

## 8<sup>th</sup> grade Physical Science comprehensive study guide

### Unit 2 – Nature of Matter

atoms/molecules; atomic models; physical/chemical properties; physical/chemical changes; types of bonds; periodic table; states of matter; phase changes; elements/compound/mixtures; Law of Conservation of Matter

### Unit 3 – Transformation of Energy

forms of energy; Law of Conservation of Energy; transfer of heat; conductors/insulators; thermal expansion; nuclear fission/fusion

### Unit 4 – Waves and Electromagnetic Radiation

behavior of waves in different mediums; EM/ mechanical waves; EM spectrum; wave characteristics; Doppler effect; pitch/intensity

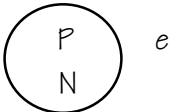
### Unit 5 – Force and Motion

force/mass/motion; acceleration; speed/velocity; balanced/unbalanced forces; Newton's Laws; types of friction; Law of Conservation of Momentum; simple machines; work; power, efficiency

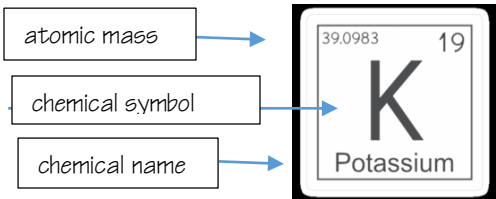
### Unit 6 – Forces in Nature

gravity; Law of Universal Gravitation; current; series/parallel circuits; magnets; electromagnets

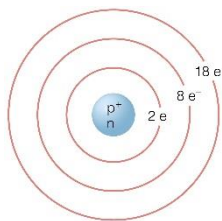
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subatomic particle	charge
proton	+
electron	-
neutron	0



Bohr model:



Electron dot model:



valence number – how many electrons at atom will gain or lose to fill up a level or go down one level. A complete shell is stable.

# Periodic Table of the Elements

# Periodic Table of the Elements

1																	18
1 H Hydrogen	2											13	14	15	16	17	18 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Cesium	56 Ba Barium	57-71 Lanthanides	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89-103 Actinides	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Uut Ununtrium	114 Uuq Ununquadium	115 Uup Ununpentium	116 Uuh Ununhexium	117 Uus Ununseptium	118 Uuo Ununoctium
57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium			
89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium			

Alkali Metals

Alkali-Earth Metals

Transition Metals

Lanthanides

Actinides

Poor Metals

Semi Metals

Non-Metals

Noble Gases

57-71  
Lanthanides

89-103  
Actinides

Layers of Learning

Periods



families

(also called groups)



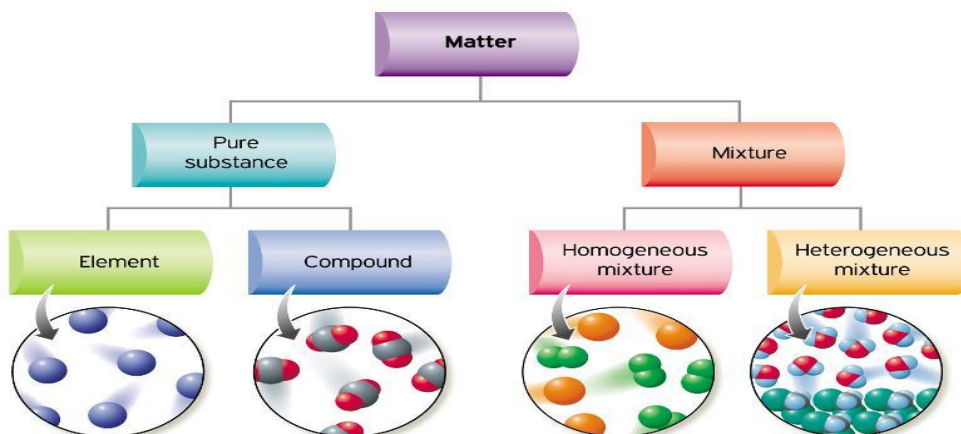
Layers of Learning

element type	properties
metal	good conductors of heat & electricity, luster, malleable, ductile, left side of periodic table
nonmetal	poor conductors of heat & electricity, dull, brittle, right side of periodic table
metalloid	properties of both metals & nonmetals, semiconductors, stair-step between metals/nonmetals

