Exam 1

- Scientific Method
- Measurements
  - Metric System
  - Sig Figs
- Mass/Density
- Speed, velocity and acc.
- Electric Field
- Electric Potential
- Electric Current
- Electrical Resistance
- Ohm's Law
- Electric Circuits
- Magnetism
- Faraday's Law
  - Applications

1

PS301

- Measurement— *numerical value* with *units*

ex-

- 20.02 volts
- 25000 KΩ
- 6023 radioactive β counts

2

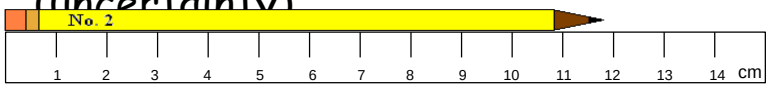
The Fundamental SI Units

Physical Quantity	*Name of Unit*	*Abbreviation*
Mass	kilogram	kg
Length	meter	m
Time	second	s

3

Length

- Measurements are made by instruments
- Instruments have different precision (uncertainty)



1.0
±0.1

between 11.8 and 12 cm

11.9 cm

caliper

22.00 mm

4

Sec 2.8

Density

- Mass of substance per unit volume of the substance.
- Common units are g/cm^3 or g/mL.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

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EXAMPLE	DENSITY (*d*)
Solids	
ice	0.917 g/cm^3 or g/mL
rubber	1.19
magnesium	1.74
aluminum	2.70
iron	7.87
lead	11.3
gold	19.3
Liquids	
ethyl ether	0.714 g/cm^3 or g/mL
ethyl alcohol	0.789
water	1.00
chloroform	1.48
mercury	13.6
Gases*	
hydrogen	0.090 g/L
helium	0.179
ammonia	0.760
air	1.29
oxygen	1.43

*The density value for each gas is given at 0 °C and a pressure equal to normal atmospheric pressure.

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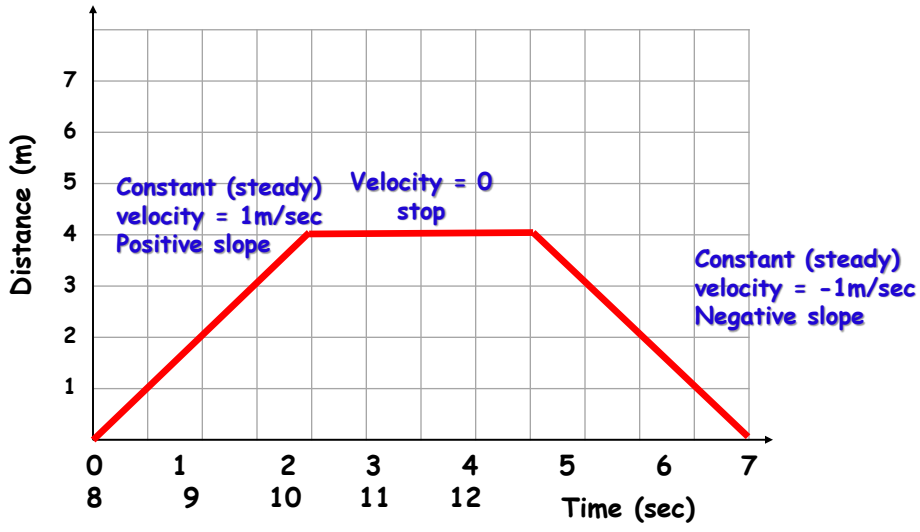
Displacement vs time graphs



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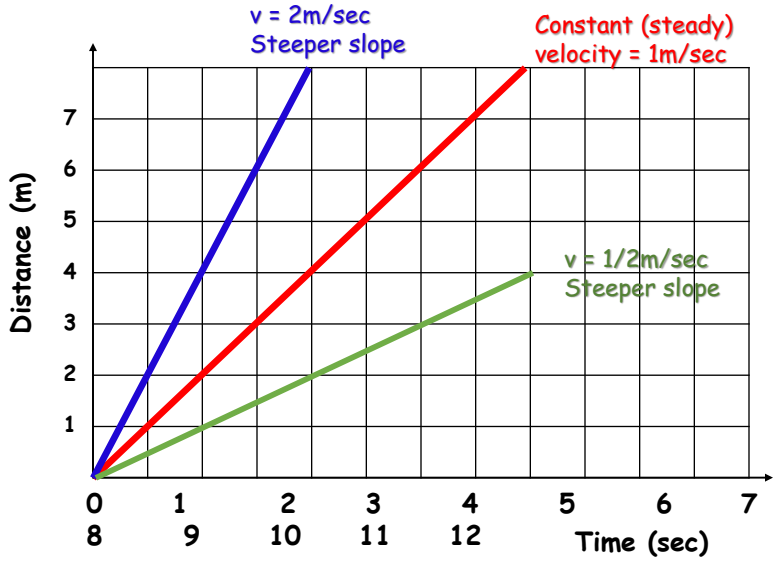
Displacement vs time graphs



