HONORS CHEMISTRY: Matter Basics DATE:_____

Objectives: **SWBAT differentiate between. . .**

…mass, volume and weight.
…solids, liquids, gases & plasma.
…physical and chemical properties.
…chemical and physical changes.

MATTER:

Volume:

Mass:

Mass is not equal to weight.

~

~

~

SING-A-LONG TIME

PHYSICAL VS. CHEMICAL PROPERTIES

Physical properties:

ex):

State of matter:

Solids:

Liquids:

Gases:

Plasma:

Chemical properties:

ex)

PHYSICAL VS. CHEMICAL CHANGES

Physical change:

chemical changes:

DID YOU KNOW… "Plasmas are a lot like gases, but the atoms are different, because they are made up of free electrons and ions of an element such as neon (Ne). You don't find naturally occurring plasmas too often when you walk around. If you have ever heard of the Northern Lights or ball lightning, you might know that those are types of plasmas. It takes a very special environment to keep plasmas going.

Man-made plasmas are everywhere. Think about fluorescent light bulbs. Inside the long tube is a gas. The electricity acts as an energy source and charges up the gas. This charging and exciting of the atoms creates glowing plasma inside the bulb. The electricity helps to strip the gas molecules of their electrons.

Another example of plasma is a neon sign. The electricity charges the gas and creates plasma inside of the tube. The plasma glows a special color depending on what kind of gas is inside. Inert gases are usually used in signs to create different colors.

You also see plasma when you look at stars. Stars are big balls of gases at really high temperatures. The high temperatures charge up the atoms and create plasma. Fluorescent lights are cold compared to really hot stars. However, they are still both forms of plasma, even with the different physical characteristics."

http://www.chem4kids.com/files/matter_plasma.html

"In baiting a mousetrap with cheese, always leave room for the mouse." ~ Saki

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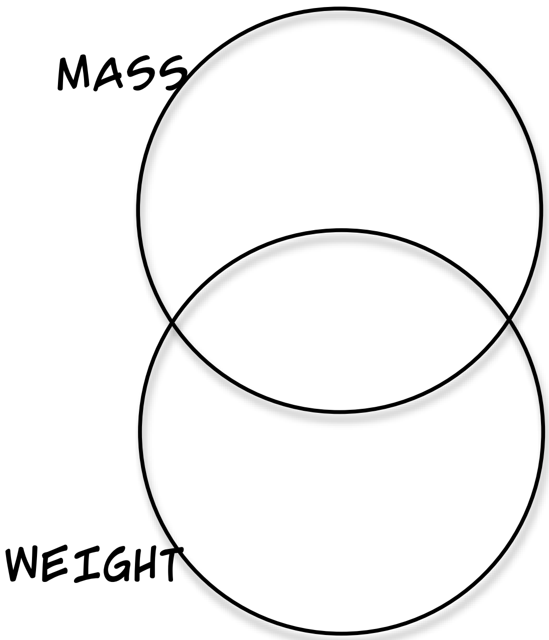
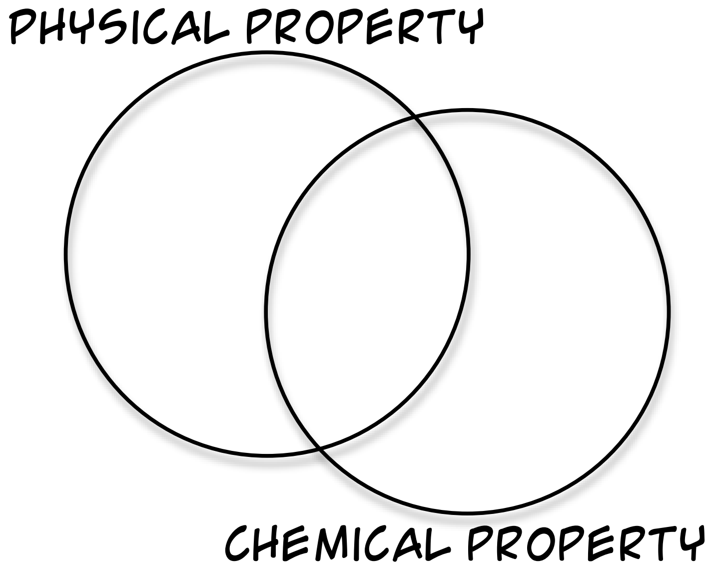
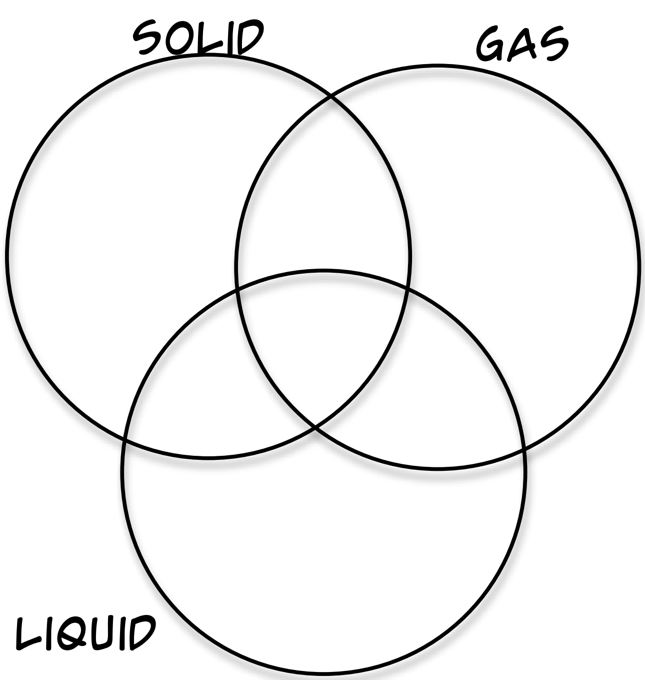
HONORS CHEMISTRY
INTRODUCTION TO MATTER

