A GOOGOL OF ATOMS?
A DIRECTED, INTERRUPTED CASE IN ESTIMATION AND LARGE NUMBERS
PART I

by
Stephen J. Shawl
Department of Physics and Astronomy
University of Kansas

You may remember a time when you were a child and you had a talk with a parent, relative, or teacher that blew your mind. I'd like to tell you of one such talk with my daughter, Jessica, when she was a precocious 7 year old.

Jessica had just become aware of the word *googol*. She was told that a googol was a very large number—a 1 followed by 100 zeros:

10000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000

I asked if a googol is larger than the number of atoms in the visible universe. She said, "There must be more atoms in the visible universe than that! How can you possibly figure it out?" I replied, "We can figure it out together. What do you think we might need to know, Jessica?"

How could you help Jessica? What do you need to know?

Questions

Use scratch paper to write out responses to the following.

1. First let's think about a number of questions:
    a. What do we mean by "the universe"?
    b. What is "matter"? In what way(s) can we say how matter is present in something?
    c. Can we see all matter?
    d. What do we mean by the "visible universe"?
2. List the specific types of information you think might be needed to determine the number of atoms in the visible universe.
3. What assumptions will you be making in obtaining your final result? How valid are those assumptions?

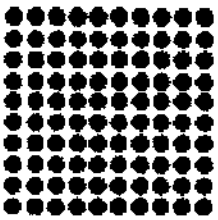
PART II

How big is a googol?

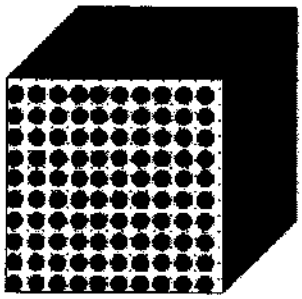
To start, here are 10 dots (covering about 1-inch):

4. Express this number (10) in scientific notation:

If we make a square 10 dots on a side, we have 100 dots:



If we fill a 10 x 10 x 10 cube with dots, we have 1000 dots, something like this:



5. Express each of these numbers in scientific notation:

100:

1,000:

If we made this cube 10 times larger *on each side* (10 inches), we'd have 1,000,000 dots inside;
10 times larger than that *on each side* (100 inches = 8.3 feet) we'd have 1,000,000,000 dots;
10 times larger than that *on each side* (1000 inches = 83 feet) we'd have 1,000,000,000,000 dots.

6. Express these numbers in scientific notation. What *words* are used for these large numbers?

1,000,000:

1,000,000,000:

1,000,000,000,000:

Words for big numbers, while meaningful, are awkward. For example, you cannot do mathematical manipulations with words; try multiplying the words *billion* and *trillion*! In any case, the numbers soon become large, difficult to imagine, and there's no simple word for them.

7. Express a googol in scientific notation.

We'll now look at some astronomical numbers. Use whatever reference sources you need (including the Internet). Be sure the units of the numbers are consistent.

We can discuss the amount of matter in a variety of ways. One is in terms of mass—the number of kilograms, say. In chemistry, one might discuss the number of *moles*. Or, the amount of matter might be discussed in terms of the number of atoms. In the discussion to come, you will begin with kilograms or moles and then make a calculation to obtain the number of atoms, which you'll then compare to a googol.

8. Approximately how much matter is there in Earth?

9. Approximately how much matter is there in the Sun?

10. How do they compare?

11. What do you think is the importance of that comparison?

12. What is the approximate number of stars in a typical (average) galaxy?

13. What is the approximate number of galaxies in the visible universe?

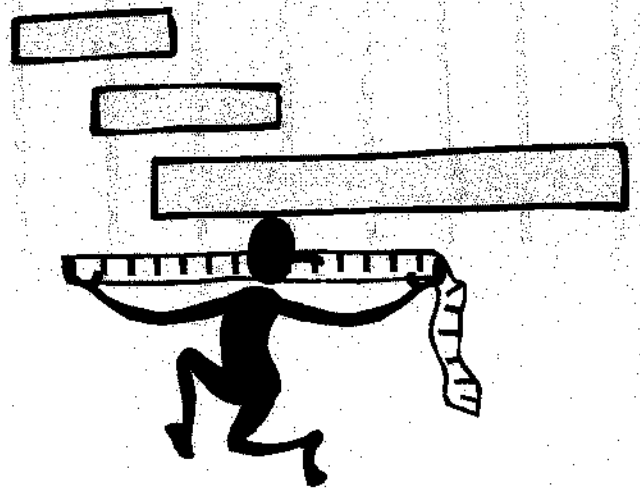
14. Now, finally, what is the number of atoms in the visible universe?

15. How does this number compare with a googol?

Date Posted: 07/14/03 nas

Originally published at **http://www.sciencecases.org/googol/googol.asp**

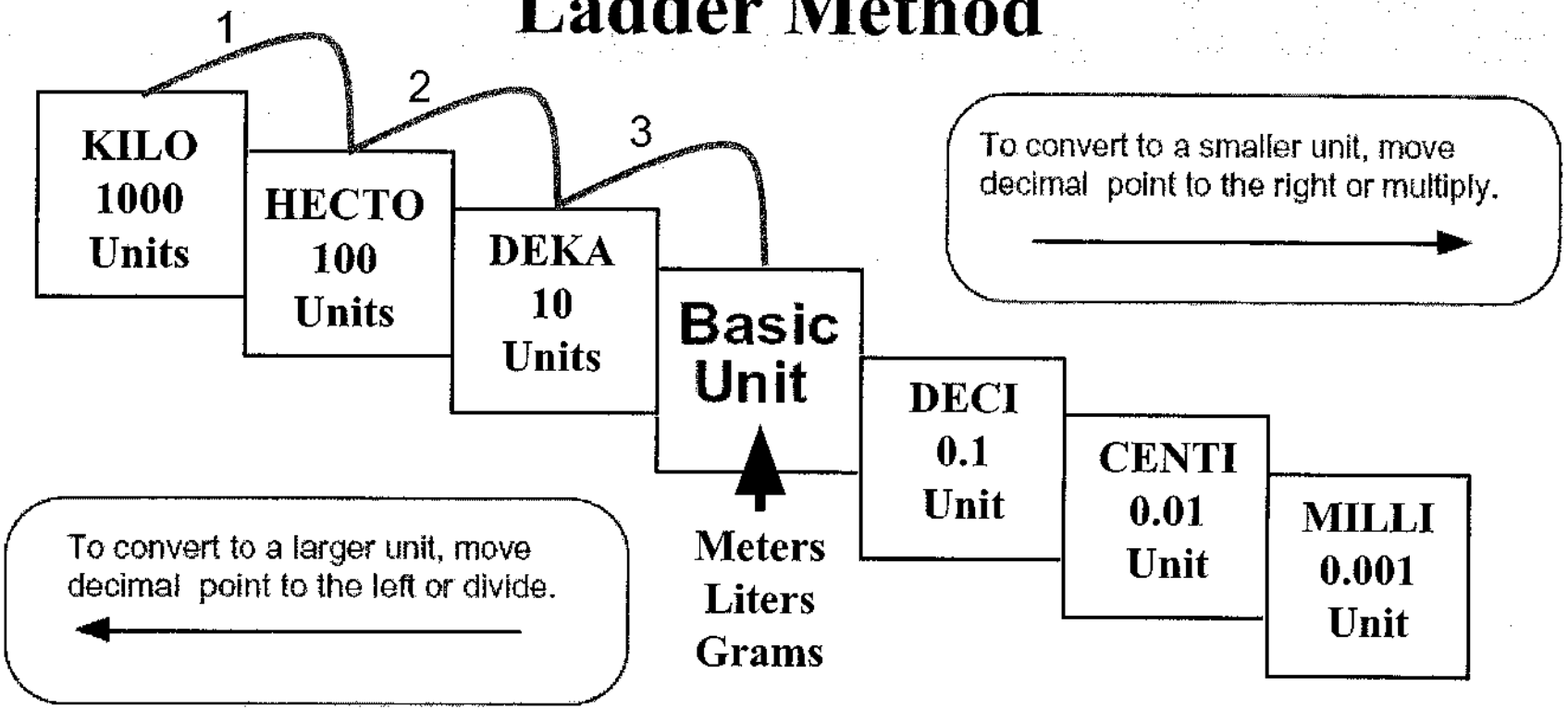
Metric Mania



Metric Conversions
Ladder Method

T. Trimpe 2008 http://sciencespot.net/

Ladder Method



How do you use the "ladder" method?

1st – Determine your starting point.

2nd – Count the "jumps" to your ending point.

3rd – Move the decimal the same number of jumps in the same direction.

4 km = _____ m

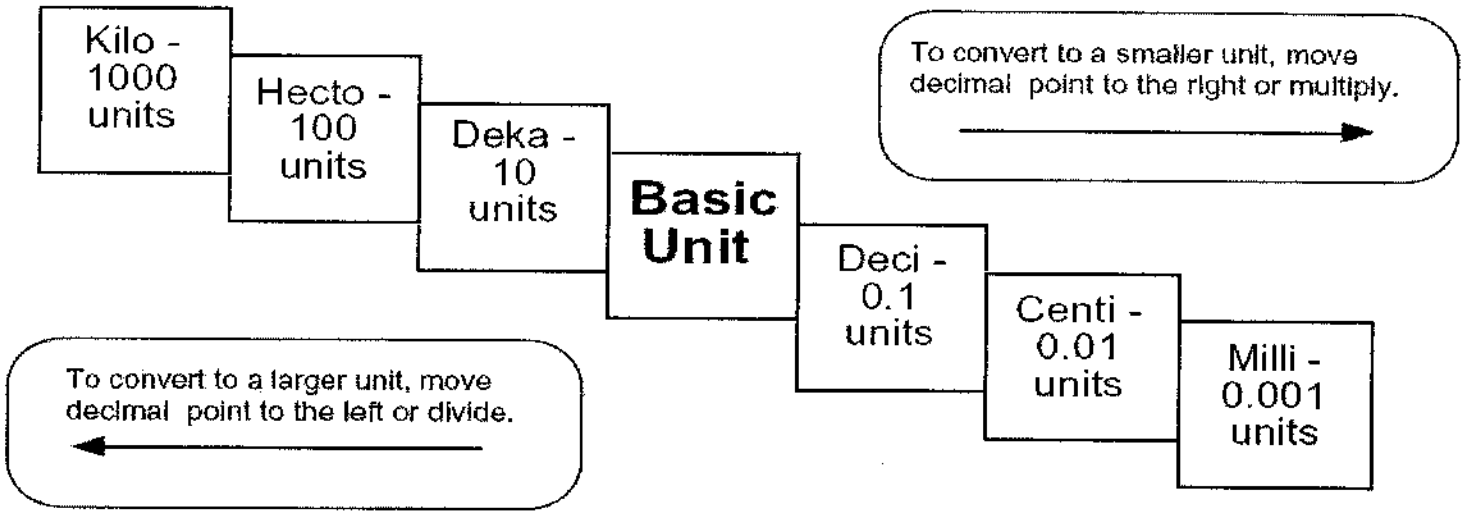
Starting Point Ending Point

How many jumps does it take?

4. _. _. _. = 4000 m

1 2 3

Conversion Practice



Try these conversions using the ladder method.

1000 mg = _____ g 1 L = _____ mL 160 cm = _____ mm

14 km = _____ m 109 g = _____ kg 250 m = _____ km

Compare using <, >, or =.

56 cm (6 m) 7 g 698 mg ( )

Metric Conversion Challenge

Write the correct abbreviation for each metric unit.

1) Kilogram _____ 4) Milliliter _____ 7) Kilometer _____

2) Meter _____ 5) Millimeter _____ 8) Centimeter _____

3) Gram _____ 6) Liter _____ 9) Milligram _____

Try these conversions, using the ladder method.

10) 2000 mg = _____ g 15) 5 L = _____ mL 20) 16 cm = _____ mm

11) 104 km = _____ m 16) 198 g = _____ kg 21) 2500 m = _____ km

12) 480 cm = _____ m 17) 75 mL = _____ L 22) 65 g = _____ mg

13) 5.6 kg = _____ g 18) 50 cm = _____ m 23) 6.3 cm = _____ mm

14) 8 mm = _____ cm 19) 5.6 m = _____ cm 24) 120 mg = _____ g

Compare using <, >, or =.

25) 63 cm ◯ 6 m

26) 536 cm ◯ 53.6 dm

27) 5 g ◯ mg

28) 43 mg ◯ 5 g

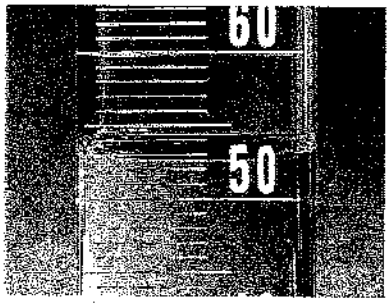
29) 1,500 mL 1.5 L ◯

30) 3.6 m ◯ m

1._____ 2._____ 3._____ 4._____

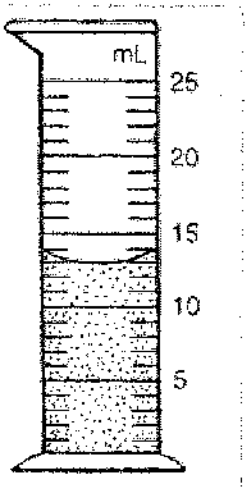
NAME: _____ Period _____ Volume Practice

For each picture below, answer the questions to the right. Be sure you use an appropriate label!
Each Tool Measures in the same units.



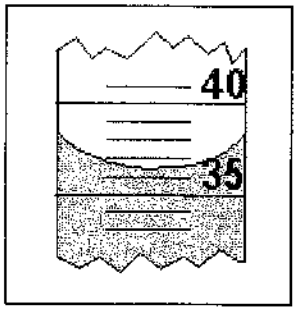
What does each graduation line stand for?_____

What is the volume of the liquid in the image? _____



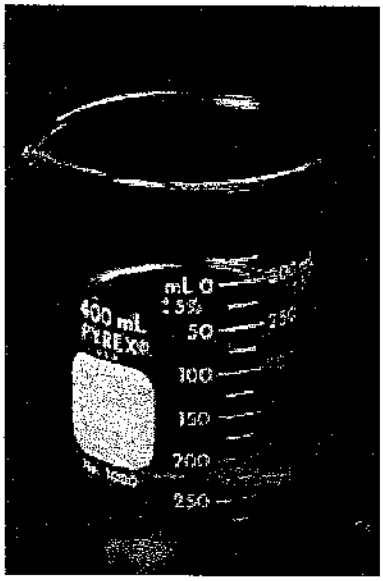
What does each graduation line stand for?_____

What is the volume of the liquid in the image? _____



What does each graduation line stand for?_____

What is the volume of the liquid in the image? _____

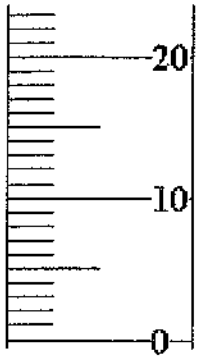


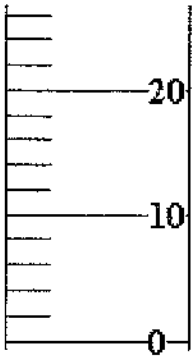
What does each graduation line stand for?_____

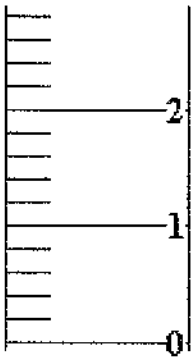
What is the volume of the liquid in the image? _____

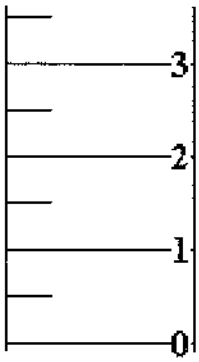
Name_____ **Period**_____ **Graduated Cylinder Worksheet**
Meemari

For each graduated cylinder, determine the amount that each graduation stands for.
Each tool measures in mL.



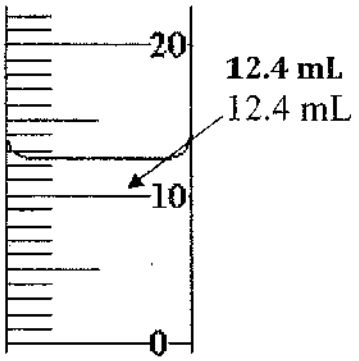




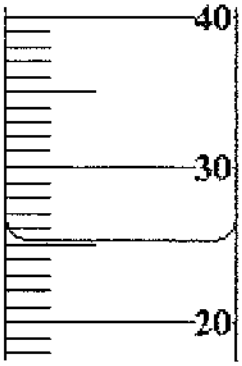


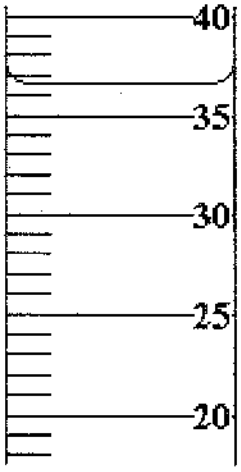
1._____ 2._____ 3._____ 4._____

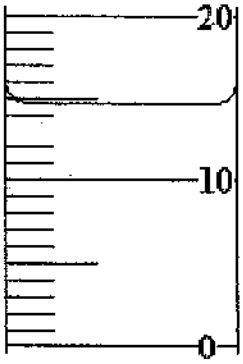
When reading a graduated cylinder you need to keep the graduated cylinder on the desk and lower your eyes to the level of the meniscus and you read where the bottom of the meniscus is. Be sure to include one point of estimation in your reading.



Determine the volume of the liquids in the following graduated cylinders.
Each tool measures mL.

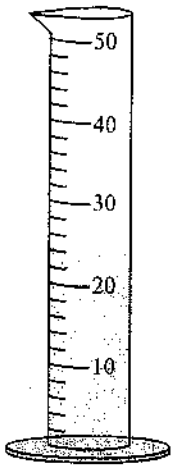


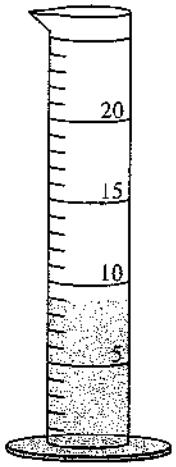


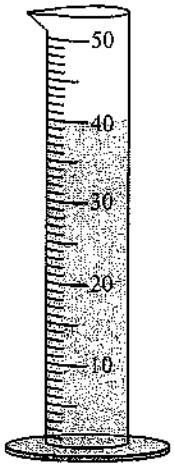


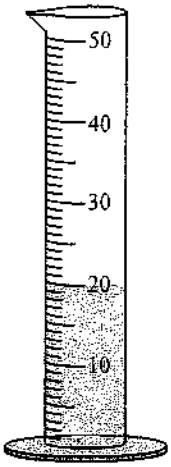
Graduated Cylinders Name:

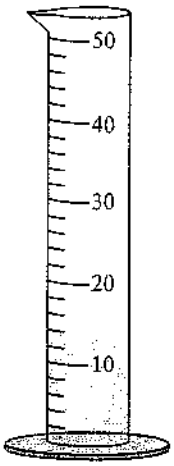
Determine how much liquid is in each graduated cylinder.

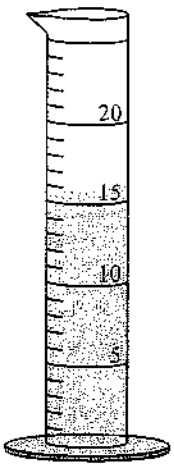
1) 

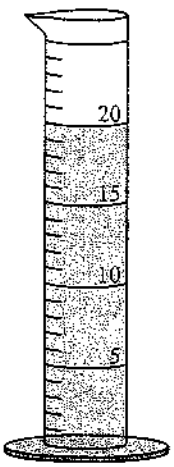
2) 

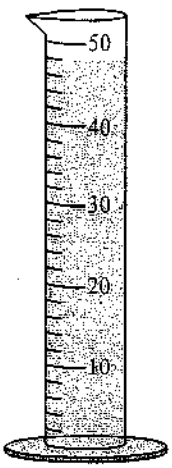
3) 

4) 

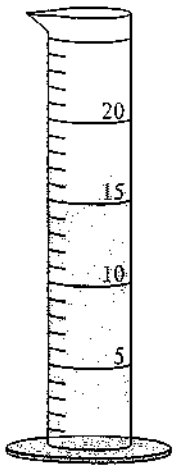
5) 

6) 

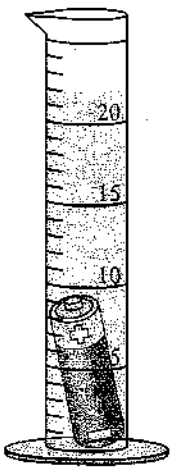
7) 

8) 

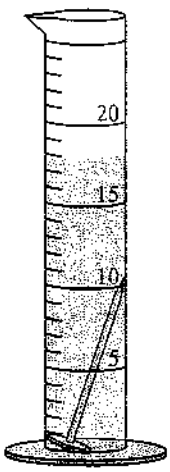
Four different objects were placed in a graduated cylinder 1 at a time:



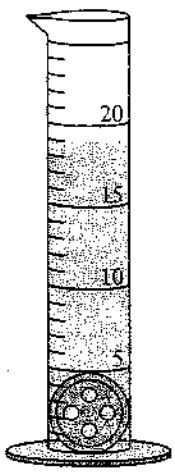
Empty

A. 

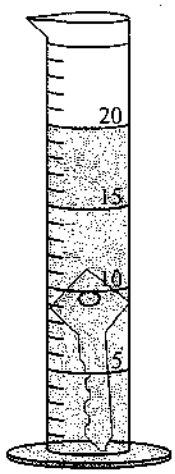
battery

B. 

nail

C. 

button

D. 

key

9) Which object had the greatest volume?

10) Which object had the least volume?