types of bonds:

ionic	N-M	Na Cl, Na F
covalent	N-N	H <sub>2</sub> O, CO <sub>2</sub>
polyatomic	3+ different elements	H <sub>2</sub> SO <sub>4</sub> , HCO <sub>3</sub>

elements, compounds and mixtures



A molecule is 2 or more atoms chemically combined. They might be two of the same kind of atom, like O<sub>2</sub>, or two different kinds of atoms, like CO<sub>2</sub>.

type of mixture	properties	examples
solution	solute dissolves completely in solvent	sweet tea, koolaid
colloid	small particles that remain suspended, filters light	milk, whipped cream,
suspension	larger particles that settle out, shake to mix	Italian dressing

	phase change	energy is...
vaporization	liquid to gas	gained
condensation	gas to liquid	lost
freezing	liquid to solid	lost
melting	solid to liquid	gained
sublimation	solid to gas	gained

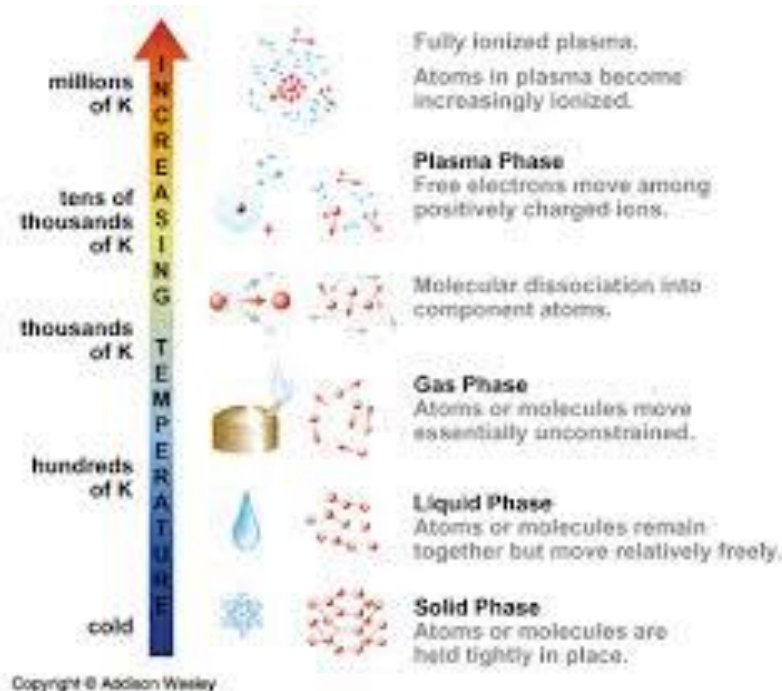
## Physical Properties

- Do not change what the object is



## Chemical Properties

- Tells you the types of changes matter can undergo



Examples of physical properties: smell, color, boiling point, freezing point, melting point, magnetivity, density.

Examples of chemical properties: reactivity with water, combustibility, ability to oxidize, pH

**Ask yourself if change is a matter of style or substance.**

**PHYSICAL (style) change**

Physical changes do not result in new substances. Water, whether ice, liquid or steam, is still H<sub>2</sub>O. Boiling point and freezing point are just two of several physical properties which identify water.

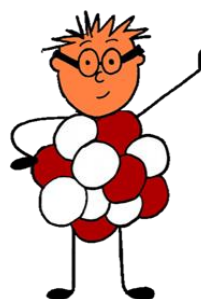
**CHEMICAL (substance) change**

Chemical changes produce new substances with different chemical makeups and properties than the original substance. When burned, wood produces new substances, one of which is called ash.

AND REMEMBER, WHETHER A CHANGE IN STYLE OR SUBSTANCE...

