H

HYDROGEN

THE LIGHTEST ELEMENT

MASS	ELECTRONS	BOILS	CHARGE	DANGER
1.008	$1s^1$	-253 °C	-1, +1	2/5 Caution

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

He

HELIUM

SECOND-MOST-ABUNDANT ELEMENT IN THE UNIVERSE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
4.0026	$1s^2$	-269 °C	0	2/5 Caution

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

Li

LITHIUM

LIGHTEST METAL

MASS	ELECTRONS	BOILS	CHARGE	DANGER
6.94	[He] 2s¹	1330 °C	+1	3/5 Hazardous

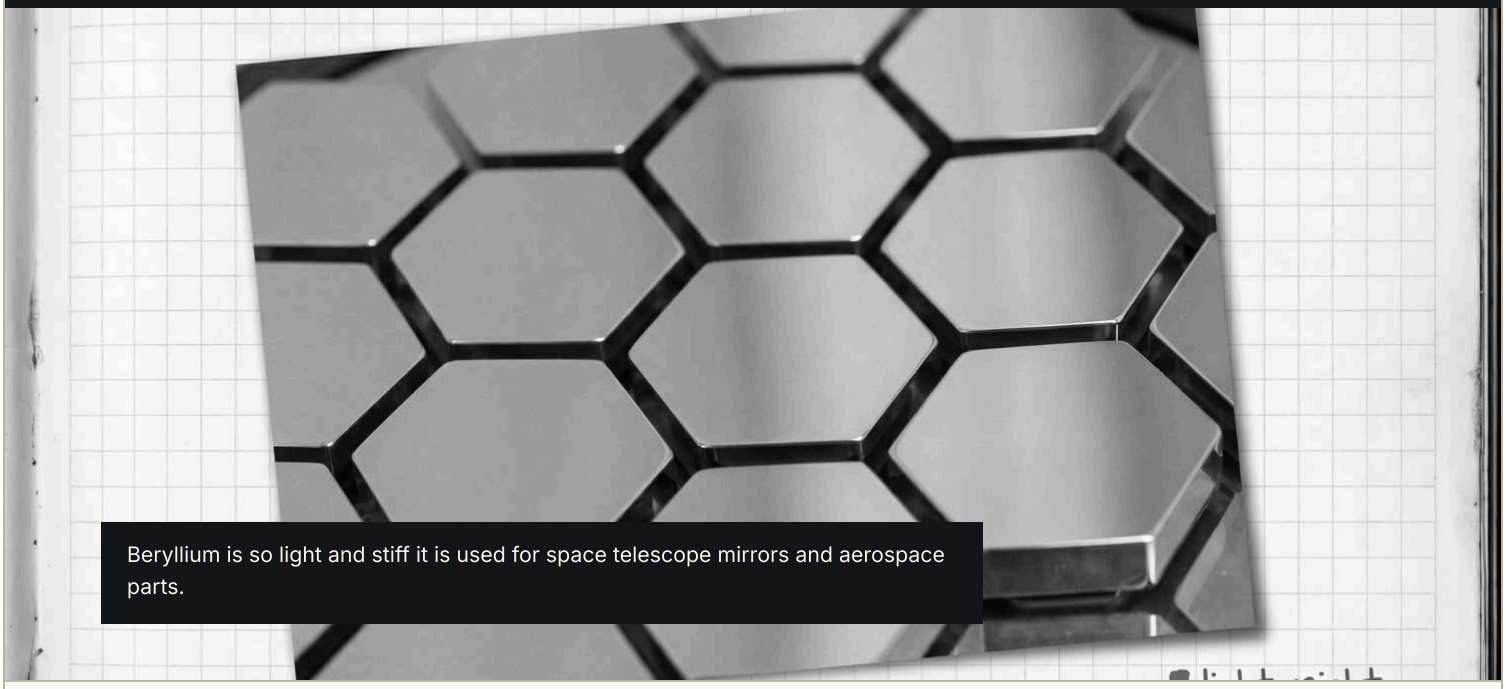
Lithium powers the rechargeable batteries in phones, laptops, and electric cars.

Be

BERYLLIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
9.0122	[He] $2s^2$	2469 °C	+2	4/5 Severe



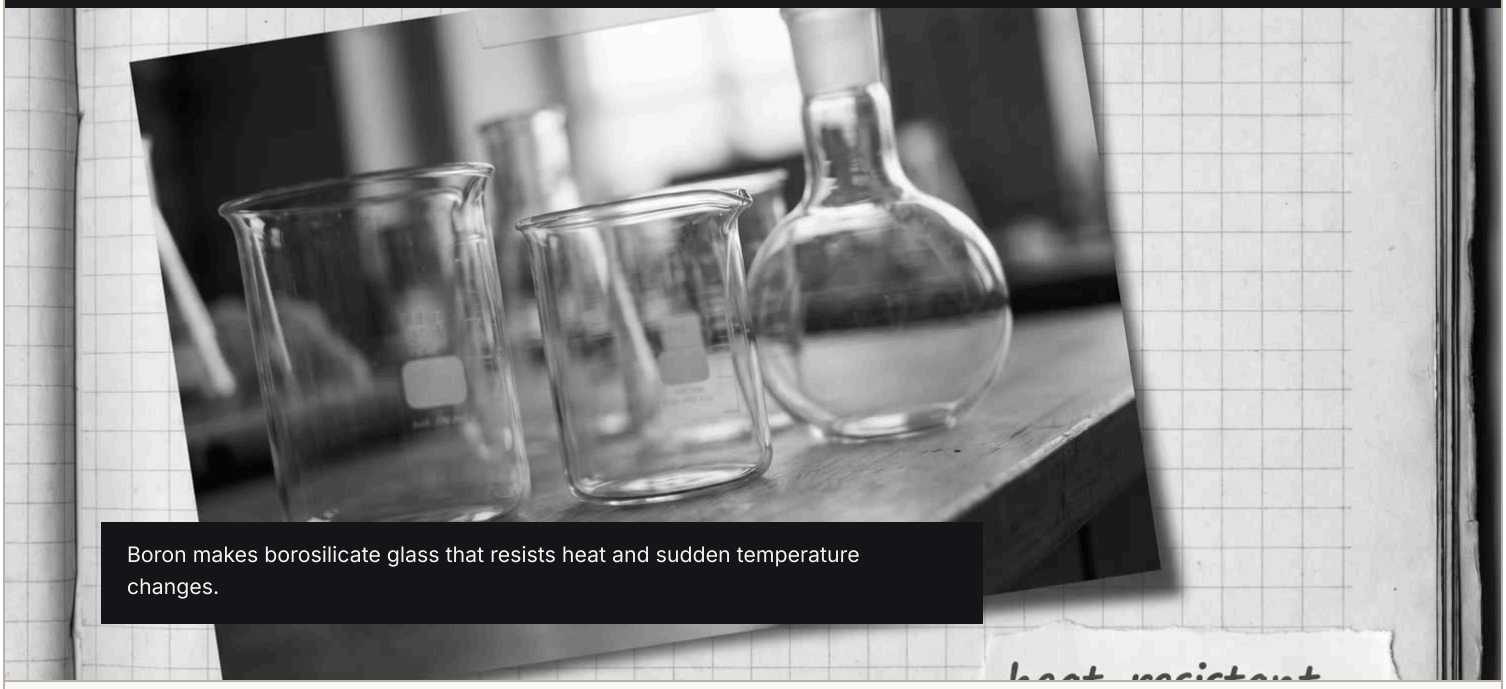
Beryllium is so light and stiff it is used for space telescope mirrors and aerospace parts.

B

BORON

IN EVERY BOROSILICATE GLASS BEAKER (PYREX)

MASS	ELECTRONS	BOILS	CHARGE	DANGER
10.81	[He] $2s^2$ $2p^1$	3927 °C	+3	0/5 Safe to handle



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

C

CARBON

THE BACKBONE OF EVERY ORGANIC MOLECULE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
12.011	[He] $2s^2$ $2p^2$	3825 °C	-4, +2, +4	1/5 Low risk

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

N

NITROGEN

78% OF THE AIR YOU ARE BREATHING RIGHT NOW IS N_2

MASS	ELECTRONS	BOILS	CHARGE	DANGER
14.007	[He] $2s^2$ $2p^3$	-196 °C	-3, +3, +5	1/5 Low risk

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

O

OXYGEN

21% OF THE AIR

MASS	ELECTRONS	BOILS	CHARGE	DANGER
15.999	[He] $2s^2$ $2p^4$	-183 °C	-2, -1	2/5 Caution

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

F

FLUORINE

THE MOST ELECTRONEGATIVE ELEMENT

MASS	ELECTRONS	BOILS	CHARGE	DANGER
18.998	[He] $2s^2$ $2p^5$	-188 °C	-1	5/5 Extreme

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

Ne

NEON

INERT

MASS	ELECTRONS	BOILS	CHARGE	DANGER
20.18	[He] $2s^2$ $2p^6$	-246 °C	0	1/5 Low risk

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

Na

SODIUM

SOFT, SILVER, AND EXPLOSIVE IN WATER

MASS	ELECTRONS	BOILS	CHARGE	DANGER
22.99	[Ne] 3s¹	883 °C	+1	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	ELECTRONS	BOILS	CHARGE	DANGER
24.305	[Ne] 3s²	1090 °C	+2	3/5 Hazardous

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

Al

ALUMINUM

THE MOST ABUNDANT METAL IN EARTH'S CRUST

MASS	ELECTRONS	BOILS	CHARGE	DANGER
26.982	[Ne] $3s^2$ $3p^1$	2519 °C	+3	1/5 Low risk

Drink cans and foil are nearly pure aluminum.

