Unit 2 – Properties of Matter

Chapter 3 of your book.

Early Booklet E.C.:	**/ 2**
Unit 2 Hwk. Pts:	**/ 24**
Unit 2 Lab Pts:	**/ 37**
Late, Incomplete, No Work, No Units Fees?	Y / N

Learning Targets for Unit 2

1.1 I can identify the characteristics of a substance.
1.2 I can distinguish between physical and chemical properties
1.3 I can differentiate among the physical states of matter.
1.4 I can define physical change and list several common physical changes.
1.5 I can define chemical chance and list several common chemical changes.
1.6 I can apply the law of conservation of mass to chemical reactions.
1.7 I can contrast mixtures and substances.
1.8 I can classify mixtures as homogeneous or heterogeneous
1.9 I can list and describe several techniques used to separate mixtures.
1.10 I can distinguish between elements and compounds
1.11 I can describe the organization of elements in the periodic table
1.12 I can explain how all compounds obey the laws of definite and multiple proportions

Unit Vocabulary for Unit 2

Chemical property	Physical property	Extensive property	Intensive property
Liquid	Gas	Solid	Vapor
Chemical change	Physical change	Phase change	Law of conservation of mass
Crystallization	Distillation	Mixture	Filtration
Sublimation	Solution	Heterogeneous mixture	Homogeneous mixture
Compound	Element	Product	Reactant

Alloy States of Matter

Possible 2.1 Pts.: 7
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 7

2.1 Problems – Properties of Matter
Section 3.1 of your book

1. Is carbon dioxide gas a pure substance? Explain.

2. List at least three physical properties of water.

3. Identify each physical property as extensive or intensive:
   a. Melting point
   b. Mass
   c. Density
   d. Length

4. Differentiate between gas and vapor.

5. Classify each as either a solid, a liquid, or a gas at room temperature:
   a. milk
   b. air
   c. copper
   d. helium
   e. diamond
   f. candle wax

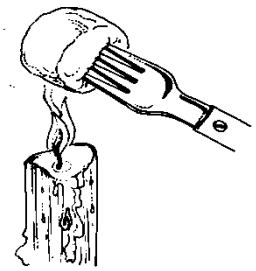
6. Classify each of the following as a physical or chemical property:
   a. Aluminum has a silvery color.
   b. Gold has a density of 19 g/cm^3.
   c. Sodium ignites when dropped in water.
   d. Water boils at 100 °C.
   e. Silver tarnishes.
   f. Mercury is a liquid at room temperature.

7. At what temperature would 250 mL of water boil? 1000 mL? Is the boiling point an intensive or extensive property? Explain!

Possible 2.2 Pts.: 5
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 5

2.2 Problems – Changes in Matter
Section 3.2 of your book.

1. Is this picture of a marshmallow toasted over a candle an example of a physical change, chemical change, or a bit of both? Explain your reasoning.



2. Is the process of a banana ripening a physical or a chemical change? Explain your reasoning.

3. Iron and oxygen combine to form iron oxide (rust). List the reactants and products of the reaction.

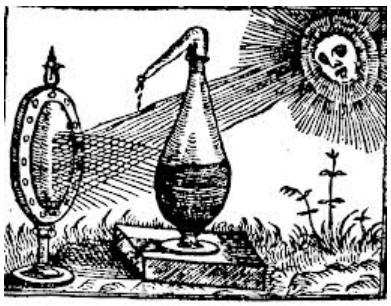
4. If 45.98g of sodium combines with an excess of chlorine gas to form 116.89g of sodium chloride, what mass of chlorine gas was used in the reaction?

5. When burning 180g of glucose in the presence of 192g of oxygen, water and carbon dioxide are produced. If 108g of water is produced, how much carbon dioxide is produced?

