It is likely that magnetic fields will appear on the exam. Make sure to study the right-hand rule.

Chapter 29: Magnetic Fields

A magnetic field can exert force on any moving charge. The force $\vec{F}$ on a charge $q$ is

$$\vec{F} = q\vec{v} \times \vec{B}$$

where $\vec{v}$ is the velocity of the charge, and $\vec{B}$ is the magnetic field vector at the present location of the charge. Magnetic field is measured in teslas (T), where $1\, \text{T} = \text{N/A} \cdot \text{m}$.

Problems: Chapter 29 # 1, 3

Chapter 30: Sources of the Magnetic Field

A long, straight, current-carrying wire produces a magnetic field whose magnitude is determined by the following equation:

$$B = \frac{\mu_0 I}{2\pi r}$$

You can determine the direction of this magnetic field using the right-hand rule.

A current-carrying solenoid (coil of wire) produces a nearly uniform magnetic field inside, with magnitude given by

$$B = \mu_0 n I$$

Here $I$ is the current and $n$ is the number of turns per unit length in the solenoid.

Problems: Chapter 30 # 2, 35  Answers: $2.000 \, \mu$

Chapter 31: Faraday's Law

The magnetic flux through a loop of wire is equal to the magnetic field through the loop multiplied by the area:

$$\Phi_B = BA$$
Faraday's law states that an emf (or potential difference) results whenever the magnetic flux through a loop of wire changes:

\[
\mathcal{E} = -\frac{d\Phi_B}{dt}
\]

Usually \( A \) is constant, in which case \( \frac{d\Phi_B}{dt} = A \frac{dB}{dt} \). According to Lenz's law, the induced emf always opposes the change in the magnetic field.

For a solenoid, the emf must be multiplied by the number of turns:

\[
\mathcal{E} = -N \frac{d\Phi_B}{dt}
\]

**Problems:** Chapter 31 # 2, 7  **Answers:** 2. 0.8 mA