8th grade Physical Science comprehensive study guide

50%

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

40%

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

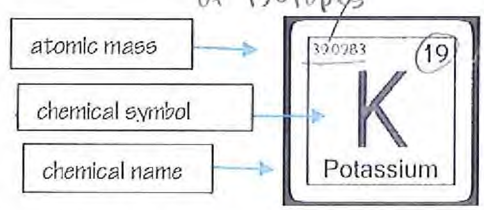
force/mass/motion; acceleration; speed/velocity; balanced/unbalanced forces; Newton's Laws; types of friction; Law of Conservation of Momentum; simple machines; work; power, efficiency

Unit 6 – Forces in Nature

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

---

not a whole number because its an avg. of isotopes



p.e

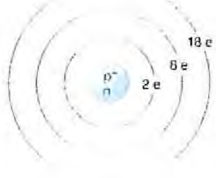
p - 19
e - 19
n - 20

mass − number = neutrons

subatomic particle		charge	amu
proton	nucleus	+	1
electron	outside	-	0
neutron	nucleus	0	1

group	val. e	
1	1	+1
2	2	+2
13	3	+3
14	4	±4
15	5	−3
16	6	−2
17	7	−1
18	8	0

Bohr model:



Electron dot model:

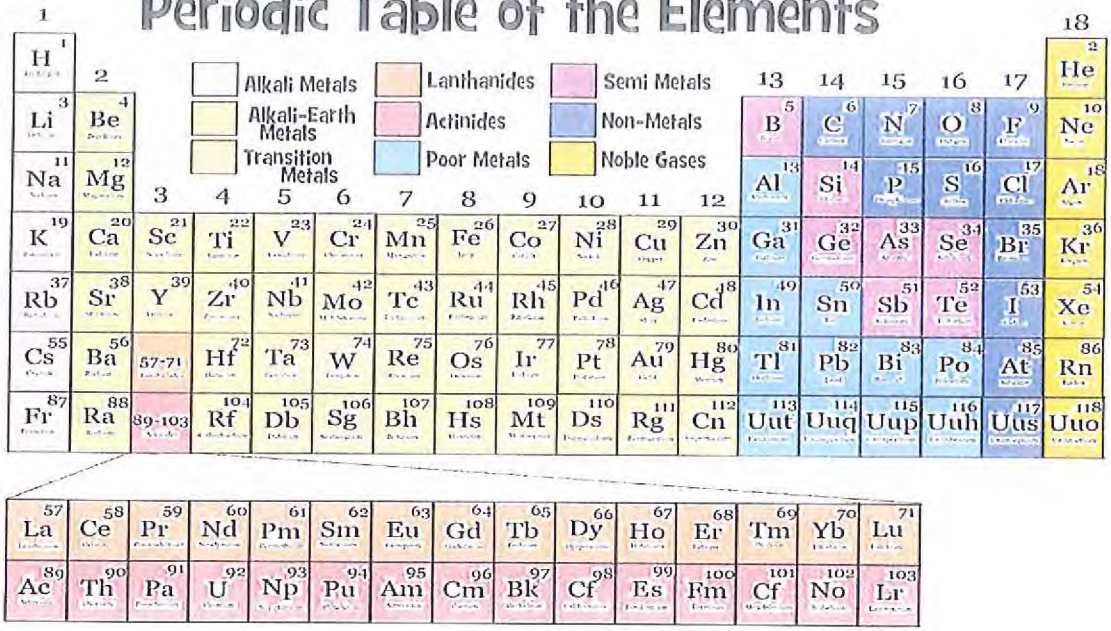
Na^+ Cl^-

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

$2H_2 + O_2 \rightarrow 2H_2O$ – balanced equation

reactants products

Periodic Table of the Elements



7 Periods →

18 families (also called groups) ↓

element type	properties (shiny, can be hammered flat, can be pulled into wires)
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:

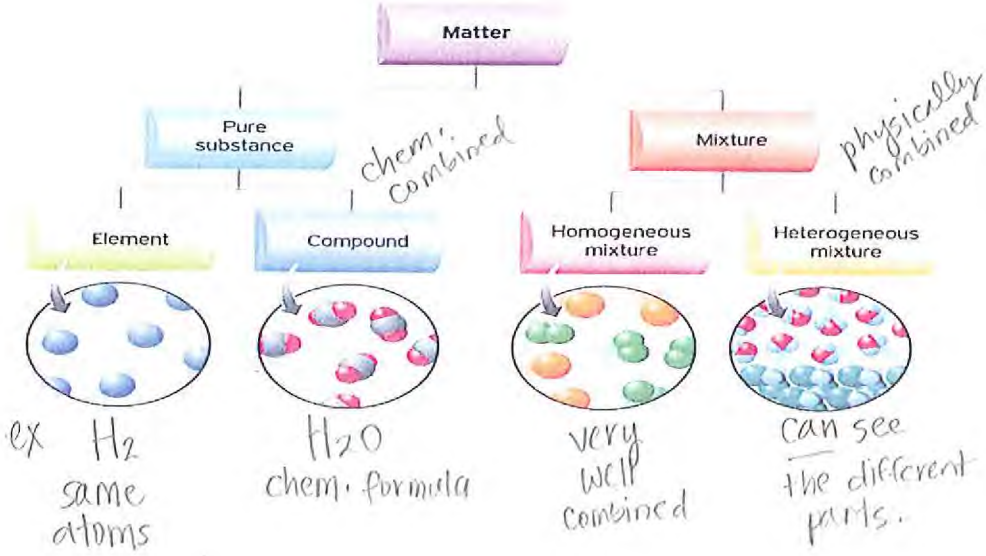
ionic	N-M	Na Cl, Na F
covalent	~~M-M~~ N-N	H_2O, CO_2
polyatomic	3+ different elements	H_2SO_4, HCO_3

X

transfers e⁻
shares e⁻
multiple bonds

many

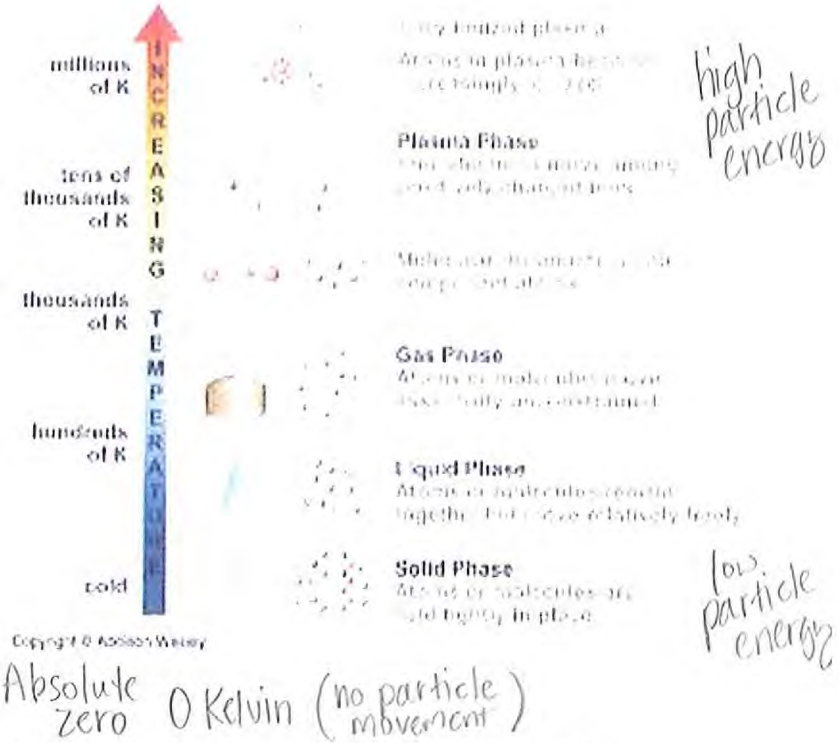
elements, compounds and mixtures

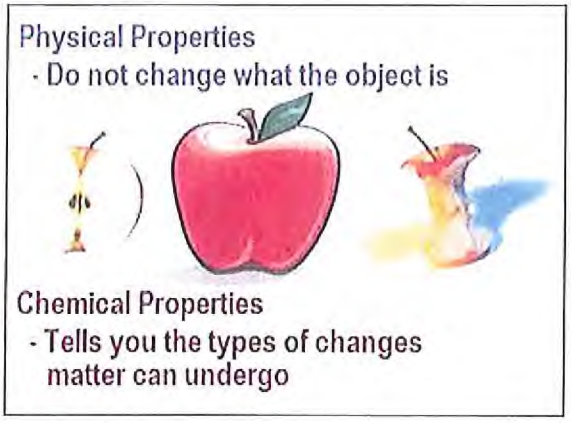


A molecule is 2 or more atoms chemically combined. They might be two of the same kind of atom, like O_2, or two different kinds of atoms, like CO_2.