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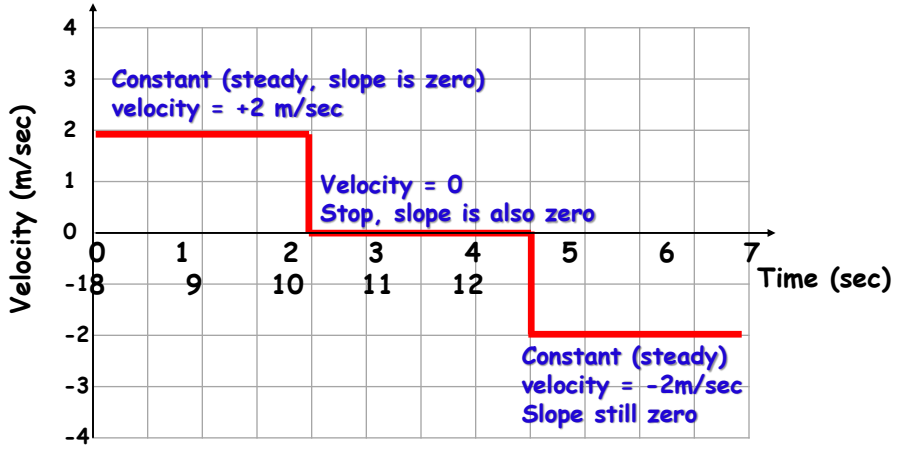
Velocity vs time graphs



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Excel

Table 1. Effect of Temperature on Rate of Solubility.

Title

Temperature of solvent (°C)	Rate of Solubility (g/sec)
-20	0.0
-10	0.0
0	0.0
10	0.0
20	0.0
30	0.0
40	0.0
50	5.3
60	6.7
70	8.8
80	11.4

Quantity name with Units in parenthesis

No units needed with individual numbers since units are given at top of column

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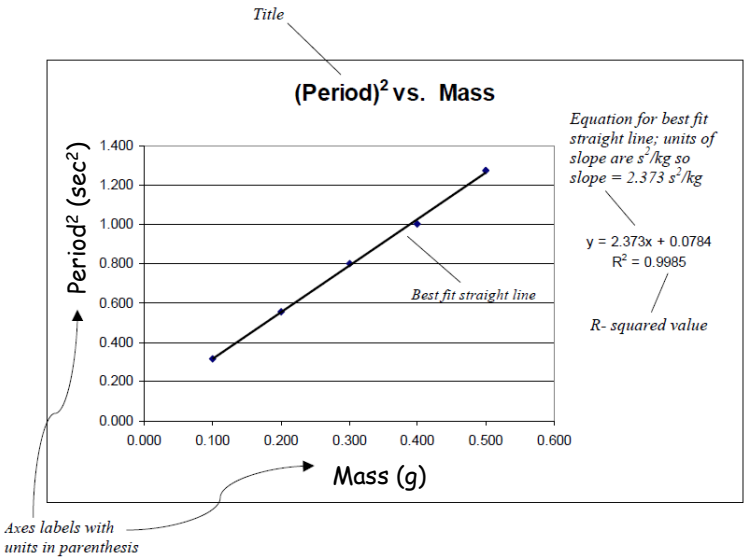
Excel



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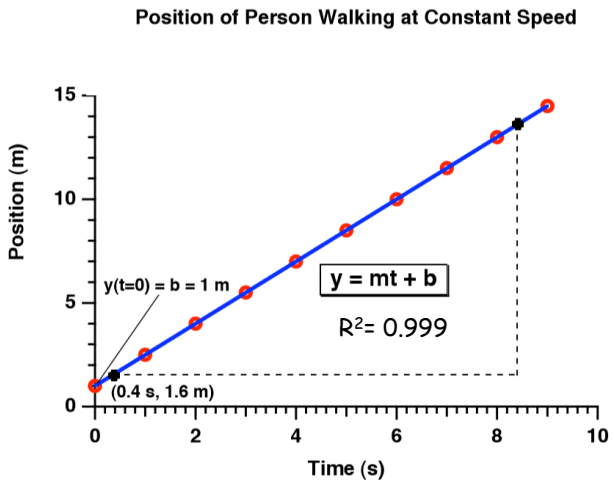
Graphs



A graph is a illustrative representation of how one variable behaves as a function
For this graph, the slope (m) is the change in position over time, speed.

