Physical Science Review

I. Scientific Investigations

A. Experimental Design – The ***independent variable*** is the variable that the experimenter changes on purpose. The ***dependent variable*** "depends" on which independent variable is used. It is what is being measured or observed. The ***control*** is one of the independent variables. It is the one that all the others are being compared to. It is often the condition with nothing added or the normal way it is done. Read each of the experimental designs and answer the questions that follow.

Problem: Does too much water affect plant growth? IV: _____ DV: _____ Control: _____	Problem: Will the temperature of water affect how much goldfish will eat? IV: _____ DV: _____ Control: _____
Hypothesis: If weight is added to a paper airplane, then its distance will decrease. IV: _____ DV: _____ Control: _____	Hypothesis: If water is heated, then more salt will dissolve. IV: _____ DV: _____ Control: _____

B. Measurement – Complete the measurement chart below.

Type of Measurement	Tool for Measurement	Unit of Measurement
Length		
	Triple Beam Balance, Electronic Balance	
		Milliliter (mL), Liter (L), cm^3
Temperature		
	Spring Scale	

C. Metric System –

1. Which measurement would you use to measure the following items?

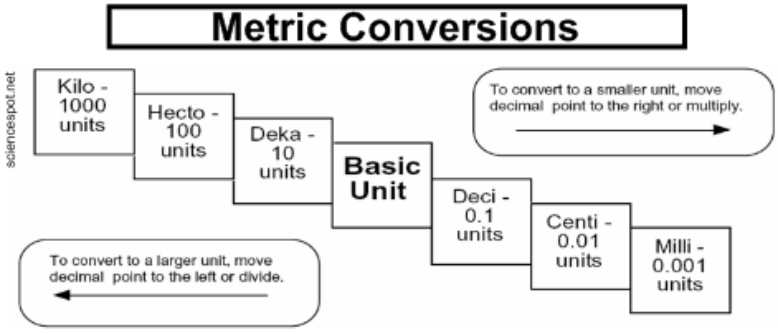
A. Length of a piece of paper:	B. Volume of a soda bottle:
C. Your mass:	D. The distance from school to the mall:
E. The volume of a glass of water:	F. The length of a pencil:

2. Which is bigger? Circle the unit in each pair of units that is the bigger unit.

A. centimeter or millimeter	B. gram or centigram
C. meter or kilometer	D. milligram or centigram
E. liter or hectoliter	F. decimeter or decameter

D. Scientific Investigations Math

1. Metric Conversions – Complete each of the following metric conversions using the conversion chart.



A. 435 cm = _____ m

B. 0.25 L = _____ mL

C. 3 km = _____ m

D. 30 mL = _____ L

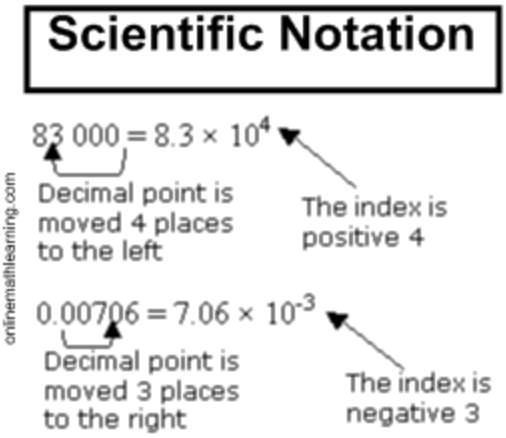
2. Scientific Notation – complete the following scientific notation problems.

Convert the following numbers into scientific notation:

1) 3,400 _____
2) 0.000023 _____
3) 101,000 _____

Convert the following numbers into standard notation:

1) 2.30 x 10^{4} _____
2) 1.76 x 10^{-3} _____
3) 8.65 x 10^{-1} _____



3. Measures of Central Tendency – Determine the mean, median, mode, and range for each type of rubber band from the data table.

Rubber Band A:
Mean: _____
Median: _____
Mode: _____
Range: _____

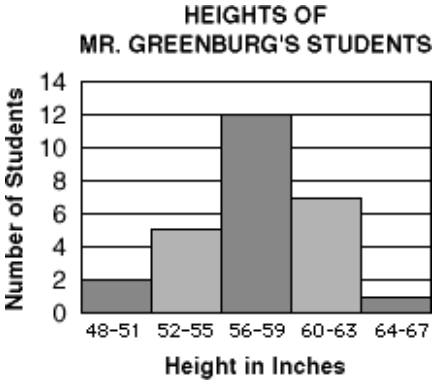
Rubber Band B:
Mean: _____
Median: _____
Mode: _____
Range: _____

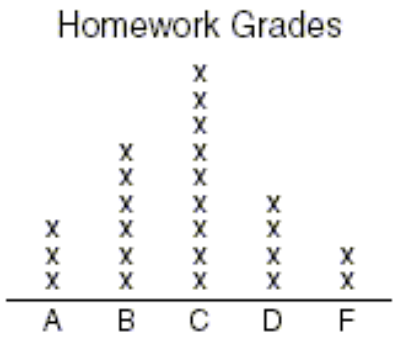
Rubber Band Data

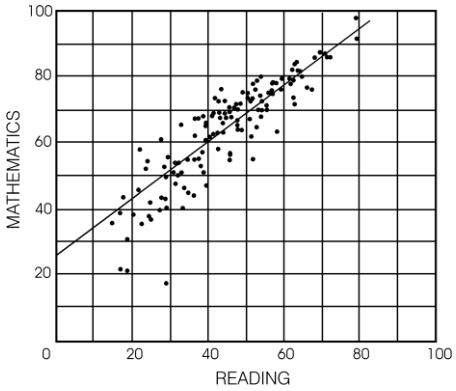
Rubber Band	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
A	3.7 cm	3.9 cm	3.7 cm	3.4 cm	3.6 cm
B	2.5 cm	2.7 cm	2.8 cm	2.7 cm	2.7 cm

E. Graphing

1. Identify the types of graphs illustrated below.







a._____ b._____ c._____

2. Answer the following questions utilizing the graphs above.
   1. In graph A, how many students are in the 56-59 inch range? _____
   2. How many students are in the 48-51 inch range in graph A? _____
   3. What does graph B illustrate? _____
   4. How many students have an "A" in graph B? _____
   5. How many students have a "D" in graph B? _____
   6. What grade do most of the students in the class have in graph B? _____
   7. What is the label on the x-axis (the IV) for graph C? _____
   8. What is the label on the y-axis (the DV) for graph C? _____
   9. What type of relationship does graph C represent? _____
   10. What is the name of the straight line on graph C? _____

