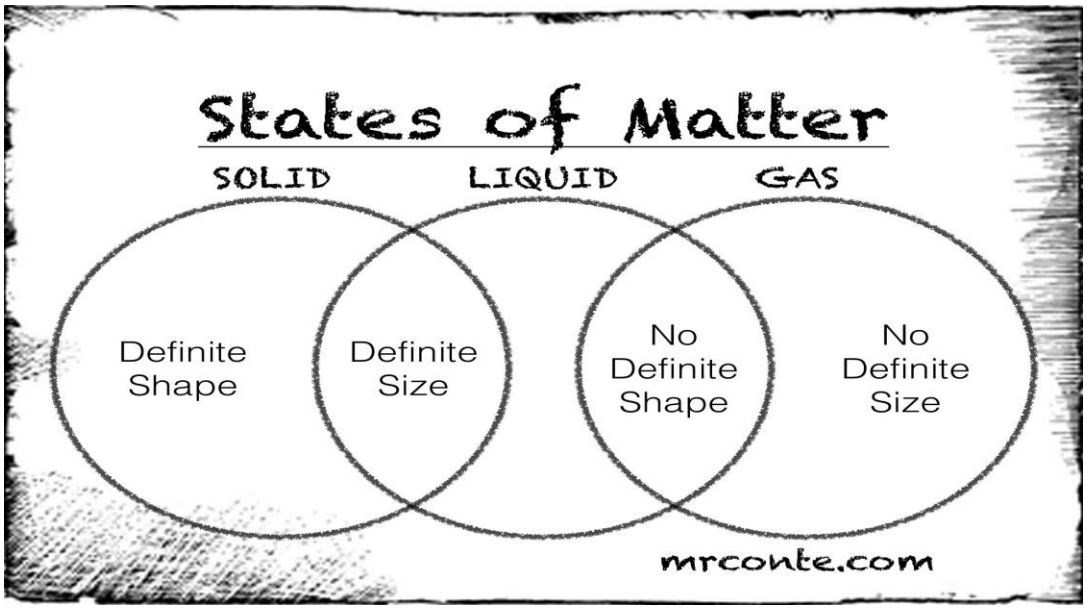
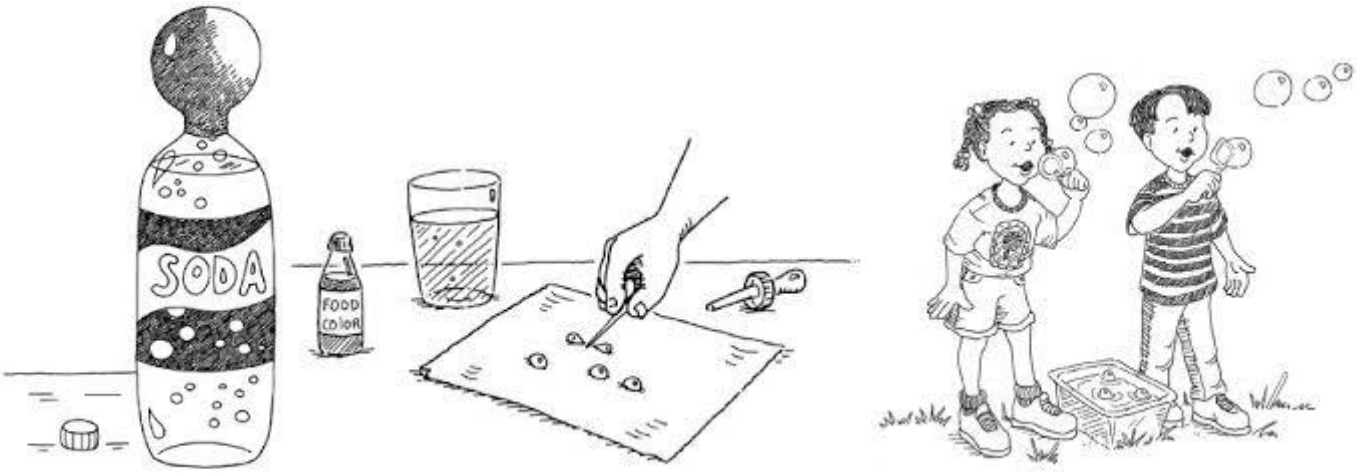
Name: _____

Broughton High School

Classification of Matter





Chapter 15 – Classification of Matter Vocabulary Words

Vocabulary Word	Definition
Chemical Change	
Chemical Property	
Colloid	
Compound	
Distillation	
Element	
Heterogeneous Mixture	
Homogeneous Mixture	
Law of Conservation of Mass	
Physical Change	
Solution	
Substance	
Suspension	
Tyndall Effect	

Solutions Worksheet

On the line at the left, write the letter of the definition that best matches each term.

