AMPÈRE'S LAW

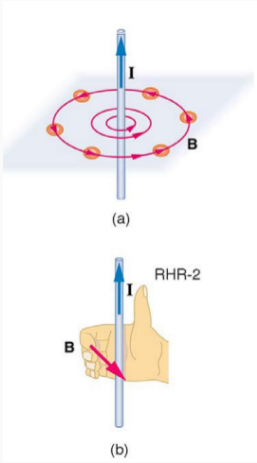

Figure 1: *Ampere's Law* gives several important results for B-fields generated by currents.

The uniform B-field of a wire of current I at a distance R is

$$\vec{B} = \frac{\mu_0 I}{2\pi R}\hat{\phi} \tag{1}$$

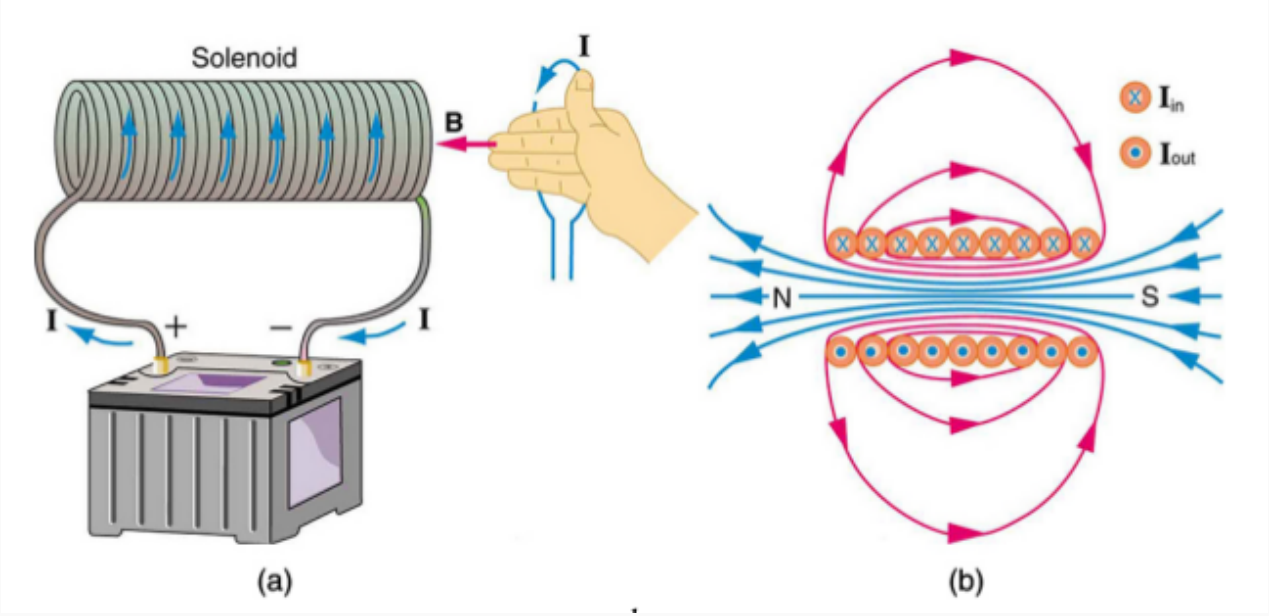

Figure 2: A *solenoid* creates a uniform B-field via *Ampere's Law*.

The uniform B-field is proportional to the coils per unit length, and the current.

$$\vec{B} = \mu_0 \frac{N}{L} I\hat{x} = \mu_0 n I\hat{x} \tag{2}$$

AMPÈRE'S LAW

1. How strong is the B-field strength inside a solenoid with 10,000 turns per meter that carries 20.0 A?
2. What is the B-field strength a distance of 1 m from a wire carrying a current of 1.0 A?
3. What is the field inside a 2.00-m-long solenoid that has 2000 loops and carries a 1600-A current?
4. Nonnuclear submarines use batteries for power when submerged. (a) Find the magnetic field 50.0 cm from a straight wire carrying 1200 A from the batteries to the drive mechanism of a submarine. (b) What is the field if the wires to and from the drive mechanism are side by side? (**Draw a diagram to help explain**). (c) Discuss the effects this could have for a compass on the submarine that is not shielded.