II. Matter

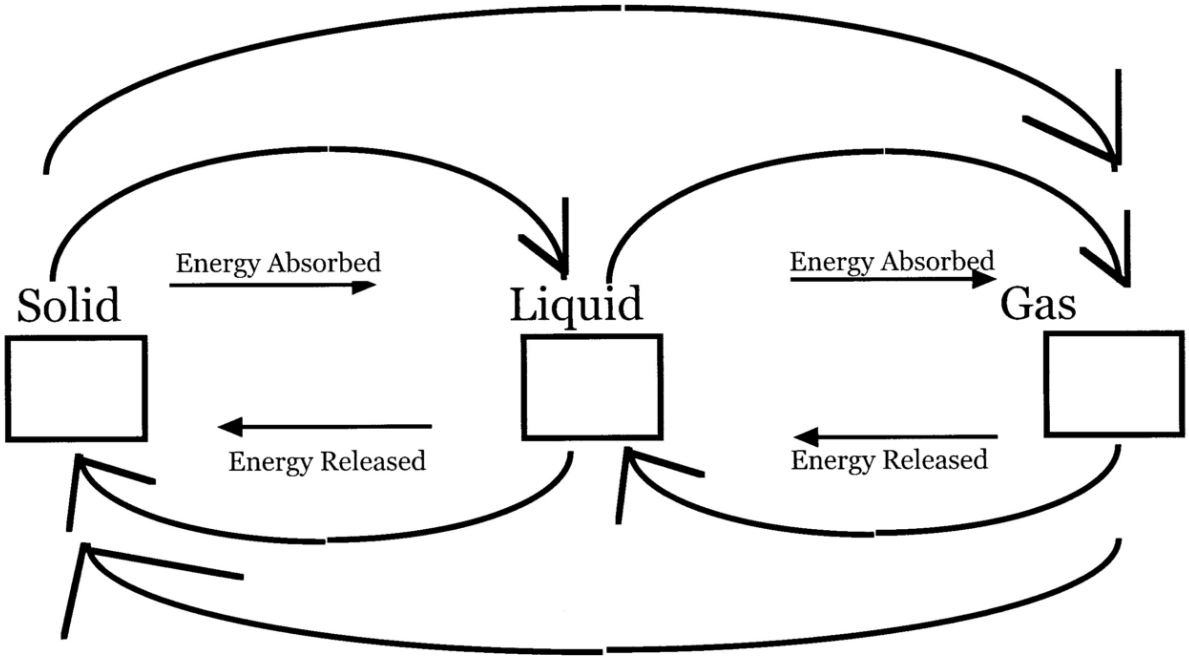
A. States of Matter & Particle Theory of Matter

- Matter is anything that has _____ and takes up _____ (has _____)
- Solids are _____ _____, have _____ energy, have _____ shape, and _____ volume.
- Liquids are _____ _____, have _____ energy, have _____ shape, and have _____ volume.

- Gases are _____ _____, have _____ energy, have _____ shape, and _____ volume.
- Plasmas are _____ _____, have _____ energy, have _____ shape, _____ volume, and have _____ particles.
- The Particle Theory of Matter states that all _____ is made of _____ that are in _____ motion.
- Atoms move _____ and _____ _____ as energy is _____.
- Atoms move _____ and _____ _____ as energy is _____.

B. Identify the states of matter in the illustration below.

C. Phase Changes – Label the phase change between each state of matter. List one example for each phase change. Draw a picture of how the molecules are arranged in each state of matter.



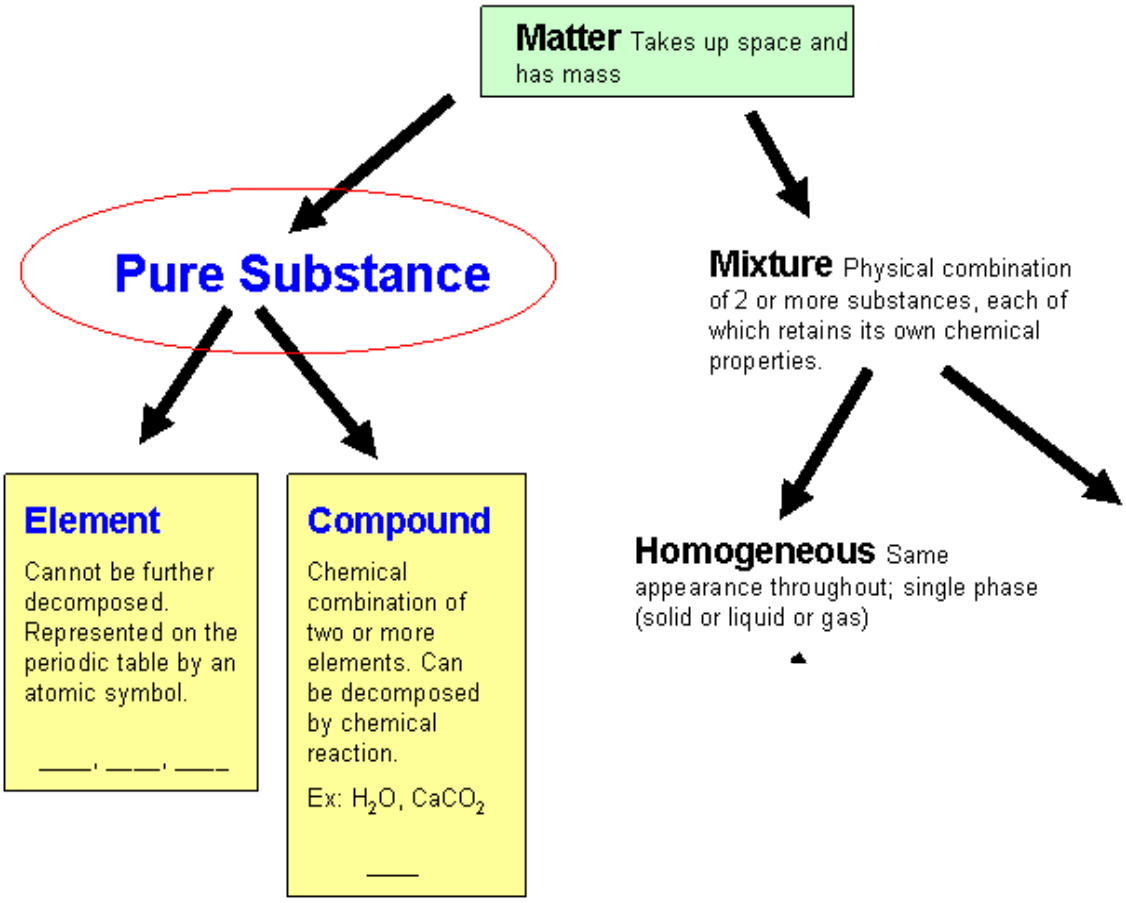
D. Properties of Matter: A _____ property describes _____ and includes shape, _____, solubility, _____, melting point, _____ _____, and color. Some _____ properties, such as density, boiling point, and solubility, are characteristics of _____ substances and are used for identification. A _____ property describes matter and indicates _____ to change _____ and includes acidity, _____, combustibility, and _____. Determine if the following properties are physical or chemical.

1. A ball is red. _____
2. Water has a pH of 7. _____
3. The density of gold is 19.3 g/cm^3. _____
4. Water boils at 100^{o}C. _____
5. Gasoline can combust. _____
6. Lye is a strong base. _____

E. Types of Matter – Read the graphic organizer below then answer questions #1 – 12 on the top right of the graphic organizer.

Directions: Classify each sample to its most specific form possible (furthest down on the paper). Write the number to the corresponding sample in the correct space provided.

