Monday Reading Assessment: Unit 4, Sources of Magnetic Fields

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1 Memory Bank

- $\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{\rm enc}$ ... Ampère's Law
- $\vec{B} = \mu_0 (N/L) I_{\rm enc} \hat{z}$ ... *Solenoid B-field.*
- $\vec{B} = \mu_0 I/(2\pi r)$ ... B-field of a wire a distance r away from it.

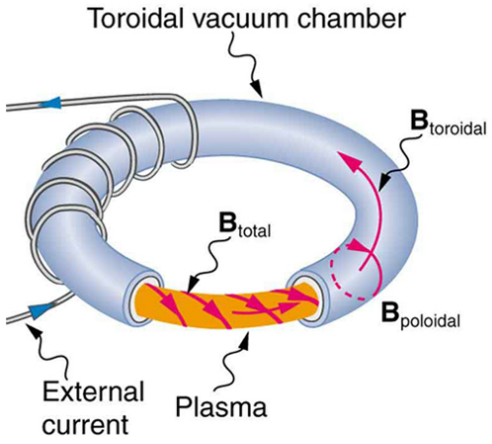

Figure 1: A basic diagram of a *toroid*, which is a solenoid wrapped into a circular tube.

2 Solenoids and Toroids

1. What is the B-field inside a solenoid with 1000 turns per meter, carrying a current of 10 A?

2. Consider Fig. 1. Suppose the current is 10 Amps, and the number of total turns is 4000. If the radius of the toroid in Fig. 1 is 2 meters, what is the toroidal B-field inside of it?

3. Suppose plasma is trapped inside the toroid, and has an effective current of 0.1 Amp. What is the *poloidal* field that results from this current, at a distance of 0.5 m from the center of the plasma, corresponding to the radius of the pipe?