Si

SILICON

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
28.085	[Ne] $3s^2$ $3p^2$	3265 °C	-4, +4	1/5 Low risk

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

P

PHOSPHORUS

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
30.974	[Ne] $3s^2$ $3p^3$	281 °C	-3, +3, +5	4/5 Severe

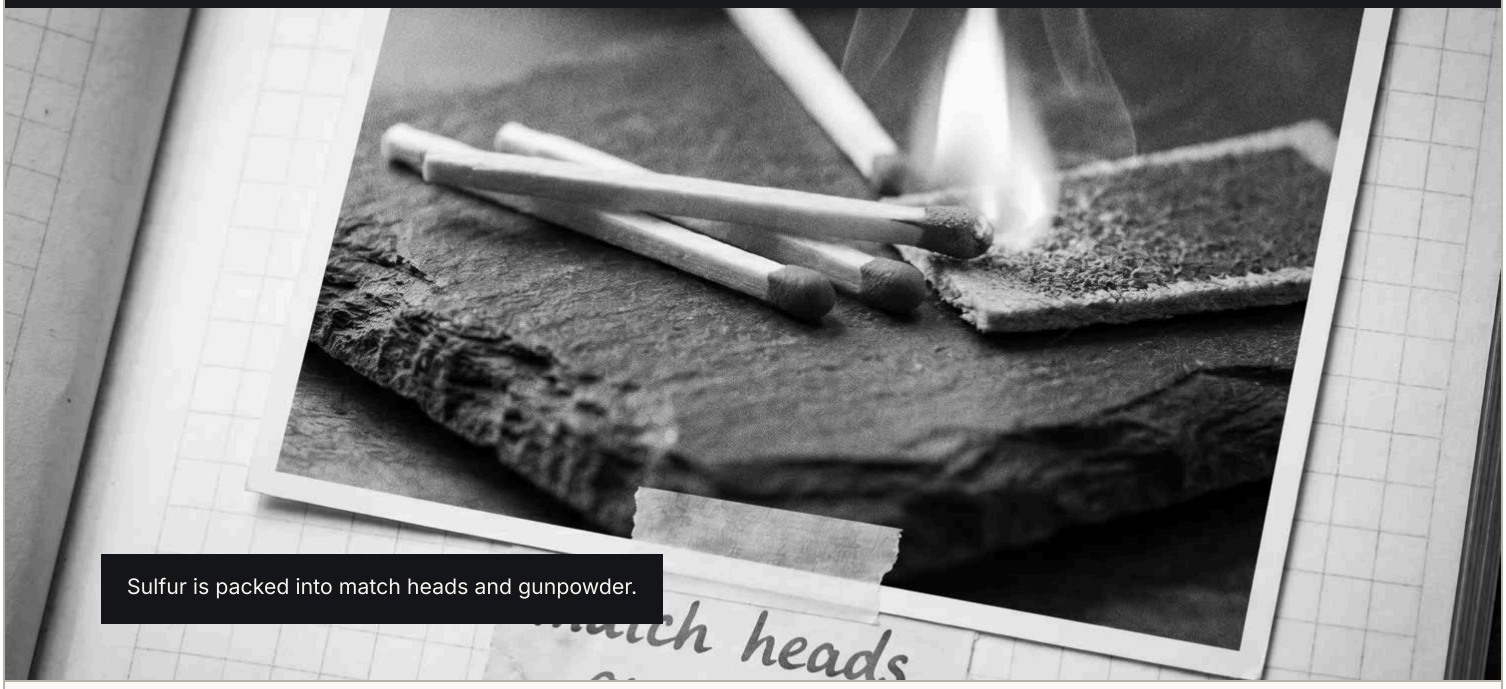
Red phosphorus coats the striking strip on a matchbox.

S

SULFUR

YELLOW WHEN PURE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
32.06	[Ne] $3s^2$ $3p^4$	445 °C	-2, +4, +6	2/5 Caution



Sulfur is packed into match heads and gunpowder.

Cl

CHLORINE

YELLOW-GREEN GAS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
35.45	[Ne] $3s^2$ $3p^5$	-34 °C	-1, +1, +3, +5, +7	4/5 Severe

A trace of chlorine is what keeps pool water clean.

Ar

ARGON

INERT NOBLE GAS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
39.95	[Ne] $3s^2$ $3p^6$	-186 °C	0	1/5 Low risk

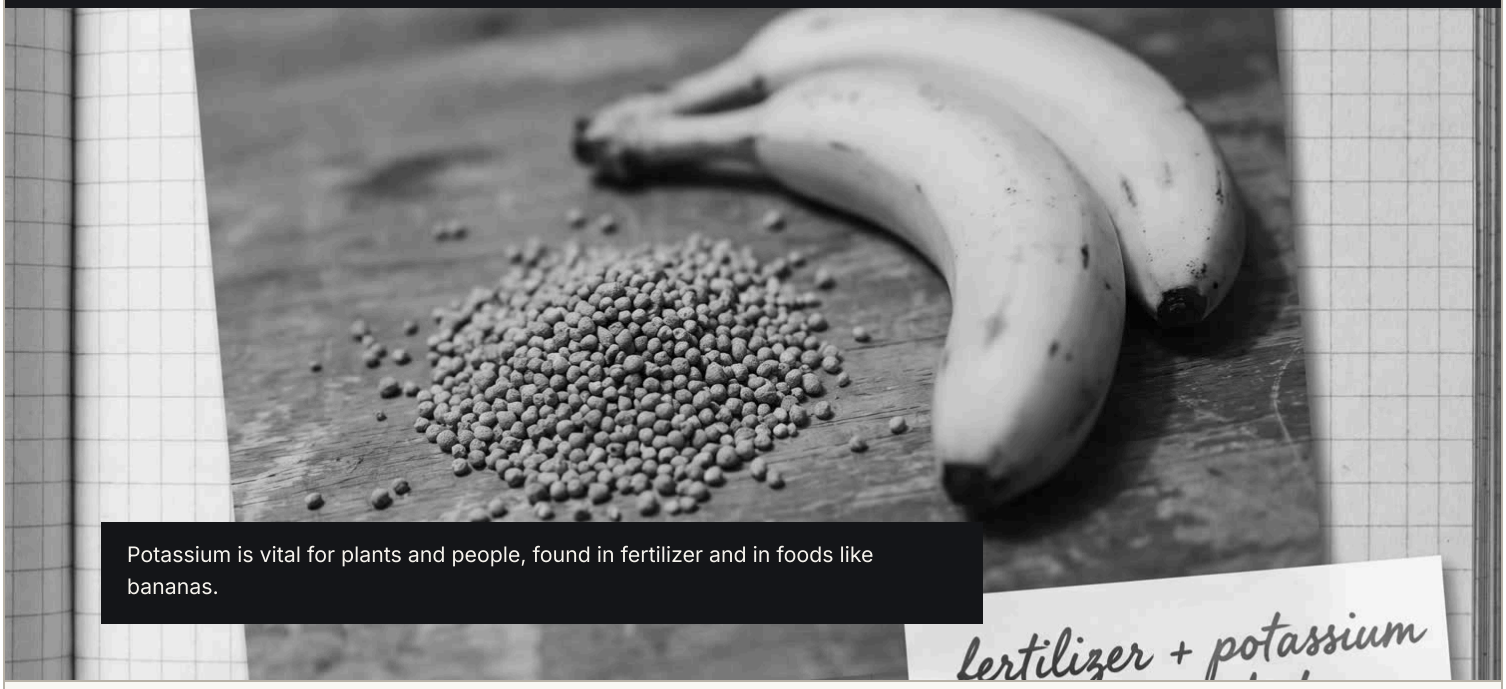
Argon fills light bulbs as an inert gas so the hot filament does not burn up.

K

POTASSIUM

MORE VIOLENT IN WATER THAN SODIUM - BURSTS INTO PURPLE FLAME

MASS	ELECTRONS	BOILS	CHARGE	DANGER
39.098	[Ar] 4s¹	759 °C	+1	4/5 Severe



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

Ca

CALCIUM

BONES, TEETH, AND CHALK

MASS	ELECTRONS	BOILS	CHARGE	DANGER
40.078	[Ar] 4s²	1484 °C	+2	2/5 Caution

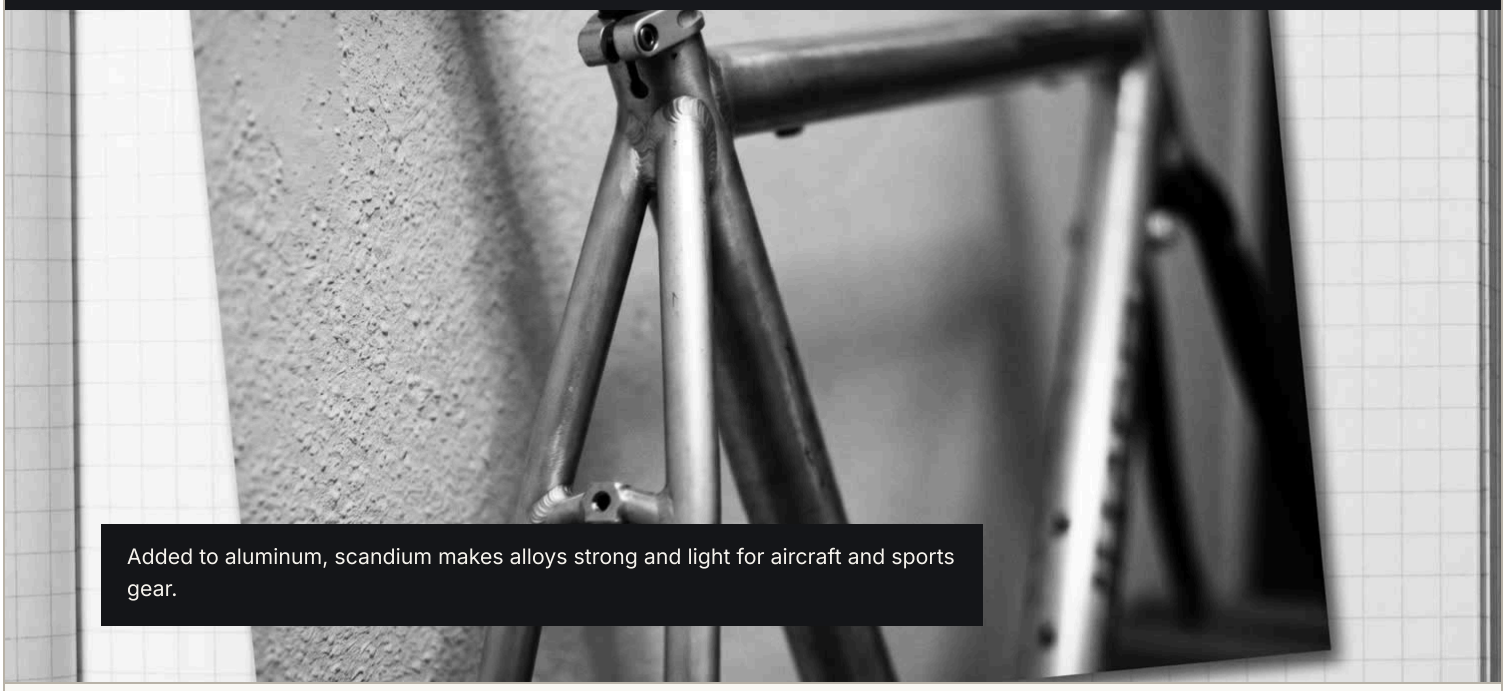
Bound up in compounds, calcium builds bones, teeth, and blackboard chalk.