1	Gravel
2	Salt (NaCl)
3	Vinegar
4	Sulfur (S)
5	Lead (Pb)
6	Beads
7	Milk of Magnesia
8	Sand
9	Copper (Cu)
10	Salt Water ($NaCl + H_2O$)
11	Air (N_2, O_2, H_2O, CO_2)
12	Glue



F. Acids & Bases – Acids release H+ ions when dissolved in water, taste sour, and have pH values 0 – 6.9. Bases release OH- ions when dissolved in water, taste bitter, feel slippery, and have pH values 7.1 – 14. Acids turn litmus paper red and bases turn litmus paper blue.

1. State whether the following substances are acids or bases.
   - A. HCl
   - B. NaOH
   - C. $Al(OH)_3$
   - D. H_2CO_3
   - E. KOH
   - F. HF
2. Different substances have pH values of 3, 5, 7, 9, and 11.
   - A. Which is neither an acid nor a base? _____
   - B. Which is the strongest acid? _____
   - C. Which is the weakest acid? _____
   - D. Which is the strongest base? _____
   - E. Which is the weakest base? _____
3. Complete the acid/base data table below.

Sample	Indicator	Color Change	Identification
Unknown 1	Litmus Paper	Red	
Unknown 2	Litmus Paper	Blue	
Unknown 3	Litmus Paper	Red	
Unknown 4	Litmus Paper	Blue	

4. Neutralization - Acids and Bases can neutralize each other in a neutralization reaction. The products of the neutralization reaction are a salt and water. Label the neutralization equation below.

$$2HCl + Mg(OH)_2 \rightarrow MgCl_2 + 2H_2O$$

G. Density – Density is the amount of _____ in a given _____. It is calculated by the following equation: Density = mass ÷ volume. Every substance has its _____ density. The density of a substance will always be the _____, regardless of the size of the substance. Water is the control for determining density and has a density of _____ g/mL. Any substance with a density _____ than 1.0 g/mL will _____ in water. Any substance with a density _____ than 1.0 g/mL will _____ in water.

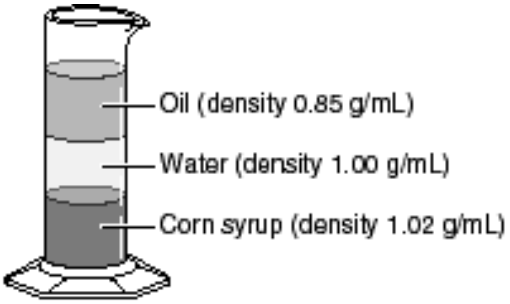
1. Calculate the density for the following substances.

A. A gold brick has a volume of 10 cm x 3 cm x 2 cm and a mass of 1,158 g. What is the density of the gold brick?

B. A liquid has a volume of 30 mL and a mass of 15 g. What is the density of the liquid?

2. Draw where each of the liquids would be in the following density column when compared to the known liquids.

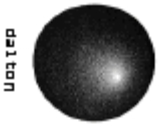
Densities of Some Unknowns	
Liquids	Density (g/mL)
Sample A	1.02
Sample B	0.96
Sample C	1.15
Sample D	0.82



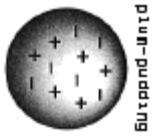
Density Column

III. Atomic Theory

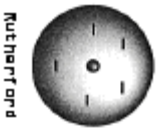
A. Atomic Theory Timeline



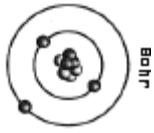
- 1808: _____ _____ stated that atoms are solid masses that cannot be split into smaller particles and resemble tiny solid marbles.



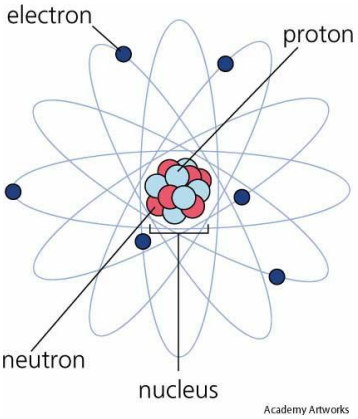
- 1897: _____ _____ discovered the electron, knew that the atom was neutral and had no overall charge. Known as the "plum pudding" model due to charges being placed randomly throughout the atom.
- 1911: _____ _____ discovered the nucleus, stated that the atom is mostly made up of empty space with a solid nucleus.



- 1913: _____ _____ stated that electrons move in fixed paths, called orbits, around a nucleus.
- 1920s: _____ & _____ stated that electrons exist in different clouds at various energy levels and shows that atom as being three-dimensional.



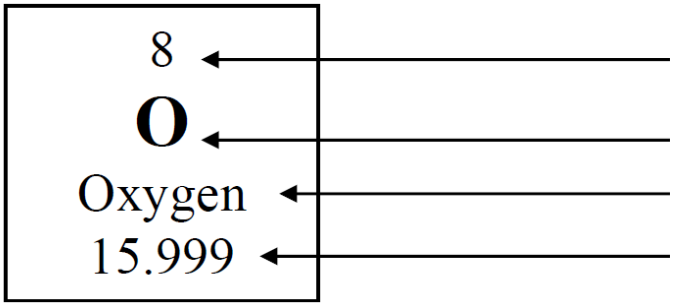
B. Parts of the Atom



- _____ - central region of atom, has _____ and _____, contains most of the atom's _____.
- _____ - _____ charged particle found in the _____.
- _____ - _____ particle found in the _____, has a mass close to a _____.
- _____ - _____ charged particle found in the _____ _____, makes up most of the atom's _____.
- _____ - fundamental particles that make up _____ and _____; there are ___ types: up, _____, top, _____, strange, and _____.

IV. Periodic Table

The periodic table of elements is a tool used to _____ information about the _____. Each box on the periodic table contains information about the _____ of an element. Fill in the information to complete the element box.



What does the atomic number represent?

_____ or _____

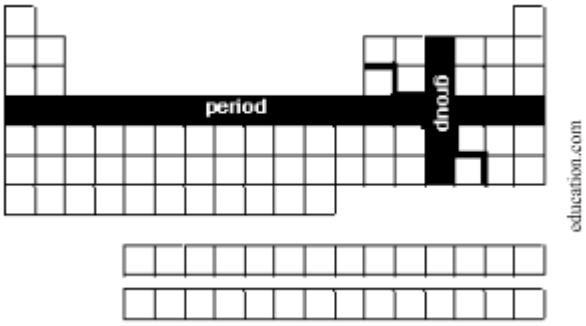
What does the atomic mass represent?

_____ + _____

Groups & Periods on the Periodic Table

Groups (also called families):

- Vertical (up & down) _____ of elements
- Have _____ properties
- Same number of _____ (outside) electrons (_____ # = # valence electrons)
- Have similar _____ reactions

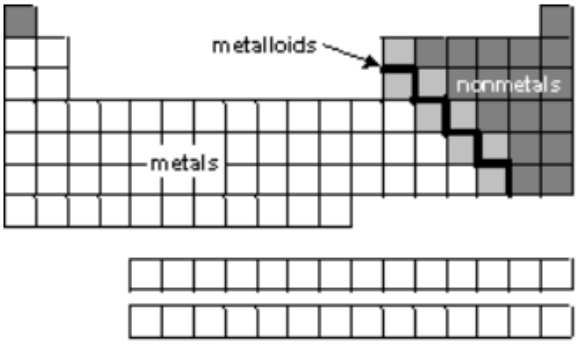


Periods:

- Horizontal (side to side) _____ of elements
- Do _____ have similar properties
- Same number of _____ _____ _____ (_____ # = # energy levels)

Elements in the periodic table are also arranged as metals, nonmetals, and metalloids.