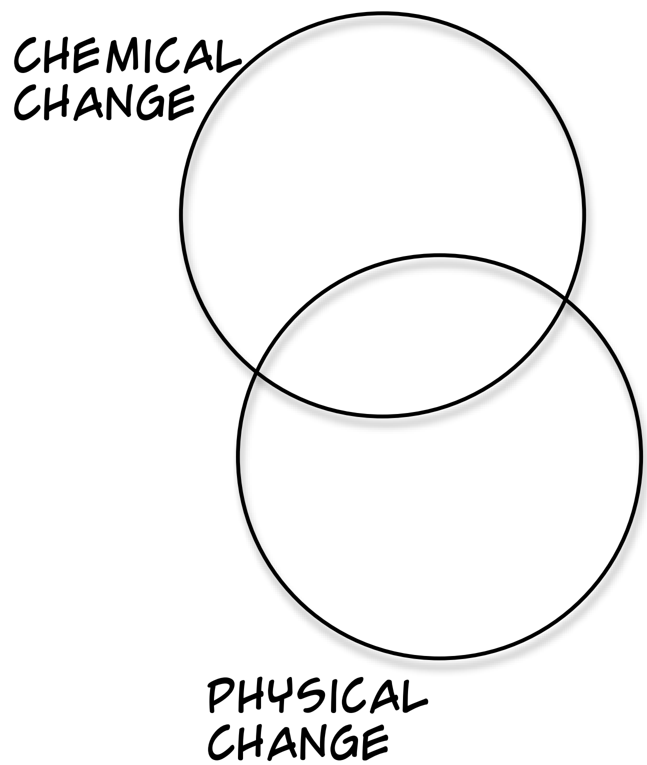
NAME ________________

Complete the following Venn Diagrams! Try to include examples.









"Knowledge is weightless, a treasure you always carry easily." – Chinese Proverb

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HONORS CHEMISTRY: As a Fact of Matter...   *DATE:_____*

Objectives: **SWBAT. . .**

…differentiate between pure substances and mixture.
…subdivide pure substances and mixtures into relevant categories.

ALL MATTER IS EITHER A PURE SUBSTANCE OR A MIXTURE.

PURE SUBSTANCE:

- Have specific chemical and physical properties *(∴)*

-

- Two types of pure substances:

1. Element:

-

Atom:

Diatomic:

Allotropes:

ex. Oxygen

ex. Carbon

GRAPHENE PRIMER

2. Compound:

-

-

- Again, like all pure substances, each has unique physical and chemical properties.