_____ 1. solution	a. capable of being dissolved
_____ 2. solute	b. solution with water as the solvent
_____ 3. solvent	c. substance that is dissolved in a solution
_____ 4. soluble	d. substance that dissolves in water to form a solution that conducts an electric current
_____ 5. alloy	e. solid solution containing two or more metals
_____ 6. aqueous solution	f. homogeneous mixture of two or more substances in a single physical state
_____ 7. electrolyte	g. substance that does the dissolving in a solution

Answer each of the following questions in the space provided.

8. Describe the properties of a solution

9. Give two examples of solutions in nature and explain why each is important.

10. Describe how a chemist can accurately prepare a solution of precise molarity.

Answer each of the following questions in the space provided.

concentration	saturated
molarity	unsaturated
molality	supersaturated

10. _____ is the concentration of a solution expressed as the number of moles of solute dissolved in each liter of solution.
11. A _____ solution contains as much solute as can possibly be dissolved under existing conditions of temperature and pressure
12. The amount of solute in a given amount of solvent or solution is the _____ of a solution.
13. A solution that contains more solute particles than are needed to form a saturated solution is _____.
14. The _____ of a solution is the number of moles of solute dissolved in each kilogram of solvent.
15. A solution that has less than the maximum amount of solute that can be dissolved is called a(n) _____ solution.

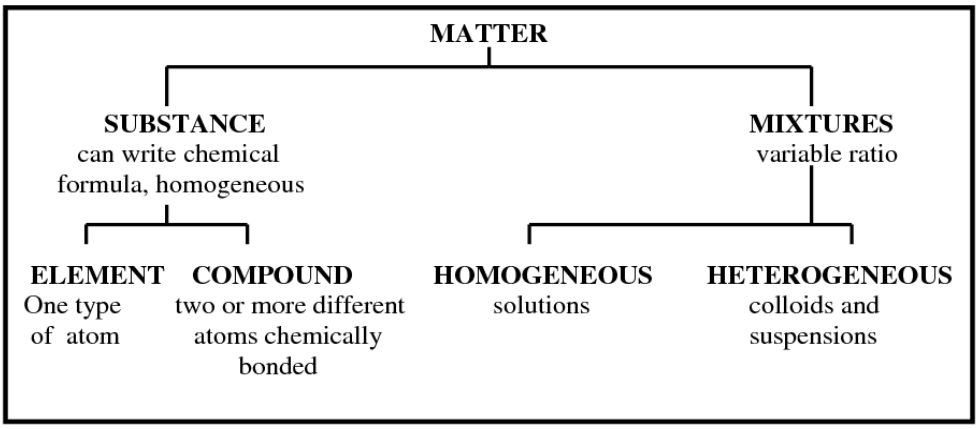
Solve each of the following problems as directed. Show all your work.

16. What is the molarity of the solution formed by mixing 0.20 mol of sodium hydroxide with enough water to make 150 ml of solution?

MATTER – SUBSTANCES VS. MIXTURES

Name_____

All matter can be classified as either a substance (element or compound) or a mixture (heterogeneous or homogenous).



Classify each of the following as to whether it is a substance or a mixture. If it is a substance, write Element or Compound in the substance column. If it is a mixture, write Heterogeneous or Homogeneous in the mixture column.

Type of Matter	Substance	Mixture
1. chlorine		
2. water		
3. soil		
4. sugar water		
5. oxygen		
6. carbon dioxide		
7. rocky road ice cream		
8. alcohol		
9. pure air		
10. iron		

Name_____PD____Date_____

Mixtures Worksheet

1) Define MIXTURE in your own words.