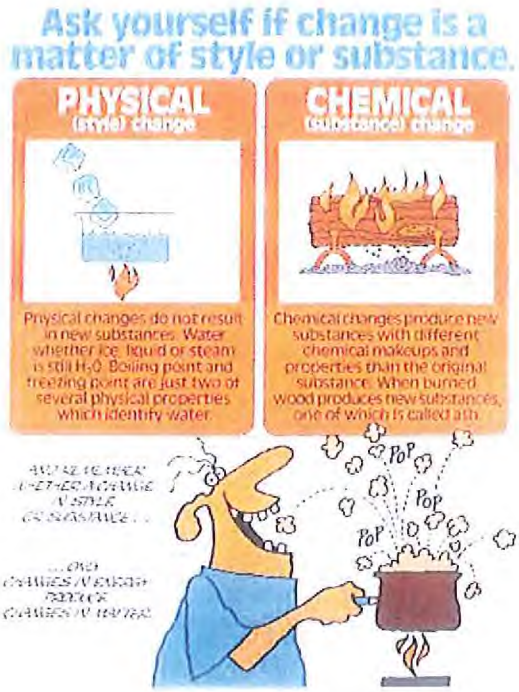
type of mixture	properties	examples
solution	solute dissolves completely in solvent	sweet tea, koolaid
colloid	small particles that remain suspended, filters light	milk, whipped cream, fog
suspension	larger particles that settle out, shake to mix	Italian dressing

	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





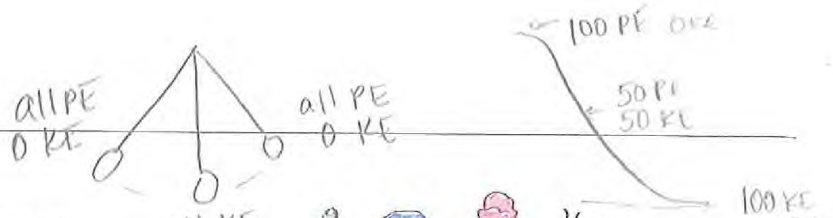
Examples of physical properties: smell, color, boiling point, freezing point, melting point, magnetivity, density.
Examples of chemical properties: reactivity with water, combustibility, ability to oxidize, pH



A chemical change produces a new substance with different properties than the original.

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

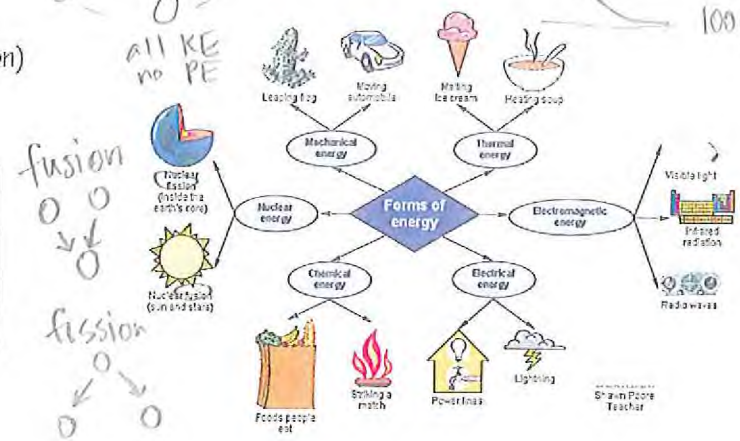


Energy can be sorted into two main categories:

Potential (stored or position) Kinetic (motion)