Molecule:

MIXTURE:

- Cannot be represented by a chemical formula! ex.
- Properties of mixtures can vary since proportions can vary.
- ex.

- Two types of mixtures:

1. Homogeneous mixture:

- a.k.a. solutions
- all regions are identical in composition and properties ex.
- *Alloy:* Brass = Steel =

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2. *Heterogeneous mixture:*

- different regions can have different compositions and properties.
- ex.

suspension: special variant - particles mixed thoroughly, but will eventually settle out

- ex)

?. Colloid: Uniformly mixed particles that don't settle out easily, but are 10 to 100 times larger than particles found in other solutions

-
-
- can be identified through the:

WHO LIKES COLLOIDS? THIS DUDE.

WHO LIKES THE TYNDALL EFFECT? THESE DUDES.

DID YOU KNOW... "in terms of specific ingredients, the recipe for ice cream is simple. But in scientific terms, it's complicated stuff. Ice cream is a **colloid**, a type of emulsion. An emulsion is a combination of two substances that don't normally mix together. Instead, one of the substances is dispersed throughout the other. In ice cream, molecules of fat are suspended in a water-sugar-ice structure along with air bubbles. The presence of air means that ice cream is also technically a foam.

In addition to milk fat, non-fat milk solids, sugar, and air, ice cream also contains stabilizers and emulsifiers. Stabilizers help hold the air bubble structure together and give the ice cream a better texture. Although gelatin was originally used as a stabilizer, xanthan gum, guar gum, and other compounds are used today. Emulsifiers keep the ice cream smooth and aid the distribution of the fat molecules throughout the colloid. Egg yolks were once used, but ice cream manufacturers now tend to use other chemical compounds. These stabilizers and emulsifiers make up a very small proportion (less than one percent) of the ice cream."

howstuffworks.com

"The believer is happy, the doubter is wise." ~ Greek Proverb

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HONORS CHEMISTRY
MATTER CLASSIFICATION

NAME ________________

Without looking at your notes, try to draw the complete matter classification tree.

There are a series of samples. Describe each bottle and then attempt to classify them in your matter classification tree. Feel free to infer the identity of the substances from your observations if that helps classify them!

"Inanimate objects are classified scientifically into three major categories - those that don't work, those that break down and those that get lost." - Russell Baker

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HONORS CHEMISTRY: Keep 'em Separated DATE:_____

Objectives: **SWBAT. . .**

…state the important distinctions between compounds and mixtures.

…list five ways to physically separate mixtures.

IMPORTANT DISTINCTIONS BETWEEN COMPOUNDS AND MIXTURES

1. Compounds are a pure substance. Mixtures can never consists of only a single substance.
2. Properties of mixtures ex.

   Properties of compounds ex.
3. Compounds have a ex.

   Mixtures can have ex.

LEGO MY MISCONCEPTIONS

FIVE WAYS TO PHYSICALLY SEPARATE MIXTURES

How do you separate stuff?

Note: separation does not chemically change substances!

MIXTURES CAN BE TASTY

A. Filter: (primary physical property exploited:)

-
- Filtrate=
- ex)

B. Centrifuge: (primary physical property exploited:)

-
- Ex.)

C. Decant: (primary physical property exploited:)

-
- ex)

YOUR NEW RINGTONE

D. Evaporation/Distillation: (primary physical property exploited:)

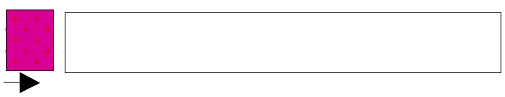
-
- Can be used to separate several different substances
- Used in petroleum industry and components are the basis of many materials, fuels, medicines etc.
- Salt water can be purified into water, but very expensive/energy-intensive.

