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

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 =

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

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!

A. Filter: (primary physical property exploited:)

-
- Filtrate=
- ex)

MIXTURES CAN BE TASTY

B. Centrifuge: (primary physical property exploited:)

-
- Ex.)

C. Decant: (primary physical property exploited:)

-
- ex)

YOUR NEW RINGTONE

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

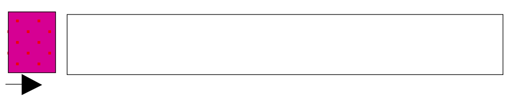
-
- Can be used to separate several different substances
- Used in petroleum industry and components are the basis of many materials, fuels, medicines etc.
- Salt water can be purified into water, but very expensive/energy-intensive.

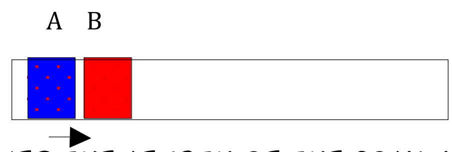
E. CHROMATOGRAPHY: (PRIMARY PHYSICAL PROPERTY EXPLOITED:)

- 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.

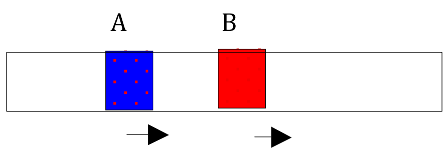
FANCIER CHROMATOGRAPHY

1) STARTS WITH SUBSTANCE A AND B MIXED TOGETHER...

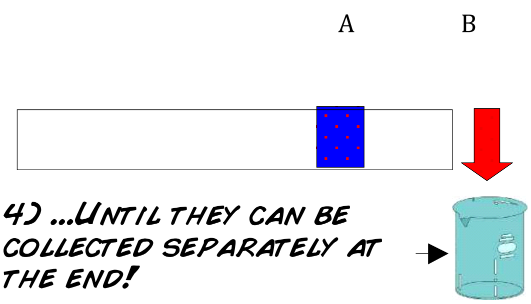




2) OVER THE LENGTH OF THE COLUMN, THEY WILL BEGIN TO SEPARATE...



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:

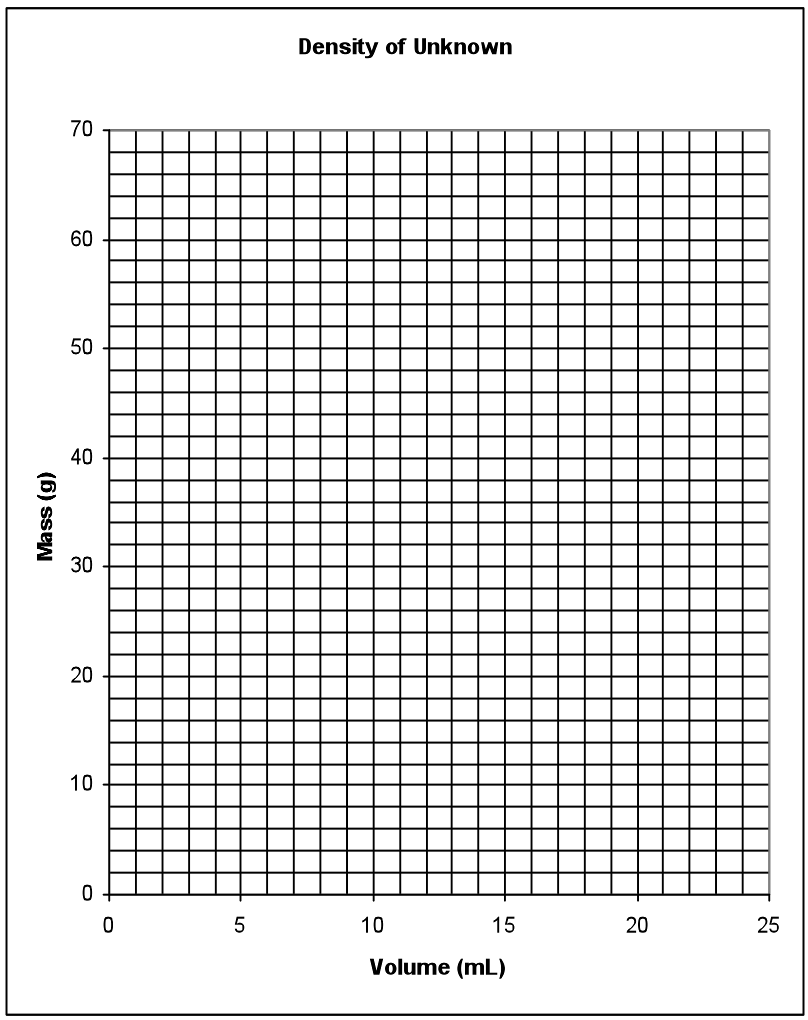
ex)

