Pre-lab: Alchemy: The Golden Penny

IDEAS TO KNOW: There are two important learning experiences in this exercise.

The first is to begin to grasp the difference between the terms; element, compound and mixture.

The second is to begin to grasp an application of the Law of the Conservation of Matter (& Energy)

First Goal:

Consider these metaphors:

Elements are like the letters of the alphabet. They can not be broken down into simpler elements.

A Compound is a discrete chemical union of elements, in a distinct, unique ratio, like a word.

Compounds can be chemically decomposed back to their elements, or simpler compounds.

A Mixture is like a sentence but instead of being a combination of words and/or letters,

a mixture is made of physically combined elements and compounds, in just about any

ratio.

When it comes to compounds, their "letters" (the elements) occur in specific ratios. For instance, think about the word "Google" (or maybe, g2o2le). The ratio between the letters is really important. Change a letter and change the word ... like Google to goggle (or g3ole)

Mixtures though are loose combinations of compounds or elements and the number of these materials can be changed fairly easily. For instance: I find the use of Google to be very helpful

I find the use of Google to be very, *very* helpful

Second Goal:

Matter cannot just be made or lost due to chemical reactions. *[Note: this does not apply to nuclear reactions, in which mass may be converted into energy & energy into mass]*

What ever matter you put into a chemical system, you must be able to account for, or rather ... get out ....

For instance, you cannot clean something, without something else becoming dirty! Think about that...

Chemically speaking if you were to react completely, 4 grams of hydrogen gas and 32 grams of oxygen gas, you would produce 36 grams of water. You can't produce iron, or carbon etc... because, you didn't put any iron or carbon into the reaction... so you can't get any out....

2 H2 + O2 → 2H2O

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

ON METALLIC ALLOYS

Most of the metallic items used in your life are alloys. An alloy is a ***mixture*** (a solution) of two or more elements, of which at least 1 element is a metal (often two or more are metals).1,2

In the simplest scenario, the constituent elements are melted together and allowed to cool. Often they are combined in varying amounts to give different qualities, hence alloys are mixtures.

Metallic alloys have advantages over the pure metals. One metal of an alloy may offer shine, while another offers resistance to corrosion.1 One part of an alloy may offer strength while a second may deliver superior malleability or help to decrease the overall density.1

In this lab, you will make brass by combining zinc and copper. A thin layer of zinc will be layered on a copper penny. The two metals will be heated in a burner flame to make brass.

A really good brass alloy is 67% Cu and 33% Zn. Since the copper is in the greater quantity, it is said to be the **solvent**, while the zinc is the **solute.**1,2

Deposited zinc layer

Copper Penny substrate

Brass Alloy {

Zn & Cu metals melted with each other

A list of other alloys may include:

**Examples Of Metallic Alloys**1,2

|  |  |  |
| --- | --- | --- |
| Alloy | Composition by Mass  **Because alloys are mixtures, we can vary the “recipe” for them, and produce varying qualities of the alloy … some are superior to other combinations.** | Uses |
| Yellow Brass | 70% to 85% **Cu**  15% to 30% **Zn** | hardware, plumbing |
| Stainless Steel | 65% to 85% **Fe**  0.1% to 1% **C**  12% to 20% **Cr**  2% to 15% **Ni**  1% to 2% **Mn**  0.5% to 1% **Si** | table utensils, cookware, razor blades,  construction materials |
| Sterling Silver | 92.5% **Ag**  7.5 % **Cu** | tableware, jewelry |
| Wood’s Metal | 50% **Bi**  25% **Pb**  12.5% **Sn**  12.5% **Cd** | fuses, automatic sprinklers |
| Gold (Yellow 18K) | 75% **Au**  10% to 20% **Ag**  5% to 15% **Cu** | jewelry, electronic equipment |
| Gold (White 18K)  (European) | 75% **Au**  4% **Ag**  4% **Cu**  17% **Pd** or Ni (in the USA) | jewelry |

Citations:

1. Brown, LeMay & Bursten, Chemistry The Central Science 6th ed., Prentice Hall 1994 p.905
2. Ryaner-Canham & Overton, Descriptive Inorganic Chemistry WH Freeman 2006 p 88