... ONLY CHANGES IN ENERGY PRODUCE CHANGES IN MATTER.

\*\*\*you can only observe a chemical property by undergoing a chemical change\*\*\*



You can change the appearance of matter, but the amount doesn't change. This is called the Law of Conservation of Matter



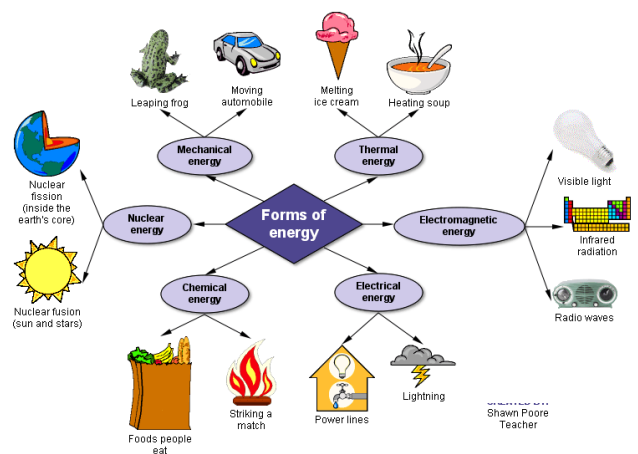
Energy can be sorted into two main categories:

Potential (stored or position)

Kinetic (motion)

- gravitational
- elastic
- chemical

An object with mechanical energy has both potential and kinetic energy.

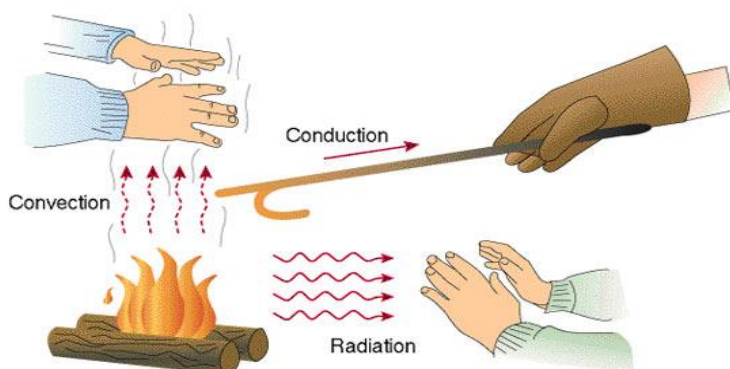
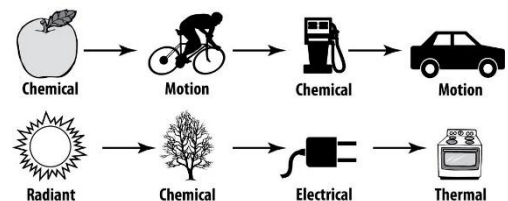


Remember MRS. CHEN

Mechanical – Radiant (EM) – Sound – Chemical – Heat (thermal) – Electrical – Nuclear

The Law of Conservation of Energy states that the total amount of energy in a system remains constant ("is conserved"), although energy within the system can be changed from one form to another or transferred from one object to another.

### Energy Transformations



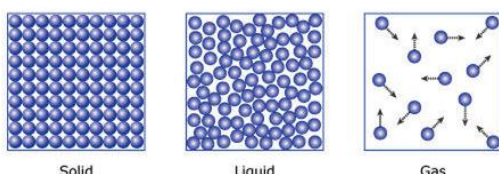
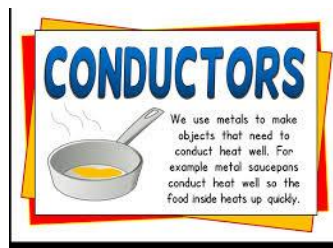
methods of heat transfer

vaporization	
evaporation	boiling
vaporization at the surface only	vaporization throughout

conduction – thermal energy transferred through the collision of molecules

convection – currents facilitate the transfer of heat (for example air currents – hot air rises, cooler air sinks)

radiation – method of heat transfer that does not require contact; may be transferred through space.