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:

LEGO MORE OF MY MISCONCEPTIONS

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

ex)

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

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?

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

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?

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

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 each 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

HONORS CHEMISTRY INTRODUCTION TO CHROMATOGRAPHY EXPERIMENT

BACKGROUND:

In chemistry one of the most important skills you need is the ability to separate different unknowns. One way of doing this is chromatography. This method exploits the differences in chemicals to physically separate them by using some type of mobile and stationary mediums.

Different compounds will act differently in different mobile and stationary phases. In this experiment you will use two different mobile phases, ethanol and water, to separate the dyes in eight markers to determine their make-up. The physical property we are measuring is called the ***Retention Factor***. You will then try to match up and unknown writing sample with one of your standards.

PROCEDURE:

1. Pour approximately 1.5 milliliters of water into a large test tube.

2. Cut four strips of chromatography paper a little longer than the length of the test tube.

3. Measure 2.00 cm up from the bottom and draw a line across in pencil. This is the ***starting line***.

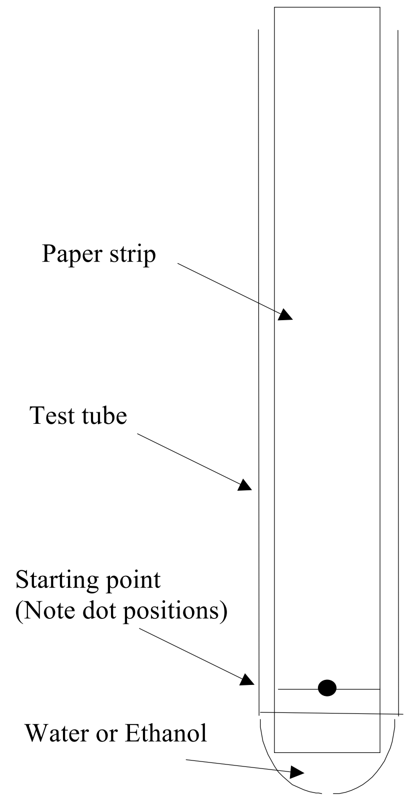
4. Cut the paper in half lengthwise. Label the marker number and solvent used at top of paper in pencil.

5. Put a small dot from the unknown pen in the middle of the starting line. Be sure to mark which pen you used.

6. Repeat steps 3-5 with the three other markers. Place all strips in the tubes. Let solvent run at least half way up strip, but not much more than 3/4 of the way up. Pull out strips, mark edge of how far the solvent has gone with a pencil. This is called the ***solvent front***. Allow to dry.

7. Repeat steps 1-6 now using ethanol instead of water.

8. Repeat steps 1-8 with the unknown strip.



RESULTS AND CALCULATIONS:

Paste chromatographic strips into your experimental write-up. Measure how far eye dye and the solvent front has moved from the starting point. Calculate an Rf (retention factor) value for each color:

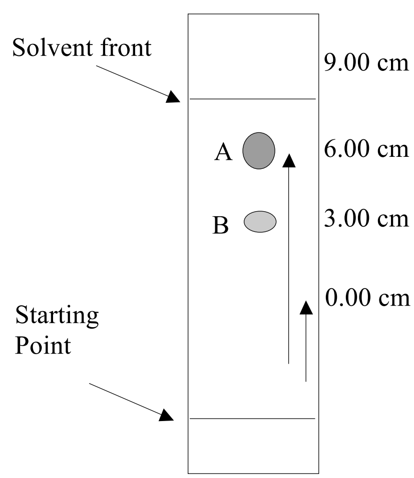
$$Rf = \frac{\text{Distance component (dye) moved from starting point}}{\text{Distance solvent has moved (a.k.a. the solvent front)}}$$

Example: *Solvent front moved 9.00 cm*
Component A moved 6.00 cm
Component B moved 3.00 cm

A's Rf = $\frac{6.00 \text{ cm}}{9.00 \text{ cm}} = .667$ B's Rf = $\frac{3.00 \text{ cm}}{9.00 \text{ cm}} = .333$

Notes:

- Measure the most intense part of each color as distance moved.
- Rf is a unitless measurement since both distance units cancel out.