Answers

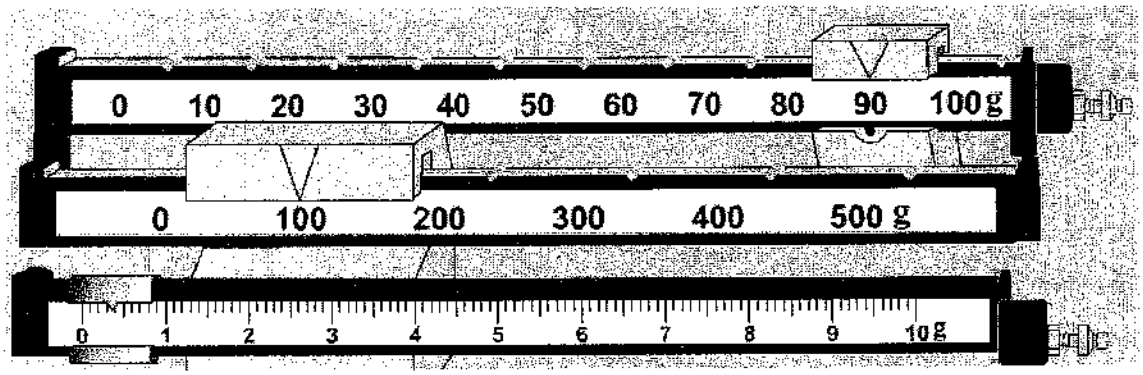
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

1-10	90	80	70	60	50	40	30	20	10	0

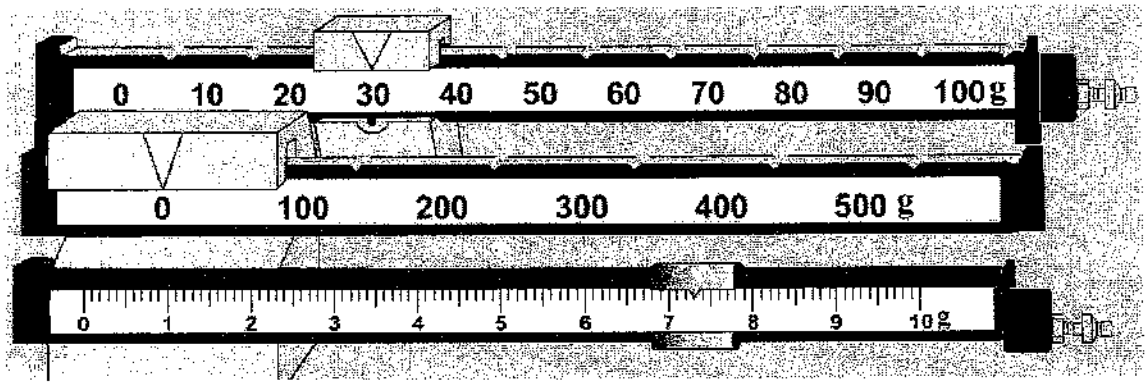
Name: _____ Period: _____

Triple Beam Balance Practice

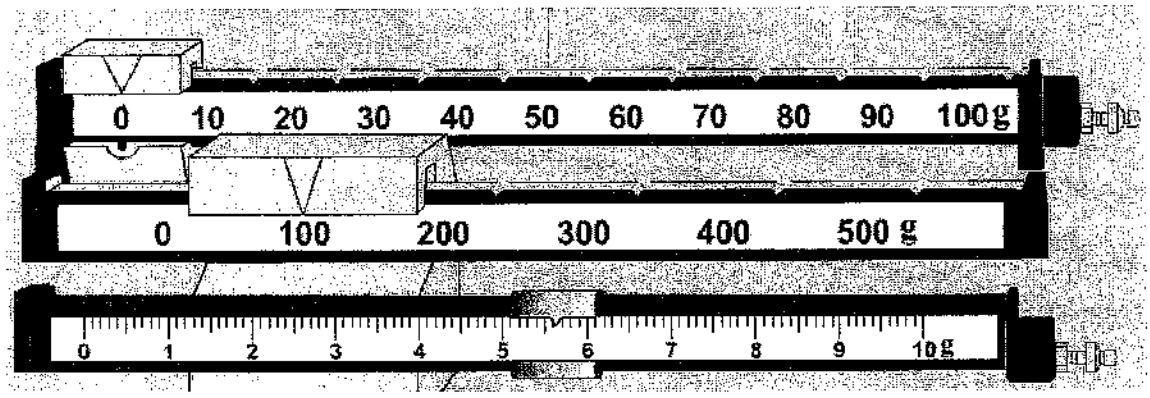
Record the mass show on each balance. Remember to include both the value on the beams and the unit of measurement.



1. _____



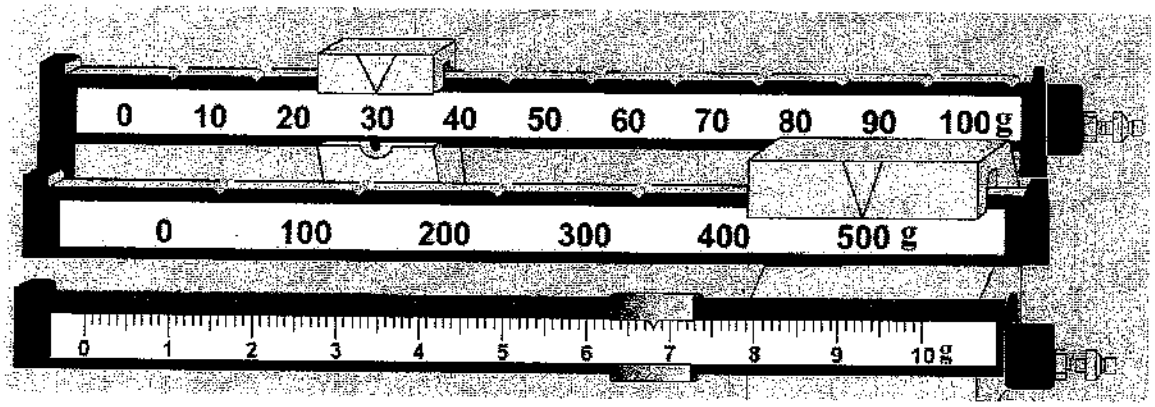
2. _____



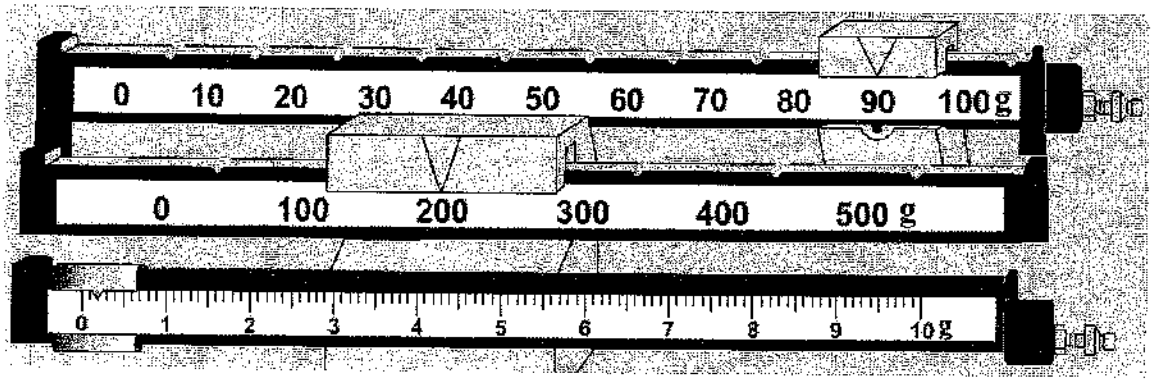
3. _____

September 29th, Tuesday

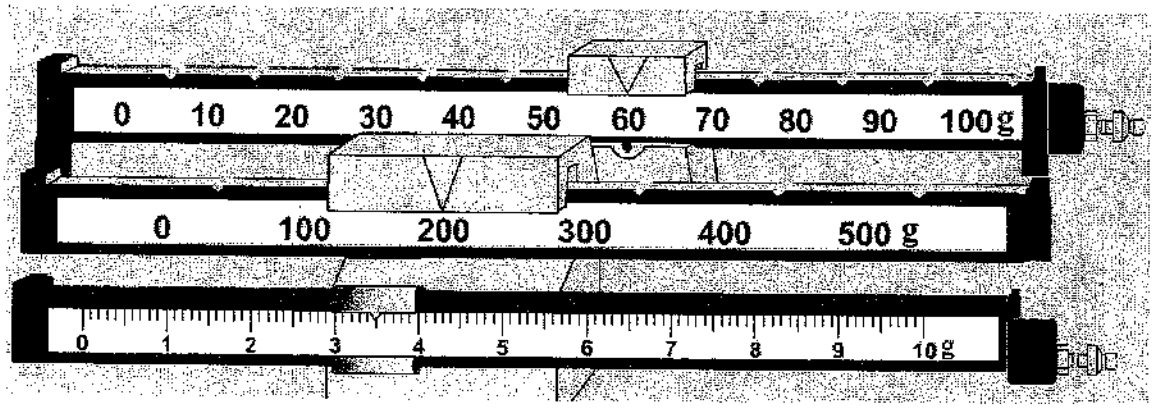
Name: _____ Period: _____



4. _____



5. _____

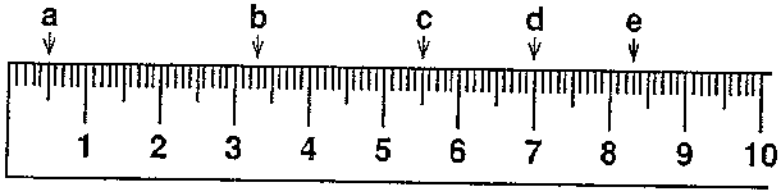


6. _____

MEASURING LENGTH

Name _____

What lengths are marked on the following centimeter ruler?



	cm	mm
a)	_____	_____
b)	_____	_____
c)	_____	_____
d)	_____	_____
e)	_____	_____

Measure the following lines with a centimeter ruler.

f) _____

g) _____

h) _____

i) _____

j) _____

k) _____

l) _____

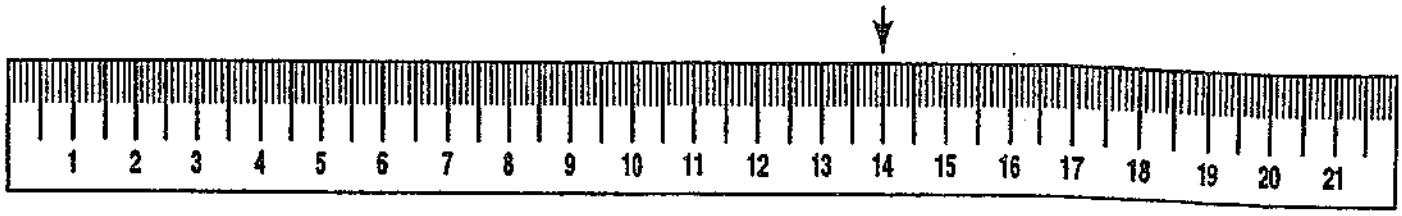
September 29th, Tuesday

The Ruler Hands-on

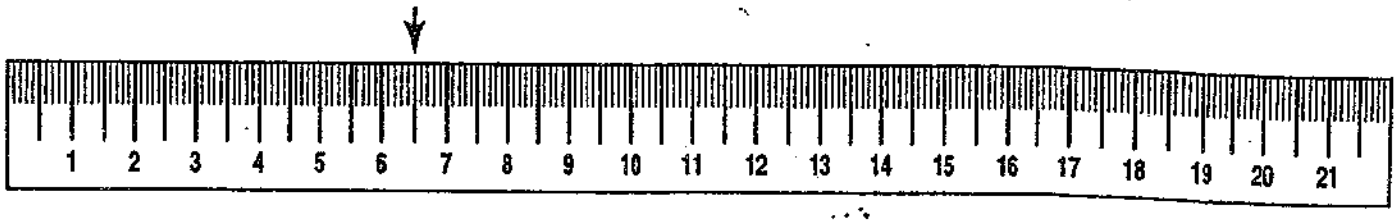
Name _____

Date _____ Hour _____

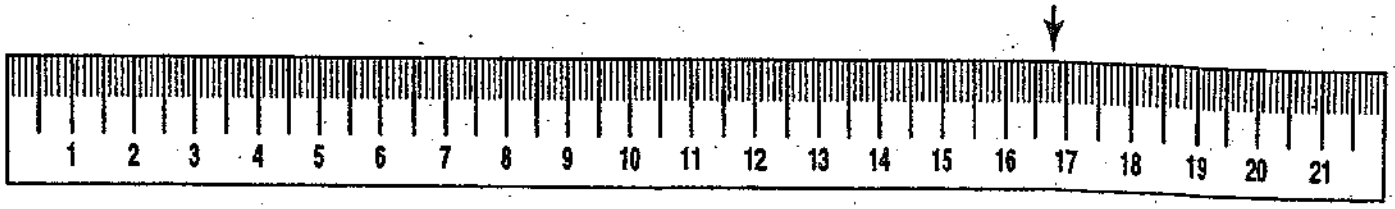
Directions: Determine what distance is shown on each ruler. Write your answers below the rulers. Be careful–some answers are in cm and others are in mm.

1. 

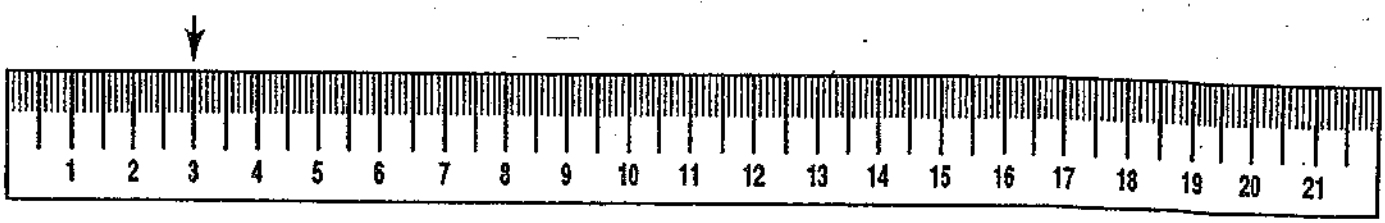
_____ cm

2. 

_____ cm

3. 

_____ cm

4. 

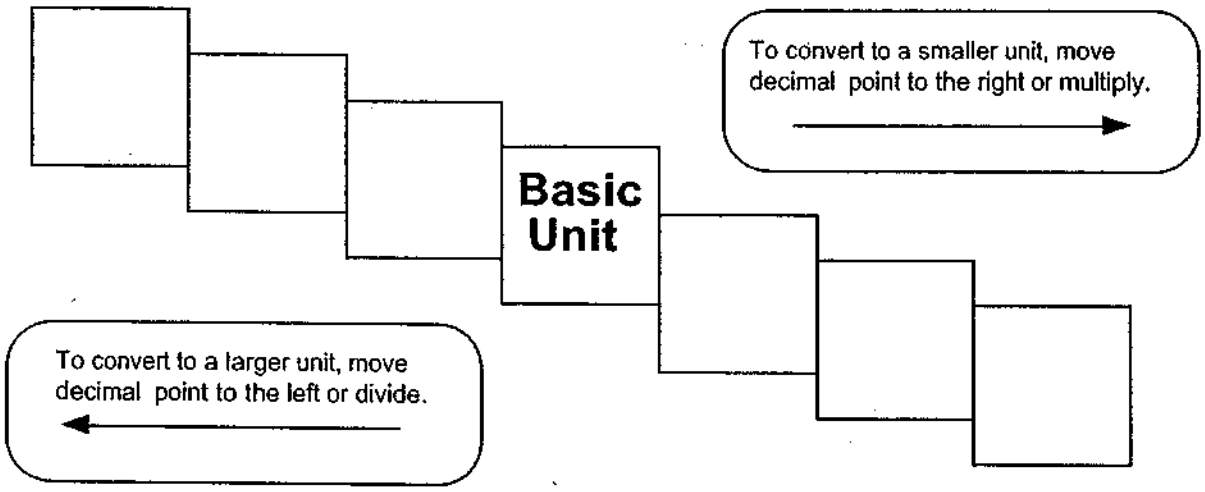
_____ mm

5. 

_____ mm

Metric Mania
Conversion Practice

Name_____



Try these conversions, using the ladder method.

1000 mg = _____ g

1 L = _____ mL

160 cm = _____ mm

14 km = _____ m

109 g = _____ kg

250 m = _____ km

Compare using <, >, or =.

56 cm ◯ 6 m

7 g ◯ 698 mg

September 30th, Wednesday

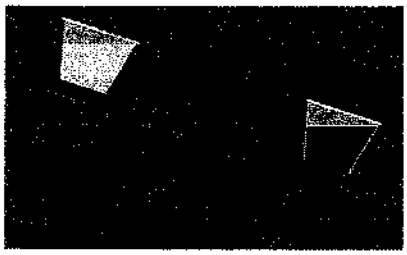
Density = Mass / Volume

[redacted]

Density of Liquids
Student Reading

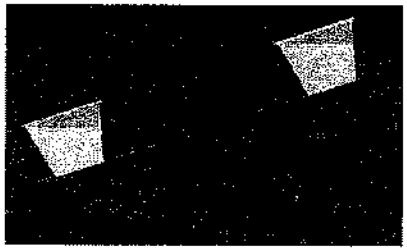
Liquids Can Float or Sink in Water

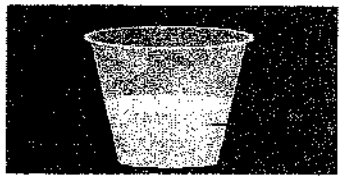
People usually think of solid objects as sinking or floating in water, but liquids can also sink or float. The rules about density that apply to solids sinking and floating also apply to liquids. If you compare the same amount of two different liquids, the one that weighs more is more dense. So if you weigh the same amount of corn syrup and water, you can tell which one is more dense or less dense than the other.



Since the corn syrup weighs more than the same amount of water, corn syrup is more dense than water. Since corn syrup is more dense than water, it sinks in water.

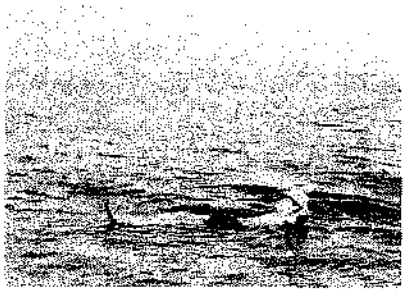
If you weigh the same amount of vegetable oil and water, you'll see that the vegetable oil weighs less. Since vegetable oil weighs less than the same amount of water, oil is less dense than water and floats in water.





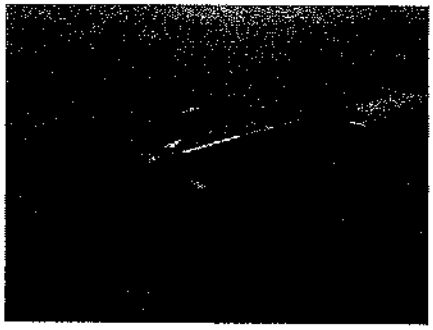
Floating is Easier in Salt Water

Salt water is more dense than fresh water. You already know that if an object is less dense than water, the object will float in water. But it's also true that because salt water is even more dense than fresh water, an object that floats in water will float more easily and higher in salt water than in fresh water.
This person is floating in the Dead Sea, which is a very salty lake in the Middle East. The Dead Sea is more than eight times as salty as the ocean, so the water is very dense and things float in it easily.



Man Floating in Dead Sea

Submarines can Sink *and* Float



Submarine Diving Deeper

Certain objects like submarines sometimes need to sink and sometimes need to float. They do this by changing how heavy they are. If the submarine needs to sink, it brings water from the ocean into special tanks which makes the submarine heavier. Since its size hasn't changed, it is now heavier for its size so it is more dense and sinks.

If the submarine needs to come up to the surface, it pushes the water out and becomes lighter for its size and less dense so it floats. It can even take in just the right amount of water so it doesn't float and it doesn't sink all the way down. It can stay right at the level it needs to be as it moves through the water beneath the surface.

Write a journal entry on how people float on dead sea. (2 paragraphs - 10-12 sentences)

Write a journal entry on how you can make a egg float in [redacted] water. (2 paragraphs - 10-12 sentences)

September 30th, Wednesday

DENSITY

Name _____

Which has the greater mass, air or lead? Most of you would answer lead, but actually this question does not have an answer. To compare these two things you need to now how much of each you have. A large amount of air could have a greater mass than a small amount of lead. To compare different things, we have to compare the masses of each that occupy the same space, or volume. This is called density.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Solve the following problems.

1. What is the density of carbon dioxide gas if 0.196 g occupies a volume of 100 mL?

   Answer: _____

2. A block of wood 3.0 cm on each side has a mass of 27 g. What is the density of this block?

   Answer: _____

3. An irregularly shaped stone was lowered into a graduated cylinder holding a volume of water equal to 2.0 mL. The height of the water rose to 7.0 mL. If the mass of the stone was 25 g, what was its density?

   Answer: _____

4. A 10.0 cm^3 sample of copper has a mass of 89.6 g. What is the density of copper?

   Answer: _____

5. Silver has a density of 10.5 g/cm^3 and gold has a density of 19.3 g/cm^3. Which would have a greater mass, 5 cm^3 of silver or 5 cm^3 of gold?

   Answer: _____

6. Five mL of ethanol has a mass of 3.9 g, and 5.0 mL of benzene has a mass of 4.4 g. Which liquid is denser?

   Answer: _____

7. A sample of iron has the dimensions of 2 cm x 3 cm x 2 cm. If the mass of this rectangular-shaped object is 94 g, what is the density of iron?

