

# H

## HYDROGEN

THE LIGHTEST ELEMENT

MASS

1.008

ELECTRONS

 $1s^1$ 

BOILS

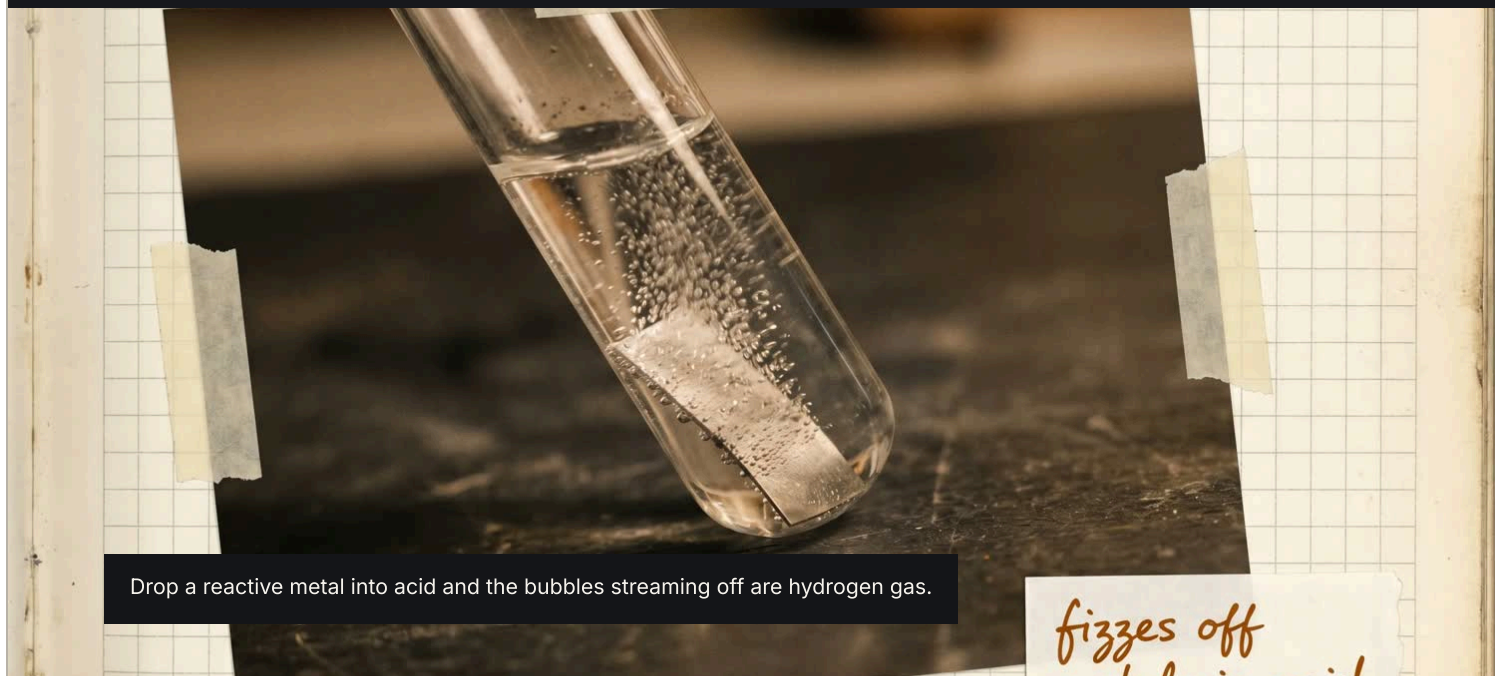
 $-253\text{ }^\circ\text{C}$ 

CHARGE

 $-1, +1$ 

DANGER

2/5 Caution



Drop a reactive metal into acid and the bubbles streaming off are hydrogen gas.

fizzes off



# He

## HELIUM

SECOND-MOST-ABUNDANT ELEMENT IN THE UNIVERSE

MASS

4.0026

ELECTRONS

1s<sup>2</sup>

BOILS

-269 °C

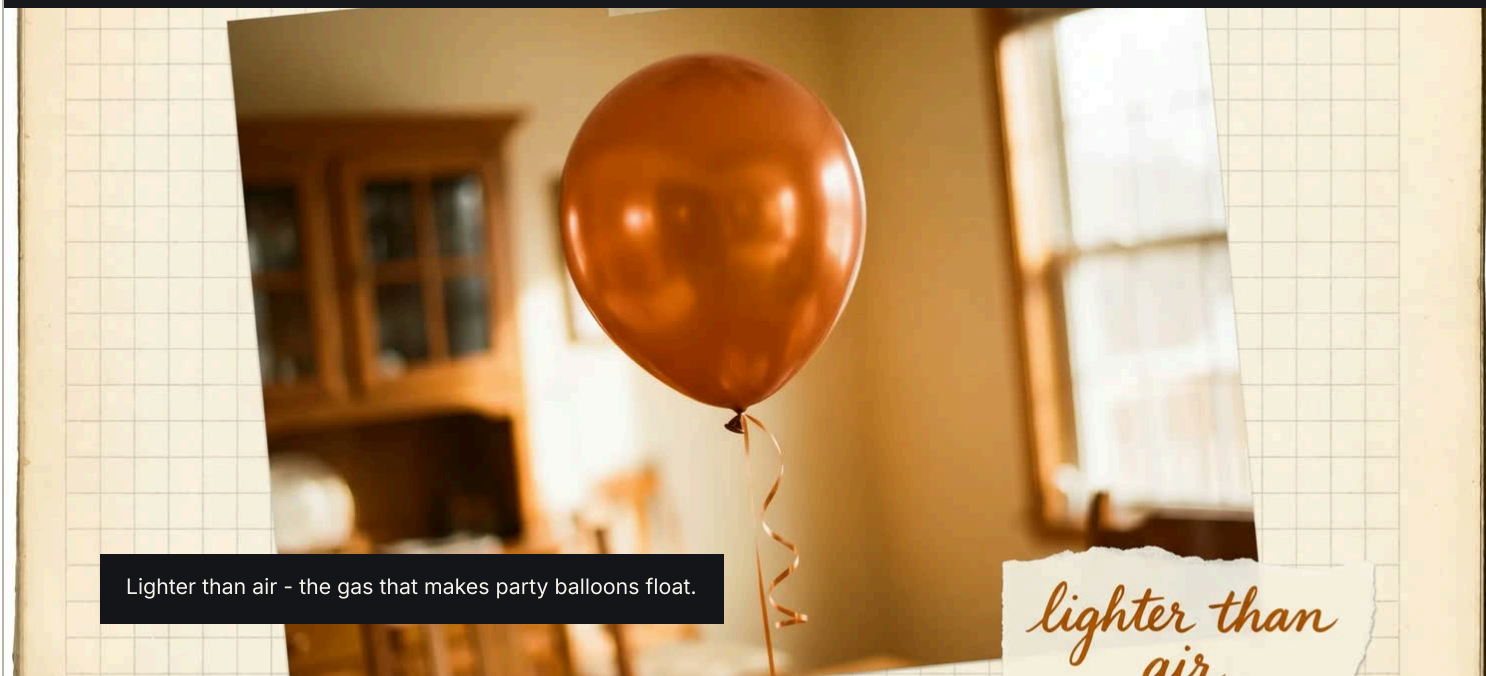
CHARGE

0



DANGER

2/5 Caution



Lighter than air - the gas that makes party balloons float.

*lighter than  
air*



# Li

## LITHIUM

LIGHTEST METAL

MASS

6.94

ELECTRONS

[He] 2s<sup>1</sup>

BOILS

1330 °C

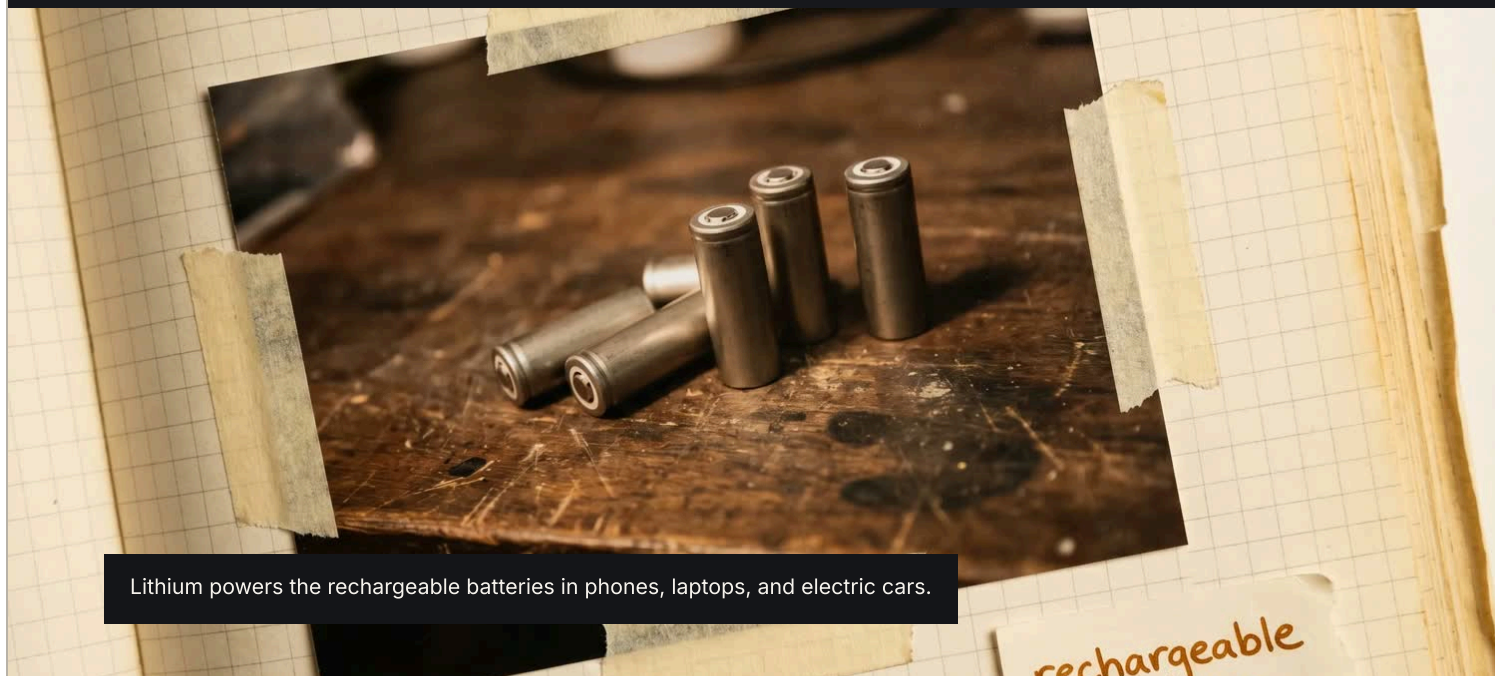
CHARGE

+1



DANGER

3/5 Hazardous



Lithium powers the rechargeable batteries in phones, laptops, and electric cars.



# Be

## BERYLLIUM

USED IN ALLOYS FOR SPACECRAFT AND IN THE WINDOWS OF X-RAY TUBES

MASS

9.0122

ELECTRONS

[He] 2s<sup>2</sup>

BOILS

2469 °C

CHARGE

+2

DANGER



4/5 Severe

Beryllium is so light and stiff it is used for space telescope mirrors and aerospace parts.



# B

## BORON

IN EVERY BOROSILICATE GLASS BEAKER (PYREX)

MASS

10.81

ELECTRONS

 $[\text{He}] 2s^2 2p^1$ 

BOILS


3927 °C

CHARGE

+3

DANGER

0/5 Safe to handle



Boron makes borosilicate glass that resists heat and sudden temperature changes.



heat resistant

# C

## CARBON

### THE BACKBONE OF EVERY ORGANIC MOLECULE

MASS

12.011

ELECTRONS

 $[\text{He}] 2s^2 2p^2$ 

BOILS

3825 °C

CHARGE

-4, +2, +4



DANGER

1/5 Low risk



A pencil's "lead" is really graphite - pure carbon sliding off in thin layers.

*pencil. "lead"*



# N

## NITROGEN

78% OF THE AIR YOU ARE BREATHING RIGHT NOW IS N<sub>2</sub>

MASS  
14.007

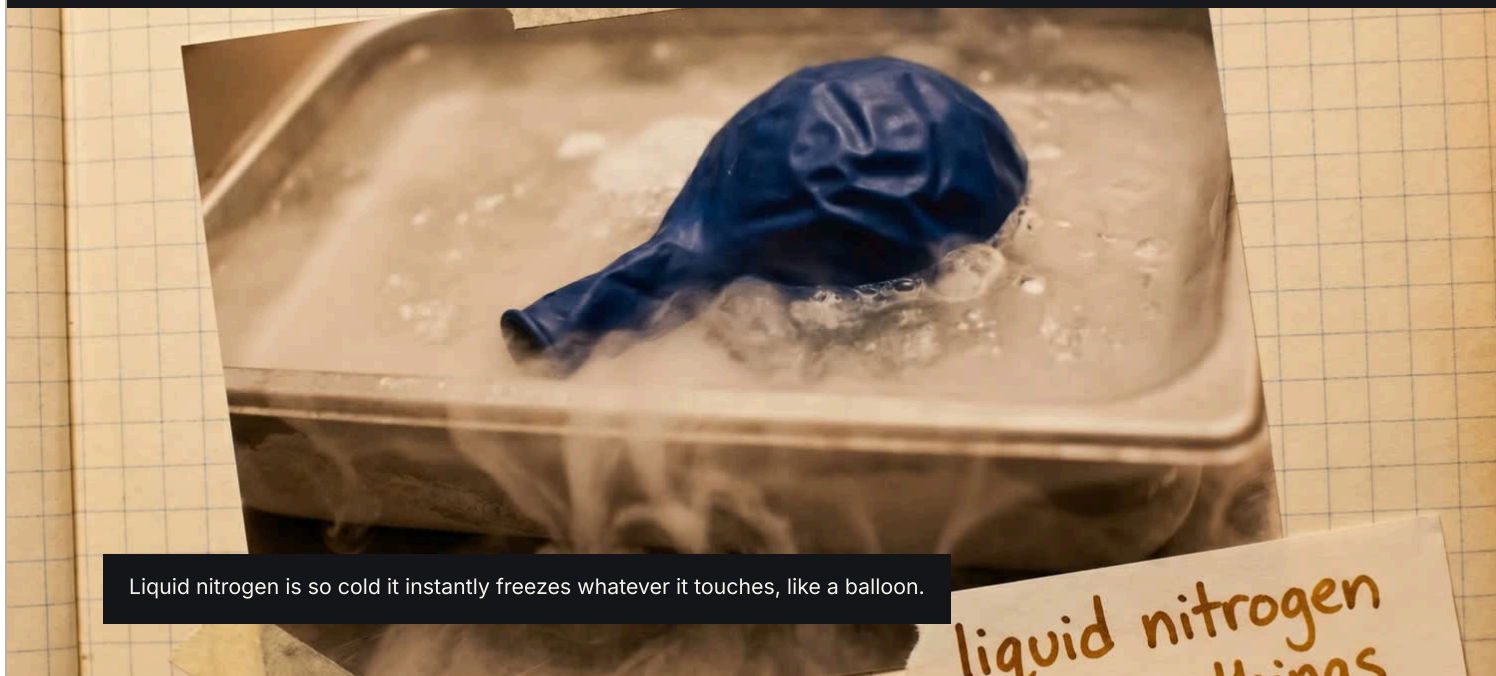
ELECTRONS  
[He] 2s<sup>2</sup> 2p<sup>3</sup>

BOILS  
-196 °C

CHARGE  
-3, +3, +5



DANGER  
1/5 Low risk



Liquid nitrogen is so cold it instantly freezes whatever it touches, like a balloon.



0

## OXYGEN

21% OF THE AIR

MASS

15.999

ELECTRONS

 $[\text{He}] 2s^2 2p^4$ 

BOILS

 $-183\text{ }^\circ\text{C}$ 

CHARGE

 $-2, -1$ 

DANGER

2/5 Caution



Oxygen feeds fire: a glowing splint bursts back into flame in an oxygen-rich jar.

reignites a



# F

## FLUORINE

THE MOST ELECTRONEGATIVE ELEMENT

MASS

18.998

ELECTRONS

 $[\text{He}] 2s^2 2p^5$ 

BOILS

 $-188\text{ }^\circ\text{C}$ 

CHARGE

-1



DANGER

5/5 Extreme

Fluorine compounds give non-stick pans their slick PTFE coating.



# Ne

## NEON

### INERT

MASS

20.18

ELECTRONS

 $[\text{He}] 2s^2 2p^6$ 

BOILS

 $-246\text{ }^\circ\text{C}$ 

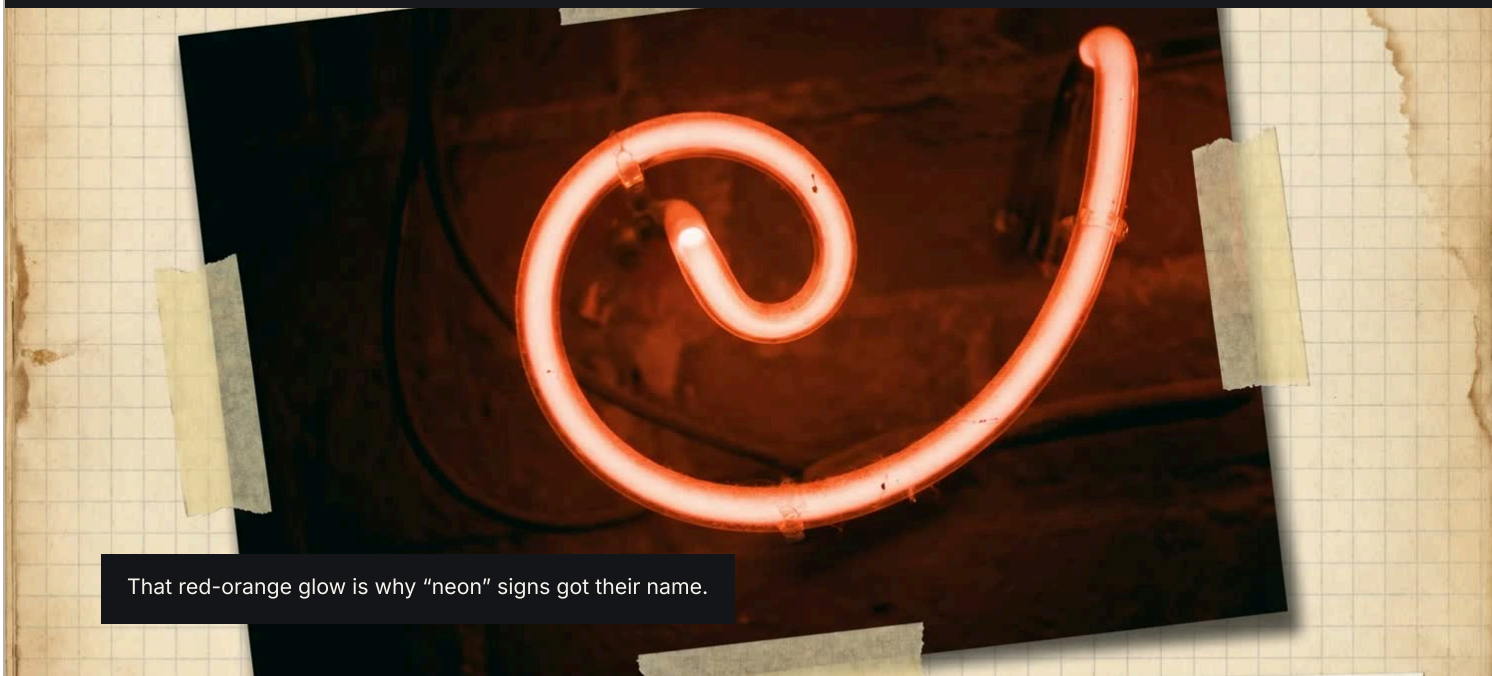
CHARGE

0



DANGER

1/5 Low risk



That red-orange glow is why "neon" signs got their name.



# Na

## SODIUM

SOFT, SILVER, AND EXPLOSIVE IN WATER

MASS

22.99

ELECTRONS

[Ne] 3s<sup>1</sup>

BOILS

883 °C

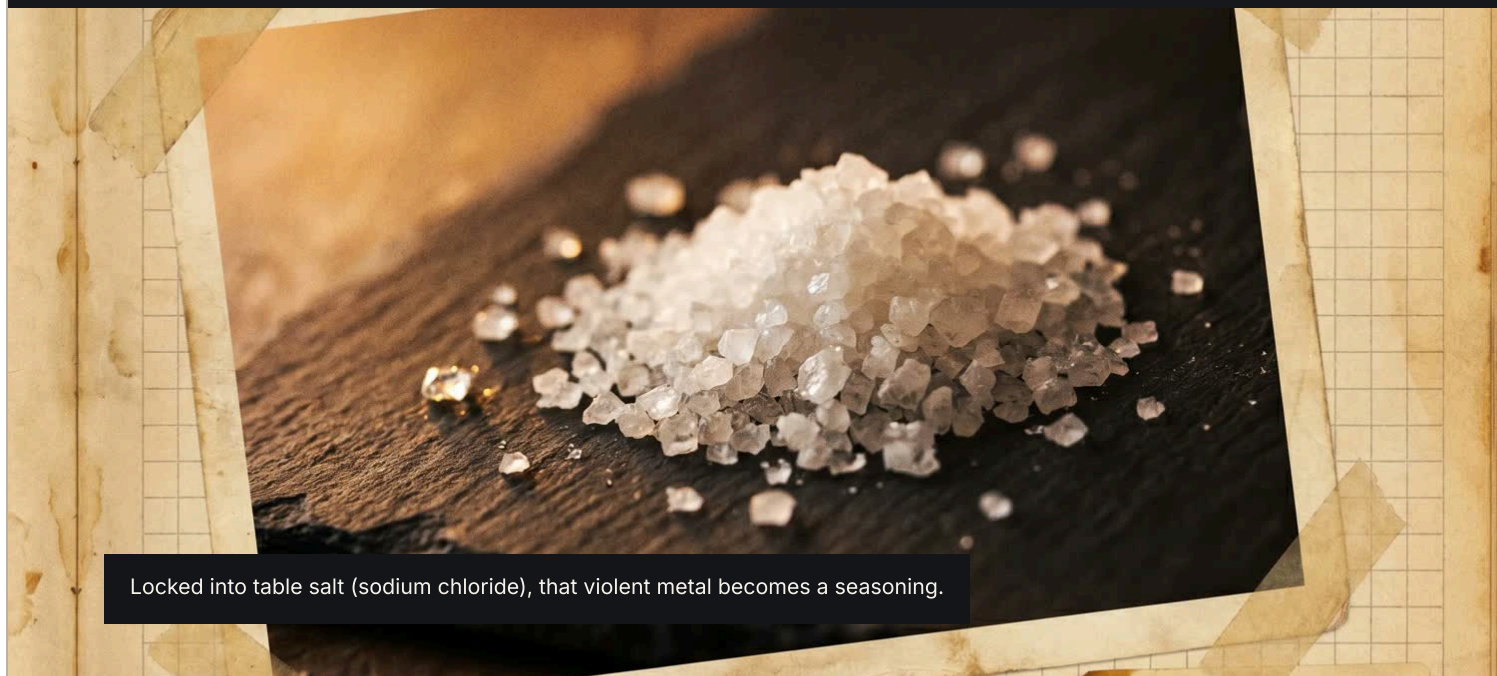
CHARGE

+1



DANGER

3/5 Hazardous



Locked into table salt (sodium chloride), that violent metal becomes a seasoning.