QUESTIONS:

1. Which is a provable statement: Permanent markers are/are not permanent. Explain.

2. Research chromatography. Decide which type of chromatography this experiment would fall under. Explain. Summarize (don't plagiarize) in a couple of sentences at least 2 other types of chromatography.

CHROMATOGRAPHY RESULTS (COPY IN LAB NOTEBOOK)

MARKER #	Distance color(s) moved in water	Solvent front distance in water	Rf values for components in water	Distance color(s) moved in ethanol	Solvent front distance in ethanol	Rf values for components in ethanol
example	Red 1.00 cm Blue 5.00 cm Yellow 10.00 cm	10.00 cm	Red .100 Blue .500 Yellow 1.000	Red 2.00 cm Yellow 6.00 cm	8.00 cm	Red .250 Yellow .750
Unknown #						

"Good questions outrank easy answers." ~ Paul A. Samuelson

HONORS CHEMISTRY SPECIFIC HEAT EXPERIMENT

INTRODUCTION:

Things heat up at different rates. It takes much longer to heat up the water than it does the metal stove it sits upon. The rate at which something heats or cools is a substances specific heat capacity (a.k.a. specific heat). This intensive property can be used to help identify substances.

You will determine the change in heat content of metal samples. You will use a simplified ***calorimeter***; a device that uses changes in temperature of a given amount of water to determine energy changes. From this you can determine the heat capacity of the metals and, hopefully, their identities.

MATERIALS:

Goggles
hot plate
balance
crucible tongs
Styrofoam cups
metal samples
stirring rod
forceps
2 250-400 ml beakers
plastic baggies for small samples
thermometer

PROCEDURE:

1. Start warming up about 200 ml of water in a beaker.
2. Determine the mass of one sample of unknown metal (may be more than one piece if small).
3. Record good qualitative observations about your metal sample.
4. When water is boiling, carefully add the sample to water. Allow to heat for at least five minutes. Record the temperature of boiling water.
5. Nestle Styrofoam cup inside 400 ml beaker. Place enough room temperature water in the calorimeter to submerge the sample. Be sure to determine the exact mass of water added. Take the temperature of water and leave thermometer in the calorimeter for the next step.
6. Carefully remove sample from hot water and quickly place into calorimeter (try to shake off any excess water clinging to sample so that it does not affect calorimeter water). Cover and gently stir while observing temperature. Record the maximum temperature change.
7. Empty calorimeter. Dry and return sample.
8. Repeat steps 2-6 with second sample of the same unknown metal.
9. Obtain a second type of unknown metal. Repeat steps 2-8.

(Use as a guide for the data table you'll create in your lab notebook)	**Metal #1: sample 1**	**Metal #1: sample 2**	**Metal #2: sample 1**	**Metal #2: sample 2**
Mass of metal sample				
Mass of calorimeter water				
Temperature of boiling water (= Initial temperature of metal)				
Initial temperature of calorimeter water				
Final temperature of calorimeter water (= Final temperature of metal)				
Calc #1: Change in calorimeter water temperature				
Calc #2: Heat absorbed by calorimeter water				
Calc #3: Change in metal sample temperature				
Calc #4: Heat capacity of sample				

CALCULATIONS:

1.) Determine the change in temperature of the water in the calorimeter.

2.) Determine the heat absorbed (in J) by the water in the calorimeter in warming to the final temperature, given the specific heat of water is 4.184 J/(g•ºC).

3.) Determine temperature change of the metal sample after cooling.

4.) Given the mass of the sample, the change in temperature of the sample and the energy gained by the water (hence lost by the sample), determine the specific heat of the metal.

5) Find the average specific heat of each of your two different metal samples.

QUESTIONS:

1.) The Law of Dulong and Petit states that the atomic mass of an element multiplied by its specific heat value is approximately 26 J. Use this law to determine the approximate atomic mass of your unknown, then (using the periodic table) predict what metal it might be. Compare to the value you found in your discussion investigation.

