Physics 222

Quiz 5 – Magnetic Field, Form: A

Name: _____

Date: _____

A battery is connected to a loop of copper wire as shown in Figure 1. The terminals of the battery are shown to be at +V and at V=0, where V is electric potential.

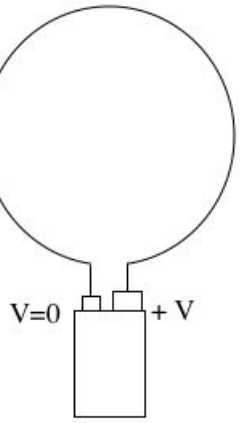

Figure 1:

1. What is the direction of conventional current around the loop. Remember that the direction of conventional current is the direction in which positive charge carriers will move due to an applied electric field.
   (a) clockwise
   (b) counterclockwise
2. What is the direction of electron current around the loop? Note: consider what direction electrons will flow in the wire.
   (a) clockwise
   (b) counterclockwise
3. What is the direction of the magnetic field at the center of the loop?
   (a) $+z$ direction
   (b) $-z$ direction
4. What is the direction of the magnetic field at points a distance d from the center of the loop along the $+z$ axis?
   (a) $+z$ direction
   (b) $-z$ direction
5. What is the direction of the magnetic field at points a distance d from the center of the loop along the $-z$ axis?
   (a) $+z$ direction
   (b) $-z$ direction

A long wire with current flowing in the +x direction is shown in Figure 2.

Figure 2:

6. What is the direction of the magnetic field at the point shown in Figure 2?
   (a) $+z$ direction
   (b) $-z$ direction
7. Suppose the point shown is very close to the wire in comparison to the length of the wire ($r << L$) and the magnitude of the magnetic field at that point is B. If you double the distance r, from the wire to that point, the magnitude of the magnetic field will be
   (a) $2B$
   (b) $4B$
   (c) $(1/2)B$
   (d) $(1/4)B$
   (e) none of the above
8. Sketch the magnetic field at each of the points shown in Figure 3. The current in the wire is flowing into the page, in the -z direction.

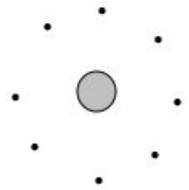

Figure 3:

Two coils of wire are arranged as shown in Figure 4. The coils are made of 10 loops of copper wire; the radius of each coil is 3 cm; the current in the horizontal (bottom) coil is 0.5 A and the current in the vertical coil is 0.2 A. The distance d is 5 cm.

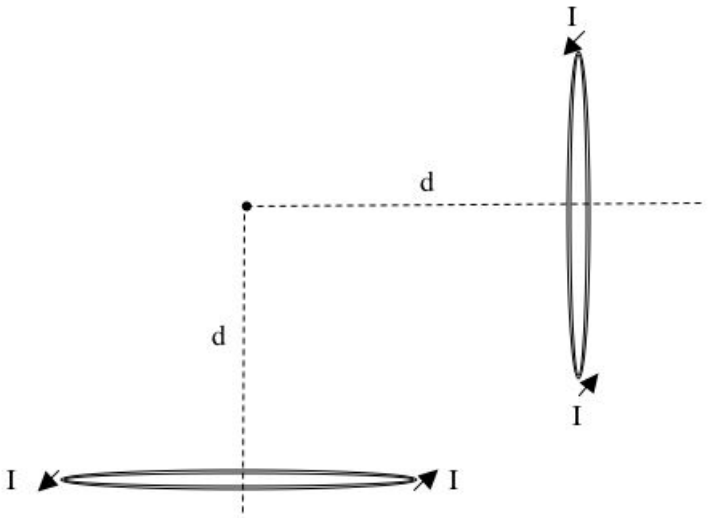

Figure 4:

9. Sketch the magnetic field due to each coil at the point shown. Also, sketch the net magnetic field due to the two coils at that point. (You should have a total of 3 vectors in your sketch, one for each coil and one for the net magnetic field.)

10. Calculate the net magnetic field at that point.

Answer Key for Exam A

1. (b)
2. (a)
3. (a)
4. (a)
5. (a)
6. (b)
7. (c)
8. The magnetic field curls clockwise around the wire. It is tangent to a circle at each point on the circle.
9. $\vec{B}_1$ is in the +y direction. $\vec{B}_1$ is in the +x direction. Thus, the net magnetic field is up and to the right.
10. $\vec{B}_{net} = < 5.7 \times 10^{-6}, 1.43 \times 10^{-5}, 0 >$ T