Name: _____ Period: _____ iPad # _____

MATTER

&

LAB BASICS

Class Notes

&

Practice

Name: _____ **Period:** _____ **iPad #** _____

I. INTRODUCTION~ Basics of Chemistry (slide show of chemistry)

****_Pre class assignment:_** read page 2 Chemistry & You ~ be prepared to defend your opinion in class

- What is Chemistry? Study of the composition & changes in matter

Matter Anything that has mass and takes up space	***Energy*** Ability to do work and create changes in matter
ex: air, water, CO_2	ex: heat, sound, PE, KE

Classification of properties of matter

Extensive (Exterior) Depends on amount of a substance	***Intensive*** (within) Depends on the type of matter not the amount
ex: mass, volume	ex: Density, BP, MP

* P.37 #9 discussion

Why Study Chemistry?

- Explain the natural World ~ environmental changes
- Prepare for a career ~
- Become an informed citizen ~

Discuss: *Why would a student that wants to be a doctor need to study chemistry?*

****_Pre class assignment:_** read page 14-15 Chemistry & You ***AND*** An Experimental approach to Science~ be prepared to discuss how scientists discover new things.

Discuss: *Puzzles & steps for solving* ex: way to short, what to wear to school, what to eat at lunch

- Scientific method
  - Problem
  - Hypothesis
  - Experiment
  - Collect data
  - Conclusion

Role of collaboration in science: to share info among scientists, humans etc. to make best decisions

Name: _____ **Period:** _____ **iPad #** _____

II. LAB ACTIVITIES, EQUIPMENT & SAFETY

- Observations of matter

Qualitative - use senses

Quantitative - numeric/measurable

Lab Equipment to know….. lab Scavenger Hunt activity

Lab safety

Classroom Lab Safety Tour & Activity

~ List the main safety features of the chemistry lab

1. hood
2. shower
3. fire blanket
4. fire extinguisher
5. eye wash

III. MEASUREMENTS

pre class assignment p.73 diff instruction

Pre class assignment: read page 62 Chemistry & You *AND* page 64 Accuracy, precision and error ~ be prepared to discuss how scientists ensure that measurements are accurate and precise.

What is the difference between accuracy & precision

Accuracy- closeness of a measurement to the actual or accepted value

p.62 chemistry & you discussion

Precision- how close and reproducible a series of measurements are irrespective of the actual value

6 tables measure same item!

Benefits of multiple trials - best results, reproducibility, reliability

Percent Error ~ to evaluate the accuracy of a measurement in lab the measured value must be compared to the correct value.

TYPO

Percent Error - observed value - actual value (experimental) x 100 → (Table T)
actual value

EXP

1. If a student finds the density of a sample of nickel to be 8.5g/mL in the lab, what is the percent error if the actual density of the element is 8.93 g/mL. Show your work and include units!

NO

$\frac{8.5\text{g/mL} - 8.93\text{g/mL}}{8.93\text{g/mL}} \times 100 =$

Name: _____ **Period:** _____ **iPad #** _____

* only apply to MEASURED VALUES!

Significant Figures & rules

- *ALL* non-zero numbers (1,2,3,4,5,6,7,8,9) are ALWAYS significant.
- *Leading Zeros within* a number are NEVER significant. Both .023 and 0.0019 contain only 2 significant figures.
- *Trailing Zeros* WITHOUT a decimal point are NOT significant. Thus, 470,000 has only *two* significant figures. BUT 270. and 1.90 each have 3 significant figures.
- *Squished zeros* between significant numbers are ALWAYS significant. Both 1001 and 3.020 each have 4 significant figures.

TYPO!

2. Round off the following numbers to 3 significant digits:

*a) 12,000 1.20 x 10^4
c) 4.53619 4.54
*b) 0.0008769 .000877 OR 8.77 x 10^-4
*d) 876493 876,000 OR 8.76 x 10^5

3. Determine the number of significant figures in the following numbers.

a) 0.02 1
c) 5,000 1
e) 020 2
b) 6. 001 4
d) 2.0 2
f) 8.0 2

4. Determine the location of the last significant place value by circling the digit. (Example 1.7)

a) 8040
c) 4.7001
e) 300
b) 0.03007
d) 2.000
f) 0.004

- Adding and subtracting significant figures: answer can only be rounded to the least significant #of decimal places. * same precision (same decimal place.)