2.) What scientific law accounts for the assumption that the heat gained by the water in the calorimeter is equal to the heat lost by the metal sample?

3.) Why do we want to keep the water in our calorimeters isolated from the environment?

4.) Would doubling the amount of metal sample change the energy absorbed in the calorimeter? Would it change the metal's specific heat?

In the days before boiling oil

5.) Medieval castle defenders would often pour boiling oil (specific heat ~ 2 J/(g•ºC)) down on invading forces. Name three reasons why oil would be superior to water. Do so by comparing physical properties.

ANALYSIS: As normal. Use the internet to look of specific heats of metals. Try to determine the identity of your unknown. Use your qualitative observations to help.

BIG HINT: You've measured another intensive property in a prior experiment that could help.

"War is sweet to those who have not experienced it."
~ Erasmus

BACKGROUND:

In science, an important skill is the ability to differentiate between different unknowns. One useful way of doing this is to use physical properties, since the properties and characteristics of pure substances are often as unique as a fingerprint. One such property is density. As you now know, density is an intensive property- it is independent of the amount of substance present.

Density(g/ml) can be calculated by simply dividing the mass(g) of a substance by the volume(ml). If several different measurements are taken, then the mass values can be plotted against volume values. The points can be connected with a best-fit line where the mass is directly proportional to the volume. The slope of this line is the density.

Density is used in crime scene investigations to match glass fragments to a potential source. In this scenario, there was a smash-n-grab robbery at a local jewelry store. A suspect was arrested with glass fragments in his pockets. You will determine if the density of glass fragments matches the glass from the store displays.

MATERIALS:

100mL or 200mL beakers, 10, 50, 100ml graduated cylinders, eyedroppers, four-beam balances/electric balances, thermometers, glass samples, forceps

PROCEDURE:

I. Determining the Density of Water

1. Measure the mass of a 100 ml or a 250 ml beaker to the nearest 0.001g on the four-beam balance. Record on your data sheet.
2. Use a balance and add exactly 50.000**g** (not ml) of water to the beaker. Start with 45 ml and add drop-wise until you reach 50.000g of water.
3. Pour the 50.000g of water into a 50 or 100 ml graduated cylinder. Read the bottom of the meniscus and record the volume with the proper number of significant figure.
4. Use a thermometer to determine the temperature of the water. Record this value.

II. Identification of a Glass Sample though Density – Crime Scene Investigation

NOTE: *Do not handle any glass fragments with your hands; use the forceps. Not only could you cut yourself, but we are simulating a crime investigation here! Do not corrupt the evidence! Watch sig figs!*

1. Obtain approximately 20 grams worth of glass fragments. Check to make sure they will fit in your 100 ml graduated cylinder. Make sure they are dry. Measure their combined mass. Make any qualitative observations you want.
2. Fill the 100 ml about one-half full with tap water. Read and record the volume to the proper number of significant figures.
3. Slowly and carefully immerse entire sample in the cylinder and record the new volume.
4. Empty the water into the sink, but retain, dry, and return the glass to the supply.
5. Repeat steps 1 - 4 with a second sample of glass. Make sure it has a noticeably different mass.
6. From other groups, find the data for eight other mass/volume samples. Record this in your table.
7. See your instructor for your evidence bag. Record the evidence letter and then determine its density. Be sure that you return the evidence to the instructor!

THINGS THAT SHOULD BE IN YOUR CALCULATION SECTION:

1. Use the data collected in Part A to calculate the density of water. Use some information source to determine the true density of water at the measured temperature. Calculate your percent error.

2. Calculate the density for each of your stock samples in part B. Use both methods. (i.e. average up the mass/volume calculations and then also determine it using a graph)

3. Determine the density of the evidence sample.

Remember to show one example of each type of calculation you do that is more complex than simple addition or subtraction (this includes error calculations).

THINGS THAT SHOULD BE IN YOUR ANALYSIS:

- how your answers compare with what should be expected (for both parts I and II)
- compare/contrast the two different methods (and answers) you used in part II to find density
- determine if the evidence sample could be from the same source as the stock sample

QUESTIONS:

Be sure to write out the questions in your write up before answering them.

1. You have nothing but a series of liquids of different, known densities. How could you use these to determine the approximate densities of unknown solids? (NOTE: this technique is also used in forensic investigations).