- gravitational
- elastic
- chemical

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

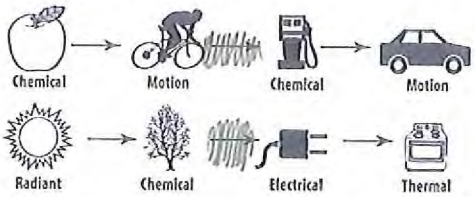


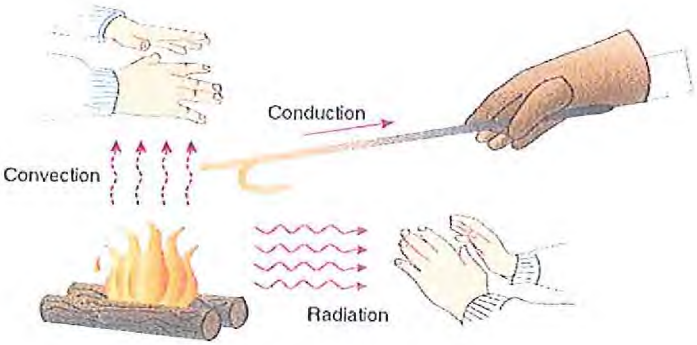
Remember MRS. CHEN

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





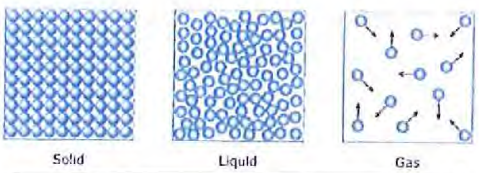
methods of heat transfer

vaporization	
evaporation	boiling
vaporization at the surface only	vaporization throughout

touch *conduction* – thermal energy transferred through the collision of molecules

rides *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.

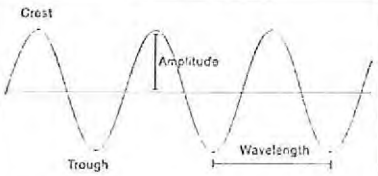
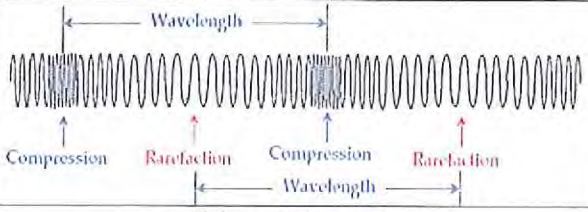


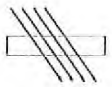
thermal expansion – as most objects gain thermal energy (heat up), they expand due to molecular movement. An exception to this is water which expands as it freezes.

Wave characteristics

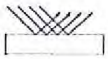
There are 2 main kinds of waves – mechanical and electromagnetic (EM)

requires a medium (S, L, G) — can travel in a vacuum (space)

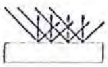
mechanical		electromagnetic	
transverse	longitudinal (compressional)	radio	decreasing energy ↑ decreasing frequency increasing wavelength
		microwaves	
		infrared	
		visible	
		ultraviolet	
		X-rays	
perpendicular particle movement	parallel particle movement	gamma	



transmitted

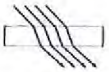


reflected



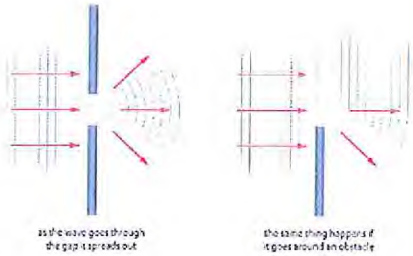
scattered

absorbed



refracted

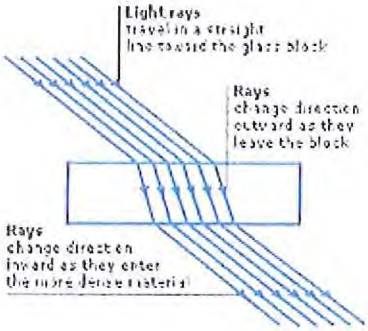
diffraction



opaque

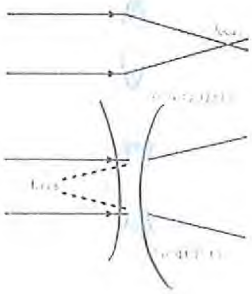
translucent

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.

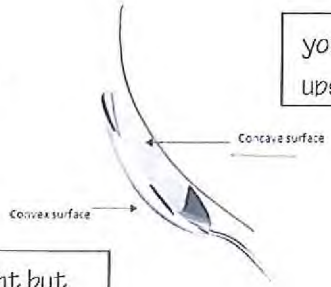
(remember the laser through the tank of water)



convex lens

concave lens

"concave" = "caved in"



you are upside down

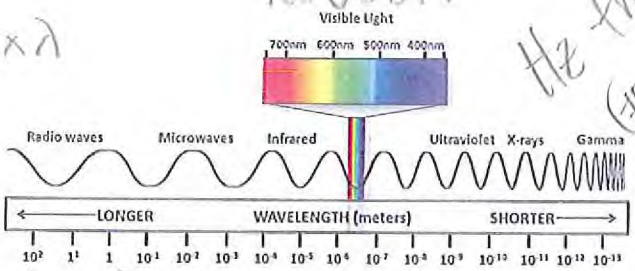
upright but smaller

visible light spectrum

ROYGBIV

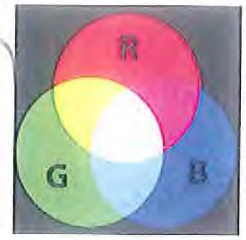
$v = f \times \lambda$

Hz frequency (# waves / sec)