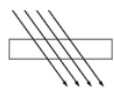
increasing thermal energy →

thermal expansion – as most objects gain thermal energy (heat up), they expand due to molecular movement. An exception to this is water which expands as it freezes.

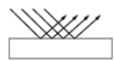
## Wave characteristics

There are 2 main kinds of waves – mechanical and electromagnetic (EM)

requires a medium		can travel in a vacuum (space)	
mechanical		electromagnetic	
transverse	longitudinal (compressional)	radio	<div> <div>↑</div> <div>decreasing energy</div> <div>decreasing frequency</div> <div>increasing wavelength</div> </div>
		microwaves	
		infrared	
		visible	
		ultraviolet	
		X-rays	
perpendicular particle movement	parallel particle movement	gamma	



transmitted



reflected



scattered

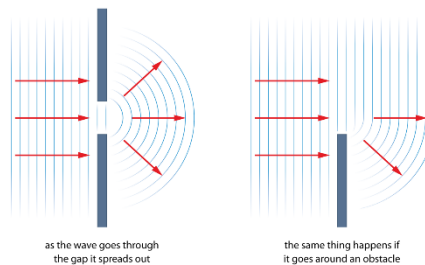


absorbed



refracted

## diffraction



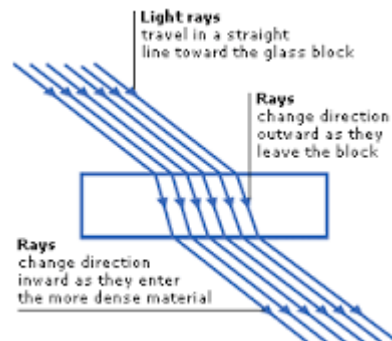
opaque



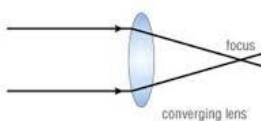
translucent



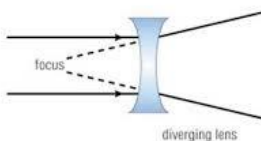
transparent



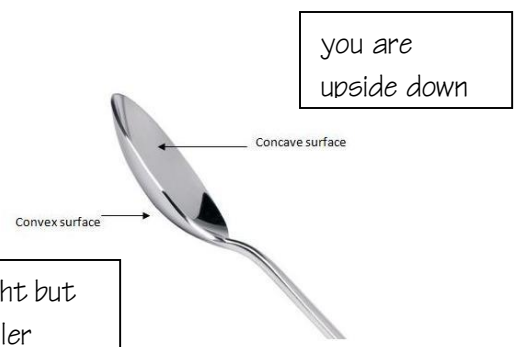
Light waves refract, or bend, as they enter a material with a different density. As they exit the material again, they will return to the original angle of incidence.



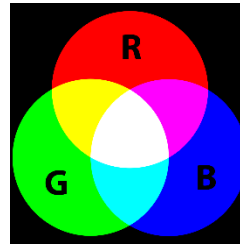
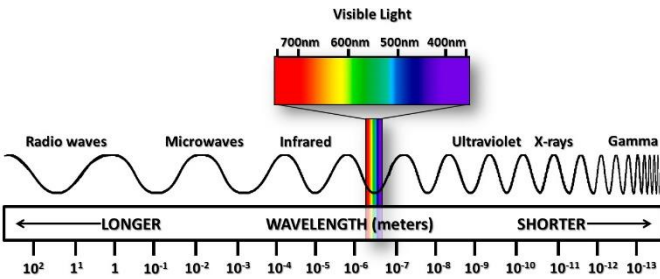
convex lens