# Mg

## MAGNESIUM

BURNS WITH A BRILLIANT WHITE FLAME - OLD CAMERA FLASHES AND MODERN FLARES

MASS  
24.305

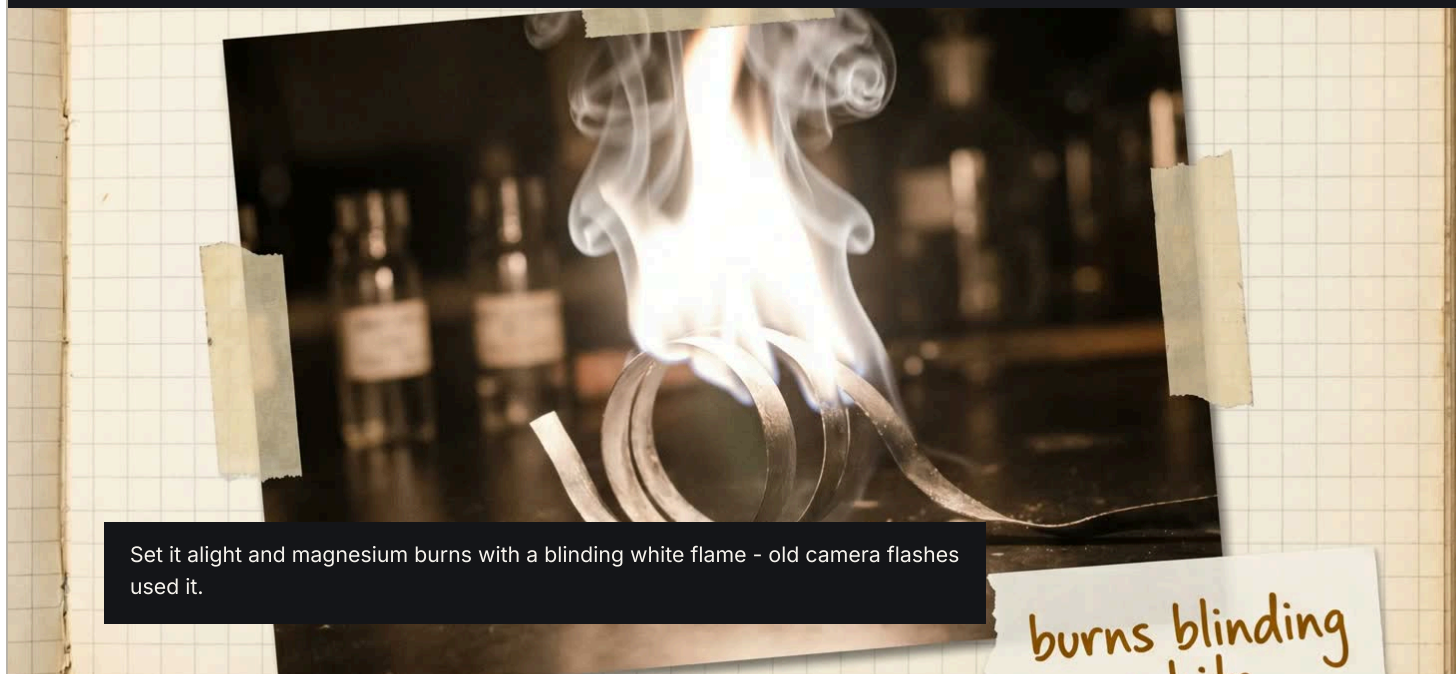
ELECTRONS  
[Ne] 3s<sup>2</sup>

BOILS  
1090 °C

CHARGE  
+2



DANGER  
3/5 Hazardous



Set it alight and magnesium burns with a blinding white flame - old camera flashes used it.

burns blinding  
life



# Al

## ALUMINUM

THE MOST ABUNDANT METAL IN EARTH'S CRUST

MASS

26.982

ELECTRONS

 $[\text{Ne}] 3s^2 3p^1$ 

BOILS

2519 °C

CHARGE

+3



DANGER

1/5 Low risk



Drink cans and foil are nearly pure aluminum.



# Si

## SILICON

THE ELEMENT OF GLASS, SAND, SEMICONDUCTORS, AND SILICON VALLEY

MASS

28.085

ELECTRONS

[Ne] 3s<sup>2</sup> 3p<sup>2</sup>

BOILS

3265 °C

CHARGE

-4, +4



DANGER

1/5 Low risk



Sliced into wafers and etched, silicon becomes every computer chip.

computer  
chips



# P

## PHOSPHORUS

IN EVERY STRAND OF YOUR DNA, IN EVERY MATCH HEAD, AND IN THE MATRIX OF BONE

MASS

30.974

ELECTRONS

 $[\text{Ne}] 3s^2 3p^3$ 

BOILS

281 °C

CHARGE

-3, +3, +5



DANGER

4/5 Severe



Red phosphorus coats the striking strip on a matchbox.

*red phosphorus*



# S

## SULFUR

YELLOW WHEN PURE

MASS

32.06

ELECTRONS

 $[\text{Ne}] 3s^2 3p^4$ 

BOILS

445 °C

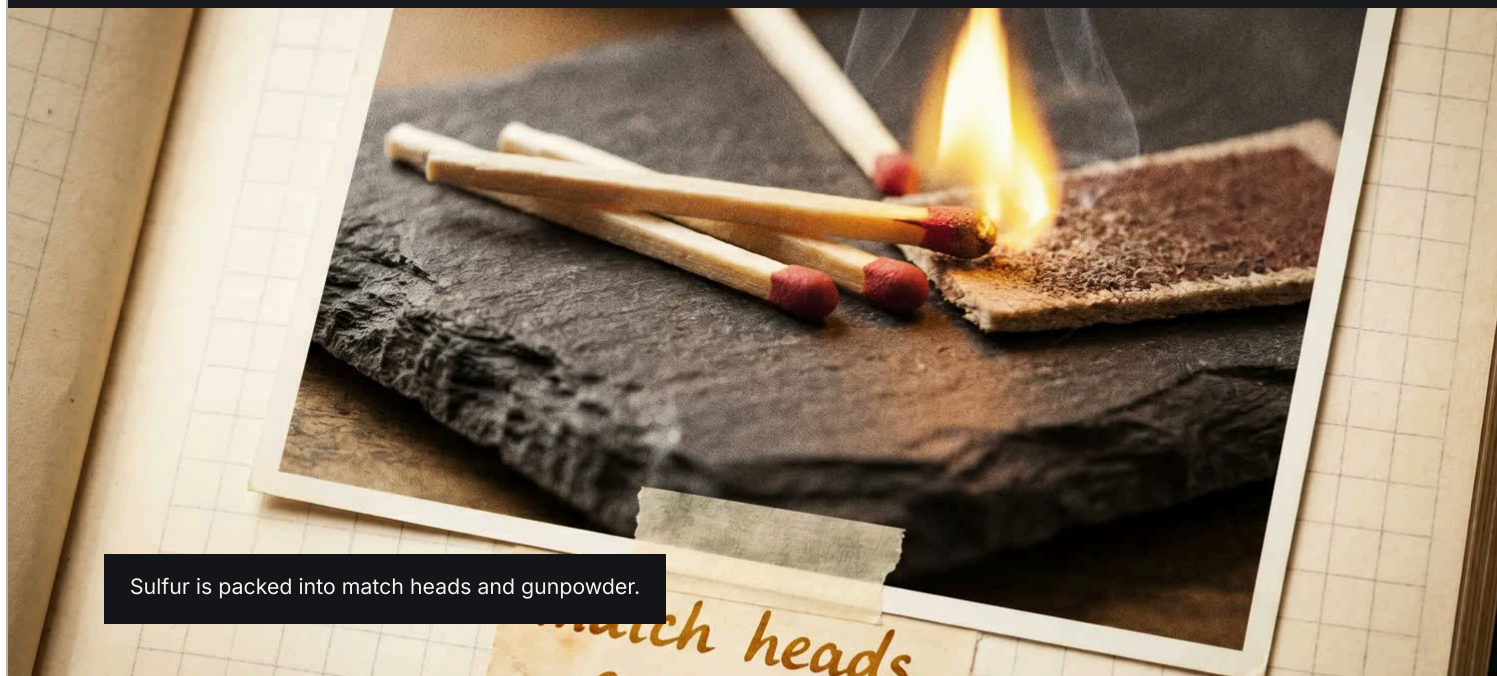
CHARGE

-2, +4, +6



DANGER

2/5 Caution



Sulfur is packed into match heads and gunpowder.



# Cl

## CHLORINE

YELLOW-GREEN GAS

MASS

35.45

ELECTRONS

 $[Ne] 3s^2 3p^5$ 

BOILS

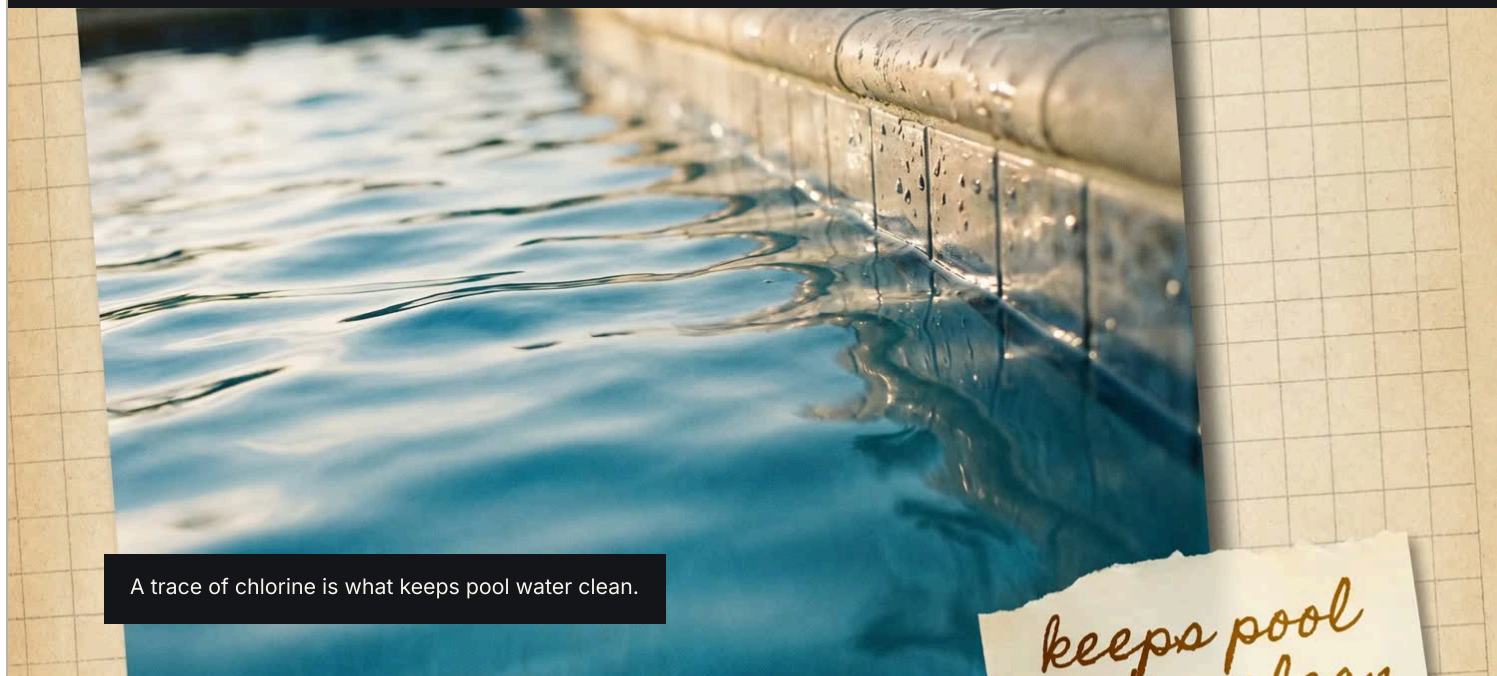
 $-34\text{ }^\circ\text{C}$ 

CHARGE

 $-1, +1, +3, +5, +7$ 

DANGER

4/5 Severe



A trace of chlorine is what keeps pool water clean.

keeps pool  
clean



# Ar

## ARGON

### INERT NOBLE GAS

MASS

39.95

ELECTRONS

 $[\text{Ne}] 3s^2 3p^6$ 

BOILS

 $-186\text{ }^\circ\text{C}$ 

CHARGE

0



DANGER

1/5 Low risk

Argon fills light bulbs as an inert gas so the hot filament does not burn up.

inert fill gas



# K

## POTASSIUM

**MORE VIOLENT IN WATER THAN SODIUM - BURSTS INTO PURPLE FLAME**

MASS

**39.098**

ELECTRONS

**[Ar] 4s<sup>1</sup>**

BOILS

**759 °C**

CHARGE

**+1**

DANGER

**4/5 Severe**

Potassium is vital for plants and people, found in fertilizer and in foods like bananas.

*fertilizer + potassium*



# Ca

## CALCIUM

### BONES, TEETH, AND CHALK

MASS

40.078

ELECTRONS

[Ar] 4s<sup>2</sup>

BOILS

1484 °C

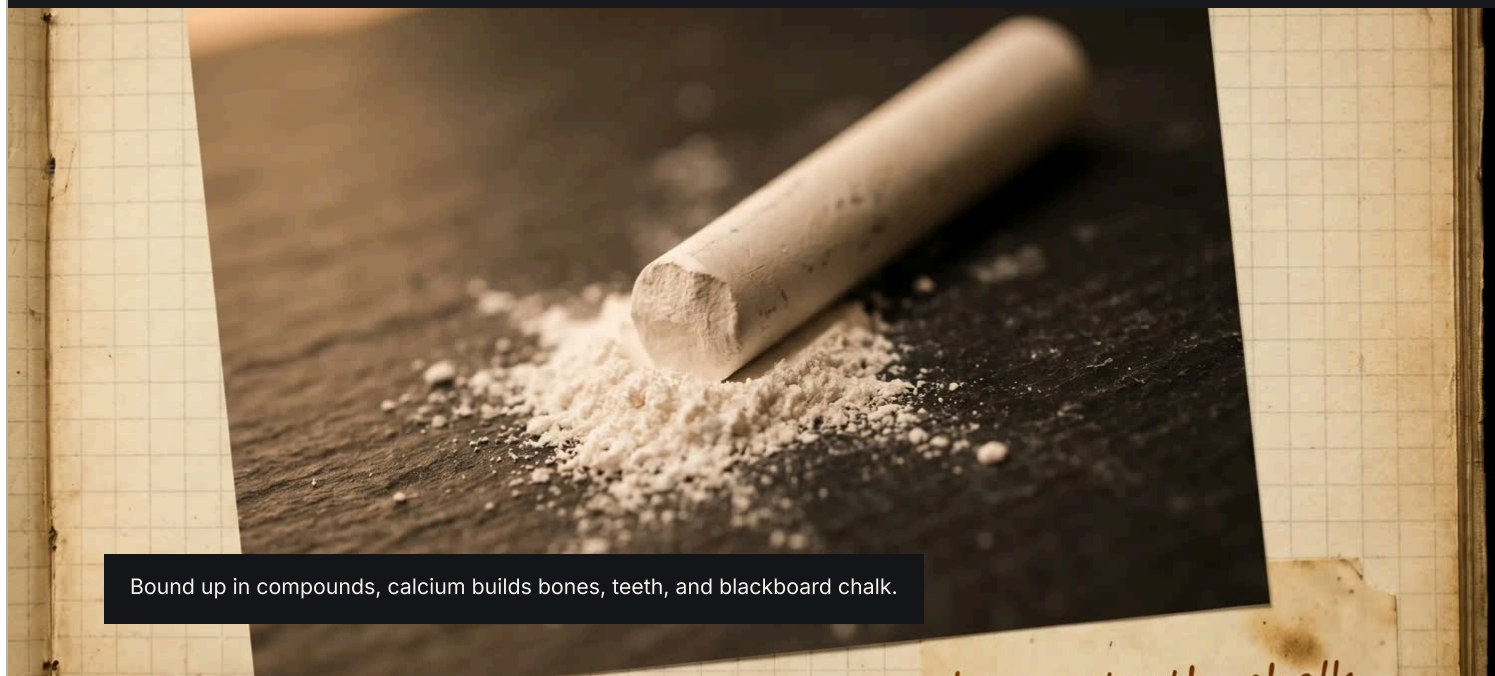
CHARGE

+2



DANGER

2/5 Caution



Bound up in compounds, calcium builds bones, teeth, and blackboard chalk.



# Sc

## SCANDIUM

LIGHTWEIGHT, STRONG, USED IN BASEBALL BATS AND AEROSPACE ALLOYS

MASS

44.956

ELECTRONS

[Ar] 3d<sup>1</sup> 4s<sup>2</sup>

BOILS

2836 °C

CHARGE

+3



DANGER

1/5 Low risk

Added to aluminum, scandium makes alloys strong and light for aircraft and sports gear.



# Ti

## TITANIUM

HALF THE WEIGHT OF STEEL AT TWICE THE STRENGTH

MASS

47.867

ELECTRONS

[Ar] 3d<sup>2</sup> 4s<sup>2</sup>

BOILS

3287 °C

CHARGE

+2, +3, +4



DANGER

1/5 Low risk



Titanium is strong, light, and body-friendly, so it is used for implants and aircraft.



# V

## VANADIUM

HARDENS STEEL FOR TOOLS, SPRINGS, AND CRESCENT WRENCHES

MASS

50.942

ELECTRONS

 $[\text{Ar}] 3d^3 4s^2$ 

BOILS

3407 °C

CHARGE

+2, +3, +4, +5



DANGER

2/5 Caution



Vanadium makes steel tougher, ideal for wrenches, springs, and tools.

tough tool



# Cr

## CHROMIUM

THE SHINE ON A CHROME BUMPER

MASS

51.996

ELECTRONS

[Ar] 3d<sup>5</sup> 4s<sup>1</sup>

BOILS

2671 °C

CHARGE

+2, +3, +6



DANGER

1/5 Low risk

Chrome plating gives metal a shiny, mirror-bright, rust-resistant finish.

shiny chrome  
plating



# Mn

## MANGANESE

HARDENS STEEL BEYOND WHAT CARBON ALONE CAN DO

MASS

54.938

ELECTRONS

 $[Ar] 3d^5 4s^2$ 

BOILS

2061 °C

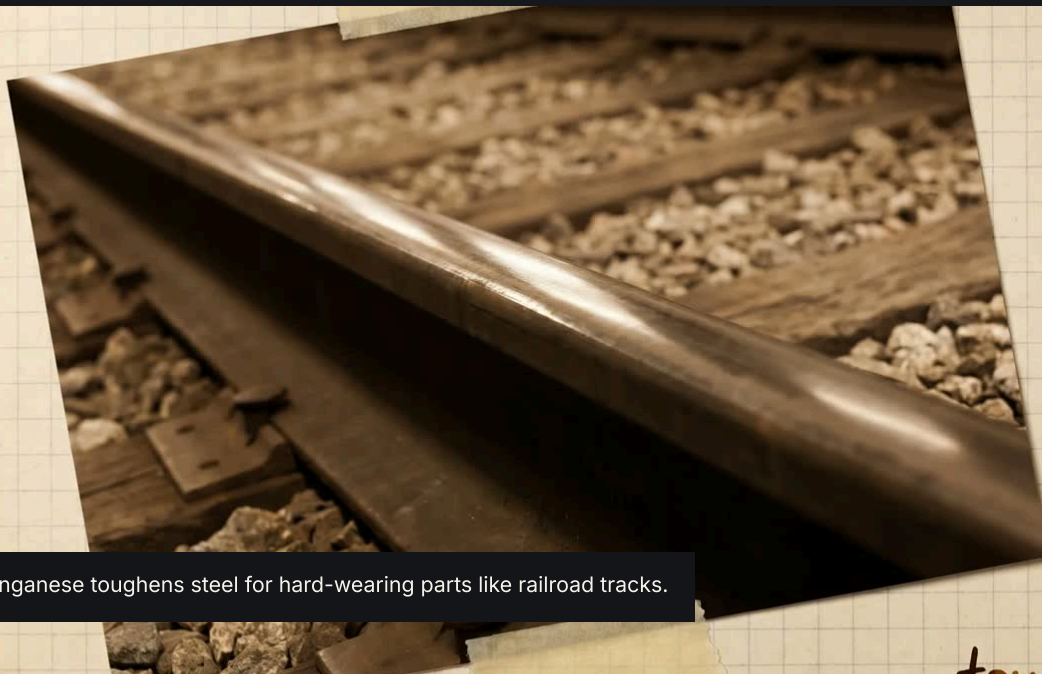
CHARGE

+2, +4, +7



DANGER

2/5 Caution



Manganese toughens steel for hard-wearing parts like railroad tracks.

*tough steel*



# Fe

## IRON

### MOST-USED METAL ON EARTH

MASS

55.845

ELECTRONS

 $[\text{Ar}] 3d^6 4s^2$ 

BOILS

2861 °C

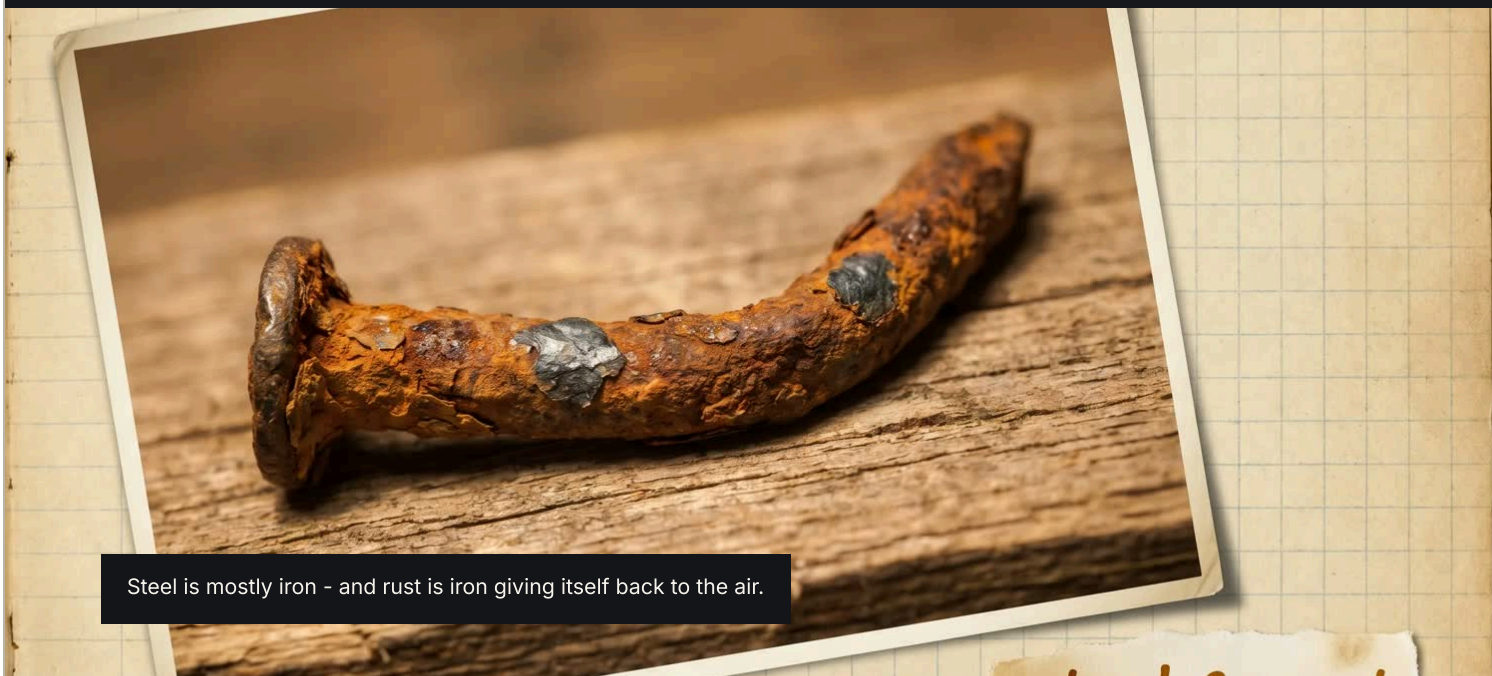
CHARGE

+2, +3



DANGER

1/5 Low risk



Steel is mostly iron - and rust is iron giving itself back to the air.



# CO

## COBALT

### THE BLUE IN COBALT-BLUE GLASS AND RENAISSANCE PAINTINGS

MASS  
58.933

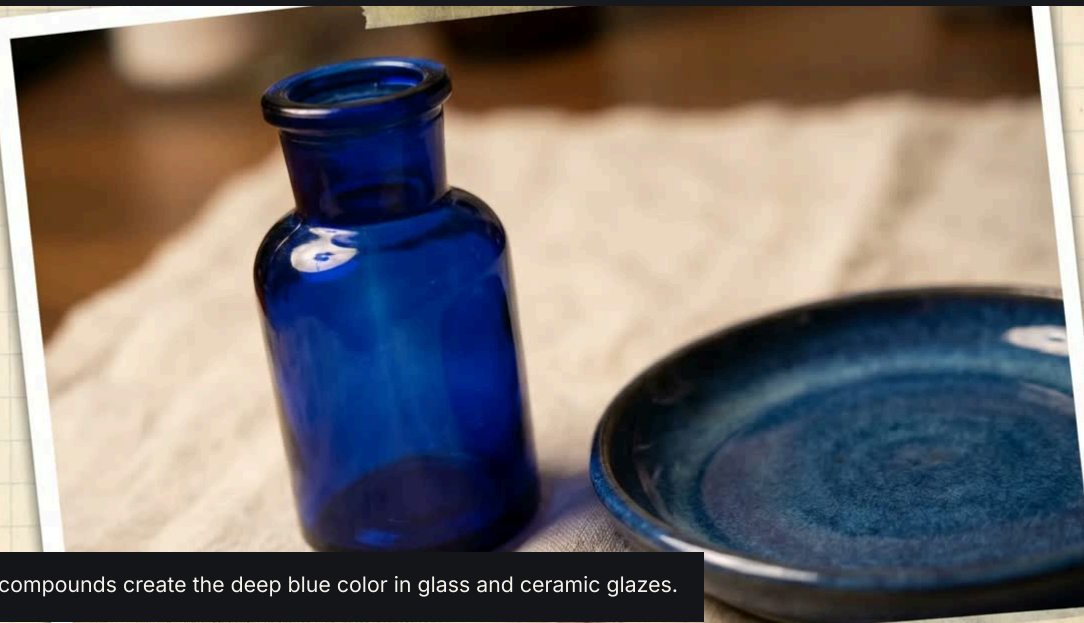
ELECTRONS  
[Ar] 3d<sup>7</sup> 4s<sup>2</sup>

BOILS  
2927 °C

CHARGE  
+2, +3



DANGER  
2/5 Caution



Cobalt compounds create the deep blue color in glass and ceramic glazes.