Possible 2.3 Pts.: 7
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 7

2.3 Problems – Mixtures of Matter
Section 3.3 of your book.

1. Name the separation technique shown in this ancient woodcut, and describe what is going on.



For Problems 2 – 4, describe in at least <u>two</u> complete sentences a method that could be used to separate each mixture:

2. Iron filings and sand

3. Sand and salt

4. The components of ink

5. Describe how homogeneous mixtures differ from heterogeneous mixtures.

6. Agitated seawater is composed of salt, sand, and water. Is this a heterogeneous or homogeneous mixture? Explain.

7. Use iced tea with and without ice cubes as examples to explain homogeneous and heterogeneous mixtures. If you allow all of the ice cubes to melt, what type of mixture is it?

Possible 2.4 Pts.: 5
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3
Final Score: / 5

2.4 Problems – Elements and Compounds
Section 3.4 of your book.

1. Classify each mixture as homogeneous or heterogeneous, and explain your choices:
   a. Brass (an alloy of copper and zinc)
   b. Salad
   c. Blood
   d. Powdered drink mix in water

2. Phosphorus combines with hydrogen to form phosphine. In this reaction, 123.9g of phosphorus combines with excess hydrogen to produce 129.9g of phosphine. After the reaction, 310g of hydrogen remains unreacted. What mass of hydrogen was used in the reaction? What was the initial mass of hydrogen?

3. You might have noticed that while eating ice cream on a hot day, the ice cream begins to melt. Is the observed change in state a physical or a chemical change? Justify your answer.

4. Sodium reacts chemically with chlorine to form sodium chloride. Is sodium chloride a mixture or a compound?

5. If 120 grams of sulfur react with oxygen to make 180 grams of sulfur monoxide, how many grams of oxygen reacted?

Chemistry	Lab 2.1 - Outdoor Observations				
Name:					Correction Credit: Half
Lab Points:	Missed:	Late, No Units, No Work Fee:	First Score:	Corrections:	Final Score:
19		-1 -2 -3 -4 -5			

In this half-hour outing, your mission is to first define, then identify physical/chemical properties and changes in the area around the school.

Range: You are not to go to Geist Road or University Avenue. You may go as far as the WV track, and the road between U-Park and Hutch, but no further.

ANY GROUPS NOT RETURNING TO HUTCH AT THE ALLOTTED TIME WILL LOSE 5 POINTS. Meet at the foyer promptly at:_____.

Write the Definition of Physical Property Here (1 pt):

Physical Property Observed (3 points total) What makes each observation a physical property?

1.

2.

3.

Write the Definition of Physical Change Here (1 pt):

Physical Change Observed (3 points total) What makes each observation a physical change?

1.

2.

3.

Write the Definition of Chemical Property Here (1 pt):

Chemical Property Observed (3 points total) What makes each observation a chemical property?

1.

2.

3.

Write the Definition of Chemical Change Here (1 pt):

Chemical Change Observed (3 points total) What makes each observation a chemical change?

1.

2.

3.

Questions (1 point each). Answer in complete sentences.

1. What was the most interesting example of a physical property/change that you observed, and why was it unique?

2. What was the most interesting example of a chemical property/change that you observed, and why was it unique?

3. Which do you think to be more commonplace here on Earth – physical or chemical change? Justify your answer.

Chemistry	2.2 Lab - Separating Mixtures				
Name:					Correction Credit: Half
Lab /Hwk Points:	Missed:	Late, No Units, No Work Fee:	First Score:	Corrections:	Final Score:
18		-1 -2 -3 -4			

Overview:

In this lab you will use different techniques of physical separation to isolate three different substances from a sample. Then, you will use the formula for percent composition to calculate percentages of the three different components in your sample:

$$\%\,\text{Mass} = \frac{\text{Mass of (Iron or Sand or Salt)}}{\text{Total Sample Mass}} \times 100\%$$

Materials:

Balance
Plastic weighing boats
Magnet
100 mL beaker
Steel Can
De-ionized water
Bunsen burner
Funnel
Filter paper
Glass stirring rod
Ring stand
Wire mesh
Metal tongs
Mix of sand, salt, iron