2. CSI: Ancient Sicily: How did Archimedes use density to determine if a crown was pure gold?

3. If the density of the evidence glass is similar to the density of the stock sample; does that prove they are from the same source? If so, why? If not, then what good is it?

DID YOU KNOW...

"FORENSIC SCIENTISTS, SOMETIMES CALLED CRIME LABORATORY ANALYSTS, PROVIDE SCIENTIFIC INFORMATION AND EXPERT OPINIONS TO JUDGES, JURIES, AND LAWYERS. MOST WORK IN LABORATORIES. SOME VISIT CRIME SCENES WHILE OTHERS WORK IN MORGUES, HOSPITALS, POLICE DEPARTMENTS, OR UNIVERSITIES.

YOU MUST BE READY TO KEEP PRECISE RECORDS, SERVE AS AN EXPERT WITNESS IN COURT, ATTEND GRADUATE SCHOOL TO QUALIFY FOR SPECIALTIES AND KEEP UP WITH THE LATEST ADVANCES. IT HELPS TO BE SOMEONE WHO LOVES SCIENCE AND WANTS TO FIGHT FOR JUSTICE. YOU'LL NEED DETERMINATION TO DISCOVER THE TRUTH- NO MATTER WHOM IT HURTS OR HELPS. YOU'LL BE HAPPIEST IN THIS CAREER IF YOU'RE GOOD WITH DETAILS AND LIKE PROJECTS REQUIRING A CAREFUL, STEP-BY-STEP APPROACH.

IF YOU ARE INTERESTED IN A CAREER IN FORENSIC SCIENCE THEN MAKE THE MOST OF YOUR MATH AND SCIENCE COURSES. DEVELOP YOUR PUBLIC SPEAKING SKILLS BY JOINING THE DEBATE TEAM OR THE DRAMA CLUB (YOU'LL NEED THEM IN THE COURTROOM). PRACTICE TAKING ORGANIZED NOTES DURING CLASS LECTURES. SCAN NEWSPAPERS TO LEARN ABOUT LEGAL CASES REQUIRING INPUT FROM FORENSIC SCIENTISTS. DO YOUR BEST ON ENGLISH PAPERS AND LAB REPORTS IN SCIENCE (YOU'LL NEED STRONG WRITING SKILLS TO DRAFT REPORTS THROUGHOUT YOUR CAREER). READ SCIENCE MAGAZINES TO STAY ON TOP OF NEW DISCOVERIES." (WWW.COLLEGEBOARD.COM)

"The beginning of knowledge is the discovery of something we do not understand."
~ Frank Herbert (1920 - 1986)

HONORS CHEMISTRY *DENSITY EXPERIMENT DATA SHEET*

*(USE THIS AS A GUIDE. **ALL DATA SHOULD BE IN LAB NOTEBOOK!)***
INDICATE WHAT EQUIPMENT YOU USED SO SIG FIGS CAN BE VERIFIED.

Part A

Mass of beaker: _________

+ Mass of water: 50.000g

= _________ (set balance to this)

Volume of 50.000g of water: _________

Calculations: Density of water (calculate): _________ @ ________°C

True value (researched): _________

Absolute error: __________ Percent error: ___________

Part B

Mass and Volume of Stock Glass Sample

mass of sample (g)	initial volume of cylinder (mL)	final volume of cylinder (mL)	volume of sample (mL)	density of sample (g/mL)

Calculations: Average density value (calculate): __________

Density value obtained from slope: __________

How do you want to set up the data table for the evidence sample? You decide…

Evidence Letter:_______

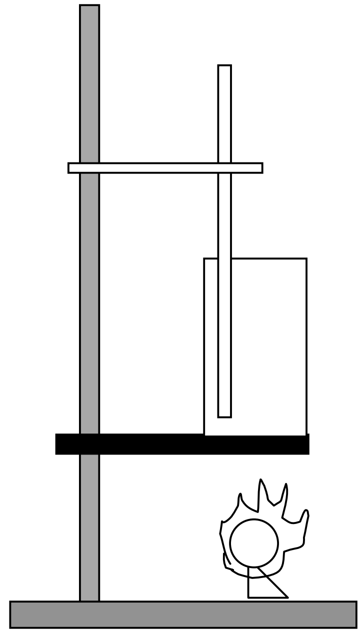
HONORS CHEMISTRY CALORIMETRY CHALLENGE

In this challenge, you'll have to set up a basic bomb calorimeter to determine the calorie content of three different types of food. Part of the challenge will be designing and bringing in your own calorimeter.

