# Science Fair

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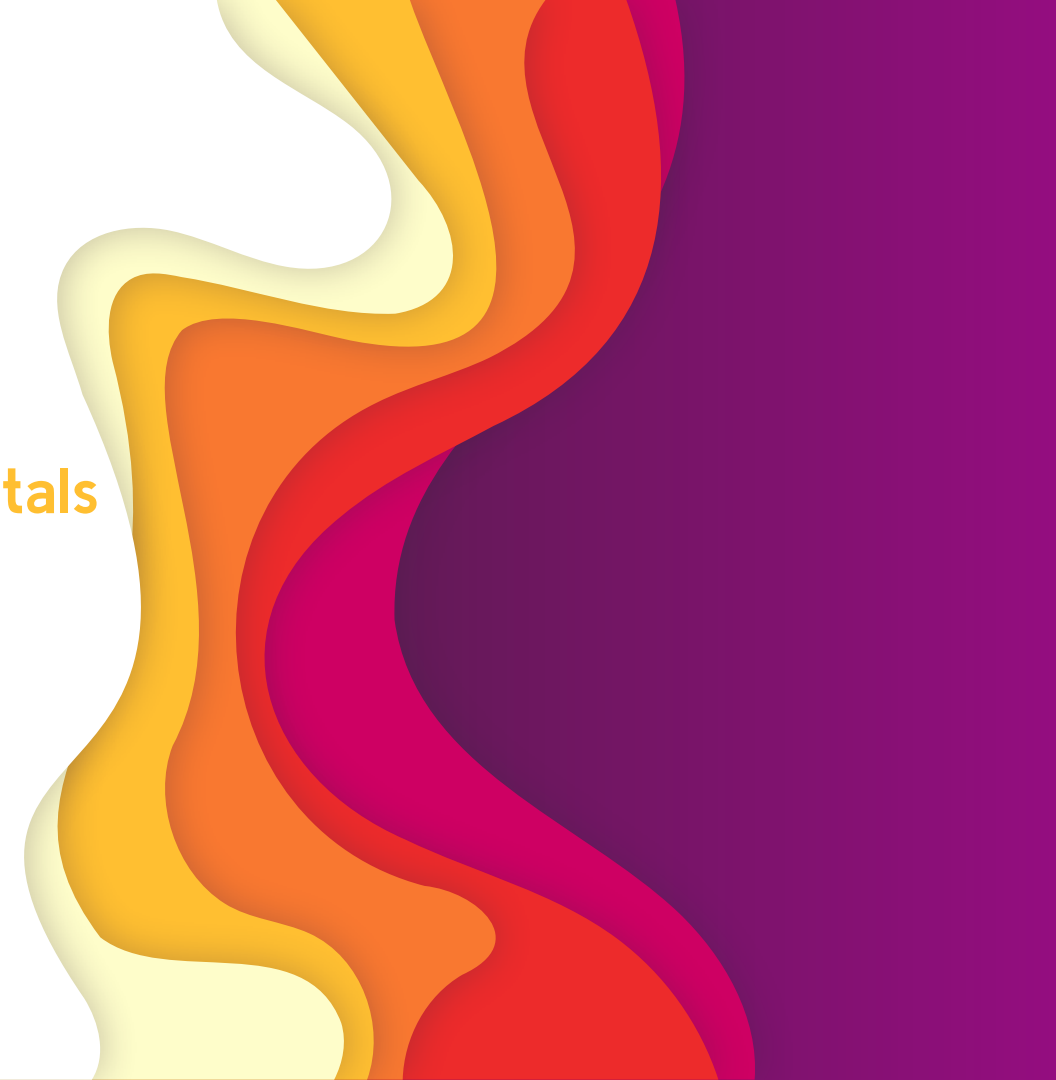


# What metals are most resistant to chemical attacks?

# Meet the Metals

Aluminum: Lightweight and easy to work with, a common metal

Cobalt: Alloys with cobalt make some of the hardest drill bits

Copper: Practically in every wire made

Nickel: One of the easiest metals to cast

Rhenium: Used in turbine blades, it has the highest boiling point of any metal.

