# Estimating Avogadro’s Number

Student Name

Date

## Data

Data Table 1

|  | **Trial 1** | **Trial 2** |
| --- | --- | --- |
| **Length of Thread Used**  *Note: Measure after the loop is made. This will be the circumference of the circle.* |  |  |
| **Radius of Loop**  *Circumference = 2π r*  *π = 3.14* |  |  |
| **Area of Loop**  *Area = π r2* |  |  |
| **Initial Volume of Stearic Acid Solution in Syringe [mL]** |  |  |
| **Final Volume of Stearic Acid Solution in Syringe [mL]** |  |  |
| **Volume of Stearic Acid Dispensed [mL]** |  |  |
| **Concentration of Stearic Acid in Hexane** | **0.0001g/mL** | **0.0001g/mL** |
| **Mass of Stearic Acid**  *Mass = concentration × volume* |  |  |
| **Moles of Stearic Acid**  *Moles = mass / mol weight*  *Mol Weight = 284.5 g / mol* |  |  |
| **Area of Stearic Acid**  Area of Stearic Acid = Area of Loop |  |  |
| **Area of One Stearic Acid** | **20.7 x 10-16 cm2** | **20.7 x 10-16 cm2** |
| **Number of Stearic Acid Molecules**  Area of Stearic Acid / Area of One Stearic Acid Molecule |  |  |
| **Avogadro’s Number**  Number of Stearic Acid Molecules / Moles of Stearic Acid |  |  |

1. Describe the appearance of the monolayer and the thread, as the first drops of stearic acid were added to the water.
2. Describe the appearance of the monolayer and thread as the last drops of stearic acid were added to the water.
3. If some the hexane had evaporated from the stearic acid solution, what effect (if any) would it have on the experimental value of Avogadro’s number? Why?
4. What assumptions are made in the stearic acid experiment to calculate the value of Avogadro’s number?
5. What is the percent error for your experimental determination of Avogadro’s number?

## Data Table 2

|  | **Trial** |
| --- | --- |
| **Length of Aluminum Foil** |  |
| **Width of Aluminum Foil** |  |
| **Area of Aluminum Foil** |  |
| **Mass of Aluminum Foil** |  |
| **Density of Aluminum** | **2.70 g/cm3** |
| **Atomic Mass of Aluminum** | **26.98 g/mol** |
| **Atomic Radius of Aluminum** | **143pm**  (picometer = 10-12 meters) |
| **Number of Layers of Aluminum Atoms** |  |
| **Number of Aluminum Atoms** |  |
| **Avogadro’s Number**  Number of Aluminum Atoms / Moles of Aluminum |  |

**Determination of Avogadro’s Number Using Aluminum Foil**

Write out a step-by-step procedure for determining Avogadro’s number using the provided data:

1. Determine the volume of the aluminum foils using the density of foil.
2. Determine the volume of one atom of aluminum.
3. Determine the number of atoms of aluminum in the foil sample.
4. Determine the moles of aluminum.
5. Calculate Avogadro’s number.

### Layers Calculation

1. Determine the thickness of the aluminum foil.
2. If aluminum atoms are stacked on top of each other and one aluminum atom has a diameter of 286 pm or 2.86 × 10-8 cm, and calculate how many layers are in the foil.

### Aluminum Foil

1. Based on your data, what value for Avogadro’s number was calculated?
2. What is the percent error for your experimental determination of Avogadro’s number?
3. Determine the number of layers of atoms, assuming each aluminum atom is stacked on top of one another and are touching from the data above.