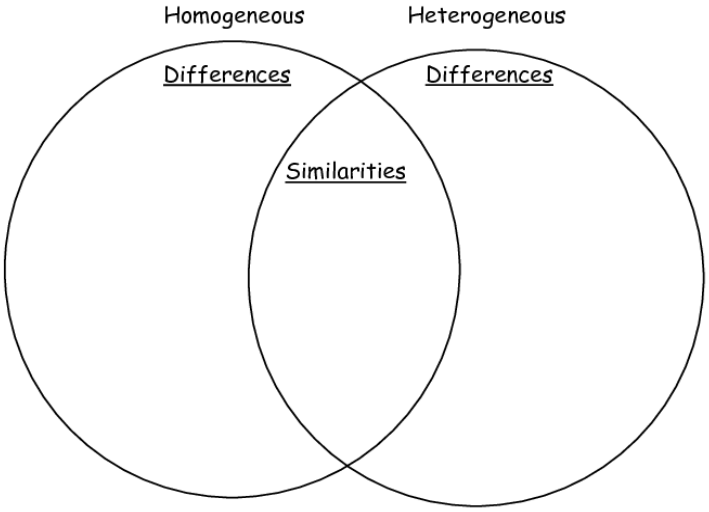
2) List two properties of mixtures.

3) What are the two parts of a solution?

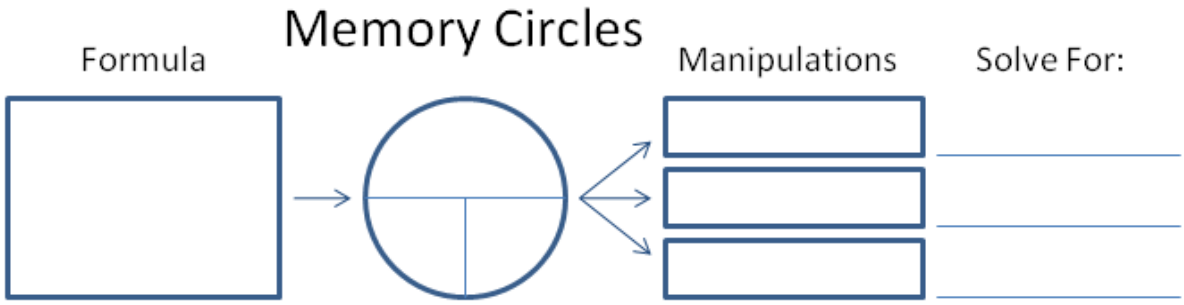
4) Complete the table below by filling in the type of mixture : Heterogeneous Mixture / Solution / Suspension

Example	Type of Mixture
a) salt water	
b) a garden salad	
c) A bag of different colored jelly beans	
d) Concrete	
e) Strawberry ice cream with fruit	
f) Instant coffee in water	

5) Complete the VEN Diagram below by listing the similarities and differences between Homogeneous and Heterogeneous Mixtures



Are you dense?



Density Problems- Show all your work and underline you final answer with correct units.

1. Cobalt has a density of 8.90 g/cm3. What volume would 17.8 g of cobalt have?

2. Calcium has a density of 1.54 g/mL. What mass would 3.00 mL have?

3. What is the density of copper if 21.4 g of it occupies 2.40 cm3 ?

4. Find the mass of 152 cm3 of ethanol if its density is 0.789 g/cm3 .

5. The mass of 10 cm3 of iron is 78.7 g. The mass of the same volume of mercury if 135 g. What is the density of iron? --of mercury?

Common Metals

Metal	Density (g/cm^3)
aluminum	2.7
iron	7.9
lead	11.4
silver	10.5

1. Which metal would occupy 15 cm^3 and have a mass of 157.5 g?

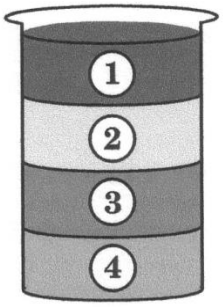
2. What would be the volume (in cm^3) of 157.5 g of aluminum?

3. If you had 10 g of each metal, which one would have the smallest volume?

4. Assuming equal masses of each metal, the one with the smallest volume will be the one with the _____ density. Also, the metal with the greatest volume will be the one with the _____ density.