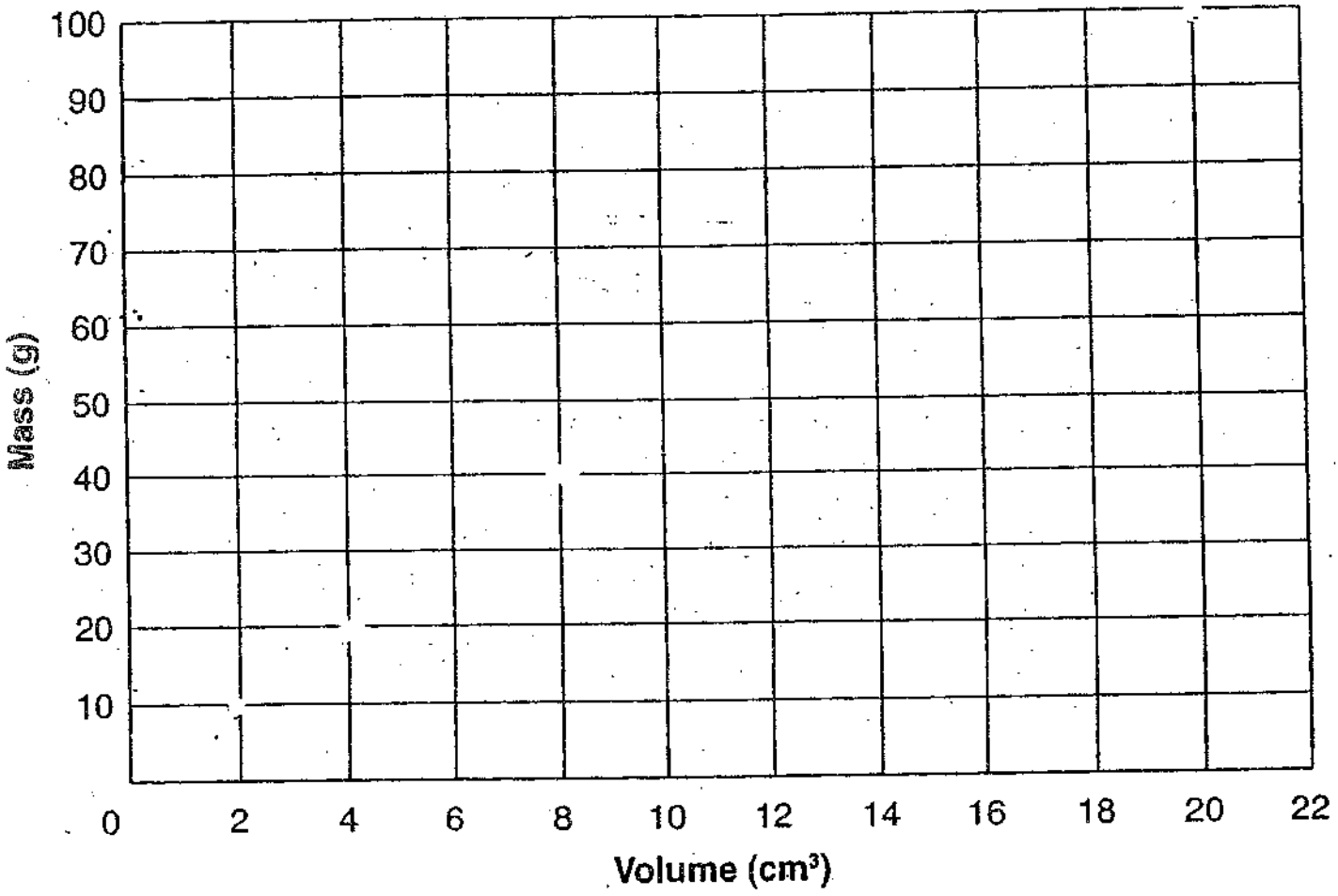
   Answer: _____

GRAPHING OF DATA

Name _____

Graphing is a very important tool in science since it enables us to see trends that are not always obvious. Graph the following data and answer the questions below.

Mass of Liquid (g)	Volume of Liquid (cm^3)
20	4
100	20
75	15
40	8
10	2



1. As mass increases, what happens to the volume? _____
2. As volume increases, what happens to the mass? _____
3. How many grams would occupy 12 mL? _____
4. What volume would 90 g occupy? _____
5. What is the density of the liquid? _____

TEMPERATURE

In your everyday life and in your study of Chemistry, you are likely to encounter three different temperature scales. When you watch the weather report on the news, they will report the temperature on one scale, yet you measure temperature in the laboratory on a different scale. Many Chemistry equations must be done using yet another temperature scale. Clearly, you can see the importance of the use of units when reporting temperature. You can also see the need, for a student of Science, to be able to convert temperatures from one scale to another. This page is designed to help you do just that.

The Fahrenheit Scale - The Fahrenheit scale is the scale that is used when they report the weather on the news each night. It is probably the temperature scale that you are most familiar with, if you live in the United States. The thermometers that you have in your house, for uses such as; swimming pools, cooking, bath tubs, or reading body temperature, are all likely to be in Fahrenheit. In Canada and most other countries, the news will report the temperature on the Celsius scale.

The Celsius Scale - The Celsius scale, is commonly used for scientific work. The thermometers that we use in our laboratory are marked with the Celsius scale. The Celsius scale is also called the Centigrade scale because it was designed in such a way that there are 100 units or degrees between the freezing point and boiling point of water. One of the limitations of the Celsius scale is that negative temperatures are very common. Since we know that temperature is a measure of the kinetic energy of molecules, this would almost suggest that it is possible to have less than zero energy. This is why the Kelvin scale was necessary.

The Kelvin Scale - The International System of Measurements (SI) uses the Kelvin scale for measuring temperature. This scale makes more sense in light of the way that temperature is defined. The Kelvin scale is based on the concept of **absolute zero**, the theoretical temperature at which molecules would have zero kinetic energy. Absolute zero, which is about -273.15 °C, is set at zero on the Kelvin scale. This means that there is no temperature lower than zero Kelvin, so there are no negative numbers on the Kelvin scale. For certain calculations, like the gas laws, which you will be learning soon, the Kelvin scale must be used.

Figure 2-9b Temperature Conversion Formulas

Conversion	Formula	Example
Celsius to Kelvin	K = C + 273	21 °C = 294 K
Kelvin to Celsius	C = K - 273	313 K = 40 °C
Fahrenheit to Celsius	C = (F - 32) x 5/9	89 °F = 31.7 °C
Celsius to Fahrenheit	F = (C x 9/5) + 32	50 °C = 122 °F

Figure 2-9a Comparison of Temperature Scales

Set Points	Fahrenheit	Celsius	Kelvin
water boils	212	100	373
body temperature	98.6	37	310
water freezes	32	0	273
absolute zero	-460	-273	0

Name:_____ Period #:___

Temperature Conversion Worksheet

Formulas:

Farenheit to Celsius

$C^o = 5/9(F^o-32)$

Celsius to Farenheit:

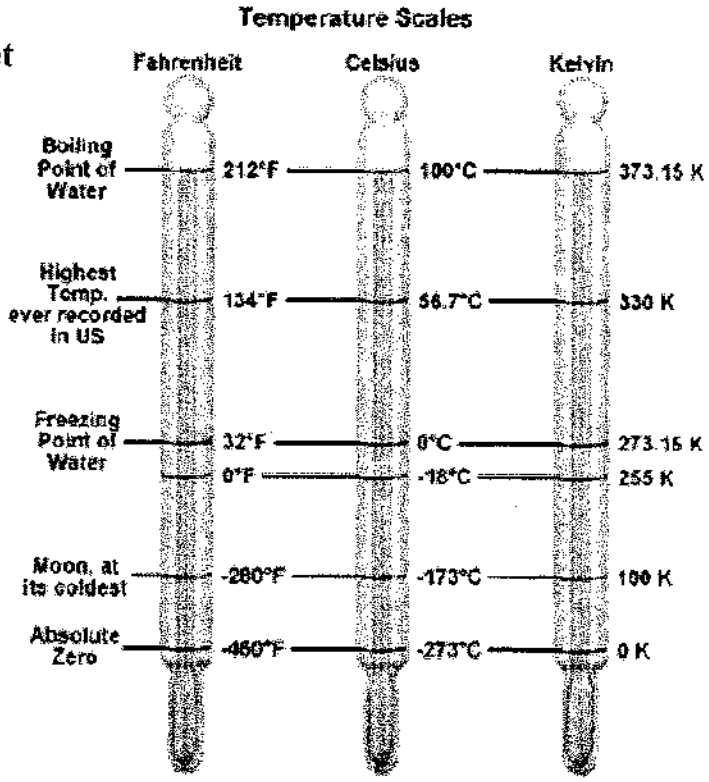
$F^o = 9/5\ C^o +32$

Celsius to Kelvin

$K^o = C^o + 273.15$

Kelvin to Celsius:

$C^o = K^o - 273.15$



Use the formulas above to convert the temerpatures to different scales.

Convert the following to Fahrenheit

1) 10° C _____

2) 30° C _____

3) 40° C _____

4) 37° C _____

5) 0° C _____

Convert the following to Celsius

6) 32° F _____

7) 45° F _____

8) 70° F _____

9) 80° F _____

10) 90° F _____

11) 212° F _____

Convert the following to Kelvin

12) 0° C _____

13) -50° C _____

14) 90° C _____

15) -20° C _____

Convert the following to Celsius

16) 100° K _____

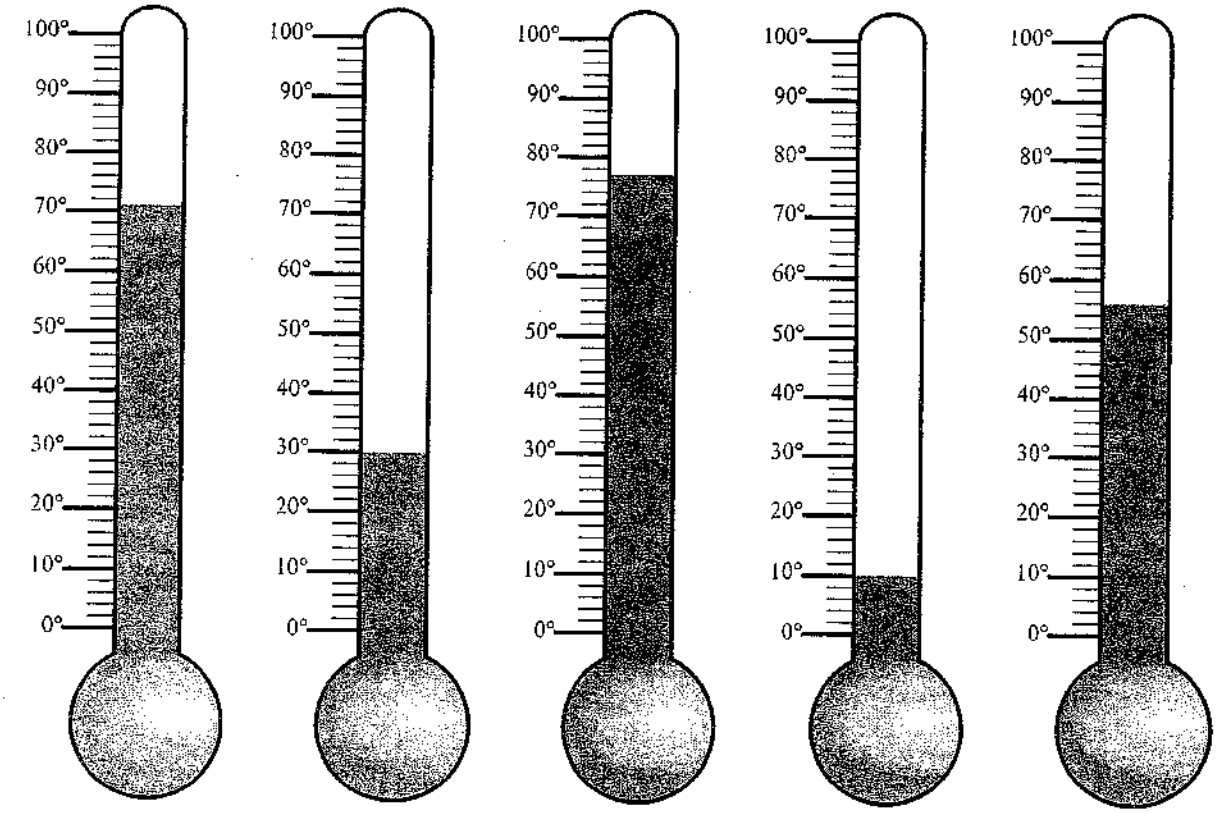
17) 200° K _____

18) 273° K _____

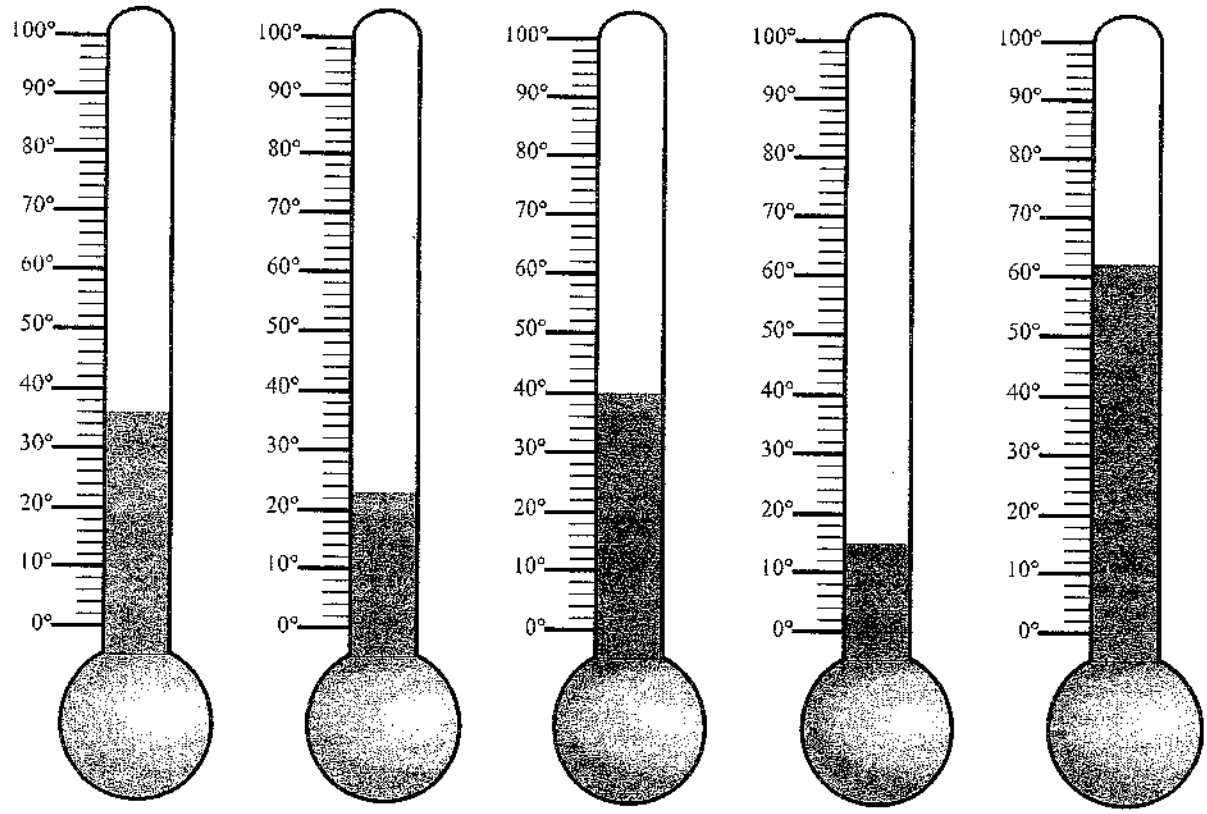
19) 350° K _____

Reading a thermometer Name:

Determine what temperature each thermometer shows.



1) _____ 2) _____ 3) _____ 4) _____ 5) _____



6) _____ 7) _____ 8) _____ 9) _____ 10) _____

Answers

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

1-10	90	80	70	60	50	40	30	20	10	0

Metric System Challenge Name ____________________

1. Instrument used to find mass. _ _ _ _ _(21) _ - _ _ _ _ _ _(17) _ _ _ _ (23)
2. Metric unit for length _ _ _ _ _(20)
3. Amount of space an object takes up _ _(16) _ _ _ _
4. $9.8\ m/s^2$ _ _ _ _ _ _(10)
5. Metric unit for mass _ _(15) _ _
6. Instrument used to measure volume _ _ _ _ _ _(6) _ _ _(8) _ _ _(25) _ _ _ _
7. Mass ÷ volume _ _(19) _ _ _(24) _ _
8. 1 meter = 100 _(4) _ _ _ _ _ _ _ _ _ _
9. Metric unit for weight _ _ _ _ _ _(5) _
10. Metric unit for liquid volume _ _ _ _(3) _
11. Amount of matter in an object _ _ _(26) _
12. Measure of the force of gravity acting on an object _ _ _ _ _(18) _
13. Metric unit for temperature _(11) _ _ _(1) _ _ _
14. 1 liter = 1,000 _ _ _(7) _ _ _ _ _ _ _ _ _
15. The name of the "bubble" _ _ _ _ _ _ _(22) _
16. 1000 grams = 1 _ _ _(12) _ _ _ _ _
17. Instrument used to measure length _ _ _(14) _ _ _ _ _ _ _
18. 1 milliliter = 1 _ _ _ _ _ _ _ _(13) _ _ _ _ _ _ _ _
19. Width, height, thickness, or distance _ _ _(9) _ _ _
20. Formula for calculating volume _ x _ x _(2)

Why were the teacher's eyes crossed?

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ !
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

T. Trimpe 2000

October 2nd, Friday

Name_____Date_____Per_____

Writing Meters, Liters, and Grams

When Moving from one unit to a **larger** unit

No. of units moved	Unit multiplied by
1	0.1
2	0.01
3	0.001
4	0.0001
5	0.00001
6	0.000001

When Moving from one unit to a **smaller** unit

No. of units moved	Unit multiplied by
1	10
2	100
3	1000
4	10000
5	10000
6	100000

1mm = .1cm
1 mm = .01 dm
1mm = .001 m
1mm = .0001dkm
1mm = .00001 hm
1mm = .000001 km

.1 cm = 1mm
.01 dm = 1 mm
.001m = 1mm
.0001dkm = 1mm
.00001 hm = 1mm
.000001 km = 1mm

Give the missing decimals

1) 3 mm = _____cm
2) 5cm = _____dm
3) 6dm= _____m
4) 8m = _____dkm
5) 6 cl = _____l
6) 7 dl = _____dkl
7) 9l= _____hl
8) 4ml= _____l
9) 25 cg =_____g
10) 15g=_____kg
11)32dg=_____kg
12) 98cg =_____g

Give the missing number

13) .3cm = _____mm
14) .6m = _____dm
15) .4hm= _____dkm
16) .9km = _____hm
17) .06l = _____cl
18) .08dkl = _____dl
19) .09hl= _____l
20) .002l= _____ml
21) .27g=_____mg
22).15g=_____mg
23).052 dkg=_____cg
24).22hg=_____g

Write as decimals.

25) 37 mm=_____cm

26) 107cm=_____m

27) 1,529m=_____km

28) 26cm=_____m

29) 276ml=_____l

30) 8,278ml=_____l

31) 27ml=_____l

32) 4,010ml=_____l 3

33) 378 g=_____kg

34) 56g=_____kg

35)9,762g=_____kg

36)8,920g=_____kg

October 2nd, Friday

Name: _____ Section: _____

Metric Conversions

Metric Conversions Worksheet III

Convert the following:

0.0075 Gm = _____ km

0.00046 ks = _____ cs

4096 MB = _____ GB

0.0002 µg = _____ mg

0.00034 µL = _____ cL

11120.33 ng = _____ cg

0.00091 TL = _____ ML

244475.3 µs = _____ hs

210 hm = _____ cm

448.5 cg = _____ g

2103.55 s = _____ ks

0.0000012 GL = _____ cL

Word Problems

1. The distance from your home to the airport is 0.0000075 Gm. How far is this in km?

2. There are 10 computers in the computer lab that each have 20 GB hard drives. How many bytes (B) of disk space do we have in the computer lab in total.

3. A challenge: convert 100125368477004 ng to Teragrams.

Name: _____ Section: _____

Metric Conversions

Metric Conversions Worksheet II

1. Convert the following to km:

1600.0 m = _____ 2050 cm = _____ 1.033 Mm = _____

245 565 mm = _____ 20 099 m = _____ 499 m = _____

2. Convert the following:

10.034 mJ = _____ cJ 36.45 cL = _____ µL

0.05 cm = _____ mm 1024 B = _____ kB

0.0325 kJ = _____ cJ 1202.5 mL = _____ L

0.42101 Gg = _____ Mg 25.5 km = _____ m

0.12907 cm = _____ mm 756 900 µs = _____ ms

5600.4 Ms = _____ Gs 268 000 cm = _____ km

October 5th, Monday

Metric Measurement Quiz (open book)

Directions: Match the letter to the correct definition. Make sure you check the abbreviation of the different units.

_____ 1. One Millimeter	A. 1000 g
_____ 2. Metric System	B. System used by the US most of the time
_____ 3. One Kilometer	C. The basic unit of length
_____ 4. The Meter	D. 0.001 L
_____ 5. One Centimeter	E. 0.001 m
_____ 6. Volume	F. How much space something takes up
_____ 7. The Gram	G. Worldwide measurement system
_____ 8. One Kilogram	H. 0.01 m
_____ 9. The Liter	I. The basic unit of volume
_____ 10. One Milliliter	J. The basic unit of mass
_____ 11. Standard System	K. 1000 meters

Directions: Write the correct conversions for the below problems.

12) 50 Dm = _____ cm

13) 2.5 cm = _____ dm

14) 12 cm = _____ mm

15) 1200 mm = _____ cm

16) 150 Kilometers = _____ meters

17) 9400 decigrams = _____ grams

18) 39.1 mg = 0.391 _____

19) 49.03 Dekaliters = 0.4903 _____

20) 54 Hg = _____ cg

21) 0.08 g = _____ cg

22) 29 m = _____ Km

23) 2 L = _____ mL

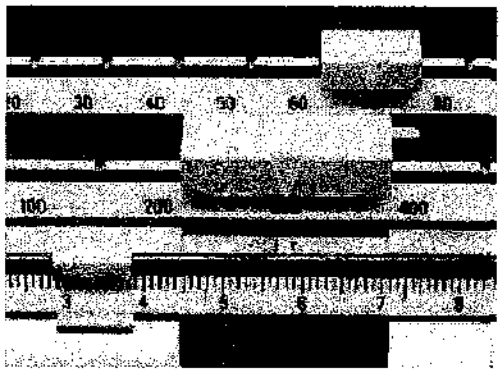
24) 80 Hectoliters = _____ milliliters

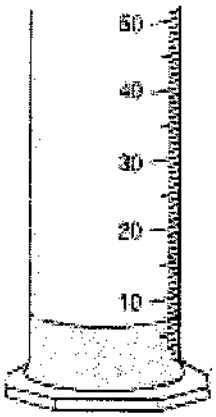
25) 0.79 Kilometers = _____ Hectometers

26) 134 dL = 13.4 _____

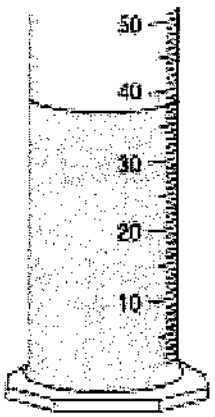
27) 9 Hectometers = 9000 _____

28) List the mass shown on the triple beam balance in grams. →





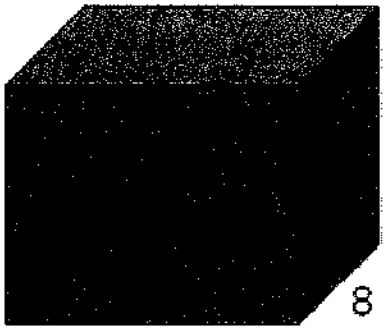
30)



31)

30) & 31) List the volume in milliliters. ←

29) List the volume of the rectangular prism in cubic centimeters. cm^3

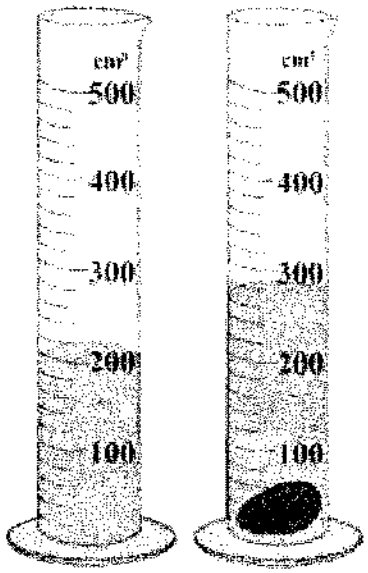


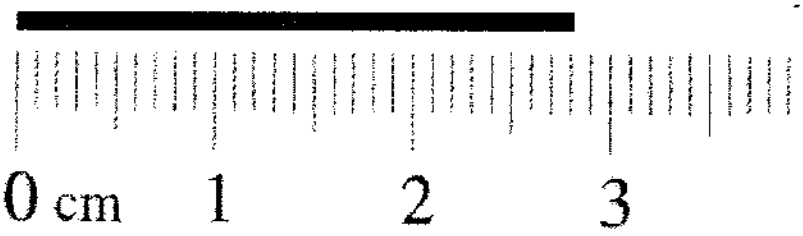
32)

Amount of H_2O with object = _____

About of H_2O without object = _____

Difference = Volume = _____





33) What is the length of the line in centimeters? _____cm

What is the length of the line in millimeters? _____mm

October 5th, Mond

Answer Sheet

Name_____

1.	18.
2.	19.
3.	20.
4.	21.
5.	22.
6.	23.
7.	24.
8.	25.
9.	26.
10.	27.
11.	28.
12.	29.
13.	30.
14.	31.
15.	32.
16.	33.
17.	

