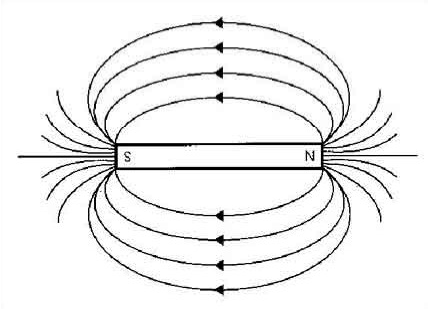
Class 10
Magnetism & Electromagnetism



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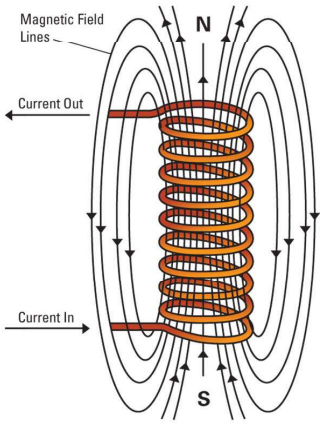
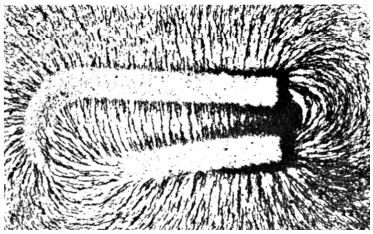
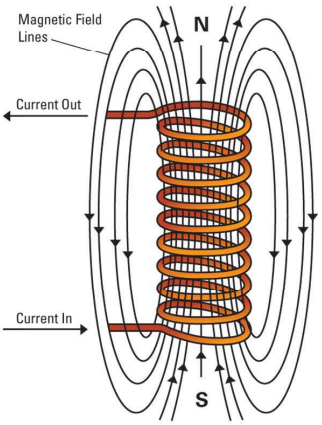
- Magnetism
  - The tendency of materials to respond to magnetic fields.
    - From electron current flow (electro-magnets)
    - From quantum spins (Ferro-magnets)



- Magnetism
  - Terms
    - *Magnetic field* – the space around a permanent magnet or current carrying conductor that has magnetic lines of force





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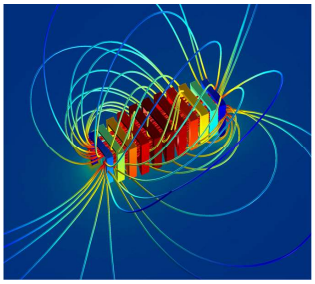

- Magnetism
  - Terms
    - *Magnetic flux* – the sum of all magnetic lines of force (Φ) created by a magnet
      - Weber – 10^8 field lines
    - Flux rules
      - Lines are continuous
      - Flow from North to South
      - Take shortest / easiest path
      - Lines in same direction additive
      - Lines in different direction subtractive
      - Do not cross

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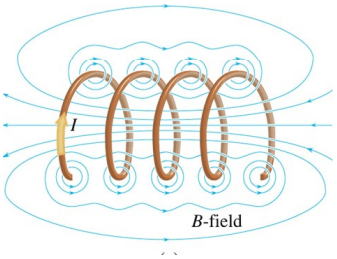
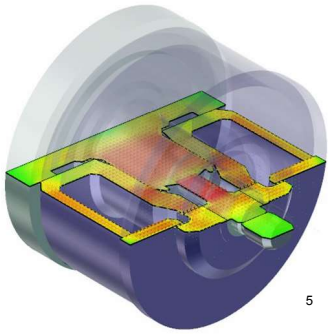
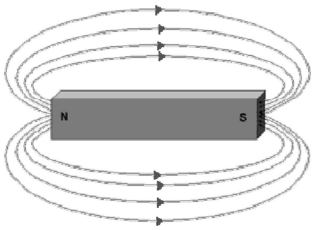
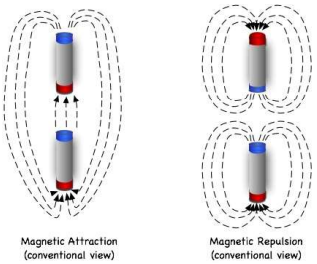
- Magnetism
  - Terms
    - *Flux density* – the magnetic flux per cross-sectional area
      - Tesla – 1 weber per square meter





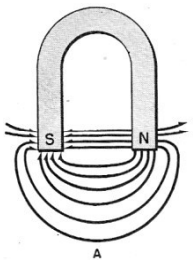
- Magnetism
  - Terms
    - *Magnetic Poles* – the concentration of magnetic lines of force in a limited region.
    - Magnetic Polarity
      - North – magnetic pole attracted to Earth's North pole
      - South – magnetic pole attracted to Earth's South pole



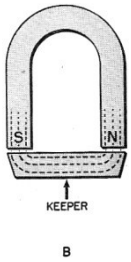


Opposites attract, likes repel [6]

- Magnetism
  - Terms
    - *Reluctance* – the opposition to the flow or concentration of magnetic lines of force
    - *Permeability* – the ability to conduct or concentrate magnetic lines of force

