

Mapping the magnetic field

Review the textbook on *Magnetic Field of Current Loops and Solenoids*:

- **Phys 1402:** Serway/Vuille: Section 19.9.
- **Phys 2426:** Serway/Jewett: Example 30.3, Section 30.4, Quick Quiz 30.5.
- **Solenoid Magnetic Field:** $B = \mu_0 NI/\ell$, where $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$

1. Figure 1 illustrates field lines for Electric and Magnetic fields. Would it be correct to say that magnetic poles (north and south) are similar to the electric charges (positive and negative)? Explain.
(No; while each of the electric charges is the actual source of the field and can exist independently, the magnetic poles are only the indicators of the direction of the field and are inseparable. For every north pole on an object, there is a south pole somewhere else on the object.)

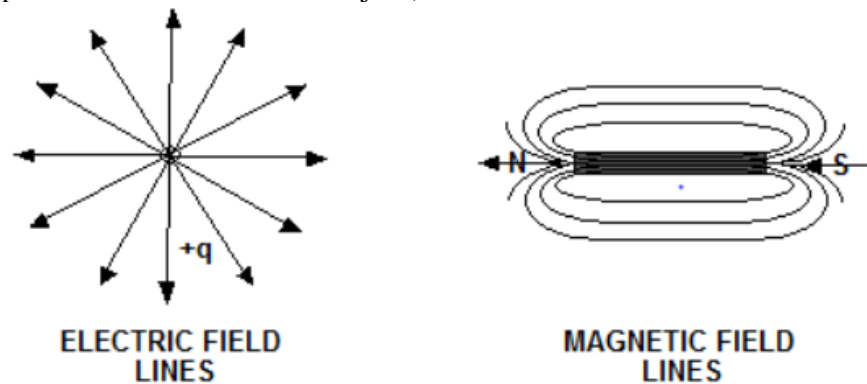


Figure 1. Diagrams of the most basic electric and magnetic fields.

2. Figure 1 illustrates field lines for Electric and Magnetic fields. How similar and how different are the field lines of the fields? Explain.
(Both field lines indicate the direction and the strength of each field; however, electrical field lines have the beginning (+) and the end (-) while the magnetic field lines run in loops)
3. A solenoid of 200 loops is 25 cm long. What is the magnitude of the magnetic field in the center of this solenoid when a current of 2 A is passing through it?
(2 mT)
4. A solenoid of 2000 loops is 20 cm long. What current will produce a magnetic field of $B = 10 \text{ mT}$ in the center of this solenoid?
(0.8 A)
5. What should be done to the potential difference across the solenoid in order to decrease the magnitude of the magnetic field in the center of it five times?
(The potential difference across the solenoid should be reduced 5 times)
6. What should be done to the potential difference across the solenoid in order to change the direction of magnetic field in the center of it without changing the magnitude?
(The potential difference across the solenoid should be reversed)