Sc

SCANDIUM

LIGHTWEIGHT, STRONG, USED IN BASEBALL BATS AND AEROSPACE ALLOYS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
44.956	[Ar] $3d^1$ $4s^2$	2836 °C	+3	1/5 Low risk



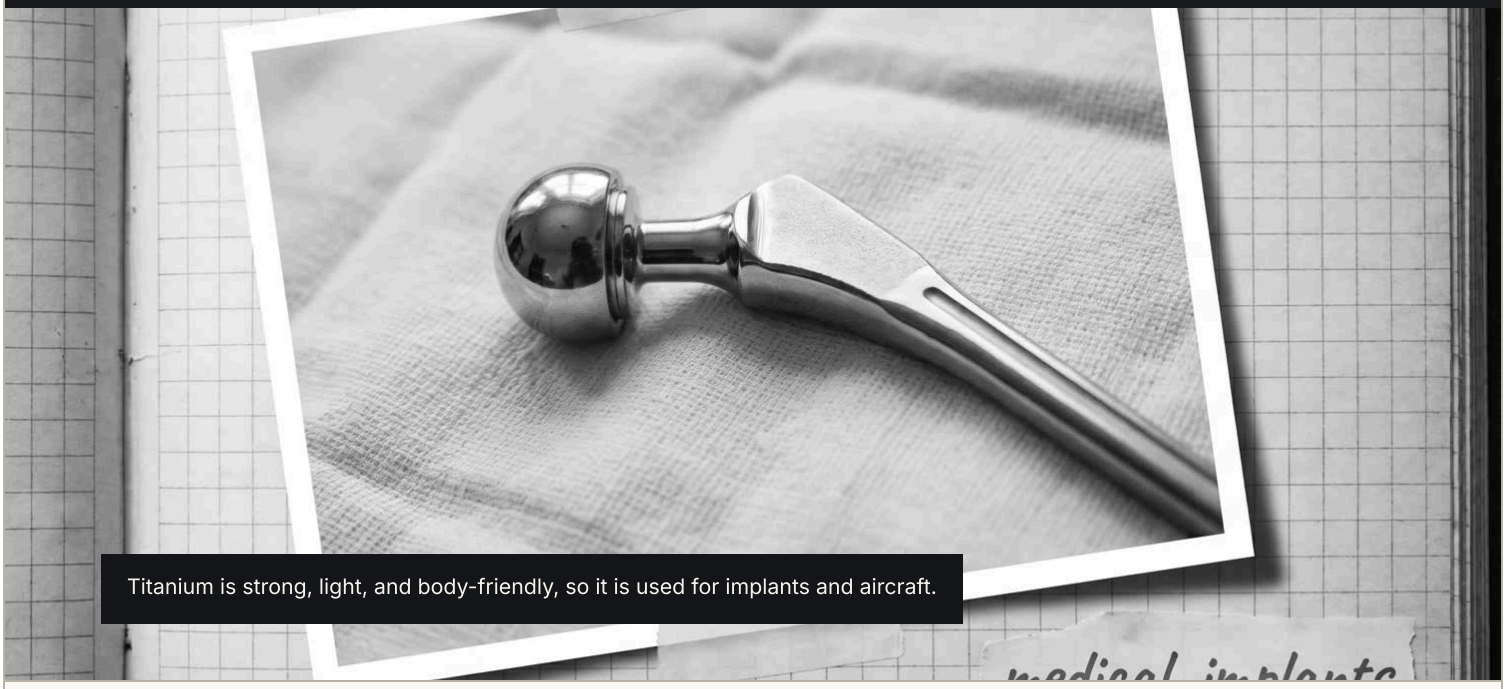
Added to aluminum, scandium makes alloys strong and light for aircraft and sports gear.

Ti

TITANIUM

HALF THE WEIGHT OF STEEL AT TWICE THE STRENGTH

MASS	ELECTRONS	BOILS	CHARGE	DANGER
47.867	[Ar] $3d^2$ $4s^2$	3287 °C	+2, +3, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
50.942	[Ar] $3d^3$ $4s^2$	3407 °C	+2, +3, +4, +5	2/5 Caution

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

Cr

CHROMIUM

THE SHINE ON A CHROME BUMPER

MASS	ELECTRONS	BOILS	CHARGE	DANGER
51.996	[Ar] $3d^5$ $4s^1$	2671 °C	+2, +3, +6	1/5 Low risk

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

Mn

MANGANESE

HARDENS STEEL BEYOND WHAT CARBON ALONE CAN DO

MASS	ELECTRONS	BOILS	CHARGE	DANGER
54.938	[Ar] $3d^5$ $4s^2$	2061 °C	+2, +4, +7	2/5 Caution

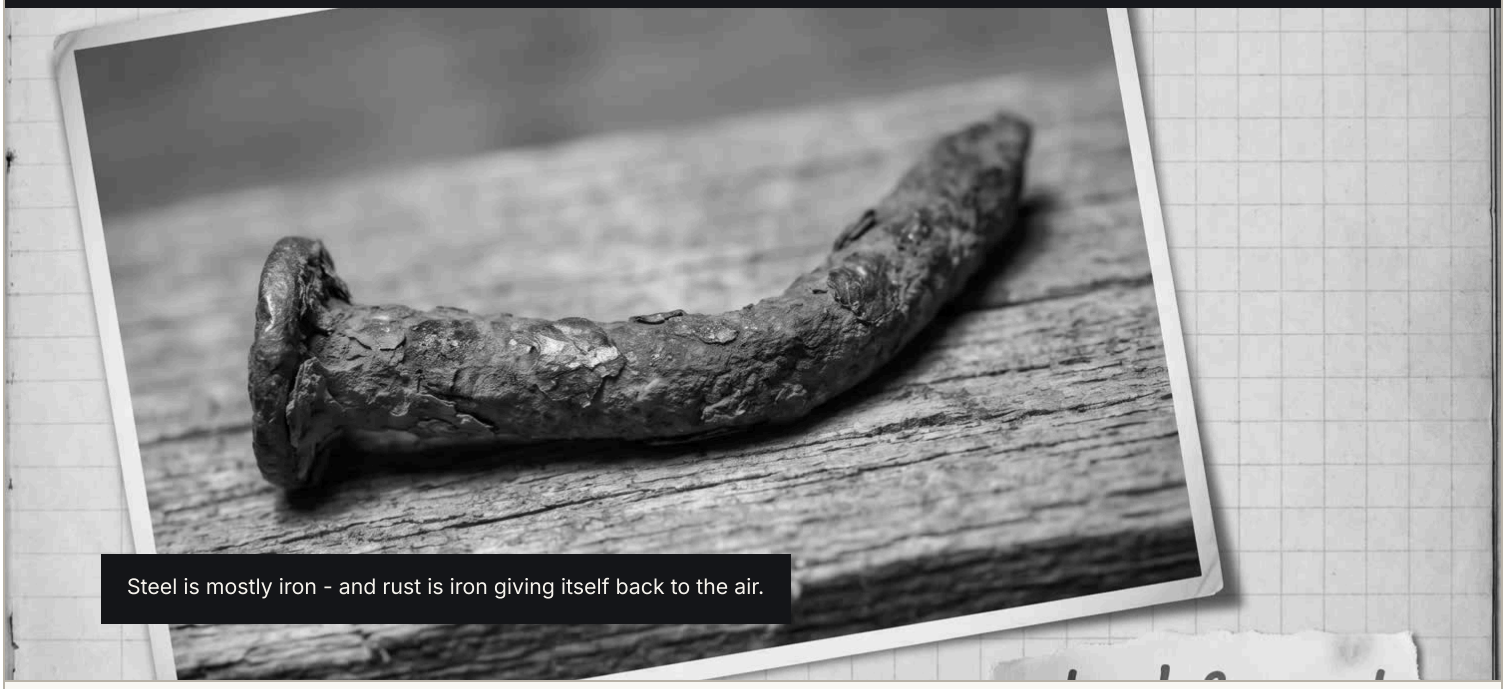
Manganese toughens steel for hard-wearing parts like railroad tracks.

Fe

IRON

MOST-USED METAL ON EARTH

MASS	ELECTRONS	BOILS	CHARGE	DANGER
55.845	[Ar] $3d^6$ $4s^2$	2861 °C	+2, +3	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	ELECTRONS	BOILS	CHARGE	DANGER
58.933	[Ar] $3d^7$ $4s^2$	2927 °C	+2, +3	2/5 Caution

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

Ni

NICKEL

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
58.693	[Ar] $3d^8$ $4s^2$	2913 °C	+2	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	ELECTRONS	BOILS	CHARGE	DANGER
63.546	[Ar] $3d^{10}$ $4s^{1}$	2562 °C	+1, +2	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	ELECTRONS	BOILS	CHARGE	DANGER
65.38	[Ar] $3d^{10}$ $4s^{2}$	907 °C	+2	1/5 Low risk

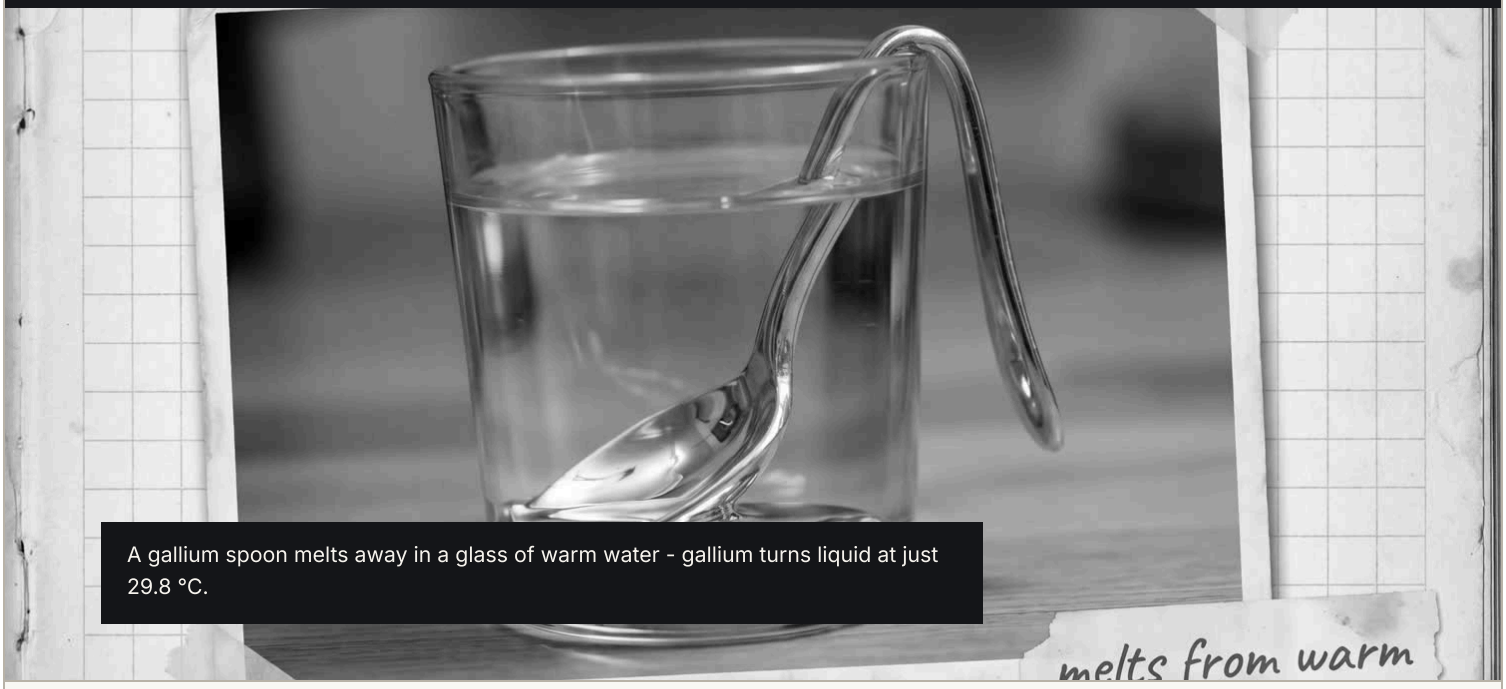
A zinc coat (galvanizing) is what stops steel buckets and nails from rusting.