*deep blue glass*



# Ni

## NICKEL

THE METAL IN EVERY STAINLESS-STEEL FORK AND MOST US COINS

MASS

58.693

ELECTRONS

 $[\text{Ar}] 3d^8 4s^2$ 

BOILS

2913 °C

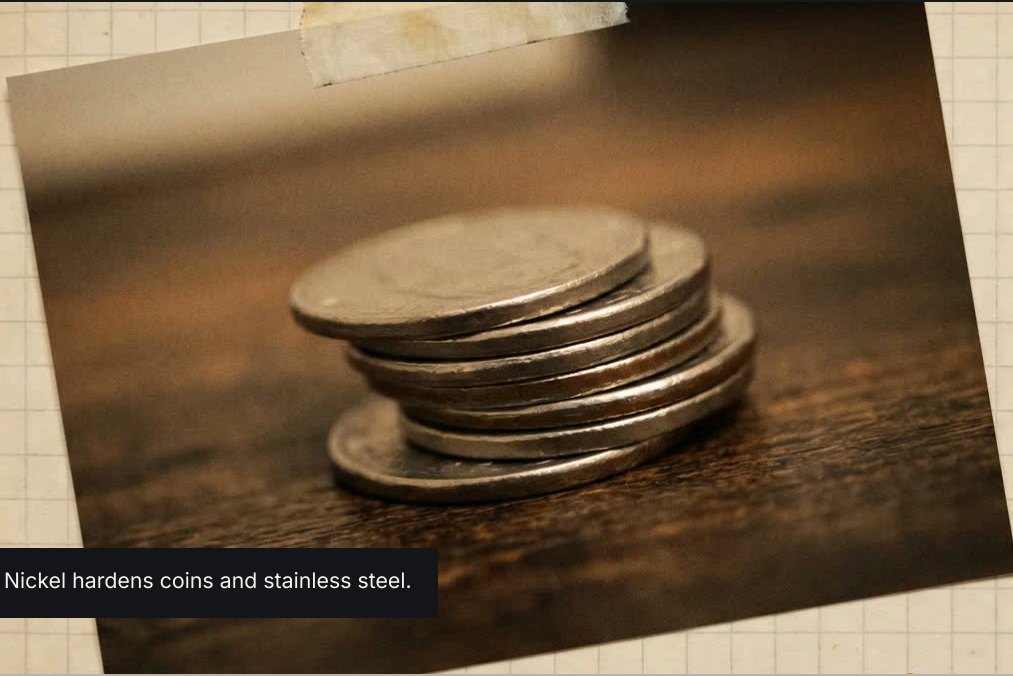
CHARGE

+2



DANGER

2/5 Caution



Nickel hardens coins and stainless steel.



# Cu

## COPPER

REDDISH METAL OF PENNIES, WIRING, AND THE STATUE OF LIBERTY  
(THE GREEN IS COPPER CARBONATE FROM OXIDATION)

MASS

63.546

ELECTRONS

[Ar] 3d<sup>10</sup> 4s<sup>1</sup>

BOILS

2562 °C

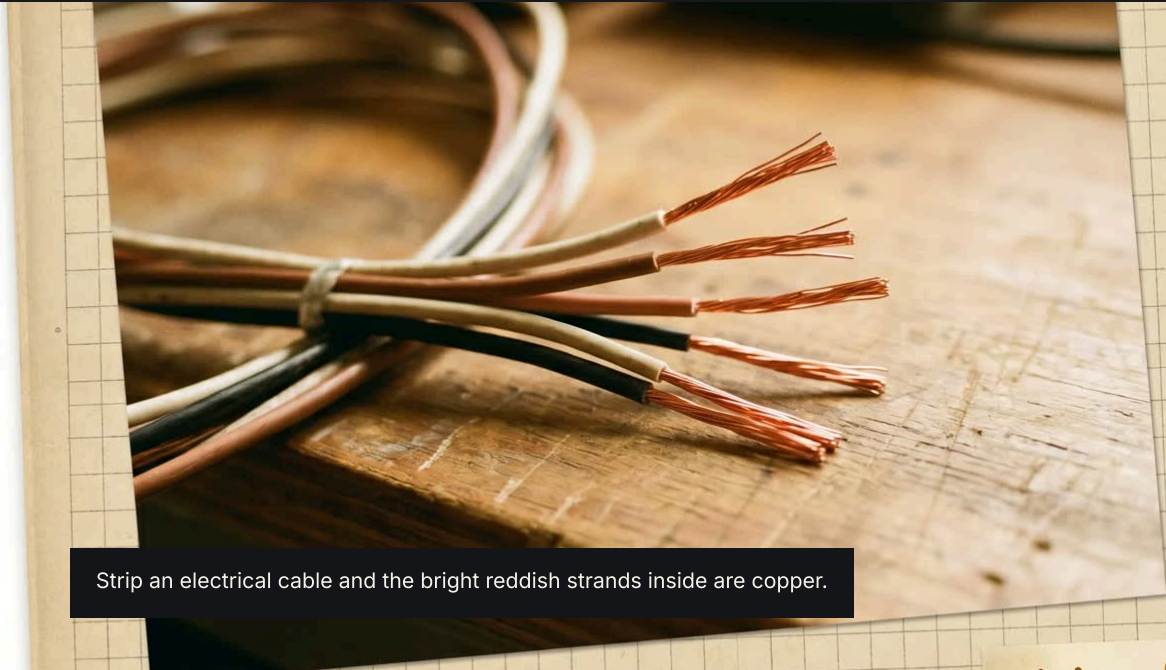
CHARGE

+1, +2



DANGER

1/5 Low risk



Strip an electrical cable and the bright reddish strands inside are copper.



# Zn

## ZINC

**GALVANIZED STEEL RESISTS RUST BECAUSE ZINC OXIDIZES FIRST**

MASS

65.38

ELECTRONS

 $[\text{Ar}] 3d^{10} 4s^2$ 

BOILS

907 °C

CHARGE

+2



DANGER

1/5 Low risk



A zinc coat (galvanizing) is what stops steel buckets and nails from rusting.

*galvanising*



# Ga

## GALLIUM

MELTS IN YOUR HAND AT BODY TEMPERATURE (29.8°C)

MASS

69.723

ELECTRONS

[Ar] 3d<sup>10</sup> 4s<sup>2</sup> 4p<sup>1</sup>

BOILS

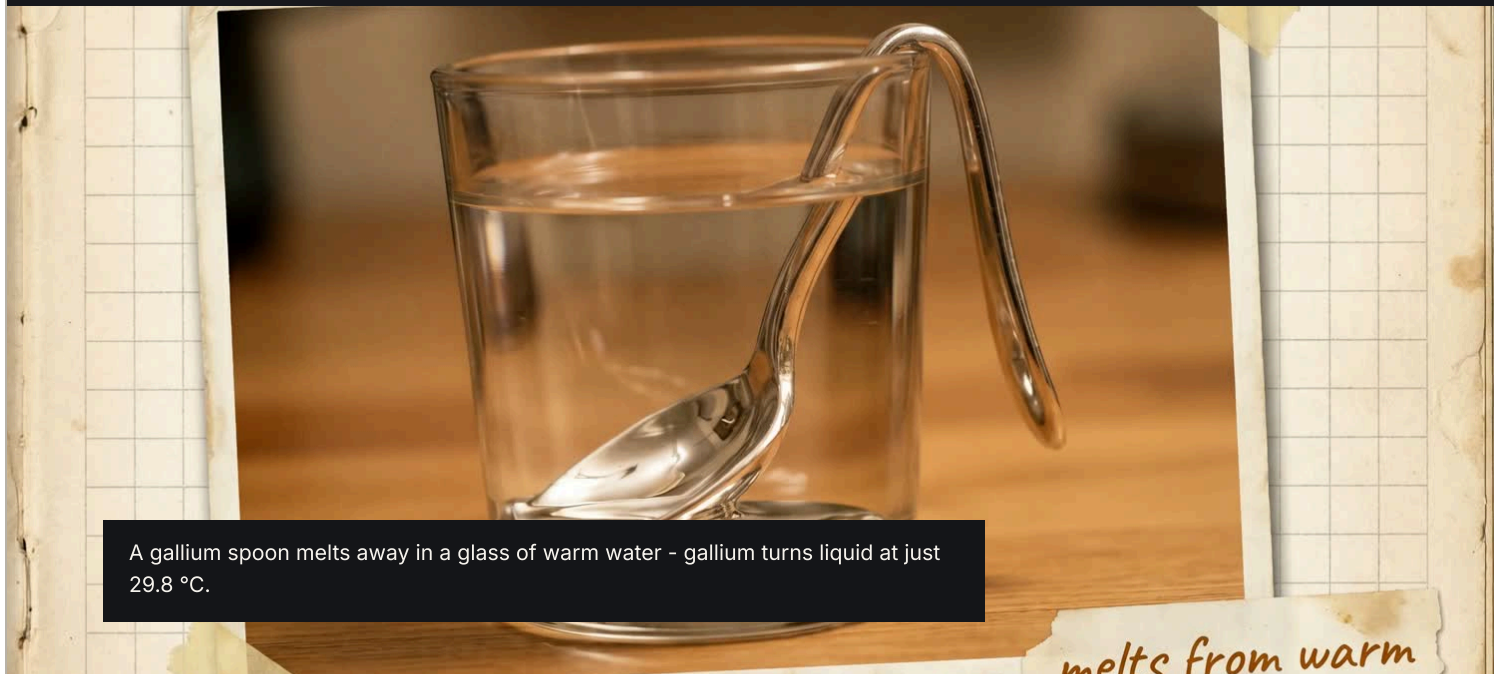
2400 °C

CHARGE

+3

DANGER

0/5 Safe to handle



A gallium spoon melts away in a glass of warm water - gallium turns liquid at just 29.8 °C.

*melts from warm*



# Ge

## GERMANIUM

THE ORIGINAL SEMICONDUCTOR ELEMENT - FIRST TRANSISTORS WERE GERMANIUM, NOT SILICON

MASS

72.63

ELECTRONS

 $[\text{Ar}] 3d^{10} 4s^2 4p^2$ 

BOILS

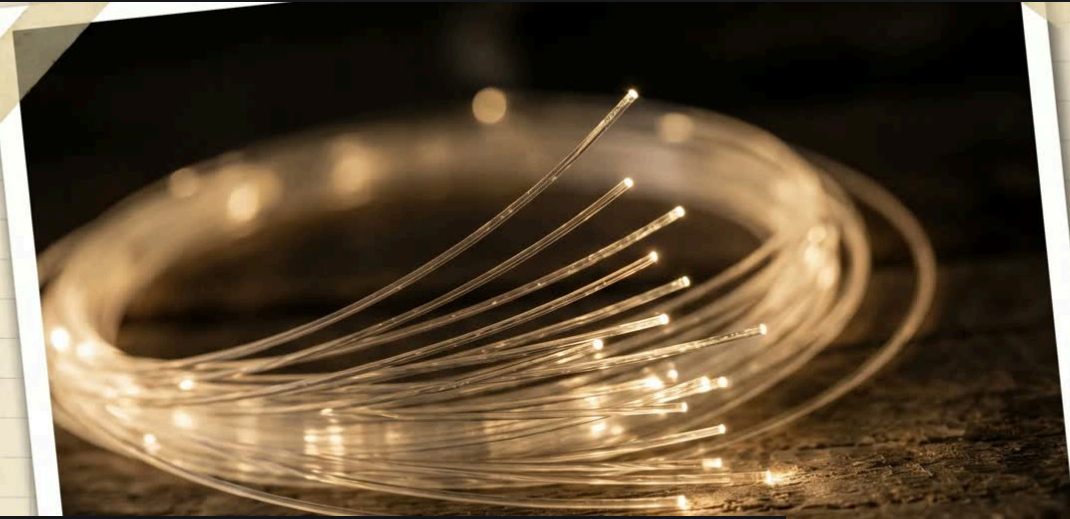
2833 °C

CHARGE

+2, +4

DANGER

0/5 Safe to handle



Germanium carries light through fiber-optic cables and focuses infrared in night-vision lenses.

*fiber optics +*



# As

## ARSENIC

THE POISONER'S METALLOID, GROUND-WATER CONTAMINANT IN BANGLADESH. SEMICONDUCTOR DOPANT IN SOLAR CELLS

MASS

74.922

ELECTRONS

 $[\text{Ar}] 3d^{10} 4s^2 4p^3$ 

BOILS

614 °C

CHARGE

-3, +3, +5

DANGER



4/5 Severe

Arsenic compounds once preserved outdoor lumber against rot - its toxicity also made it a poison.

old wood  
preservative



# Se

## SELENIUM

IN PHOTOCOPIER DRUMS (LIGHT HITS SE, CHARGE FLOWS)

MASS

78.971

ELECTRONS

 $[\text{Ar}] 3d^{10} 4s^2 4p^4$ 

BOILS

685 °C

CHARGE

-2, +4, +6

DANGER



3/5 Hazardous



Selenium gives glass a deep ruby-red color, used in art glass and signal lenses.

*colors glass a  
ruby red*



# Br

## BROMINE

THE ONLY LIQUID NONMETAL AT ROOM TEMPERATURE

MASS  
79.904

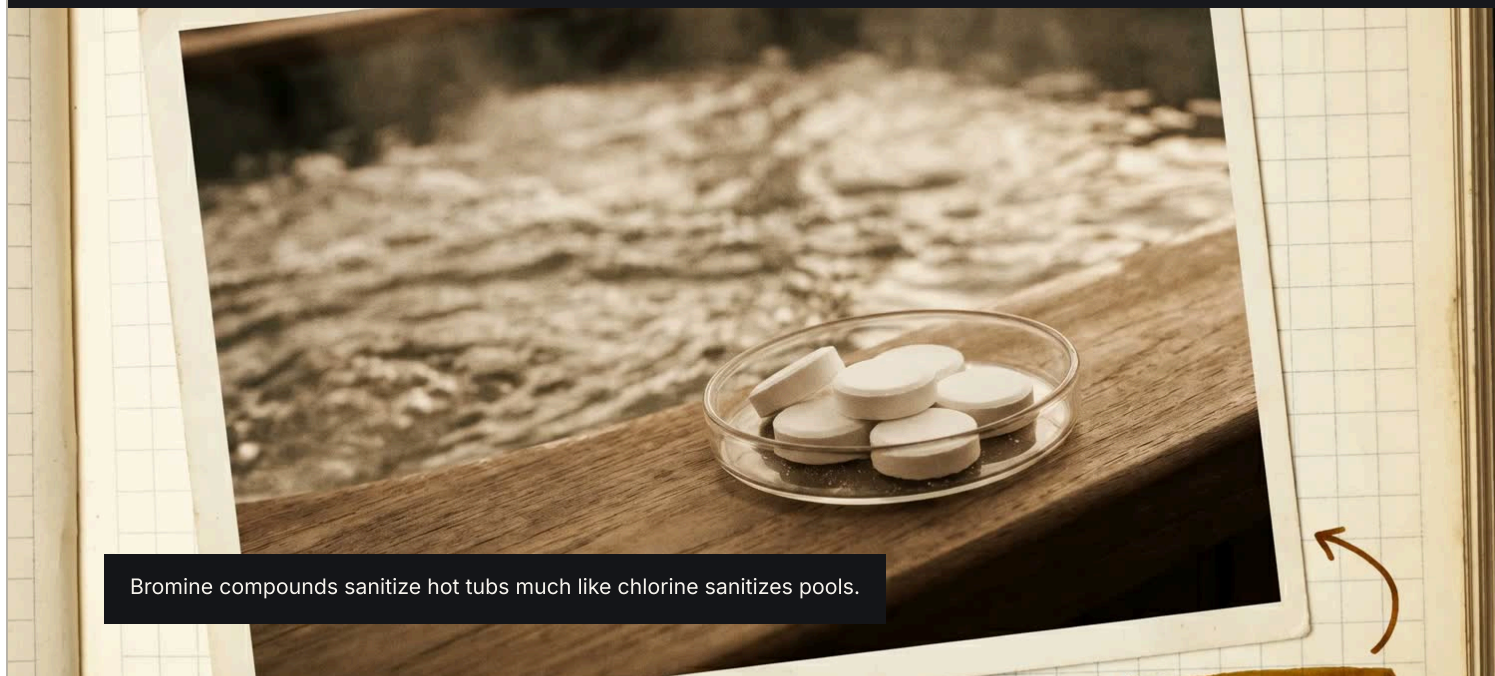
ELECTRONS  
 $[\text{Ar}] 3d^{10} 4s^2 4p^5$

BOILS  
59 °C

CHARGE  
-1, +1, +3, +5, +7



DANGER  
4/5 Severe



Bromine compounds sanitize hot tubs much like chlorine sanitizes pools.



# Kr

## KRYPTON

### INERT NOBLE GAS

MASS

83.798

ELECTRONS

 $[\text{Ar}] 3d^{10} 4s^2 4p^6$ 

BOILS

 $-153\text{ }^{\circ}\text{C}$ 

CHARGE

0, +2



DANGER

1/5 Low risk



Krypton fills the gap in energy-saving double-pane windows to slow heat loss.



# Rb

## RUBIDIUM

EVEN MORE REACTIVE THAN POTASSIUM - ALKALI METAL TREND CONTINUES

MASS

85.468

ELECTRONS

[Kr] 5s<sup>1</sup>

BOILS

688 °C

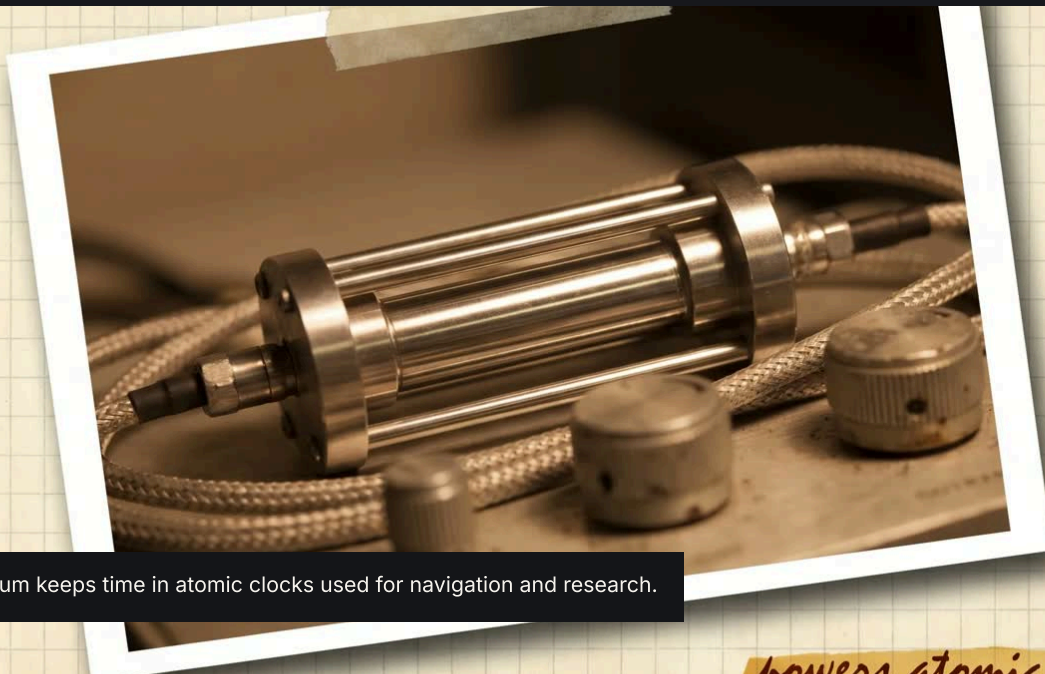
CHARGE

+1



DANGER

5/5 Extreme



Rubidium keeps time in atomic clocks used for navigation and research.

*powers atomic clocks*



# Sr

## STRONTIUM

THE BRIGHT RED IN FIREWORKS AND OLD TV PHOSPHORS

MASS

87.62

ELECTRONS

[Kr] 5s<sup>2</sup>

BOILS

1382 °C

CHARGE

+2



DANGER

2/5 Caution



Strontium burns crimson red - it is what makes red fireworks and flares red.



# Y

## YTTRIUM

YTTRIUM-ALUMINUM-GARNET (YAG) LASERS CUT STEEL AND TATTOO SKIN

MASS

88.906

ELECTRONS

[Kr] 4d<sup>1</sup> 5s<sup>2</sup>

BOILS

3345 °C

CHARGE

+3



DANGER

1/5 Low risk



Yttrium phosphors help white LEDs glow and once made the red in old TV screens.

phosphors in  
white LEDs



# Zr

## ZIRCONIUM

### CUBIC ZIRCONIA IN THE ENGAGEMENT-RING CASE

MASS

91.224

ELECTRONS

[Kr] 4d<sup>2</sup> 5s<sup>2</sup>

BOILS

4409 °C

CHARGE

+4



DANGER

2/5 Caution



Cubic zirconia - made from a zirconium oxide - sparkles like diamond for a fraction of the cost.

*cubic zirconia*



# Nb

## NIOBIUM

### SUPERCONDUCTING MAGNETS IN MRI MACHINES AND THE LHC

MASS

92.906

ELECTRONS

[Kr] 4d<sup>4</sup> 5s<sup>1</sup>

BOILS

4744 °C

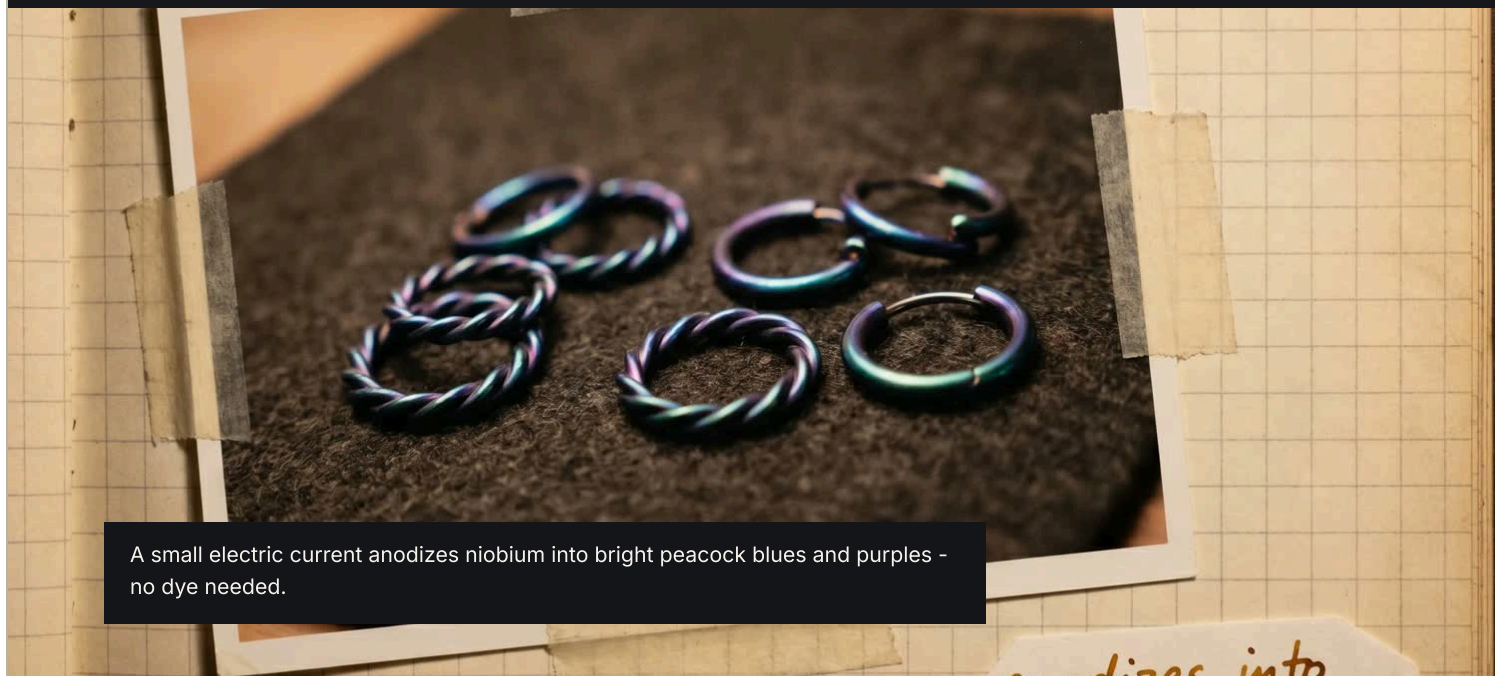
CHARGE

+3, +5

DANGER



1/5 Low risk



A small electric current anodizes niobium into bright peacock blues and purples - no dye needed.



