

Name:	Partner's Name:
Date of lab:	If absent, data obtained from:

## Lab 4.1 - Elements, Mixtures, and Compounds

\*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.\*

Procedure	Observations
-----------	--------------

**Elements** are substances which can NOT be broken down into simpler substances by ordinary chemical methods. They are composed of the same type of atoms throughout. Examples are hydrogen gas, carbon (diamonds), carbon (coal), helium gas, mercury liquid, aluminum metal.

**Mixtures** are materials which are put together but are not chemically combined. Their parts can be separated out. Examples are cinnamon and sugar seasoning, air, sea water (salt and water), regular water (water and dirt, dust, bacteria, etc.), oil and vinegar.

**Compounds** are elements which have been combined chemically. Examples are sodium chloride (table salt), acetic acid (acid in vinegar), carbon dioxide (one of the gases we exhale), etc.

### Part A - The Elements Copper and Sulfur, and the Compound Copper Sulfide

\_\_\_\_1. Obtain 3 vials from your teacher. One has the element copper in it, one has the element sulfur in it, and one has the compound copper sulfide in it. Describe each:

Copper: \_\_\_\_\_

Sulfur: \_\_\_\_\_

Copper Sulfide: \_\_\_\_\_

### Part B - Copper and Sulfur Combined

\_\_\_\_2. Obtain 4 vials from your teacher labeled **X, Y, Z, EZ**. **Do not shake or disturb the vials !**

\_\_\_\_ 3. Complete the following Data Table:

Vial	Appearance	How many substances are present ?	What elements or compounds are present ?
X			
Y			
Z			
EZ			

### Part C - Copper and Sulfur Combined Again with a Little Oxygen

\_\_\_\_ 4. Obtain 2 pieces of copper, one lump of sulfur, one vial of copper sulfide, and one vial of copper oxide from your teacher.

\_\_\_\_ 5. Which materials look alike ? \_\_\_\_\_

\_\_\_\_ 6. Which material(s) are elements ? \_\_\_\_\_

\_\_\_\_ 7. Which material(s) are compounds ? \_\_\_\_\_

\_\_\_\_ 8. Sand both pieces of copper with sandpaper until one side of each is shiny.

\_\_\_\_ 9. Rub the lump of sulfur on **one** of the shiny copper pieces. Describe the change that takes place on the copper: \_\_\_\_\_

\_\_\_\_ 10. A new substance was formed on the copper. What is the probable name of the new substance which was formed (remember the 2 things you rubbed together )? \_\_\_\_\_

\_\_\_\_ 11. The vial with the copper sulfide has the powdered form of what you formed on the copper.

\_\_\_\_ 12. Hold the second shiny copper piece (the one that did **not** have sulfur rubbed on it) in the cooler top section of a burner flame for about one minute. **Do**

**not get the copper really hot.** Describe the changes that take place on the copper: \_\_\_\_\_

\_\_\_\_ 13. A new substance was formed on the copper. What is the probable name of the new substance which was formed since the copper was heated in air ? \_\_\_\_\_

\_\_\_\_ 14. The vial with the copper oxide has the powdered form of what you formed on the copper.

Name:	Partner's Name:
Date of lab:	If absent, data obtained from:

## Lab 4.2 - Household Chemicals

'Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.'

Procedure	Observations
-----------	--------------

### Part A - Testing Chemicals

- \_\_\_\_ 1. Obtain 5 test tubes all approximately the same size.
- \_\_\_\_ 2. Wash the test tubes if necessary.
- \_\_\_\_ 3. Place your clean test tubes in a test tube rack in a 1 - 5 order.
- \_\_\_\_ 4. Refer to **Data Table # 1** below: Place 2 to 3 cm of each of the solutions in the correct test tube.

Test Tube #	Solutions	Describe any Odor	Red Litmus	Blue Litmus	Barium chloride
1	Sodium chloride				
2	Acetic acid				
3	Magnesium sulfate				
4	Potassium bromide				
5	Ammonium hydroxide				

- \_\_\_\_ 5. Note the odor of each chemical (remember to waft !) Record your observations in the Data Table above.
- \_\_\_\_ 6. Dip a piece of red litmus paper into each solution. Use a new piece of litmus paper for each solution. Record your observations in the Data Table # 1 above.
- \_\_\_\_ 7. Dip a piece of blue litmus paper into each solution. Use a new piece of litmus paper for each solution. Record your observations in the Data Table # 1 above.
- \_\_\_\_ 8. Put 2 to 3 cm of barium chloride solution into each solution. Record your observations above.
- \_\_\_\_ 9. Pour out your solutions into the sink and wash your test tubes.