Ga

GALLIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
69.723	[Ar] $3d^{10}$ $4s^{2}$ $4p^{1}$	2400 °C	+3	0/5 Safe to handle



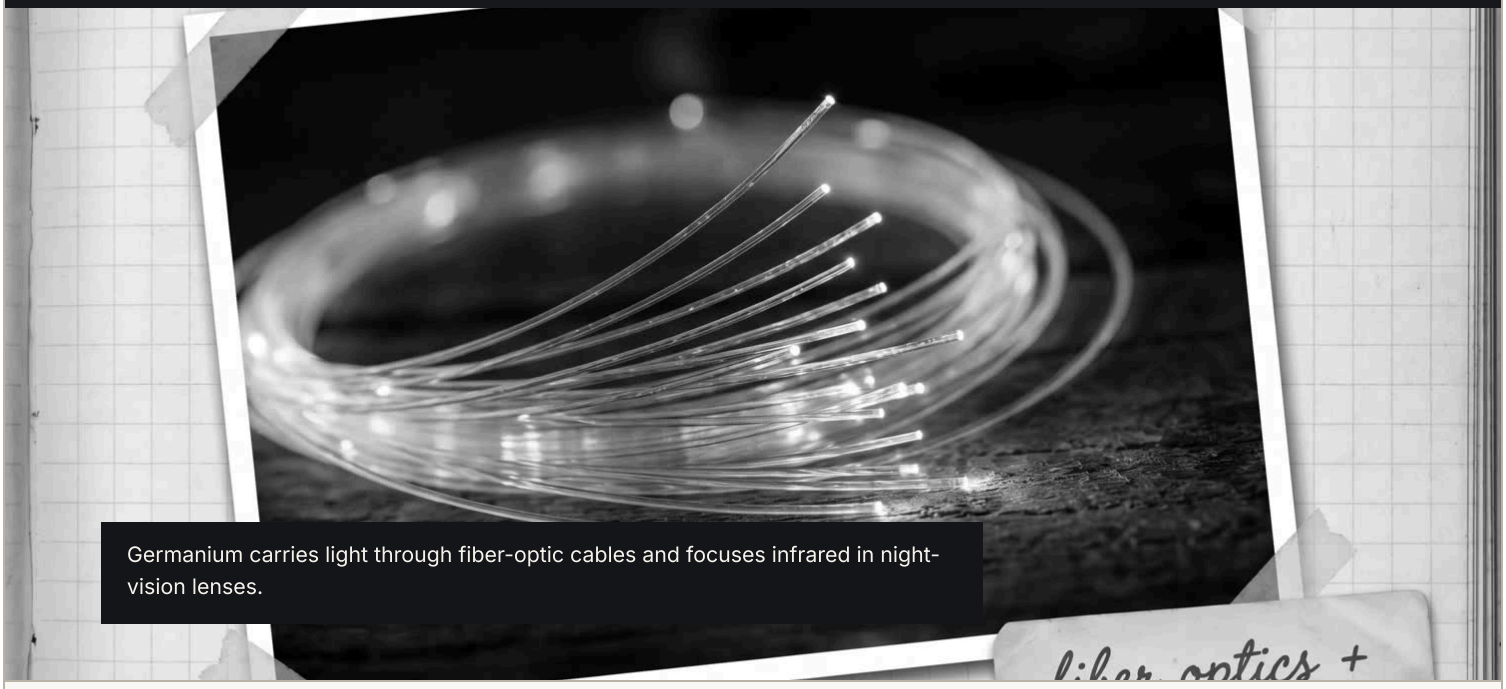
A gallium spoon melts away in a glass of warm water - gallium turns liquid at just 29.8 °C.

Ge

GERMANIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
72.63	[Ar] $3d^{10}$ $4s^2$ $4p^2$	2833 °C	+2, +4	0/5 Safe to handle



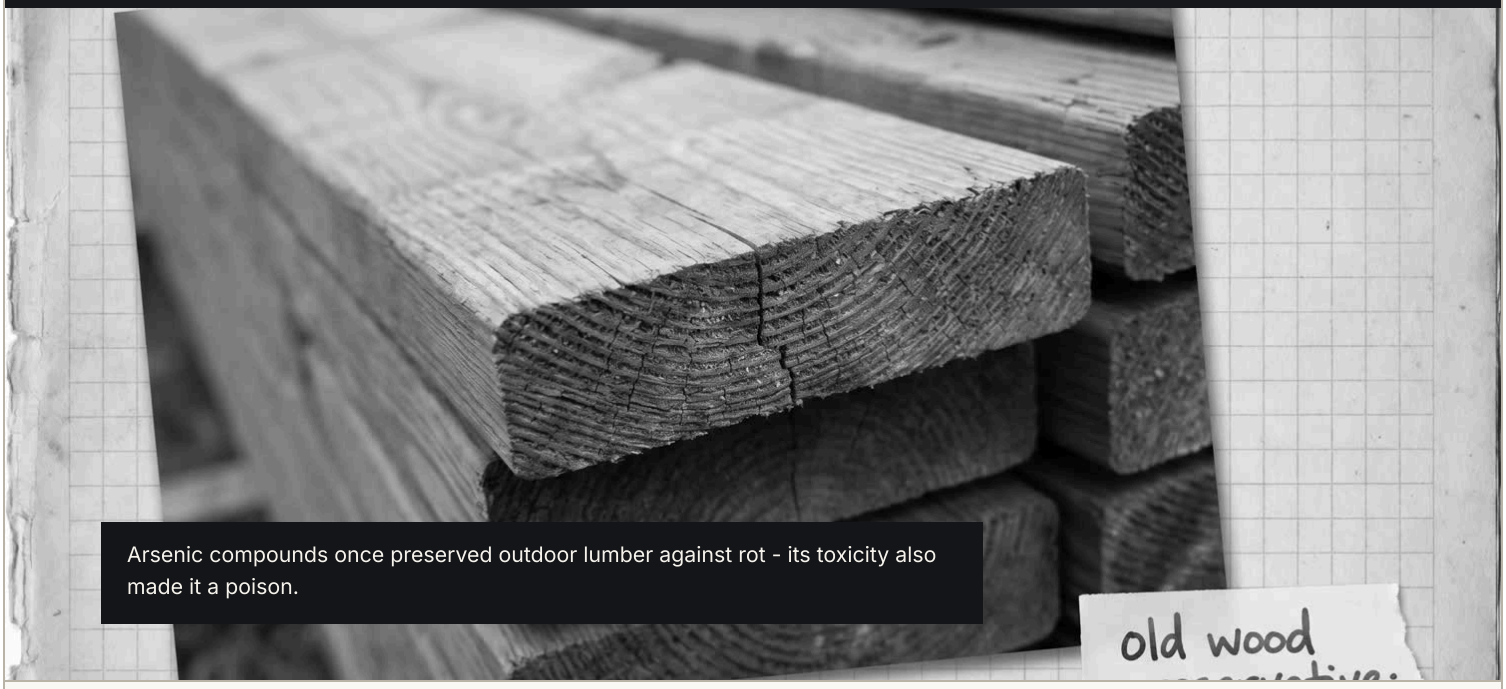
Germanium carries light through fiber-optic cables and focuses infrared in night-vision lenses.

As

ARSENIC

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
74.922	[Ar] $3d^{10}$ $4s^2$ $4p^3$	614 °C	-3, +3, +5	4/5 Severe



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

Se

SELENIUM

IN PHOTOCOPIER DRUMS (LIGHT HITS SE, CHARGE FLOWS)

MASS	ELECTRONS	BOILS	CHARGE	DANGER
78.971	[Ar] $3d^{10}$ $4s^2$ $4p^4$	685 °C	-2, +4, +6	3/5 Hazardous

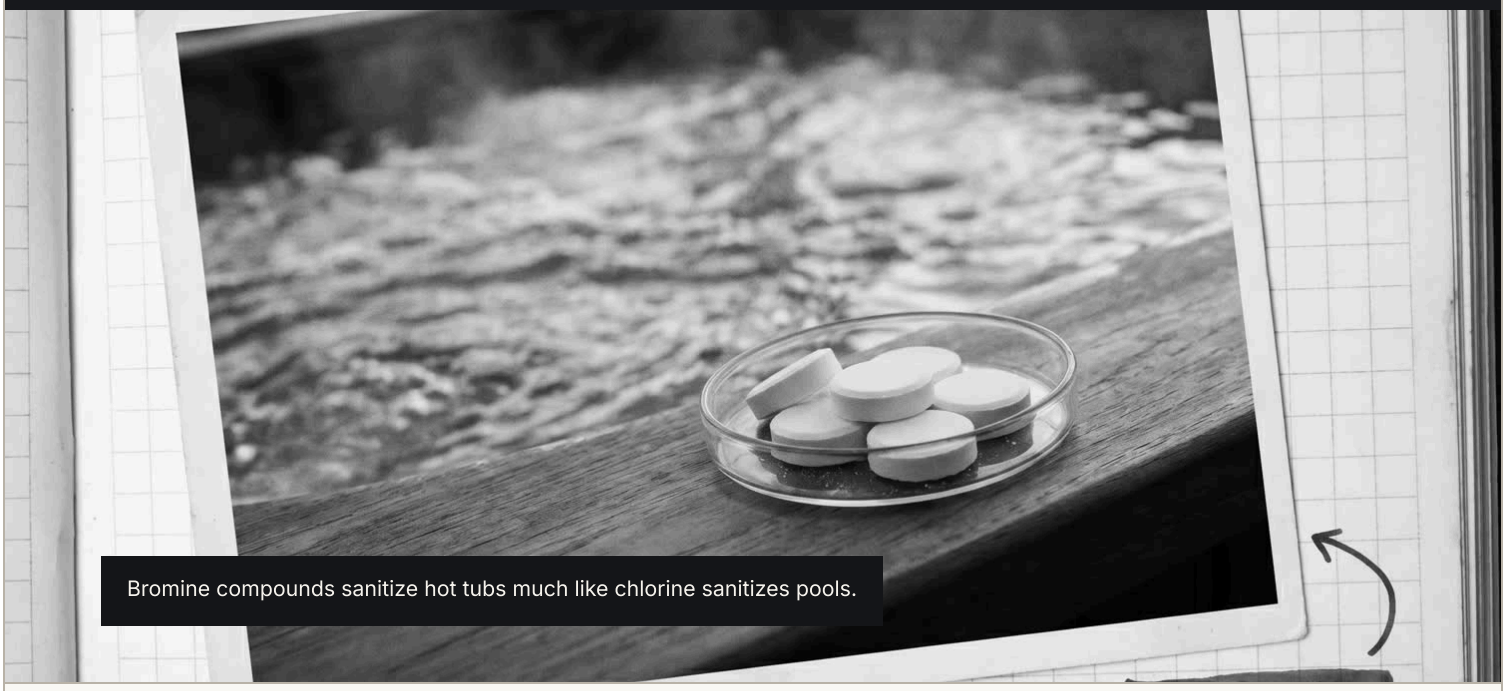
Selenium gives glass a deep ruby-red color, used in art glass and signal lenses.