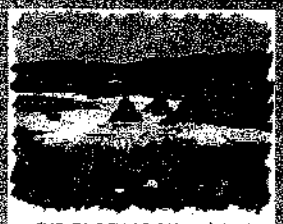
Answer Sheet

Name_____

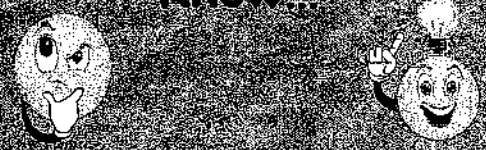
1.	18.
2.	19.
3.	20.
4.	21.
5.	22.
6.	23.
7.	24.
8.	25.
9.	26.
10.	27.
11.	28.
12.	29.
13.	30.
14.	31.
15.	32.
16.	33.
17.	

October 6th, Tuesday
9/16/2020

Physical and Chemical Properties



Properties of Matter- Words to Know...

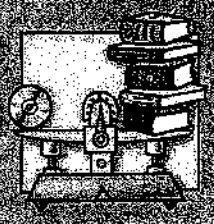


Mass

- A measure of how much matter is in an object

Weight

- A measure of the force of gravity on an object.

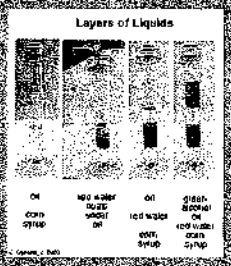


Volume

- The amount of space that matter occupies.

Density

- The measurement of how much mass of a substance is contained in a given volume.
- Density

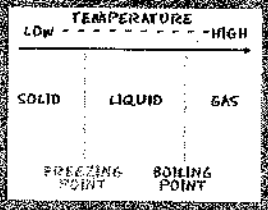


States of Matter

- There are different "states" of matter. No, not like Texas, Oklahoma, New Mexico. States of matter are also known as phases (a physical state of matter). Elements and compounds can move from one phase to another phase when special physical forces are present.

Freezing point

- The temperature at which a liquid changes into a solid.

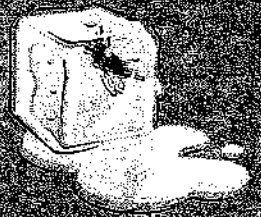


Boiling point

- The boiling point of an element or compound means the temperature at which the liquid form of an element or compound is at equilibrium with the gaseous form.

Melting point

- The temperatures at which the solid form of the element or compound is at equilibrium with the liquid form.
- Basically the range at which the solid changes its state into a liquid.



Compound

- A substance made of two or more elements chemically combined in a set ratio.

All substances have properties... Including people!

Examples:
- Physical properties
- Chemical properties

Face (ex. to expressions)	Voice	Height	Finger prints
Eye color	Hair color	Teeth	DNA

What are properties?

- Matter has observable and measurable qualities.
- We can use general properties to identify substances.
- Two basic types of properties of matter: Physical properties and Chemical properties.

Physical Properties

- Physical properties are used to identify, describe and classify matter.
  - Characteristic of a substance that can be observed (using your senses).
  - Do not change the substance into something else.

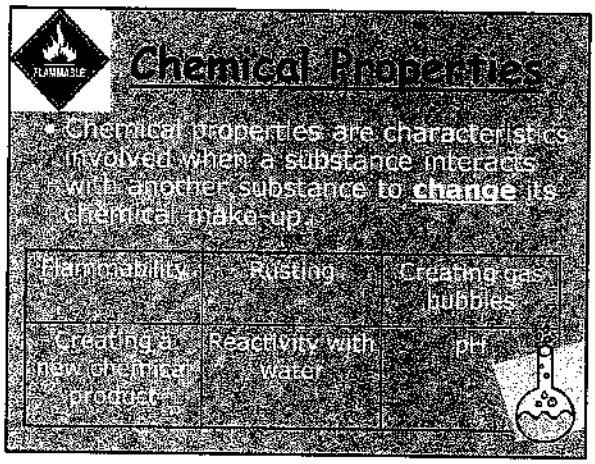
Hardness	Texture	Color
Odor	Taste	Temperature

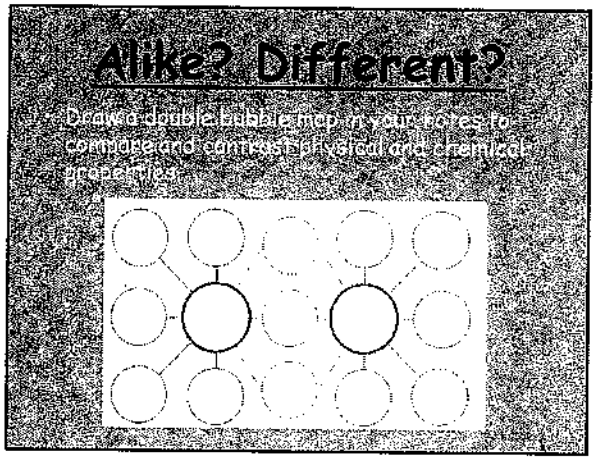
More EXAMPLES – Physical

- size, shape, freezing point, boiling point, melting point, magnetism, viscosity, density, luster and many more
  - Viscosity – The resistance of a liquid to flowing.
  - Examples:
    - Low viscosity-water, rubbing alcohol
    - High viscosity-honey

October 6th, Tuesday

9/16/2020





PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

Name _____Key_____

PHYSICAL PROPERTY	CHEMICAL PROPERTY
1. observed with senses 2. determined without destroying matter	1. indicates how a substance reacts with something else 2. matter will be changed into a new substance after the reaction

Identify the following as a chemical (C) or physical property (P):

_____1. blue color
_____2. density
_____3. flammability (burns)
_____4. solubility (dissolves)
_____5. reacts with acid
_____6. supports combustion
_____7. sour taste
_____8. melting point
_____9. reacts with water
_____10. hardness
_____11. boiling point
_____12. luster
_____13. odor
_____14. reacts with air

PHYSICAL CHANGE	CHEMICAL CHANGE
1. a change in size, shape, or state 2. no new substance is formed	1. a change in the physical and chemical properties 2. a new substance is formed

Identify the following as physical *(P)* or chemical *(C)* changes.

_____1. NaCl (Table Salt) dissolves in water.
_____2. Ag (Silver) tarnishes.
_____3. An apple is cut.
_____4. Heat changes H_2O to steam.
_____5. Baking soda reacts to vinger.
_____6. Fe (Iron) rusts.
_____7. Alcohol evaporates .
_____8. Ice melts.
_____9. Milk sours.
_____10. Sugar dissolves in water.
_____11. Wood rots.
_____12. Pancakes cook.
_____13. Grass grows.
_____14. A tire is inflated.
_____15. Food is digested.
_____16. Paper towel absorbs water.

Physical and Chemical Changes

Part A

Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a **physical change** (P) has occurred. If the substance has been changes into another substance, a **chemical change** (C) has occurred.

1.		An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2.		Two chemical are mixed together and a gas is produce.
3.		A bicycle changes color as it rusts.
4.		A solid is crushed to a powder.

Tuesday

Part B

Read each scenario. Decide whether a physical or chemical change has occurred and give evidence for your decision. The first one has been done for you to use as an example.

	Scenario	Physical or Chemical Change?	Evidence...
1.	Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it.		
2.	Your friend decides to toast a piece of bread, but leaves it in the toaster too long. The bread is black and the kitchen if full of smoke.		
3.	You forgot to dry the bread knife when you washed it and reddish brown spots appeared on it.		
4.	You blow dry your wet hair.		
5.	In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise.		
6.	You take out your best silver spoons and notice that they are very dull and have some black spots.		
7.	A straight piece of wire is coiled to form a spring.		
8.	Food color is dropped into water to give it color.		
9.	Chewing food to break it down into smaller particles represents a _____ change, but the changing of starch into sugars by enzymes in the digestive system represents a _____change.		
10.	In a fireworks show, the fireworks explode giving off heat and light.		

Part C: True (T) or False (F)

1.		Changing the size and shapes of pieces of wood would be a chemical change.
2.		In a physical change, the makeup of matter is changed.
3.		Evaporation occurs when liquid water changes into a gas.

october 6th, Tuesday

Describing and classifying

MATTER

1. Write the definition of MATTER on the lines below the big word MATTER
2. Fold the paper following the solid vertical lines.
3. Explain with your words the meaning of physical properties on the back of the big PHYSICAL PROPERTIES.
4. Explain with your words the meaning of chemical properties on the back of the big CHEMICAL PROPERTIES.
5. On the White tab, draw pictures that represent the properties.
6. Check your work with the teacher, then, glue this side to your notebook.

Physical Properties

Chemical Properties

Describing and classifying

MATTER

October 17th, Wednesday

If you have time, draw pictures of examples of what your element bonds into. For example, if you chose Na, it likes to bond with Cl to make salt; so draw table salt!

WHICH ELEMENT IS IT?

1)This element has an atomic mass of 16 and is *essential* to life on Earth. What element is it and what is the atomic number of this element? Oxygen, 8

2) This material is a **metal**. It is **shiny** and therefore could conduct electricity very well. It has an atomic number of 79. Which element is it? How many protons would it have?? Gold, 79 protons

3) This element has a melting point of 1,538 degrees celsius. What element is this and would melting point be considered a **physical** or **chemical** characteristic? Fe (Iron), physical

4) This element is an **alkaline metal**. It chemically bonds with the element Cl to make our everyday table salt. Na (sodium)

5) This element is a non-metal. Some periodic tables show it as its own category. It is also the most abundant element in our universe. H (hydrogen)

6)This element is a **metalloid**.You could find versions of it in our computers and cellphones as silicon chips. Si (silicon)

7) This **noble gas** glows vividly when an electric current passes through it. What Group number is this element found in? Ne (neon) Group number 18

PICK AN ELEMENT

Choose **2** elements to "adopt" and describe special characteristics of the elements, such as...

- Fun facts about the elements
- The element's atomic number, atomic mass, and number of neutrons.
- Is it a metal, nonmetal, metalloid, alkali metal or noble gas?

Finally, tell me the **physical** and **chemical** characteristics of the element.

- Physical : shiny, brittle, malleable? conducts electricity? The melting point of the elements.
- Chemical: what other elements do your element react to? Does it react violently?

October 1th, Wednesday

Worksheet 4.1 Elements, Mixtures and Compounds

Name: _____ Class: _____ Date: _____

Elements:

1. An element is a **pure substance** which cannot be broken down into any simpler substances by any ordinary physical or chemical methods.
2. **All metals** (e.g. Sodium, Magnesium, Aluminium) exist as **solid** at room temperature except for mercury.
3. **Non- metals** such as **Hydrogen, Oxygen, Nitrogen, Fluorine, Chlorine, Helium, Argon,** and **Neon** exist as **gases** at room temperature.
4. Only **Bromine (non-metal)** and **Mercury (metal)** exist as **liquid** at room temperature.
5. Properties of Metals and Non-metals:

Metals	Non-metals
Good conductors of heat	Poor conductors of heat
Good conductors of electricity	Poor conductors of electricity
Usually hard	Usually soft
Shiny in appearance	Dull in appearance
Malleable & ductile	Brittle

6. Periodic Table:
   - Row in Periodic Table is known as **Period**
   - Column in Periodic Table is known as **Group**
   - Elements in **same group** have **similar chemical properties**
   - Across a period from left to right, there's a gradual **change from metallic properties to non-metallic properties.**
7. Uses of Some Common Elements

Element	Uses
Gold	to make sculptures, ornaments and jewellery
Hydrogen	for fuel in space shuttles
Copper	to make water pipes, copper wire
Iron	to make bridges, ships and buildings
Aluminium	Make aircraft
Silicon	to make electronic parts for radios, televisions and computers
Mercury	used in thermometers
Helium	to fill balloons, weather balloons and airships
Chlorine	to kill bacteria in swimming pools and drinking water

October 17th
Wednesday

Exercises

1. The following diagrams show the composition of 16 different materials (A to P) in terms of the arrangement of their atoms. There are three kinds of atoms represented by ◯ , ▨ and □ .

   Identify the diagram(s) that matches each of the following descriptions.

   (a) A mixture of an element and a compound. _____

   (b) A compound made up of two elements. _____

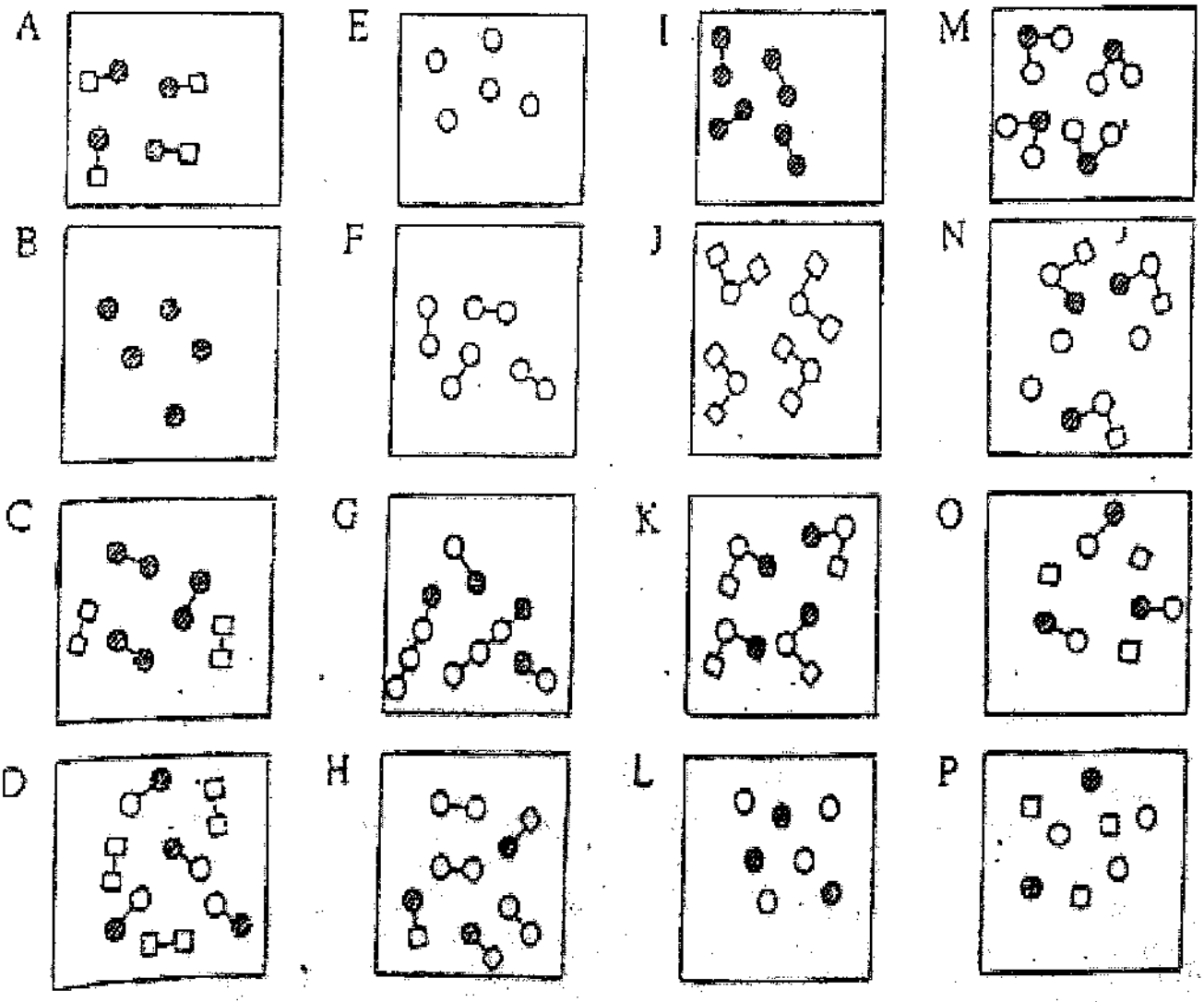
   (c) An element made up of single atoms. _____

   (d) A mixture of two elements. _____

   (e) An element made up of molecules. _____

   (f) A mixture of two compounds. _____

   (g) A compound made up of three elements. _____



October 17th, Wednesday

Compounds:

1. A compound is a substance made up of **2 or more elements** chemically combined together

2. Examples of compounds:

Compound	Their elements which made up the compound
Water (H_2O)	Hydrogen, oxygen
Nitrogen oxide	Nitrogen , Oxygen
Common salt/ Table salt (sodium chloride)	Sodium , Chlorine
Sugar	Carbon, Hydrogen , Oxygen
Chalk (Calcium carbonate)	Calcium, Carbon , Oxygen
Sand (Silicon dioxide)	Silicon and Oxygen

3. A compound can be broken down into simpler substances by **heat or electricity**.

e.g. Copper chloride solution → copper + chlorine

(green liquid) (reddish-brown solid) (greenish-yellow poisonous gas)

Compound **Element** **Element**

Mixtures:

1. A mixture is made up of 2 or more substances **not** chemically combined together.

E.g. **Sea water; Bronze; Milk; Air; Blood; Salt solution**

2. Differences between mixture & compound:

Mixture	Compound
made up of 2 or more substances not chemically combined together	made up of 2 or more elements chemically combined together.
can be separated by any physical methods like filtration, evaporation, etc.	**cannot** be separated by any physical methods like filtration, evaporation, etc.
No chemical change or reaction must occur in order to form a mixture	To form a compound, a chemical change or reaction must occur
A mixture has no fixed boiling or melting point.	Pure compound has a fixed boiling or melting point
A mixture has the properties of the substances that make it up.	A compound doesn't have the properties of the substances that make it up.

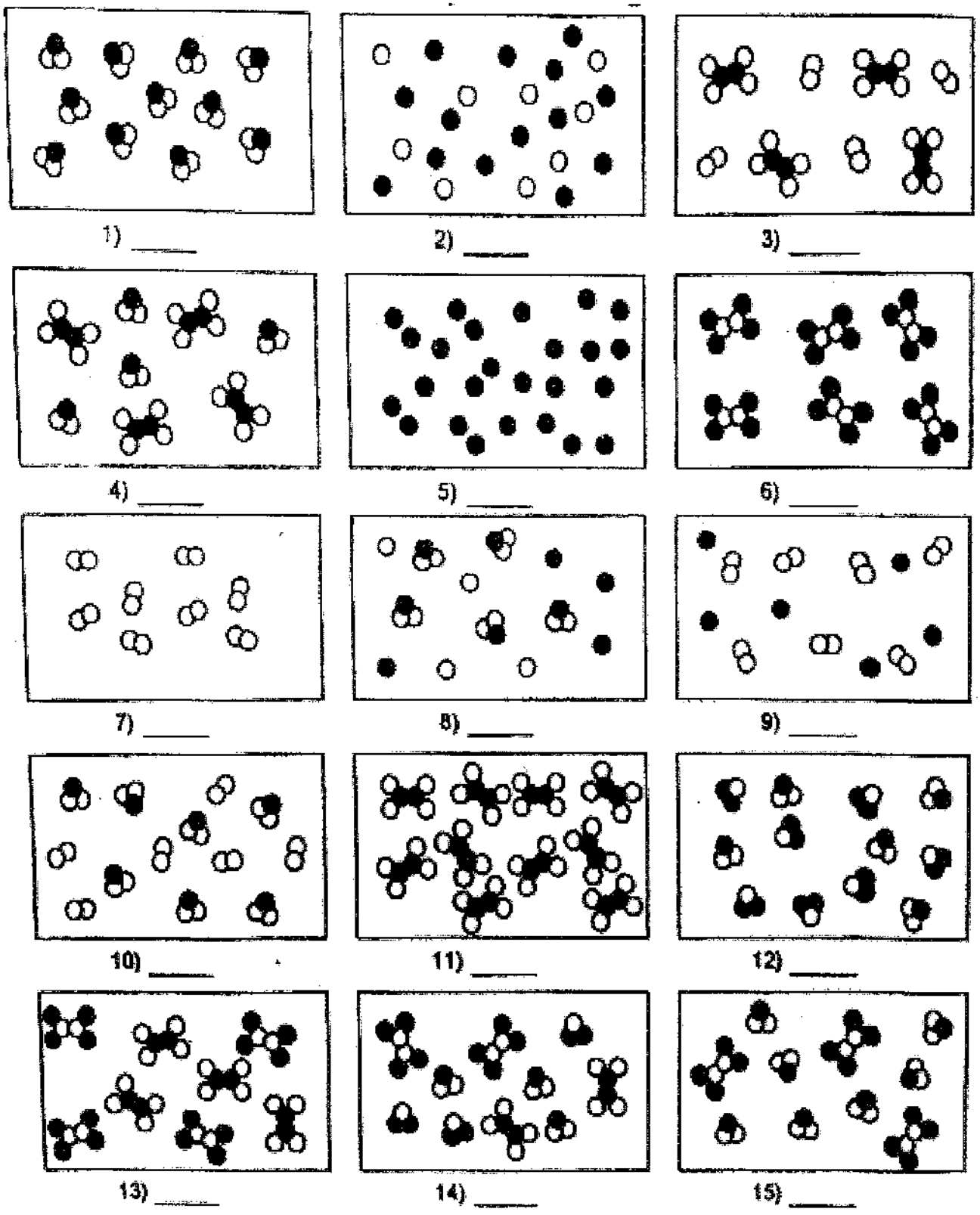
October 1th

2. Classify each of the pictures below by placing the correct label in the blanks below. Wednesdc

A = Element **B** = Compound **C** = Mixture of Element

D = Mixture of compounds **E** = Mixture of Elements and compounds

Each circle represents an atom and each different color represents a different kind of atom. If two atoms are touching, then they are bonded together.