5. Four liquids that will not mix have settle into distinct layers. Which layer is the least dense?

6. Rank the layers for their respective densities from greatest to least.
____>____>____>____



Densities of Gemstones

Gemstone	Density (g/cm^3)
Opal	2.20
Diamond	3.01
Garnet	3.15
Topaz	3.50

7. Identify the gemstone described by the following physical properties:

a) mass= 60 g and volume= 19 cm^3

b) volume = 25 cm^3 and mass of 55 g

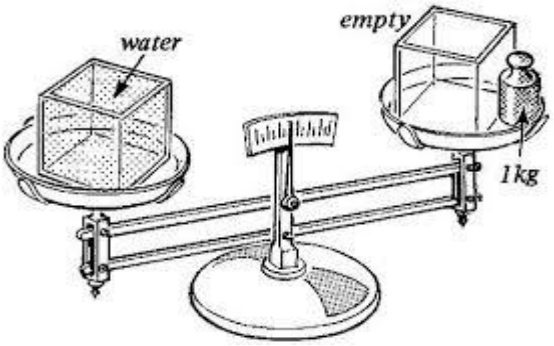
c) mass of 45.2 g and volume of 15 cm^3

d) volume of 220 mL and mass of 100 g

e) assuming equal masses of each stone, which one would have the greatest volume?

Fill in the following table for Density, mass and volume. Use the proper units!

#	substance	Density	Mass	Volume
13	lead	11.43 g/cm^3		6.2 cm^3
14	water	1.00 g/cm^3	645 g	
15	cork		163.2 g	680 cm^3
16	air		1.95 g	1500 cm^3
17	hydrogen	0.000090 g/cm^3		975 cm^3
18	iron	7.87 g/cm^3	72.5 g	



Classifying Properties and Changes

Physical Properties and Changes can alter the size, shape, or physical phase of any matter—but not its chemical make-up or formula.

Examples are:

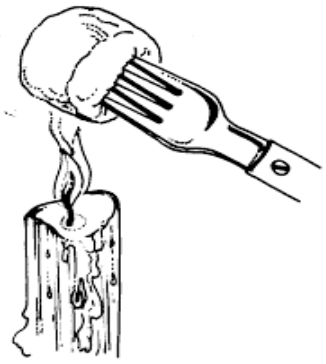
any changes of phase	
any mixing or separations	
any changes of size or shape	
any measure of quantity	

Chemical Properties or Changes have to do with chemical reactions. New substances with new properties are formed. Often heat, light, or a gas is given off.

Examples are:

Any types of chemical reactions	
Any cooking or burning	
Any reaction with light or oxygen (even very slow	
Any decay or spoiling	

Tarnish
Freezing
Burning wood
Exploding
Fading
Separating M&M's
decomposing acid
evaporation of ethanol
cooking hamburger
Setting off fireworks
lightning makes ozone
pop a balloon
cutting
dissolve sugar
boiling
toasting
crushing
shredding
rotting egg
melting point
Breaking glass
condensation
vaporization
Shuffling cards
evaporation
crumpling
spoiled milk
shape of an apple
sawing
rusting
melting chocolate
sound from a horn
density
Snow melts
fry an egg
mass
mix nuts
baking a cake



Properties of Matter

Identify each of the following as terms associated with chemical (C) or physical (P) changes.

1. ____ gas released from a reaction
2. ____ dissolve
3. ____ reaction that produces a solid
4. ____ burning
5. ____ baking or cooking
6. ____ melting
7. ____ heat is released
8. ____ radioactive decay
9. ____ crushing
10. ____ fading of dye on cloth
11. ____ freezing
12. ____ magnetize

25. ____ boil
26. ____ rust
31. ____ cutting
27. ____ separation of cards
28. ____ mixing
29. ____ tarnish
30. ____ evaporation
31. ____ dissolve
32. ____ explodes
33. ____ sound produced by a guitar
34. ____ separation of salt water
35. ____ heat is taken in during the change

Identify these types of matter as heterogeneous mixtures (M), elements (E), solutions (S) or compounds (C)