Br

BROMINE

THE ONLY LIQUID NONMETAL AT ROOM TEMPERATURE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
79.904	[Ar] $3d^{10}$ $4s^2$ $4p^5$	59 °C	-1, +1, +3, +5, +7	4/5 Severe



Bromine compounds sanitize hot tubs much like chlorine sanitizes pools.

Kr

KRYPTON

INERT NOBLE GAS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
83.798	[Ar] $3d^{10}$ $4s^{2}$ $4p^{6}$	-153 °C	0, +2	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	ELECTRONS	BOILS	CHARGE	DANGER
85.468	[Kr] 5s¹	688 °C	+1	5/5 Extreme

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

Sr

STRONTIUM

THE BRIGHT RED IN FIREWORKS AND OLD TV PHOSPHORS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
87.62	[Kr] 5s²	1382 °C	+2	2/5 Caution

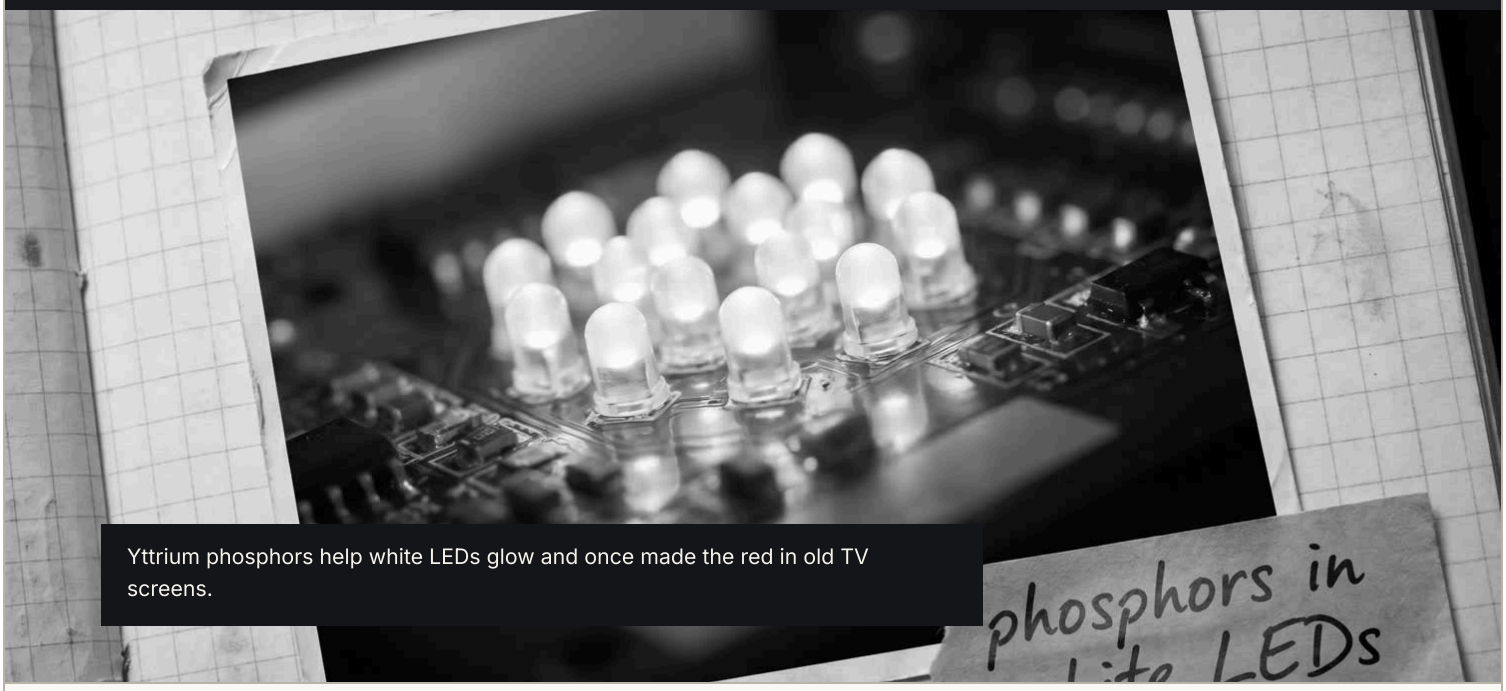
Strontium burns crimson red - it is what makes red fireworks and flares red.

Y

YTTRIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
88.906	[Kr] 4d¹ 5s²	3345 °C	+3	1/5 Low risk



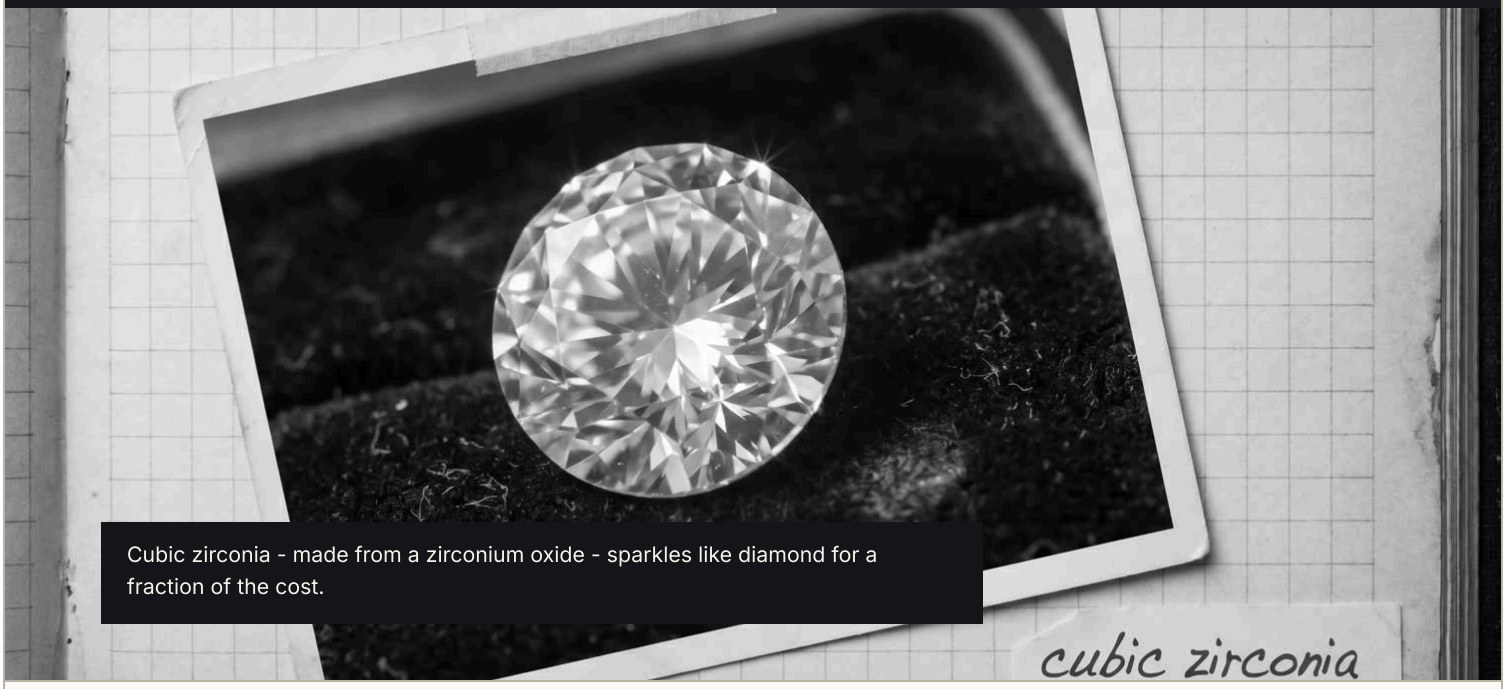
Yttrium phosphors help white LEDs glow and once made the red in old TV screens.

Zr

ZIRCONIUM

CUBIC ZIRCONIA IN THE ENGAGEMENT-RING CASE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
91.224	[Kr] 4d² 5s²	4409 °C	+4	2/5 Caution



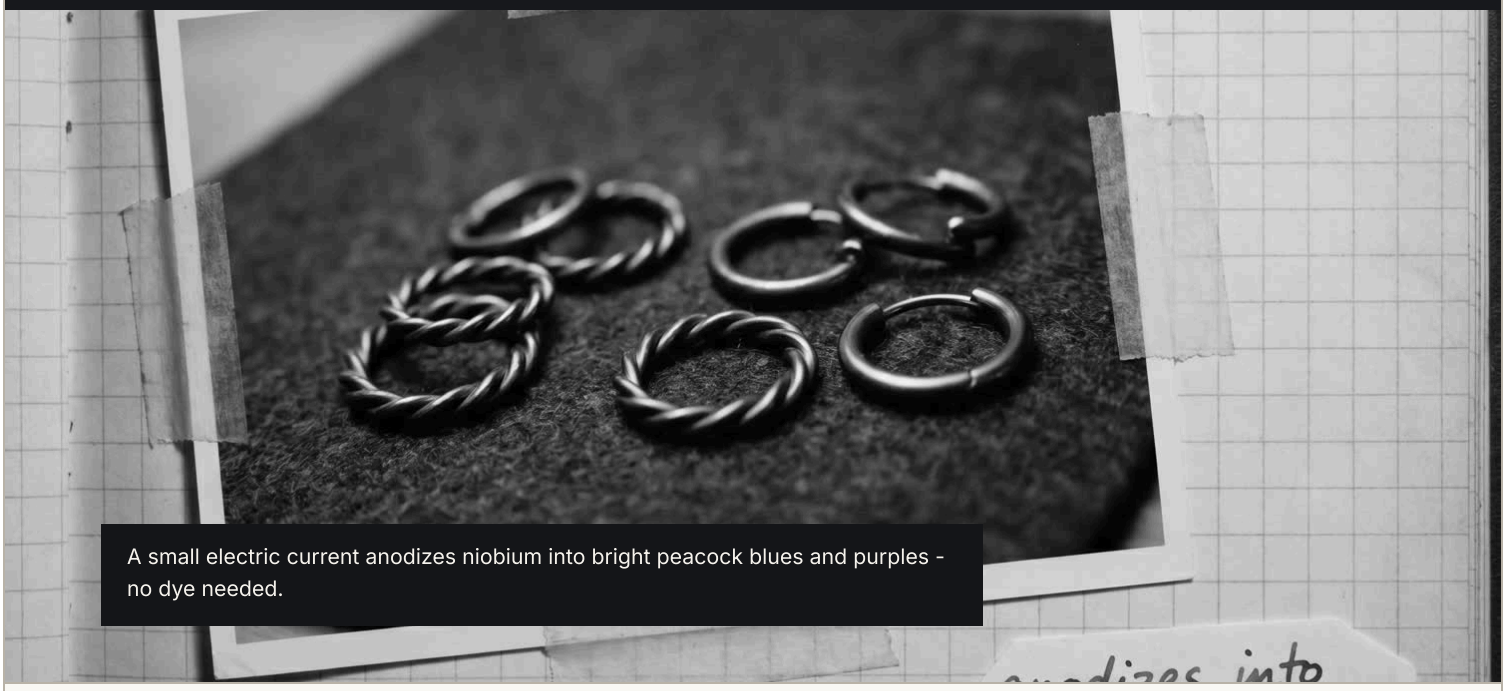
Cubic zirconia - made from a zirconium oxide - sparkles like diamond for a fraction of the cost.