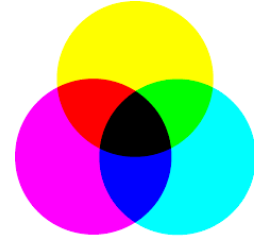
concave lens



visible light spectrum

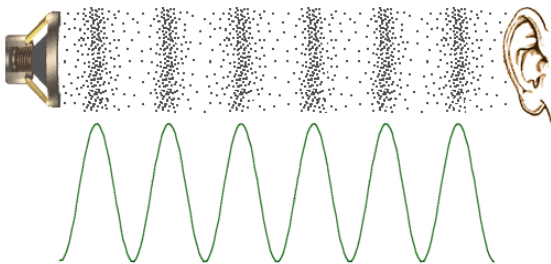


primary  
colors of  
light



primary  
colors of  
pigment

Sound waves are an example of compressional or longitudinal waves



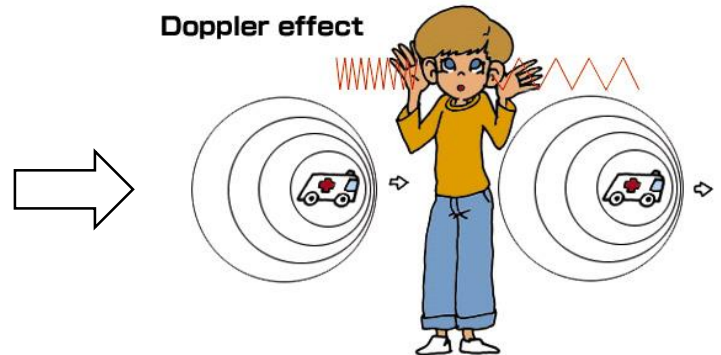
Pitch is determined  
by the frequency.  
Higher frequency  
equals higher pitch.

Loudness or intensity is  
determined by the  
amplitude. Greater  
amplitude equals louder  
or more intense sound.

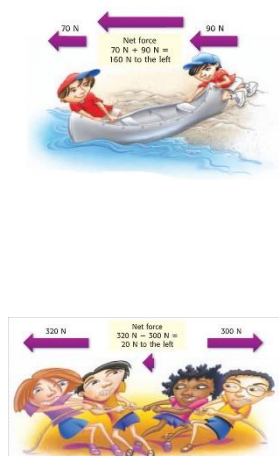
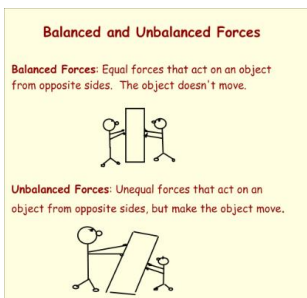
Remember that pitch is determined by frequency.

As the sound is approaching the observer, the air particles are compressed creating a higher frequency wave (higher pitch). After the vehicle passes, he is observing the more spread out, or lower frequency waves (lower pitch).

**Doppler effect**

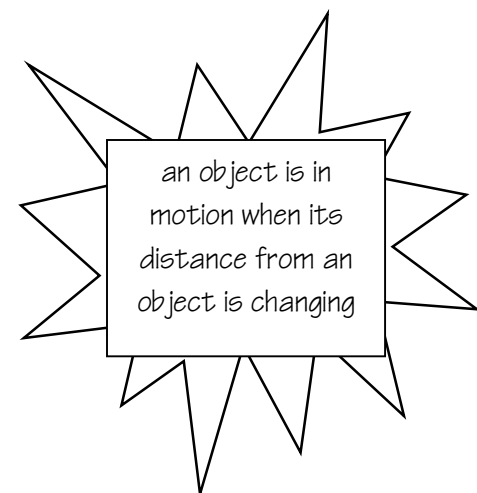


a force is a push or a pull



forces in  
the same  
direction  
are added

forces in  
opposite  
directions  
are  
subtracted



only unbalanced forces result in movement

Velocity Vs. Speed	
<b>Velocity:</b> Velocity is the <b>vector</b> quantity that signifies the magnitude of the rate of change of position and also the <b>direction</b> of an object's movement.	<b>Speed:</b> Speed is the scalar quantity that Signifies only the magnitude of the rate of change of an object's movement.
<b>Example:</b> 	<b>Example:</b> 

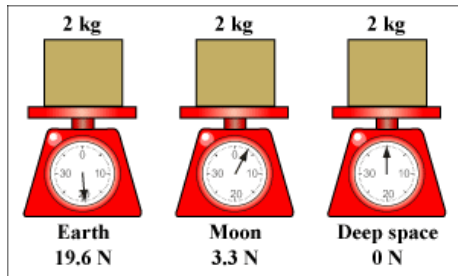
velocity and speed are not the same thing!