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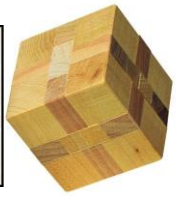
Labs 7 -9 Electricity

What is a conductor?

What is an insulator?



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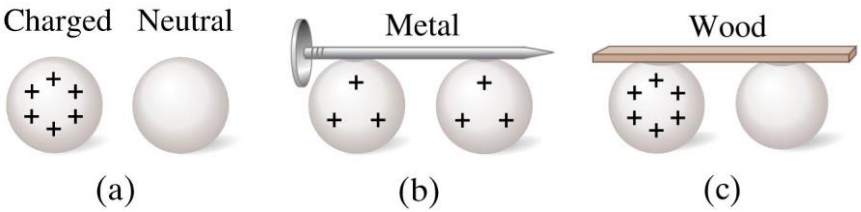
Insulators and Conductors

Conductor:	Insulator:
Charge flows freely	Almost no charge flows
Metals	Most other materials

Some materials are semiconductors.



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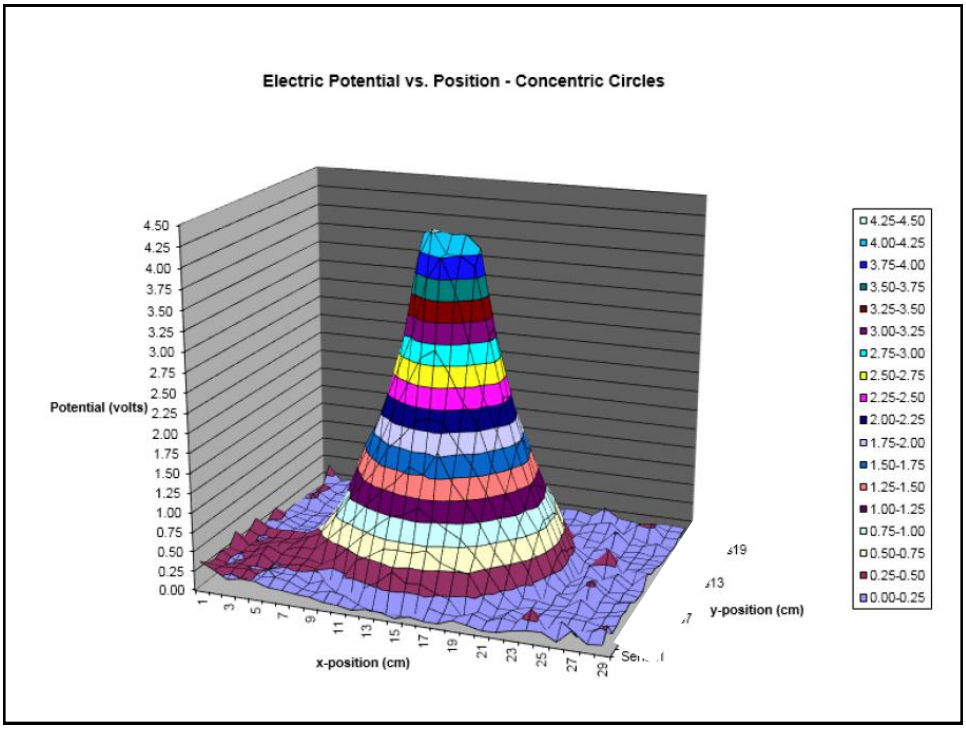

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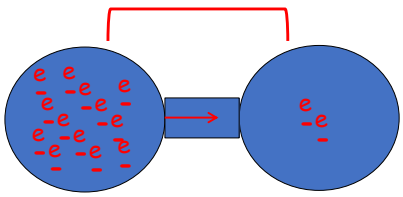
Electric Potential & Resistance