Nb

NIOBIUM

SUPERCONDUCTING MAGNETS IN MRI MACHINES AND THE LHC

MASS	ELECTRONS	BOILS	CHARGE	DANGER
92.906	[Kr] $4d^4$ $5s^1$	4744 °C	+3, +5	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	ELECTRONS	BOILS	CHARGE	DANGER
95.95	[Kr] $4d^5$ $5s^1$	4639 °C	+4, +6	1/5 Low risk

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

Tc

TECHNETIUM

THE FIRST SYNTHETIC ELEMENT - NO STABLE ISOTOPES EXIST ON EARTH

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[98]	[Kr] $4d^5\ 5s^2$	4265 °C	+4, +7	4/5 Severe

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

Ru

RUTHENIUM

CATALYZES HYDROGEN FUEL CELLS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
101.07	[Kr] $4d^7$ $5s^1$	4150 °C	+3, +4, +8	1/5 Low risk

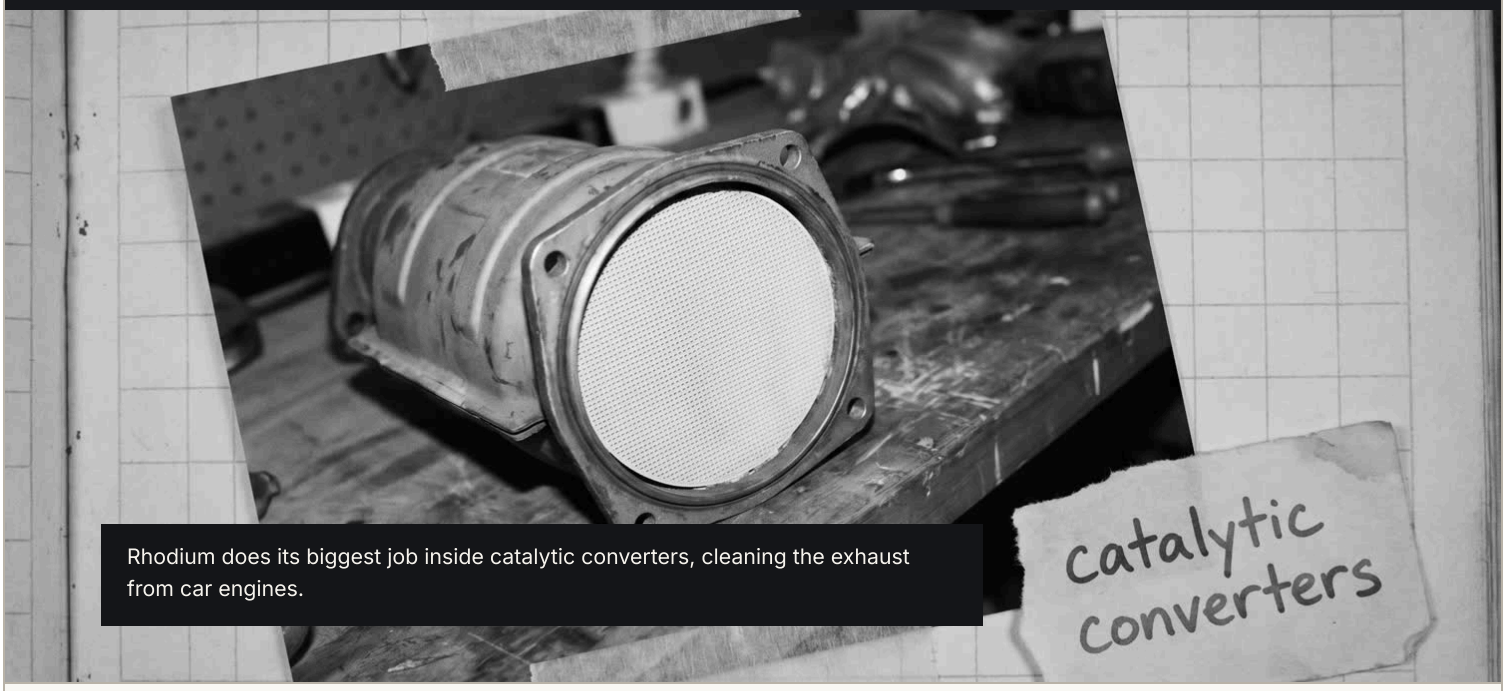
A thin ruthenium coating helps hard-drive platters store more data.

Rh

RHODIUM

CATALYTIC CONVERTER ON EVERY GASOLINE CAR

MASS	ELECTRONS	BOILS	CHARGE	DANGER
102.91	[Kr] $4d^8$ $5s^1$	3695 °C	+3	0/5 Safe to handle



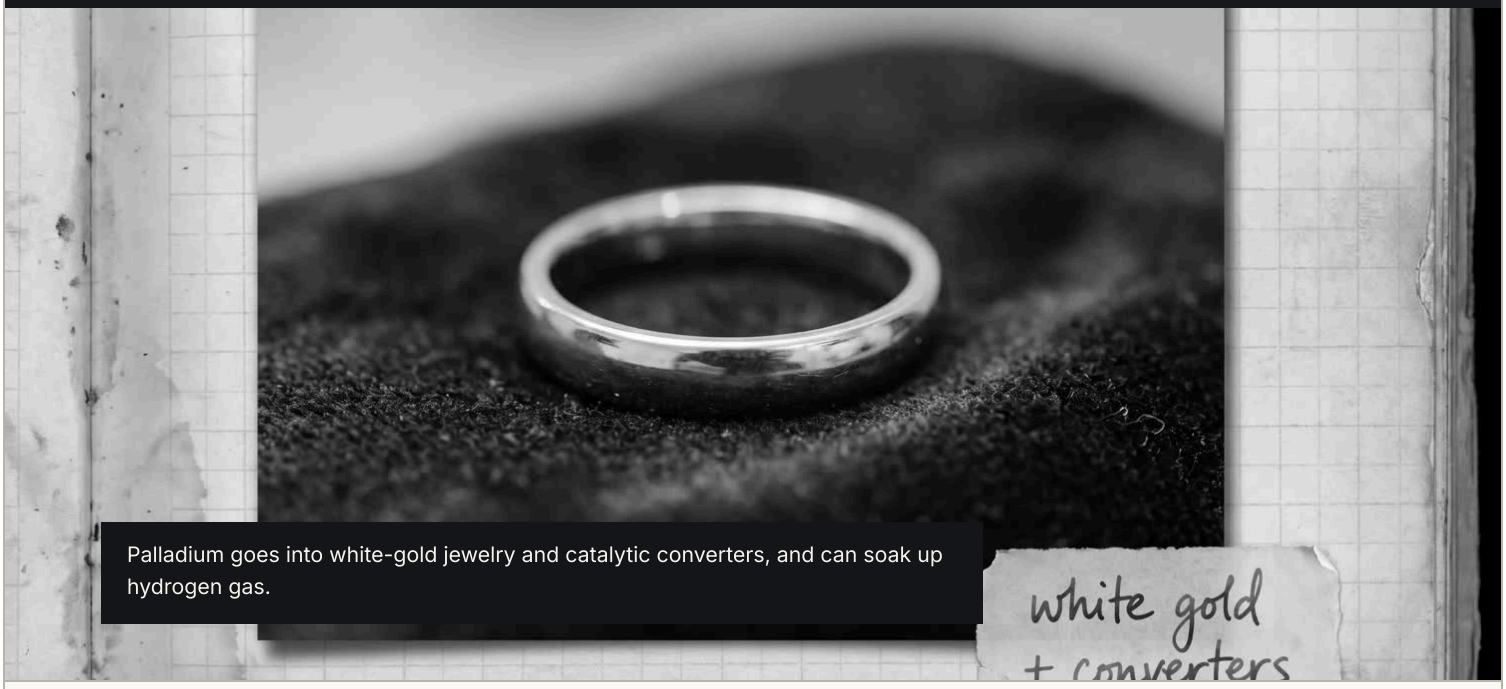
Rhodium does its biggest job inside catalytic converters, cleaning the exhaust from car engines.