- _____ are elements on the _____ side of the stair-step line; they tend to _____ electrons in chemical reactions and form _____ ions. Properties of _____ include: ductility (_____), _____ (hammered thin), conductors, and _____.
- _____ are elements _____ the metals and nonmetals and illustrate _____ of both metals and nonmetals.
- _____ are elements on the _____ side of the stair-step line; they tend to _____ electrons in chemical reactions and form _____ ions. Properties of _____ include being _____, dull, and are _____.



The periodic table of elements is an arrangement of elements according to _____ _____ _____. Information on the periodic table can be used to _____ chemical reactivity. Groups include:

- _____ Metals: Group ____, most _____ metals of all metals
- _____ _____ Metals: Group ____, very _____
- _____ Metals: Groups ___ to ___, typical metals
- _____: Group _____, most _____ nonmetals
- _____ _____: Group ____, stable and _____.

An atom's _____ is directly related to the number of _____ in its _____. Gaining or losing _____ makes the atom an _____. Gaining or losing _____ makes the atom an _____.

A. Complete the periodic table review chart below using information from the previous page and from the review booklet.

Element Name	Lithium	Oxygen	Silicon
Atomic #			
Mass #			
# protons			
# neutrons			
# electrons			
Group #			
Period #			
# valence electrons			
Is it a metal, nonmetal, or metalloid?			

B. Chemical Formulas - _____ and _____ that identifies type and number of atoms in a _____. Write the element names and number of each atom for the compounds below.

1. Fe_2O_3: _____
2. $CaSO_4$: _____
3. H_2O: _____
4. H_2SO_4: _____

C. Organic vs. Inorganic Compounds – Organic compounds contain the element _____ (C). Inorganic compounds do not contain _____. For each of the compounds below, state if they are organic or inorganic.

CO_2	MgCl	CH_4
$CaCl_2$	H_2CO_3	H_2O

D. Ionic vs. Covalent Bonds – Ionic bonds form when _____ charged ions attract between a _____ and a _____. Electrons are _____ and _____ in an ionic bond. Covalent bonds form when atoms _____ valence electrons between two or more _____. Determine if the following compounds are ionic or covalent.

1. $CaCl_2$	2. CO_2	3. H_2O	4. NaF
5. CH_4	6. SO_3	7. MgO	8. LiBr

E. Binary Compounds – In binary compounds, _____ combine to form a _____ compound. Read the sample then determine the binary compounds formed below.

SAMPLE: $Na^{1+} + S^{2-} = Na_2S$ Sodium sulfide

1. $Ba^{2+} + F^{1-}$ = _____
2. $Al^{3+} + Br^{1-}$ = _____
3. $Ni^{3+} + O^{2-}$ = _____

V. Changes in Matter

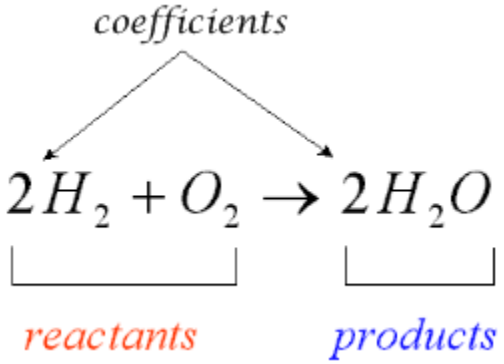
A. Physical vs. Chemical Change

- A _____ change is a change in the appearance of a substance. The _____ composition of the substances does _____ change.
- A _____ change is a change in _____ _____ of a substance. A different and _____ substance is formed with _____ properties.
- Determine if the following examples are physical change or chemical change.

1. Sharpening a pencil
2. Evaporating water
3. Rusting steel wool

4. Melting ice cream 5. Burning leaves 6. Neutralization reaction

B. Law of Conservation of Mass – the law states that _____ cannot be _____ or _____ in a _____ reaction. The mass of the _____ must equal the mass of the _____. In order to follow the law, chemical _____ must be balanced. To balance we place _____ in front of substances, thus _____ the number of atoms of substances. Balance the following equations.



1. _____ $Mg + N_2 \rightarrow Mg_2N_2$
   Mg= Mg=
   N= N=

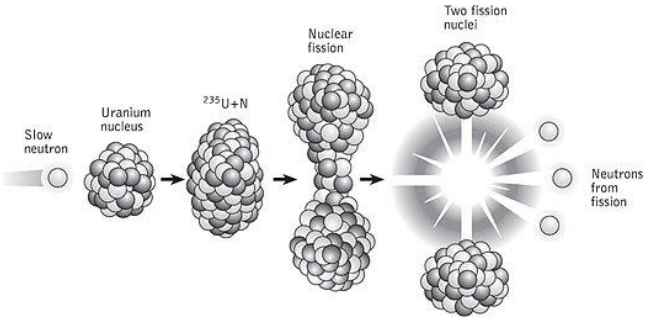
2. 2BN + _____ $F_2 \rightarrow 2BF_3 + N_2$
   B= B=
   N= N=
   F= F=

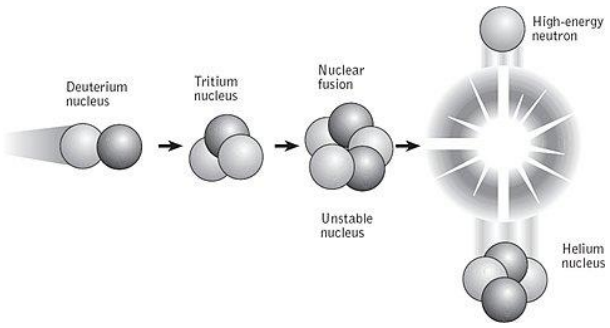
3. _____ $Ca + N_2 \rightarrow Ca_3N_2$
   Ca= Ca=
   N= N=

- **Chemical Equation:** represents changes that take place in a chemical reaction.
- **Reactants:** substances entering into a chemical change; located on the left side of the equation.
- **Products:** substances made from a chemical change; located on the right side of the equation.

C. Nuclear Energy – nuclear energy is created by changing the _____ of an atom.

- Fission is when the nucleus of a large atom (above 92) _____; they do _____ normally occur in nature; produce highly _____ wastes.





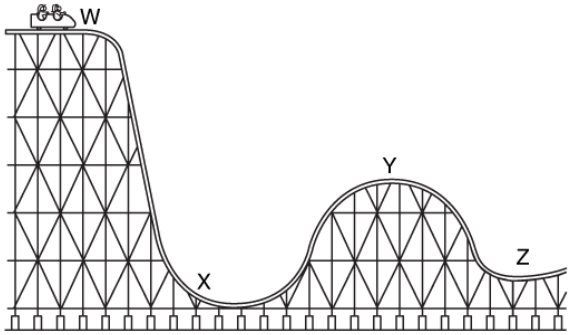
- Fusion is when the nuclei of _____ atoms _____ to form a _____ atom. These reactions occur in _____ with _____ radioactive by-products.