## Acceleration

**= change in velocity**

change in speed      Change in Direction      Change in both

weight is gravity's pull on an object's mass



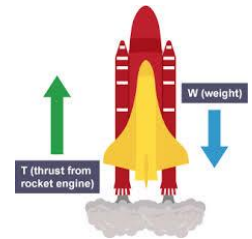
types of friction:

1. static (an object that is not moving)
2. sliding
3. rolling
4. fluid (liquids & gases)



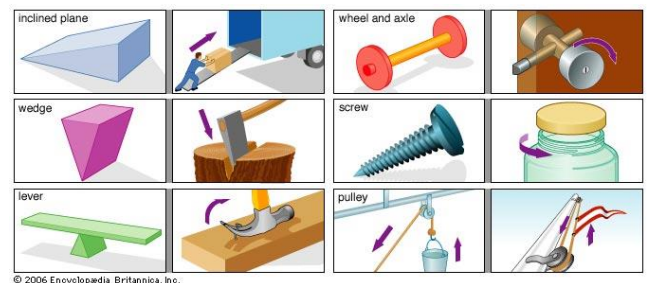
Newton's Three Laws of Motion:

1. Objects in motion tend to stay in motion, objects at rest stay at rest unless acted on by an outside force. (inertia)
2. Force = mass x acceleration
3. For every action there is an equal and opposite reaction.

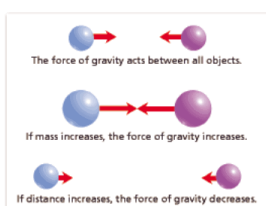


## SIMPLE MACHINES

Simple machines may convert one type of force to another, change the direction of an applied force or trade distance travelled for force applied.



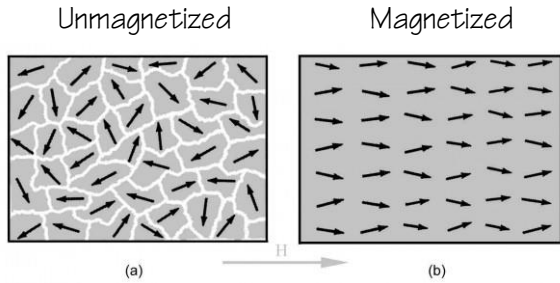
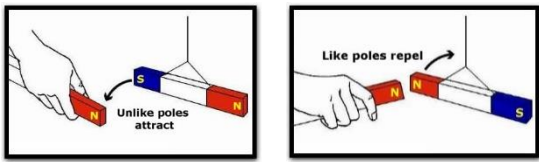
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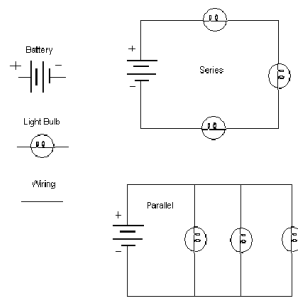
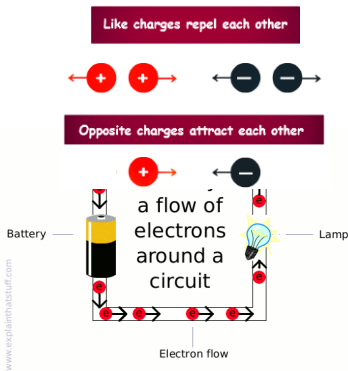
Every object exerts gravitational force on every other object. The force exerted depends on how much mass the objects have and the distance between them.



A magnet is a material that contains or is attracted to iron.