5. 505 kg - 450.25 kg= 55kg

505
-450.25
54.75

6. 12.01 mL + 35.2mL + 6 mL = 53mL

12.01
35.2
+ 6
53.21

7. Use the following information; calculate the mass of the sample in significant figures:

Mass of the beaker and sample .....12.612 g
Mass of the beaker .....11.5 g
Mass of the sample ..... 1.112 → 1.1 g

- Multiplying and dividing significant figures: answer can only have the least number of significant digits in the question

Perform the following operations and express in correct significant figures

8. 5m ÷ 2.467m= 2m^2

2.0267531

9. .021 cm x 3.2 cm x 100.1 cm = 6.7 cm^3

6.7267

* Look up winning times from 1948 & 2008 Olympic Games.

nearest .1 nearest .01

measure Activity - instruments on desk → pick one to measure an (object) in cm, m, km, inches, feet - how determine measure:

Metric Conversions

kilo ~~hecta~~ ~~deka~~ BASIC UNIT ~~deci~~ ~~centi~~ milli

(gram, meter, liter, joule)

10. Conveert each of the following:

a) 14,500 m → 1.45 km

b) 3540mg → 3.54 g

c) .45 km → 450 m

d) .5420 kl → 542 L

11. Write the correct abbreviation for each metric unit