13. ____ oreo cookie
14. ____ baking soda
15. ____ iron
16. ____ air
17. ____ salt
18. ____ potassium
19. ____ vinegar
20. ____ saltwater
21. ____ pure gold
22. ____ CO_2
23. ____ iodine
24. ____ 14 K gold
25. ____ CO or NO

36. ____ mercury
37. ____ oil and vinegar
38. ____ ALNICO magnet (with Al, Ni, and Co)
39. ____ chex mix
40. ____ brass (Cu and Zn)
41. ____ car
42. ____ water
43. ____ Kool aid
44. ____ bromine
45. ____ hot fudge sundae
46. ____ $AgNO_3$
47. ____ granite
48. ____ Co or No

Fill in the blank

49. Freezing and boiling points are _____ properties.
50. Compounds are decomposed by _____ changes.
51. Shape and color are _____ properties.
52. Heat and Light are released in a _____ change.
53. Boiling is a change from a _____ to a _____.

Burning of fuel

Melting of ice-cream

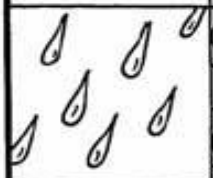
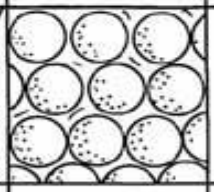
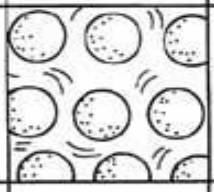
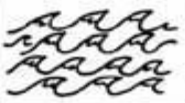
Water converts to steam

Bursting of explosive

Lighting of electric bulb

A-MAZING MATTER

While physicist Dr. Thermo Sparks is describing the three states of matter, his pet rat is worrying about his next meal. Here's how you can help him. Color the squares about liquids red, the squares about gases green, and the squares about solids yellow. Then draw a line on the yellow path for Robo Rat to get to the cheese.

LIQUID	**SOLID**	has a definite size but no definite shape			Water takes this form above 100° C.
has a definite size & shape	**GAS**	has no definite size or shape		can be poured	
		Water takes this form below 0° C.	takes the shape and size of any container		Things take this form when they freeze.
takes the shape of the container but not the size		Water takes this state between 0° and 100° C.	Water changes to this state above 100°C.		
	Solids take this state when they melt.				Liquids take this state when they evaporate.

PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

Name _____

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.
5.		Two substances are mixed and light is produced.
6.		A piece of ice melts and reacts with sodium.
7.		Mixing salt and pepper.
8.		Chocolate syrup is dissolved in milk.
9.		A marshmallow is toasted over a campfire.
10.		A marshmallow is cut in half.

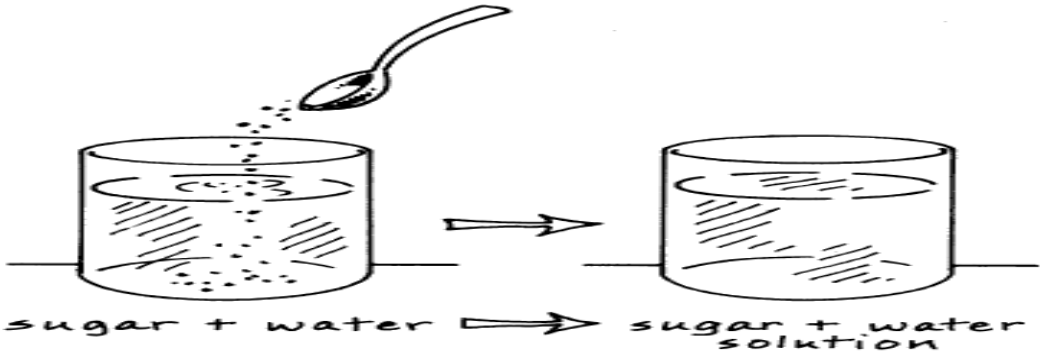
A CHANGEABLE DAY

What a day Dr. Sparks has had! There have been so many changes! Some of them have been physical changes, and some have been chemical changes. Write P for physical or C for chemical before each change that happened today.

(Remember: No new substance is formed in a physical change. In a chemical change, one or more new substances are formed.)