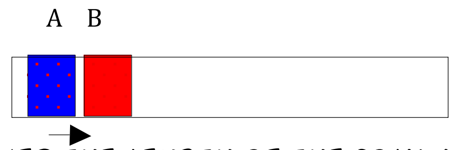
E. Chromatography: (Primary physical property exploited:)

- Techniques which use a ___________ and___________ phase to physically separate substances.
- Different substances separate based on their attraction to either a stationary phase or a solvent that passes over it (the mobile phase).
- ex.)
- The more something is attracted to the stationary phase,
- The more something is attracted to the mobile phase,
- Many complex, high-tech variations of this but the basic principles stay the same.

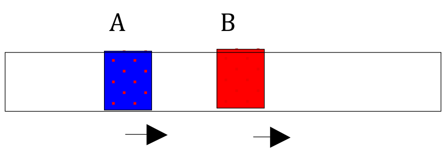
FANCIER CHROMATOGRAPHY

1) Starts with substance A and B mixed together...

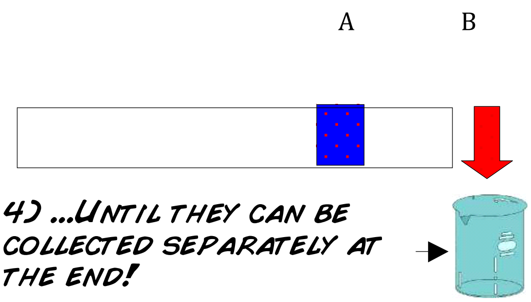




2) Over the length of the column, they will begin to separate...



3) More and more...



4) ...Until they can be collected separately at the end!

> **DID YOU KNOW...** "Chromatography was developed in the early 1900's when a Russian scientist, Mikhail Tsvett, was searching for a way to separate the hidden red and yellow pigments from green leaves. Like many students, Tsvett knew that the colored pigments were present in green leaves, but remained hidden until the chlorophyll broke down in the fall, allowing the leaves' true colors to appear. He crushed green leaves into a thick solution, and discovered that when this solution was mixed with a certain powder, different colors appeared in specific areas of the powder. The hidden colors in the leaves separated to different areas, depending on how easily they were absorbed by the powder. Hence the name, chromatography (Latin roots = 'color record').
>
> Because of the tragic events in Russia at the beginning of the 20th century, Tsvett's chromatography method went into oblivion and was recollected 10 years after his death thanks to German scientist Edgar Lederer and Austrian biochemist Richard Kuhn."
>
> www.chemistrydaily.com and www.galileo.phys.virginia.edu

"The real voyage of discovery consists not in seeking new landscapes, but in having new eyes."
~ Marcel Proust

HONORS CHEMISTRY: You Are My Density DATE:_____

Objectives: **SWBAT. . .**

… define and calculate density values.

… explain the difference between intensive and extensive properties.

DENSITY: What is it?

~

~ Density (D) =

~

Intensive property:

ex)

Extensive property:

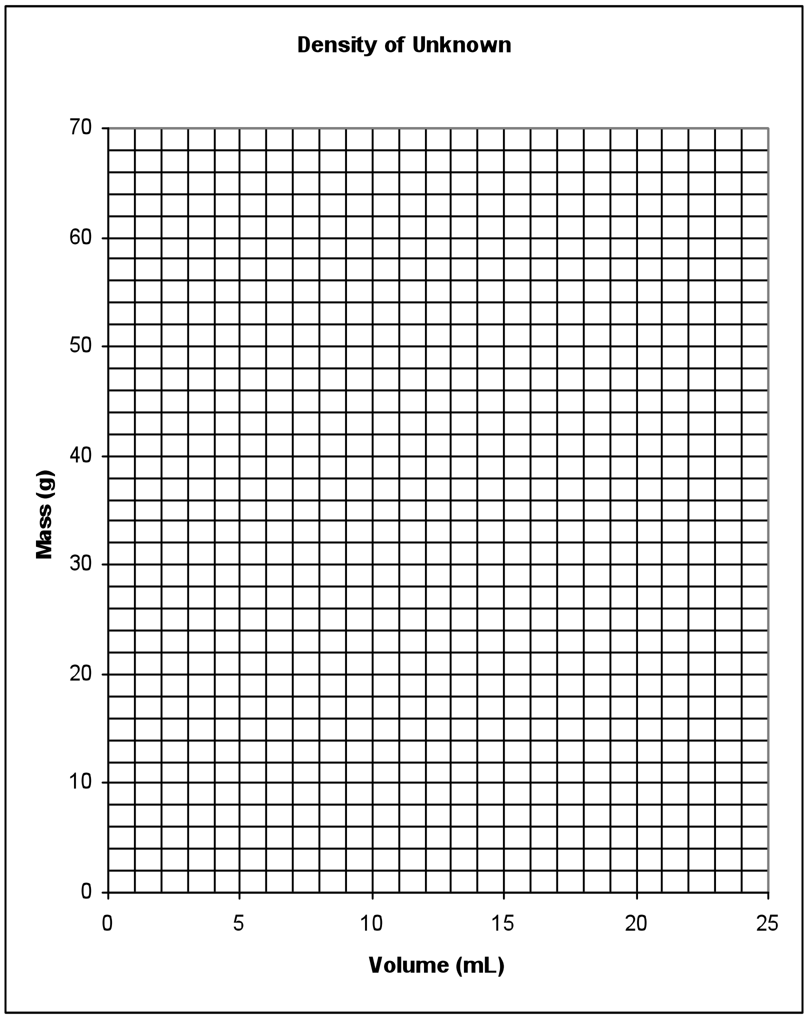
ex)