# MO

## MOLYBDENUM

THE MO IN “MOLY” - MOLYBDENUM-STEEL ARMOR PLATE, JET-ENGINE ALLOYS, AND THE STUFF THAT HARDENS DRILL BITS

MASS

95.95

ELECTRONS

[Kr] 4d<sup>5</sup> 5s<sup>1</sup>

BOILS

4639 °C

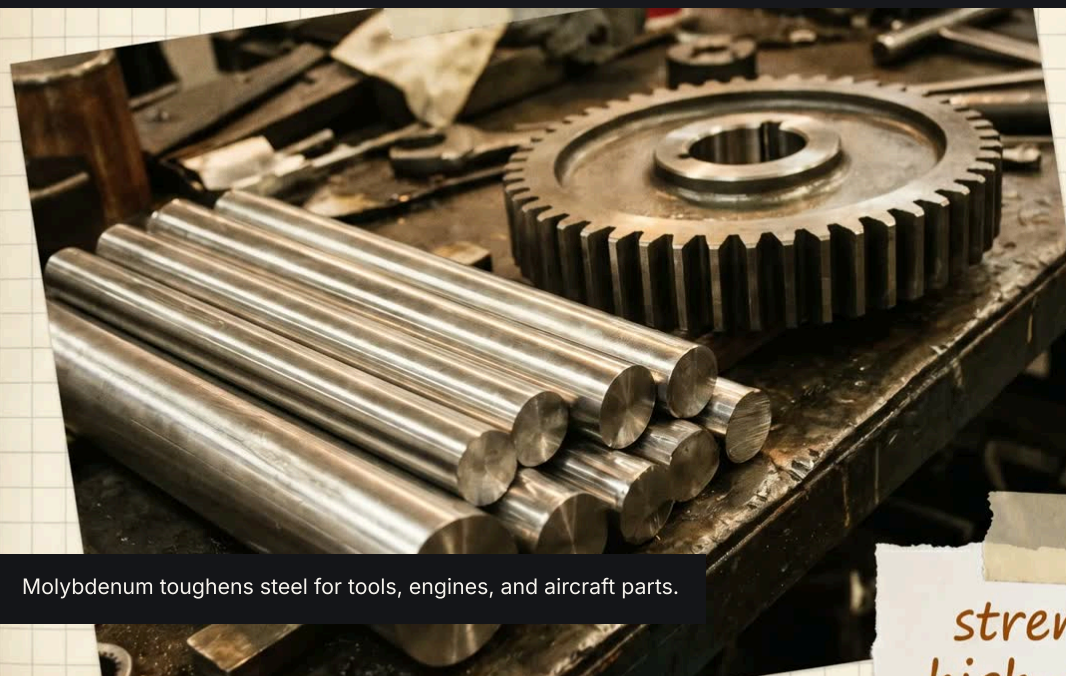
CHARGE

+4, +6



DANGER

1/5 Low risk



Molybdenum toughens steel for tools, engines, and aircraft parts.

strengthens  
high strength



# Tc

## TECHNETIUM

THE FIRST SYNTHETIC ELEMENT - NO STABLE ISOTOPES EXIST ON EARTH

MASS

[98]

ELECTRONS

[Kr] 4d<sup>5</sup> 5s<sup>2</sup>

BOILS

4265 °C

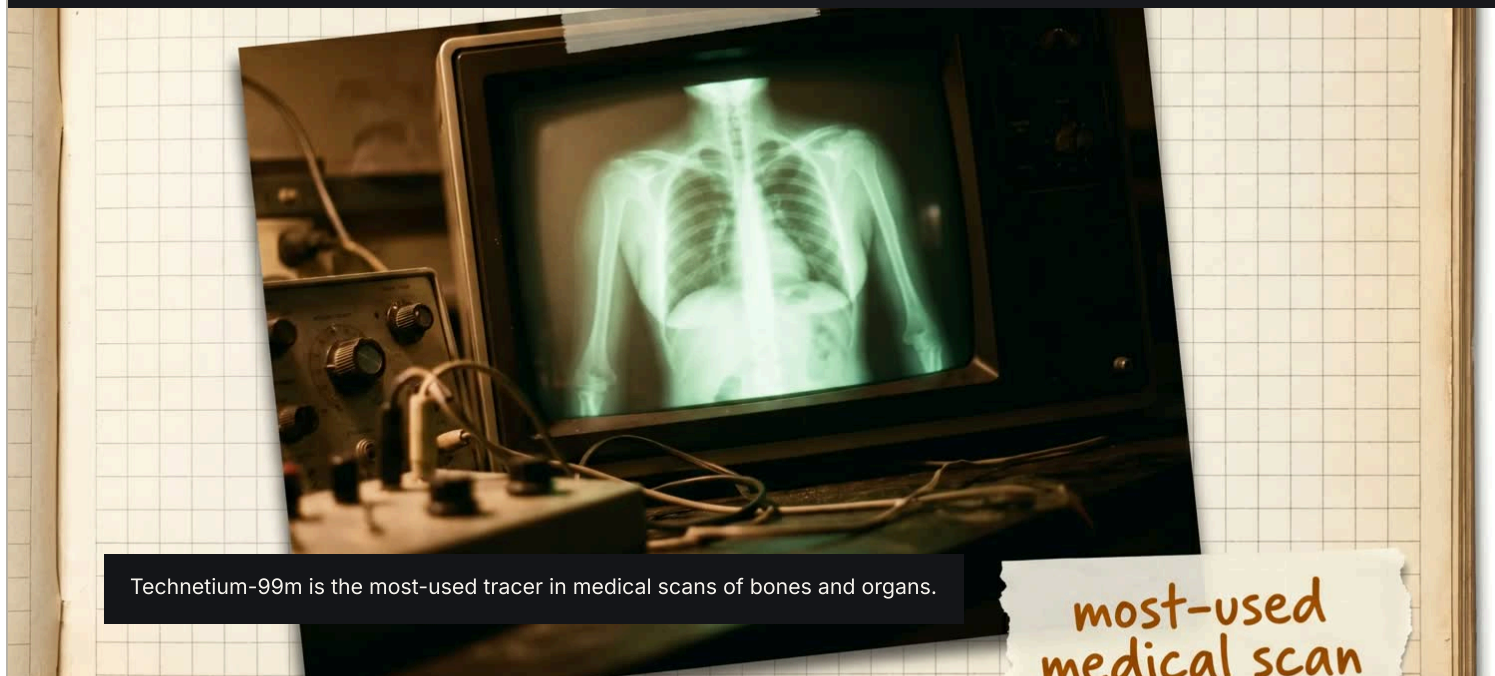
CHARGE

+4, +7



DANGER

4/5 Severe



Technetium-99m is the most-used tracer in medical scans of bones and organs.

most-used  
medical scan



# RU

## RUTHENIUM

CATALYZES HYDROGEN FUEL CELLS

MASS

101.07

ELECTRONS

[Kr] 4d<sup>7</sup> 5s<sup>1</sup>

BOILS

4150 °C

CHARGE

+3, +4, +8



DANGER

1/5 Low risk



A thin ruthenium coating helps hard-drive platters store more data.



# Rh

## RHODIUM

### CATALYTIC CONVERTER ON EVERY GASOLINE CAR

MASS

102.91

ELECTRONS

[Kr] 4d<sup>8</sup> 5s<sup>1</sup>

BOILS

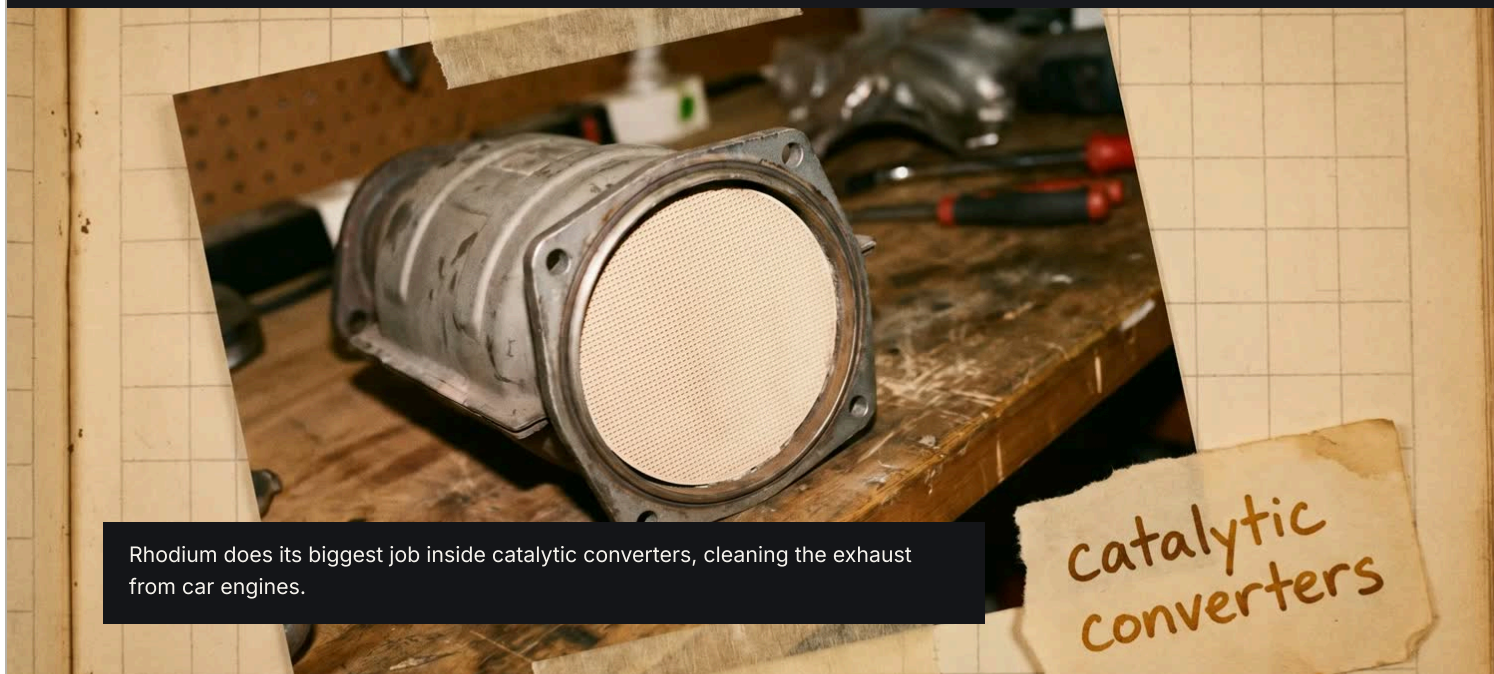
3695 °C

CHARGE

+3

DANGER

0/5 Safe to handle



Rhodium does its biggest job inside catalytic converters, cleaning the exhaust from car engines.

catalytic  
converters



# Pd

## PALLADIUM

CATALYTIC CONVERTERS SCRUB CAR EXHAUST CLEAN

MASS  
106.42

ELECTRONS  
[Kr] 4d<sup>10</sup>

BOILS  
2963 °C

CHARGE  
+2, +4



DANGER  
1/5 Low risk

Palladium goes into white-gold jewelry and catalytic converters, and can soak up hydrogen gas.

white gold  
+ converters



# Ag

## SILVER

BEST ELECTRICAL AND THERMAL CONDUCTOR OF ANY METAL

MASS

107.87

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^1$ 

BOILS

2162 °C

CHARGE

+1



DANGER

1/5 Low risk

Jewelry, cutlery, and mirrors - silver tarnishes dark but polishes back to a bright shine.

*jewellery,  
cutlery.*



# Cd

## CADMIUM

YELLOW-ORANGE PAINT PIGMENT USED BY MONET AND VAN GOGH -  
ALSO A HEAVY-METAL POISON THAT CROSSES THE PLACENTA

MASS

112.41

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2$ 

BOILS

767 °C

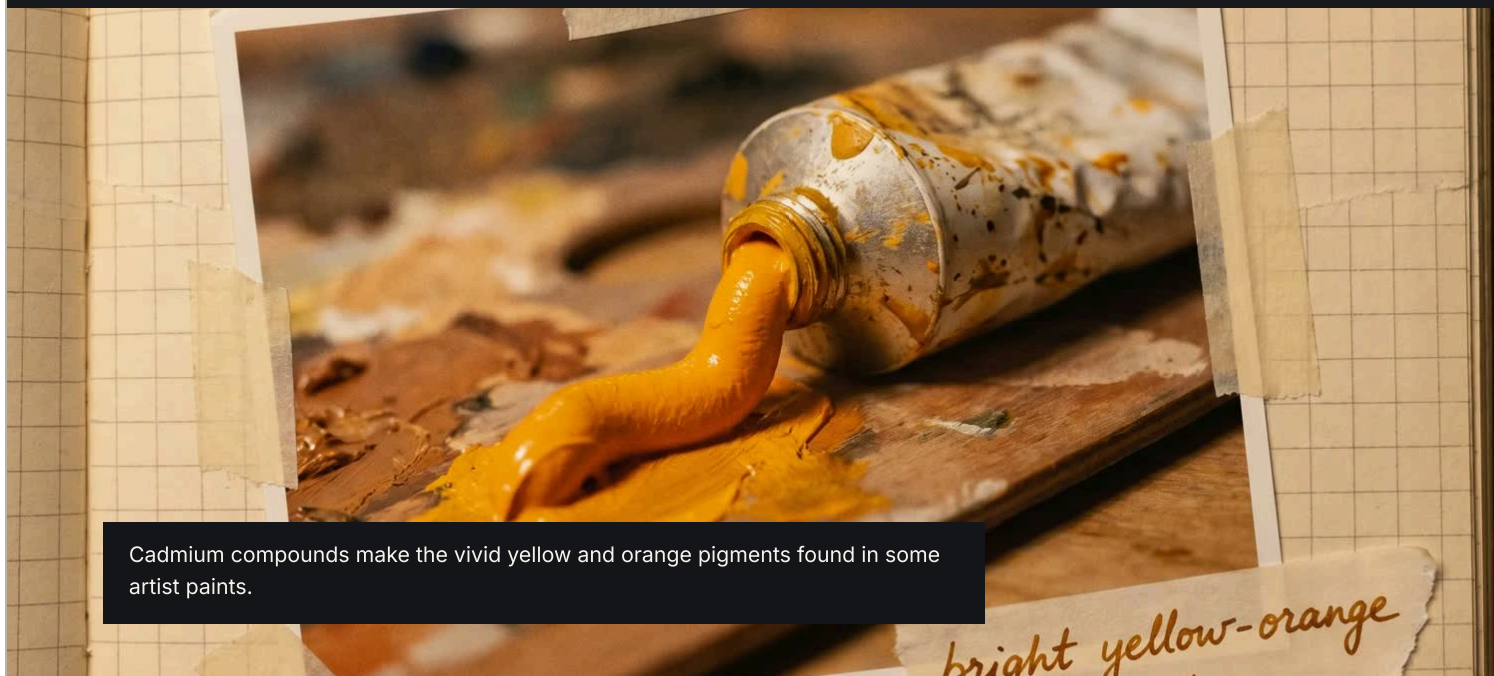
CHARGE

+2

DANGER



3/5 Hazardous



Cadmium compounds make the vivid yellow and orange pigments found in some artist paints.



# In

## INDIUM

INDIUM-TIN-OXIDE (ITO) IS THE TRANSPARENT CONDUCTOR IN EVERY TOUCHSCREEN, OLED, AND SOLAR PANEL

MASS

114.82

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2 5p^1$ 

BOILS

2072 °C

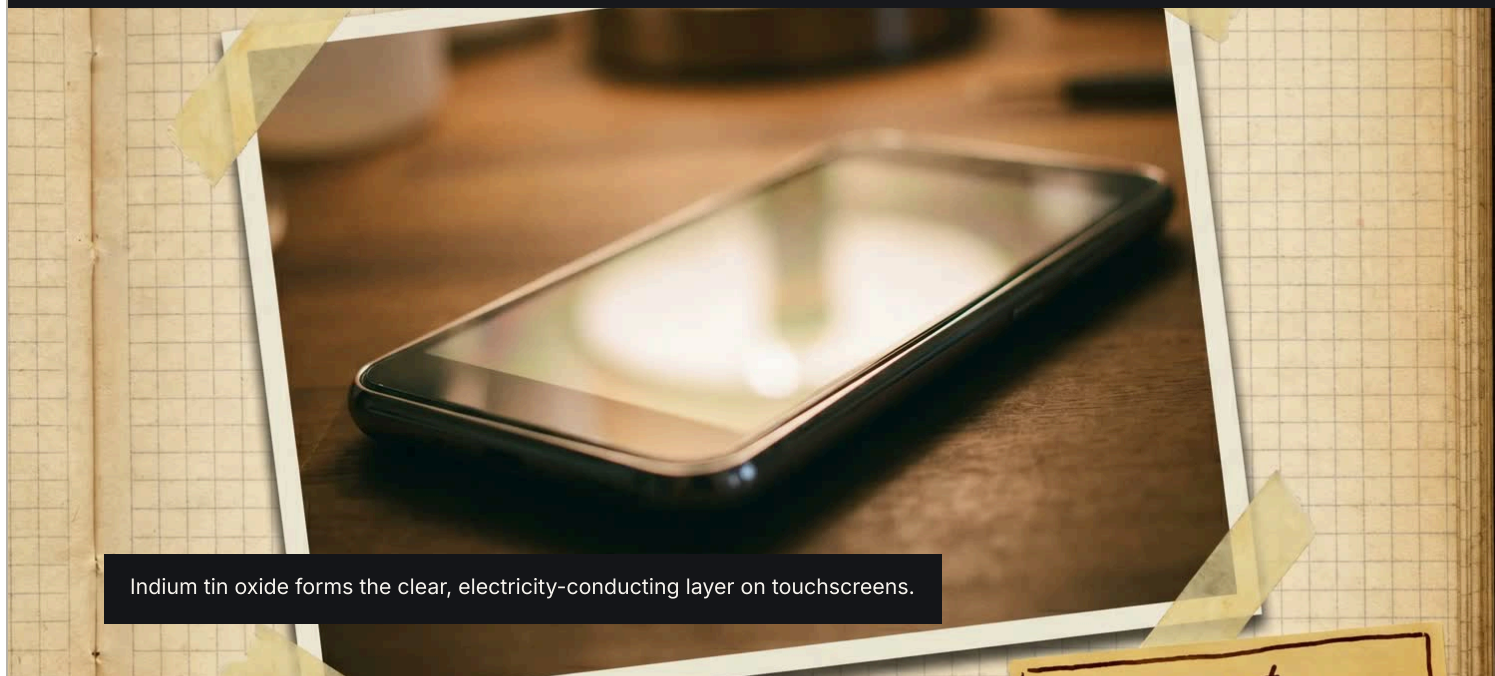
CHARGE

+3



DANGER

1/5 Low risk



Indium tin oxide forms the clear, electricity-conducting layer on touchscreens.



# Sn

## TIN

BRONZE IS COPPER + TIN

MASS

118.71

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2 5p^2$ 

BOILS

2602 °C

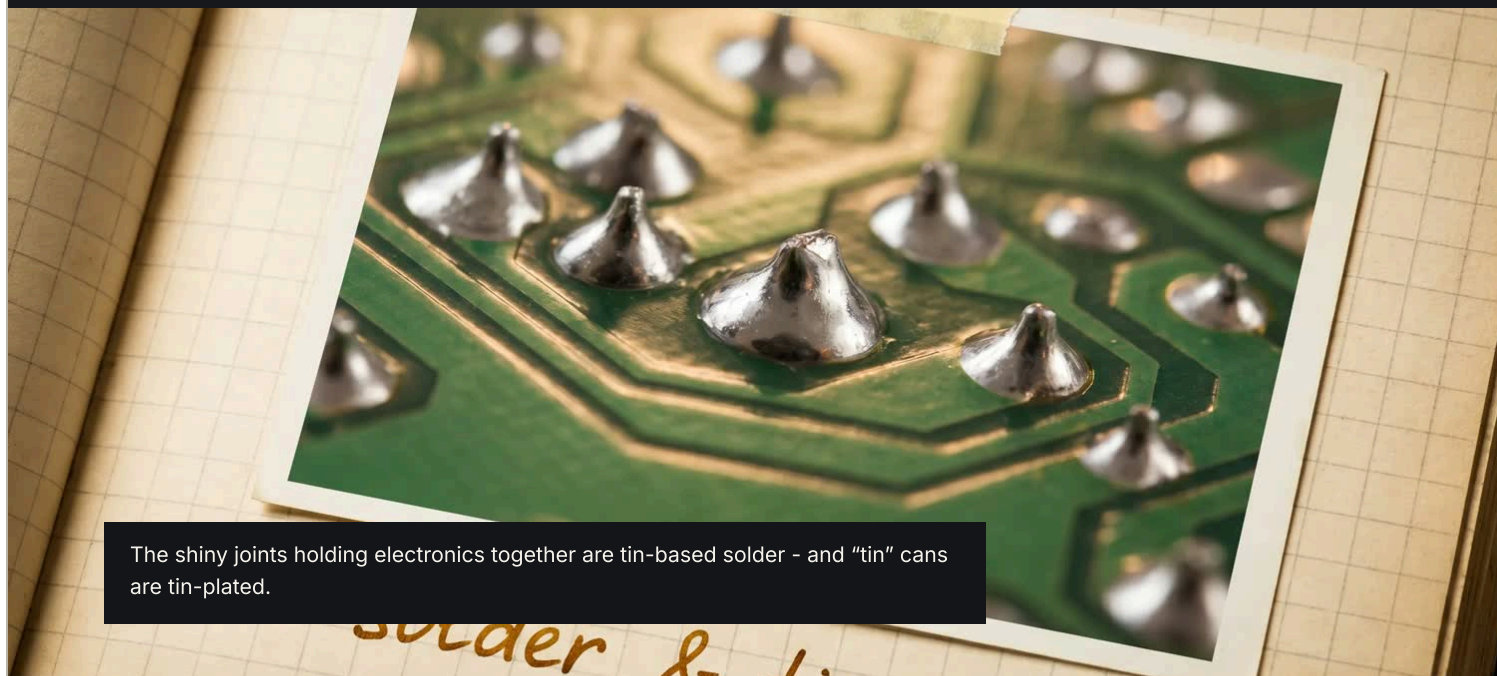
CHARGE

+2, +4



DANGER

1/5 Low risk



The shiny joints holding electronics together are tin-based solder - and "tin" cans are tin-plated.



# Sb

## ANTIMONY

BRITTLE METALLOID

MASS

121.76

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2 5p^3$ 

BOILS

1587 °C

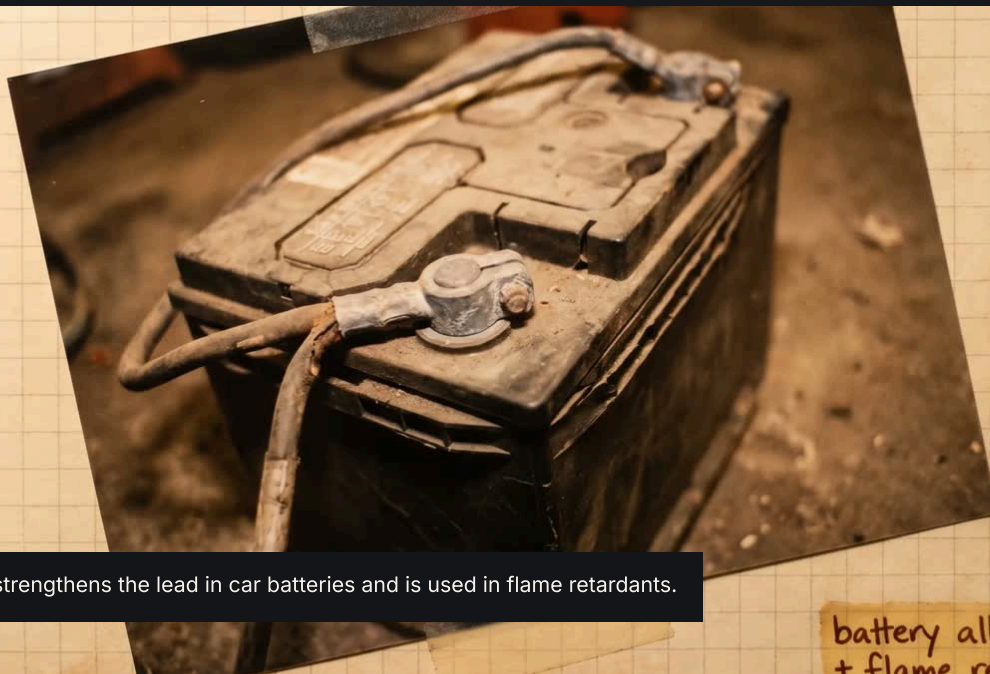
CHARGE

-3, +3, +5

DANGER



3/5 Hazardous



Antimony strengthens the lead in car batteries and is used in flame retardants.