a) Kilogram kg

b) Gram G

c) Milliliter mL

d) Millimeter mm

e) Liter L

f) milligram mg

12. Compare the following values using >,< or =

a) 536 m > 53.6 mm

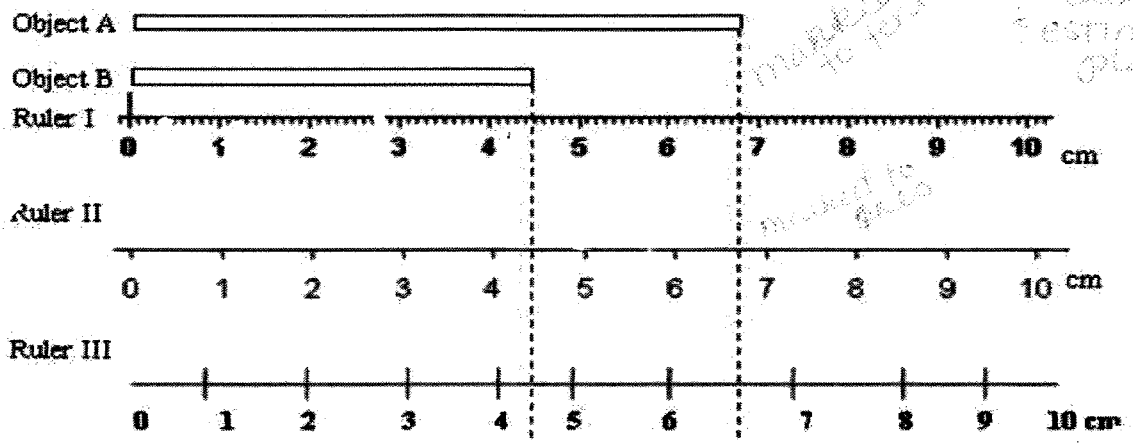
b) 5g > 508mg

c) 1,500mL = 1.5L

d) 3.6m < 36km

V. BASICS OF MEASUREMENTS

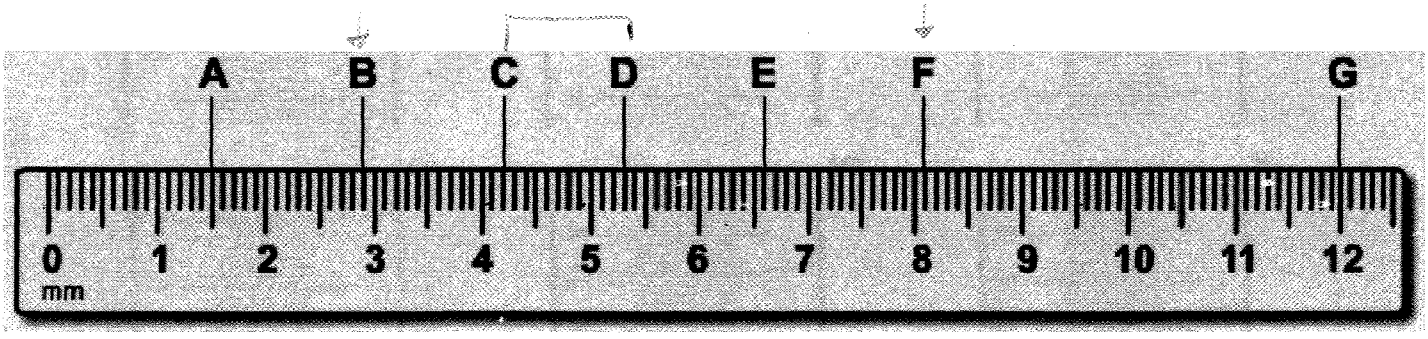
➢ Length→ metric ruler- used to determine length of an object



6.30cm | 4.5cm

6.8cm | 4.4cm

6.50cm | 4.3cm



B: 2.90

F: 8.09

Segment C-D: 1.09

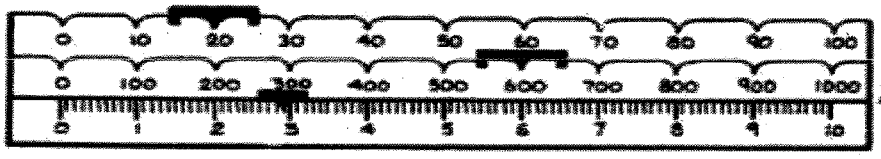
9.20 − 5.29

5.29
− 4.20
1.09

- Mass→Triple Beam Balance - used to measure mass in grams

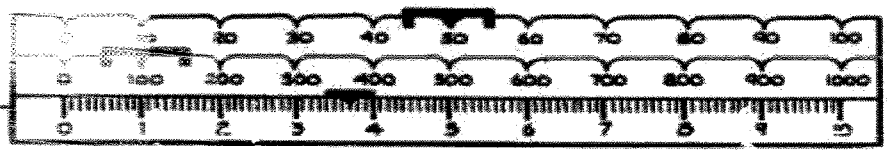
What masses are shown on each of the following balances?

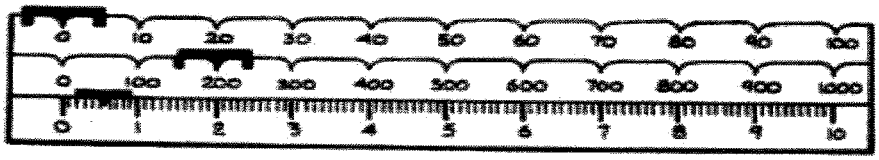
Triple Beam Balance



Answer: 6.22.91

Answer: 153.71

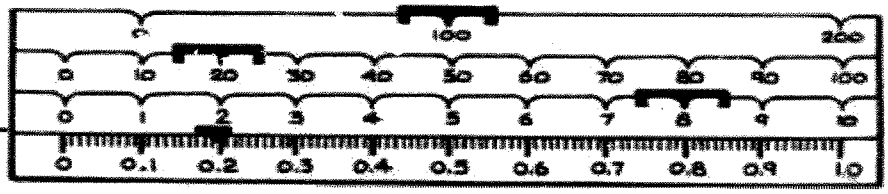




Answer: 200.52

Four Beam Balance

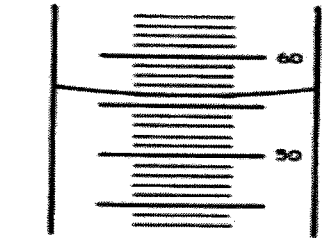
Answer: 128.194



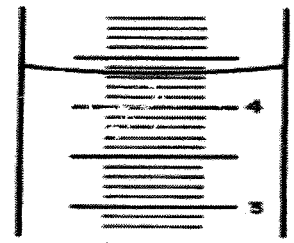
if 1kg = 2.2 lbs and if 1kg = 1000g than how many grams are in 1 lb?