CAN GRAPHICALLY DETERMINE DENSITY

Set y=mass and x=volume and graph.

Plot this data:

Volume (ml)	Mass (g)
21.2	60.5
10.5	31.0
5.6	15.2
4.1	12.9
2.1	6.1



Slope =

=

=

=

Density, like the slope, is a constant!

The mass is *directly proportional* to the volume.

-

What would *inversely proportional* mean?

-

(ex. *see-saw*)

Now mathematically verify your density value for the data by dividing the average of the masses by the average of the volumes:

SINCE DENSITY IS A CONSTANT
IT CAN BE USED TO IDENTIFY SUBSTANCES.

ex)

LEGO MORE OF MY MISCONCEPTIONS

ex.) Pure gold has a density of 19.3 g/mL. Your ring has a volume of 3.0 mL and a mass of 47.9 g. Is it pure gold?

Finally denser object sink. Can be useful in crude comparisons.

ex)

DID YOU KNOW… "In the early 1600s, Galileo Galilei created a simple, fairly accurate thermometer. The Galileo thermometer consists of a sealed glass tube that is filled with water and several floating bubbles. The bubbles are glass spheres filled with a colored liquid mixture. This liquid mixture may contain alcohol, or it might simply be water with food coloring.

Attached to each bubble is a little metal tag that indicates a temperature. A number and degree symbol are engraved in the tag. These metal tags are actually calibrated counterweights. The weight of each tag is slightly different from the others. Since the bubbles are all hand-blown glass, they aren't exactly the same size and shape. The bubbles are calibrated by adding a certain amount of fluid to them so that they have the exact same density. So, after the weighted tags are attached to the bubbles, each differs very slightly in density (the ratio of mass to volume) from the other bubbles, and the density of all of them is very close to the density of the surrounding water.

The basic idea is that as the temperature of the air outside the thermometer changes, so does the temperature of the water surrounding the bubbles. As the temperature of the water changes, it either expands or contracts, thereby changing its density. So, at any given density, some of the bubbles will float and others will sink. The lowest bubble that hasn't sunk to the bottom is closest to the current density of the water, hence closest to the approximate current temperature."

Source - howstuffworks.com

"I am part of all I have met." ~ Alfred Lord Tennyson

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HONORS CHEMISTRY
DESTINY… I MEAN, DENSITY

NAME ________________

Write down the equation for density. Solve it for all three variables. Then make sure the units work through all three versions correctly.

Show how an object's density could be used as an equivalence statement in factor-label.

Choose one of the unknowns. Determine its destiny, I mean, density using a four-beam balance and a graduated cylinder. Show all work.

"I'm your density. I mean, your destiny." – George McFly, "Back To The Future"

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HONORS CHEMISTRY: FEEL THAT ENERGY! DATE:_____

Objectives: **SWBAT. . .**

…differentiate between different types of energy.
…differentiate between temperature and heat.
…differentiate between exothermic and endothermic processes.