long λ low f low energy

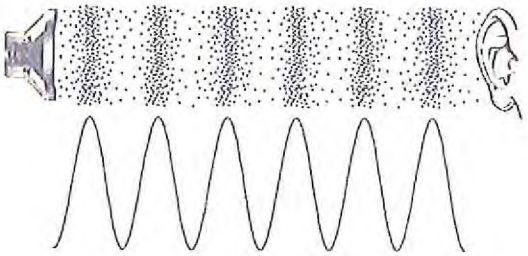
short λ high f high energy



primary colors of light

primary colors of pigment

Sound waves are an example of compressional or longitudinal waves

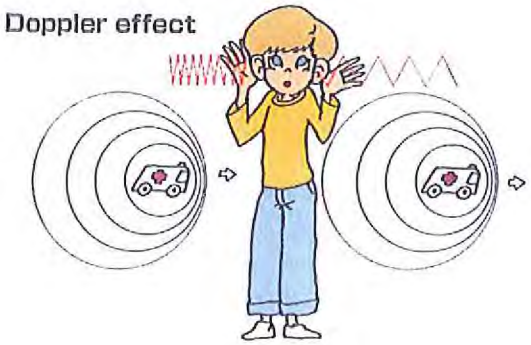


Pitch is determined by the frequency. Higher frequency equals higher pitch.

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).



1/16

HW- finish to here

HW- complete reading

---

a force is a push or a pull

Balanced and Unbalanced Forces

Balanced Forces: Equal forces that act on an object from opposite sides. The object doesn't move.

Unbalanced Forces: Unequal forces that act on an object from opposite sides. But make the object move.

Newtons (N)

only unbalanced forces result in movement

forces in the same direction are added

forces in opposite directions are subtracted

an object is in motion when its distance from an object is changing

km/hr

Velocity Vs. Speed

Velocity:	Speed:
Example: 	Example: 

m/s

distance / time

direction

velocity and speed are not the same thing!

Acceleration

= change in velocity

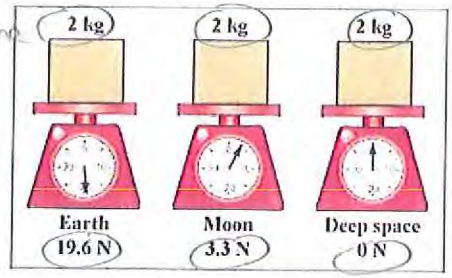
change in speed | Change in Direction | Change in both

motion → ← friction

speed up | slow down

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

mass same



weight changes

types of friction:

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

air resistance

larger mass requires more force to accelerate

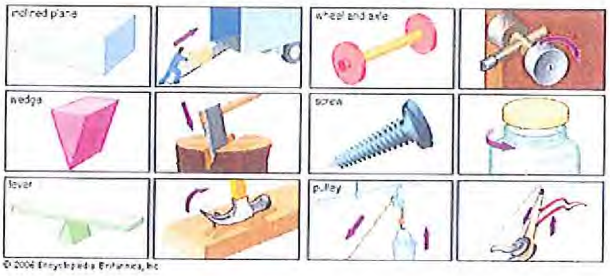
Newton's Three Laws of Motion:

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.

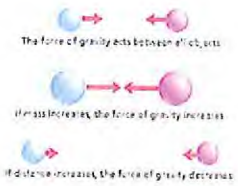
work: force → motion →

not work: force ↑ motion →

SIMPLE MACHINES — makes work easier



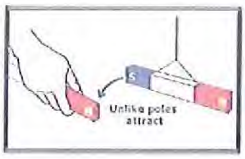
Simple machines may convert one type of force to another, change the direction of an applied force or trade distance travelled for force applied.

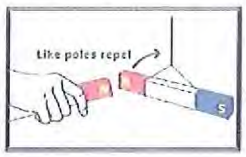


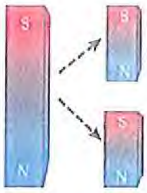
main point

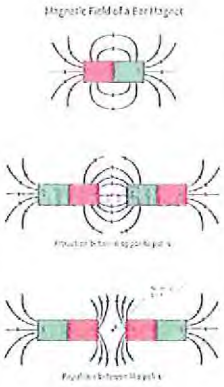
Every object exerts gravitational force on every other object. The force exerted depends on how much mass the objects have and the distance between them.