# Te

## TELLURIUM

THE EARTH-NAMED TWIN OF SELENIUM (THE MOON)

MASS

127.6

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2 5p^4$ 

BOILS

988 °C

CHARGE

-2, +4, +6

DANGER



3/5 Hazardous

Cadmium telluride is used to make thin-film solar panels that turn sunlight into power.



# I IODINE

ANTISEPTIC TINCTURE ON EVERY BATTLEFIELD WOUND UNTIL WWII

MASS

126.9

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2 5p^5$ 

BOILS

184 °C

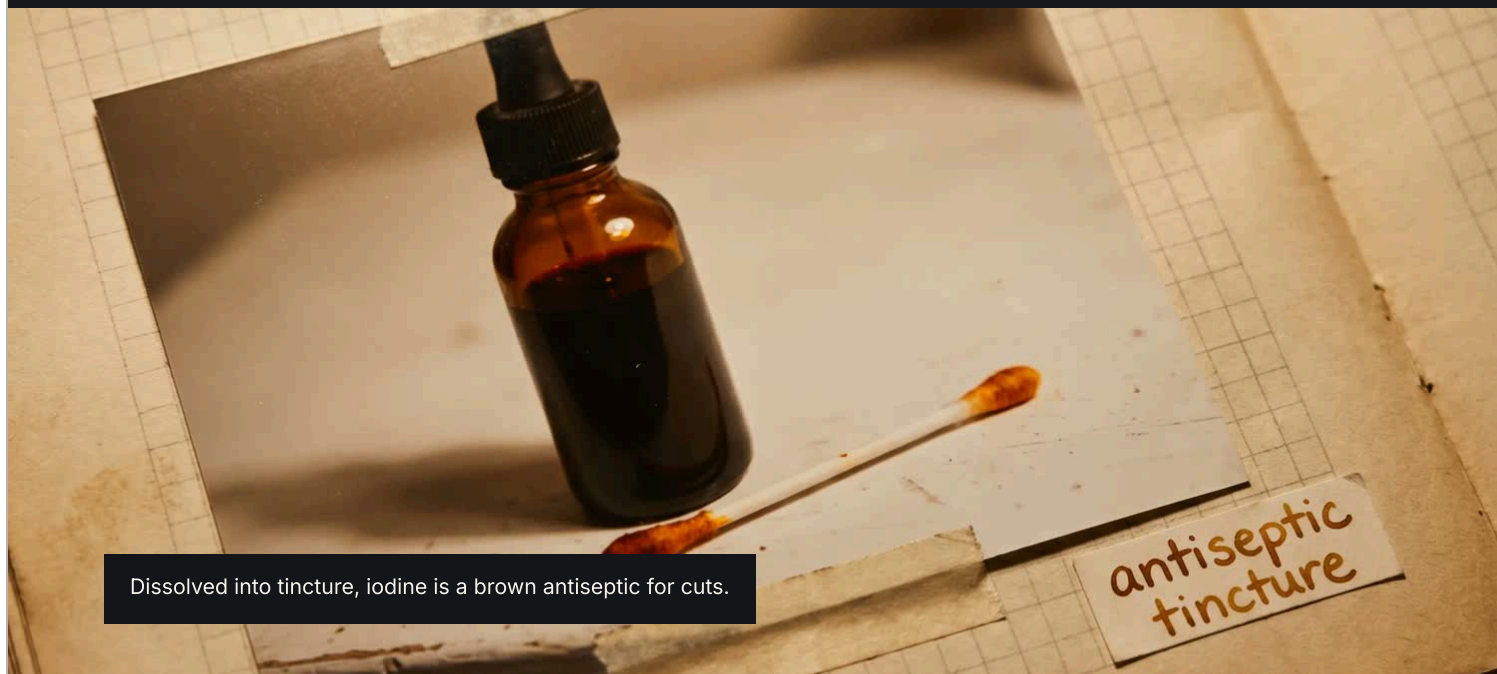
CHARGE

-1, +1, +3, +5, +7



DANGER

2/5 Caution



Dissolved into tincture, iodine is a brown antiseptic for cuts.



# Xe

## XENON

### HIGH-INTENSITY HEADLAMPS ON LUXURY CARS

MASS

131.29

ELECTRONS

 $[\text{Kr}] 4d^{10} 5s^2 5p^6$ 

BOILS

 $-108\text{ }^{\circ}\text{C}$ 

CHARGE

0, +2, +4, +6, +8



DANGER

1/5 Low risk



Xenon gas powers the bright blue-white HID headlights on some cars.



# CS

## CESIUM

THE ATOMIC-CLOCK ELEMENT - THE SECOND IS DEFINED BY CESIUM-133 HYPERFINE TRANSITIONS

MASS

132.91

ELECTRONS

 $[Xe] 6s^1$ 

BOILS

671 °C

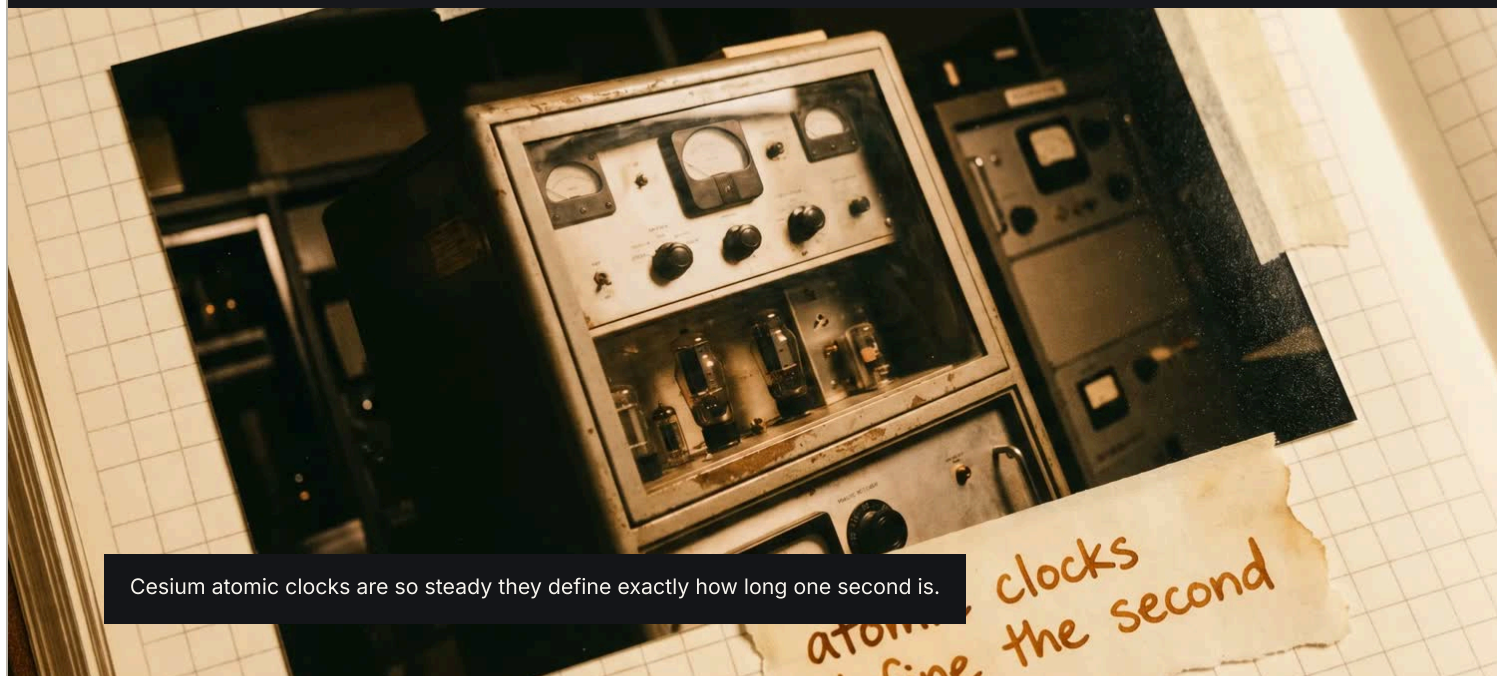
CHARGE

+1



DANGER

5/5 Extreme



Cesium atomic clocks are so steady they define exactly how long one second is.



# Ba

## BARIUM

THE “BARIUM SWALLOW” FOR X-RAY IMAGING - DENSE ENOUGH TO BLOCK X-RAYS

MASS

137.33

ELECTRONS

[Xe] 6s<sup>2</sup>

BOILS

1845 °C

CHARGE

+2



DANGER

2/5 Caution



Barium compounds burn bright green, giving fireworks their vivid green bursts.

green fireworks



# La

## LANTHANUM

KICKS OFF THE LANTHANIDE ROW

MASS

138.91

ELECTRONS

 $[\text{Xe}] 5d^1 6s^2$ 

BOILS

3464 °C

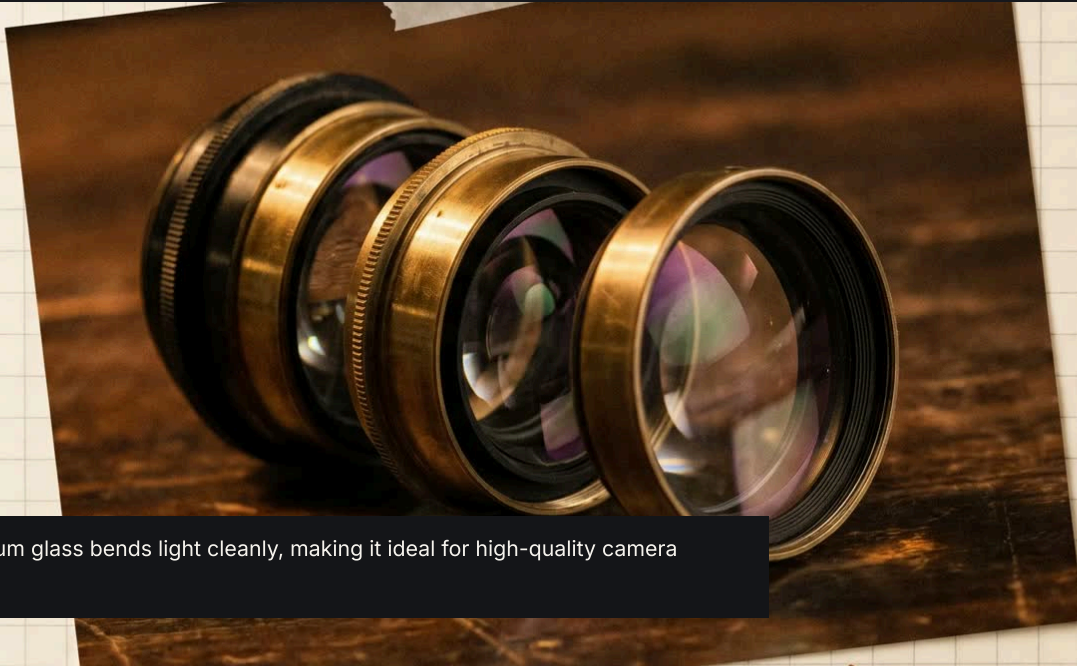
CHARGE

+3



DANGER

1/5 Low risk



Lanthanum glass bends light cleanly, making it ideal for high-quality camera lenses.



# CE

## CERIUM

THE FLINT IN EVERY CIGARETTE LIGHTER

MASS

140.12

ELECTRONS

 $[\text{Xe}] 4f^1 5d^1 6s^2$ 

BOILS

3443 °C

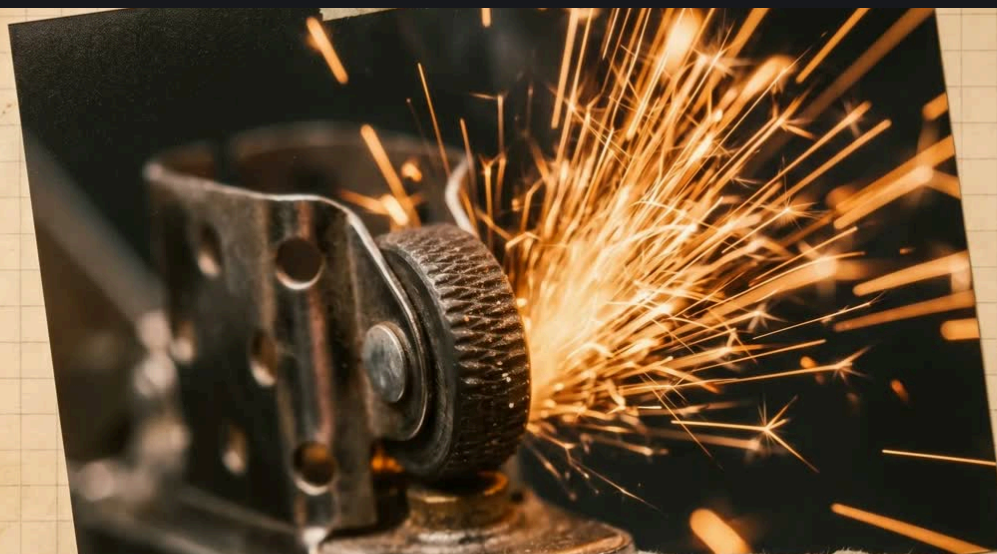
CHARGE

+3



DANGER

2/5 Caution



Cerium alloy is the flint in lighters, throwing sparks when you strike the wheel.

sparks from  
lighter flint



# Pr

## PRASEODYMIUM

THE GREEN FILTER IN WELDER'S GOGGLES

MASS

140.91

ELECTRONS

 $[\text{Xe}] 4f^3 6s^2$ 

BOILS

3520 °C

CHARGE

+3



DANGER

1/5 Low risk



Praseodymium tints the yellow glass in welding goggles that shields the eyes.

yellow  
welding goggles



# Nd

## NEODYMIUM

**NDFeB MAGNETS - THE STRONGEST PERMANENT MAGNETS EVER MADE**

MASS

144.24

ELECTRONS

[Xe] 4f<sup>4</sup> 6s<sup>2</sup>

BOILS

3074 °C

CHARGE

+3



DANGER

1/5 Low risk



Neodymium makes the strongest permanent magnets, found in headphones and motors.

*the strongest*



# Pm

## PROMETHIUM

NO STABLE ISOTOPES - VANISHINGLY RARE ON EARTH

MASS

[145]

ELECTRONS

[Xe] 4f<sup>5</sup> 6s<sup>2</sup>

BOILS

3000 °C


CHARGE

+3



DANGER

4/5 Severe



Promethium once powered glow-in-the-dark watch dials and is used in tiny long-life nuclear batteries.

old glow-in-the-dark



# Sm

## SAMARIUM

SMCO MAGNETS WORK HOT WHERE NDFEB FAILS

MASS

150.36

ELECTRONS

[Xe] 4f<sup>6</sup> 6s<sup>2</sup>

BOILS

1794 °C

CHARGE

+3



DANGER

1/5 Low risk



Samarium-cobalt magnets stay strong at high temperatures, so they run motors and precision devices.

high-temp



# EU

## EUROPIUM

THE RED PHOSPHOR IN OLD CRT TV TUBES

MASS

151.96

ELECTRONS

 $[Xe] 4f^7 6s^2$ 

BOILS

1529 °C

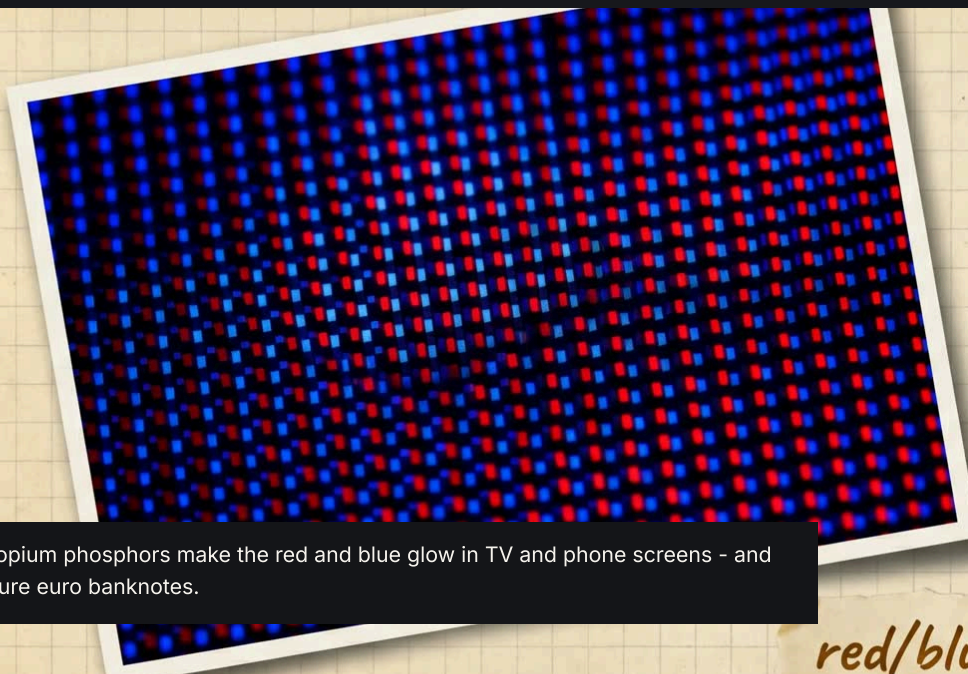
CHARGE

+3



DANGER

2/5 Caution



Europium phosphors make the red and blue glow in TV and phone screens - and secure euro banknotes.

*red/blue screen*



# Gd

## GADOLINIUM

MRI CONTRAST AGENT -  $Gd^{3+}$ 'S SEVEN UNPAIRED F-ELECTRONS MAKE IT MAGNETICALLY LOUD

MASS

157.25

ELECTRONS

 $[Xe] 4f^7 5d^1 6s^2$ 

BOILS

3273 °C

CHARGE

+3



DANGER

1/5 Low risk



A gadolinium solution injected before an MRI makes certain tissues stand out clearly in the scan.

MRI contrast agent



# Tb

## TERBIUM

GREEN PHOSPHOR IN FLUORESCENT LAMPS AND TRICHROMATIC LEDS

MASS

158.93

ELECTRONS

[Xe] 4f<sup>9</sup> 6s<sup>2</sup>

BOILS

3230 °C

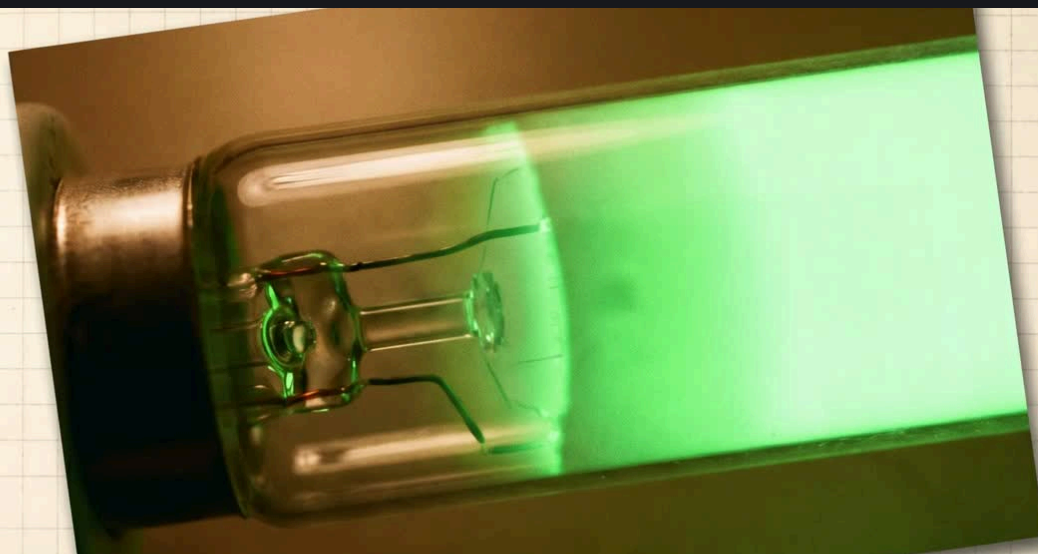
CHARGE

+3



DANGER

1/5 Low risk



Terbium is the green phosphor in fluorescent lamps and many color displays.

*green display*



# Dy

## DYSPROSIUM

HARD DRIVE HEADS, WIND TURBINE MAGNETS, ELECTRIC VEHICLE MOTORS

MASS

162.5

ELECTRONS

[Xe] 4f<sup>10</sup> 6s<sup>2</sup>

BOILS

2567 °C

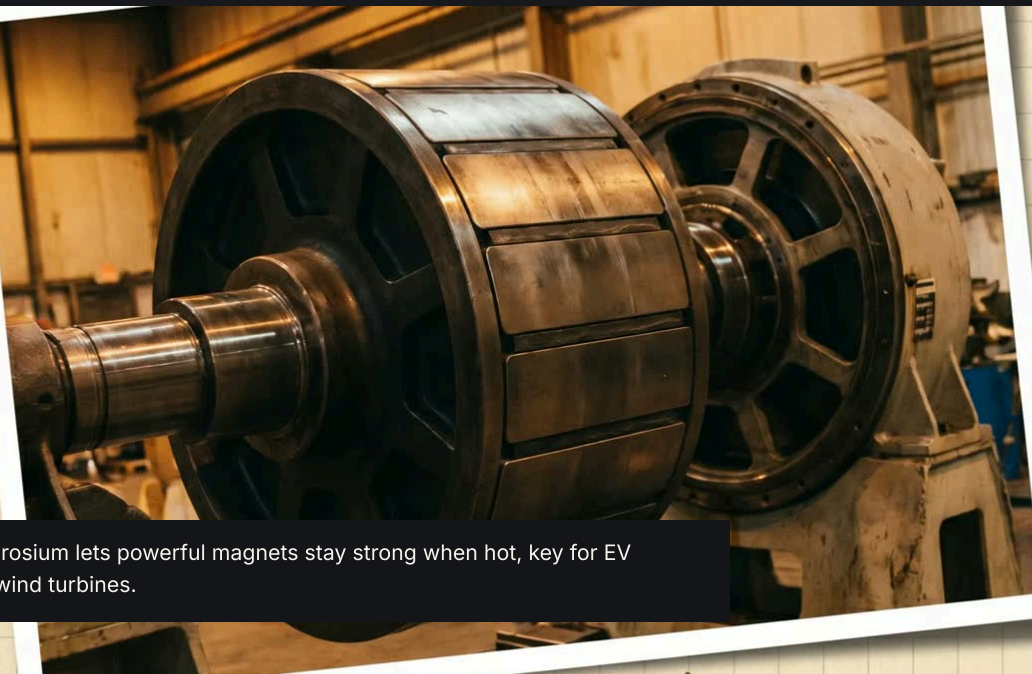
CHARGE

+3



DANGER

1/5 Low risk



Adding dysprosium lets powerful magnets stay strong when hot, key for EV motors and wind turbines.