ENERGY:

Many types of energy and one type can be transformed into other types.

ex)

LAW OF CONSERVATION OF ENERGY:

ex)

SOME IMPORTANT ENERGY EQUATIONS:

POTENTIAL ENERGY:

ex)

Gravitational potential energy = mass x acceleration due to gravity x height

Units =

KINETIC ENERGY:

KE =

Units =

ex) Cheetah runs 28m/s and has a mass of 60. Kg. What is its kinetic energy?

EINSTEIN SPEAKS

EINSTEIN'S EQUIVALENCE EQUATION:

E = m = c =

Units =

What does equation mean?

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HONORS CHEMISTRY
ENERGY, DAY ONE

NAME _________________

WORK THOSE EQUATIONS!
Write down the equations for gravitational potential energy, kinetic energy and energy equivalence. For now, choose one and solve it for each variable (or constant). Then make sure the units work through all versions correctly. (For later, you can do the other two!)

Determine either A) how much energy you produce when you run at your top speed, or B) how much energy you'd produce if you fall off the chair and hit the ground.

Create a new equivalence statement about yourself, using the answer to the problem above.

What law establishes the idea that energy cannot be created nor destroyed in chemical and physical changes?

"It takes as much energy to wish as it does to plan." - Eleanor Roosevelt

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TEMPERATURE VS. HEAT

Temperature:

Heat:

ex)

Compare a match and a warm bath. Which has a higher temperature?

Which has a bigger heat content?

OLD SCHOOL

EXOTHERMIC CHANGES VS. ENDOTHERMIC CHANGES

ENDOTHERMIC :

ex)

EXOTHERMIC:

ex)

NEWER SCHOOL

Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd, 1939

F.D. Roosevelt,
President of the United States,
White House
Washington, D.C.

Sir:

Some recent work by E.Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:

In the course of the last four months it has been made probable - through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction in a large mass of uranium,by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

-2-

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source of uranium is Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an inofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States;

b) to speed up the experimental work,which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsäcker, is attached to the Kaiser-Wilhelm-Institut in Berlin where some of the American work on uranium is now being repeated.

Yours very truly,
A. Einstein
(Albert Einstein)

"The release of atomic energy has not created a new problem.
It has merely made more urgent the necessity of solving an existing one."
~ Albert Einstein