VI. Energy

A. Potential vs. Kinetic Energy

- Energy is the ability to do _____.
- Potential energy is _____ energy or energy of _____ (height).
- Kinetic energy is energy of _____ and depends on an object's _____ and _____.
- Answer the following questions about the roller coaster diagram.

1. Which letter has the most potential energy? _____
2. Which letter has the most kinetic energy? _____
3. Which letter has the least kinetic energy? _____
4. Which letter has the least potential energy? _____
5. Which letter has more potential energy, Y or Z? _____



B. Common Forms of Energy – There are 6 common forms of energy.

- _____ energy: electromagnetic energy that travels in _____. Ex. _____ light
- _____ energy: the total _____ of a substance's or material's _____ due to their movement of vibration; can cause a change in _____. Ex. Geothermal energy
- _____ energy: potential energy stored in _____. Ex. Fossil fuels, _____
- _____ energy: energy of moving _____ charges (electrons). Ex. Lightning and _____
- _____ energy: energy associated with the _____ or _____ of an object. Ex. Sound, _____
- _____ energy: energy stored in the _____ of an atom; it is released during _____ or _____.Ex. Nuclear reactor, _____

C. Energy Transformations – The Law of Conservation of _____ states that energy cannot be _____ or _____, it can only change _____. State the energy transformation for each of the following examples.

Windmill

Energy Transformation:

Flashlight

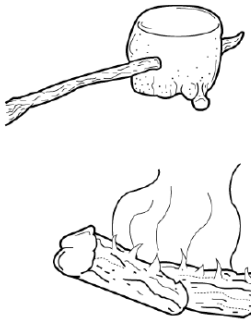
Energy Transformation:

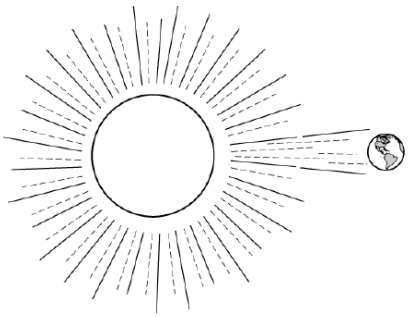
Microwave

Energy Transformation:

VII. Thermal Energy

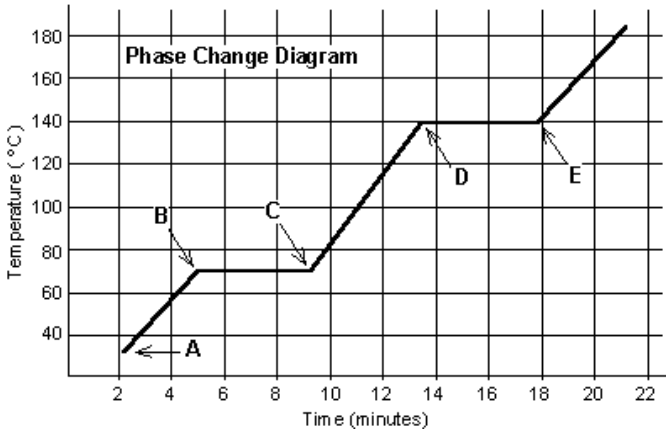
A. Conduction, Convection, & Radiation – The transfer of thermal occurs in three ways: conduction, convection, and radiation. _____ is transfer of thermal energy between _____ by direct contact. _____ is the transfer of thermal energy by movement of _____ within a fluid (liquids & gases). _____ is transfer of thermal energy by _____ waves. Identify the following examples as conduction, convection, or radiation.





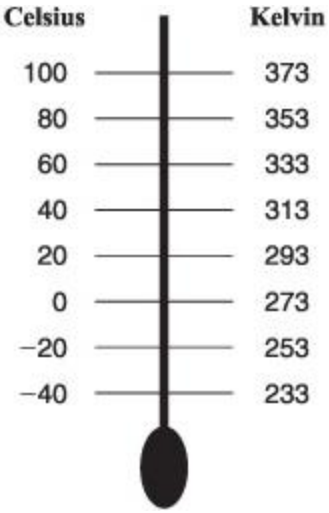
1. Hot air balloon rises: _____
2. Grilling hamburgers over a charcoal flame: _____
3. Stir frying vegetables: _____

B. Phase Change Graph – Also a time/temperature graph. As _____ energy is added or _____ away from a system, the _____ does not always change. There is _____ change in _____ during a _____ change (freezing, melting, condensing, and vaporizing) as this energy is being used to move molecules closer together or farther apart. Look at the phase change graph to answer the following questions.



1. What is the state of matter at point A? _____
2. What is the state of matter from C to D? _____
3. What is the state of matter after point E? _____
4. What is the phase change from B to C? _____
5. What is the phase change from D to E? _____
6. Where is the heat of fusion? _____
7. Where is the heat of vaporization? _____
8. As time increases, what is being added to the substance? _____
9. Does the temperature increase as melting is occurring? _____
10. Does the temperature increase as the substance is in the liquid phase? _____

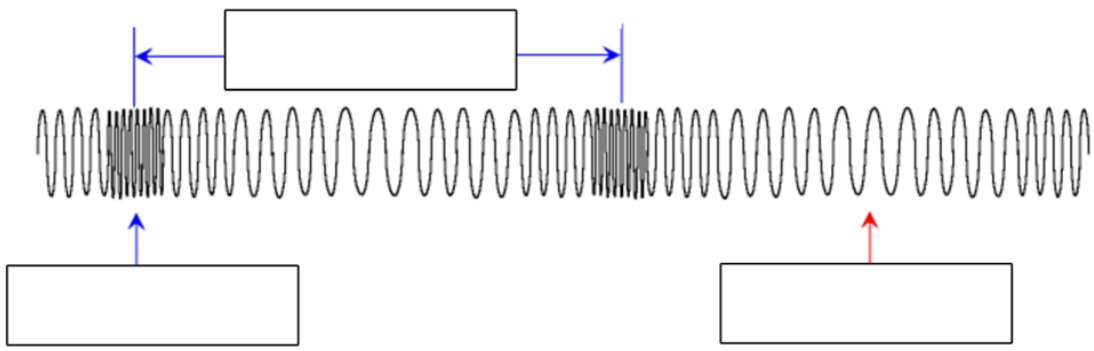
C. Heat vs. Temperature – Heat and temperature are NOT the same thing! _____ is the transfer of thermal energy between substances of _____ temperatures, moving from _____ to _____. _____ is a measure of the average _____ energy of the molecules of a substance. Increased temperature means _____ average kinetic energy. _____ _____ is the lowest possible temperature at _____. At this temperature all _____ motion stops. To convert between Kelvin and Celsius is easy. If you are going from Celsius to Kelvin, add 273. If you are going from Kelvin to Celsius, subtract 273. Solve the following temperature conversion problems.