- Volume →Graduated Cylinder-used to measure volume in ml (read at meniscus)

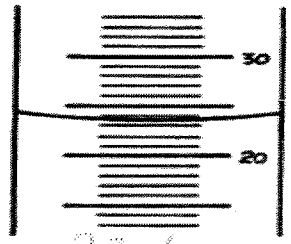
What volume is indicated on each of the graduated cylinders below? The unit of volur is mL.



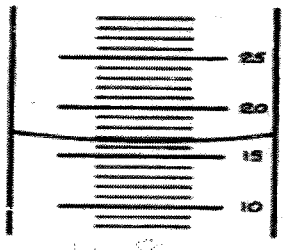
a) 56.1



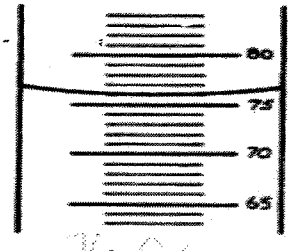
b) 4.36



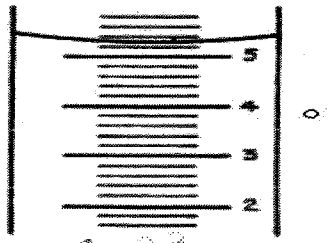
c) 23.6



d) 16.8



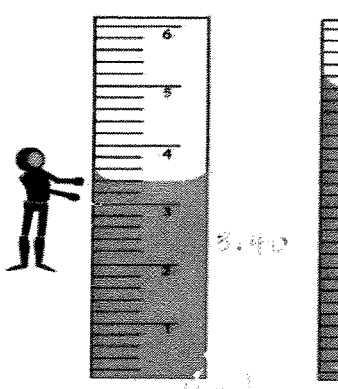
e) 76.0

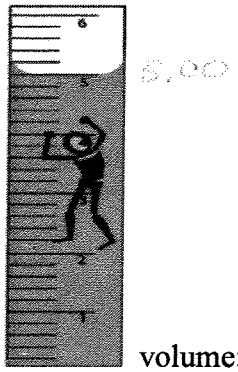


f) 5.25

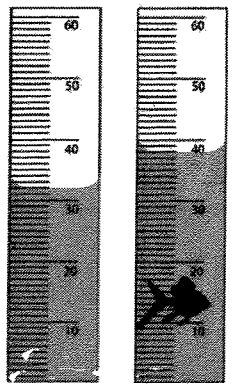
* 1mL = 1cm³
(graduated cylinder) = (1 sugar cube)

→ Displacement method- used with an irregular shaped object



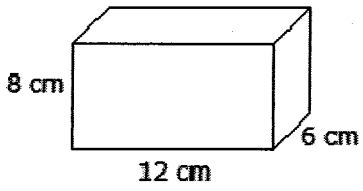


volume: 14.60 mL



volume: 6.1 mL

→ L x W x H of a regular shaped object (cubes / squares)

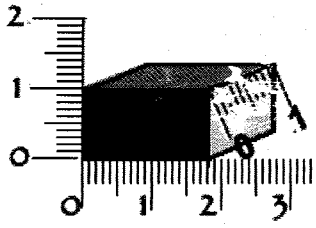


Calculate the volume:

8 x 12 x 6

576 cm³

600cm³

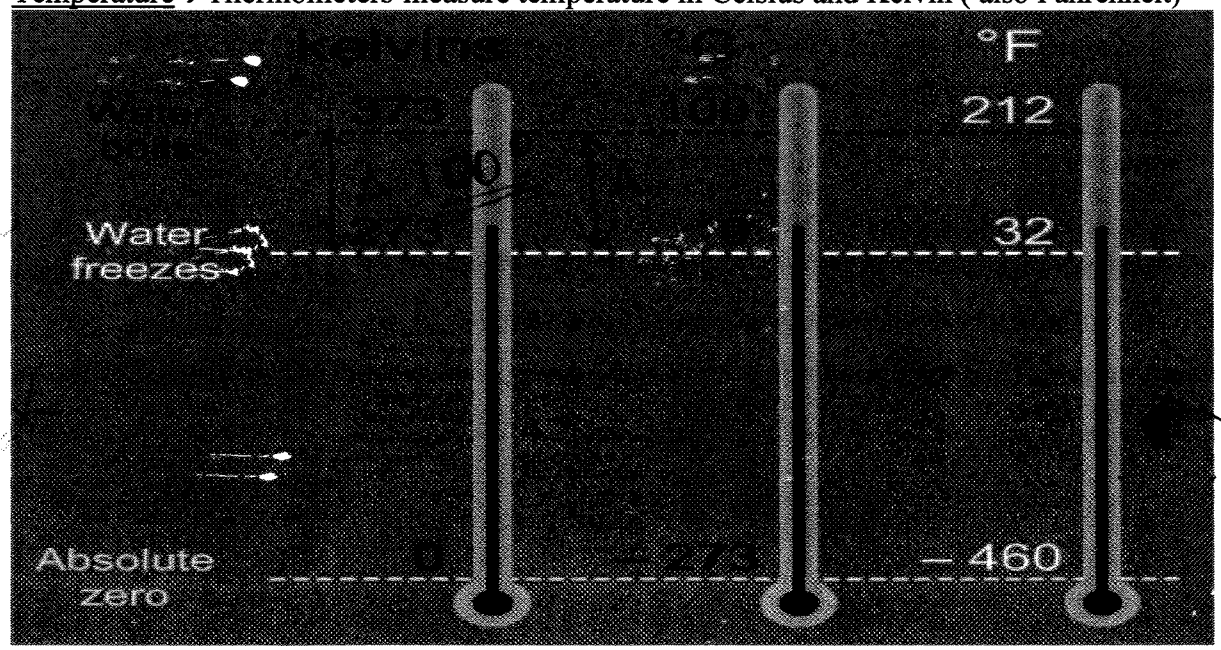


Calculate the volume:

1.81 x 1.00 x 1.00

1.81 cm³

Temperature→Thermometers-measure temperature in Celsius and Kelvin (also Fahrenheit)



old + little used in science

Same # of degrees btwn FP & BP

p.77 Evaluate/Review various measurement units

Density

ALWAYS make sure you round to correct significant figures

- Calculating density of a substance (Table T)

Find on Reftable T

Density = $\frac{\text{Mass}}{\text{volume}}$ * Density Column ~ Density Burrito

1. a piece of lead has a mass of 22.7g ands occupies a volume of 2.00cm^3. Find the density of Pb?

$D = \frac{m}{V}$ $\quad D = \frac{22.7\text{g}}{2.00\text{cm}^3} = 11.35$ use to round $\quad 11.49/\text{cm}^3$

2. A piece of magnesium occupies a volume of 4.00 cm^3 and has a mass of 38g. Find the density of Mg?

$D = \frac{m}{V}$ $\quad \frac{38\text{g}}{4.00\text{cm}^3} = 9.5\text{g/cm}^3$

3. A piece of lead has a density of 11.4g/cm^3 and a mass of 22.8g. What volume does it occupy?

$D = \frac{m}{V}$ $\quad 11.4\text{g/cm}^3 = \frac{22.8\text{g}}{x}$ $\quad x = 2.00\text{cm}^3$

4. A student used a balance and graduated cylinder to collect the following data of a sample object of Iron by a technique called water displacement.

mass of sample	10.9 g
volume of water	30.0 mL
volume of water and sample	34.0 mL

a) What is the volume of the iron sample described in the experiment 34.0mL - 30.0mL = 4.0mL

b) What is the formula to calculate the density of this iron sample $D = \frac{m}{V}$

c) Calculate the density of the Iron sample. Include the appropriate number of significant figures and proper units. Show the work.

$D = \frac{m}{V}$ $\quad \frac{10.9\text{g}}{4.0\text{mL}} = 2.725\text{g/mL}$ $\quad 2.7\text{g/mL}$

Significant Figures

all non zeroes

zeroes squished between sig figs

trailing zeroes w/ a decimal

leading zeroes ARE NEVER SIGNIFI. CANT

Percent Error ~ (Table T)

- Percent Error - observed(experimental) value – actual (accepted) value x 100
  actual (accepted) value

5. Using the students experimental density from calculation C ~ calculate the percent error if the accepted value is = 2.9 g/ml

does NOT factor into sig figs since NOT MEASURED in lab!

$$\frac{2.7 - 2.9}{2.9} \times 100 \qquad ① \frac{.2}{② 2.9}$$

6. What *error* is introduced if the volume of the sample is determined *first*?

excess water will increase mass value ∴ increase density calculation

7. If a student finds the density of a sample of nickel to be 8.5g/mL in the lab, what is the percent error if the actual density of the element is 8.93 g/mL. SHOW all work

$$\frac{8.5 - 8.93}{8.93} \times 100 \qquad ① .4 \qquad ③ \frac{.4}{8.93} \times 100 \qquad 4.479 \qquad 4\%$$

Scientific Notation

Expression of numbers to a power of ten (base number always less than 2)…remember *CORRECT* scientific notation!