Day 1 – Iron and Salt Extraction

1. Determine the mass of an empty weighing boat; **put your period/group number on a filter.**
2. Obtain 6 – 8 grams of the iron/salt/sand mixture in one weighing boat and record its mass in the table. Be sure to account for the mass of the weighing boat.
3. Use the magnet to remove all the iron filings from the sample WITHOUT COVERING THE MAGNET WITH FILINGS.
4. Record the iron's mass in the table. Save it in the weighing boat.
5. Separately obtain the masses of the dry, steel can and **labeled** filter paper, and record them.
6. Put the salt/sand mixture in the 100 mL beaker and add 10 mL of distilled water. Stir it with the rod, then pour all the contents into a filter/funnel assembly – capture the filtrate in the steel can. Add 10.0 more mL of water to the beaker to rinse it, then add that to the filter.
7. Use the Bunsen burner to gently boil off the water from your 20 mL of salty water in the steel can. The mixture spatters when the water is nearly gone, so use the tongs to lift the can above the heat to minimize this. Heat until crackling sounds stop, and be careful not to tip the can.
8. Cool the can for five minutes before weighing it and recording the mass.
9. Clean up: Store your filter with sand in the bin at the front of the room for drying, then put iron filings in the labeled waste beaker. Wash all lab equipment that was used – dissolve the salt in your steel can and pour it down the drain..

Day 2 – Sand Mass

1. Retrieve your filter with sand from the bin and record its mass.
2. Clean up: put filter paper and sand in the labeled waste beaker at the front of the room.
3. Wash all lab equipment and return it to your stations.

Data Table (6 pts – include units)			
Mass of empty boat		Mass of steel can	
Mass boat and mixture		Mass of filter paper	
Mass of iron/salt/sand mixture		Mass of salt and can	
Mass of iron and boat		Mass of salt	
Mass of iron		Mass of sand and filter	
		Mass of sand	

Calculations:

1. (2 pts each) Use this space to calculate the percent composition of each of the three components of your sample. Use the equation in the overview. Show all your work for full credit, but enter the amounts you get in the box provided.

	Percent by Mass
Iron	
Salt	
Sand	

Questions: Answer in complete sentences.

1. (1 pt) What separation technique was used to remove the iron from the sample?

2. (1 pt) What separation techniques were used to separate the salt from the sand?

3. (1 pt) What separation technique was used to separate the water from the sand?

4. (1 pt) What separation technique was used to separate the water from the salt?

5. (2 pts) Add up the iron, salt, and sand masses and compare this value to that of the original sample. Based on this, was your process effective at separating the components? What could account for differences in mass?

63 Elements to Memorize

This is a list of elements which you are responsible for knowing the symbols and names. This will help you in the long run as we get deeper into the study of chemistry and use only symbols when talking about chemical compounds.

Atomic Number	Symbol	Name	Atomic Number	Symbol	Name	Atomic Number	Symbol	Name
1	H	Hydrogen	22	Ti	Titanium	48	Cd	Cadmium
2	He	Helium	23	V	Vanadium	50	Sn	Tin
3	Li	Lithium	24	Cr	Chromium	51	Sb	Antimony
4	Be	Beryllium	25	Mn	Manganese	52	Te	Tellurium
5	B	Boron	26	Fe	Iron	53	I	Iodine
6	C	Carbon	27	Co	Cobalt	54	Xe	Xenon
7	N	Nitrogen	28	Ni	Nickel	55	Cs	Cesium
8	O	Oxygen	29	Cu	Copper	56	Ba	Barium
9	F	Fluorine	30	Zn	Zinc	74	W	Tungsten
10	Ne	Neon	31	Ga	Gallium	77	Ir	Iridium
11	Na	Sodium	32	Ge	Germanium	78	Pt	Platinum
12	Mg	Magnesium	33	As	Arsenic	79	Au	Gold
13	Al	Aluminum	34	Se	Selenium	80	Hg	Mercury
14	Si	Silicon	35	Br	Bromine	82	Pb	Lead
15	P	Phosphorus	36	Kr	Krypton	83	Bi	Bismuth
16	S	Sulfur	37	Rb	Rubidium	86	Rn	Radon
17	Cl	Chlorine	38	Sr	Strontium	87	Fr	Francium
18	Ar	Argon	40	Zr	Zirconium	88	Ra	Radium
19	K	Potassium	42	Mo	Molybdenum	90	Th	Thorium
20	Ca	Calcium	46	Pd	Palladium	92	U	Uranium
21	Sc	Scandium	47	Ag	Silver	94	Pu	Plutonium

