at point P to be zero?

b.) What then are the magnitude and direction of the net field at Q?

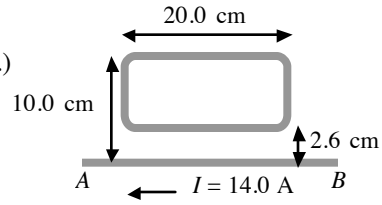
c.) What then are the magnitude and direction of the net field at S?

3.)



Calculate the magnitude and direction of the magnetic field at point P due the current in the semicircular section of wire shown in the figure to the left. (Does the current in the long straight section of the wire produce any field at P?) (29-20)

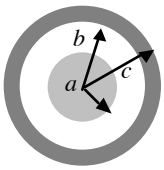
4.)



The long, straight wire AB carries a current of 14.0 A. The rectangular loop whose long edges are parallel to the wire carries a clockwise current of 5.00 A. Find the magnitude and direction of the net force exerted on the loop by the magnetic field of the wire. (29-49)

5.) A solenoid of length 20.0 cm and radius 3.00 cm is closely wound with 500 turns of wire. The current in the windings is 6.00 A. Find the magnetic field at a point near the center of the solenoid. (29-24)

6.)



The cross section of a coaxial cable consisting of solid conductor of radius a is supported by insulating disks on the axis of the conducting tube with inner radius b and outer radius c is shown in the figure to the left. The central conductor and tube carry currents I in opposite directions. The currents are uniformly distributed over the cross sections of each conductor. Derive an expression for the magnetic field (29-28)

a.) for $r < a$ b.) for $a < r < b$ c.) for $b < r < c$ d.) for $r > c$

7.) A long, straight wire with circular cross section of radius R carries current I. Assume the current density is no constant across the cross section of the wire but rather varies as $J = \alpha r$, where α is a constant. (29-59)

a.) By the requirement that J integrated over the cross section of the wire gives the total current I, calculate the constant α in terms of I and R.

b.) Use Ampere's law to calculate the magnetic field $B(r)$ for i.) $r \le R$ ii.) $r \ge R$.

8.) A wire carries a current of 30 A along the x-axis from $x = 0$ to $x = +3.0$ cm. Determine the magnitude of the magnetic field at the point $y = 4.0$ cm on the y-axis.