October 7th
Wednesday

3. Which of the following contains three elements?

A argon, magnesium, phosphorus
B brass. phosphorus, potassium
C chlorine, air, nitrogen
D petrol, alcohol, water ( )

4. A substance X has the following properties:

I High melting point
II Good conductor of electricity
III Malleable

What could X be?

A graphite **B** iron
C silicon(IV) oxide **D** sodium chloride ( )

5. A mixture _____.

A has a fixed melting point.
B has a fixed boiling point.
C is made by a chemical reaction.
D can be separated by physical methods. ( )

6. Which one of the following sets contains only one metal?

A	sodium	hydrogen	calcium
B	iron	oxygen	sulfur
C	copper	carbon	calcium
D	sulfur	magnesium	copper

( )

7. The table below shows the properties of substances X and Y.

Substance	Appearance	Electrical conductivity	Effect of heating the substance
X	Yellow solid	Do not conduct electricity	Turn into yellowish-orange liquid and produced a pungent gas
Y	Silver solid	Conduct electricity	Turn into silver liquid at high temperature

Which substance is most likely an element? Explain your answer.

_____

_____

October 7th Wednesday

8. *Anhydrite* is a white rock with the formula $CaSO_4$.
Name the elements present in *anhydrite* and state whether each one is a metal or a non-metal.

_____

_____

9. A list of substances is given below.

Air	*Water*	*Ethanol*	*Steel*
Graphite	*Petrol*	*Chromium*	

Choose from the list **one** substance which

(i) is an element. _____

(ii) is a compound containing two elements only. _____

(iii) is a mixture of compounds. _____

(iv) is a mixture of elements. _____

10. The table below shows the properties of 4 elements, K, L, M and N.

Element	Electrical conductivity	Thermal conductivity	Melting point	Strength
K	High	Low	Low	Brittle
L	High	High	High	Strong
M	Low	Low	Low	Brittle
N	High	High	Low	Strong

Which element is definitely a metal? Give your reason.

_____

_____

The New York Times https://nyti.ms/ARoh52

OP-ED CONTRIBUTORS

Corn for Food, Not Fuel

By Colin A. Carter and Henry I. Miller

July 30, 2012

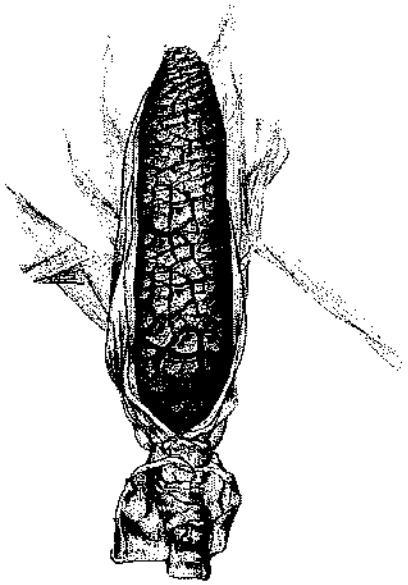
IT is not often that a stroke of a pen can quickly undo the ravages of nature, but federal regulators now have an opportunity to do just that. Americans' food budgets will be hit hard by the ongoing Midwestern drought, the worst since 1956. Food bills will rise and many farmers will go bust.

An act of God, right? Well, the drought itself may be, but a human remedy for some of the fallout is at hand — if only the federal authorities would act. By suspending renewable-fuel standards that were unwise from the start, the Environmental Protection Agency could divert vast amounts of corn from inefficient ethanol production back into the food chain, where market forces and common sense dictate it should go.

The drought has now parched about 60 percent of the contiguous 48 states. As a result, global food prices are rising steeply. Corn futures prices on the Chicago exchange have risen about 60 percent since mid-June, hitting record levels, and other grains such as wheat and soybeans are also sharply higher. Livestock and dairy product prices will inevitably follow.

More than one-third of our corn crop is used to feed livestock. Another 13 percent is exported, much of it to feed livestock as well. Another 40 percent is used to produce ethanol. The remainder goes toward food and beverage production.

Previous droughts in the Midwest (most recently in 1988) also resulted in higher food prices, but misguided energy policies are magnifying the effects of the current one. Federal renewable-fuel standards require the blending of 13.2 billion gallons of corn ethanol with gasoline this year. This will require 4.7 billion bushels of corn, 40 percent of this year's crop.



Mark Pernice

Other countries seem to have a better grasp of market forces and common sense. Brazil, another large ethanol producer, uses sugar instead of corn to make ethanol. It has flexible policies that allow the market to determine whether sugar should be sold on the sugar market or be converted to fuel. Our government could learn from the Brazilian approach and direct the E.P.A. to waive a portion of the renewable-fuel standards, thereby directing corn back to the marketplace. Under the law, the E.P.A. would first have to determine that the program was causing economic harm. That's a no-brainer, given the effects of sharply higher grain prices that are already rippling through the economy.

The price of corn is a critical variable in the world food equation, and food markets are on edge because American corn supplies are plummeting. The combination of the drought and American ethanol policy will lead in many parts of the world to widespread inflation, more hunger, less food security, slower economic growth and political instability, especially in poor countries.

If the E.P.A. were to waive the rules for this year and next, the ethanol industry and corn farmers, who have experienced a years-long windfall, would lose out. Wheat and soybean farmers would also lose, because the prices of those crops have also been driven up: corn competes with soybeans for acreage and is substituted for wheat in some feed rations.

Any defense of the ethanol policy rests on fallacies, primarily these: that ethanol produced from corn makes the United States less dependent on fossil fuels; that ethanol lowers the price of gasoline; that an increase in the percentage of ethanol blended into gasoline increases the overall supply of gasoline; and that ethanol is environmentally friendly and lowers global carbon dioxide emissions.

The ethanol lobby promotes these claims, and many politicians seem intoxicated by them. Corn is indeed a renewable resource, but it has a far lower yield relative to the energy used to produce it than either biodiesel (such as soybean oil) or ethanol from other plants. Ethanol yields about 30 percent less energy per gallon than gasoline, so mileage drops off significantly. Finally, adding ethanol actually raises the price of blended fuel because it is more expensive to transport and handle than gasoline.

As the summer drags on, the drought is only worsening. Last week the International Grains Council lowered its estimate of this year's American corn harvest to 11.8 billion bushels from 13.8 billion. Reducing the renewable-fuel standard by a mere 20 percent — equivalent to about a billion bushels of corn — would offset nearly half of the expected crop loss due to the drought.

All it would take is the stroke of a pen — and, of course, the savvy and the will to do the right thing.

Colin A. Carter is a professor of agricultural and resource economics at the University of California, Davis. Henry I. Miller, a physician, is a fellow in scientific philosophy and public policy at the Hoover Institution.

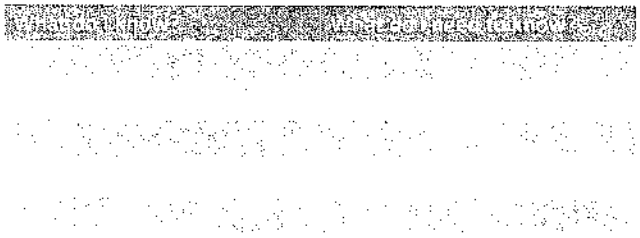
A version of this article appears in print on July 31, 2012, Section A, Page 21 of the New York edition with the headline: Corn for Food, Not Fuel

Analysis

1. What are the potential issues and major topics in this scenario that we as chemists/scientists can address?

Analysis

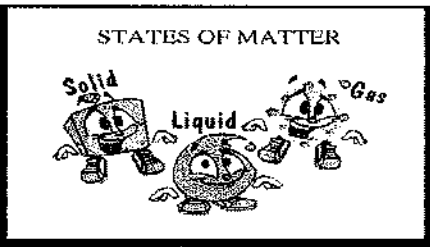
2. Compile a list for each category:



3. Rank the importance of the questions in the "What do I need to know" column.

October 8th, Thursday

States of Matter



States of Matter: one of the forms that matter takes, such a

Phase	Motion of Particles How would you describe the movement of these particles?	Speed of Particles How would you describe the speed of these particles?
Solid	Particles vibrate in place and are tightly packed	Slow

Can we do this out?

We can look at these 3 properties to figure out which state of matter an object is:

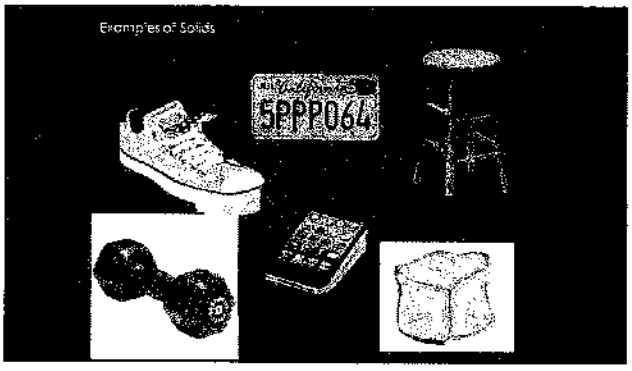
... does it have a definite shape?

... does it have a definite amount of matter?

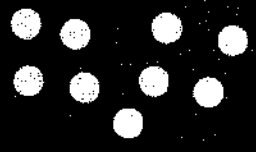
... does it take up a definite amount of space?

Predictions anyone?	SOLID
Definite SHAPE?	YES
Definite MASS?	YES
Definite VOLUME?	YES

Examples of Solids



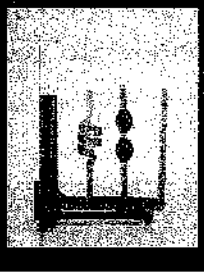
Phase	Motion of Particles How would you describe the movement of these particles?	Speed of Particles How would you describe the speed of these particles?
Liquid	Particles are close, but can slide past one another	Medium



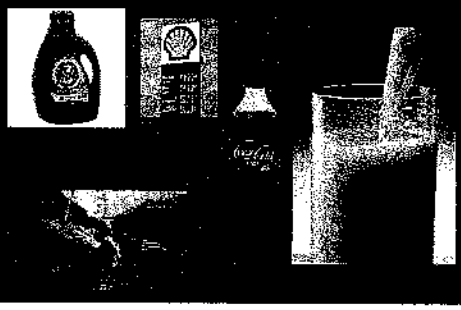
copy into notes

Predictions anyone?	LIQUID
Definite SHAPE?	NO
Definite MASS?	YES
Definite VOLUME?	YES

Because liquid molecules can move, they will take the shape of their container.



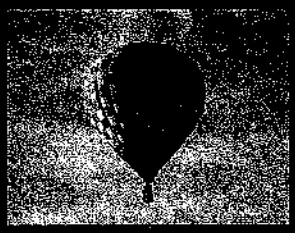
Examples of Liquids

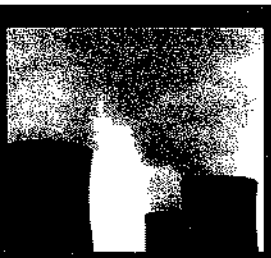


Phase	Motion of Particles How would you describe the movement of the particles?	Speed of Particles How would you describe the speed of these particles?
Gas	Particles are constantly expanding and far apart	Fast

copy into notes

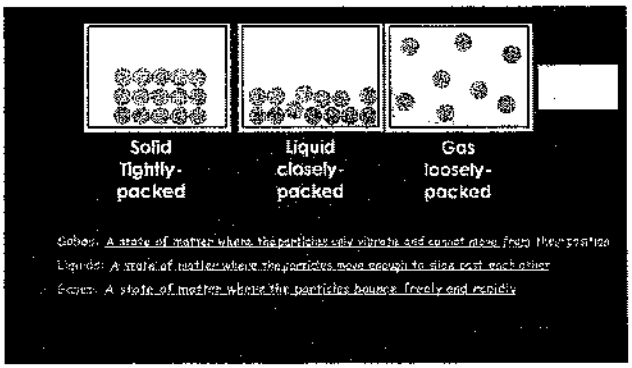
Predictions anyone?	GAS
Definite SHAPE?	NO
Definite MASS?	YES
Definite VOLUME?	NO





If unconfined, gases will spread out indefinitely.

Examples of Gases



Solid: A state of matter where the particles only vibrate and cannot move from their position

Liquid: A state of matter where the particles move enough to slide past each other

Gas: A state of matter where the particles bounce freely and rapidly

States of Matter Simulation

- http://phet.colorado.edu/en/simulation/states-of-matter-basics

copy into notes

	SOLID	LIQUID	GAS
Definite SHAPE?	YES	NO	NO
Definite MASS?	YES	YES	YES
Definite VOLUME?	YES	YES	NO

Phase	Motion of Particles	Speed of Particles
Solid	Particles vibrate in place and are tightly packed	Slow
Liquid	Particles are close, but can slide past one another	Medium
Gas	Particles are constantly expanding	Fast

State of matter: one of the forms that matter takes, such as solid, liquid, or gas.
Solid: matter that has a fixed volume and a fixed shape.
Liquid: matter that has a fixed volume but not a fixed shape.
Gas: matter that has no fixed volume or fixed shape.

11) Complete the following table to describe three states of matter. The table has been partially completed to help you.

	Solid	Liquid	Gas
Shape		Not fixed; takes the shape of the container	
Volume	Fixed volume		
Spaces between particles			
Movement of particles			Can move freely and quickly in all directions in the container

12) Use your knowledge of the kinetic molecular theory to explain the following statements:

(a) Solids have a definite shape because _____

_____

_____

(b) Liquids and gases flow because _____

_____

_____

(c) Ice cubes form in the freezer because _____

_____

_____

(d) Ice cream melts quickly on a hot day because _____

_____

_____

(e) Gases do not have a definite shape because _____

_____

_____

October 9th, Thursday

SCIENCE 8 – STATES OF MATTER WORKSHEET

NAME: _____

Vocabulary			
Contracts	Kinetic molecular theory	Move around quickly	State of matter
Expands	Mass	Slide past each other	Vibrate
Faster	Matter	Slower	Volume

Use your notes from pages 1 – 2 and the terms in the vocabulary box to fill in the blanks for the following nine questions. You will not need to use every term.

1) _____ is the amount of matter that makes up something.

2) _____ is the amount of space that a material takes up.

3) Anything that has mass and volume is called _____.

4) When you add energy to matter, the particles move _____ and the matter _____.

5) Particles in a solid are packed so close together they can only _____.

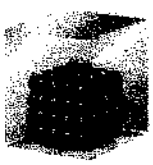
6) Particles in a liquid can _____.

7) Particles in a gas can _____.

8) When you remove energy from particles they move _____ and the matter _____.

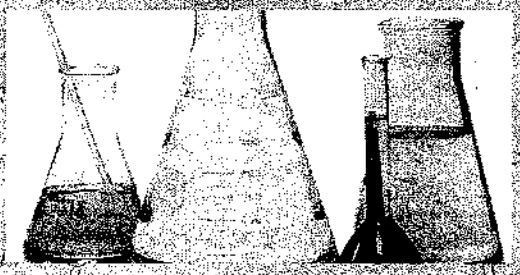
9) The _____ explains how particles act when their spacing and movement change.

10) Match each **Term** on the left with the best **Descriptor** on the right. Each **Descriptor** may be used only once

	Term		Descriptor
	Mass	A.	Anything that has mass and volume
	Solid	B.	Amount of space an object takes up
	Gas	C.	Amount of matter in an object
	Matter	D.	
	Liquid	E.	
	Volume	F.	

October 9th, Friday

MIXTURES, SOLUTIONS AND PURE SUBSTANCES

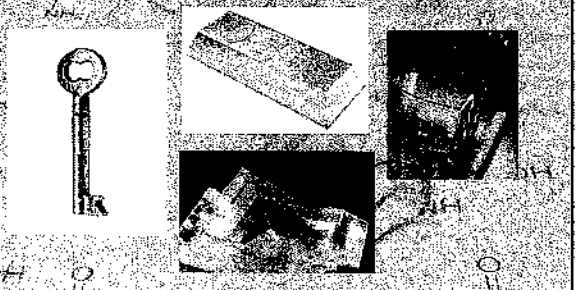


Matter and its appearance

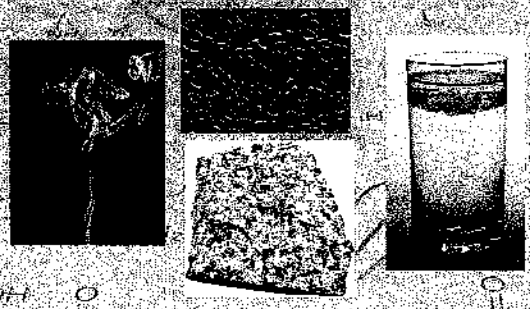
According to its appearance, there are two kinds of material systems:

- **Homogeneous systems:** they have **the same properties and compositions** in all different parts of them.
- **Heterogeneous systems: different parts** with **different properties** can be found in them.

Homogeneous Systems



Heterogeneous Systems



Heterogeneous Mixtures

Systems with several **different substances** that can be **distinguished**:

- Oil and water.
- Granite is a rock that has three different substances, quartz, mica and felspar.
- Blood, using a microscope we can see a liquid (plasma) and different kinds of cells.
- Smoke: has solid particles in a gas (air).




Heterogeneous Mixtures

How to separate their components:

- If the components are a solid and a liquid, we can separate them by **filtering**.
  - E.g. water and sand

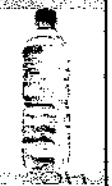
Heterogeneous Mixtures

How to separate their components:

- **Decantation**. This method uses the different densities of the components to separate them.
  - (E.g. oil and water)


Homogeneous Systems

- There are two kinds of homogeneous systems:
  - **Pure substances:**
    - They have **only one component**.
    - They have **constant composition and properties**.
  - **Solutions:**
    - They have **several components**.
    - Their **composition** can be **changed**.




Solutions

- A solution has at least two components:
  - **Solute:**
    - It is the component that is present in a **lower quantity** in the solution.
  - **Solvent:**
    - It is the component that is present **in excess**.
    - **Its state never changes** when the solution is being formed.
- A simple sample: salty water
  - There is much more water than salt.
  - Water is a liquid and the solution too.
  - SOLUTE = SALT and SOLVENT = WATER

Solutions

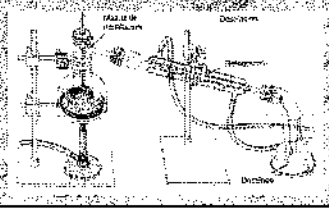
- They are **not always liquids !!!**

Solutions

- How to separate its components:
  - **Evaporation and crystallization:** a liquid evaporates at room temperature, but a solid doesn't.

Solutions

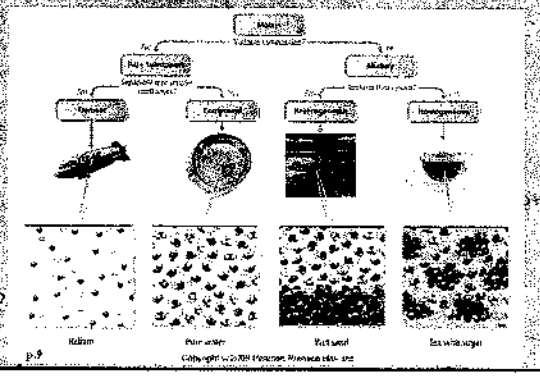
- How to separate its components:
  - **Distillation:** this method is useful to separate:
    - Liquids whose boiling points are different
    - Liquids and solids



Pure Substances

- Pure substances:
  - They have a **constant composition**
  - They **can't be separated** in simpler substances using **physical methods**
- There are two different kinds of pure substances:
  - **Chemical compounds**: pure substances that **cannot be separated** using **chemical methods**
  - **Elements**: pure substances that **can't be separated** into others

Four kinds of matter



October Thursday

Name: _____

Date: _____

Classification of Matter

Directions: Classify the following substances as either a ***mixture*** or a ***pure substance***. If it is a mixture, classify it as ***homogenous*** or ***heterogeneous***. If it is a pure substance, classify it as an ***element*** or ***compound.***

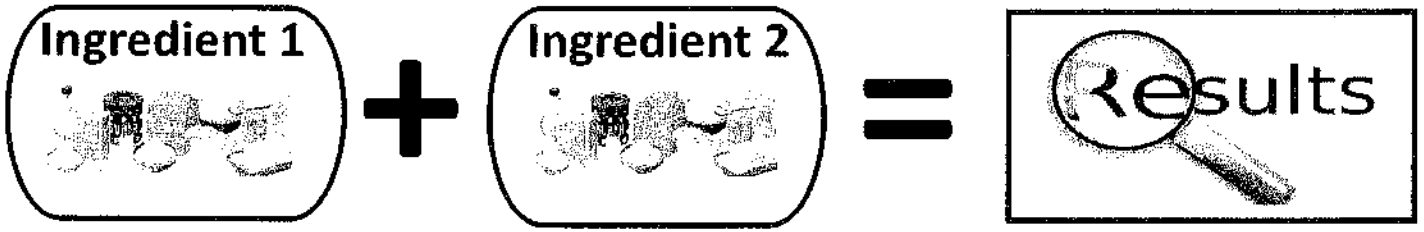
Substance	Mixture/ Pure Substance	Homogeneous/ Heterogeneous Or Element/ Compound
1. Pure Water (H_2O)		
2. Pepsi		
3. Iron Filings (Fe)		
4. Food Coloring in Water		
5. Chunky Salsa		
6. Copper Penny (Cu)		
7. Apple Juice with No Pulp		
8. Baking Soda ($CaCO_3$)		
9. Orange Juice with Pulp		
10. Sulfur (S)		

Name: _____ Date: _____

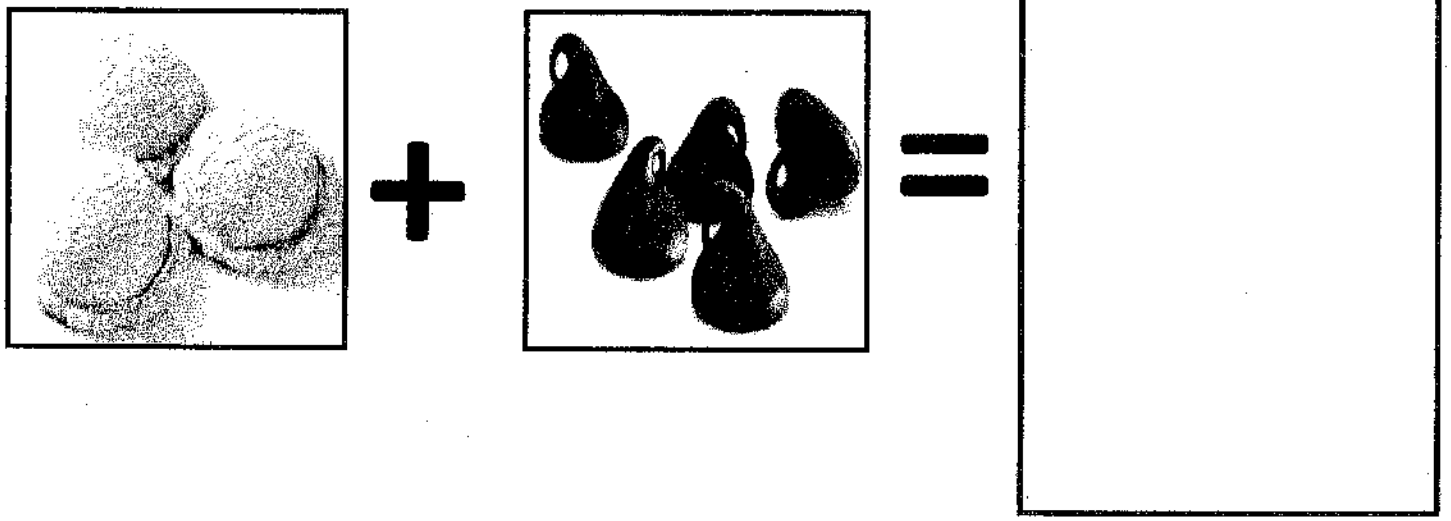
Compare and Contrast Substances and Mixtures

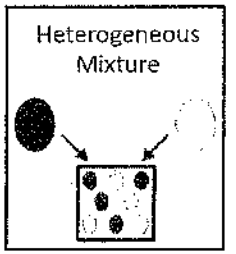
S8P1 Obtain, evaluate, and communicate information about the structure and properties of matter. a. Develop and use a model to compare and contrast pure substances (elements and compounds) and mixtures. (Clarification statement: Include heterogeneous and homogeneous mixtures. Types of bonds and compounds will be addressed in high school physical science.)