## Part B - Household Chemicals

\_\_\_\_10. Refer to **Data Table # 2** below: Place 2 to 3 cm of each of the solutions in the correct test tube. Some of the substances will be solids. Put a small amount in the test tube and add 2 to 3 cm of water ; pluck to dissolve.

**Data Table # 2**

Test Tube #	Solutions	Describe any Odor	Red Litmus	Blue Litmus	Barium chloride
1	Vinegar				
2	Ammonia				
3	Epsom Salt				
4	Table Salt				

\_\_\_\_11. Dip a piece of red litmus paper into each solution. Use a new piece of litmus paper for each solution. Record your observations in the **Data Table # 2** above.

\_\_\_\_11. Dip a piece of blue litmus paper into each solution. Use a new piece of litmus paper for each solution. Record your observations in the **Data Table # 2** above.

\_\_\_\_12. Put 2 to 3 cm of barium chloride solution into each solution. Record your observations above.

\_\_\_\_13. Pour out your solutions into the sink and wash your test tubes.

## Questions

1. The household chemicals in Part B are some of the chemical solutions from Part A. Compare **Data Tables # 1** and **# 2**, and determine which chemical solutions the household items are. Complete the table below.

Household Item	Chemical Solution
Vinegar	
Ammonia	
Epsom Salt	
Table Salt	

## Review Questions

1. What is an **element** ? \_\_\_\_\_
2. What compound is formed when elemental sulfur is rubbed on elemental copper ? \_\_\_\_\_
3. Copper + oxygen -----> \_\_\_\_\_
4. What does elemental copper look like ? \_\_\_\_\_

Name: \_\_\_\_\_

## Exercise : 4-A Synthesis (Direct Union) Word Equations

**Part A - Complete each of the following synthesis word equations. The second word in each compound's name ends in "-ide".**

1. zinc + sulfur -----> \_\_\_\_\_
2. aluminum + oxygen -----> \_\_\_\_\_
3. copper + chlorine -----> \_\_\_\_\_
4. magnesium + iodine -----> \_\_\_\_\_
5. sodium + bromine -----> \_\_\_\_\_
6. hydrogen + fluorine -----> \_\_\_\_\_
7. calcium + nitrogen -----> \_\_\_\_\_
8. barium + phosphorus -----> \_\_\_\_\_
9. potassium + chlorine -----> \_\_\_\_\_
10. iron + sulfur -----> \_\_\_\_\_
11. lithium + iodine -----> \_\_\_\_\_
12. strontium + oxygen -----> \_\_\_\_\_
13. cesium + chlorine -----> \_\_\_\_\_
14. radium + iodine -----> \_\_\_\_\_
15. titanium + bromine -----> \_\_\_\_\_
16. manganese + fluorine -----> \_\_\_\_\_
17. cobalt + nitrogen -----> \_\_\_\_\_
18. silver + phosphorus -----> \_\_\_\_\_
19. cadmium + chlorine -----> \_\_\_\_\_
20. gold + sulfur -----> \_\_\_\_\_

**OVER**

**Part B - Complete each of the following synthesis word equations.**

1. \_\_\_\_\_ + oxygen -----> zinc oxide
2. copper + \_\_\_\_\_ -----> copper iodide
3. \_\_\_\_\_ + \_\_\_\_\_ -----> silver chloride
4. \_\_\_\_\_ + fluorine -----> nickel fluoride
5. cadmium + \_\_\_\_\_ -----> cadmium sulfide
6. \_\_\_\_\_ + \_\_\_\_\_ -----> gold bromide
7. \_\_\_\_\_ + phosphorus -----> chromium phosphide
8. barium + \_\_\_\_\_ -----> barium nitride
9. \_\_\_\_\_ + \_\_\_\_\_ -----> calcium oxide
10. \_\_\_\_\_ + \_\_\_\_\_ -----> cesium iodide
11. \_\_\_\_\_ + oxygen -----> titanium oxide
12. cobalt + \_\_\_\_\_ -----> cobalt iodide
13. \_\_\_\_\_ + \_\_\_\_\_ -----> strontium chloride
14. \_\_\_\_\_ + fluorine -----> vanadium fluoride
15. lithium + \_\_\_\_\_ -----> lithium sulfide
16. \_\_\_\_\_ + \_\_\_\_\_ -----> tungsten bromide
17. \_\_\_\_\_ + phosphorus -----> francium phosphide
18. mercury + \_\_\_\_\_ -----> mercury nitride
19. \_\_\_\_\_ + \_\_\_\_\_ -----> nickel oxide
20. \_\_\_\_\_ + \_\_\_\_\_ -----> iron iodide