# Ho

## HOLMIUM

THE HO:YAG LASER VAPORIZES KIDNEY STONES AND PROSTATE TISSUE

MASS

164.93

ELECTRONS

[Xe] 4f<sup>11</sup> 6s<sup>2</sup>

BOILS

2600 °C

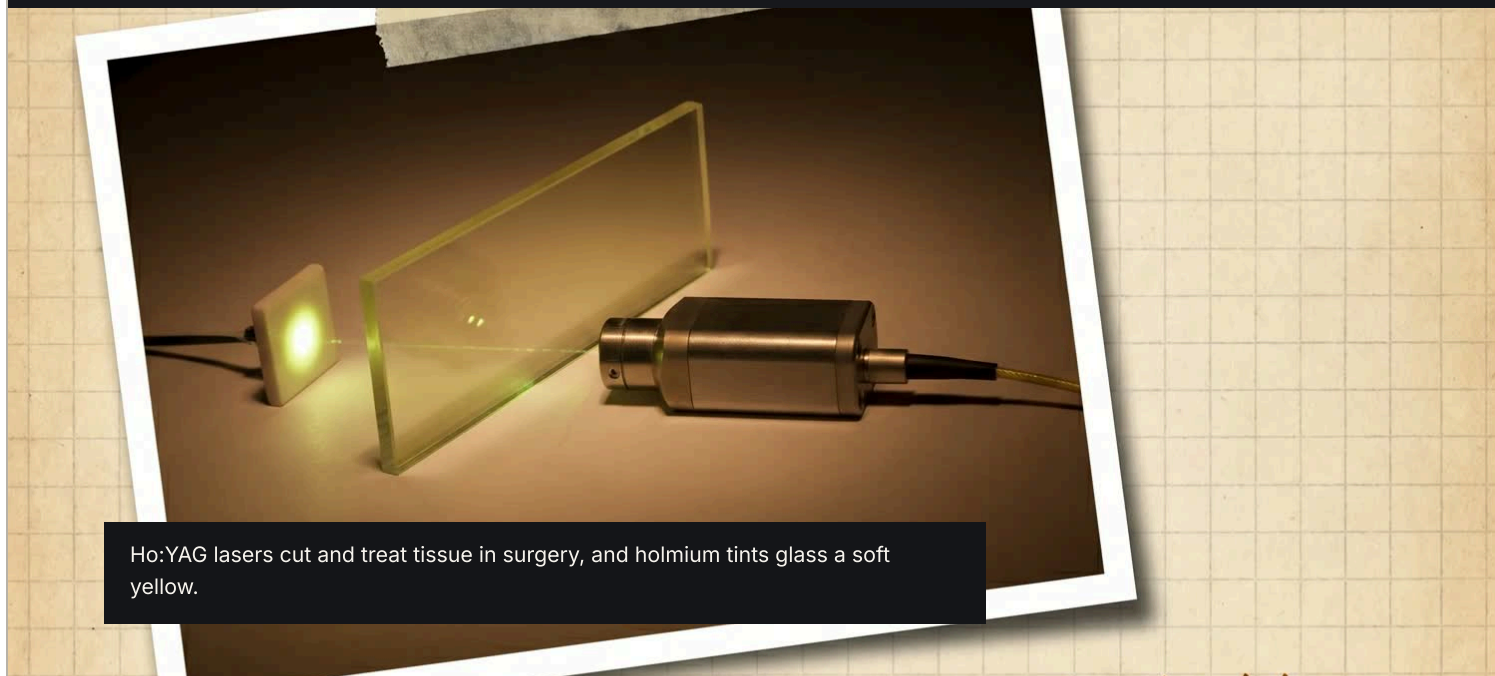
CHARGE

+3



DANGER

1/5 Low risk



Ho:YAG lasers cut and treat tissue in surgery, and holmium tints glass a soft yellow.



# Er

## ERBIUM

ERBIUM-DOPED FIBER AMPLIFIERS (EDFAS) CARRY THE ENTIRE INTERNET ACROSS OCEANS

MASS

167.26

ELECTRONS

[Xe] 4f<sup>12</sup> 6s<sup>2</sup>

BOILS

2868 °C

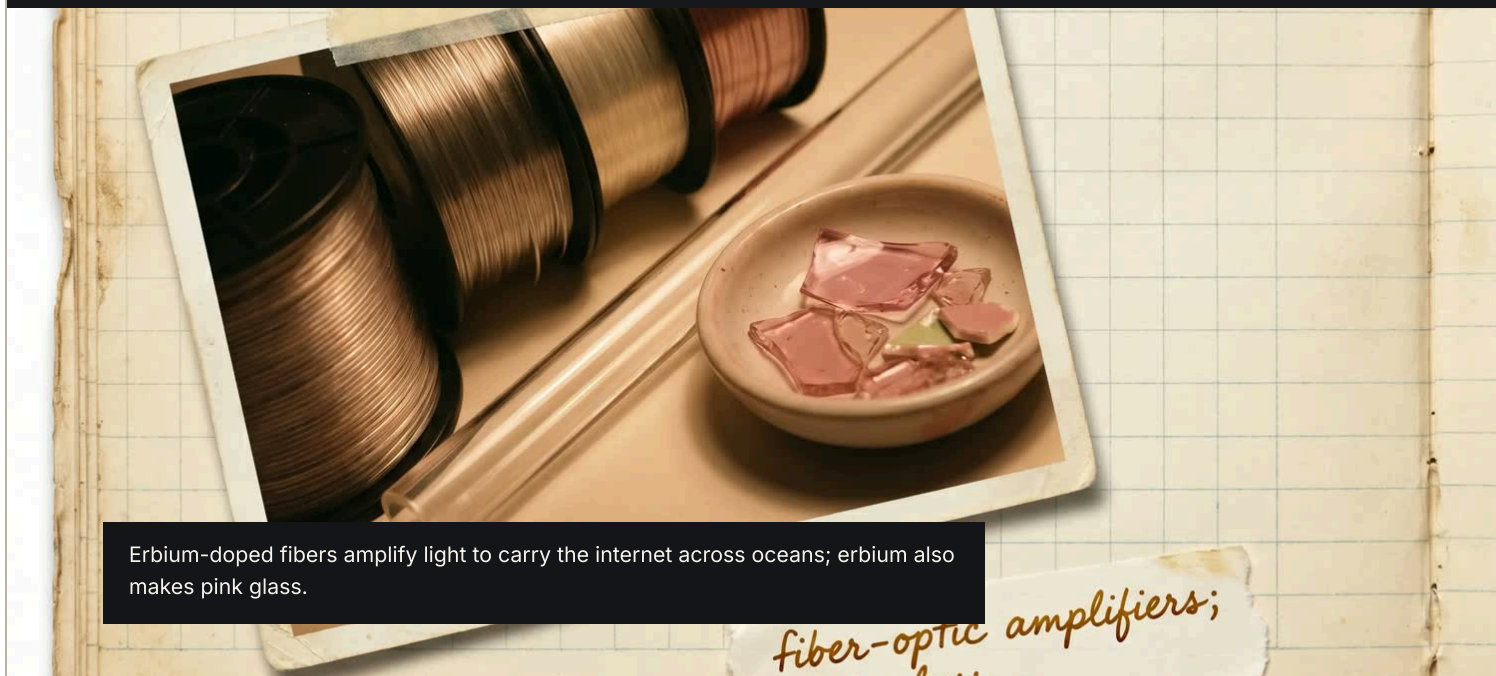
CHARGE

+3



DANGER

1/5 Low risk



Erbium-doped fibers amplify light to carry the internet across oceans; erbium also makes pink glass.

*fiber-optic amplifiers;*



# Tm

## THULIUM

### PORTABLE X-RAY SOURCES FOR INDUSTRIAL AND MEDICAL IMAGING

MASS

168.93

ELECTRONS

 $[\text{Xe}] 4f^{13} 6s^2$ 

BOILS

1950 °C

CHARGE

+3



DANGER

1/5 Low risk



A thulium isotope powers small portable X-ray machines used far from hospitals.

portable X-ray



# Yb

## YTTERBIUM

### YTTERBIUM ATOMIC CLOCKS BEAT CESIUM FOR PRECISION

MASS

173.05

ELECTRONS

 $[Xe] 4f^{14} 6s^2$ 

BOILS

1196 °C

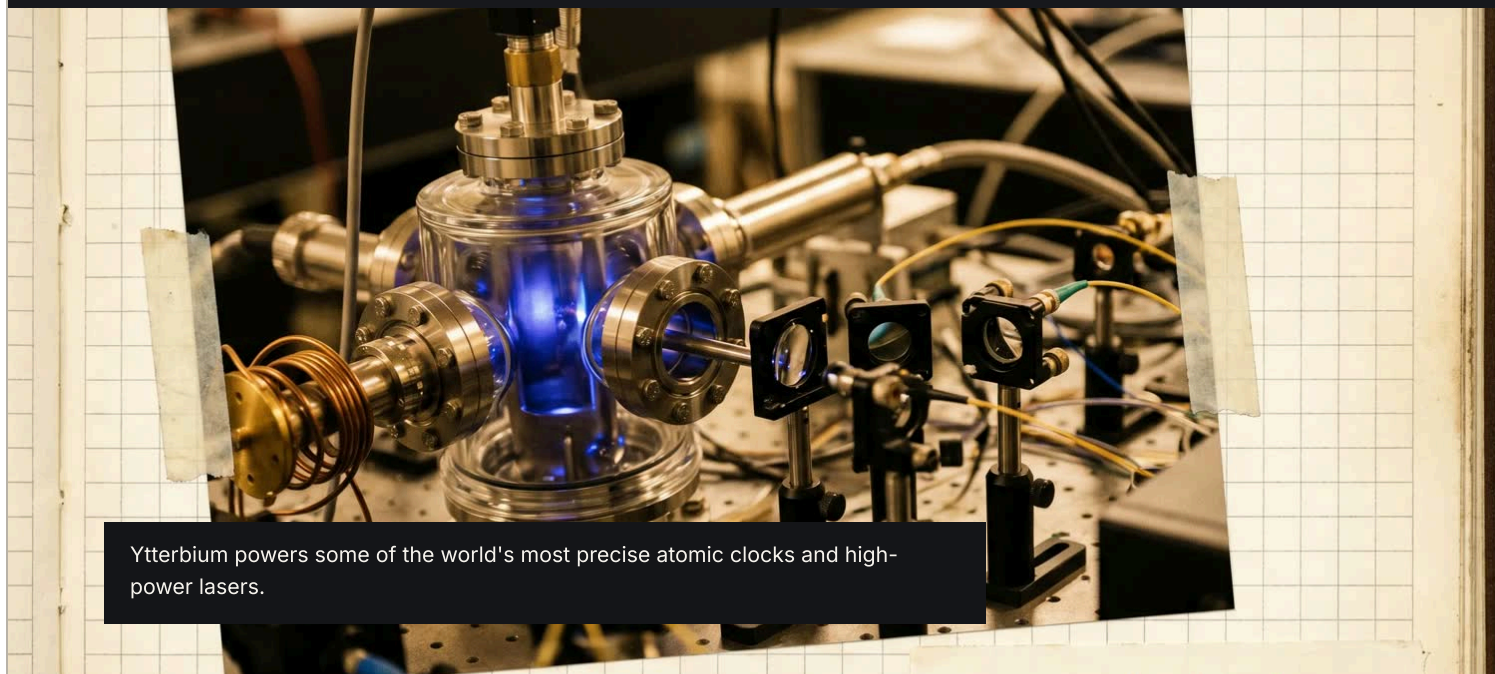
CHARGE

+3



DANGER

2/5 Caution



Ytterbium powers some of the world's most precise atomic clocks and high-power lasers.



# Lu

## LUTETIUM

LAST LANTHANIDE, HARDEST TO ISOLATE

MASS

174.97

ELECTRONS

 $[Xe] 4f^{14} 5d^1 6s^2$ 

BOILS

3402 °C

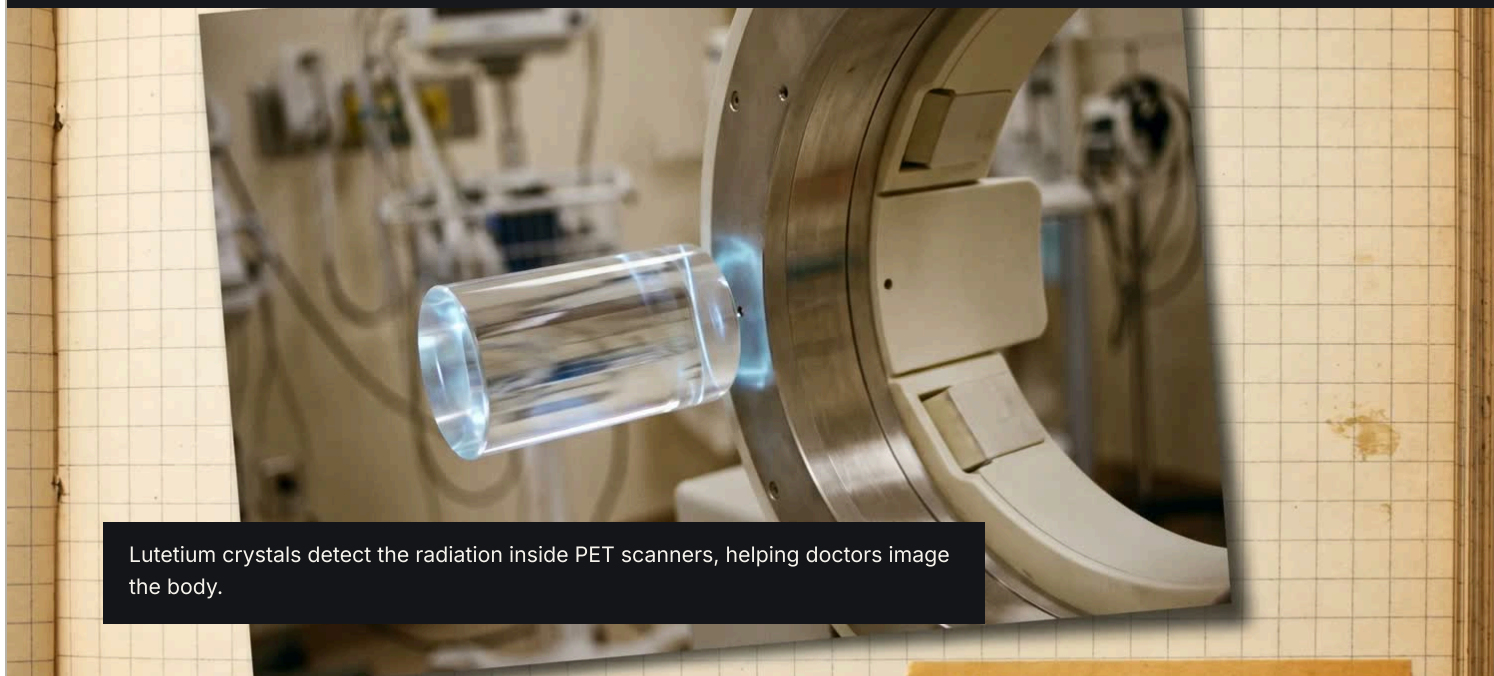
CHARGE

+3



DANGER

1/5 Low risk



Lutetium crystals detect the radiation inside PET scanners, helping doctors image the body.



# Hf

## HAFNIUM

NUCLEAR-REACTOR CONTROL RODS (HIGH NEUTRON-CAPTURE CROSS-SECTION)

MASS

178.49

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^2 6s^2$ 

BOILS

4603 °C

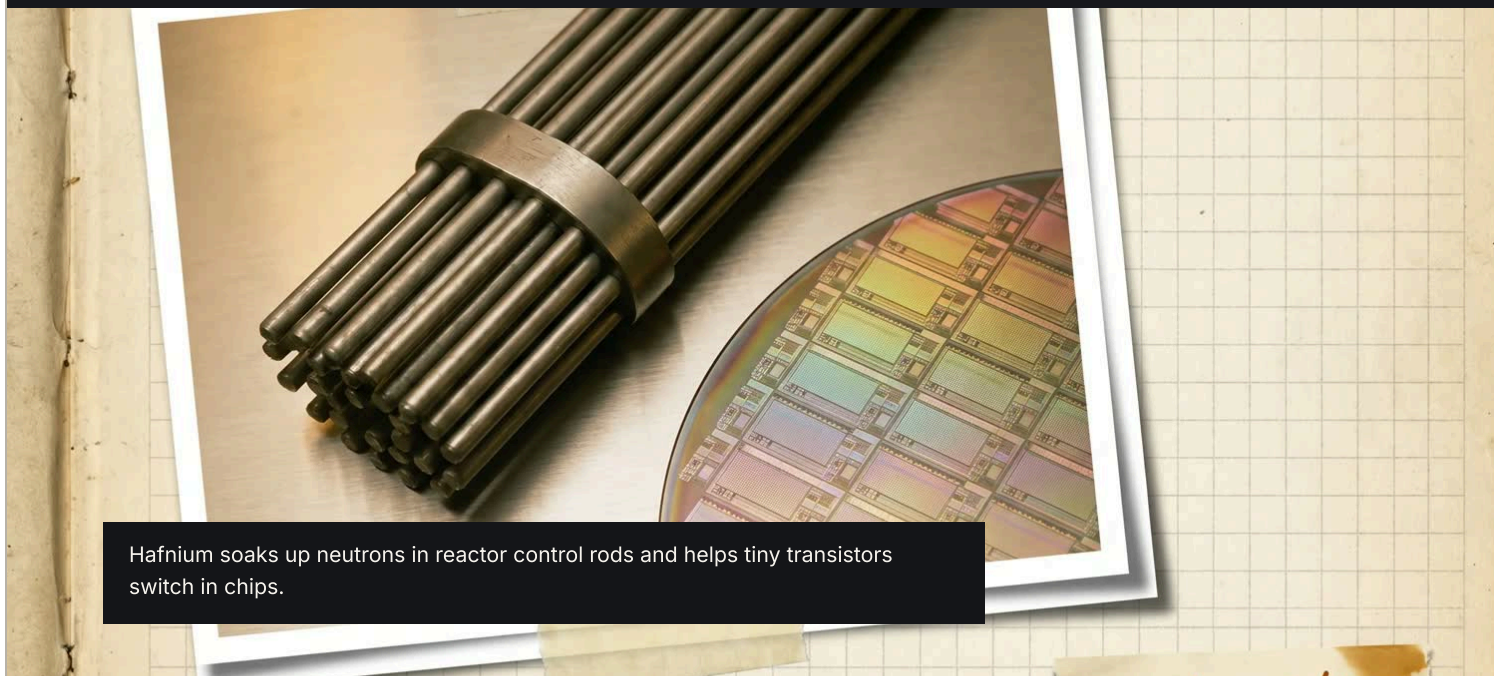
CHARGE

+4



DANGER

1/5 Low risk



Hafnium soaks up neutrons in reactor control rods and helps tiny transistors switch in chips.



# Ta

## TANTALUM

CAPACITORS IN EVERY SMARTPHONE ( $\text{Ta}_2\text{O}_5$  DIELECTRIC)

MASS

180.95

ELECTRONS

[Xe] 4f<sup>14</sup> 5d<sup>3</sup> 6s<sup>2</sup>

BOILS

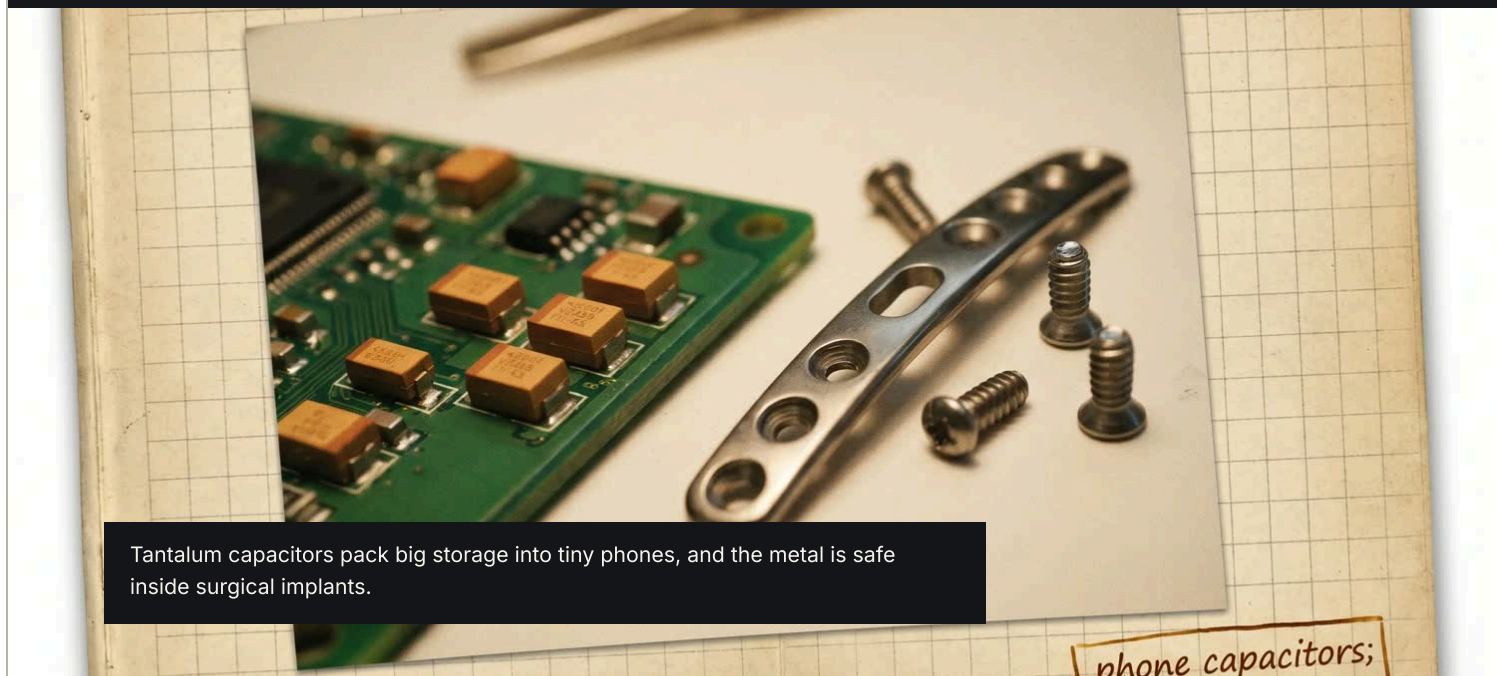
5458 °C

CHARGE

+5

DANGER

0/5 Safe to handle



Tantalum capacitors pack big storage into tiny phones, and the metal is safe inside surgical implants.

phone capacitors;



# W

# TUNGSTEN

HIGHEST MELTING POINT OF ANY ELEMENT (3422°C)

MASS

183.84

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^4 6s^2$ 

BOILS

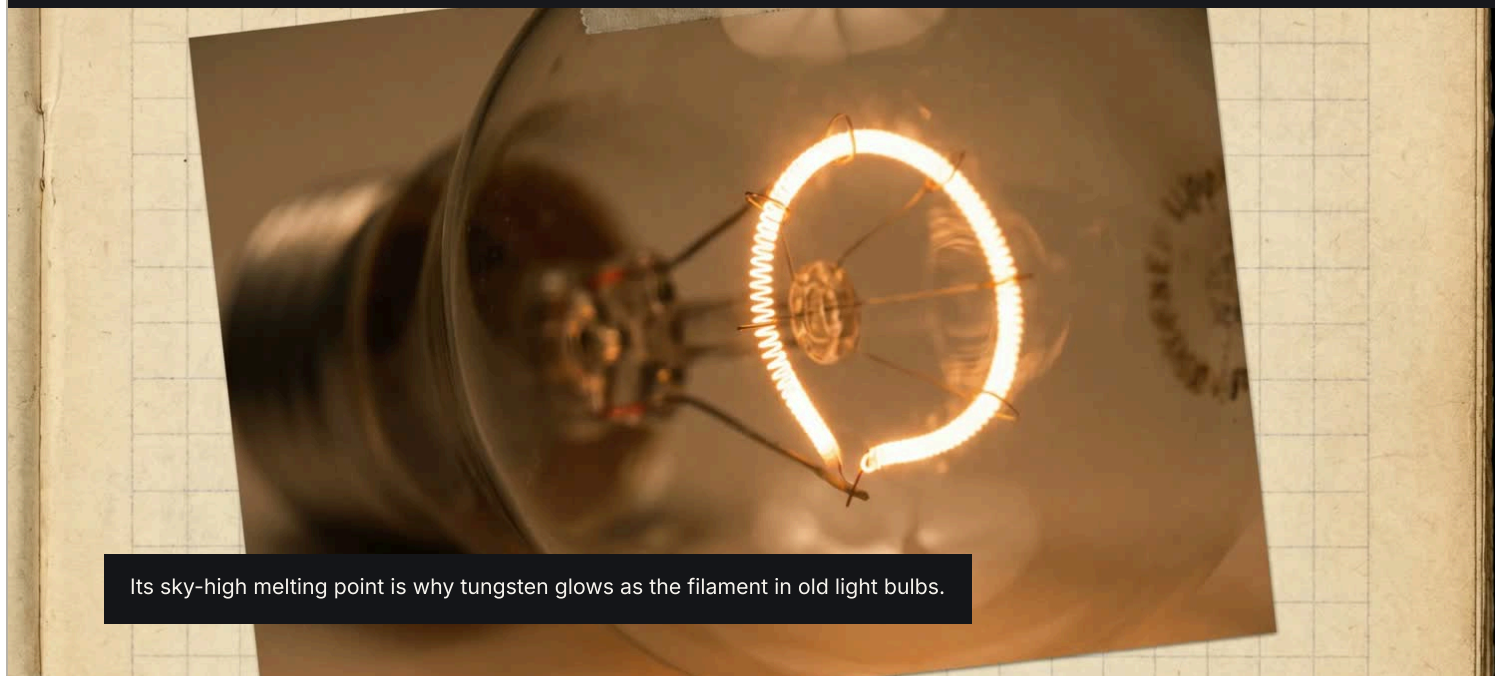
5930 °C

CHARGE

+4, +6

DANGER

0/5 Safe to handle



Its sky-high melting point is why tungsten glows as the filament in old light bulbs.