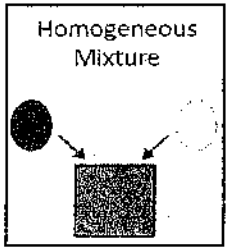
Directions: Review the items shown in each example and then determine what the resulting mixture will be or what ingredient is missing. After determining the ingredients and the resulting mixture, decide whether it is a heterogeneous or homogeneous mixture. Circle your answer.



Circle the type of mixture/ substance







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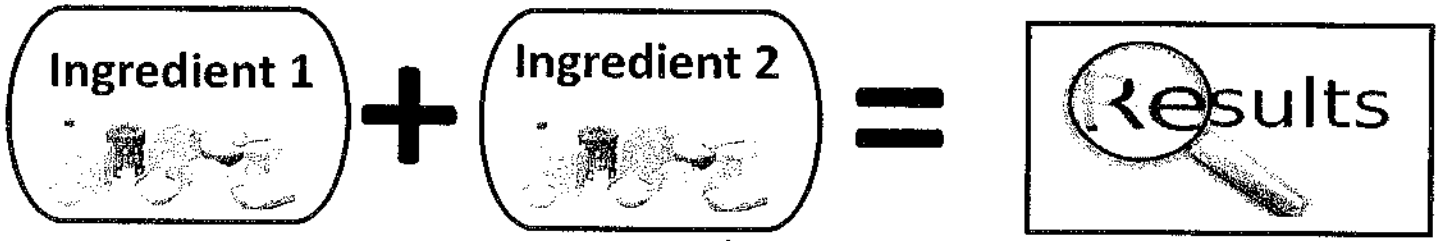
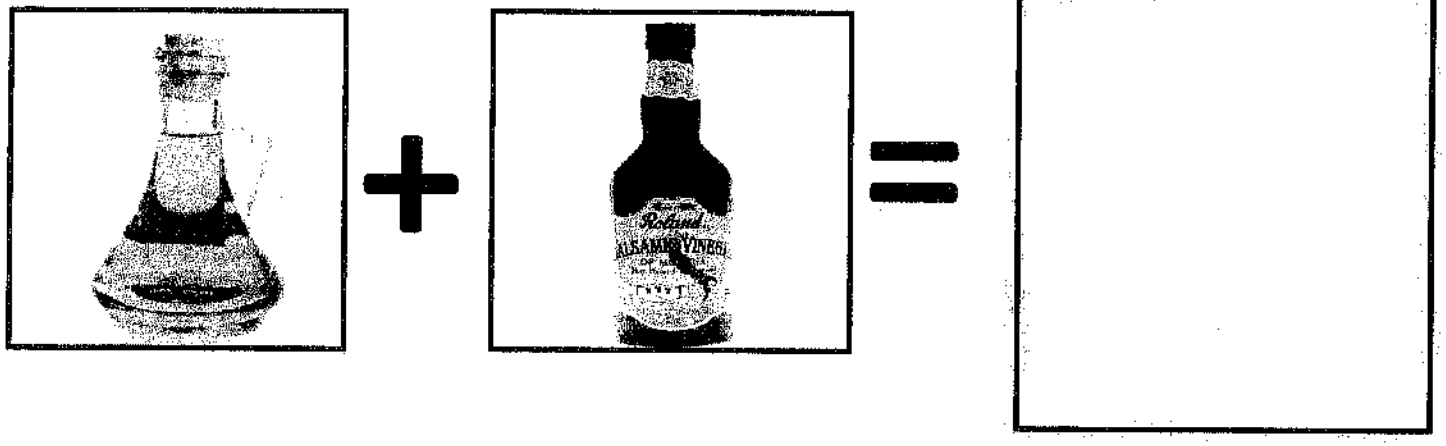
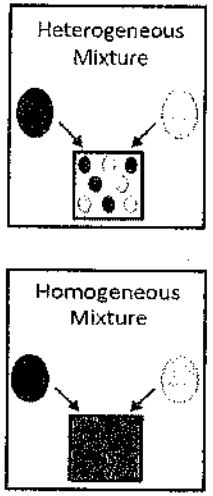
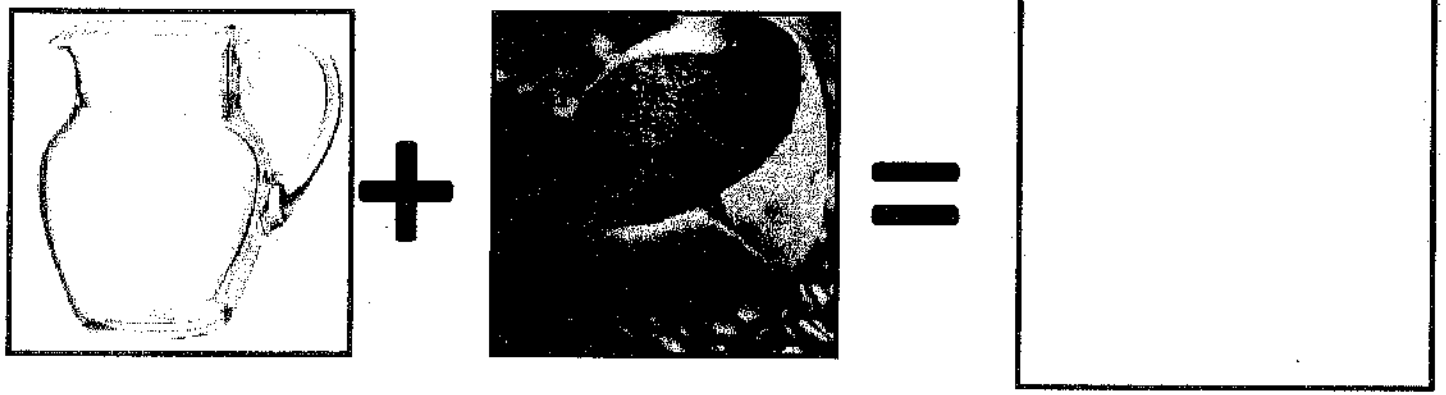
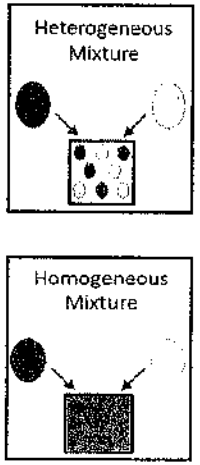


Circle the type of mixture/ substance

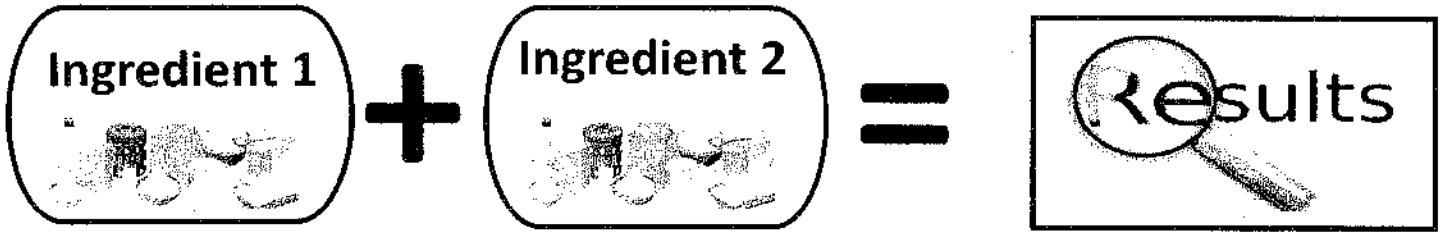




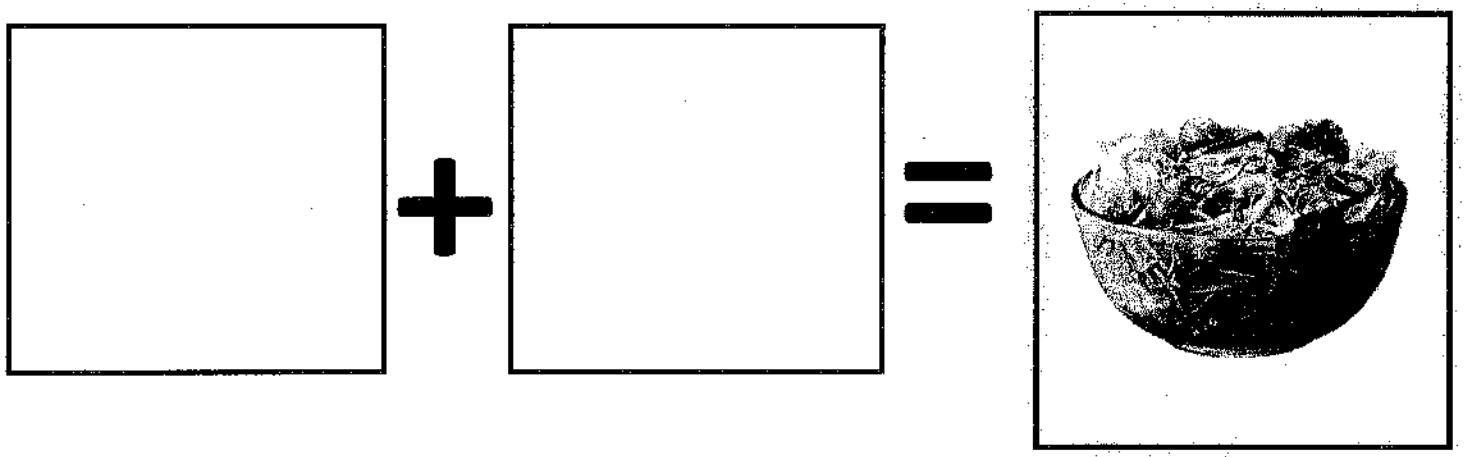


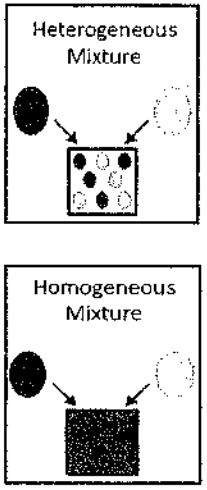


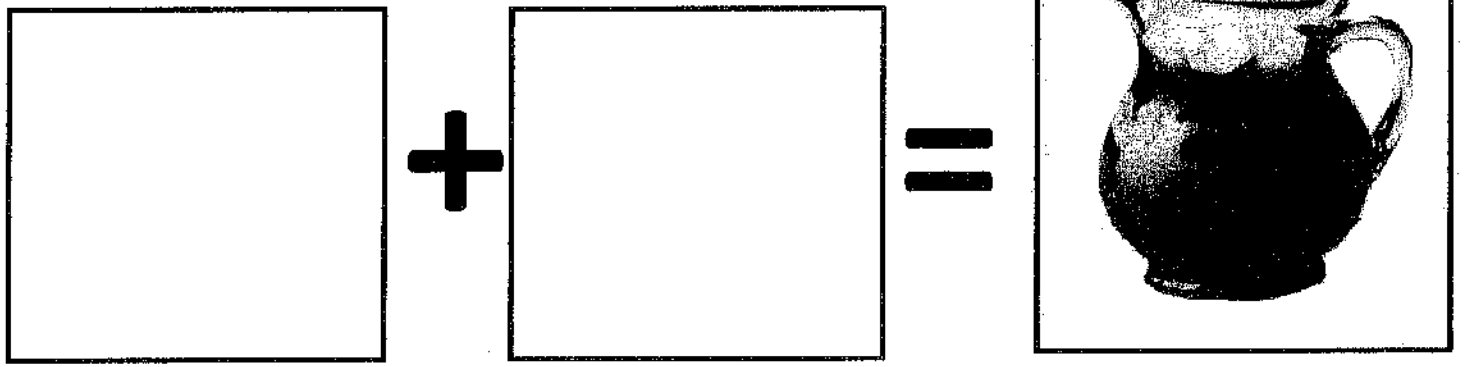
Name:_____ Date: _____

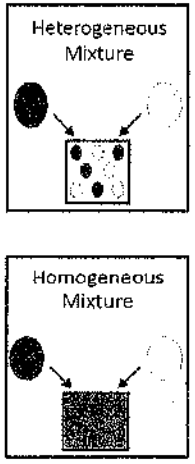


Circle the type of mixture/ substance



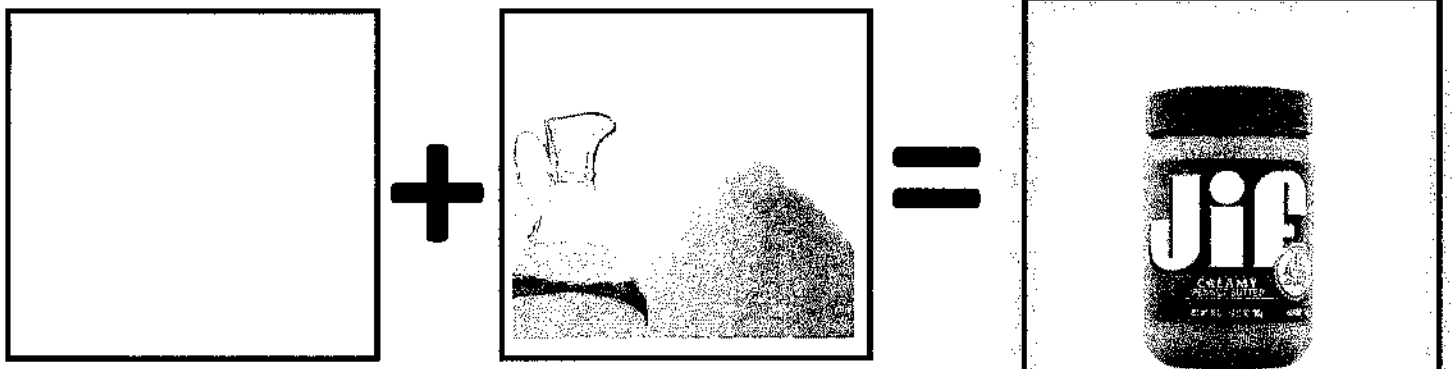


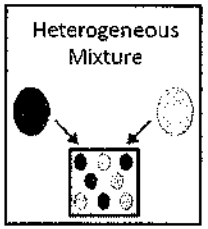


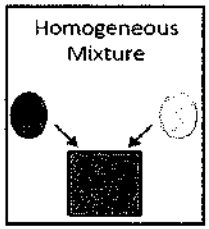


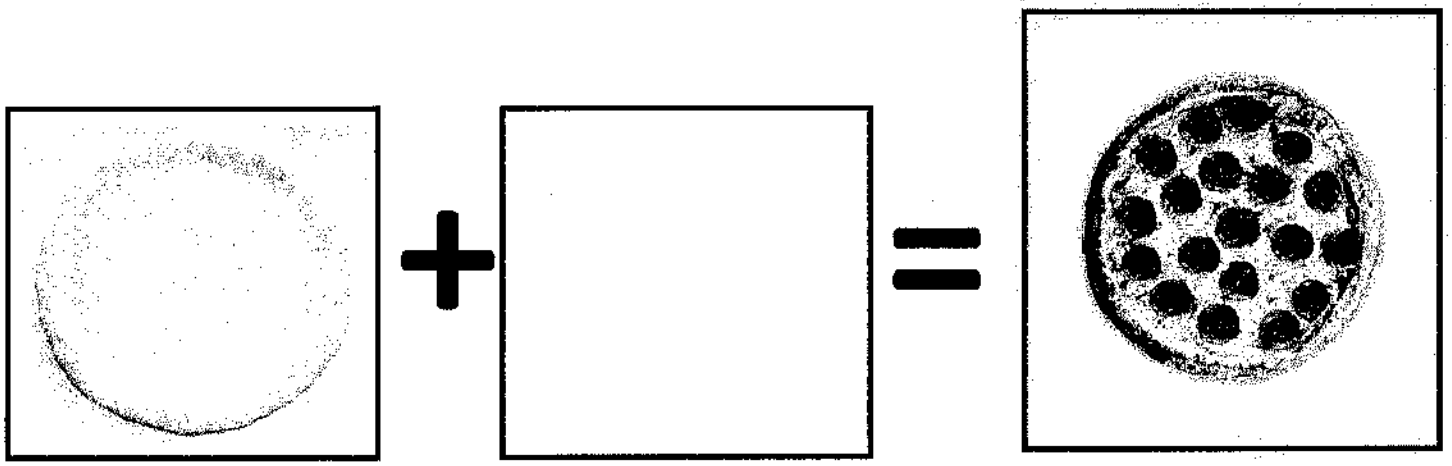
Name:_____ Date: _____

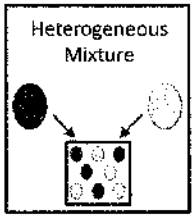
Circle the type of mixture/ substance

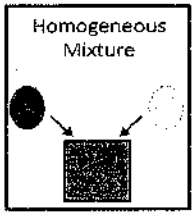




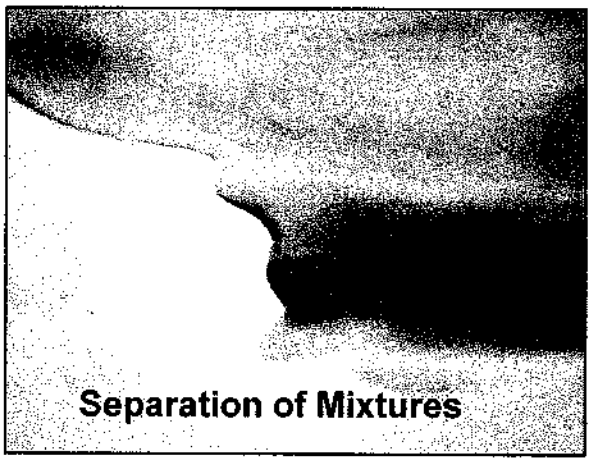








Mon Oct 12, 2020



Separation of Mixtures

5 Common Separation Methods:

- Magnetic attraction
- Filtration
- Evaporation
- Distillation
- Paper chromatography

Physical methods

Mixtures

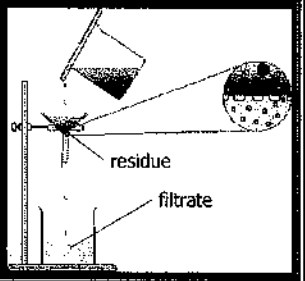
- Many mixtures contain useful substances
- Examples of mixtures include air, sea water, water in reservoirs and crude oil
- Different types of methods are used to separate mixtures

Magnetic Attraction

- Can be used to separate magnetic materials from those that are not attracted by magnets
- Used in food processing and salvaging scrap iron and steel

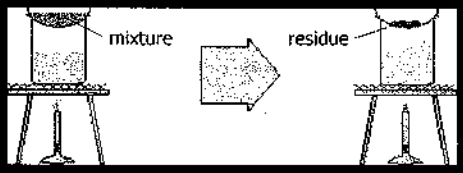
What is Filtration?

Used to separate an insoluble solid from a solid-liquid mixture



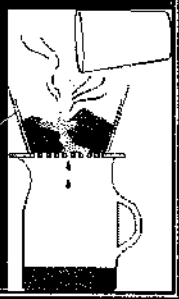
Evaporation

Used to separate a dissolved solid from a solid-liquid mixture



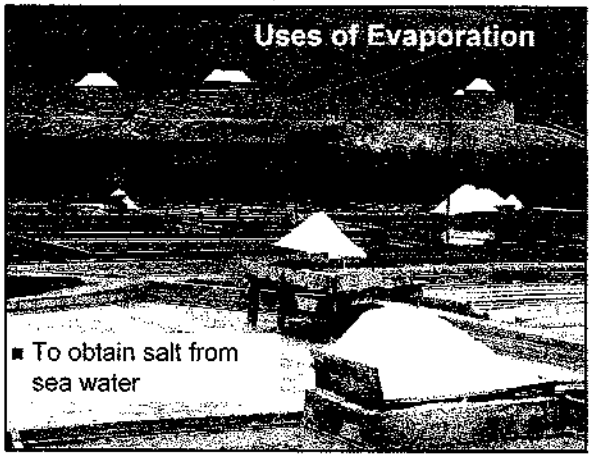
Uses of Filtration

- Vacuum cleaners
- Coffee makers
- Water treatment



Filter jugs are used to prepare fresh coffee.