Powers of ten

Powers of 10			
Power of 10	Standard Form	Fractional Form	Place Value
10^4	10,000	$\frac{10,000}{1}$	ten thousands
10^3	1,000	$\frac{1,000}{1}$	thousands
10^2	100	$\frac{100}{1}$	hundreds
10^1	10	$\frac{10}{1}$	tens
10^0	1	$\frac{1}{1}$	ones
10^{-1}	0.1	$\frac{1}{10}$	tenths
10^{-2}	0.01	$\frac{1}{100}$	hundredths
10^{-3}	0.001	$\frac{1}{1,000}$	thousandths
10^{-4}	0.0001	$\frac{1}{10,000}$	ten thousandths

Sci notation will ALWAYS express all sig figs!
* Use to distinguish between sig/nonsig 0's!
Go BACK + review page 12 #2A, D

- Scientific notation conversions from whole # → sci notation

8. Convert the following to *correct* scientific notation

a) 0.009 9×10^{-3}

b) 0.9 9×10^{-1}

c) 24,212,000 2.4212×10^{7}

d) 0.000665 6.65×10^{-4}

CORRECTING scientific notation

(Lets Be Real Smart) move the decimal left = exponent gets smaller move the decimal right = exponent gets larger

9. Convert the following to *correct* scientific notation

e) 63.91×10^{5} 6.391×10^{6}

f) 210.0×10^{-3} 2.100×10^{-1}

g) 15.300×10^{-9} 1.5300×10^{-6}

h) $.003710 \times 10^{-2}$ 3.710×10^{-5}

why included in Sci Notation? ⇒ already Significant!

We will practice this MORE during Mole Conversions!

easily done on calculator

→ adding and subtracting scientific notation
- need same exponents (**need to convert one)

→ multiplying and dividing
- multiplying → multiply first numbers then add exponents
- dividing → divide first numbers then subtract exponents

pre-lesson - categorize items on index cards.

IV. MATTER * preassignment p.38 Foundations for Reading

- **Matter** – anything that has mass and takes up space

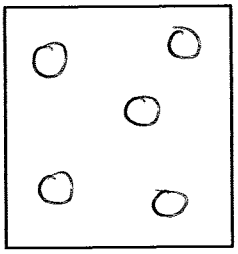
Mass – the amount of "stuff" in an object *Space* – the amount of volume something takes up

- **Substance** - matter with same properties and composition (ELEMENTS & COMPOUNDS)
- **Element** - **can't be decomposed**, found on periodic table, made of all the same atoms.

Metals: malleable, ductile, conductors, mobile or free electrons, left of steps
Non metals: brittle, non conductors, all phases, right of steps
Metalloids: can act as metals or non metals, on the steps

Monoatomic elements- elements that occur alone (elemental state, free elements)

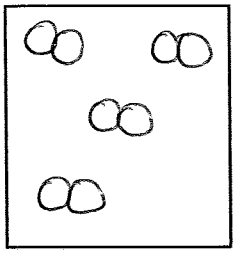
ex: Ne(g)



Diatomic elements- occur in pairs (BrINClHOF)

Br_2 I_2 N_2 Cl_2 H_2 O_2 F_2

ex: H_2



symbol- shorthand of letters that represent an element

Aluminum

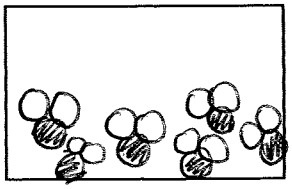
Al

burned toast chemical: sugar, amino acids

- **Compound** - 2 or more elements chemically combined, can be decomposed, always in same proportions w/ definite ratios.

Binary compounds- contains only 2 elements
(only 2 capital letters and if the name is given will end in "ide").