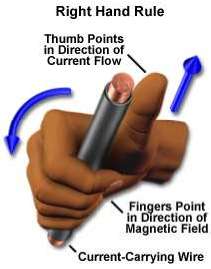


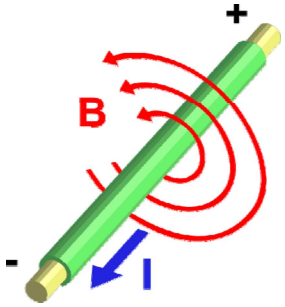
Air has greater reluctance than iron

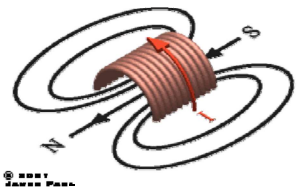


Iron has greater permeability then air

- Electro Magnetism
  - Hans Orsted – Copenhagen 1820
    - Current in motion creates a magnetic field







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- Electro Magnetism
  - Field strength control
    - Number of coil turns
    - Current through coil
    - Coil area
    - Type of core (reluctance)

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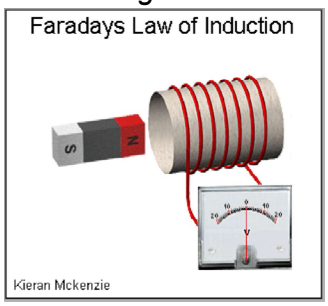
- Electro Magnetism (induction)
  - Michael Faraday - 1831
    - *The induced electromotive force or EMF in any closed circuit is equal to the time rate of change of the magnetic flux through the circuit.*
    - *Voltage = flux x length x relative velocity*



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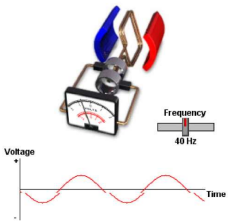
- Electro Magnetism (induction)
  - Generator action
    - The conversion of mechanical energy (torque) into electrical energy
    - Induced voltage is directly proportional to the number of coil turns and the rate the conductor cuts through magnetic lines of force



$$V_{ind} = N \times \frac{Wb}{s}$$

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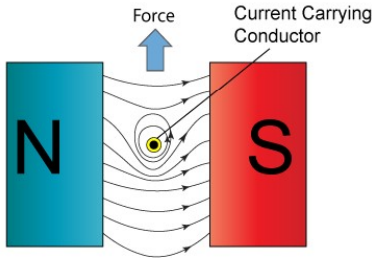
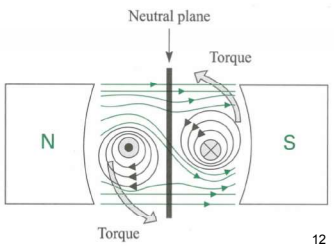
- Electro Magnetism (induction)
  - Motor action
    - AKA Lorentz Force
    - The conversion of electrical energy to mechanical energy
    - Force on a conductor is created by field addition & subtraction
    - Force is normal to current and magnetic field (left hand rule)
    - *Force = field strength x current x length (F=BIL)*





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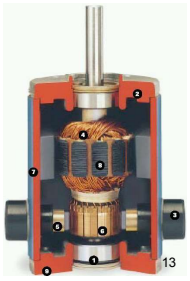
- Electro Magnetism (induction)
  - Lenz's Law – Counter electromotive force (CEMF)
    - *An induced current is always in a direction to oppose the motion or change causing it*
    - *Every motor is a generator*

$$I_{\exp} = \frac{EMF_{applied}}{R_{measured}}$$

$$I_{act} = \frac{EMF_{applied} - CEMF}{R_{measured}}$$



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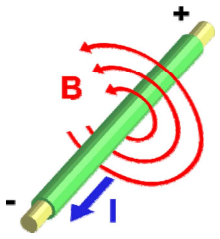
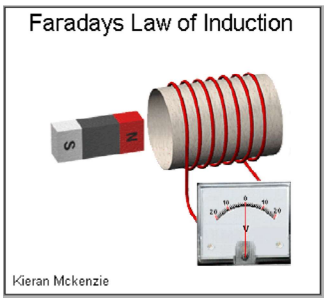
- Electro Magnetism
  - *Electricity & magnetism*
    - *Electron flow creates magnetic forces*
      - *Magneto-motive force*
    - *Magnetic forces creates electron flow*
      - *Electro-motive force*





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- Lab 10 – Light Operated Switch

Learning Objectives

- Understand the function of a light dependent resistor
- Understand the function of a comparator (the LM311)
- Measure electrical values using a digital voltmeter

		Points Possible
Documentation	Quality of documentation (neatness, clarity, spelling, grammar), Expected and measured values recorded on schematic diagram	**10**
Circuit 1	Resistance values and divider voltage recorded in data table	**5**
Circuit 2	Comparator input and output voltages recorded in data table	**5**
	Comparator input and output voltages recorded in data table (with R1 & LDR reversed)	**5**
Conclusions	Questions answered completely & accurately	**10**
	Total	**35**

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