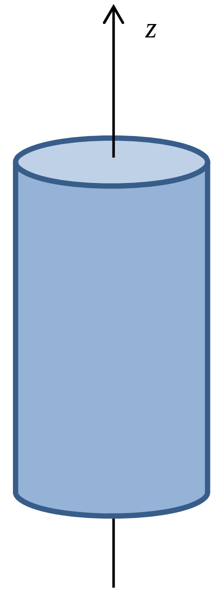
Lesson #39: The "Auxiliary" Field **Name: ________________________**

Study section 6.3 and example 6.2. Then answer the following questions.

Consider a simple cylindrical magnet (radius R) having a uniform "frozen-in" magnetization given by $\vec{\mathbf{M}}(\vec{r}) = M_0 \hat{z}$, where M_0 is a constant. There are no free currents in this problem, and you may assume the magnet is infinitely long.



1. Neatly sketch and clearly label the following: $\vec{\mathbf{M}}, \vec{\mathbf{B}}, \vec{\mathbf{H}}, \vec{\mathbf{K}}_{\mathbf{b}}$, and $\vec{\mathbf{J}}_{\mathbf{b}}$. Only consider the region inside ($s < R$) the magnet.

2. Calculate the bound current densities (magnitude and direction).

   $\vec{\mathbf{K}}_{\mathbf{b}} =$

   $\vec{\mathbf{J}}_{\mathbf{b}} =$

3. Using Ampere's law for $\vec{\mathbf{B}}$ and your results from question 2, determine the magnetic field (magnitude and direction) inside ($s < R$) the magnet. Be sure to sketch your Amperian loop.

4. To check your answer to question 3, use Ampere's law for $\vec{\mathbf{H}}$ to determine the auxiliary field inside the magnet, and then use the relation between $\vec{\mathbf{H}}$ and $\vec{\mathbf{B}}$ to determine the magnetic field.

5. Comment on the ways in which this cylindrical magnet is similar to a well-studied example from Chapter 5.