Electric potential,
Voltage, *V (volts)*



Conductor

Flow of electrons= current, ***I (Amps)***

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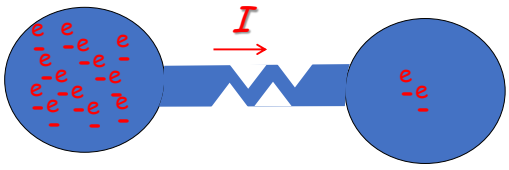
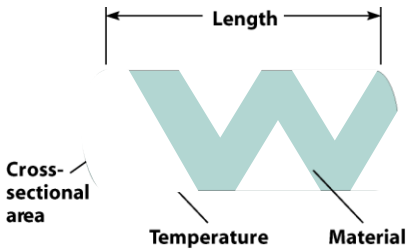
More on Resistance





- Resistance factors
  - Type of material
  - Length
  - Cross-sectional area
  - Temperature
- Superconductors
  - Negligible resistance at very low temperatures

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Ohm's Law

Ohm's Law

relationship between current, voltage, and resistance

Current in a circuit varies in direct proportion to the potential difference (voltage) and inversely with the resistance:

$$\text{current} = \frac{\text{voltage}}{\text{resistance}} \quad \text{or} \quad I = \frac{V}{R}$$

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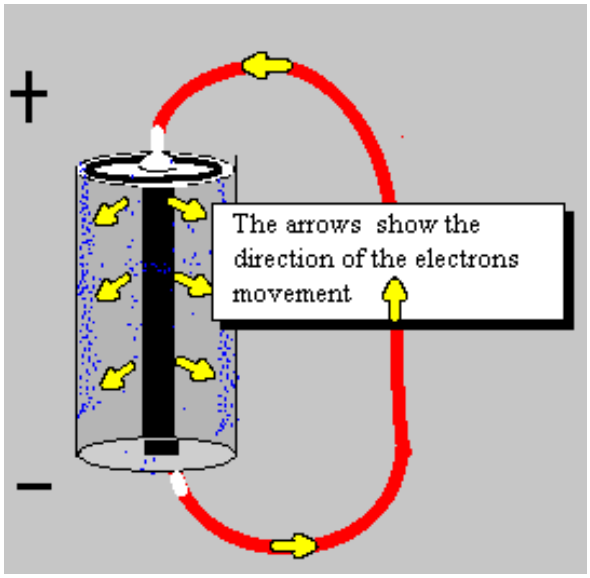
Voltage Sources



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Current

- Electric current is given the symbol, **I**
- Electric current is the movement of negative charges (electrons) in a Circuit
- Current is the amount of charge flowing per second and is given the unit Amps (A)

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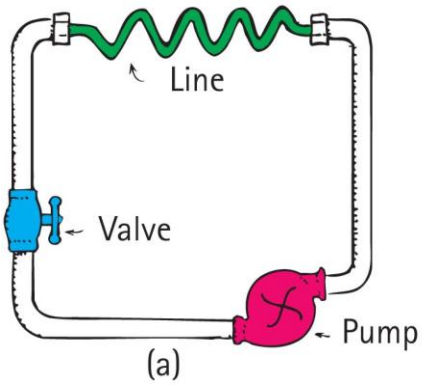
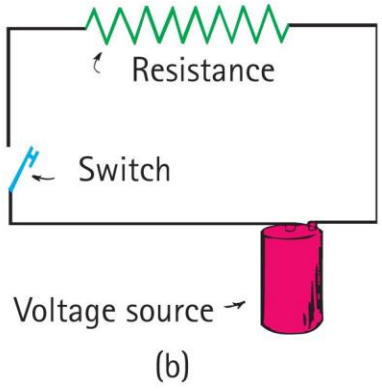
Resistance

Electric potential difference (continued)

- Water and electric circuits compared





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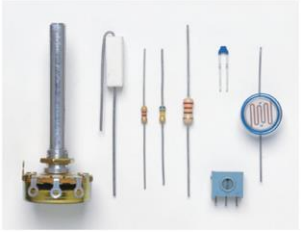
Resistors

Standard resistors are manufactured for use in electric circuits; they are color-coded to indicate their value and precision.

The resistance of a wire is directly proportional to its length and inversely proportional to its cross-sectional area:

$$R = \rho \frac{\ell}{A}$$



The constant ρ, the resistivity, is characteristic of the material.

