Physical Science
Independent Learning Packet 4

Student Name: ________________________
Teacher:________________________________
Period:____________________
Classification of Matter

matter - physical material of the universe

- different compositions due to different arrangements of elements
- atoms - smallest building blocks of matter
- properties of matter change due to composition/structure of the atoms
- molecule - 2+ atoms joined in a specific shape

states of matter - gas, liquid, or solid

- gas - aka vapor, has no definite shape/volume; molecules move at high speeds, often colliding w/ each other
- liquid - definite volume, but no definite shape; molecules can slide over each other
- solid - definite shape/volume, molecules held tightly together

pure substances - has distinct properties and doesn’t vary from sample to sample

- either elements or compounds
- elements - cannot be decomposed into simpler substances
  - oxygen, silicon, aluminum, iron, calcium make up most of crust
  - oxygen, carbon, hydrogen makes up most of human body
  - similar elements grouped in the same column on the periodic table
- compounds - combination of 2+ elements
  - law of constant composition (definite proportions) - composition of a pure compound is always proportionally the same
- mixture - combination of 2+ substances; each substance keeps its characteristics
  - components - substances making up a mixture
  - homogeneous mixture (solution) - same throughout
  - heterogeneous mixture - not the same composition throughout
properties of matter - can be physical or chemical

- physical changes - can be measured w/o changing the composition of the substance (ex. odor, color, density, melting point, boiling point, hardness)
- chemical properties - describes how the substance reacts w/ other substances (ex. flammability)
- intensive property - doesn't depend on amount of substance available
- extensive property - depends on the amount of substance available
- physical change - substance retains composition but changes appearance
- chemical change - substance changes to a chemically different substance

separation of mixtures - possible by using the components' different properties

- filtration - uses a filter to separate a mixture (usually water-solid mixture)
- substances w/ lower boiling points are more volatile
- distillation - boiling a solution to isolate the more volatile substance
- chromatography - "writing of colors"; depends on ability of substances to adhere to surfaces of various solids

scientific method - guidelines for the practice of science

- starts w/ data collection
- hypothesis - temporary explanation for something; can be disproved
- scientific law - verbal/mathematical statement that summarizes lots of observations
- theory - general hypothesis that can consistently predict results

Notes from https://course-notes.org/chemistry/topic_notes/matter_and_measurement/classification_of_matter

Writing Assignment

Think about the process of cooking spaghetti from the time you boil noodles until the finished product is complete. List each process from start to finish and label each part. Indicate whether you are adding, combining, or making an element, compound, or mixture and list it below. Be specific!
**Classification of Matter**

1. For each material decide if it is a pure substance **or** a mixture.
2. Then, answer the questions for the last column.

<table>
<thead>
<tr>
<th>Material Observed</th>
<th>Is it a Pure Substance or Mixture?</th>
<th>Is it an Element, Compound, Homogeneous mixture, or Heterogeneous mixture?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td></td>
<td></td>
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<tr>
<td>Sugar + Pure Water ((C_{12}H_{22}O_{11} + H_2O))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron Filings (Fe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limestone ((CaCO_3))</td>
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<td></td>
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<tr>
<td>Orange Juice (with pulp)</td>
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<td></td>
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<tr>
<td>Helium Inside a Balloon</td>
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<td></td>
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<tr>
<td>Aluminum ((Al))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium ((Mg))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetylene ((C_2H_2))</td>
<td></td>
<td></td>
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<tr>
<td>Tap Water in a Glass</td>
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<td></td>
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<tr>
<td>Soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Water ((H_2O))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromium ((Cr))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chex Mix</td>
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<td></td>
</tr>
<tr>
<td>Salt + Pure Water ((NaCl + H_2O))</td>
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<td></td>
</tr>
<tr>
<td>Benzene ((C_6H_6))</td>
<td></td>
<td></td>
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<tr>
<td>Muddy Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brass ((Cu mixed with Zn))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baking Soda ((NaHCO_3))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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 a 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?
Physical or Chemical? Highlight/circle the best choice for each of the statements below.

1. (Physical or Chemical) properties describe matter.
2. (Physical or Chemical) properties of a substance can be easily observed.
3. One can use their five senses to determine the (Physical or Chemical) properties of a substance.
4. (Physical or Chemical) properties usually describe how a substance reacts.
5. (Physical or Chemical) properties are not as easy to observe.
6. (Physical or Chemical) properties can be used to identify substances.

**Identify if the following are chemical (C) or physical properties (P)**

7. Oxygen is odorless and colorless
8. Copper turns green when exposed to the environment
9. The piece of metal is magnetic
10. The density of water is 1.0 gram per cubic centimeter
11. Diamonds are a very hard substance
12. The tree is 8 meters high
13. Sodium reacts very easily with other elements.
14. Copper conducts electricity
15. Water is a liquid
16. The mass of the NaCl sample is 30 grams
17. Gold is nonflammable
18. Alka-Seltzer tablets react with water to produce gas
19. The color of the ball is red
20. Iron reacts with oxygen and forms rust
21. The boiling point of water is 100 degrees C
22. Baking soda reacts with vinegar
23. The gas is flammable
24. Oxygen is a gas
25. Argon is not very reactive
26. Nitrogen is a colorless gas
27. The silver spoons tarnished and turned dark
28. The piece of metal is magnetic
29. A student’s shirt suddenly bursts into flames.
30. Silver necklaces tarnish and turn green.