Uses of Evaporation

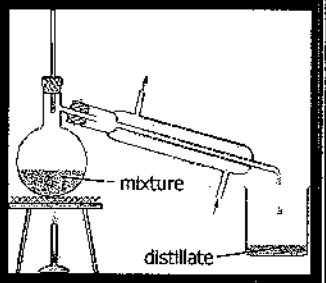


- To obtain salt from sea water

Oct 12, 20

Distillation

Used to separate a pure liquid from a solid-liquid or liquid-liquid mixture



Fractional Distillation

Used to separate **more than two liquids** in a mixture of miscible liquids

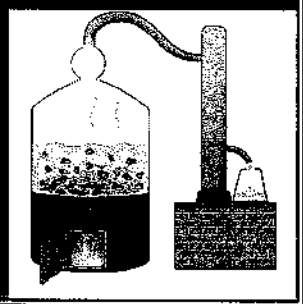
Oil refineries use fractional distillation to separate crude oil into useful product such as petrol, diesel and kerosene

Uses of Distillation

To make perfumes

Desalination plant

To make distilled water (pure H_2O)



Paper Chromatography

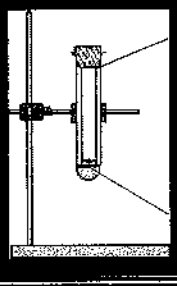
Used to separate small amounts of mixtures

Uses a stationary phase (such as filter paper) and a mobile phase (such as water)

Makes use of the fact that different substances dissolve to different extent in a mixture

Used to separate mixtures of pigments found in inks

Paper chromatography is usedto identify the contents of a mixture or to test the purity of a liquid.



Different substances in the mixture are separated on the chromatography paper.

Other Separation Methods

Manual Separation – physically separate parts of a mixture using your fingers

- Used to separate the red M&Ms from the rest of the M&Ms

Sifting – use a sieve or sifter to separate larger solids from smaller ones

- Used to sift flour in order to separate the larger particles from the smaller ones

Uses of Paper Chromatography

To find the dyes used in ink

To find the dyes used in food

Other Separation Methods (cont.)

Decanting – pouring off a less dense top liquid layer

- Used to separate oil & water

OCT 12, 202

Separating Mixtures

Mixtures are physical combinations of two or more different substances. These substances can be elements or compounds. They retain their individual properties and can be separated by physical means, such as **sifting, evaporation, or magnetism.**

Today you will separate mixtures using each one of these means. You will be allowed access to the following tools: a pipette, a microwave, a magnet, a mesh sift, and a fork. You **do not** have to use all the tools. You can **NOT** use your hands to pick things out.

Answer the questions below *BEFORE* you conduct the experiment. Write in COMPLETE SENTENCES.

1. Your first mixture is "Fish Tank" water. It includes pebbles and salt water. You must separate the pebbles and salt from the water.
   What tools are you going to use to remove these materials? Why?
   (NEED at least TWO SENTENCES)

2. The second mixture you have is steel and Cheerios mixed together. You must separate the steel from the Cheerios.
   What tool are you going to use to remove this material? Why?

Answer the questions below AFTER you conduct the experiment. Write in COMPLETE SENTENCES.

3. Were you successful in separating all the materials? Why or why not?

4. Which is the only material that you cannot physically give back to me? Why?

5. Complete the sentence below using the **red vocabulary** above.

To remove the pebbles from the water, we used _____.

To remove the salt from the water, we _____ the water.

To remove the steel from the cheerios, we used _____.

Assignment: Find a mixture in your house (ask a parent) and begin sifting it. Draw a picture of your final product which should be two distinct objects unmixed. Example- Mix flour and rice, sift the rice out of the flour.

Tue Oct 13, 2020

Gummy Bear Lab

Name: _____

Hour: _____

Problem: What do you think will happen to the volume, mass and density of a gummy bear when you put it in water over night?

Hypothesis: _____

_____

_____

Procedure A: Choose one gummy bear or other piece of candy at home. Use the equipment available to measure your gummy bear/candy and record the data in the chart for Day 1.

Measurements:

- ✓ The length of your gummy bear should be measured from the top of its head to the bottom of its feet to the nearest millimeter.
- ✓ Measure the width at the widest point across the back of the bear to the nearest millimeter.
- ✓ Measure the thickness from the front to the back at the thickest point to the nearest millimeter.
- ✓ Calculate the volume by multiplying the length, width, and thickness. Round to the nearest hundredth.
- ✓ Measure the mass using the scale to the nearest tenth of a gram.
- ✓ Calculate the density by dividing the mass by the volume. Round answer to the nearest hundredth.

Part B: Put the bear in a cup labeled with your name and class period. Add 50 ml of water to the cup and allow it to sit overnight. On Day 2, remove the gummy bear from the cup of water and use a towel to dry it off to prevent it from dripping all over the place. Repeat the measurements from Part A and record your data in the correct portion of the chart. Determine the amount of change for each measurement and record in the chart.

Experiment Data:

Day	Bear Color	Length	Width	Thickness	Volume	Mass	Density
1							
2							
Amount of change							

Questions:

1. Was your hypothesis correct? Why or why not? (support with specific data!)

2. Which change is greater - volume or mass? Explain.

3. Was there a change in density? Why?

4. How do your results compare to those of your classmates?

Oct 13 / Mes

Elements and compounds: Worksheet 1.2

What's in a compound?

Compounds are named from the elements they are made from. If the compound contains a metal and a non-metal, the metal element is usually listed first and the non-metal last.

For example, a compound made from magnesium and oxygen is called magnesium oxide. The name of the metal part does not change, but oxygen is changed to oxide.

The table shows what some names mean in compounds.

Name used in a compound	The compound contains ...
Oxide	oxygen
Sulfide	sulfur
Nitride	nitrogen
Chloride	chlorine
Bromide	bromine
Iodide	iodine

1. Complete the table below to show which elements the compounds contain.

Name of compound	Elements it contains ...
Magnesium oxide	
Calcium sulfide	
Sodium bromide	
Potassium iodide	
Lithium oxide	
Aluminium chloride	
Copper nitride	
Copper sulfide	

2. These are the formulae for some compounds. Name the compounds and the elements they contain.

a) MgS _____

b) FeS _____

c) CuO _____

d) KI _____

e) NaCl _____

f) CaO _____

g) LiBr _____

h) MgO _____

Elements and Compounds Worksheet 1.1

Symbols, elements, compounds and chemical reactions

1. Use your copy of the periodic table to find the chemical symbol for:

   a) carbon _____; b) oxygen _____; c) calcium _____; d) copper _____

   e) sodium _____ ; f) hydrogen _____; g) potassium _____; h) iron_____

2. a) Suggest why the symbol for silicon is Si and not S.

   _____

   b) Most chemical symbols are derived from the English names for the element. Give the names and symbols of four exceptions.

   _____

   _____

3. Read this description of two elements reacting together to make a compound.

   A piece of clean, grey, shiny sodium metal was heated on a deflagrating spoon until it started to burn. It was then put into a gas jar of chlorine gas. Chlorine gas is green/yellow. The sodium burnt vigorously with a brilliant white light and a white powder was left on the walls of the gas jar.

   a) Name the elements. _____

   b) Name the compound made. _____

   c) Which chemical symbols make up the formula of the compound?_____

   d) What evidence is there that a chemical reaction has taken place?

   _____

   e) How does this description show that new substances are made in chemical reactions?

   _____

   f) What is needed to change the compound back into the elements?

   _____

UCT 14

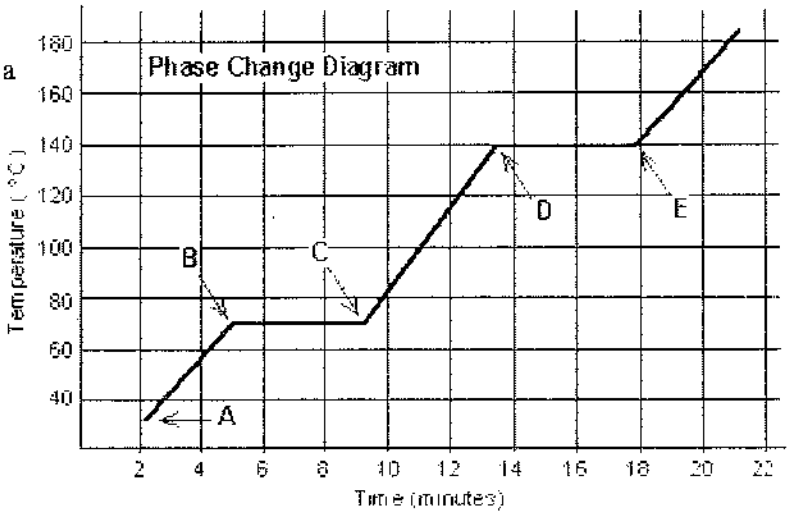
Phase Change Worksheet

Name:_____

Date:_____Period:_____

The graph was drawn from data collected as a substance was heated at a constant rate.

Use the graph to answer the following questions 1-23.



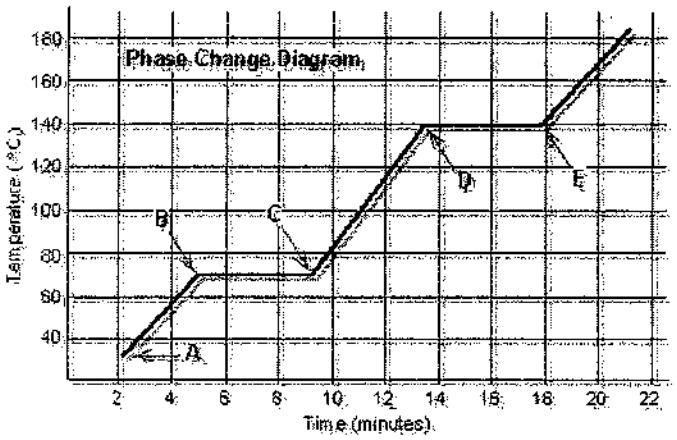
1. – 22. At **point A**, the beginning of observations, the substance exists in a solid state. Material in this phase has _____ volume and _____ shape. With each passing minute, _____ is added to the substance. This causes the molecules of the substance to _____ more rapidly which we detect by a _____ rise in the substance. At **point B**, the temperature of the substance is _____°C. The solid begins to _____. At point C, the substance is completely _____ or in a _____ state. Material in this phase has _____ volume and _____ shape. The energy put to the substance between minutes 5 and 9 was used to convert the substance from a _____ to a _____. Between 9 and 13 minutes, the added energy increases the _____ of the substance. During the time from **point D to point E**, the liquid is _____. By **point E**, the substance is completely in the _____ phase. Material in this phase has _____ volume and _____ shape. The energy put to the substance between minutes 13 and 18 converted the substance from a _____ to a _____ state.. Beyond **point E**, the substance is still in the _____ phase, but the molecules are moving _____ as indicated by the increasing temperature.

23. Which of these three substances was likely used in this phase change experiment?

Substance	Melting point	Boiling point
Bolognium	20 °C	100 °C
Unobtainium	40 °C	140 °C
Foosium	70 °C	140 °C

UNIT 14

Phase Change Worksheet



The graph was drawn from data collected as a substance was heated at a constant rate. Use the graph to answer the following questions.

At **point A**, the beginning of observations, the substance exists in a solid state. Material in this phase has _____ volume and _____ shape. With each passing minute, _____ is added to the substance. This causes the molecules of the substance to _____ more rapidly which we detect by a _____ rise in the substance. At **point B**, the temperature of the substance is _____°C. The solid begins to _____. At point C, the substance is completely _____ or in a _____ state. Material in this phase has _____ volume and _____ shape. The energy put to the substance between minutes 5 and 9 was used to convert the substance from a _____ to a _____. This heat energy is called the **latent heat of fusion**.

Between 9 and 13 minutes, the added energy increases the _____ of the substance. During the time from **point D to point E**, the liquid is _____. By **point E**, the substance is completely in the _____ phase. Material in this phase has _____ volume and _____ shape. The energy put to the substance between minutes 13 and 18 converted the substance from a _____ to a _____ state. This heat energy is called the **latent heat of vaporization**. Beyond **point E**, the substance is still in the _____ phase, but the molecules are moving _____ as indicated by the increasing temperature.

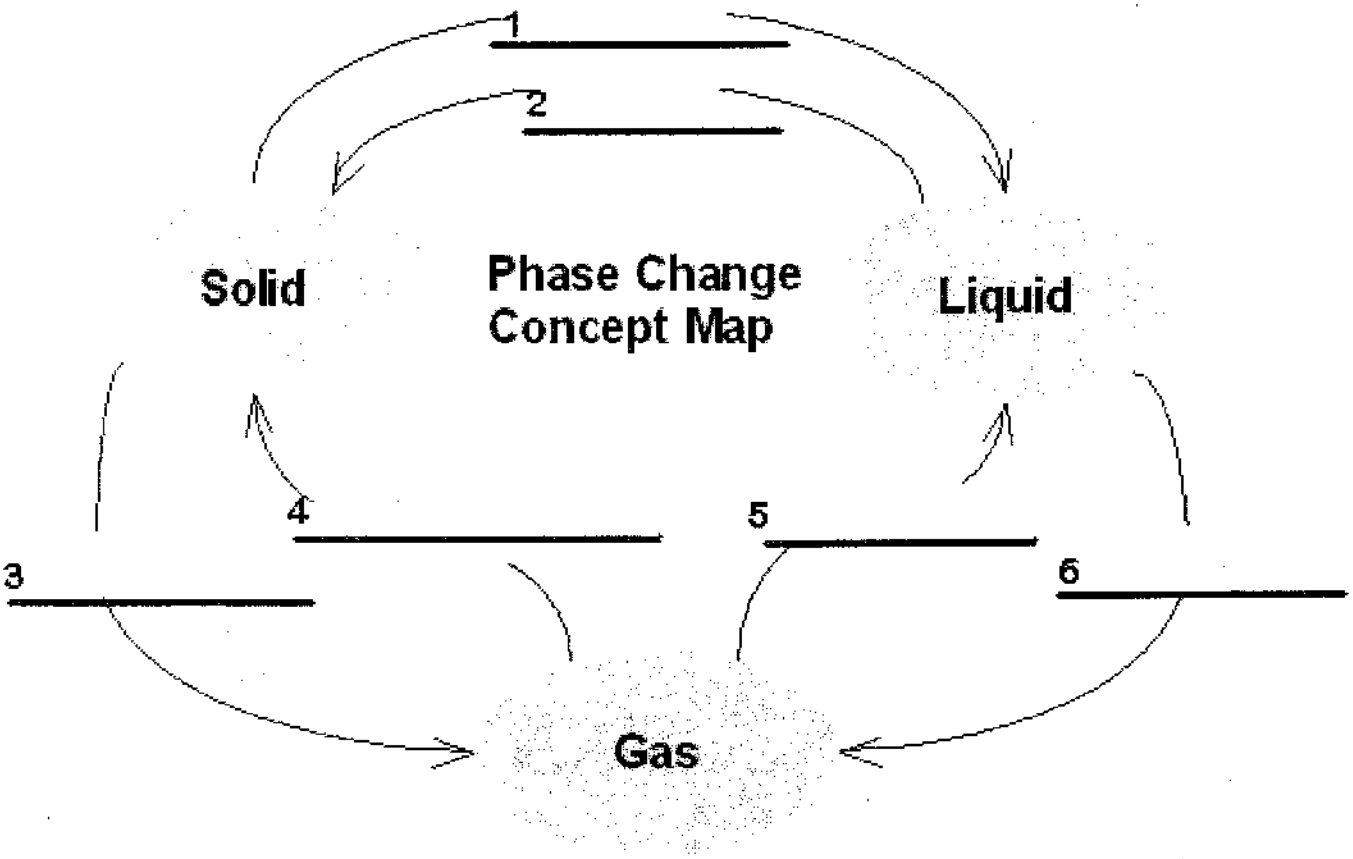
Which of these three substances was likely used in this phase change experiment?

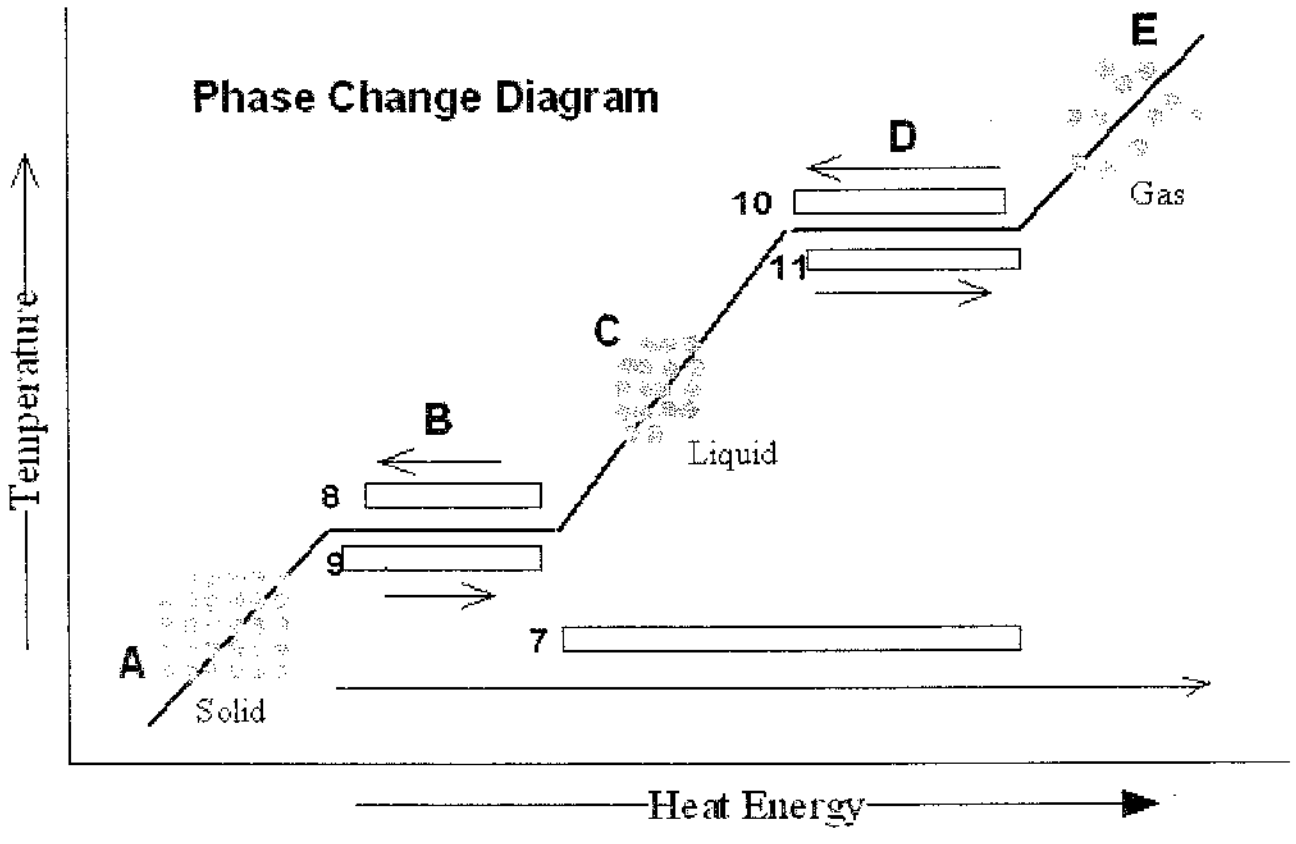
Substance	Melting point	Boiling point
Bolognium	20 °C	100 °C
Unobtainium	40 °C	140 °C
Foosium	70 °C	140 °C

BONUS: For water, the value for the latent heat of vaporization is 6.8 times greater than the latent heat of fusion. Imagine we were adding heat at a constant rate to a block of ice in a beaker on a hot plate, and it took 4 minutes for the ice to melt completely. How long would it take, after the water started boiling, for the beaker to be completely empty (the liquid water totally converted to water vapor)?

UG 14

Fill in the phase changes in the blank provided.





Phase Changes Worksheet **Name** _____

Kinetic Theory of Matter:

- Molecules are always moving. This is known as the *kinetic* theory of matter.
- We measure this kinetic energy with a thermometer as *temperature*.
- The greater the material's internal energy, the higher the temperature of that material.
- *Heat* is the energy flow between objects of different temperature.
- Heat and temperature are NOT the same.
- *Brownian motion* describes how visible particles are seen moving due to invisible molecules bumping into them.

Phases of Matter:

Solid

matter that has definite volume and shape.
The molecules are packed together tightly and move slowly.

Liquid

matter that has definite volume but not shape.
Since the molecules of a liquid are loosely packed and move with greater speed, a liquid can flow and spread.

Gas

matter that has no definite volume or shape.
Molecules of a gas are so loosely arranged and move so rapidly that they will fill their container.

Phase Change Descriptions:

Melting

the change from solid to liquid.

Freezing

the change from liquid to solid.

Vaporization

the change from liquid to gas.

Evaporation

vaporization from the surface of a liquid.

Boiling

vaporization from within as well as from the surface of a liquid.

Condensation

the change from gas to liquid.

Sublimation

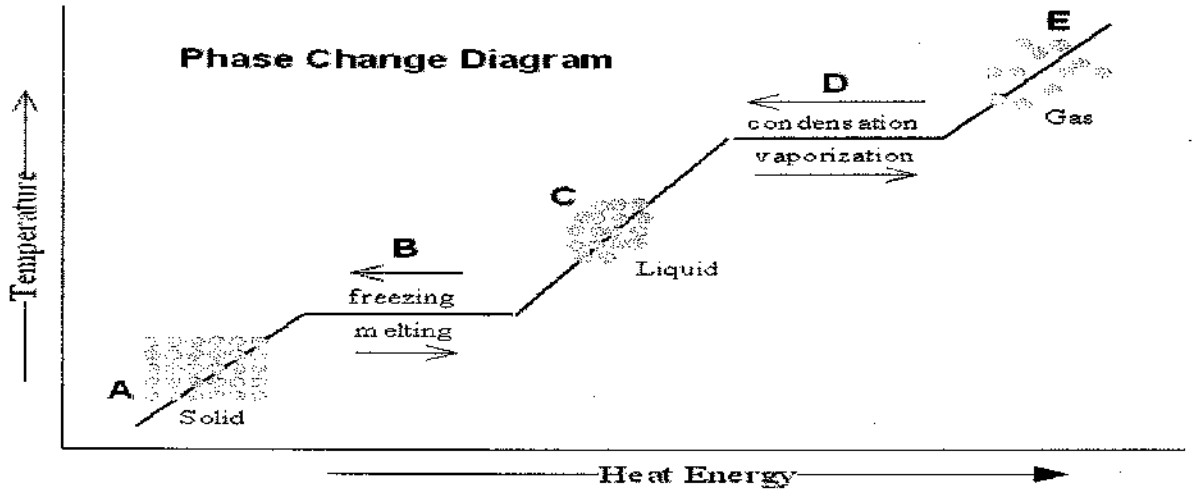
the change from solid to gas.

Deposition

the change from gas to solid.