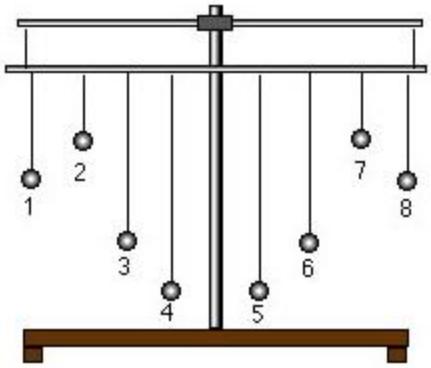
1. 0 K = _____ °C
2. 100°C = _____ K
3. 273 K = _____ °C
4. 326°C = _____K
5. 297 K = _____ °C
6. 0°C = _____ K

VIII. Sound Waves

Sound is produced by _____ and is a type of _____ energy. Sound travels in _____ (_____) waves at a speed much _____ than light. Sound requires a _____ (solid, liquid, or gas) in which to travel. In a compression wave, matter vibrates _____ (same direction) in which the wave travels. Label the sound wave below.

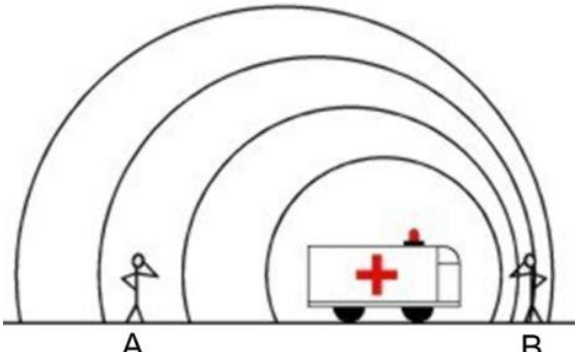


Longitudinal/compression waves travel faster in _____ and in _____ temperatures than in _____ temperatures. As the _____ of the wave increases, the _____ decreases. _____ is the tendency of an object to _____ at the same frequency as another object. Examples include an opera singer breaking a glass by singing and the Tacoma Narrows Bridge collapsing.



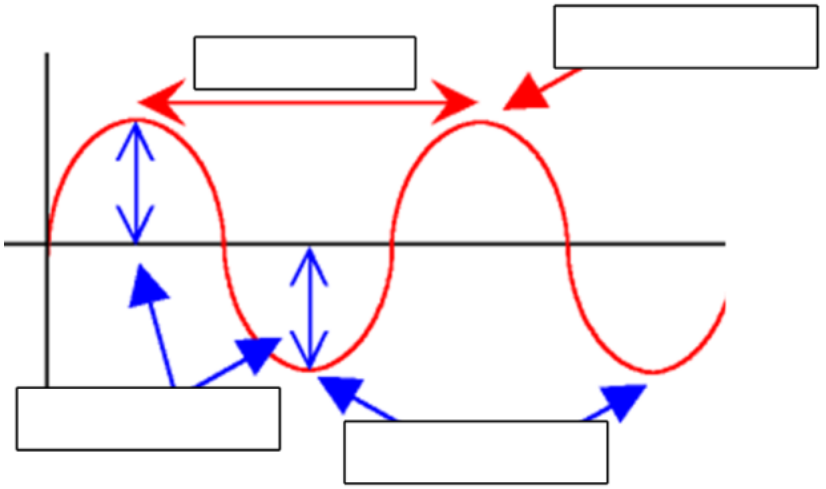
Which spheres in the diagram will resonate at the same frequency?
_____

Applications of sound waves include _____ and _____. _____ _____ is the change in frequency of a sound as the source of the sound moves in relation to the listener. Label the following picture indicating where the person will hear the sound the loudest.



IX. Light Waves

A. Visible light is a form of _____ energy that moves in _____ waves. All _____ exhibit certain characteristics: _____, crest, _____, frequency, and _____. Label the parts of the transverse wave.

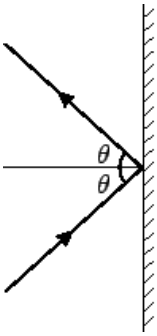


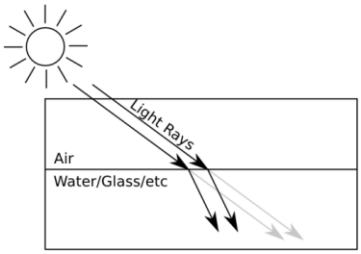
_____ waves travel _____ than _____ waves which is why we see lightning before we hear thunder.

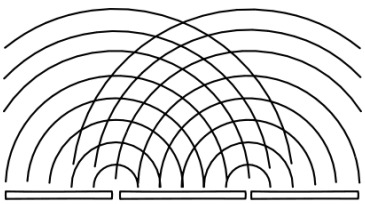
B. _____ travels in straight lines until is strikes an object, where it can be _____, absorbed, or _____. As _____ light travels through different materials, it undergoes a change in _____ that may result in _____.

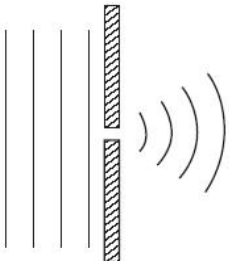
- _____ takes place when two or more waves overlap and combine. There are two types of _____: constructive (_____) and destructive (_____).
- _____ is the bending of waves as it travels from one medium to another. It is the result of a change in _____ of light.
- _____ is the bouncing back of a wave when it strikes a surface. The _____ _____ states that the angle of incidence (_____) equals the angle of reflection (_____).
- _____ is when light waves bend around a barrier.

Label the types of wave interactions below.





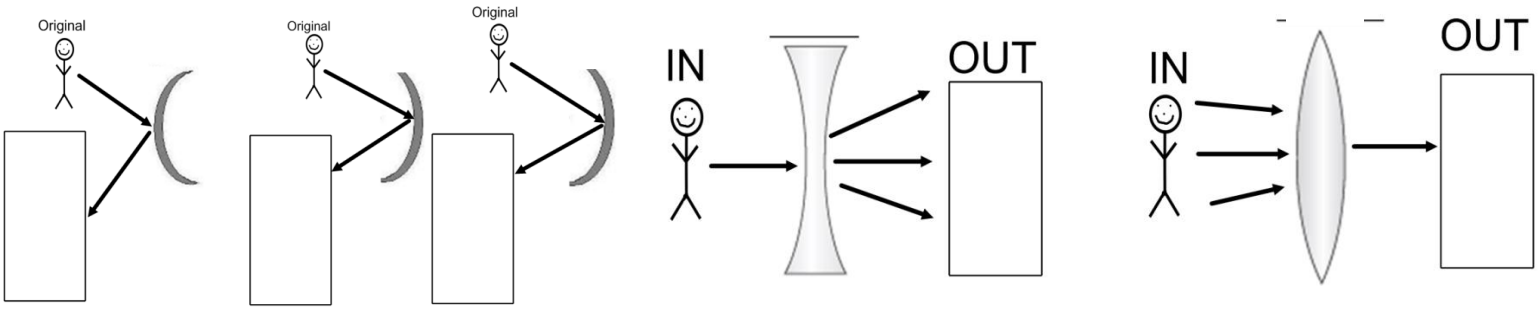




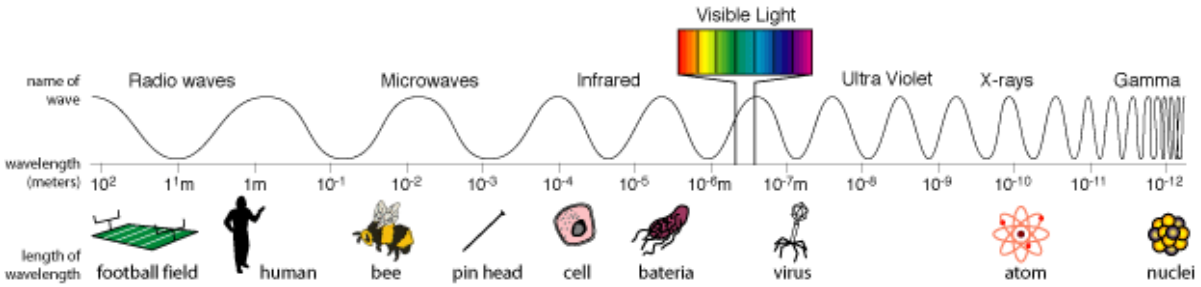
C. Mirrors & Lenses: _____ means to curve outward while _____ means to curve inward.

