Elements, Compounds & Mixtures Worksheet

Part 1: Read the following information on elements, compounds and mixtures. Fill in the blanks where necessary.

Elements:
- A pure substance containing only one kind of ______ atom ______.
- An element is always uniform all the way through (homogeneous).
- An element ______ cannot ______ be separated into simpler materials (except during nuclear reactions).
- Over 100 existing elements are listed and classified on the periodic table ______.

Compounds:
- A pure substance containing two or more kinds of ______ atoms/elements ______.
- The atoms are ______ chemically ______ combined in some way. Often times (but not always) they come together to form groups of atoms called molecules.
- A compound is always homogeneous (uniform).
- Compounds ______ cannot ______ be separated by physical means. Separating a compound requires a chemical reaction.
- The properties of a compound are usually different than the properties of the elements it contains.

Mixtures:
- Two or more ______ elements ______ or ______ compounds ______ NOT chemically combined.
- No reaction between substances.
- Mixtures can be uniform (called ______ homogeneous ______) and are known as solutions.
- Mixtures can also be non-uniform (called ______ heterogeneous ______).
- Mixtures can be separated into their components by chemical or physical means.
- The properties of a mixture are similar to the properties of its components.

Part 2: Classify each of the following as elements (E), compounds (C) or Mixtures (M). Write the letter X if it is none of these.

- E Diamond (C)  C Sugar (C₆H₁₂O₆)  M Milk  E Iron (Fe)
- M Air  M Sulphuric Acid (H₂SO₄)  M Gasoline  X Electricity  M Popcorn  E Gold (Au)
- E Krypton (K)  E Bismuth (Bi)  E Uranium (U)  X A dog  M Paint of Garbage  X Pizza
- C Water (H₂O)  C Alcohol (CH₃OH)  M Pail of Garbage  M Ink  M Concrete  C Baking Soda (NaHCO₃)
Part 3: Match each diagram with its correct description. Diagrams will be used once.

[A] 1. Pure Element – only one type of atom present.
[C] 3. Pure compound – only one type of compound present.
[D] 4. Mixture of two compounds – two types of compounds present.

Part 4: Column A lists a substance. In Column B, list whether the substance is an element (E), a compound (C), a Heterogeneous Mixture (HM), or a Solution (S). (Remember a solution is a homogeneous mixture.)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gatorade</td>
<td>S</td>
</tr>
<tr>
<td>2. Steam</td>
<td>C</td>
</tr>
<tr>
<td>3. Salt Water</td>
<td>S</td>
</tr>
<tr>
<td>4. Aluminum foil (Al)</td>
<td>E</td>
</tr>
<tr>
<td>5. Dirt</td>
<td>HM</td>
</tr>
<tr>
<td>6. Pepsi</td>
<td>HM</td>
</tr>
<tr>
<td>7. Silver (Ag)</td>
<td>E</td>
</tr>
<tr>
<td>8. Mouthwash</td>
<td>S</td>
</tr>
<tr>
<td>9. A burrito</td>
<td>HM</td>
</tr>
<tr>
<td>10. Black coffee</td>
<td>S</td>
</tr>
</tbody>
</table>
Matter Practice Worksheet

1. **Classify** the following mixtures as homogeneous mixture or a heterogeneous mixture.
   a. hetero a pail of sand and water  
   b. homo air  
   c. homo human blood  
   d. hetero banana split  
   e. homo chocolate syrup  
   f. homo sea water

2. **Determine** which of the following are pure substances and which are mixtures.
   a. M salt water  
   b. PS isopropyl alcohol, C₆H₁₂O  
   c. PS mercury, Hg  
   d. PS ammonia, NH₃  
   e. M an egg yolk  
   f. M Honey

3. **Classify** each of the following as an element or a compound.
   a. C benzene, C₆H₆  
   b. E aluminum, Al  
   c. C aspirin, C₉H₈O₄  
   d. E titanium, Ti  
   e. C acetylene, C₂H₂  
   f. E zinc, Zn

4. **Compare and contrast** atoms and compounds.
   
   Atoms are **single particles that are the building blocks of matter**. Compounds are molecules made up of **two or more atoms of different elements**.
5. Explain the difference between a pure substance and a homogeneous mixture.
Pure substances are composed of a single type of particle (compound or element). Mixtures that are homogeneous have one or more pure substances (solute) dissolved in another pure substance (solvent), so the mixture contains different types of particles.

6. Explain why elements and compounds are pure substances.
Elements and compounds are pure substances because every particle in them is the same.

7. Name three methods for separating mixtures and one example of a mixture that could be separated using each technique.

a. Technique #1:

Sedimentation and Decantation

How does this technique work?
Particles separate based on density, then the layers of this heterogeneous mixture can be separated into distinct substances.

Example of mixture separated by this technique:
sand + water: sand falls and forms a sediment, pour off water.
b. Technique #2:

Filtration

How does this technique work?

Separates different particles of a heterogeneous mixture based on particle size. The filter holds back the larger particles, smaller particles pass through.

Example of mixture separated by this technique:

Fresh squeezed orange

c. Technique #3:

Distillation

How does this technique work?

Substance with lower boiling point evaporates, is recaptured as a liquid by condensation.

