***Investigation 1: What is the Unknown Metal?***

***Set B***

*A metal scrap yard wants to recycle metals but needs to know the identity of the metal before sending it for recycling. In this investigation you will determine a way to identify unknown metals using intensive properties. Density is an example of an intensive property that can be used to identify different metals.*

*In this investigation, you will determine the identity of two unknown metal samples by calculating the density of each sample.*

**A group of students recorded the following information during the course of this investigation:**

**Lab Notes**

Investigation Name: \_\_What is the Unknown Metal?\_\_\_\_ Date: 05/03/2016

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

**Proposal**

We were given two unknown metals to identify. We decided to use density which is an intensive property to identify the different metals. *An intensive property is one that does not depend on the amount of material present. Density is defined as mass divided by volume (D=m/V).*

*We will first determine the mass by weighing each sample of the unknown metals. We will also determine their Volume by measuring the amount of water displaced when each unknown metal is completely submerged in water.*

**Data**

List of the materials we used for this investigation:

-We were assigned **Set B**: **Unknown II** & **Unknown IV**

-An electronic balance

-100mL graduated cylinder

-Water

Each metal was observed and described, then the weight of each cylinder was taken and recorded on Table 1. Three trial were performed.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Unknown I |  | Unknown IV |
| Description | Reddish-orange, heavy weight metal |  | Metallic brownish, heavy weight metal |

Table 1: Unknowns Metals

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Unknown II |  | Unknown IV |
| Trial 1 | Mass (g) | 244.558 |  | 234.782 |
| Trial 2 | Mass (g) | 244.675 |  | 234.941 |
| Trial 3 | Mass (g) | 244.515 |  | 234.325 | |

We filled a graduated cylinder with 20mL of water, then we submerged the Unknown II completely and we recorded the new volume. This procedure was repeated for the other unknown. At the end the difference in volume was calculated. This was repeated two more times and the data was recorded.

Table 2: Volume Displacement

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Unknown II | |  |  | Unknown IV | |  |
|  | Trial 1 | Trial 2 | Trial 3 |  | Trial 1 | Trial 2 | Trial 3 |
| Initial Volume (mL) | 20.00 | 20.00 | 20.00 |  | 20.00 | 20.00 | 20.00 |
| Final Volume (mL) | 47.11 | 46.26 | 46.40 |  | 50.07 | 50.63 | 49.51 |
| Vol Difference (mL) | 27.11 | 26.26 | 26.40 |  | 30.07 | 30.63 | 29.51 |

**Calculations**

We calculated the average mass for each of the unknowns

Unknown II: (244.558g + 244.675g + 244.515g)/ 3 = **244.583g**

Unknown IV: (234.782g + 234.941g + 234.325g) /3 = **234.6839**

We calculated the average volume for each of the unknowns

Unknown II: (27.11mL + 26.26mL + 26.40mL)/ 3 = **26.59mL**

Unknown IV: (30.07mL + 30.63mL + 29.51mL)/ 3 = **30.07mL**

We calculated the density for each unknown

Unknown II: 244.583g / 26.59 mL = **9.198 g/mL**

Unknown IV: 234.683g / 30.07 mL = **7.804 g/mL**

**Results**

We compared our calculated densities to the densities of various metals and alloys found in appendix J

The calculated density of **Unknown II** is similar to the density of copper, 9.02 g/mL.

The calculated density of **Unknown IV** is similar to the density of bronze, 7.80 g/mL.

**APPENDIX J: DENSITIES OF VARIOUS METALS**