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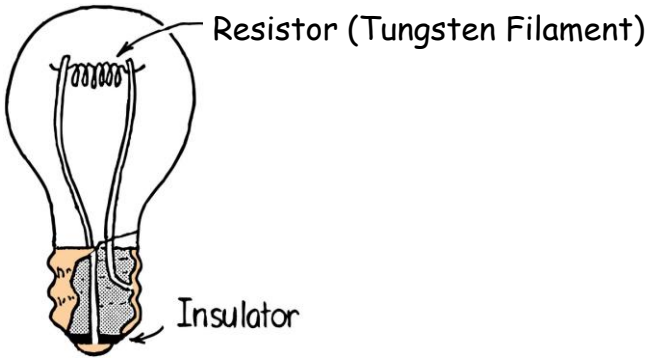
Electric Resistance

- Light Bulb



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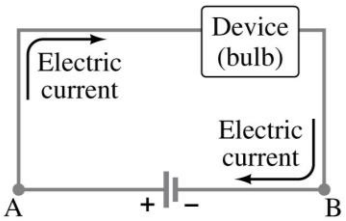
Electric Circuits

Electric circuits:

any closed path along which electrons can flow

for continuous flow — no gaps (such as an open electric switch)



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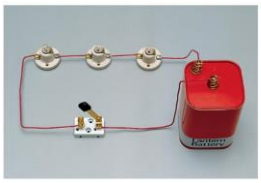
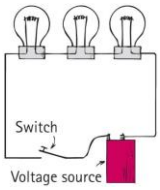
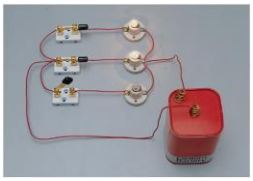
Electric Circuits

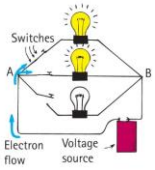
Devices connect to a circuit in one of two ways:

- Series
- Parallel









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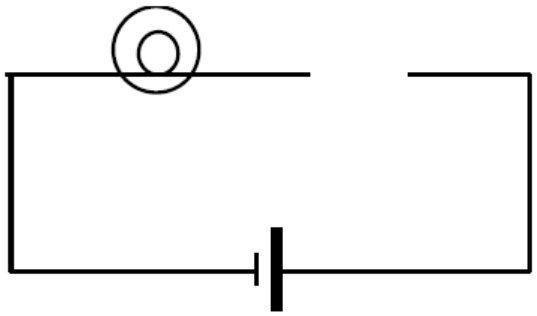
Circuits in Series



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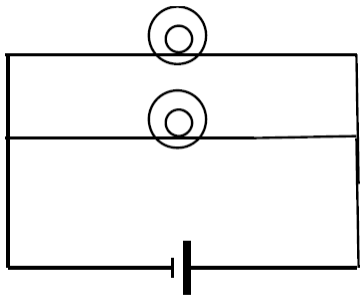
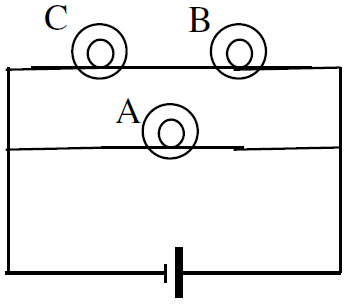
Circuits in Parallel





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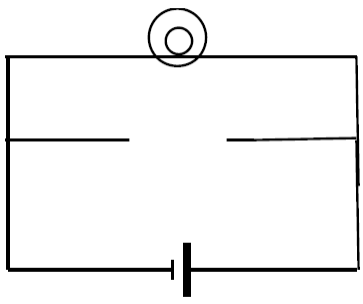
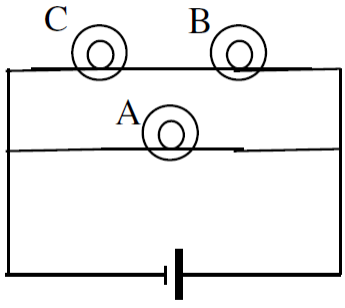
Circuits in Parallel





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Ohm's Law

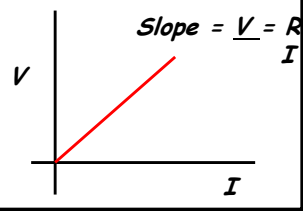
Ohm's Law

relationship between current, voltage, and resistance

Current in a circuit varies in direct proportion to the potential difference (voltage) and inversely with the resistance:

$$\text{current} = \frac{\text{voltage}}{\text{resistance}}$$

Solving for R, $R = \frac{V}{I}$



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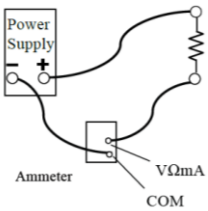
Instruments, devices



brown-black-brown color code

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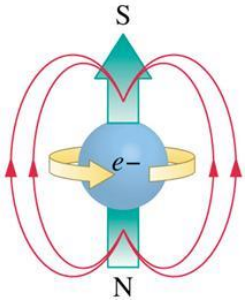
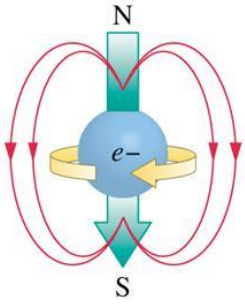
Ferromagnetism

Ferromagnetic materials are those that can become strongly magnetized, such as iron and nickel.