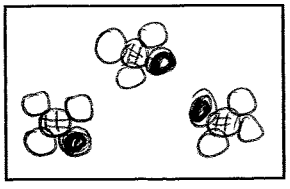
ex: NaCl or H_2O



$H_2O(\ell)$

Ternary compounds- contain more than 2 elements
(more than 2 capital letters can end in "ate" , "ite" or **"ide"
(look at table F for these compounds)

H_2SO_4, $KClO_3$, CH_3Cl



CH_3Cl

discussions of seasoning (pure vs. mixtures)

salad dressing

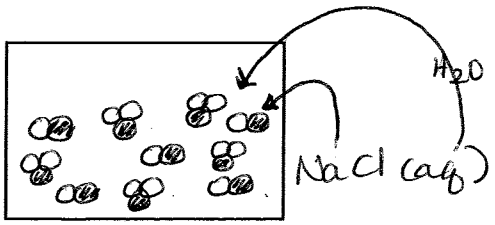
- **Mixtures**- 2 or more substances **not chemically** combined, can be **separated** without chemical decomposition EX: ($NaCl_{(aq)}$ → evaporate)

Demo: Sugar + H_2SO_4 (stir w/ glass rod in evap dish!)

* give ex: of when you have seperated at home/school

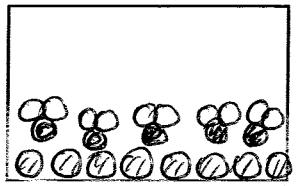
Homogeneous - same throughout and looks all the same
(all elements and compounds …some mixtures (aq) = homogenous mixture)
aq = aqueos (dissolved in water)

ex: NaCl (aq)



Heterogeneous - different parts ,parts don't look the same
(only some mixtures…NOT elements or compounds)

ex: sand in water
oil in water



notice the layers - can see diff parts!

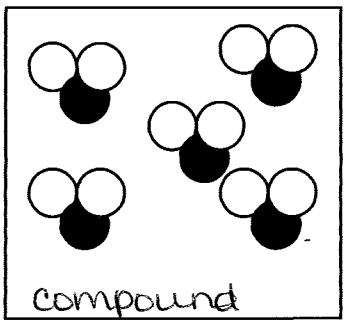
Separation of mixtures

- ➔ Separation➔ Filter paper-separate insoluble **solids** from liquids (mixture separation)
- ➔ Evaporation → separating a mixture (solution) of a soluble solute and a solvent (salt in water). The process involves heating the solution until the solvent evaporates (changes from liquid to a gas) leaving behind the solid residue.

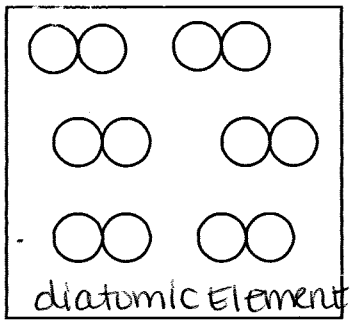
Show distillation apparatus

- ➔ Fractional Distillation → used to separate a solution of 2 or more miscible (soluble) liquids by varying boiling points.
- ➔ Chromatography → Based on Solubility! relies on the idea that the solvent and the paper both have an attraction for the components in a mixture. If a material is placed on one spot on the paper and is soluble in the liquid solvent, the material will be dissolved when the solvent moves over it. When we get to solutions ~ LIKE DISSOLVES LIKE!

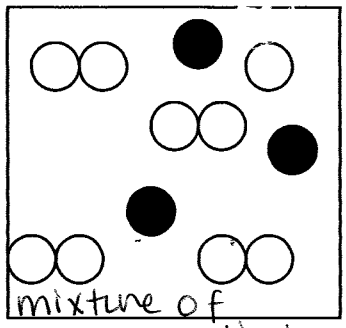
1. Classify the following types of matter as element, comopund or mixture:
   a) CO C
   b) H_2O C
   c) Air M
   d) Milk M
   e) LiF C
   f) Sugar C
   g) Sodium E
   h) Soda M
   i) Sand and iron M
   j) rock M
   k) copper E
   l) Salt (NaCl) C
2. Classify each of the following as pure substances or as a mixture
   a) alcohol C - pure
   b) Uranium E - pure
   c) Gold E - pure
   d) Garden mulch M
   e) Cereal in milk M
   f) Carbon dioxide C - pure
3. Given the diagrams X, Y, and Z below:



X



Y



Z

diatomic + monoatomic elements

4. Which diagram represents an element? Y
   B) Which diagram represents a compound? X
   C) Which diagram represents a mixture of elements? Z
   D) Are all the substances represented by the diagrams homogeneous or heterogeneous forms of matter? Explain your answer. homogeneous → uniform throughout

Evaluate - identify 3 substances fit into each category

Substance
homogeneous mixture

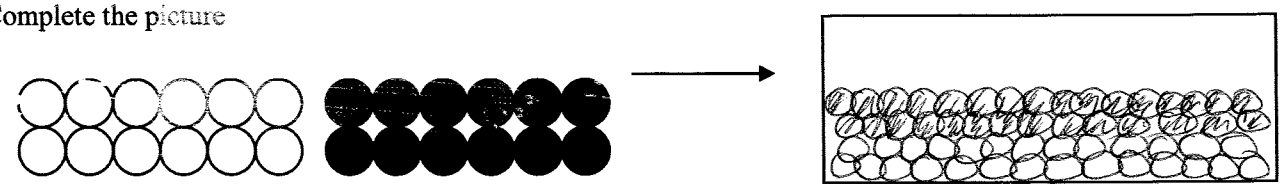
5. You are given a flask that contains sea water that has been contaminated with oil. Some sand is also present in the flask. Describe how you would separate the sand, oil and sea salt and water from each other. (Describe specific techniques in an orderly lab process.)

add water → salt will dissolve. Allow oil to sit at top of water + sand settle to bottom. Decant oil, filter sand out, evaporate water from remaining salt

6. Why is every solution a mixture but not every mixture is a solution?

Solutions are ALL homogeneous but mixtures can also be heterogeneous.

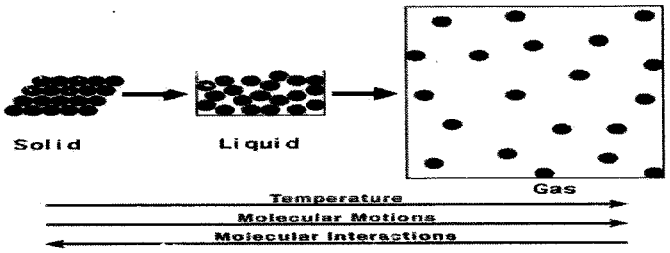
7. Complete the picture



Water oil 10 minutes after mixing

States of matter

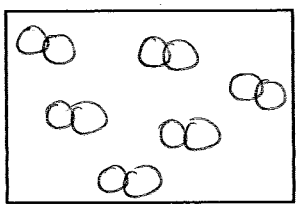
Activity- solids liquids gases



8. Base your answers to the following questions on the diagram of a molecule of nitrogen shown below:

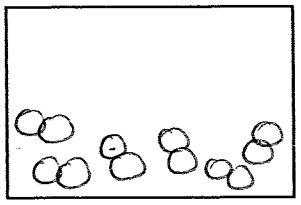
a) draw a particle model that shows at least 6 molecules of nitrogen gas

a)



b) draw a particle model that shows 6 molecules of liquid nitrogen.

b)



c) Describe in terms of particle motion the difference between nitrogen gas and liquid nitrogen.

gases move more quickly + randomly (greater entropy) than in liquids.

Properties of matter

Physical -describes observable characteristics (color, shape, odor, size)

Chemical -describes how it will react with another substance
(no reaction, violent reaction, produces heat)

Changes in matter (investigated more in Phase changes & Energy)

Physical – change in appearance does **NOT** change composition (crush chalk)

Chemical – change in chemical composition

Signs of chemical change:

- Heat or temperature change
- Bubbling or gas release
- Precipitate (blob like formation) $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow$
- Color change w/ one other sign of chemical change

Laws of matter

Conservation of matter (mass, energy, charge!) – matter (mass, energy , charge) cannot be created or destroyed c only change forms

Law of definite proportions- substances (such as compounds) are composed in the same proportions and will not change while the proportions in a mixture can change

Sort the substances & mixtures
24 index cards (post it notes)