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



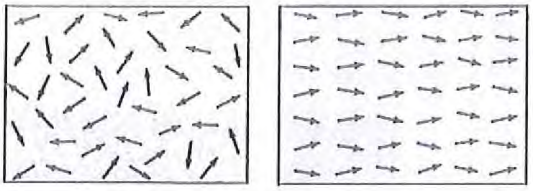






a magnetic field is the area in which a magnetic force can be exerted

Unmagnetized Magnetized



(a) (b)

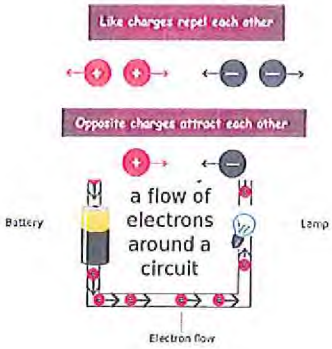
Some materials can become temporary magnets when their magnetic domains are aligned.

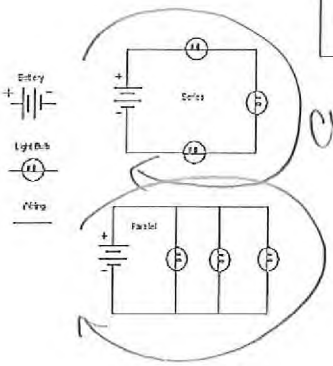
transfer of charges:

friction

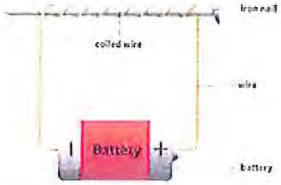
conduction

induction

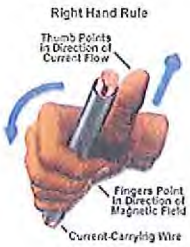




Current flow

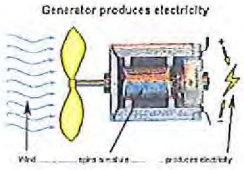


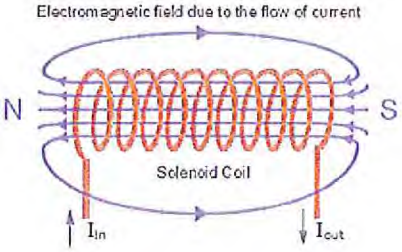
An electric current produces a magnetic field. You can use the "Right hand rule" to determine the direction of the field

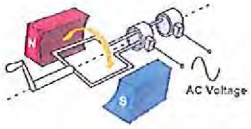


an electromagnet is a strong magnet that can be turned on and off

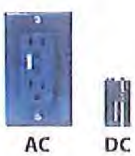
mechanical energy ⟹

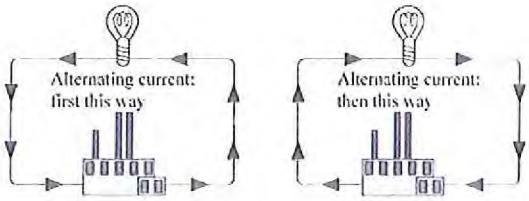






An electric motor works the opposite way – it transforms electrical energy into mechanical energy.





8th grade Physical Science content standards

S8P1. Students will examine the scientific view of the nature of matter.
a. Distinguish between atoms and molecules.
b. Describe the difference between pure substances (elements and compounds) and mixtures.
c. Describe the movement of particles in solids, liquids, gases, and plasmas states.
d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
e. Distinguish between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change in color).
f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.
g. Identify and demonstrate the Law of Conservation of Matter.

S8P2. Students will be familiar with the forms and transformations of energy.
a. Explain energy transformation in terms of the Law of Conservation of Energy.
b. Explain the relationship between potential and kinetic energy.
c. Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, sound) and their characteristics.
d. 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.
a. Determine the relationship between velocity and acceleration.
b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
c. 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.
a. Identify the characteristics of electromagnetic and mechanical waves.
b. Describe how the behavior of light waves is manipulated causing reflection, refraction, diffraction, and absorption.
c. Explain how the human eye sees objects and colors in terms of wavelengths.
d. Describe how the behavior of waves is affected by medium (such as air, water, solids).
e. Relate the properties of sound to everyday experiences.
f. 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.
a. 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.
b. Demonstrate the advantages and disadvantages of series and parallel circuits and how they transfer energy.
c. Investigate and explain that electric currents and magnets can exert force on each other.