Investigating Aluminum Foil

SCH3U

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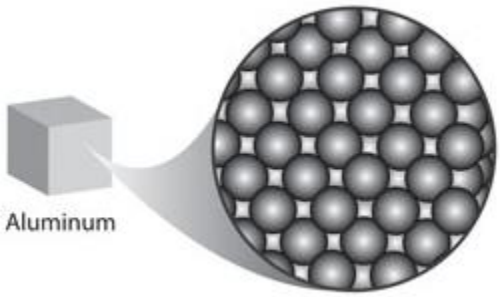


Investigating Aluminum Foil

1. **Purpose:**
   1.1. To determine the thickness of one sheet of aluminum foil in centimetres.
   1.2. To determine the thickness of one sheet of aluminum foil in terms of number of atoms of aluminum.

Background Properties of Aluminum

Symbol Al

Atomic Number 13 **What does this mean?**

This number represents how many protons are in the atom.

Mass Number 27 **What does this mean?**

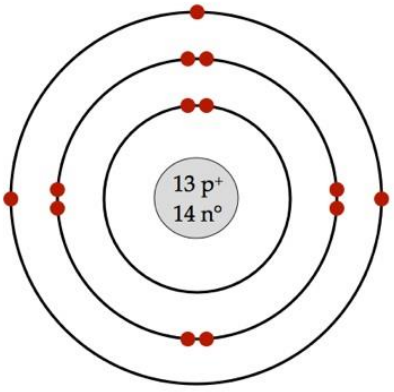
This number is the sum of protons and neutrons.

Atomic Mass 26.98amu **What does this mean?**

This number represents the sum of the individual particle masses in an atom.

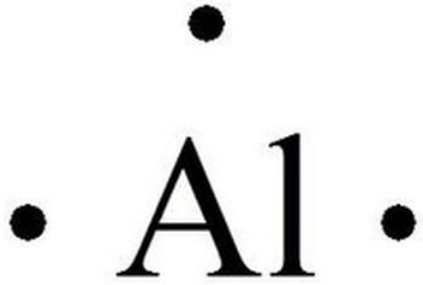
Number of electrons in a neutral atom of aluminum? 13

Bohr-Rutherford Diagram:



Aluminum

Lewis Dot Diagram:



How many electrons must an atom of aluminum gain or lose in order to form a stable ion? Explain why?

It must lose three electrons to become stable, because to be stable it must have no valence electrons.

What would be the charge of this ion? Explain why?

It will have a charge of $^{3+}$, because there will be three more protons than electrons.

Is aluminum a metal or non-metal? Metal

Density 2.70g/cm^3 **Colour** Silver

Malleable yes **Ductile** yes

Atomic Radius 1.82Å **Melting Point** 933.5 K (660.32^o C)

2. Materials List:

- Sheet of Aluminum foil
- Ruler
- Electronic scale

3. Diagram of Apparatus:

Not needed in this experiment.

4. Procedure:

1. Get your piece of aluminum foil, making sure to get the lines as straight and smooth as possible.
2. Measure the length and width of your piece of aluminum and record this information in your observation chart.
3. Using an electronic scale, measure the weight of your piece of aluminum.
4. Look to the periodic table to find the density and atomic radius of aluminum.
5. Use the equation V = D x M to find the volume of the aluminum. Then use the equation A = L x W to find the area. After you have done both of those, use the equation T = V ÷ A to find the thickness in centimeters.
6. Now, use the equation D = r x 2 to find the diameter of one aluminum atom. Then convert your answer in Å to cm. After that use the equation # Atoms = T (thickness in cm) x D (diameter of aluminum atom) to find the thickness of a sheet in atoms.

5. Observations:

Mass of Sheet	1.965g
Length	30.3cm
Width	15.6cm
Density	$2.70 g/cm^3$

6. Calculations:

Calculations for thickness in cm.

$V = D \times M$ $\quad$ $A = L \times W$ $\quad$ $T = V \div A$

$V = 2.70 g/cm^3 \times 1.965 g$ $\quad$ $A = 30.3 cm \times 15.6 cm$ $\quad$ $T = 5.31 cm^3 \div 472.68 cm^2$

$V = 5.31 cm^3$ $\quad$ $A = 472.68 cm^2$ $\quad$ $T = 0.01122535 cm$

Calculations for thickness in atoms.

$D = r \times 2$ $\quad$ $3.64 Å = 3.64 \times 10^{-8}$ $\quad$ $\#\ atoms = 0.01122535 \div 3.64 \times 10^{-8}$

$D = 1.82 Å \times 2$ $\quad$ $\#\ atoms = 308{,}388.7363$

$D = 3.64 Å$

7. Conclusions:

1. I conclude that the thickness of a piece of aluminum foil in centimeters is 0.0112cm.
2. I conclude that the thickness of a piece of aluminum foil in atoms is roughly 308,389 atoms.

8. Discussion:

The results most likely aren't terribly accurate. They're somewhere in the right ballpark but a lot of things, such as the rigidness of the edges of our piece and human error while measuring, could have thrown our results off by a bit. Another thing that we struggled with a bit was getting an accurate reading when it came to the mass of our aluminum. The scale was so sensitive that even breathing on it altered the number, and it never really stayed at one. To try to make it more accurate we could take extra care to cut the edges so they were straight and all met at perfect 90^o angles. We could have also been more careful when measuring the mass.