Pd

PALLADIUM

CATALYTIC CONVERTERS SCRUB CAR EXHAUST CLEAN

MASS	ELECTRONS	BOILS	CHARGE	DANGER
106.42	[Kr] 4d¹⁰	2963 °C	+2, +4	1/5 Low risk



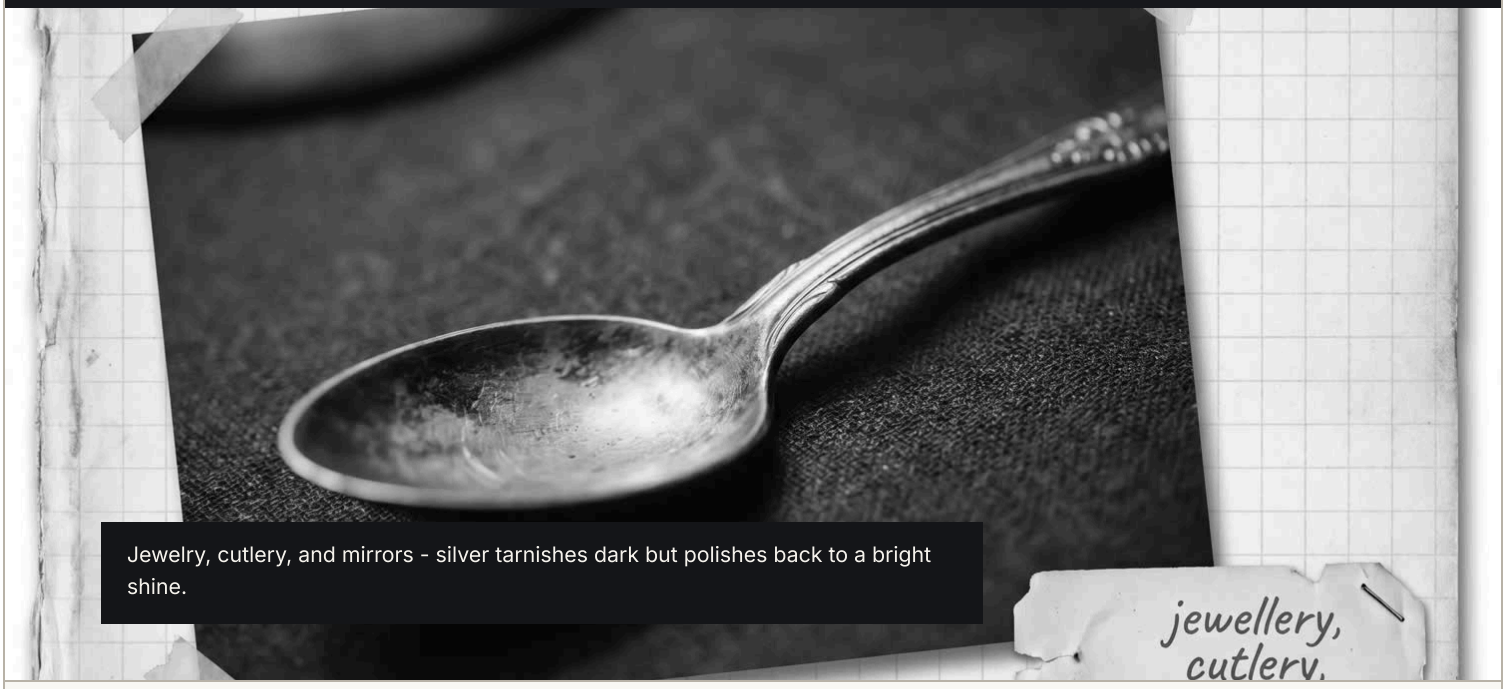
Palladium goes into white-gold jewelry and catalytic converters, and can soak up hydrogen gas.

Ag

SILVER

BEST ELECTRICAL AND THERMAL CONDUCTOR OF ANY METAL

MASS	ELECTRONS	BOILS	CHARGE	DANGER
107.87	[Kr] $4d^{10}$ $5s^{1}$	2162 °C	+1	1/5 Low risk



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

Cd

CADMIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
112.41	[Kr] $4d^{10}$ $5s^{2}$	767 °C	+2	3/5 Hazardous

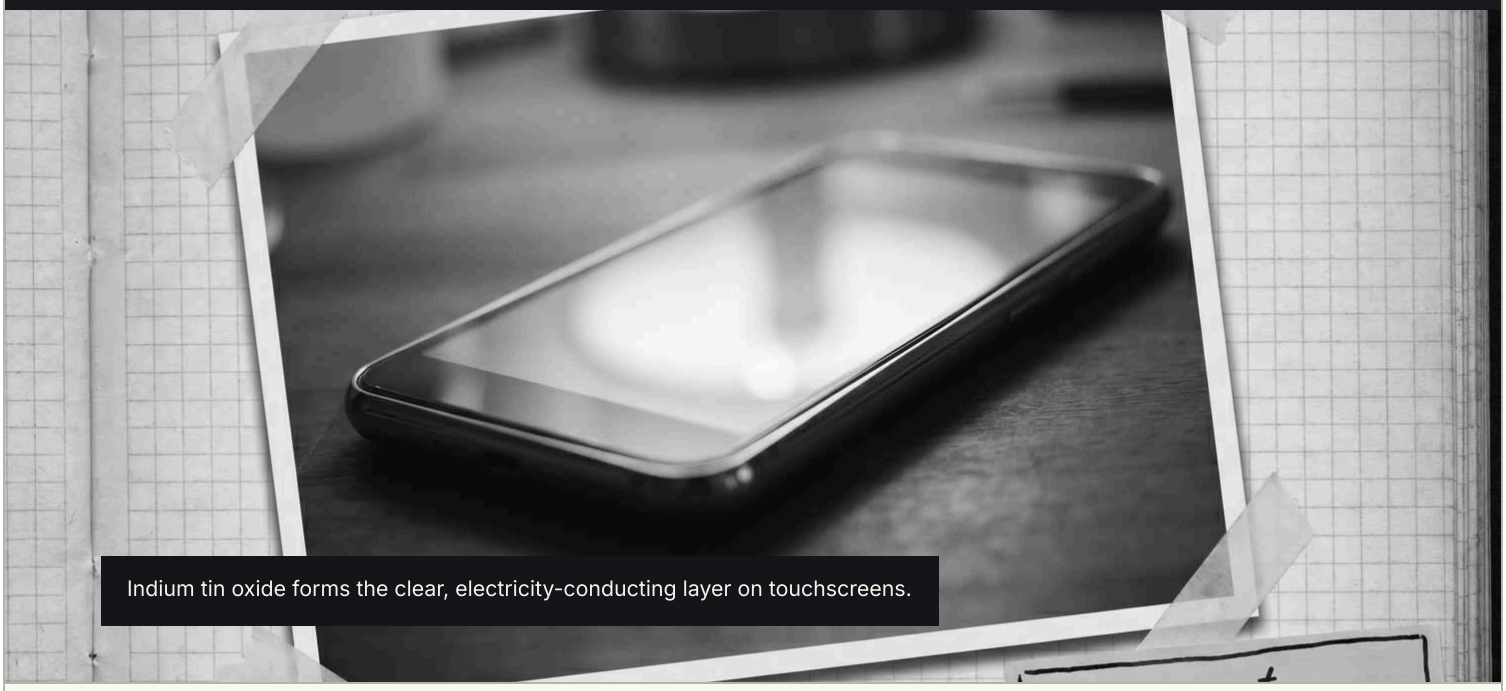
Cadmium compounds make the vivid yellow and orange pigments found in some artist paints.

In

INDIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
114.82	[Kr] $4d^{10}$ $5s^{2}$ $5p^{1}$	2072 °C	+3	1/5 Low risk



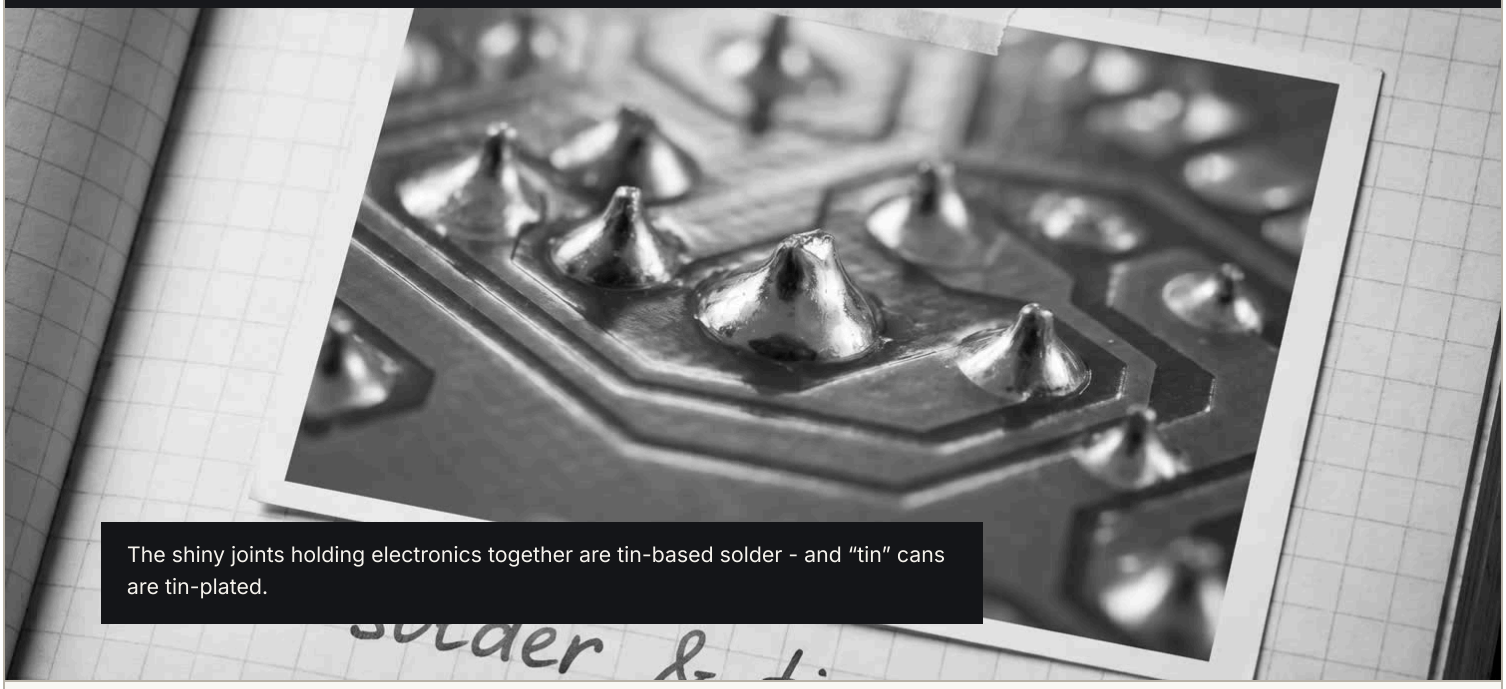
Indium tin oxide forms the clear, electricity-conducting layer on touchscreens.