Example of mixture separated by this technique:

Salt water: water is evaporated, then condensed into a separate container.
Practice Problems: Conservation of Mass

1. When 10 grams of calcium are burned in oxygen, 14 grams of calcium oxide are formed. Conservation of mass says that the sum of the masses of the reactants (the substances we start with) must be the same as the sum of the masses of the products (the substances we produce). What mass of oxygen was used?

\[
\text{calcium} + \text{oxygen} \rightarrow \text{calcium oxide}
\]
\[
10g \quad + \quad ?\quad \longrightarrow \quad 14g
\]
\[
10g + x = 14g
\]
\[
x = 14g - 10g
\]
\[
x = 4g
\]

2. If 50 grams of sodium reacts with chlorine to form 126 grams of salt (sodium chloride). How many grams of chlorine reacted?

\[
\text{sodium} + \text{chlorine} \rightarrow \text{sodium chloride}
\]
\[
50g \quad + \quad ?\quad \longrightarrow \quad 126g
\]
\[
50 + x = 126
\]
\[
x = 126 - 50
\]
\[
x = 76
\]

3. When 33 g of wood was burned in air, it combined with 32 g of oxygen to form 3 g of ash and a gas mixture of carbon dioxide and water. When the gas mixture was cooled, 18 g of water condensed. How much carbon dioxide was formed?

\[
\text{wood} + \text{oxygen} \rightarrow \text{ash} + \text{CO}_2 + \text{H}_2\text{O}
\]
\[
33g \quad + \quad 32g \quad \longrightarrow \quad 3g \quad + \quad ?\quad \quad + \quad 18g
\]
\[
33 + 32 = 3 + x + 18
\]
\[
65 = x + 21
\]
\[
x = 65 - 21
\]
\[
x = 44
\]

4. When 16.0 g of methane react with chlorine, 40.5 g of methyl chloride and 36.5 g of hydrogen chloride form. How much chlorine was used?

\[
\text{methane} + \text{chlorine} \rightarrow \text{methyl chloride} + \text{hydrogen chloride}
\]
\[
16.0g \quad + \quad ?\quad \longrightarrow \quad 40.5g \quad + \quad 36.5g
\]
\[
16 + x = 40.5 + 36.5
\]
\[
x = 77 - 16
\]
\[
x = 61
\]
5. When 32.0 g of methane react with chlorine, 81.0 g of methyl chloride and 73.0 g of hydrogen chloride form. How much chlorine was used?

\[
\text{methane} + \text{chlorine} \rightarrow \text{methyl chloride} + \text{hydrogen chloride}
\]

\[
32.0 \, \text{g} + 122.0 \, \text{g} \rightarrow 81.0 \, \text{g} + 73.0 \, \text{g}
\]

\[
32.0 + x = 81.0 + 73.0
\]

\[
x = 81.0 + 73.0 - 32.0
\]

\[
x = 122.0
\]

6. If 178.8 g of water is separated into hydrogen and oxygen gas, and the hydrogen gas has a mass of 20.0 g. What is the mass of the oxygen gas produced?

\[
\text{water} \rightarrow \text{hydrogen} + \text{oxygen}
\]

\[
178.8 \rightarrow 20.0 + 158.8
\]

\[
178.8 = 20.0 + x
\]

\[
x = 178.8 - 20.0
\]

\[
x = 158.8
\]

7. From a laboratory process, a student collects 28.0 g of hydrogen and 224.0 g of oxygen. How much water was originally involved in the process?

\[
\text{H}_2\text{O} \rightarrow \text{H}_2 + \text{O}_2
\]

\[
252.0 \rightarrow 28.0 + 224.0
\]

\[
x = 28.0 + 224.0
\]

\[
x = 252.0
\]

8. A student carefully placed 23.0 g of sodium in a reactor with an excess quantity of chlorine gas. When the reaction is complete, the student obtained 58 grams of salt. How many grams of sodium reacted?

\[
\text{sodium} + \text{chlorine} \rightarrow \text{sodium chloride} \quad \text{(salt)}
\]

\[
23.0 \, \text{g} + 35.0 \, \text{g} \rightarrow 58 \, \text{g}
\]

\[
23.0 + x = 58
\]

\[
x = 58 - 23.0
\]

\[
x = 35.0
\]
9. A 10 gram sample of iron reacts with oxygen to form 18.2 grams of ferric oxide. How many grams of oxygen reacted?

\[
\text{iron} + \text{oxygen} \rightarrow \text{ferric oxide}
\]

\[
10g + \boxed{8.2g} \rightarrow 18.2g
\]

\[
10 + x = 18.2
\]

\[
x = 18.2 - 10
\]

\[
x = 8.2
\]

10. If 20 grams of aluminum reacts with 200 grams of bromide to form aluminum bromide, and no aluminum is left after the reaction, but 23 grams of bromine remained unreacted. How any grams of aluminum bromide were formed?

\[
\text{aluminum} + \text{bromine} \rightarrow \text{aluminum bromide}
\]

\[
20g + \frac{200g}{-23} \rightarrow \boxed{197g}
\]

\[
x = 20 + 177
\]

\[
x = 197
\]