**Title: Quality Control of Aluminum Foil**

Imagine that you are a quality assurance manager at a metals manufacturing company. Three new types of aluminum foil have been developed to be marketed and sold to different consumers at different costs. Your job is to rank these foils according to thickness, and calculate the thickness and number of moles in each sample of foil.



**Purpose**: To use measurements, tabulated data, and calculations to determine and rank three foils according to their relative thickness.

**Materials / Equipment**: Three brands of foil, ruler, balance, scissors, and periodic table.

**Procedure:** Obtain one sheet each of three different kinds of aluminum foil, each 10” x 14.” Use a ruler to find the exact length, width and area of each sheet of paper. Record these values on table below. Next, find the mass of each sheet of foil on a balance. Convert this number into moles using the molar mass of aluminum, 26.98 g/mol.

**Data**: Collect and analyze appropriate data table, which includes both raw and derived data.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample** | **Length** | **Width** | **Area**  **(L x W)** | **Mass (g)** | **Moles** |
| A |  |  |  |  |  |
| B |  |  |  |  |  |
| C |  |  |  |  |  |

**Graph**: Plot Mass vs. Area using the Vernier Logger Pro Application. Use solid graphing techniques, being careful to follow all the guidelines for a good graph that were taught in unit one. Use a linear fit for the data plotted.

**Calculations**: Determine the thickness of each foil sample. The laboratory tools normally available to us are not suitable for the direct measurement of the thickness of a sheet of aluminum. Instead, use some familiar measurement techniques and formulae to find the thickness indirectly. The volume of a regular object is found with the following formula:

Volume (V) = Length (L) X Width (W) X Height (H)

For a rectangular-shaped piece of foil, the formula could be revised to read:

Volume (V) = Length (L) X Width (W) X Thickness (T)

Since length times width gives area, the formula could become:

Volume (V) = Area (A) X Thickness (T)

Since this experiment is all about measuring the thickness of aluminum foil, we can isolate for thickness by transforming the equation as follows:

Thickness (T) = Volume (V) / Area (A)

Density may be used in order to find the volume of the aluminum foil. Since density is mass divided by volume, we can isolate volume as mass divided by density. Using this relationship, we can substitute in the previous equation, giving us:

Thickness (T) = Mass (m) / Density (D) / Area (A)

What information does the slope of the line from your graph tell you? What is the relationship between mass and area?

**Conclusions:**

1. What foil sample had the greatest number of moles of aluminum contained in it?
2. How the thickness of foil vary from piece to piece?
3. If you had to choose one of the foils to purchase for use at home, which one would you choose and why?