Name: \_\_\_\_\_

## Exercise : 4-B

### Element Symbols

**Part A** - Using a periodic table, write the symbol for each element listed.

1. oxygen \_\_\_\_\_
2. hydrogen \_\_\_\_\_
3. chlorine \_\_\_\_\_
4. mercury \_\_\_\_\_
5. fluorine \_\_\_\_\_
6. barium \_\_\_\_\_
7. helium \_\_\_\_\_
8. uranium \_\_\_\_\_
9. radon \_\_\_\_\_
10. sulfur \_\_\_\_\_
11. plutonium \_\_\_\_\_
12. americium \_\_\_\_\_
13. radium \_\_\_\_\_
14. germanium \_\_\_\_\_
15. zinc \_\_\_\_\_
16. arsenic \_\_\_\_\_
17. lead \_\_\_\_\_
18. iron \_\_\_\_\_
19. calcium \_\_\_\_\_
20. cobalt \_\_\_\_\_
21. argon \_\_\_\_\_
22. polonium \_\_\_\_\_

23. xenon \_\_\_\_\_
24. lithium \_\_\_\_\_
25. chromium \_\_\_\_\_
26. cadmium \_\_\_\_\_
27. rubidium \_\_\_\_\_
28. osmium \_\_\_\_\_
29. europium \_\_\_\_\_
30. yttrium \_\_\_\_\_

**Part B** - Using a periodic table, write the name for each element listed.

31. Kr \_\_\_\_\_
32. K \_\_\_\_\_
33. C \_\_\_\_\_
34. Ne \_\_\_\_\_
35. Si \_\_\_\_\_
36. Zr \_\_\_\_\_
37. Sn \_\_\_\_\_
38. Pt \_\_\_\_\_
39. Na \_\_\_\_\_
40. Al \_\_\_\_\_
41. Cu \_\_\_\_\_
42. Ag \_\_\_\_\_
43. P \_\_\_\_\_
44. Mn \_\_\_\_\_

- 45. I \_\_\_\_\_
- 46. Au \_\_\_\_\_
- 47. Mg \_\_\_\_\_
- 48. Ni \_\_\_\_\_
- 49. Br \_\_\_\_\_
- 50. Ti \_\_\_\_\_
- 51. Be \_\_\_\_\_
- 52. W \_\_\_\_\_
- 53. Np \_\_\_\_\_
- 54. Bl \_\_\_\_\_
- 55. Es \_\_\_\_\_
- 56. Pr \_\_\_\_\_
- 57. Ho \_\_\_\_\_
- 58. Bk \_\_\_\_\_
- 59. No \_\_\_\_\_
- 60. Fm \_\_\_\_\_



Name:	Partner's Name:
Date of lab:	If absent, data obtained from:

## Lab 4.3 - Separating a Mixture

\*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.\*

Procedure	Observations
-----------	--------------

- \_\_\_\_ 1. Obtain a jar which contains a mixture of substances.
  - a. How many substances do you **think** are in the mixture ? \_\_\_\_\_
- \_\_\_\_ 2. Obtain 5 or 6 pieces of paper from your teacher.
- \_\_\_\_ 3. Sift the mixture through a screen catching the material on one piece of paper.
  - a. Describe the material(s) left on the paper: \_\_\_\_\_  
 \_\_\_\_\_
- \_\_\_\_ 4. Using tongs, remove the materials on the screen and place them on paper squares. Put all the materials which look alike on the same piece of paper.
  - a. Describe the material(s) left on the screen: \_\_\_\_\_  
 \_\_\_\_\_
- \_\_\_\_ 5. Place a bar magnet inside a plastic bag.
- \_\_\_\_ 6. Drag the plastic bag and magnet over the material which passed through the screen.
- \_\_\_\_ 7. On a separate sheet of paper, loosen the plastic bag from the magnet and let the material fall to the paper.  
**PLEASE DO NOT GET ANY MATERIAL DIRECTLY ON THE MAGNET !!!**
- \_\_\_\_ 8. Do steps 6 and 7 several times until no more material sticks to the magnet.
  - a. Describe the material which stuck to the magnet: \_\_\_\_\_  
 \_\_\_\_\_
- \_\_\_\_ 9. Examine what is left from the material which passed through the screen.
  - a. Describe the material(s) which are left: \_\_\_\_\_  
 \_\_\_\_\_

- \_\_\_\_\_ 10. Put about 100 mL of water into a 250 mL beaker.
- \_\_\_\_\_ 11. Pour the remaining material into the beaker.
- \_\_\_\_\_ 12. Stir the contents of the beaker for 2 or 3 minutes. Does it appear that anything dissolved ? \_\_\_\_\_
- \_\_\_\_\_ 13. Set up a filtering apparatus.
- \_\_\_\_\_ 14. Filter the contents of the beaker into an evaporating dish, making sure to get all of the solid material into the filter paper.
- \_\_\_\_\_ 15. When the filtering is complete, put the filter paper and its contents on a square of paper.
- a. Describe the appearance of the contents of the filter paper: \_\_\_\_\_
- \_\_\_\_\_ 16. Place the evaporating dish on a wire gauze on an iron ring stand.
- \_\_\_\_\_ 17. Slowly evaporate the liquid in the evaporating dish to dryness. Do not rush this step, you may break the evaporating dish.
- a. Describe the dry contents of the evaporating dish: \_\_\_\_\_
- \_\_\_\_\_ 18. Line up your squares of paper and your evaporating dish.
- a. How many total substances were in your mixture in the jar ? \_\_\_\_\_
- \_\_\_\_\_ 19. Walk around and examine the **amount** of each substance that other members of the class obtained. Did everyone have the same amount of each substance ? \_\_\_\_\_
- \_\_\_\_\_ 20. Put all of the substances back into the jar you were given, except the substance in the evaporating dish. Return the jar to your teacher. Wash out the evaporating dish.

## Questions

1. Step #	Appearance of Material
4.a.	
4.a.	
4.a.	
8.a.	
15.a.	
17.a.	

2. Did you initially guess the correct number of substances in your jar ? \_\_\_\_\_
3. Why were you able, or not able, to guess the correct number of substances ? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Do different samples of mixtures have the same amount of each substance in them ? \_\_\_\_\_
5. How might you separate a mixture of oil and water (be **logical and simple**) ? \_\_\_\_\_  
\_\_\_\_\_
6. If you were blindfolded, and without tasting, explain how you could separate a mixture of gumdrops, peanuts, and caramels ?  
\_\_\_\_\_  
\_\_\_\_\_
7. If you had a mixture of sugar and table salt, could you separate these by filtration ? \_\_\_\_\_  
Why, or why not ? \_\_\_\_\_  
\_\_\_\_\_
8. Read the procedure and list the methods used to separate your mixture:
- (1) \_\_\_\_\_
- (2) \_\_\_\_\_
- (3) \_\_\_\_\_
- (4) \_\_\_\_\_
- (5) \_\_\_\_\_

## Review Questions

9. What is a compound ? \_\_\_\_\_
10. How is a compound different from a mixture ? \_\_\_\_\_  
\_\_\_\_\_
11. What does elemental sulfur look like ? \_\_\_\_\_
12. What compound is formed when copper is heated gently in a burner flame ? \_\_\_\_\_
13. What is table salt's chemical name ? \_\_\_\_\_
14. What is acetic acid's common name ? \_\_\_\_\_



