

Name:

Date:

Unit 1 – Properties and Classification of Matter and Energy

Chemistry I

Part I. Elements to Learn NOW!

The Internet has many Periodic Tables that provide information about elements' properties and names. Find the origin of the names of the following elements. This website provides an interactive Periodic Table that will help you with this assignment. <http://www.webelements.com/>

	Name	Symbol	Name comes from . . .
1	Hydrogen		
2	Lithium		
3	Sodium		
4	Potassium		
5	Rubidium		
6	Cesium		
7	Francium		
8	Beryllium		
9	Magnesium		
10	Calcium		
11	Strontium		
12	Barium		
13	Radium		
14	Boron		
15	Aluminum		
16	Gallium		
17	Carbon		
18	Silicon		
19	Germanium		
20	Tin		

21	Lead		
22	Nitrogen		
23	Phosphorus		
24	Arsenic		
25	Antimony		

26	Bismuth		
27	Oxygen		
28	Sulfur		
29	Selenium		
30	Fluorine		
31	Chlorine		
32	Bromine		
33	Iodine		
34	Astatine		
35	Helium		
36	Neon		
37	Argon		
38	Krypton		
39	Xenon		
40	Radon		
41	Nickel		
42	Titanium		
43	Chromium		
44	Gold		
45	Iron		
46	Cobalt		
47	Copper		

Part II. Classification of Matter

Pure Substances

1. A given compound always contains the same relative masses of its constituent elements. How is this idea related to the relative numbers of each kind of atom present?
2. Write the formula for each of the following compounds, listing the elements in the order given:
 - a. a molecule containing one phosphorus atom and three chlorine atoms
 - b. a molecule containing two boron atoms and six hydrogen atoms
 - c. a compound containing one calcium atom for every two chlorine atoms
 - d. a molecule containing one carbon atom and four bromine atoms

3. Compare Atom, Element, Molecule, Compound. Check each box that applies.

	a. N ₂	b. O ₂	c. H ₂ O	d. P ₄	e. CO ₂	f. Cu	g. NH ₃ (ammonia)
1. atom							
2. element							
3. molecule							
4. compound							

Mixtures

4. Classify the following materials as to whether it is a pure substance or a mixture. If it is a pure substance, write E (Element) or C (Compound). If it is a mixture, write H (Heterogeneous) or S (Solution, which is the same as a homogeneous mixture) in the Mixture column.

Type of Matter	Pure Substance E or C	Mixture H or S
5. soil		
6. water		
7. oxygen gas		
8. sugar water		
9. carbon dioxide		
10. air		
11. iron		
12. milk		

13. brass

14. Gatorade

15. Rubbing alcohol

5. Give three examples of heterogeneous mixtures and three examples of solutions that you might use in everyday life.

6. Describe how the process of distillation could be used to separate a solution into its component substances. Give an example.

7. Describe how the process of filtration could be used to separate a mixture into its components. Give an example.

8. In a common laboratory experiment in general chemistry, students are asked to determine the relative amounts of benzoic acid and powdered charcoal in a solid mixture. Benzoic acid is relatively soluble in hot water, but charcoal is not. Devise a method for separating the two components of this mixture.

m. Are all chemical changes accompanied by physical changes?

13. Vocabulary Review

Complete the following sentences. Each word can be used once, more than once or not at all.

chemical	solute	electrolysis	solution
energy	filtration	liquid	elements
matter	physical means	solid	homogeneous
phase	distillation		heterogenous
evaporation	gas	solvent	
physical	plasma	compounds	

- a. Mixtures are separated by _____.
- b. Separating a solid/liquid suspension such as sand from water can be done by _____.
- c. The separation technique that takes advantage of differences in boiling points is called _____.
- d. The best way to decompose water into oxygen and hydrogen is by _____.
- e. _____ is anything that has mass and volume.
- f. _____ changes alter the identity of a substance whereas _____ changes do not.
- g. The two states of matter that occupy a definite volume are _____ and _____.
- _____ and _____ are the two other states of matter.
- h. The dissolved material in a solution is the _____.
- i. _____ are substances, such as pure salt or pure sugar, that always have elements chemically combined in the same proportion.
- j. A(n) _____ is homogeneous matter composed of more than one material.
- k. Substances composed of only one kind of atom are called _____.
- l. _____ materials are those consisting of only one phase.

Part IV. Energy!

The Nature of Energy

14. Explain the difference between kinetic and potential energy.

Temperature and Heat

15. Explain the differences among heat, temperature and thermal energy.

16. Provide a molecular-level explanation of why the temperatures of a cold soft drink and hot coffee in the same room will eventually be the same.

17. In which case is more heat involved: mixing 100.0-g samples of 90°C water and 80°C water or mixing 100.0-g samples of 60°C water and 10 °C water? Assume no heat is lost to the environment.

18. If 100.0 g of water at 90°C is added to 50.0 g of water at 10 °C, estimate the final temperature of the water. Explain your reasoning.

Exothermic and Endothermic Processes

19. Are the following processes exothermic or endothermic? Explain.
- When solid KBr is dissolved in water, the solution gets colder.

 - Natural gas (CH₄) is burned in a furnace.

- c. When concentrated sulfuric acid is added to water, the solution gets very hot.
- d. Water is boiled in a tea kettle.

Part V. Challenge Problem

Crossword Puzzle: In the 2x2 box shown here, each answer must be correct four ways: horizontally, vertically, diagonally, and by itself. Instead of words, use symbols of elements. When the puzzle is complete, the four spaces will contain the overlapping symbols of 10 elements. There is only one correct solution. (Puzzle appeared in Chemical & Engineering News, p.86, December 14, 1987 and in Chem Matters, October 1988.)

1	2
3	4

Horizontal

1-2: Two-letter symbol for a metal used in ancient times

3-4: Two-letter symbol for a metal that burns in air and is found in Group 5A (Group 15)

Vertical

1-3: Two-letter symbol for a metalloid

2-4: Two-letter symbol for a metal used in U.S. coins

Single squares: All one-letter symbols

1: A colorful nonmetal

2: Colorless, gaseous nonmetal

3: An element that makes fireworks green

4: An element that has medicinal uses

Diagonal

1-4: Two-letter symbol for an element used in electronics

2-3: Two-letter symbol for a metal used with Zr to make wires for superconducting magnet