These materials are made up of tiny regions called domains; the magnetic field in each domain is in a single direction.





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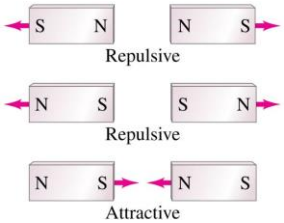
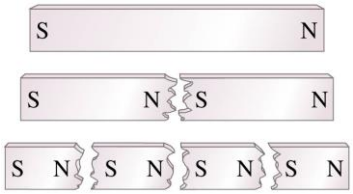
Magnetic Poles

Magnets have two ends—poles—called north and south.

Like poles repel; unlike pol





If you cut a magnet in half — get two smaller magnets.

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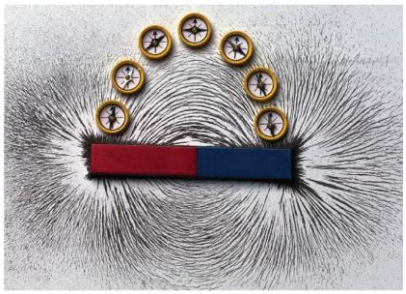
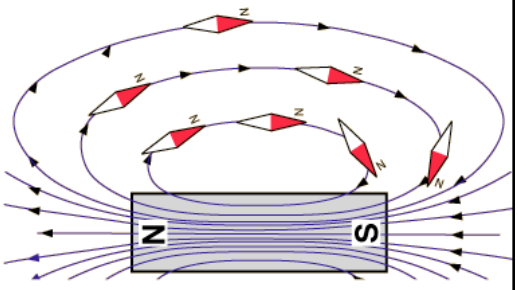
Magnets and Magnetic Fields

Magnetic fields can be visualized using magnetic field lines, which are always closed loops.





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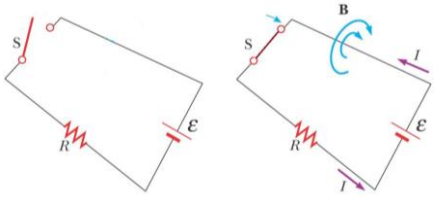
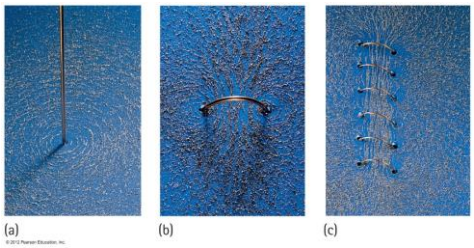
Electricity and Magnetism-EMF



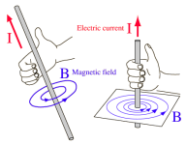


Switch Open: No current
And no magnetic field

Switch Closed: Current increases, creates and magnetic field or electromagnetic field (EMF)

Magnetic field intensity

- increases as the number of loops increase in a current-carrying coil



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Electromagnetic Induction and Faraday's Law

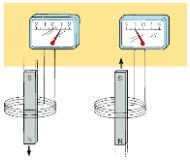
Michael Faraday
1791- 1867

Causes:

- Relative motion between magnetic fields and conductors
- Changing magnetic fields near conductors

Effect:

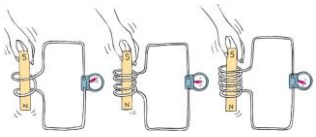
- Induced voltages and currents



Induced voltage depends on:

- Number of loops
- Strength of magnetic field
- Rate of magnetic field change

Faraday's law
the induced voltage in a coil is proportional to the number of loops, multiplied by the rate at which the magnetic field changes within those loops



More loops; more induct

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Quantity	Symbol	Unit of measure	Abbreviation
Distance	D	Meter	m
Time	t	Second	s
Mass	m	gram	g
Density	ρ	g/mL	
Velocity	*v*	Meter/sec	m/s
Acceleration	a	Meter/sec^2	m/s^2
Voltage	v	volts	v
Current	I	Amps	A
Resistance	R	Ohms	Ω

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