Name: \_\_\_\_\_

## Exercise 4-C: Chapter 4 Review

1. Name the 3 groups of substances which make up all matter in the universe :

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

2. Define element: \_\_\_\_\_

\_\_\_\_\_

3. Define mixture: \_\_\_\_\_

\_\_\_\_\_

4. Define compound: \_\_\_\_\_

\_\_\_\_\_

5. Describe the appearance of the element sulfur: \_\_\_\_\_

6. Describe the appearance of the element copper: \_\_\_\_\_

7. Copper      Sulfur      Copper sulfide      Copper oxide

Which of the above are mixtures: \_\_\_\_\_

Which of the above are elements: \_\_\_\_\_

Which of the above are compounds: \_\_\_\_\_

8. Describe the appearance of copper sulfide: \_\_\_\_\_

9. Describe the appearance of copper oxide: \_\_\_\_\_

10. How can you make copper oxide ? \_\_\_\_\_

\_\_\_\_\_

11. \_\_\_\_\_ Which of these is a mixture ?

a) salad oil

b) salt

c) sugar

d) French salad dressing

12. Write the word equation for the synthesis reaction between calcium and oxygen:

\_\_\_\_\_ + \_\_\_\_\_  $\rightarrow$  \_\_\_\_\_

13. What are the 3 common phases of matter ? \_\_\_\_\_

14. Name at least 3 methods used to separate the mixture in Lab 4.3. \_\_\_\_\_

\_\_\_\_\_

15. What material was pulled from the mixture with the magnet in Lab 4.3 ? \_\_\_\_\_

16. Matching:

_____ Vinegar	A) ammonium hydroxide
_____ Ammonia	B) sodium chloride
_____ Epsom salts	C) acetic acid
_____ Table salt	D) magnesium sulfate

17. Complete the following:

copper	+	chlorine	----->	_____
_____	+	_____	----->	hydrogen fluoride
cesium	+	_____	----->	_____ sulfide
_____	+	nitrogen	----->	lithium _____
cobalt	+	bromine	----->	_____
_____	+	_____	----->	gold phosphide
mercury	+	_____	----->	_____ iodide
_____	+	oxygen	----->	barium _____

18. Indicate the symbol for the following:

_____ calcium	_____ carbon	_____ chlorine
_____ cobalt	_____ cadmium	_____ copper
_____ californium	_____ cesium	_____ silver

19. A chemical property is concerned with the matter making up a substance and how it changes during a chemical reaction. A physical property does not involve a chemical change. Mark the properties of materials listed below with a "P" for a physical property, or a "C" for a chemical property:

_____ a) color, taste, odor	_____ b) burns in air
_____ c) liquid at room temperature	_____ d) shape, size
_____ e) destroyed by heat	_____ f) density

20. A physical change is a change in the size, shape or phase of a substance. A chemical change results in the formation of at least one new substance.

20-1) \_\_\_\_ Which of the following is a physical change ?

- |                              |  |
|------------------------------|--|
| a) ripening of a fruit       | b) water freezes to ice                        |
| c) forming of copper sulfate | d) formation of exhaust gases in an automobile |

20-2) \_\_\_\_ Which of the following is a chemical change ?

- |                             |                      |
|-----------------------------|----------------------|
| a) breaking of a glass dish | b) boiling water     |
| c) burning of a fuel        | d) stretching rubber |

21 Mark an "E" for each element listed below, or a "C" for each compound:

- |  |                          |                          |             |
|--|--------------------------|--------------------------|-------------|
| ____ a) KCl                            | ____ b) H                | ____ c) Mg               | ____ d) ZnS |
| ____ e) H <sub>2</sub> SO <sub>4</sub> | ____ f) Fe               | ____ g) HNO <sub>3</sub> | ____ h) C   |
| ____ i) Ca                             | ____ j) H <sub>2</sub> O | ____ k) CO               | ____ l) KF  |





## Questions

1. In **Part C**, you performed 2 synthesis (or direct union) reactions. A synthesis reaction is one in which you combine 2 substances to form a compound. An example of a synthesis word equation is:

lithium + chlorine  $\longrightarrow$  lithium chloride

Please notice that the last word in the name of the compound ends in "-ide".

Write the word equations for the 2 synthesis reactions you performed:

\_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  \_\_\_\_\_

\_\_\_\_\_ + \_\_\_\_\_  $\longrightarrow$  \_\_\_\_\_

3. Using complete sentences (including correct spelling and punctuation), explain how mixtures and compounds are different. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. What is an element ? \_\_\_\_\_

\_\_\_\_\_

