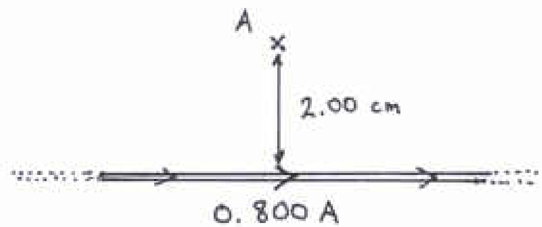
Units?
Units?

Name

Phys 2020, Section 1
Quiz #3 — Spring 2002



1. A very long straight wire in the plane of the page carries a current of 0.800 A in the direction shown.

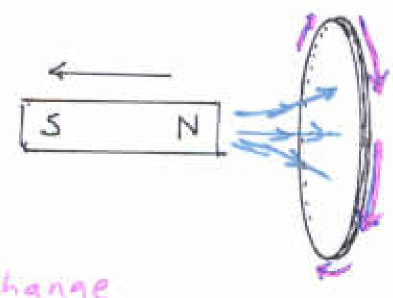
a) Find the magnitude of the magnetic field at point A (located 2.00 cm from the wire.

At a distance of 2.00 cm, the magnetic field has magnitude

$$B = \frac{\mu_0 I}{2\pi r} = \frac{(\cancel{4}^{2}\cancel{\pi} \times 10^{-7}\ \frac{T\cdot m}{A})(0.800 A)}{\cancel{2\pi}\ (2.00 \times 10^{-2} m)} = \boxed{8.00 \times 10^{-6}\ T}$$

b) What is the direction of the magnetic field at point A?

Using RHR-2, field goes $\boxed{\text{out of the page}}$ at point A

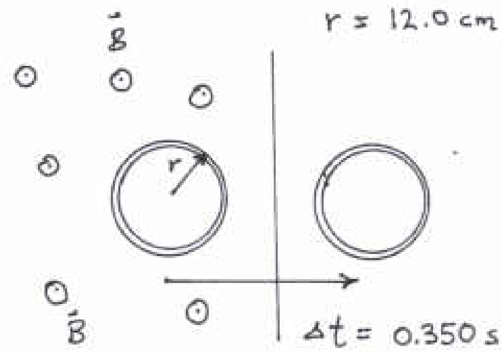


2. A magnet has its North pole pointing toward the middle of a circular loop of wire as shown at the right. The magnet is moved *away* from the loop, generating a current in the loop.

Use Lenz's Law to find the direction of the current induced in the loop. Show its direction *clearly* on the diagram and explain in words how you used Lenz's Law to arrive at your answer.

The magnet gives a flux directed to the right, but it is decreasing. To oppose this change the induced current in the loop must produce a flux directed to the right. From RHR-2 we see that if the induced current goes in the direction shown it will produce the needed flux.

3. A circular loop of wire having radius 12.0 cm has a resistance $4.00\,\Omega$. It is located in a magnetic field of 0.200 T directed at right angles to the plane of the coil. The coil is removed from the field in 0.350 s.



a) What is the area of the loop?

$$A = \pi r^2 = \pi\,(12.0\times10^{-2}\,\text{m})^2 = \boxed{4.52\times10^{-2}\,\text{m}^2}$$

b) What is (magnitude of) the change in magnetic flux in the loop?

magnitude of initial flux is

$$\Phi = BA\cos\phi = (0.200\,\text{T})(4.52\times10^{-2}\,\text{m}^2)(1) = \boxed{9.05\times10^{-3}\,\text{T}\cdot\text{m}^2}$$

= weber!

Since the final flux is zero this is the same as the change in flux

c) What is the (average) induced emf in the loop?

(magnitude of $\mathcal{E}$:)

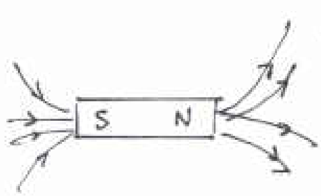
$$\mathcal{E} = N\frac{\Delta\Phi}{\Delta t} = 1\cdot\frac{(9.05\times10^{-3}\,\text{weber})}{(0.350\,\text{s})} = \boxed{2.59\times10^{-2}\,\text{V}}$$

d) What is the (average) induced current in the loop?

$$I = \frac{\mathcal{E}}{R} = \frac{(2.59\times10^{-2}\,\text{V})}{(4.00\,\Omega)} = \boxed{6.5\times10^{-3}\,\text{A}}$$

(Ohm's Law for loop)

You must show all your work and include the right units with your answers!



$V = IR$ $\quad \mu_0 = 4\pi\times10^{-7}\,\frac{\text{T}\cdot\text{m}}{\text{A}}$ $\quad B_{\text{wire}} = \frac{\mu_0 I}{2\pi r}$ $\quad B_{\text{sol}} = \mu_0 n I$

$\mathcal{E} = vBL$ $\quad \Phi = BA\cos\phi$ $\quad \mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$ $\quad \mathcal{E} = -L\frac{\Delta I}{\Delta t}$

$\lambda f = c$ $\quad \overline{S}_{\text{pol}} = \frac{1}{2}\overline{S}_{\text{unpol}}$ $\quad \overline{S} = \overline{S}_0\cos^2\theta$