Scandium: Used in high-end bike frames and baseball bats

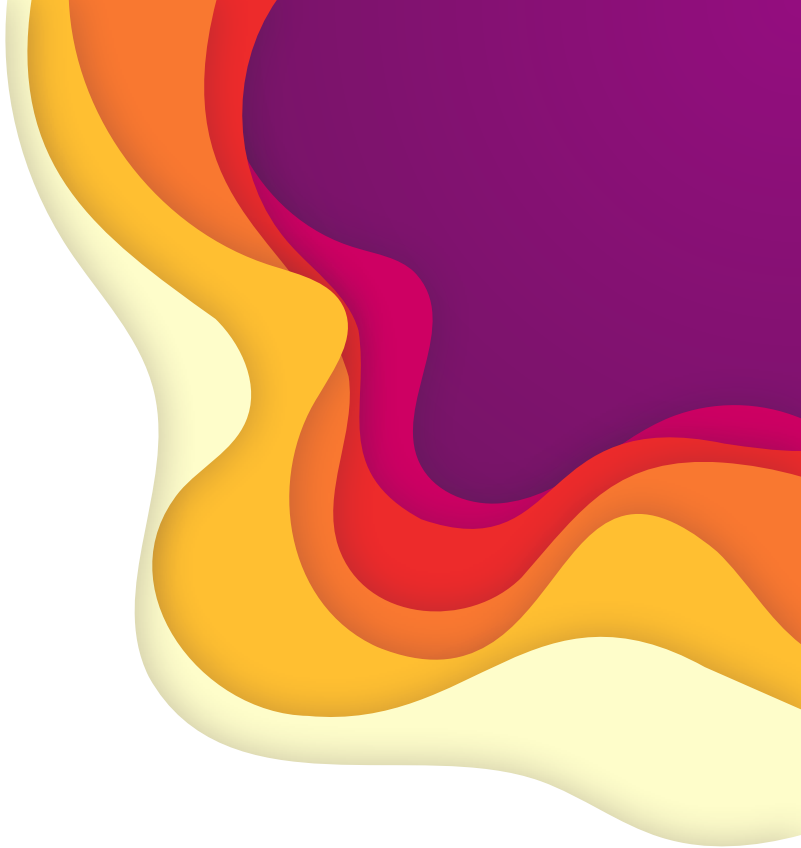
Silicon: Well, it's not actually a metal. It's a metalloid which means it has similar traits to a metal. But it's used as a semiconductor in computer chips
Iron: This metal is basically the base material of most alloys
Titanium: The "Name brand" of metal.
Tungsten: Incredibly hard to break, extremely dense, and has the highest melting point of all the metals.
Zinc: Very cheap to get.
Silver: Very resistant to chemical attacks, It's the most conductive of metals.
Magnesium: Flammable and reactive, used in some photo flashes

# Procedures

- **Materials:** Vinegar (5% acetic acid), Aluminum, Cobalt, Copper, Iron, Nickel, Rhenium, Scandium, Silicon, Titanium, Tungsten, Zinc, Silver, Magnesium
- **Methods:** Step 1: Pour 50 milliliters of vinegar in a cup. Step 2: Record mass of metal. Step 3: Put metal in acid, wait 30 minutes before taking it out. Step 4: Record new mass of metal. Repeat all of these 3 times for each metal

# Safety

- Wear safety goggles
- Wash hands after touching chemicals
- Wear closed-toe shoes



# Hypothesis

I think that Aluminum will do the worst because of its reactive nature.

I think that Silicon will do the best because if it is used in computers then it should have resistance

# Data

| Metal | Initial Mass (g) | Mass after trial 1 (g) | Mass after trial 2 (g) | Mass after trial 3 (g) | Total Change in Mass (g) | Moles Reacted | Atoms Reacted |
|---|---|---|---|---|---|---|---|
| aluminum | 6.31 | 6.3 | 6.29 | 6.29 | 0.02 | 0.000741 | 4.46E+20 |
| cobalt | 6.22 | 6.22 | 6.22 | 6.22 | 0 | 0.000000 | 0 |
| copper | 11.30 | 11.3 | 11.3 | 11.3 | 0 | 0.000000 | 0 |
| nickel | 6.65 | 6.65 | 6.61 | 6.6 | 0.05 | 0.000852 | 5.13E+20 |
| rhenium | 6.16 | 6.16 | 6.16 | 6.16 | 0 | 0.000000 | 0 |
| scandium | 0.98 | 0.98 | 0.98 | 0.98 | 0 | 0.000000 | 0 |
| silicon | 7.12 | 7.09 | 7.09 | 7.09 | 0.03 | 0.001068 | 6.43E+20 |
| iron | 6.69 | 6.66 | 6.65 | 6. 64 | 0.05 | 0.000895 | 5.39E+20 |
| titanium | 6.13 | 6.11 | 6.11 | 6.11 | 0.02 | 0.000418 | 2.52E+20 |
| tungsten | 10.7 | 10.67 | 10.65 | 10.62 | 0.08 | 0.000436 | 2.63E+20 |
| zinc | 6.45 | 6.44 | 6.44 | 6.44 | 0.01 | 0.000153 | 9.21E+19 |
| magnesium | 0.695 | 0.18 | 0.36 | 5.37 | 1.005 | 0.041350 | 2.49E+22 |
| silver | 31.15 | 31.14 | 31.13 | 31.13 | 0.02 | 0.000185 | 1.12E+20 |

# Atoms reacted

Aluminum=4.4638209*10^20
Cobalt=0 (compared to other data results)
Copper=0 (compared to other data results)
Nickel=5.1302036*10^20
Rhenium=0 (compared to other data results)
Scandium=0 (compared to other data results)
Silicon=6.4327657*10^20
Iron=5.3918353*10^20
Titanium=2.5161973*10^20
Tungsten=2.6254565*10^20
Zinc=9.2109831*10^19
Magnesium=2.4901044*10^22
Silver=1.116555*10^20

# Conclusion

Dear inventors, if you want to make your product chemical resistant, make it out of Copper or Cobalt, and if you want it to be fancy, Scandium or Rhenium.

Finding out some of these results was honestly kind of crazy. I never thought Aluminum would survive so much. (Most likely due to a reaction with the air forming Aluminum oxide.) Silicon took a big hit in trial 1, and even Silver, lost mass in trial 1 and 2. That's how I learned that coins are an inaccurate source. This was an amazing experience (especially watching the magnesium bubble like a jacuzzi.)

# Sources

Dynamic Periodic table

The Elements by Theodore Gray

Google Calculator

Avogadros number; Google search

Luciteria (Site where chemicals were purchased)