

Name: \_\_\_\_\_

Physics 4B

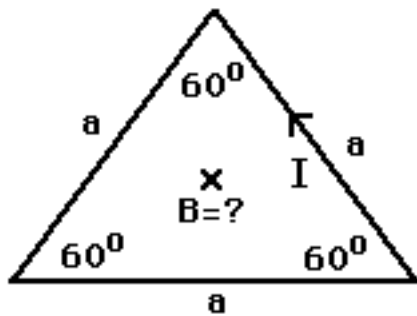
THIRD EXAM Chapters 26 - 30

Spring 1987

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 20 points. You must show your work in a logical fashion starting with the correctly applied physical principles from the back page. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

1. Copper has a density of  $8.9 \times 10^3 \text{ kg/m}^3$ . Find the minimum current needed to float a wire of radius 5.0mm in the Earth's magnetic field of  $52\mu\text{T}$ .

2. Find the magnetic field at the center of the equilateral triangle shown below.



3. Find the magnetic field inside and outside of a long straight wire of radius,  $R$ , carrying a uniform current density,  $j$ . Sketch the field as a function of distance from the wire.

4. A coil of 300 turns has a resistance of  $100\ \Omega$  and a radius of 10cm. It lies initially so that its plane is parallel to a 1.0T magnetic field. The coil then flips  $180^\circ$  so that its plane is again parallel with the field. Find (a) the current as a function of time in the coil, and (b) the total charge that flows through the coil during the flip.

5. In the lab, you studied the behaviour of a coil of wire wrapped around an iron core. The coil was connected to the wall current (110V at 60Hz). When the current was turned on in the coil, a small light bulb with its own smaller coil, also went on. (a) Explain why the bulb lights and (b) estimate the mutual inductance of the system assuming that the bulb needs 1.5V to light when the wall current in the primary coil is 1.0A.