# Re

## RHENIUM

JET-ENGINE TURBINE BLADES - RE SUPERALLOYS SURVIVE HIGHER TEMPERATURES THAN ANY OTHERS

MASS

186.21

ELECTRONS

 $[Xe] 4f^{14} 5d^5 6s^2$ 

BOILS

5596 °C

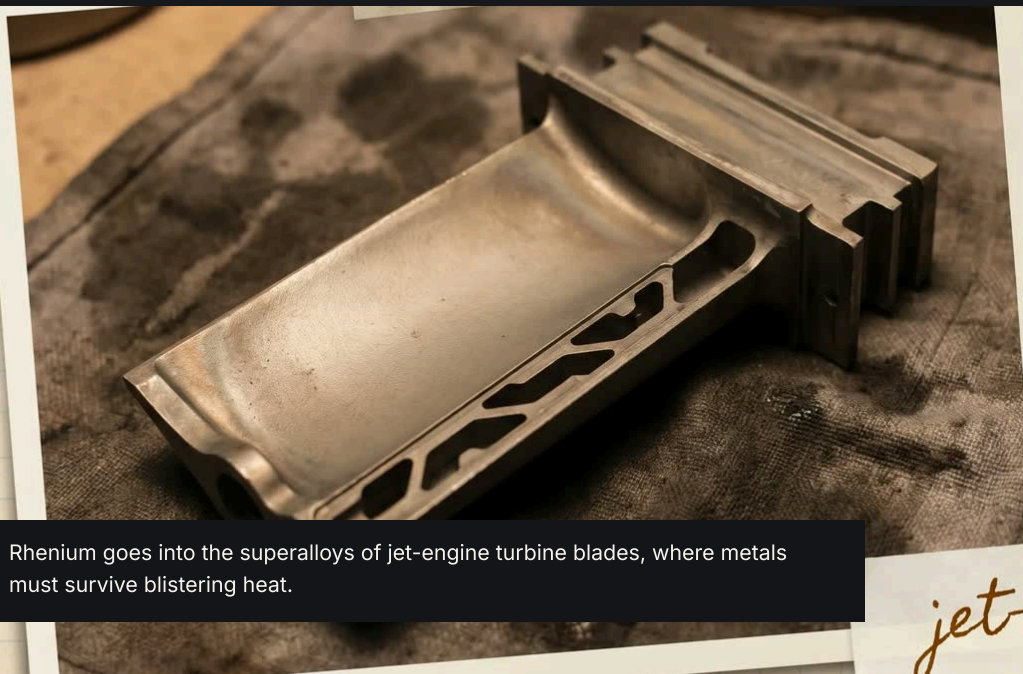
CHARGE

+4, +7



DANGER

1/5 Low risk



Rhenium goes into the superalloys of jet-engine turbine blades, where metals must survive blistering heat.

*jet-engine  
alloys*



# Os

## OSMIUM

DENSEST STABLE ELEMENT (22.59 G/CM<sup>3</sup>)

MASS

190.23

ELECTRONS

[Xe] 4f<sup>14</sup> 5d<sup>6</sup> 6s<sup>2</sup>

BOILS

5012 °C

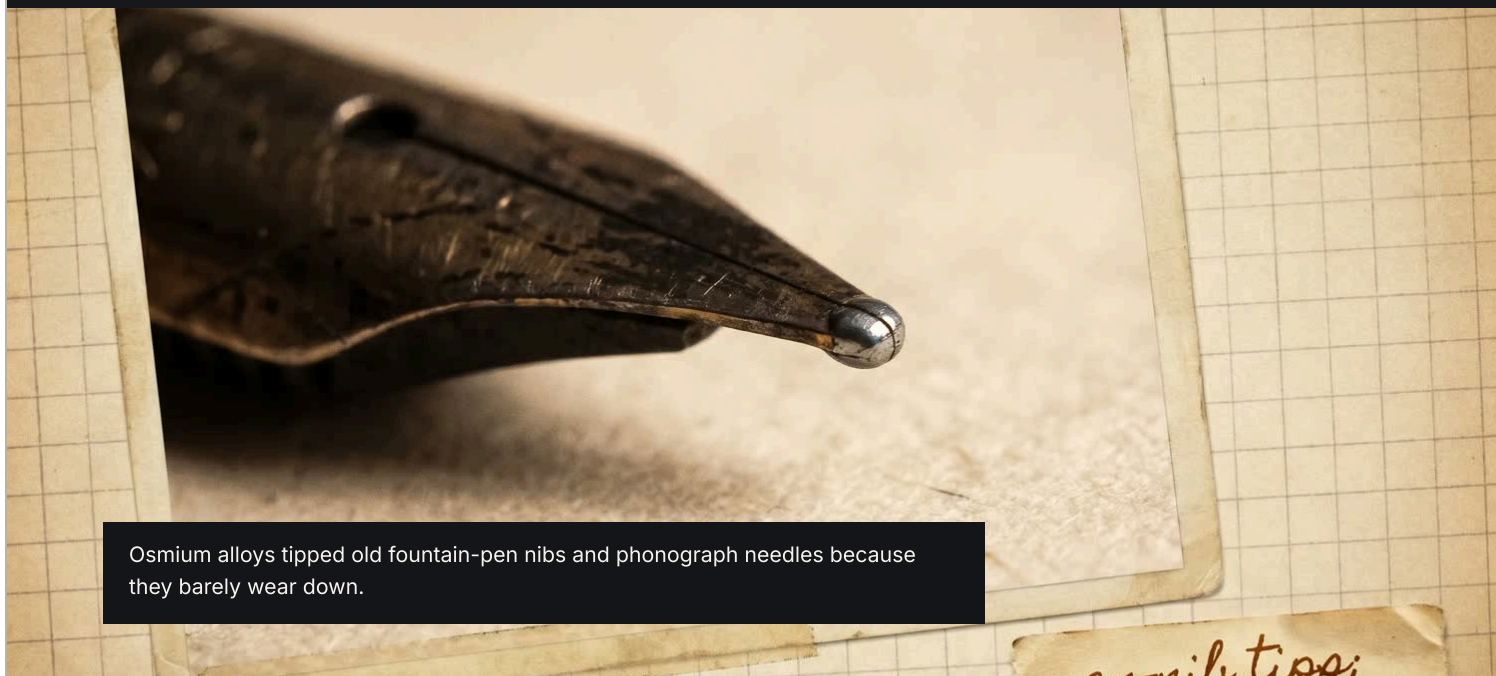
CHARGE

+4, +8

DANGER



3/5 Hazardous



Osmium alloys tipped old fountain-pen nibs and phonograph needles because they barely wear down.



# Ir

## IRIDIUM

THE IRIDIUM-RICH CRETACEOUS-PALEOGENE BOUNDARY LAYER  
MARKS THE DINOSAUR-KILLING ASTEROID

MASS

192.22

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^7 6s^2$ 

BOILS

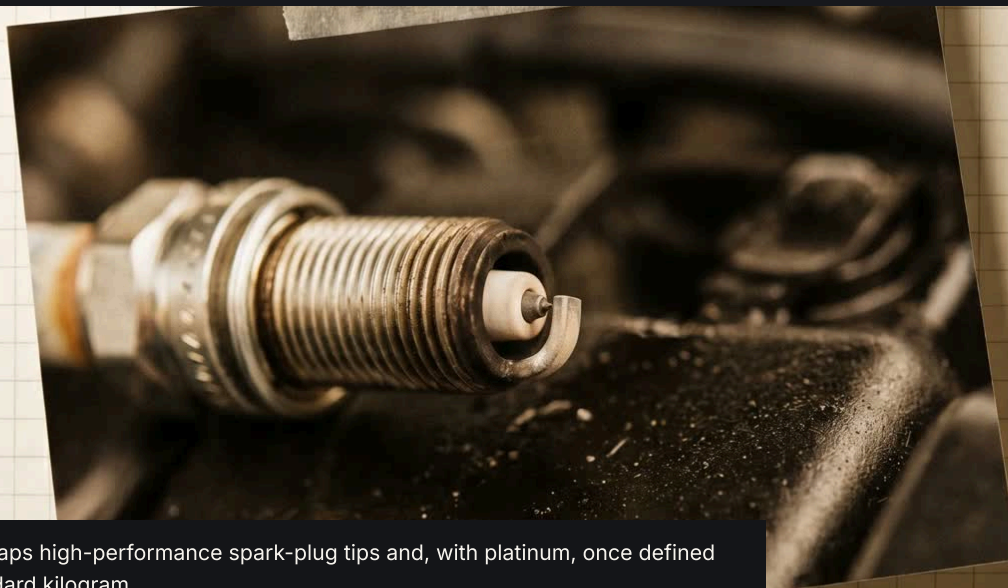
4428 °C

CHARGE

+3, +4

DANGER

0/5 Safe to handle



Iridium caps high-performance spark-plug tips and, with platinum, once defined the standard kilogram.



# Pt

## PLATINUM

### CATALYTIC CONVERTERS

MASS

195.08

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^9 6s^1$ 

BOILS

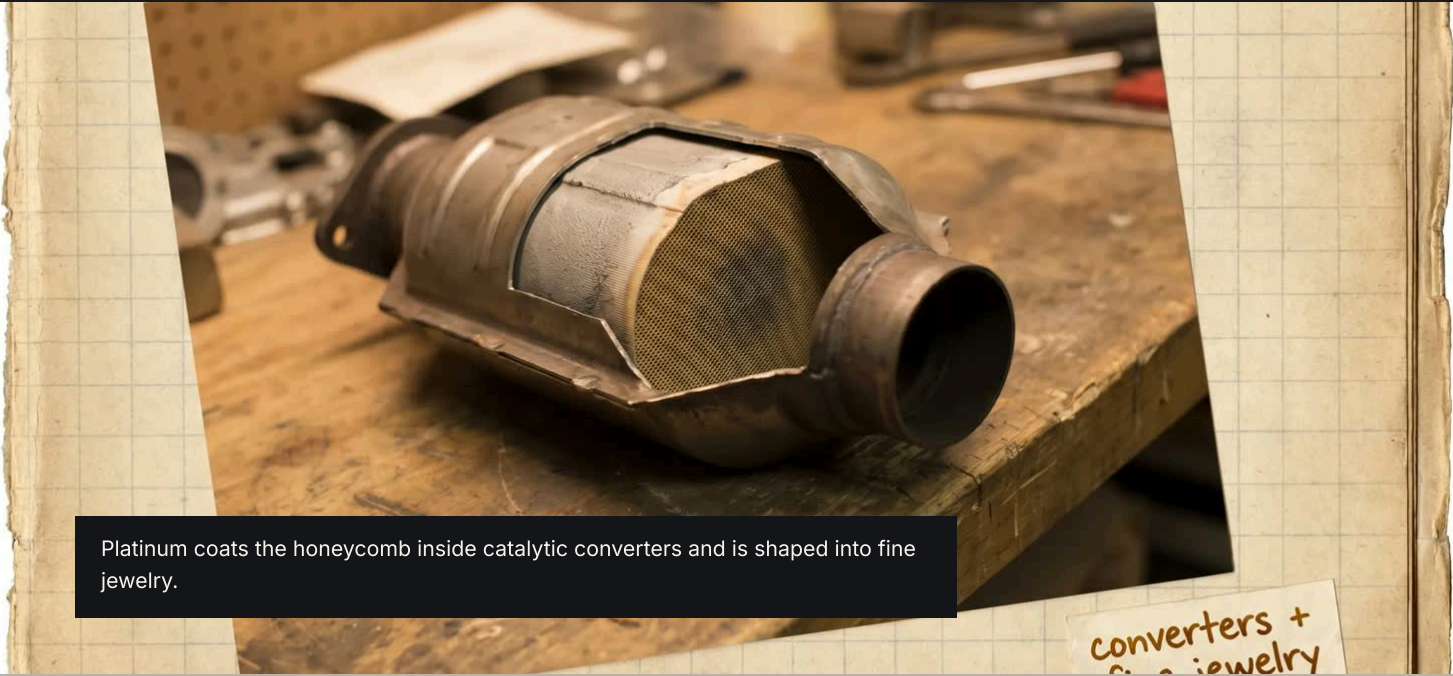
3825 °C

CHARGE

+2, +4

DANGER

0/5 Safe to handle



Platinum coats the honeycomb inside catalytic converters and is shaped into fine jewelry.

converters +  
jewelry



# AU

## GOLD

SOFT, DENSE, ALMOST CHEMICALLY INERT AT ROOM TEMPERATURE

MASS

196.97

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^{10} 6s^1$ 

BOILS

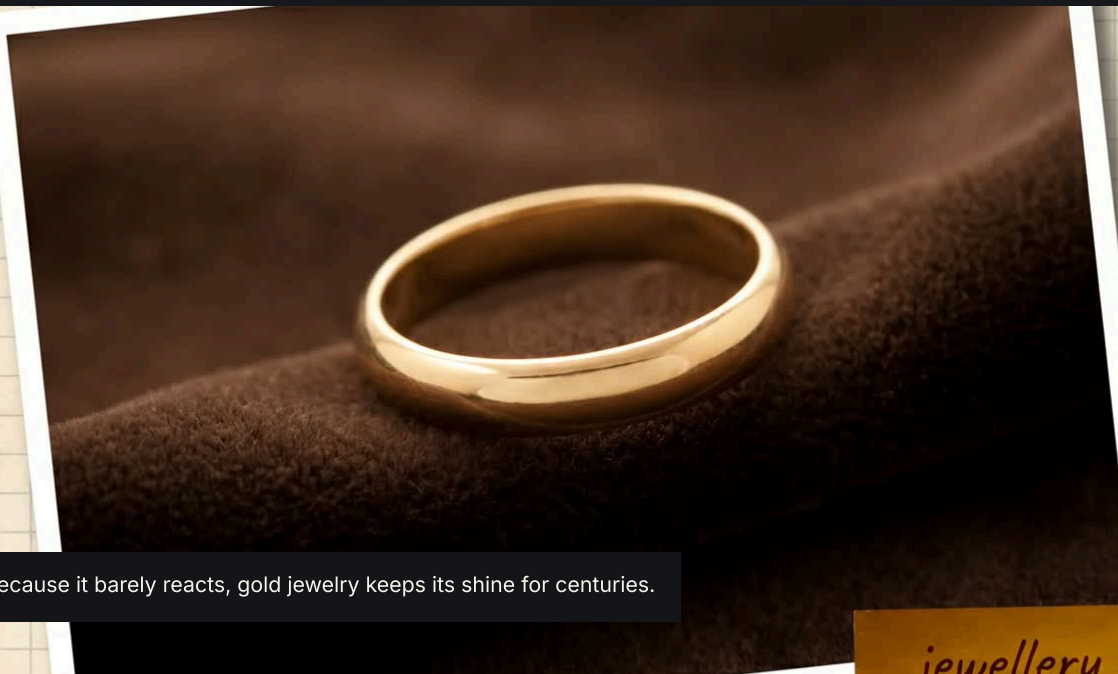
2856 °C

CHARGE

+1, +3

DANGER

0/5 Safe to handle



Because it barely reacts, gold jewelry keeps its shine for centuries.

*jewellery that*



# Hg

## MERCURY

THE ONLY METAL LIQUID AT ROOM TEMPERATURE

MASS

200.59

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^{10} 6s^2$ 

BOILS

357 °C

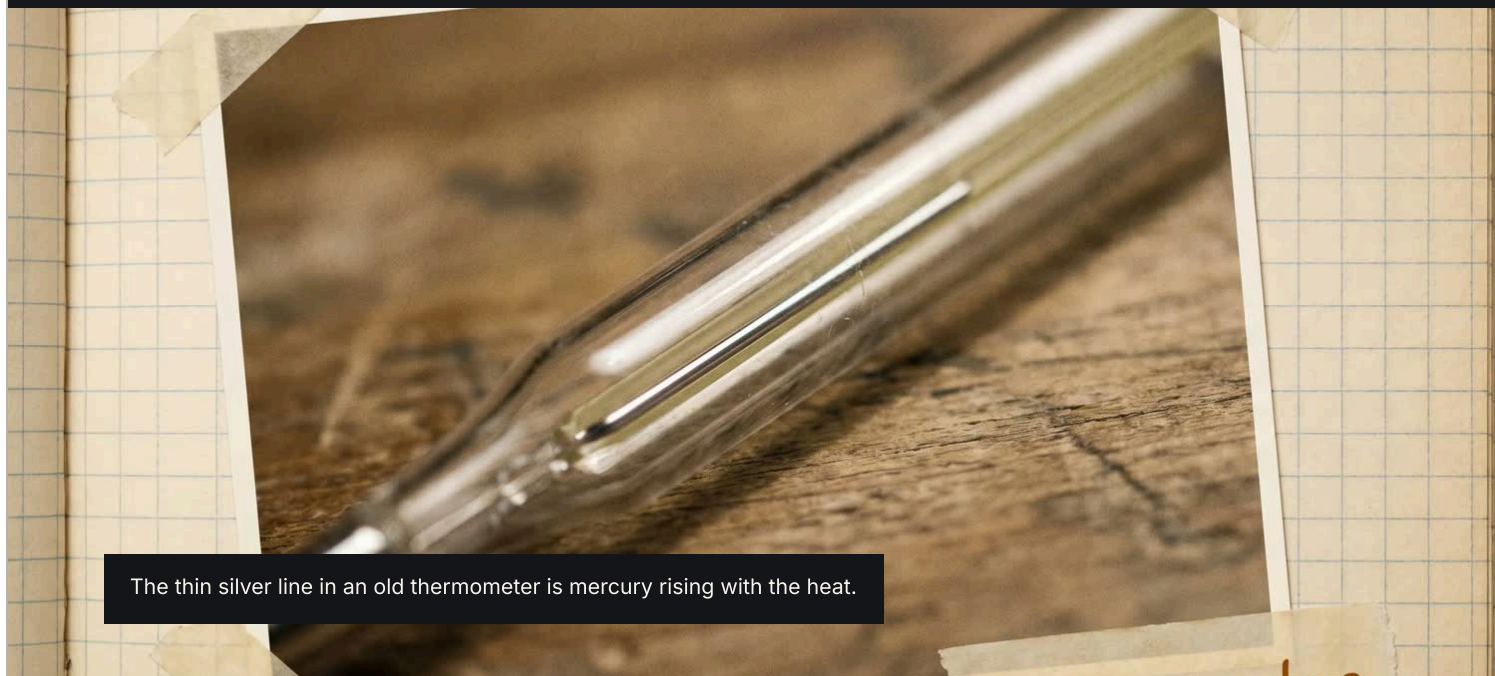
CHARGE

+1, +2

DANGER



3/5 Hazardous



The thin silver line in an old thermometer is mercury rising with the heat.



# Tl

## THALLIUM

THE “POISONER’S POISON” - ODORLESS, TASTELESS, LETHAL

MASS

204.38

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^{10} 6s^2 6p^1$ 

BOILS

1473 °C

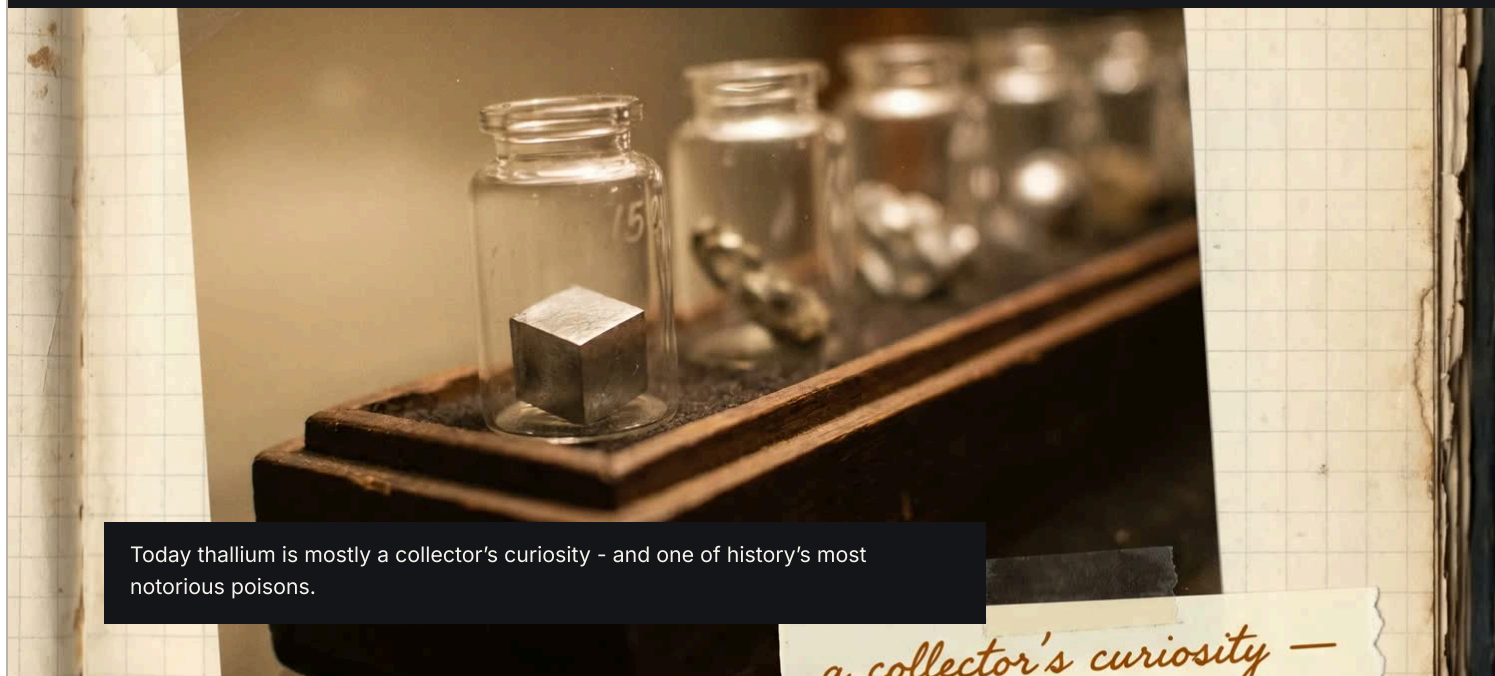
CHARGE

+1, +3

DANGER



4/5 Severe



Today thallium is mostly a collector's curiosity - and one of history's most notorious poisons.

*a collector's curiosity —*



# Pb

## LEAD

DENSE, SOFT, TOXIC

MASS

207.2

ELECTRONS

 $[\text{Xe}] 4f^{14} 5d^{10} 6s^2 6p^2$ 

BOILS

1749 °C

CHARGE

+2, +4

DANGER



3/5 Hazardous



Lead's density makes it ideal for fishing sinkers and car batteries.

fishing sinkers,



# Bi

## BISMUTH

PEPTO-BISMOL (BISMUTH SUBSALICYLATE) COATS YOUR STOMACH  
PINK

MASS

208.98

ELECTRONS

 $[Xe] 4f^{14} 5d^{10} 6s^2 6p^3$ 

BOILS

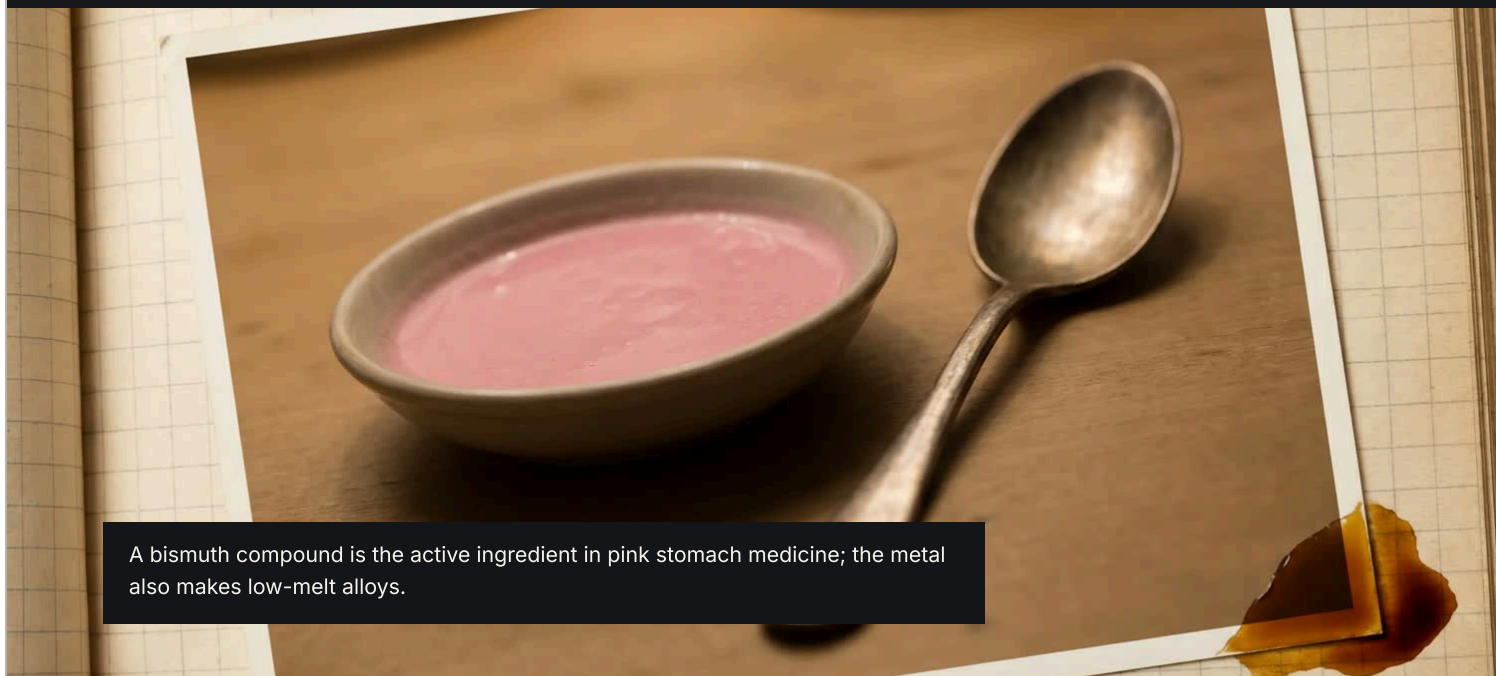
1564 °C

CHARGE

+3, +5

DANGER

0/5 Safe to handle



A bismuth compound is the active ingredient in pink stomach medicine; the metal also makes low-melt alloys.