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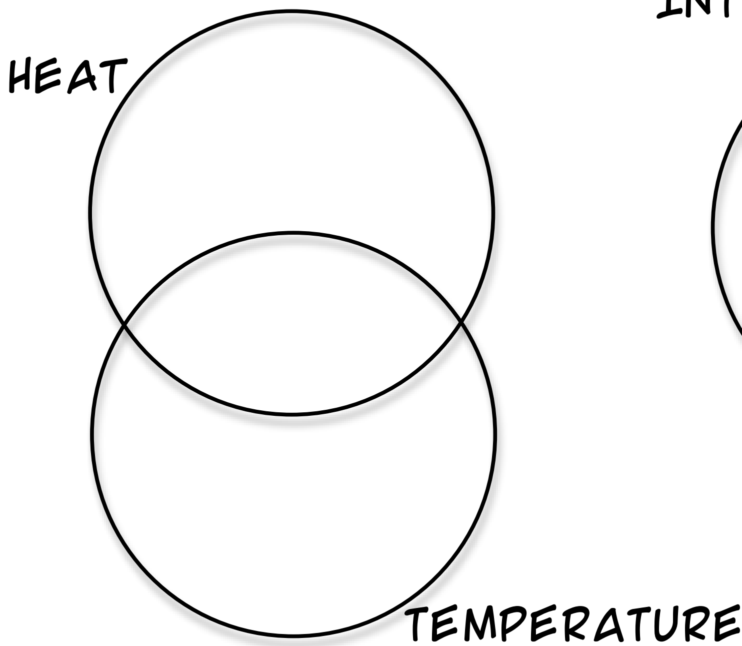
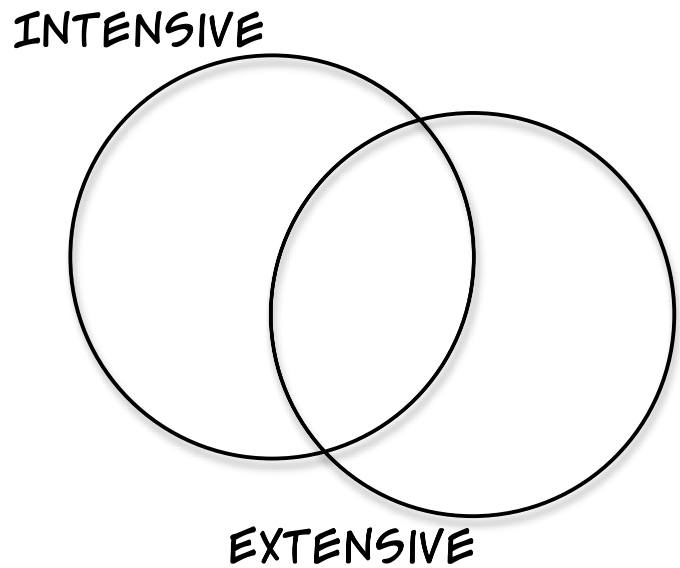
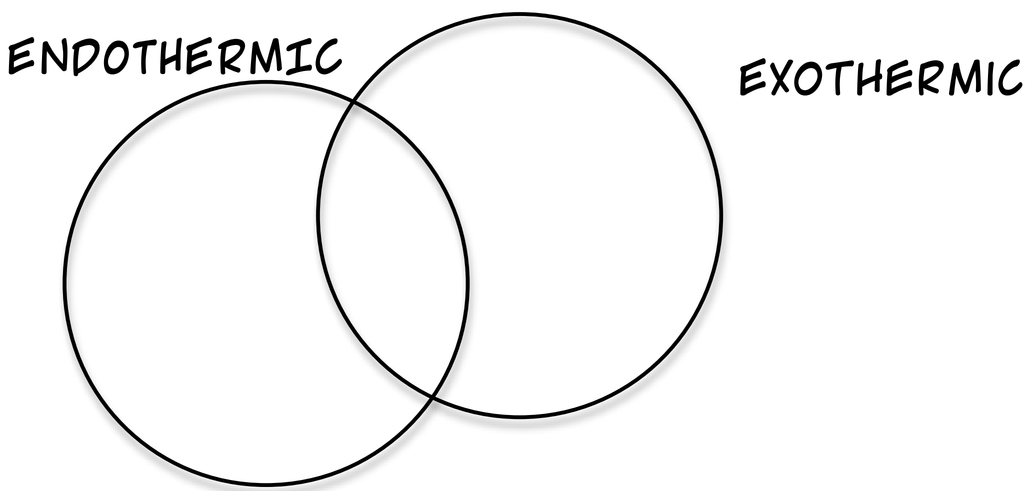
HONORS CHEMISTRY
ENERGY, DAY TWO

NAME ________________

WORK THOSE VENN DIAGRAMS! Make sure you also include an example in each. (Explain your examples too, off to the side...)







Draw a picture of an energy transfer and identify the endo and exothermic parts.

"If you want to find the secrets of the universe,
think in terms of energy, frequency and vibration." - Nikola Tesla

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HONORS CHEMISTRY: Why Does Hot Apple Pie Stay so HOT? DATE:_____

Objectives: **SWBAT. . .**

…define and calculate variables related to specific heat.

…define and convert between calories, joules and Calories.

NOT ALL THINGS HEAT AT THE SAME RATE.

SPECIFIC HEAT: (A.k.a. specific heat capacity) Symbol= s or c_p

DEFINITION:

- Units =
-
- An intensive property! ex) liquid water's c_p =
- Different states of matter of the same substance can have different specific heat values.

EQUATION: Change in heat (Q) =

- Units =
- Careful: *When determining a change, the value is <u>always</u> **final condition – initial condition**!*

ex) How much energy is released when a cup of 200.g (~ 7 ounces) of hot tea at 65°C cools down to your body temp (37°C)?

SPECIFIC HEAT VS. HEAT CAPACITY
(HE REVERSES Q, SO BE CAREFUL)

How much gold (c_p = 0.13 J/g·°C) needs to cool down so that both the temperature change and energy released remains the same?