When you determined the specific heat of unknown metals, determined Cp by adding hot metal to the water. Here, you'll heat up the water externally to determine the energy in the food by assuming any heat gained by the water was lost by the burning food.

A simple calorimeter can be a pop can with water on small iron ring with a thermometer suspended in known amount of water. A Paper-clip stand can be designed to hold food items. You may want to try and build a better set-up. Use only tin cans or pop cans. Watch the sharp edges!

It is recommended that you run multiple samples to get help determine precision of data. You will be ranked based on combined percent error. Answer must be in food calories and (in addition to keeping good notes in your lab notebook) you must turn in a loose-leaf copy of your calculations with your answers.



The most basic set - up...

"If more of us valued food and cheer and song above hoarded gold, it would be a merrier world."
~ J. R. R. Tolkien

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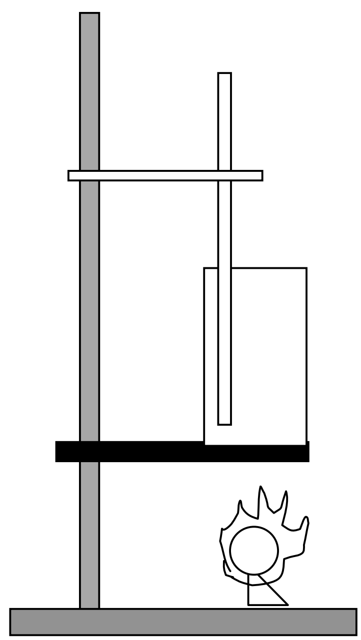

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HONORS CHEMISTRY *SEPARATION CHALLENGE*

BACKGROUND: We have talked about separating mixtures by exploiting physical properties that vary between the constituents. In this experiment you will use any of the separation techniques we have talked about in class to separate out the three components of your unknown (water, salt, and sand).

There is no experimental write-up for this laboratory activity. You will be graded completely on the accuracy of your results (as always, lab protocol points can be lost for improper lab behavior!). When you have determined the mass of each of your three components, write your answers on a note-card or a piece of paper (along with your unknown number) and turn them in to Mr. Anticole. **Graded on a relative scale of 15 points.**

Note: Mistakes on units or significant figures will result in a penalty!

PROCEDURE: Look over the included separation directions. You will get only one unknown, so make sure you have worked out your plan before you start experimenting. Feel free to practice. Even though there is no official write-up, you are expected to take good notes in your laboratory notebook. You must turn in your answers by the end of the double period! **GOOD LUCK!**

"Have no fear of perfection - you'll never reach it." ~ Salvador Dali

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1. <u>EVAPORATING</u> - boiling off the more volatile liquid (one with the lower boiling point), or allowing it to slowly evaporate off itself over night.

Used when: The mixture contains 2 liquids and you only need to keep the less volatile one, or the mixture contains a solid dissolved in a liquid and you only need to keep the solid.

Steps:

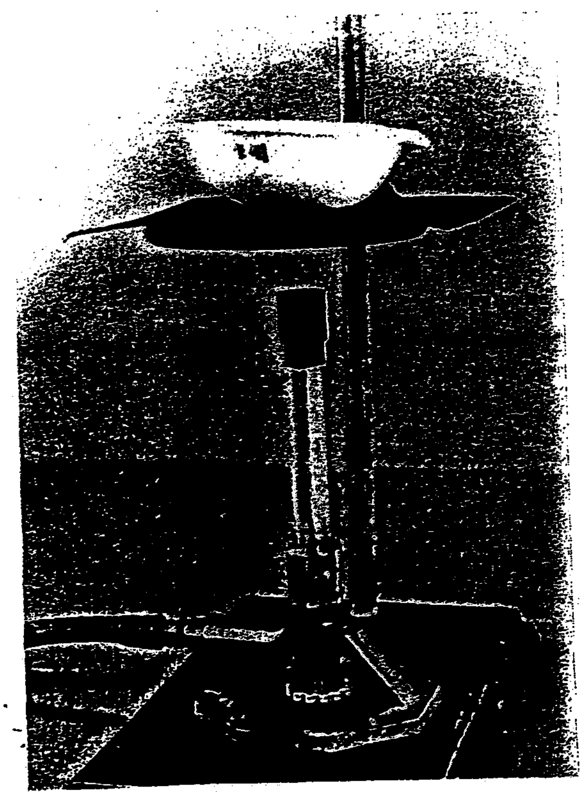
a. Place the solution in an evaporating dish (should be no more than $\frac{3}{4}$ full).

