

Chapter 6 Electricity and Magnetism

Electric Charge

- Fundamental property of certain elementary particles of which all matter is composed
- Two kinds
 - o **Positive and negative**
 - Same signs repel each other
 - Opposite signs attract each other
- Unit of charge is the *coulomb*
 - o All charges occur in multiples of $e = 1.6 \times 10^{-19}$ C

Composition of atoms

- Electrons (-e), protons (+e), neutrons (no charge)
 - o Protons and neutrons have almost equal masses (nearly 2,000x greater than the electron mass)
- Ions
 - o **Positive** – atom that has lost one or more electrons
 - o **Negative** – atom that has picked up one or more electrons

Electric Current

- A flow of charge from one place to another
 - o Measured in the *ampere (A)*
 - Equal to 1 coulomb per second
- Charge flows easily through a **conductor**, more difficulty through a **semiconductor**, with great difficulty through an **insulator**
 - o No resistance at all to the flow of charge in a **superconductor**

Potential Difference (or voltage) between two points is the work needed to take a charge of 1 C from one of the points to the other

- Unit of Potential Difference is the **volt**
 - o Equal to 1 joule/coulomb

Ohm's Law

- Current in a metal conductor is proportional to the potential difference between its ends and inversely proportional to its **resistance**
 - o Unit of resistance is the *ohm* = to 1 volt/ampere

The **power** of an electric current is the rate at which it does work

Every electric current (and moving charge) has a **magnetic field** around it that exerts a sidewise force on any other electric current (or moving charge) in its presence.

- All atoms contain moving electrons, and **permanent magnets** are made from substance, notably iron, whose atomic magnetic fields can be lined up instead of being randomly oriented

Electromagnetic Induction refers to the production of a current in a wire when there is relative motion between the wire and a magnetic field

The direction of an **alternating current** reverses itself at regular intervals

- In a **transformer** an alternating current in one coil of wire induces an alternating current in another nearby coil.
 - o Depending on the ratio of turns, the induced current can have a voltage

Chapter 7

Waves

- Carry energy from one place to another by a series of periodic motions of the individual particles
- **Longitudinal waves** the particles vibrate back in forth in the direction in which the wave travels
 - o Sound waves
- **Transverse waves** particles vibrate from side to side perpendicular to the wave direction
 - o Ex: waves in a stretched string
- Water waves are a combo of both

Frequency

- Number of crests that past a particular point per second

Period

- Time needed for a complete wave to pass a particular point

Wavelength

- Distance between crests or troughs

Amplitude

- Maximum displacement of a particle of the medium on either side of its normal position when the wave passes

Doppler Effect

- The change in frequency of a wave when there is relative motion between its source and an observer