Some materials can become temporary magnets when their magnetic domains are aligned.

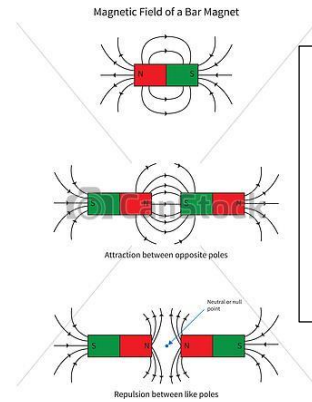


transfer of charges:

friction

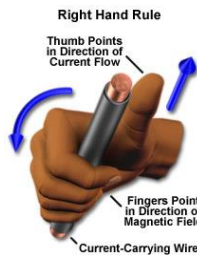
conduction

induction

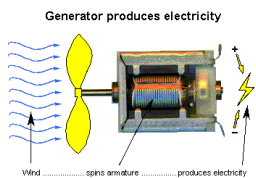


a magnetic field is the area in which a magnetic force can be exerted

An electric current produces a magnetic field. You can use the "Right hand rule" to determine the direction of the field

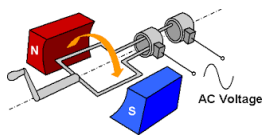
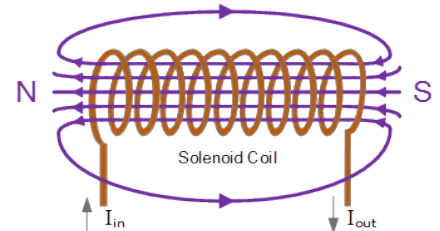


mechanical energy

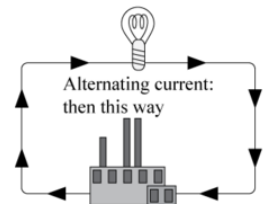
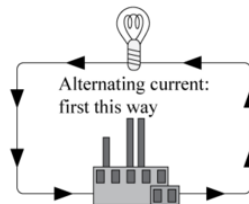


an electromagnet is a strong magnet that can be turned on and off

Electromagnetic field due to the flow of current



An electric motor works the opposite way – it transforms electrical energy into mechanical energy.





## 8<sup>th</sup> grade Physical Science content standards

S8P1. Students will examine the scientific view of the nature of matter.

- Distinguish between atoms and molecules.
- Describe the difference between pure substances (elements and compounds) and mixtures.
- Describe the movement of particles in solids, liquids, gases, and plasmas states.
- Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
- Distinguish between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change in color).
- Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.
- Identify and demonstrate the Law of Conservation of Matter.

S8P2. Students will be familiar with the forms and transformations of energy.

- Explain energy transformation in terms of the Law of Conservation of Energy.
- Explain the relationship between potential and kinetic energy.
- Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, sound) and their characteristics.
- Describe how heat can be transferred through matter by the collisions of atoms (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection).

S8P3. Students will investigate relationship between force, mass, and the motion of objects.

- Determine the relationship between velocity and acceleration.
- Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
- Demonstrate the effect of simple machines (lever, inclined plane, pulley, wedge, screw, and wheel and axle) on work.

S8P4. Students will explore the wave nature of sound and electromagnetic radiation.

- Identify the characteristics of electromagnetic and mechanical waves.
- Describe how the behavior of light waves is manipulated causing reflection, refraction, diffraction, and absorption.
- Explain how the human eye sees objects and colors in terms of wavelengths.
- Describe how the behavior of waves is affected by medium (such as air, water, solids).
- Relate the properties of sound to everyday experiences.
- Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

S8P5. Students will recognize characteristics of gravity, electricity, and magnetism as major kinds of forces acting in nature.

- Recognize that every object exerts gravitational force on every other object and that the force exerted depends on how much mass the objects have and how far apart they are.
- Demonstrate the advantages and disadvantages of series and parallel circuits and how they transfer energy.
- Investigate and explain that electric currents and magnets can exert force on each other.