CHANGES on THURSDAY

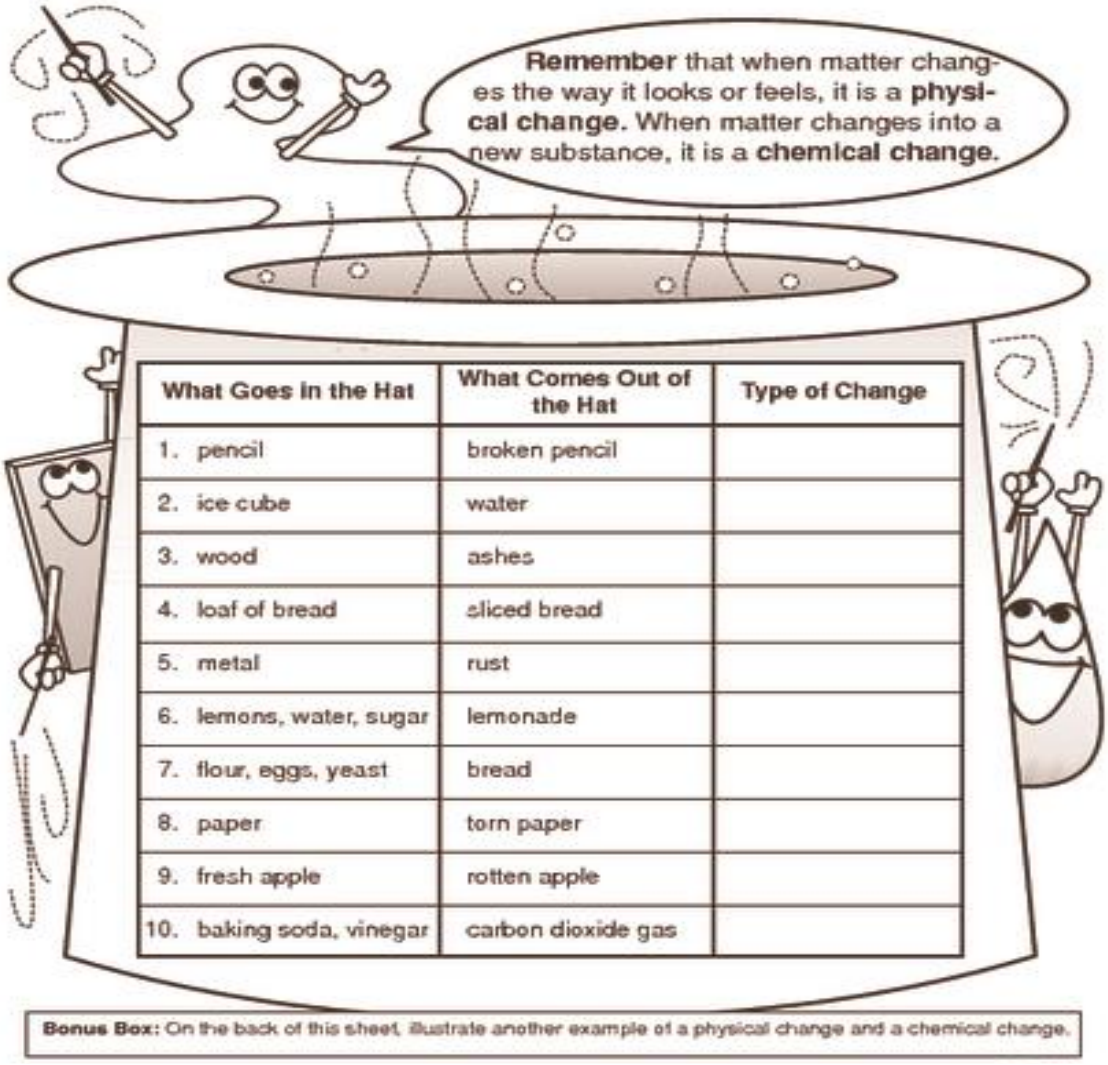
_____ 1. The rain turned to snow.
_____ 2. Whoops! Robo broke a glass on the bathroom floor.
_____ 3. I burned my bagel!
_____ 4. I fried three eggs for breakfast.
_____ 5. The teakettle hissed and steamed when I made tea.
_____ 6. Robo and I froze chocolate-covered bananas.
_____ 7. My bike got rusty from being left out in the snow.
_____ 8. The snow melted on my way to work.
_____ 9. At the lab, I turned on the dehumidifier to take the extra moisture out of the air.
_____ 10. I mixed baking soda and vinegar for a science class.
_____ 11. I heated sand to its melting point.
_____ 12. An important paper caught on fire at the lab!
_____ 13. My bananas had turned rotten. I threw them away!
_____ 14. The bread in my refrigerator got moldy.
_____ 15. I sanded my bike to remove the rust.
_____ 16. I burned candles at dinner.
_____ 17. Robo and I stirred sugar into the lemonade.
_____ 18. My neighbor burned leaves all evening.
_____ 19. I baked a chocolate cake for desert.
_____ 20. I whipped cream for the cake.