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CALORIES: A specialized energy unit =

- Note: The **c**alories in food are actually dietary **C**alories =
    - Can set-up factor label conversions:

Ex) A candy bar has 200. Calories. How many calories is that? How many joules?

CALORIES ANIMATED

CALORIMETER:

- Some are used to determine the specific heat of an unknown substance.
- Some (called bomb calorimeters) measure the energy content of material (often food) by combusting it.
- How can we do that? Look at specific heat equation.
    -
    -
    -
    -

CALORIMETRY

DID YOU KNOW... ""Calories are strictly neutral. Meaning: from an energy viewpoint it doesn't matter whether you eat a healthy 500 calorie meal (eg. meat, potatoes and vegetables) or two 250-calorie candy bars. Both offer 500 calories worth of energy. But energy/calories alone will not keep you healthy - the calories you eat must contain sufficient nutrition to maintain your organs and tissue in good health, otherwise your well-being and energy levels will suffer.

No one food (or food group) contains more than a small percentage of the necessary nutrition to sustain good health. Calories from good fats (or good carbs) may contain nutrition, but not enough. To be sure of getting adequate nutrition you need to take your calories from a wide variety of different foods. For this reason, fat-free or carb-free diets are unhealthy and dangerous to health. Even very-low-fat or very-low-carb diets are a health risk.

We tend to associate calories with food, but anything containing energy contains calories. For example, a gallon (about 4 liters) of gasoline contains about 31,000,000 calories!"

www.calorie-counter.net

I merely took the energy it takes to pout and wrote some blues. ~ Duke Ellington

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HONORS CHEMISTRY
CALORIMETRY

NAME ________________

WORK THOSE EQUATIONS!
Write down the equation for Q and then solve it for each variable. Then make sure the units work through all versions correctly.

Why don't we measure mass in kg, like the other energy equations?

What kind of substance is going to take a lot of energy to heat up? A little energy to heat up?

What kind of substance is going to release a lot of heat when it cools? A little heat when it cools?

Convert the specific heat of your favorite substance to cal/kg/°C (show work)

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LIST RELEVANT INFO! WRITE DOWN BLANK EQUATION! PLUG IN NUMBERS WITH UNITS! CIRCLE ANSWER! WATCH SIG FIGS AND UNITS!

You find a 1979 copper penny (pre-1982 pennies are pure copper) in the snow and pick it up. How much heat (in Joules) does the penny absorb as it warms from the temperature of the snow, -5.0∘C to the temperature of your body, 37∘C. Assume the penny is pure copper and has a mass of 3.10 g. (The specific heat capacity of copper is 0.385 J/g/∘C.)

The temperature of a lead fishing weight rises from 26∘C to 38∘C as it absorbs 11.3 J of heat. What is the mass of the fishing weight in grams? (The specific heat capacity of lead is 0.128 J/g/∘C.)

What is the temperature change in 355 mL of water upon absorption of 34 kcal of heat?

"The true measure of a man is how he treats someone who can do him absolutely no good."
- Samuel Johnson

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HONORS CHEMISTRY MATHEMATICS REVIEW SHEET II

Metric conversions (show all work!)

1) 2.0×10^2 kl to ? Ml

2) .001 mm to ? in

3) 200.1 lbs to ? kg

UNITS

Determine the final unit.

1) cm + cm = ?

2) cm - cm = ?

3) cm / cm = ?

4) cm x cm = ?

5) g x g x g / (g^2 x kl) = ?

6) (ml – ml)/ml x % = ?

7) mol x cm x g^2 / mol x cm^4

8) nl + ml = ?

Calculations

Perform the following calculations, using the proper number of significant figures. Watch units!

1) 200 cm + 12.1 cm - 98.75 cm

2) True value = 13.510 g
Observed value = 12.999 g
(Determine absolute and percent error)

3) 14.0 ml, 14.05 ml, 12.02 ml, 13.50 ml
(Determine average)

4) $2{,}000{,}\bar{0}00$ hm / 2000 people

And once again…

Count and write down the number of significant figures next to <u>each</u> number on this sheet.

"If you haven't found something strange during the day, it hasn't been much of a day."
~ John A. Wheeler

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