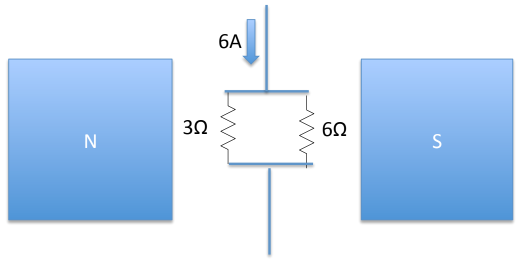

FIG. 1: Figure for loop problems

1B quiz 3 version A

1. In a laboratory experiment, someone measures a magnetic field which over some range of x, y, z values equals $\vec{B}(x,y,z) = B_0 x \hat{\jmath}$, where B_0 is a constant. Which of the following is a true statement about this finding?
   - a. A charged particle moving in this region would have a non-constant energy
   - b. Any current loop placed in this field would experience no force, just a torque.
   - c. Ampere's law says that there must be some current flowing in the z direction
   - d. This field is impossible to create
2. A ball with charge $2\mu C$ falls vertically at a speed of 5 cm/sec at the equator, where the earth's magnetic field has magnitude $.5 \times 10^{-4} T$ and points north. What is the magnetic force on the ball?
   - a.1. $\times 10^{-12}$ Newtons, southward direction
   - b. 0.
   - c. 2.5 $\times 10^{-12}$ Newtons, westward direction
   - d. 5.0 $\times 10^{-12}$ Newtons, eastward direction
3. A proton of energy 50MeV enters a region with a constant magnetic field and feels an immediate acceleration of $10^{14} m/s^2$. What are the possible values of the magnetic field magnitude? The mass of the proton is 1.67×10^{-27} kg.

- a. $0 < B < 2.6 \times 10^{-4}$T
- b. $0 < B < 1.1 \times 10^{-2}$T
- c. 2. 6 $\times 10^{-4}$T $< B < \infty$
- d. 1.1×10^{-2}T $< B < \infty$

4. Consider the square loop with side length 2 cm shown in the figure above, where the current of 6A divides into flow going through the two resistors of 3Ω (left) and 6Ω (right). The loop is placed in a region of constant magnetic field (created by the bar magnets) of magnitude .01T. What is the total force on the loop? (note: do not include any force on the wires attached to the loop itself)

- a. $6.0 \times 10^{-4} N$ out of the paper
- b. $1.2 \times 10^{-3} N$ out of the paper
- c. $6.0 \times 10^{-4} N$ into the paper
- d. $7.2 \times 10^{-3} N$ into the paper

5. In the same case as the previous problem, what is the magnitude of the torque on the loop about the $\hat{\jmath}$ axis going down the loop's center?

- a. $4.0 \times 10^{-6} N$
- b. $1.2 \times 10^{-5} N$
- c. $3.4 \times 10^{-6} N$
- d. $1.2 \times 10^{-5} N$

6. A long straight wire carries a current of 250A. At what distance from the wire will the field equal $10^{-3} T$?

- a. 5 cm
- b. 30 cm
- c. 2.5 m
- d. 50 m

7. A long solenoid has 5×10^4 turns of wire over a length of 2 meters. Attaching this solenoid to a power supply of 10V produces a magnetic field in the interior of the solenoid of magnitude 5×10^{-2}T. Find the resistance of the wire.

   - a. 1.6 Ω
   - b. 6.3 Ω
   - c. 15.7 Ω
   - d. 32 Ω

8. The magnetic field at the surface for a neutron star has magnitude 3×10^7T. What is the radius of a circular orbit of an electron moving there at 3×10^6 m/sec? The mass of an electron is 9.1×10^{-31} kg.

   - a. 6.1×10^{-7} m
   - b. 2.4×10^{-9} m
   - c. 8.3×10^{-11} m
   - d. 5.7×10^{-13} m