Name_____ Matter
Physical and chemical changes

Matter Magic

What goes in the magic hat never comes out the same!
Read the chart to see how each item changes.
Then write *physical* or *chemical* to tell which type of change took place.

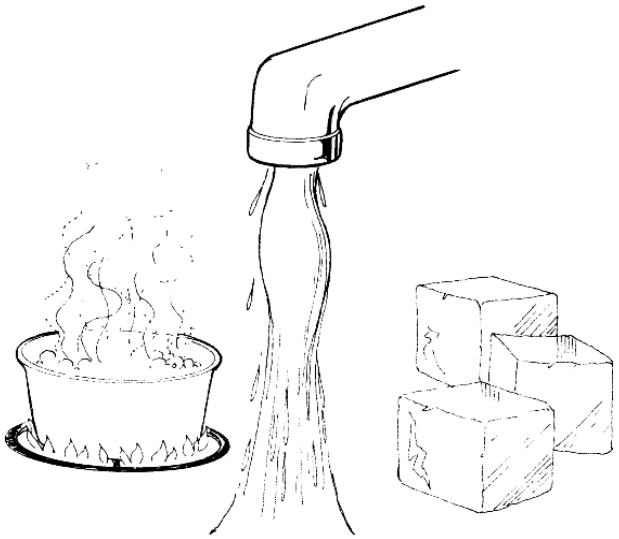


What Goes in the Hat	What Comes Out of the Hat	Type of Change
1. pencil	broken pencil	
2. ice cube	water	
3. wood	ashes	
4. loaf of bread	sliced bread	
5. metal	rust	
6. lemons, water, sugar	lemonade	
7. flour, eggs, yeast	bread	
8. paper	torn paper	
9. fresh apple	rotten apple	
10. baking soda, vinegar	carbon dioxide gas	

Bonus Box: On the back of this sheet, illustrate another example of a physical change and a chemical change.

PHYSICAL VS. CHEMICAL CHANGE

Name _____



In a physical change, the original substance still exists, it has only changed in form. Energy changes usually do not accompany physical changes, except in phase changes and when substances dissolve,

In a chemical change, a new substance is produced. Energy changes always accompany chemical changes. Chemical changes are always accompanied by physical changes.

Classify the following as examples of a physical change, a chemical change or both kinds of change.