# PO

## POLONIUM

MARIE CURIE'S FIRST NEW ELEMENT, NAMED FOR HER OCCUPIED HOMELAND

MASS

[209]

ELECTRONS

[Xe] 4f<sup>14</sup> 5d<sup>10</sup> 6s<sup>2</sup> 6p<sup>4</sup>

BOILS

962 °C

CHARGE

-2, +2, +4



DANGER

5/5 Extreme

**Why no photograph?** Polonium is intensely radioactive and exists only in tiny traces. The pure metal has been made in minute, heavily shielded amounts - never anything you would encounter.



# At

## ASTATINE

THE RAREST NATURALLY-OCCURRING ELEMENT ON EARTH - LESS THAN 30 GRAMS IN THE ENTIRE CRUST AT ANY GIVEN MOMENT

MASS

[210]

ELECTRONS

[Xe] 4f<sup>14</sup> 5d<sup>10</sup> 6s<sup>2</sup> 6p<sup>5</sup>

BOILS

337 °C

CHARGE

-1, +1, +3, +5, +7



DANGER

5/5 Extreme

**Why no photograph?** Astatine is the rarest naturally occurring element. It is so radioactive that any visible amount would instantly boil away in its own heat - no one has ever seen it.



# Rn

## RADON

COLORLESS, ODORLESS, RADIOACTIVE GAS SEEPING OUT OF GRANITE

MASS

[222]

ELECTRONS

[Xe] 4f<sup>14</sup> 5d<sup>10</sup> 6s<sup>2</sup> 6p<sup>6</sup>

BOILS

-62 °C

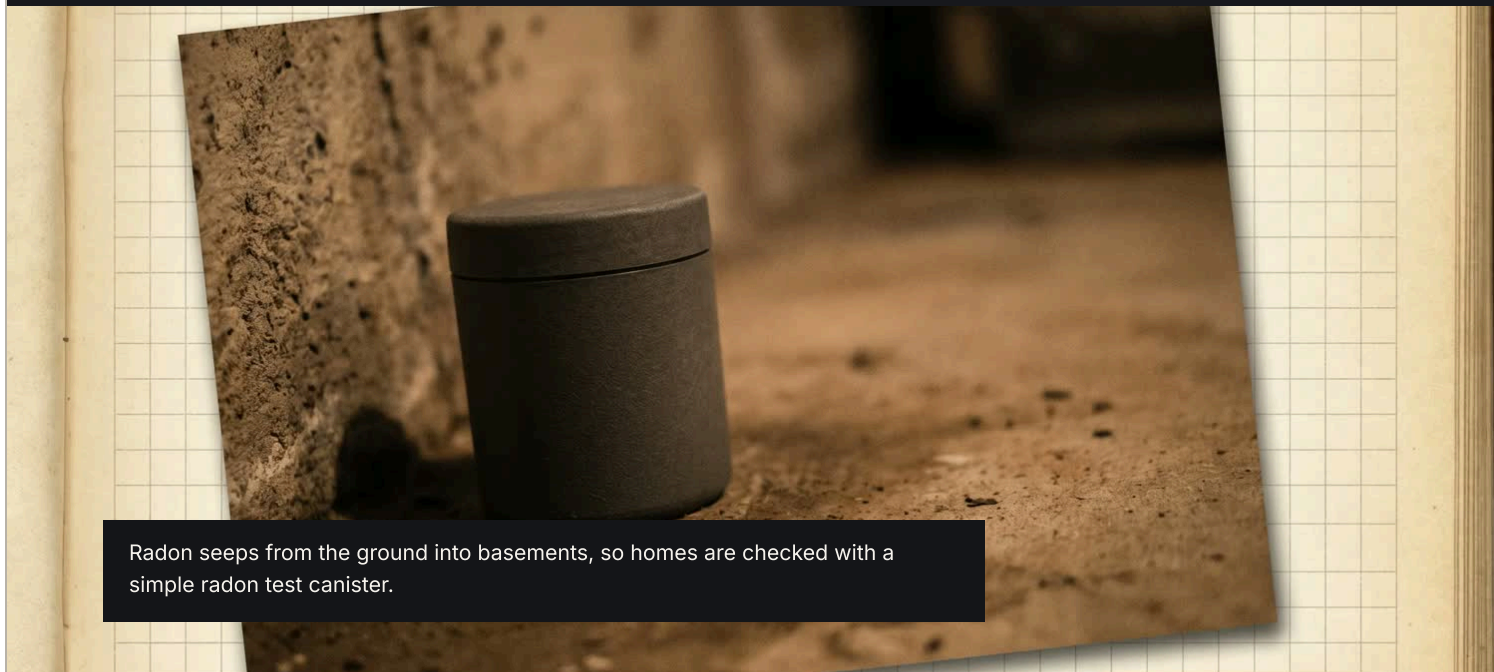
CHARGE

0, +2



DANGER

4/5 Severe



Radon seeps from the ground into basements, so homes are checked with a simple radon test canister.



# Fr

## FRANCIUM

THE RAREST OF THE “NATURALLY-OCCURRING” ELEMENTS AFTER  
ASTATINE

MASS

[223]

ELECTRONS

[Rn] 7s<sup>1</sup>

BOILS

677 °C

CHARGE

+1



DANGER

5/5 Extreme

**Why no photograph?** Francium is wildly unstable: its longest-lived form lasts about 22 minutes. It exists only as a fleeting step in uranium's decay chain, so although new atoms keep forming in trace amounts, it has never been gathered into a visible piece.



# Ra

## RADIUM

### MARIE CURIE'S GLOW-IN-THE-DARK ELEMENT

MASS

[226]

ELECTRONS

[Rn] 7s<sup>2</sup>

BOILS

1737 °C

CHARGE

+2



DANGER

5/5 Extreme



Radium paint made old watch and clock dials glow green in the dark, a practice long since abandoned.

*old glowing*



# AC

## ACTINIUM

GLOWS BLUE IN THE DARK FROM THE RADIATION IT EMITS

MASS

[227]

ELECTRONS

[Rn] 6d<sup>1</sup> 7s<sup>2</sup>

BOILS

3200 °C

CHARGE

+3



DANGER

5/5 Extreme

**Why no photograph?** Actinium is so radioactive it glows faintly blue in the dark. It exists only in tiny lab-made amounts and is never seen outside shielded research.



# Th

## THORIUM

POTENTIAL NEXT-GENERATION NUCLEAR FUEL - ABUNDANT, CAN'T WEAPONIZE EASILY

MASS

232.04

ELECTRONS

 $[Rn] 6d^2 7s^2$ 

BOILS

4788 °C

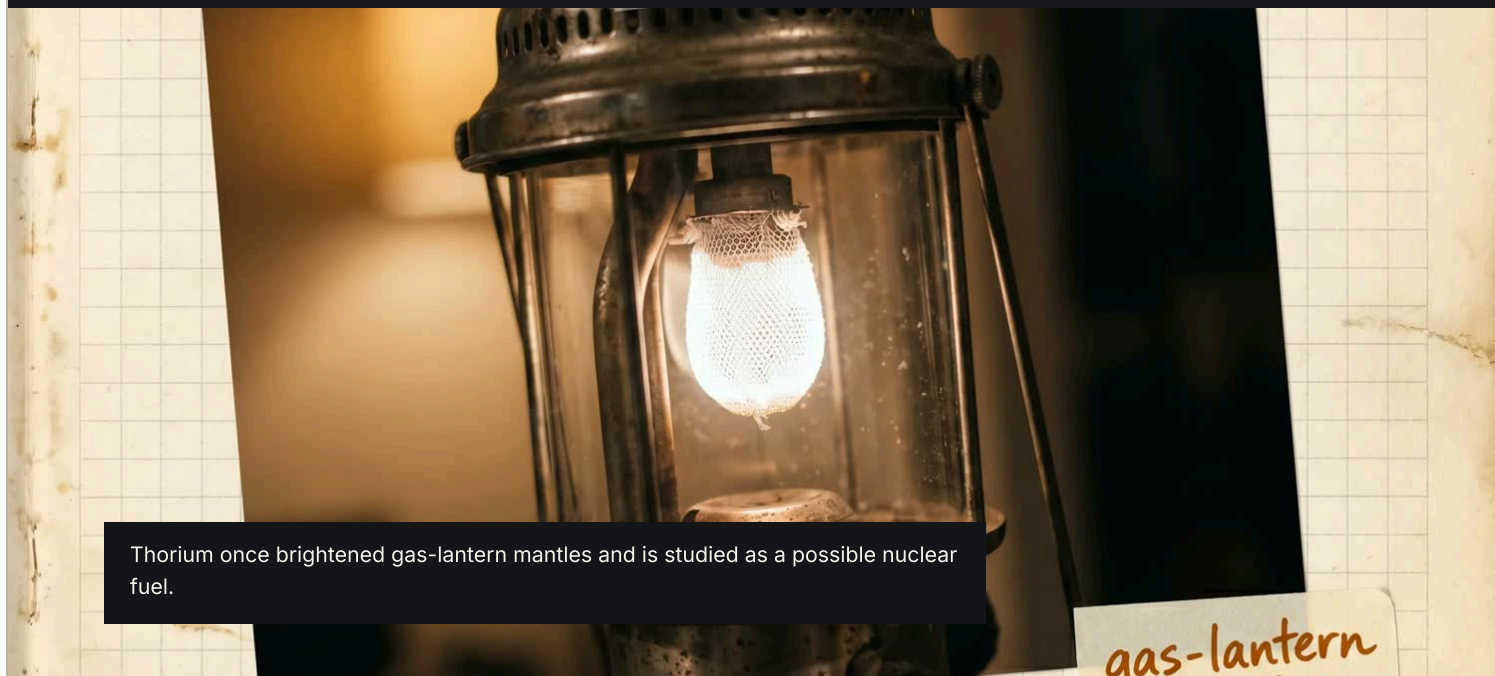
CHARGE

+4



DANGER

3/5 Hazardous



Thorium once brightened gas-lantern mantles and is studied as a possible nuclear fuel.



# Pa

## PROTACTINIUM

DECAYS INTO ACTINIUM - THAT IS THE ENTIRE REASON FOR ITS NAME

MASS

231.04

ELECTRONS

 $[Rn] 5f^2 6d^1 7s^2$ 

BOILS

4027 °C

CHARGE

+4, +5



DANGER

4/5 Severe

**Why no photograph?** Protactinium is one of the rarest and most radioactive natural elements - isolated only in tiny research quantities, never something you would meet.



# U

## URANIUM

HEAVIEST ELEMENT FOUND IN SIGNIFICANT AMOUNTS IN NATURE

MASS

238.03

ELECTRONS

 $[Rn] 5f^3 6d^1 7s^2$ 

BOILS

4131 °C

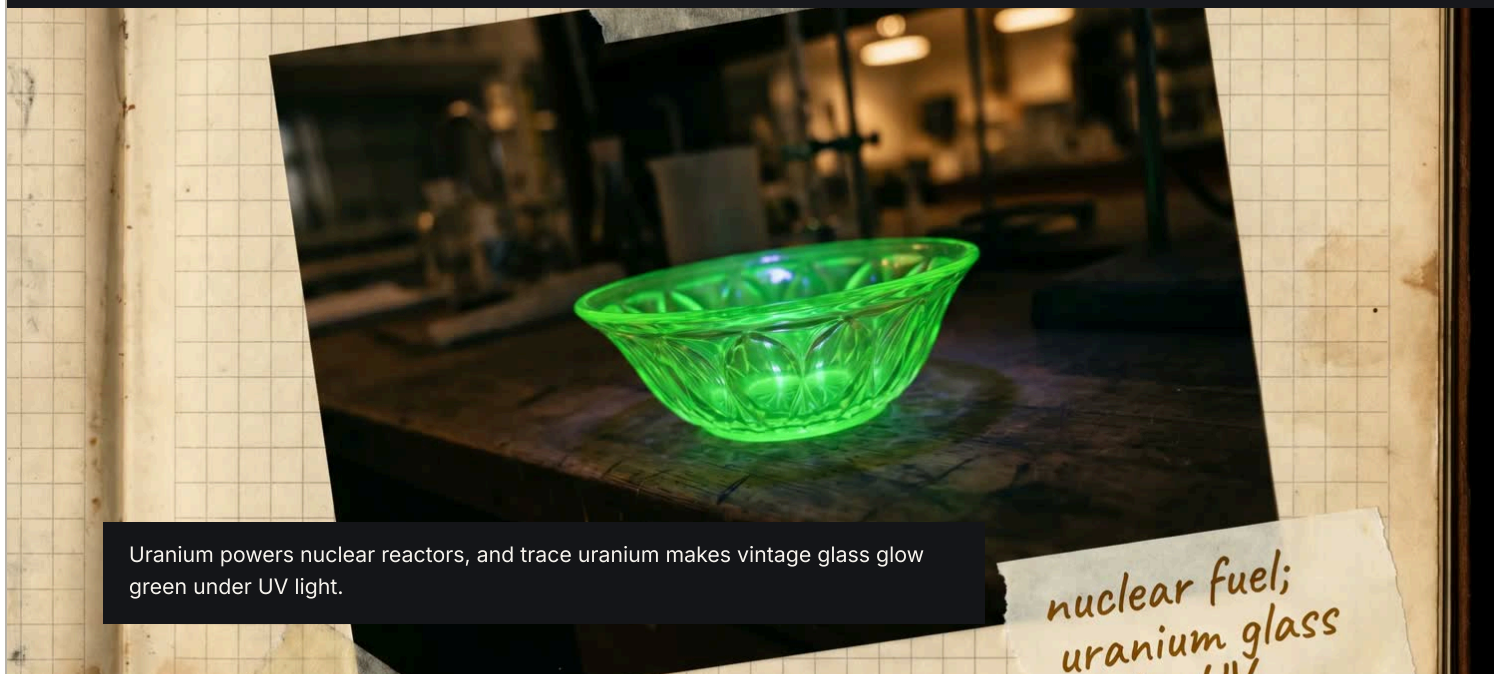
CHARGE

+3, +4, +5, +6



DANGER

4/5 Severe



Uranium powers nuclear reactors, and trace uranium makes vintage glass glow green under UV light.

nuclear fuel;  
uranium glass



# Np

## NEPTUNIUM

FIRST ELEMENT BEYOND URANIUM SYNTHESIZED (1940)

MASS

[237]

ELECTRONS

[Rn] 5f<sup>4</sup> 6d<sup>1</sup> 7s<sup>2</sup>

BOILS

4000 °C

CHARGE

+3, +4, +5, +6, +7



DANGER

4/5 Severe

**Why no photograph?** Neptunium is synthetic, forged in nuclear reactors and handled only behind heavy shielding. It exists in real amounts, but never anywhere you would encounter it.



# PU

## PLUTONIUM

THE TRINITY TEST CORE

MASS

[244]

ELECTRONS

[Rn] 5f<sup>6</sup> 7s<sup>2</sup>

BOILS

3228 °C

CHARGE

+3, +4, +5, +6



DANGER

5/5 Extreme

**Why no photograph?** Plutonium has been made by the ton for reactors and spacecraft power, and even photographed - but it is intensely radioactive and locked inside shielded facilities. You will never meet it.



# Am

## AMERICIUM

THE RADIOACTIVE ISOTOPE INSIDE EVERY HOUSEHOLD IONIZATION  
SMOKE DETECTOR

MASS

[243]

ELECTRONS

[Rn] 5f<sup>7</sup> 7s<sup>2</sup>

BOILS

2011 °C

CHARGE

+3, +4, +5, +6



DANGER

4/5 Severe

**Why no photograph?** Americium is synthetic and radioactive - yet a microscopic sealed speck sits inside almost every smoke detector, quietly watching for smoke. You still never see the bare metal.



# Cm

## CURIUM

POWER SOURCE FOR MARS ROVERS (IN SOME CONFIGURATIONS)

MASS

[247]

ELECTRONS

[Rn] 5f<sup>7</sup> 6d<sup>1</sup> 7s<sup>2</sup>

BOILS

3110 °C

CHARGE

+3, +4



DANGER

5/5 Extreme

**Why no photograph?** Curium is so radioactive it glows from its own energy. A sealed speck has flown on Mars rovers to read the chemistry of rocks, but it never leaves shielded handling.



# BK

## BERKELIUM

SYNTHESIZED AT UC BERKELEY BY GLENN SEABORG'S TEAM IN 1949

MASS

[247]

ELECTRONS

[Rn] 5f<sup>9</sup> 7s<sup>2</sup>

BOILS

2627 °C

CHARGE

+3, +4



DANGER

5/5 Extreme

**Why no photograph?** Berkelium has only ever been made in amounts smaller than a grain of sand, in a handful of labs on Earth. Almost no one has ever seen it.



# Cf

## CALIFORNIUM

**STRONG NEUTRON EMITTER - USED IN OIL-WELL LOGGING, TREATMENT OF CERVICAL CANCER, AND AS A STARTING MATERIAL FOR HEAVIER...**

MASS

[251]

ELECTRONS

[Rn] 5f<sup>10</sup> 7s<sup>2</sup>

BOILS

1470 °C

CHARGE

+2, +3, +4



DANGER

5/5 Extreme

**Why no photograph?** Californium is among the most expensive substances on Earth, made in microscopic specks. A glimpse or two has been recorded - but you will never encounter it.



# ES

## EINSTEINIUM

FIRST IDENTIFIED IN THE FALLOUT OF THE “IVY MIKE” HYDROGEN-BOMB TEST (1952)

MASS

[252]

ELECTRONS

[Rn] 5f<sup>11</sup> 7s<sup>2</sup>

BOILS

996 °C

CHARGE

+3



DANGER

5/5 Extreme

**Why no photograph?** Einsteinium has only been made in invisible trace amounts; the largest samples ever made glow from their own radioactivity. Essentially no one has seen it.



# Fm

## FERMIUM

HEAVIEST ELEMENT ACCESSIBLE BY NEUTRON-CAPTURE CASCADE -  
BEYOND FM REQUIRES HEAVY-ION BOMBARDMENT

MASS

[257]

ELECTRONS

[Rn] 5f<sup>12</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+2, +3



DANGER

5/5 Extreme

**Why no photograph?** Fermium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Md

## MENDELEVIVM

FIRST SYNTHESIZED ONE ATOM AT A TIME AT UC BERKELEY (1955)

MASS

[258]

ELECTRONS

[Rn] 5f<sup>13</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+2, +3



DANGER

5/5 Extreme

**Why no photograph?** Mendeleevium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# No

## NOBELIUM

DISCOVERY CONTESTED BETWEEN BERKELEY, DUBNA, AND THE NOBEL INSTITUTE IN STOCKHOLM - NAME WAS THE POLITICAL COMPROMISE

MASS

[259]

ELECTRONS

[Rn] 5f<sup>14</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+2, +3



DANGER

5/5 Extreme

**Why no photograph?** Nobelium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Lr

## LAWRENCIUM

LAST ACTINIDE

MASS

[266]

ELECTRONS

[Rn] 5f<sup>14</sup> 7s<sup>2</sup> 7p<sup>1</sup>

BOILS

—

CHARGE

+3



DANGER

5/5 Extreme

**Why no photograph?** Lawrencium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Rf

## RUTHERFORDIUM

FIRST ELEMENT OF THE D-BLOCK SUPER-HEAVIES

MASS

[267]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>2</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+4



DANGER

5/5 Extreme

**Why no photograph?** Rutherfordium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Db

## DUBNIUM

SYNTHESIZED AT THE JINR (JOINT INSTITUTE FOR NUCLEAR RESEARCH) IN DUBNA, RUSSIA

MASS

[268]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>3</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+5



DANGER

5/5 Extreme

**Why no photograph?** Dubnium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Sg

## SEABORGIUM

THE ONLY ELEMENT OFFICIALLY NAMED FOR A PERSON WHO WAS ALIVE AT THE NAMING

MASS

[269]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>4</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+6



DANGER

5/5 Extreme

**Why no photograph?** Seaborgium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Bh

## BOHRIUM

SYNTHESIZED AT GSI DARMSTADT (1981)

MASS

[270]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>5</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+7



DANGER

5/5 Extreme

**Why no photograph?** Bohrium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Hs

## HASSIUM

SYNTHESIZED AT GSI IN DARMSTADT

MASS

[269]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>6</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+8



DANGER

5/5 Extreme

**Why no photograph?** Hassium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Mt

## MEITNERIUM

HONORS THE UNRECOGNIZED CO-DISCOVERER OF NUCLEAR FISSION

MASS

[278]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>7</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+3, +4, +6



DANGER

5/5 Extreme

**Why no photograph?** Meitnerium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Ds

## DARMSTADIUM

SYNTHESIZED AT GSI DARMSTADT IN 1994

MASS

[281]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>8</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+2, +4, +6



DANGER

5/5 Extreme

**Why no photograph?** Darmstadtium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Rg

## ROENTGENIUM

HONORS THE DISCOVERER OF X-RAYS

MASS

[282]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>9</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+3, +5



DANGER

5/5 Extreme

**Why no photograph?** Roentgenium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Cn

## COPERNICIUM

CLOSES THE D-BLOCK

MASS

[285]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup>

BOILS

—

CHARGE

+2



DANGER

5/5 Extreme

**Why no photograph?** Copernicium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Nh

## NIHONIUM

FIRST ELEMENT DISCOVERED IN ASIA

MASS

[286]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup> 7p<sup>1</sup>

BOILS

—

CHARGE

+1, +3, +5



DANGER

5/5 Extreme

**Why no photograph?** Nihonium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Fl

## FLEROVIUM

IN THE PREDICTED “ISLAND OF STABILITY” - FL-298 MAY HAVE A HALF-LIFE OF YEARS RATHER THAN SECONDS, IF ANYONE CAN EVER...

MASS

[289]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup> 7p<sup>2</sup>

BOILS

—

CHARGE

+2, +4



DANGER

5/5 Extreme

**Why no photograph?** Flerovium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Mc

## MOSCOVIUM

SYNTHESIZED AT DUBNA (2003)

MASS

[290]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup> 7p<sup>3</sup>

BOILS

—

CHARGE

+1, +3



DANGER

5/5 Extreme

**Why no photograph?** Moscovium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



Lv

## LIVERMORIUM

SYNTHESIZED 2000 AT DUBNA IN COLLABORATION WITH LAWRENCE LIVERMORE

MASS

[293]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup> 7p<sup>4</sup>

BOILS

—

CHARGE

+2, +4



DANGER

5/5 Extreme

**Why no photograph?** Livermorium is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Ts

## TENNESSINE

THE NEWEST HALOGEN - SITS BELOW ASTATINE ON THE PERIODIC TABLE

MASS

[294]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup> 7p<sup>5</sup>

BOILS

—

CHARGE

-1, +1, +3, +5



DANGER

5/5 Extreme

**Why no photograph?** Tennessine is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.



# Og

## OGANESSON

HEAVIEST ELEMENT EVER SYNTHESIZED

MASS

[294]

ELECTRONS

[Rn] 5f<sup>14</sup> 6d<sup>10</sup> 7s<sup>2</sup> 7p<sup>6</sup>

BOILS

—

CHARGE

0, +2, +4



DANGER

5/5 Extreme

**Why no photograph?** Oganesson is a synthetic element made only in vanishingly small, intensely radioactive amounts - its atoms decay so quickly that no piece big enough to see or photograph has ever existed.