b. Set the evaporating dish on a small iron ring attached to a ring stand.

c. Using a Bunsen Burner, heat the dish GENTLY (small, blue flame) until the liquid is completely evaporated. Do not heat TOO MUCH or you may destroy the solid (it will turn brown).

d. Turn off the burner and allow the dish to cool before removing or weighing it. (If you place a hot item on the balance it will destroy the internal mechanism and I will not be happy with you.)

Example: Sea water



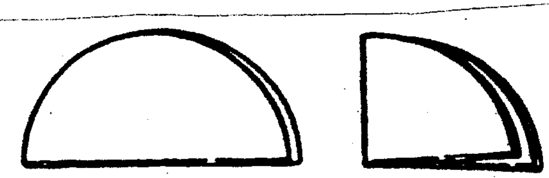
2. **FILTERING** - separation by particle size.

Used when: The mixture contains a solid and a liquid.

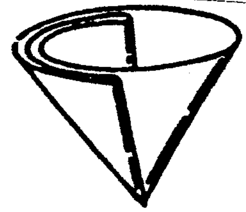
Steps:

a. Obtain filter paper, a funnel, a ring stand, an iron ring, a 150mL beaker, and a stirring rod.

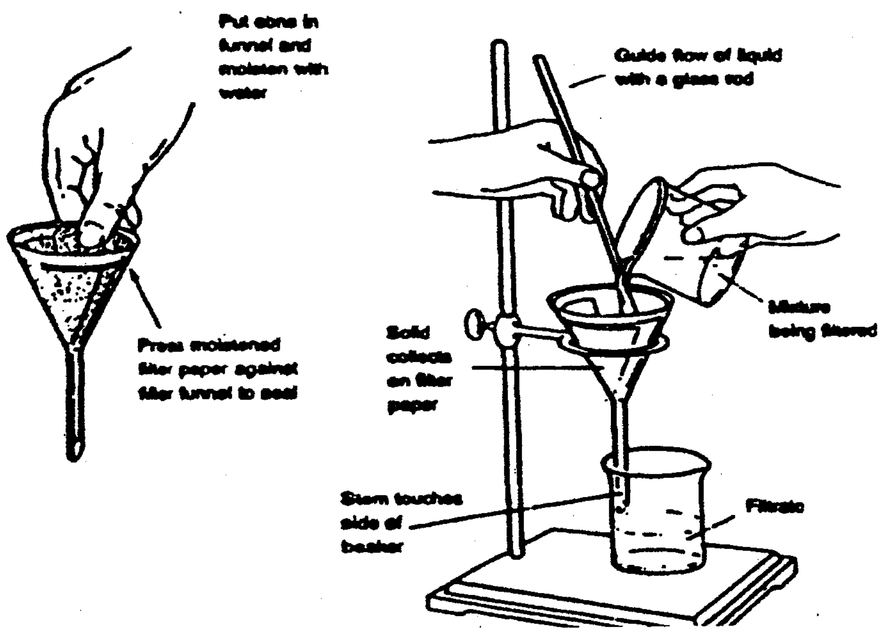
b. Fold a piece of filter paper in half, then in half again, as shown below.



c. Open the folded paper to make a pointed cup, as shown.



d. Set put the apparatus below. Put the filter paper in the glass funnel; moisten it with a small amount of distilled water from your wash bottle. Press the moistened filter paper against the funnel to seal it. See below.



e. Place a 150mL beaker below the funnel. Note that the end of the funnel is inside the beaker and TOUCHING the side of the beaker.

f. Pour the heterogeneous mixture into the funnel by letting it drip down the stirring rod. Make sure the liquid level never exceeds the end of the filter paper. The liquid that passes through the filter paper is called the filtrate.

Example: Orange juice with pulp