The memorization process will last six weeks. I recommend using flash cards.

The weekly elements and quizzes to focus on are as follows:

Week 1: Hydrogen – Neon
Week 2: Sodium – Scandium
Week 3: Titanium – Gallium
Element Quiz #1 – Date: _____
Week 4: Germanium – Silver
Week 5: Cadmium – Iridium
Week 6: Platinum – Plutonium
Summary Element Quiz – Date: _____

Points Possible:	10
Late/Inc. Fee: -1	-2 - 3
Final Score:	/ 10

Unit 2 Review – Properties of Matter

This serves as test preparation for the Unit 2 exam. Points earned are based on completion, and we will go over any questions you have during the review. Additionally, you may be called upon to present a selection of these problems to the class.

1. What is a mixture? How is it different from a compound?

2. Define, and give four examples of physical change.

3. Define intensive physical property, and give four examples.

4. How many individual atoms are in the formula H_2SO_4? How many individual atoms are in three molecules of water?

5. List the four states of matter, and connect them with labeled process arrows: Example: between liquid and gas, an arrow labeled "boiling" is correct.

6. List three physical properties, and two chemical properties of sodium metal. This may require research.

7. Define, and give four examples of a chemical property.

8. Describe how to separate a mixture of sand and salt.

9. Describe the process of distillation, and provide a drawing of a distillation apparatus.

10. Describe chromatography, and draw an image of chromatography.

11. Describe filtration, and draw a filtration apparatuses.

12. What is the Law of Conservation of Mass?

13. What is the percent by mass of hydrogen in a sample of sulfuric acid that has a mass of 32.7 grams (mass of hydrogen = 0.7 grams)?

14. What is a pure element? How are they different from compounds?

15. The chemical reaction of hydrogen with oxygen produces water. A chemist mixes 14.2 grams of hydrogen gas with oxygen, and obtains 127.8 grams of water, and 24.3 grams of excess oxygen. How much oxygen was necessary for the reaction, and how much did the chemist have initially?

16. What is a compound? How are they different from elements?

17. Describe how you would separate a mixture of iron filings from sand.

18. Nitrogen triiodide (NI_3) explodes producing nitrogen gas and iodine vapor according to the following reaction:

$$NI_3 \rightarrow N_2 + 3\,I_2$$

If a chemist exploded a sample of nitrogen triiodide and got 8.5 grams of nitrogen and 27.2 grams of iodine, what was the initial mass of nitrogen triiodide?

19. Give an example of a mixture that contains gas, liquid, and solid components, and describe how you could separate those components.

20. What is the percent by mass of the elements in the following 22.5 gram sample of sugar ($C_6H_{12}O_6$): carbon is 9.0 g, hydrogen is 1.5 g, and oxygen is 12.0 g.

21. For the following list, indicate which samples are pure elements, and which are compounds: Carbon, oxygen, carbon dioxide, lithium, sodium chloride, and sugar.

22. Write down four elements that belong to the same group (family) of the periodic table.

23. Write down six elements that belong to the same period of the periodic table.

24. For the following list, indicate which samples are pure elements, and which are alloys: brass, zinc, iron, steel, copper, tin, bronze, aluminum, stainless steel.