- _____ mirror curves outward, the image in the mirror is smaller and shows a wider area. Examples include car mirrors, store security mirrors, and the back of a spoon.
- _____ mirror curves inward, the image in the mirror is larger and may be upside down. Examples include makeup mirrors, the inside of flashlights (area around the light bulb), and the front of a spoon.
- _____ lens curves outward, brings light rays together (_____), and makes objects appear larger. Examples include a magnifying glass and camera zoom lenses.
- _____ lens curves inward, spreads light rays out (_____, and makes objects appear smaller. Examples include telescopes and door peep holes.

Label the types of mirrors and lenses below as well as draw what the image is going to look like.



D. Electromagnetic Spectrum: Electromagnetic waves are arranged on the electromagnetic spectrum by _____. All types of electromagnetic radiation travel at the speed of _____, but differ in _____. The electromagnetic spectrum includes gamma rays, _____, ultraviolet, _____ _____, infrared, and radio & _____.



Use the electromagnetic spectrum to answer the following questions.

1. _____ waves are the lowest energy waves and have the longest wavelength and the lowest frequency. They are used to communicate with astronauts in space.
2. _____ waves are the highest energy waves and have the shortest wavelength and the highest frequency. They are used to kill cancer cells.
3. _____ waves lies in between and makes up only a small portion of the EM spectrum. They are used to make objects visible. This is the only part of the EM spectrum we can see and can be separated into the color spectrum, ROYGBIV.
4. _____ are a type of radio wave with short wavelength and high frequency. They are used in microwave ovens, cell phone signals, radar, and MRI imaging.
5. _____ mean "below red" and are felt as heat. They are used in heat lamps and ovens.
6. _____ means "above violet" and has more energy than visible light. They cause sunburns and are used to kill bacteria on food, plants, and hospital equipment.
7. _____ have shorter wavelengths, higher frequencies, and high energy. They can go through most matter and are used to take pictures of bones and check for weaknesses in materials like concrete.
8. Circle the radiation that has the shortest wavelength.
    a. Radio waves or gamma rays
    b. Infrared or Visible Light
    c. Ultraviolet or infrared
    d. Gamma rays or X-rays
9. Which EM wave has the shortest wavelength of all waves? _____
10. List the forms of EM energy from longest to shortest wavelength. _____
    _____
11. Which two forms of EM radiation can the human body detect besides visible light? _____

X. Motion & Forces

A. Speed, Velocity & Acceleration

- _____ is a change in position relative to a nonmoving reference point.
- _____ is a change in position of an object per unit of time. Units include m/s and km/hr.
- _____ is speed and direction of an object. Units include m/s east and km/hr north.
- _____ is a change in velocity per unit of time. Units include m/s^2 and km/hr/sec. It can be positive (speeding up) or negative (slowing down).

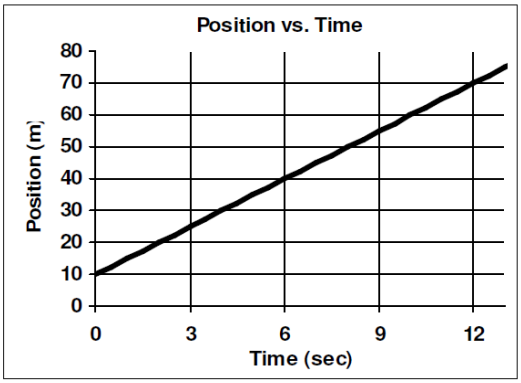
Look at the data table and answer the following questions.

1. Which mode of transportation is the fastest? _____
2. Which mode of transportation is the slowest? _____
3. What is the distance traveled in all three trials? (HINT: D = S x T) _____

MODE OF TRANSPORTATION	SPEED (km/hr)	Time (hr)
Walking	5	2
Riding a bike	10	1
Driving a car	60	0.167

Look at the graph to answer the following questions.

1. What is the object's speed at 6 seconds? _____
2. What is the object's speed at 12 seconds? _____
3. What type of speed is this object illustrating? _____



Solve the following calculations.

1. A train travels a distance of 1,200 km in 20 hours. What is the speed of the train?

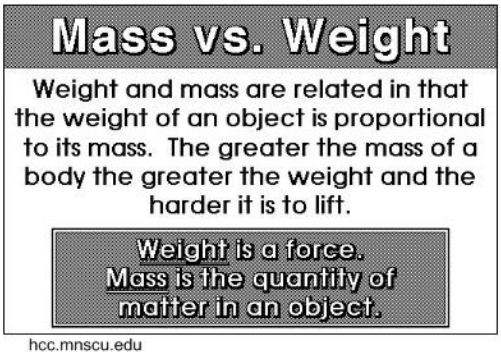
2. It takes a caterpillar 15 minutes to crawl 3 meters up a tree. How fast was it crawling?

3. A car starts from rest and reaches a speed of 15 m/s in 10 seconds. What is the car's acceleration?

4. A person walks north 5 miles in 2 hours. What is their velocity?

B. Mass vs. Weight

- _____ is the amount of matter in a substance and is measured in grams.
- _____ is the measure of the force due to gravity on an object and is measured in Newtons.

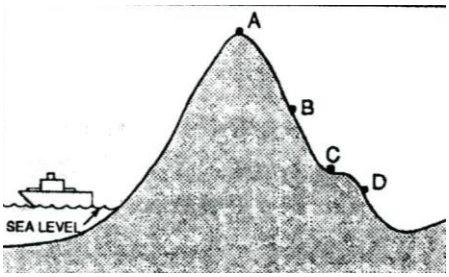


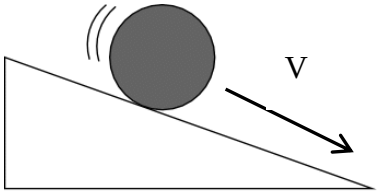
A rectangular piece of iron weighs 96 N on the surface of the earth. The piece of iron is transported to the moon and weighed. The weight of the rectangular piece of iron on the moon's surface is 16 N.

a. The mass of the moon is (more / less) than the earth.
b. The force of gravity is (less / more) on the moon than on Earth.
c. The mass of the iron on the moon is (different than / the same as) on Earth.
d. The weight of the iron on the moon is (less / more / the same) than its weight on earth.
e. Gravitational force and weight (are / are not) related.