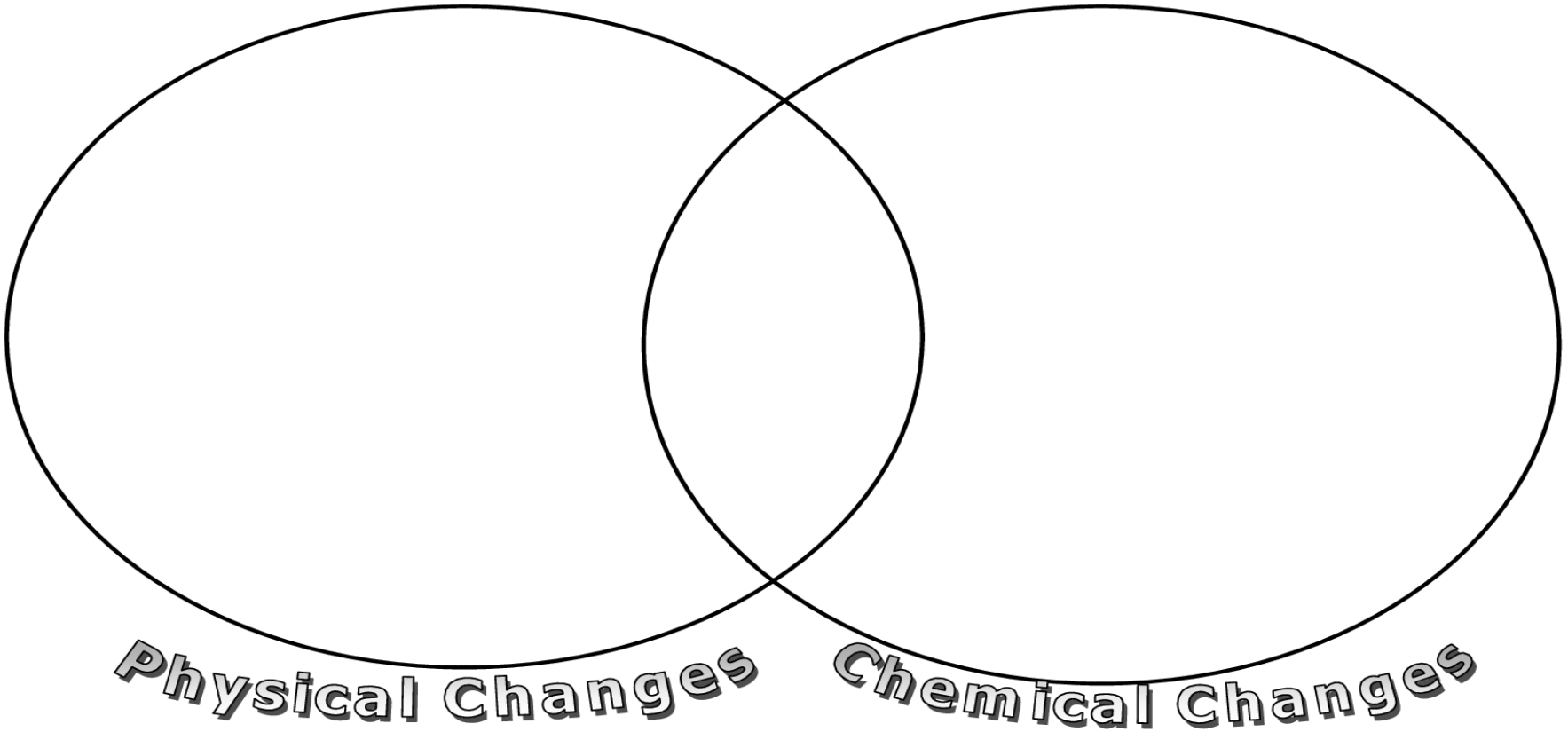
1. Sodium hydroxide dissolves in water, _____
2. Hydrochloric acid reacts with sodium hydroxide to produce a salt, water and heat. _____
3. A pellet of sodium is sliced in two. _____
4. Water is heated and changed to steam, _____
5. Potassium chlorate decomposes to potassium chloride and oxygen gas. _____
6. Iron rusts. _____
7. Ice melts. _____
8. Acid on limestone produces carbon dioxide gas, _____
9. Milk sours. _____
10. Wood rots, _____

- Create a Venn diagram to compare and contrast **physical and chemical changes**
- You must include:
  - 2 pictures of each type of change (by hand or cut & past from clip art)
  - At least 15 facts (only 5 can be examples)
  - **At least** 5 on each side and 3 in the middle, final 2 you get to choose

Name: _____

Per: _____ Date: _____

YSICAL VS. CHEMICAL CHANGES



PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

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

PHYSICAL PROPERTY	CHEMICAL PROPERTY
1. observed with senses	1. indicates how a substance
2. determined without destroying matter	reacts with something else

_____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	1. a change in the physical and

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.

5.		Two substances are mixed and light is produced.
6.		A piece of ice melts and reacts with sodium.
7.		Mixing salt and pepper.
8.		Chocolate syrup is dissolved in milk.
9.		A marshmallow is toasted over a campfire.
10.		A marshmallow is cut in half.

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.	Physical	No change in substances. No unexpected color change, temperature change or gas given off.
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.		