OCH 14

Phase Change



24. Does the temperature increase during melting? _____

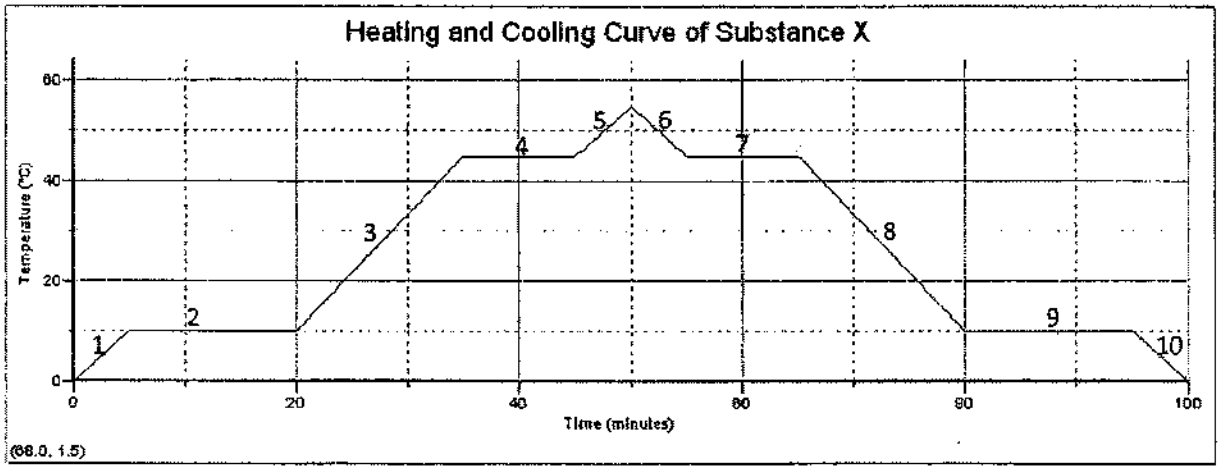
25. Is Energy required for each phase change? _____

26. Can both liquid water and steam exist at 100°C? _____

27. What must be changed, temperature or heat energy, during condensation? _____

28. How would you describe the change in the arrangement of particles as heat energy and temperature increase? _____

29 – 36. Label the graph with: solid, liquid, gas, vaporization, melting, freezing, condensation.



37. At what temperature does substance X freeze? _____ boil? _____ melt? _____

38. What is happening to the substance during section 3? _____

39. What is happening to the substance during section 7? _____

40. What is happening to the substance during section 10? _____

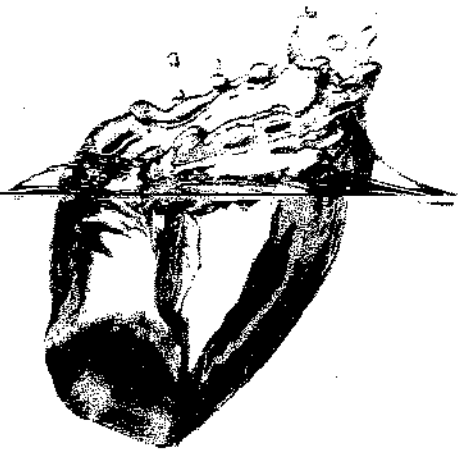
41. During which section is energy being released? _____ being added? _____

- Jhur OCT 15, 2022

A Cool Glass of Water: A Mystery

by

Li-hsuan Yang, Department of Education, University of Michigan—Flint



Part I—A Surprise

In an undergraduate science course, a group of student teachers just finished some experiments using salt and ice. They had observed that salt made ice melt at temperatures below its normal melting point.

"That makes sense—remember how we use salt to melt ice on the sidewalk? Salt helps the ice to melt," said Marian to her group members. They all agreed.

The instructor then introduced them to a teaching project. She announced, "Now I want you to take a look at the state curriculum standards. Try to find a science concept that is interesting to you and your group members. You are asked to put together a lesson to teach that concept to elementary school students. Feel free to use the knowledge you have acquired in this class for your teaching project."

Marian: Why don't we teach children the three states of water? We can do experiments with them, like melting ice cubes.

John: Yeah, we can ask children to predict which ice cube will melt first, the one in salt water or the one in fresh water. That will catch their attention.

Gail: Good idea. Then we can do the experiment with them to check their predictions.

Sally: Let's try the experiment first ourselves.

Gail: I'll make some salt water and measure out 200 milliliters of salt water and fresh water. John, can you measure their temperatures to make sure they are the same?

John: Yes, they are; they're at room temperature, 22 degrees Celsius.

Sally: I'll have to find two ice cubes with the same size and shape. Okay, I have them. Ready? Get set; go!

Sally put one ice cube in each of the two liquids at the same time while Gail started the stop watch to measure the time elapsed. Both ice cubes floated in the liquid. To their surprise, the ice cube in fresh water melted much more quickly than the one in salt water.

"How come?!" said everyone.

OCHS

Part II—Related Phenomena

That afternoon, the group members went home thinking about this mystery. Marian wanted to bake some cookies for her family. As she poured some water and oil in the measuring cup, she noticed that the oil was sitting on top of the water. She thought about that for a moment. Then suddenly she exclaimed, "I know what happened with the ice cubes! I must tell my group the first thing next Monday."

John went to a hot air balloon show that evening. As he was watching the hot air balloons rising, John said to himself, "I guess I might have an idea to solve the problem involved in our experiment."

Gail's family went on a vacation that weekend. As Gail went swimming in the ocean, she noticed that her body seemed to float higher in ocean water than in fresh water. She thought, "I bet I know why that ice cube in the salt water took so long to melt."

Sally accidentally knocked over a glass of iced tea on the counter of her bathroom. She noticed that the brown iced tea seemed to go to the bottom of the bath tub filled with warm water. "I wonder if that has anything to do with our experiment."

The four of them saw each other on Monday. After exchanging ideas, they thought they now had a perfect explanation for the mystery. They wanted to test their idea. They made colored ice cubes by putting several drops of food coloring in the water before freezing it into ice. Then they repeated the original experiment with the colored ice cubes. They couldn't wait to see if the test would confirm their idea or not.

Question

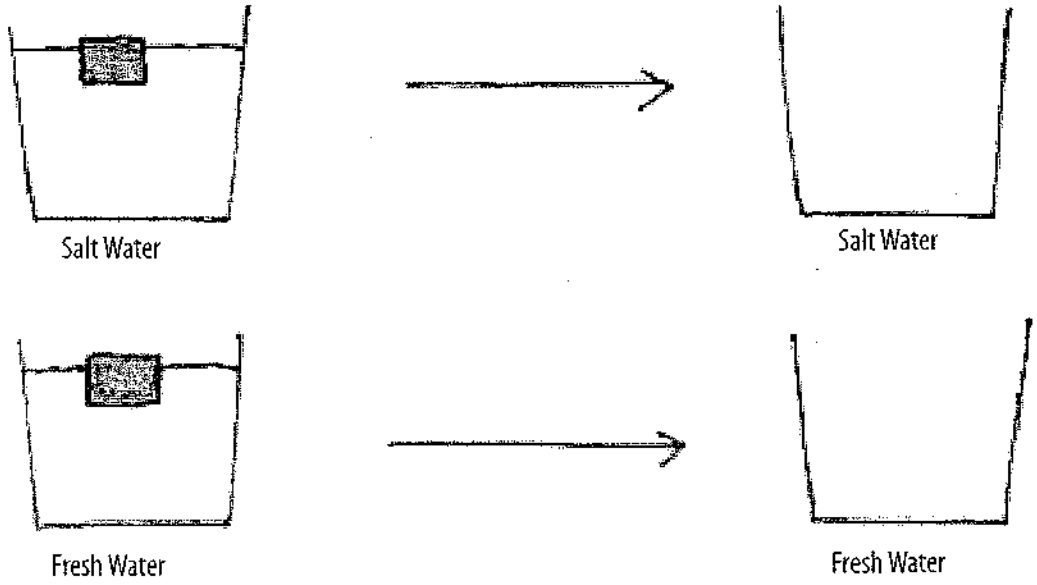
1. What do you think might be the explanation they are trying to test with the colored ice cubes?

OCT 15

Part III— Predictions and Observations

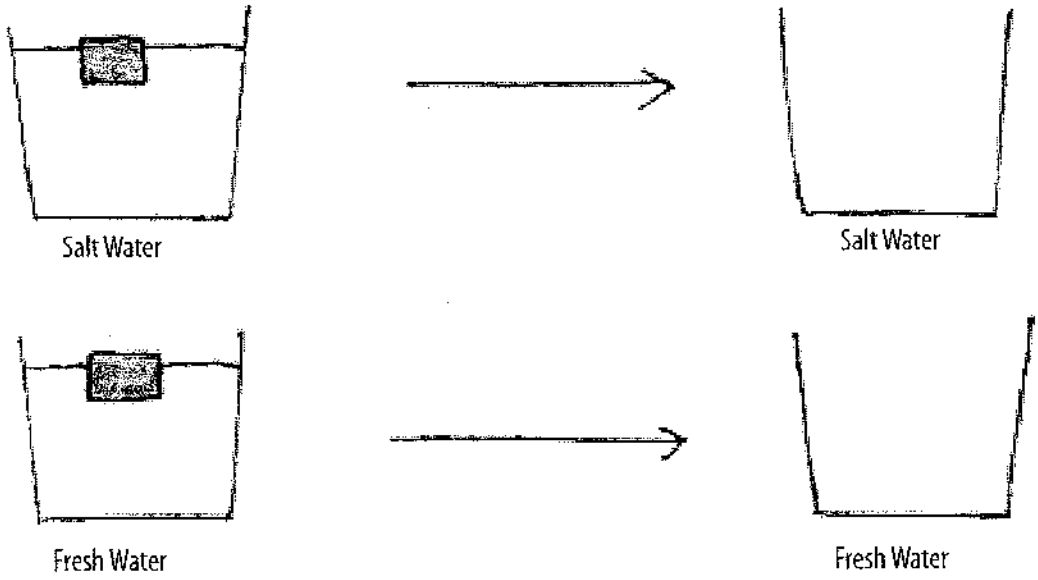
If their explanation were correct, draw what you would expect to see in the experiment with colored ice cubes.

Figure 1—Predicitions for colored ice melting.



After you have drawn your predictions and shared them with your group members, do the experiment and record your observations. Are the observations consistent with your predictions?

Figure 2—Observations of colored ice melting.



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Part IV—Experimental Design and Explanation

As Marian, John, Gail, and Sally were doing the experiment, they noticed that the two ice cubes not only melted at different rates, they also melted in different ways.

Sally: Look! This one in fresh water is becoming smaller and smaller all around, but that one in salt water seems to be staying the same size if you look at it from above.

Marian: But actually the one in salt water is also melting, just more slowly. It's becoming thinner and thinner.

John: It looks like it's not melting from the sides. Do you think it's melting from the top down or from the bottom up?

Gail: I'm not sure. What do you think?

Figure 3—Fresh water observations.

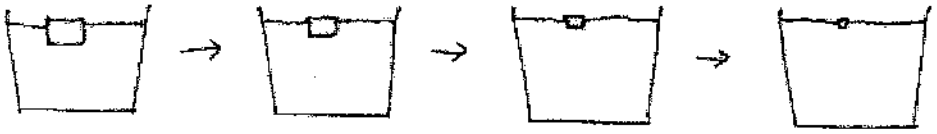
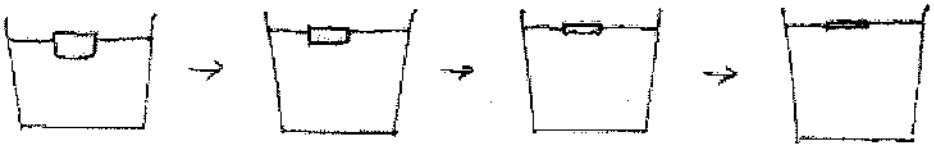


Figure 4—Salt water observations.



Questions

1. Do you think the ice cube in salt water is melting from the top down or from the bottom up?
2. Why do you think so?
3. What test would you do to verify your idea?
4. How would you explain what you see in the test?
5. How does the density of an object or a fluid affect its floating or sinking behavior in another fluid? Can you think of examples of this principle at work in everyday experience?
6. What are the two ways that heat is transferred from a region of higher temperature to a region of lower temperature in this example of an ice cube in a glass of water? Is there yet another way that heat could be transferred between two objects?
7. Can you think of examples of heat transfer in everyday experiences? Which way(s) of heat transfer is (are) involved in each example?

Chemistry Worksheet: Matter #1

3. A mixture (*is/is not*) a chemical combining of substances.

4. In a compound the (*atoms/molecules*) are (*chemically/physically*) combined so that the elements that make up the compound (retain/lose) their identities and (*do/do not*) take on a new set of properties.

5. The smallest identifiable unit of a compound is a(n) _____,which is made up of _____ which are chemically bonded.

6. True or False: A mixture is always made up of a combination of elements.

7. In a mixture, the substances (*lose/retain*) their identities.

8. In a mixture the substances involved (*can/cannot*) be separated by a simple physical process.

9. In a compound the elements involved (*can/cannot)* be separated by a simple physical process because the elements are (physically combined/chemically bonded).

10. (*True or False*): An element can be broken down into a simpler substance.

11. The smallest identifiable unit of an element is a(n) _____.

12. How can you tell if an substance is an element?

13. From the following list of substances, circle the ones that are ELEMENTS. *(HINT: Periodic table?)*

silver carbon	dioxide wood	alcohol chromium
water	hydrogen	carbon nitrogen
oxygen	gold	sugar
salt	air	sulfur
magnesium	nickel	aluminum

Think it through…

14. Explain how to separate the sugar and water in a solution of sugar and water.

15. How would you separate a mixture of alcohol and water?

16. How would you separate sand and water?

Classification of Matter

OCT 15

1. In the left hand column, how can you tell what is a mixture and what is a compound?

2. In the left hand column, how can you tell the difference between a compound and a heterogeneous mixture?

Material	***Pure Substance or Mixture***	***Element, Compound, Homogeneous, Heterogeneous***
concrete		
sugar + pure water ($C_{12}H_{22}O_{11}$ + H_2O)		
iron filings (Fe)		
limestone ($CaCO_3$)		
orange juice (w/pulp)		
Pacific Ocean		
helium inside a balloon		
aluminum (Al)		
magnesium (Mg)		
acetylene (C_2H_2)		
tap water in a glass		
soil		
pure water (H_2O)		
chromium (Cr)		
Chex mix		
salt + pure water (NaCl + H_2O)		
benzene (C_6H_6)		
muddy water		
brass (Cu mixed with Zn)		
baking soda ($NaHCO_3$)		

1. **Compare a *mixture* and a *compound*. How are they alike?**

2. **Contrast a *mixture* and a *compound*. How are they different?**

Worksheet: Classification of Matter Name_____ OCH15

I. Fill in the Blanks

A(n) _____ is a pure substance that is made of only one kind of atom. The symbol for a(n) _____ is always one or two letters. When the symbol contains two letters, the first letter is always _____, and the second letter is always _____.

A(n) _____ is a pure substance containing two or more elements that are _____ combined. A(n) _____ is represented by a chemical _____. The elements in a(n) _____ always combine in _____ proportions.

A(n) _____ is made of two or more substances that are _____ combined. A(n) _____ that is uniformly mixed is called _____. A special name for this is a(n) _____. A(n) _____ that is not uniformly mixed is called _____. A special type of mixture that is a solid _____ of two or more metals is called a(n) _____.

II. Classify each of the following as an element (E), compound (C), homogeneous mixture/solution (S), or heterogeneous mixture (HE).

chocolate chip cookie	_____
oxygen gas	_____
salt water	_____
taco	_____
gold	_____
carbon dioxide	_____
water	_____
kool aid	_____
table salt	_____
muddy water	_____
potassium	_____
brass	_____
graphite	_____
glass	_____
air	_____

fri Oct 16

9/17/2020

Aim: How do we calculate density?

Do Now: Convert the following metric units

564 L = ____ mL 600 Hg = ____ dg
1.23 g = ____ cg 1.3 Dm = ____ Km
.02 KL = ____ mL 99 dm = ____ Dm

Homework: Study formetric quiz

What is density?

- Density is a specific property of matter that is related to the mass divided by the volume

Introduction to Density

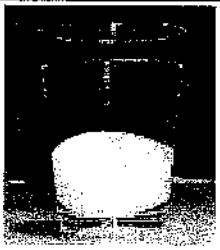
What is the formula for density?

- D = Mass / Volume
- D = M / V
- D = Density
- M = Mass
- V = Volume

Why does a penny sink in water?

- Pennies are more dense than water, therefore **they sink**

How will an egg float in water?



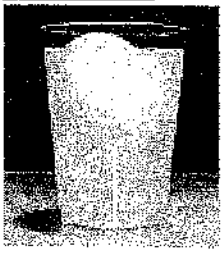
- Egg in fresh water
  - The egg will sink because it is **more dense** than the fresh water

Why does ice float in water?

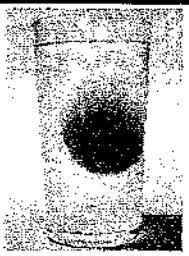
- Ice cubes are less dense than water, therefore **they float**

How will an egg float in water?

- Egg in salt water
  - The egg will float because it is **less dense** than the salt water



How will an egg float in water?



- Egg in fresh and salt water
  - The egg will be suspended in the middle because it is the **same density** as the water mixture

How Do We Calculate Density in 3 Easy Steps?

- Step 1
  - Calculate the mass of your object using the triple-beam balance

Work on the Density Calculations

Check your answers with your neighbor

How Do We Calculate Density in 3 Easy Steps?

- Step 2
  - Calculate the volume
    - Measure the length, width and height and use the volume formula
    - Use the graduated cylinder for liquids or irregular solids

How Do We Calculate Density in 3 Easy Steps?

- Step 3
  - Use the density formula

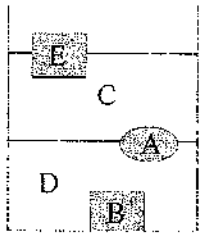
$$D = \frac{\text{Mass}}{\text{Volume}}$$

Summary

1. What is density?
2. Is Ice more or less dense than water? Why?
3. Name an item that is more dense than water.
4. Why does an egg float in salt water?
5. How can we calculate the density of common items?

Place these items in order of density from least to greatest

- E
- C
- A
- D
- B



Name_____

Density Practice Problem Worksheet

1) A block of aluminum occupies a volume of 15.0 mL and weighs 40.5 g. What is its density?

2) Mercury metal is poured into a graduated cylinder that holds exactly 22.5 mL. The mercury used to fill the cylinder weighs 306.0 g. From this information, calculate the density of mercury.

3) What is the weight of the ethyl alcohol that exactly fills a 200.0 mL container? The density of ethyl alcohol is 0.789 g/mL.

4) A rectangular block of copper metal weighs 1896 g. The dimensions of the block are 8.4 cm by 5.5 cm by 4.6 cm. From this data, what is the density of copper?

0 of 10

5) A flask that weighs 345.8 g is filled with 225 mL of carbon tetrachloride. The weight of the flask and carbon tetrachloride is found to be 703.55 g. From this information, calculate the density of carbon tetrachloride.

6) Calculate the density of sulfuric acid if 35.4 mL of the acid weighs 65.14 g.

7) Find the mass of 250.0 mL of benzene. The density of benzene is 0.8765 g/mL.

8) A block of lead has dimensions of 4.50 cm by 5.20 cm by 6.00 cm. The block weighs 1587 g. From this information, calculate the density of lead.

9) 28.5 g of iron shot is added to a graduated cylinder containing 45.50 mL of water. The water level rises to the 49.10 mL mark, from this information, calculate the density of iron.

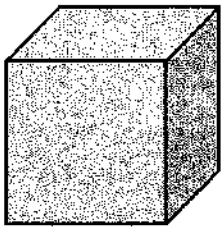
10) What volume of silver metal will weigh exactly 2500.0 g. The density of silver is 10.5 g/cm3.

Name: _____ Date: _____ OCH6

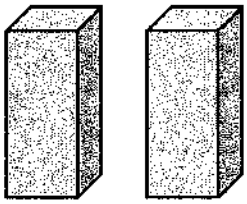
Density

1. Write the density formula below. (Hint: ♥)

2. Calculate the density of the metal cube shown below. The mass is 8 grams and the volume is 4 ml. What is the density? Write the problem and answer below.



3. Imagine that the cube is split in half exactly.



What is the mass of one half of the cube? _____

What is the volume of one half of the cube?_____

Calculate the density. Write the problem and the answer below.

4. Does size affect density? _____

_____

_____

The New York Times

The Opinion Pages
Dot Earth
New York Times blog

A Sun-Powered Hydrogen Car (Sort of)

By Andrew C. Revkin February 7, 2008 8:55 am

I have mixed feelings about a post on a new toy, given my focus yesterday on Adam Smith's warning about the "endless pursuit of unnecessary things." Do we really need another radio-controlled gadget?

Yet in this case, well, it's a *very cool* gadget — presuming it works as promoted at the Nuremberg Toy Fair on Wednesday. And you can't ignore anything that might entice young people to become engaged in the quest for new ways to harvest and harness energy without the side effects that come from reliance on fossil fuels.

As I've been saying for a while, it's time to move away from the "woe is me, shame on you" rhetoric on this issue and get kids excited about it.

The H2GO car seems to have it all worked out. The basic energy source is a solar panel that both charges the radio-control unit and provides the electricity to split water into hydrogen and oxygen in a little fueling station. The hydrogen fills a tiny bladder inside the car as needed. The hydrogen there generates a flow of electricity sufficient to power the car for about 5 minutes, according to Corgi International, the manufacturer. That's shorter than the 15 minutes a typical battery-powered toy like this runs. But Corgi says the H2GO simply pops back over to the filling station for an immediate fill-up, while toys with batteries have to be recharged.

The basic technology comes from Horizon Fuel Cell Technologies, a company that had an earlier toy car running on hydrogen. You can see that one demonstrated on YouTube here:

So, the car of the future is here now, at least in miniature, and at $99.99 apiece. A lot more fuel-cell-powered toys are in the works.

Keep in mind that if we all end up buzzing around in full-size hydrogen-powered cars someday, that still won't solve the congestion problem in an urbanizing world heading toward 9 billion people.

But having all the steps in a clean-energy transportation system worked out in front of kids' eyes might open a few.

One proviso: I haven't been to the Wah Shing toy factory in Hong Kong, where Corgi says the vehicle is made. It may well look like one of the vast facilities seen in the documentary "Manufactured Landscapes" — which may or may not be a good thing, but is something to consider when weighing whether to buy yet another potentially "unnecessary thing."

Comments are no longer being accepted.

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Analysis

1. What are the potential issues and major topics in this scenario that we as chemists/scientists can address?

Analysis

2. Compile a list for each category:

What do I know?	What do I need to know?

3. Rank the importance of the questions in the "What do I need to know" column.