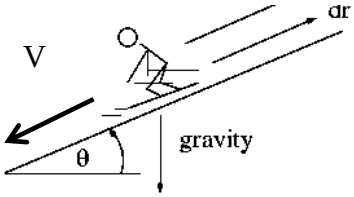
C. Forces

- _____ is a push or pull that is exerted on an object.
- _____ is a force that opposed motion. It is a force that one surface exerts on another when the two rub against each other. Types of _____ include sliding, _____, and rolling.
- _____ is a force that pulls objects toward each other. Two factors that affect the force of _____ are distance and _____.
- Which point in the picture has the strongest pull of gravity on it? _____
- Which point is the pull of gravity the weakest? _____
- Label the following friction pictures as being sliding, fluid, or rolling. Draw the friction arrows in each picture.

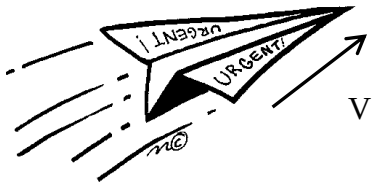




Type of friction: _____



Type of friction: _____



Type of friction: _____

D. Work, Mechanical Advantage, Efficiency & Power

- _____ is done when an object is moved a distance in the direction of the applied force and is measured in joules.
- _____ _____ is the number of times a force if multiplied by a machine.
- _____ is the ratio of work output to work input and is expressed as a percentage. No machine is 100% efficient due to _____.
- _____ is work done per unit of time and is measured in watts.
- The six simple machines are: _____, wedge, _____, lever, _____ _____, and wheel & axle. They are devices that make work easier.
- Simple machines have the following purposes: change the _____ needed (mechanical advantage), change the _____ or distance through which the force is applied, change the _____ at which the resistance moves, or a combination of these.
- Due to _____, the work put _____ a machine is always greater than the work _____.

Solve the following calculations.

1. A deflated hot-air balloon weighs a total of 8000 N. Filled with hot air, the balloon rises to a height of 1000 m. How much work is accomplished by the hot air?

2. A rope is thrown over a beam, and one end is tied to a 300 N bundle of lumber. You pull the free end of the rope 2 m with a force of 400 N to lift the lumber off the ground. How much work have you done?

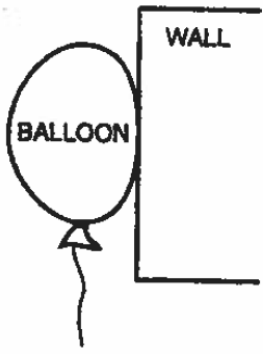
3. A machine produces 4000 Joules of work in 5 seconds. How much power does the machine produce?

4. How much power is needed to move a 600 N box 4 meters in 2 seconds?

E. Newton's Laws of Motion

- Newton's _____ Law of Motion states that an object at rest will stay at _____, and an object in motion will stay in _____ unless acted upon by an unbalanced force. It is also called the Law of _____, which is an object's tendency to resist change in its motion (or lack of motion).
- Newton's _____ Law of Motion states that the force on an object is equal to the product of its acceleration and its mass. It is calculated by the formula: F = ma
- Newton's _____ Law of motion states that for every action there is an equal and opposite reaction.
- Predict the motion. Read each sentence and predict what will happen according to Newton's Laws of Motion.
    - 2^{nd} Law: You hit a ping-pong ball and a tennis ball. Which one will travel farther? _____
    - 1^{st} Law: If you leave a cookie on a plate and there is no one else in the house, where will the cookie be in an hour? _____
    - 3^{rd} Law: If you let the air out of a balloon, what will happen to the balloon? _____
- Which law is it? Reach each statement and determine which law of motion it is illustrating.
    - _____ A rocket from NASA gains speed as it leaves the launch pad.
    - _____ A bullet leaves a rifle and the rifle "kicks" your shoulder.
    - _____ The lab cart slowly rolls across the lab floor until it stops.
- Solve the following calculations:
    - What force gives a 6 kg object an acceleration of 4 m/s^2?
    - If a person is pushing a cart with a force of 40 Newtons and it accelerates at 0.5 m/s^2, what is the mass of the cart?
    - What is the acceleration of a 3 kg rock that is thrown with a force of 18 N?

XI. Magnetism & Electricity

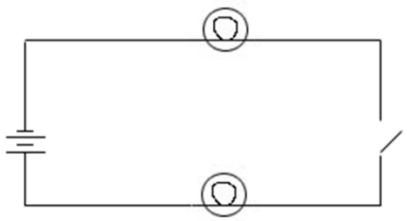


- _____ _____ is the buildup of charges on an object by _____.
- A dangerous form of static electricity is _____.
- Draw the charges that would allow the balloon to stick to the wall.

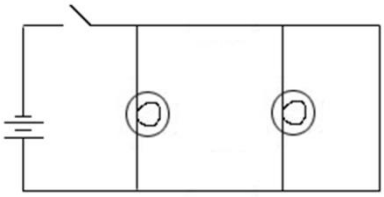
A. Circuits

Series Circuit

- An electric circuit with only _____ path for _____ to flow.
- As you _____ lights, they become _____.
- When _____ light goes _____, they _____ go _____.
- If any _____ of a series circuit is _____, the circuit _____.
- The series circuit _____ is dependent on _____ other parts of the circuit.
- Ex. _____



Parallel Circuit



- An electric circuit with _____ than one _____ for the _____ to flow.
- As you _____ lights, they _____ the same intensity.
- If _____ light goes _____, the others stay _____.
- The _____ of a parallel circuit are _____ of each other.
- Ex: _____

B. Resistance, Current, & Voltage

- _____ is a property of matter that affects the flow of electricity and is measured in ohms. Long skinny wires have more _____ than short, fat wires.
- _____ is the flow of electric charge through a material and is measured in amps.
- _____ is the difference in electric potential energy between two points in a circuit. It is the amount of energy the electrons are carrying and is measured in volts.
- Solve the following calculation:
    - Find the resistance of a piece of aluminum if a current of 2.3 amps is produced by a 1.5-volt power source.
    - What is the voltage of a power source when a nickel wire with a 9.5-ohm resistance allows 0.6 amps to flow through it?
    - What amount of current will pass through a resistance of 15 ohms with a 9-volt power source is used?

C. Magnetism & Electromagnetism

- _____ fields can produce _____ current in conductors.
- _____ can produce a _____ _____ and cause iron and steel objects to act like _____.
- _____ are temporary magnets that lose their magnetism when the electric current is removed. The strength of an _____ can be increased by using an _____ core, increasing the number of _____, make the coils _____, or increasing the _____.
- A _____ is a device that converts mechanical energy into electrical energy. Most of the electrical energy we use comes from _____.
- _____ _____ convert electrical energy into mechanical energy that is used to do work. It is a device that uses an electric current to turn an axle which produces motion.
- _____ is a material that transfers electric current well. Examples include most metals and water.
- _____ is a material that does not transfer an electric current. Examples include glass, air, and plastic.
- _____ is in-between a conductor and insulator. They conduct current better than an insulator, but not as well as a conductor. Examples include diodes, LEDs, and transistors.