Sn

TIN

BRONZE IS COPPER + TIN

MASS	ELECTRONS	BOILS	CHARGE	DANGER
118.71	[Kr] $4d^{10}$ $5s^2$ $5p^2$	2602 °C	+2, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
121.76	[Kr] $4d^{10}$ $5s^2$ $5p^3$	1587 °C	-3, +3, +5	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	ELECTRONS	BOILS	CHARGE	DANGER
127.6	[Kr] $4d^{10}$ $5s^2$ $5p^4$	988 °C	-2, +4, +6	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	ELECTRONS	BOILS	CHARGE	DANGER
126.9	[Kr] $4d^{10}$ $5s^2$ $5p^5$	184 °C	-1, +1, +3, +5, +7	2/5 Caution

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

Xe

XENON

HIGH-INTENSITY HEADLAMPS ON LUXURY CARS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
131.29	[Kr] $4d^{10}\ 5s^{2}\ 5p^{6}$	-108 °C	0, +2, +4, +6, +8	1/5 Low risk

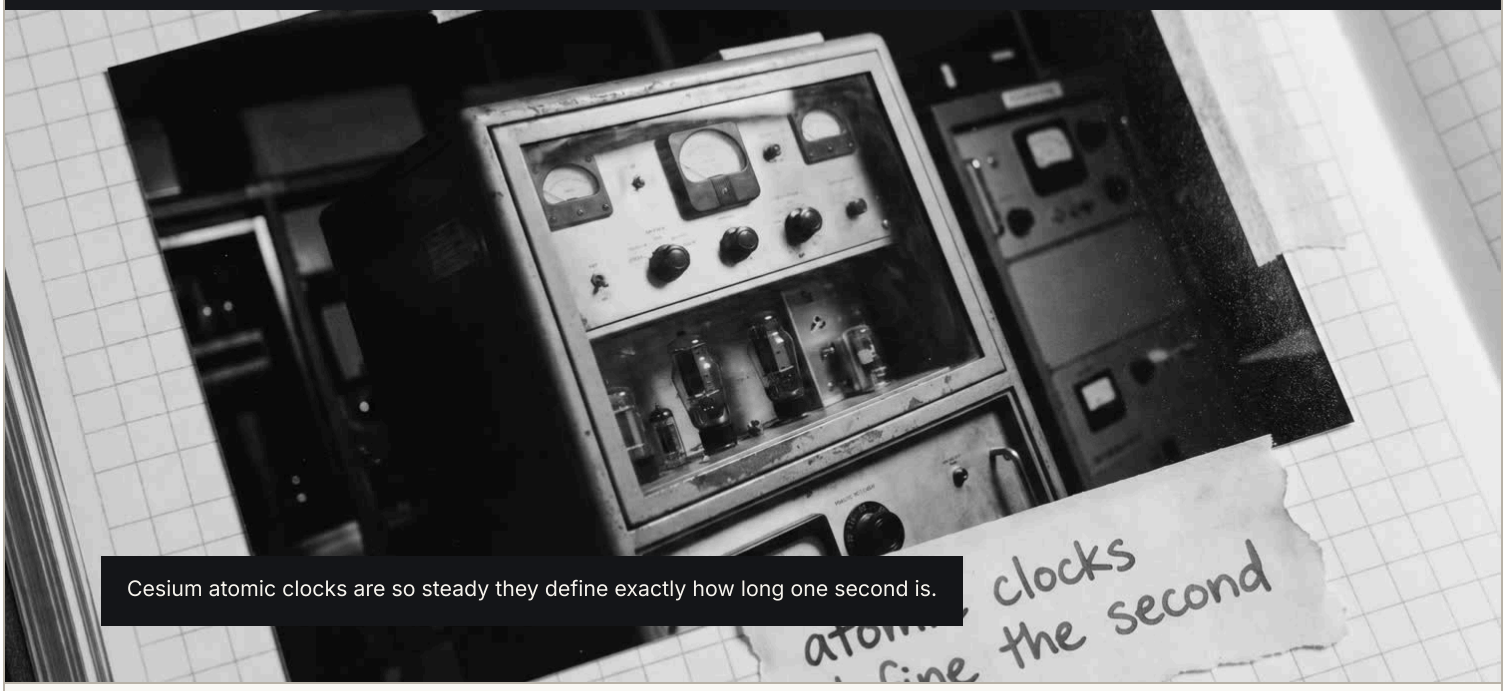
Xenon gas powers the bright blue-white HID headlights on some cars.

Cs

CESIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
132.91	[Xe] 6s¹	671 °C	+1	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	ELECTRONS	BOILS	CHARGE	DANGER
137.33	[Xe] 6s²	1845 °C	+2	2/5 Caution

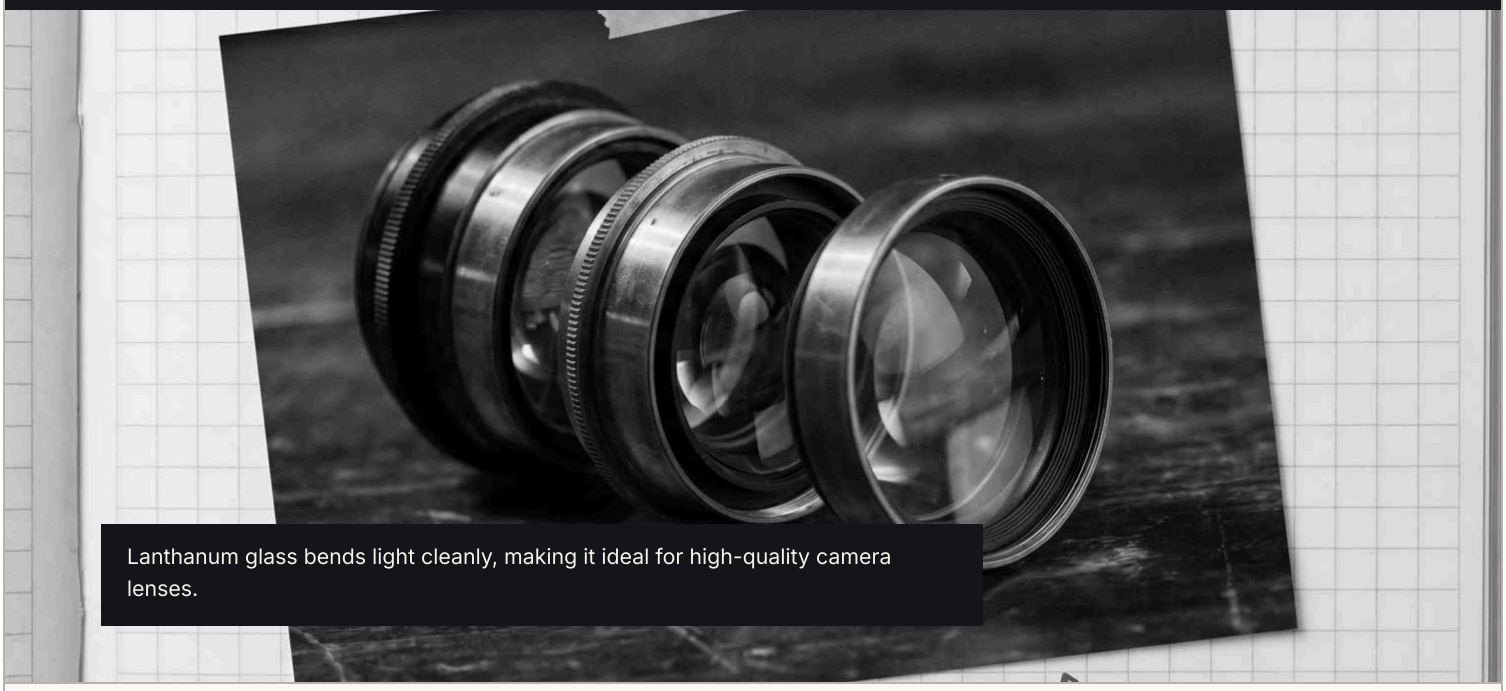
Barium compounds burn bright green, giving fireworks their vivid green bursts.

La

LANTHANUM

KICKS OFF THE LANTHANIDE ROW

MASS	ELECTRONS	BOILS	CHARGE	DANGER
138.91	[Xe] 5d¹ 6s²	3464 °C	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
140.12	[Xe] $4f^1$ $5d^1$ $6s^2$	3443 °C	+3	2/5 Caution

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

Pr

PRASEODYMIUM

THE GREEN FILTER IN WELDER'S GOGGLES

MASS	ELECTRONS	BOILS	CHARGE	DANGER
140.91	[Xe] $4f^3$ $6s^2$	3520 °C	+3	1/5 Low risk

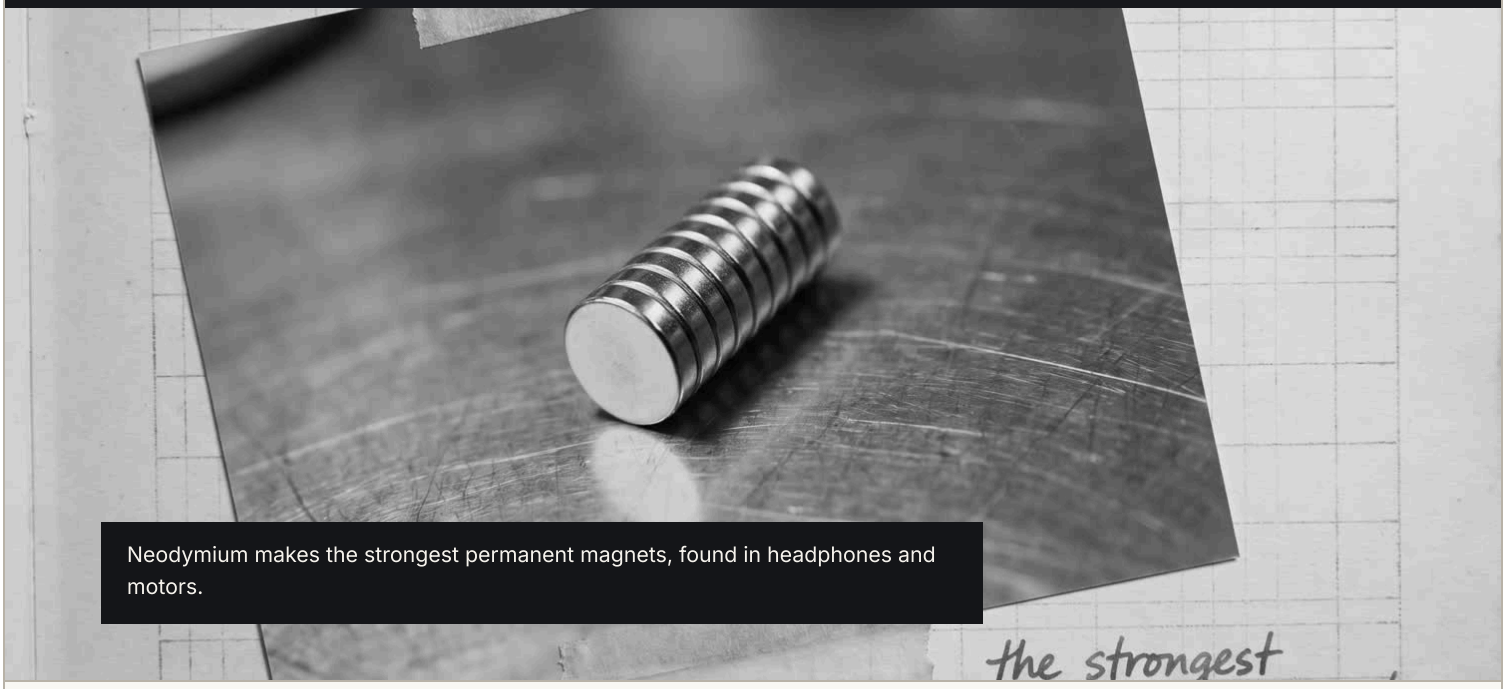
Praseodymium tints the yellow glass in welding goggles that shields the eyes.

Nd

NEODYMIUM

NDFEB MAGNETS - THE STRONGEST PERMANENT MAGNETS EVER MADE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
144.24	[Xe] $4f^4$ $6s^2$	3074 °C	+3	1/5 Low risk



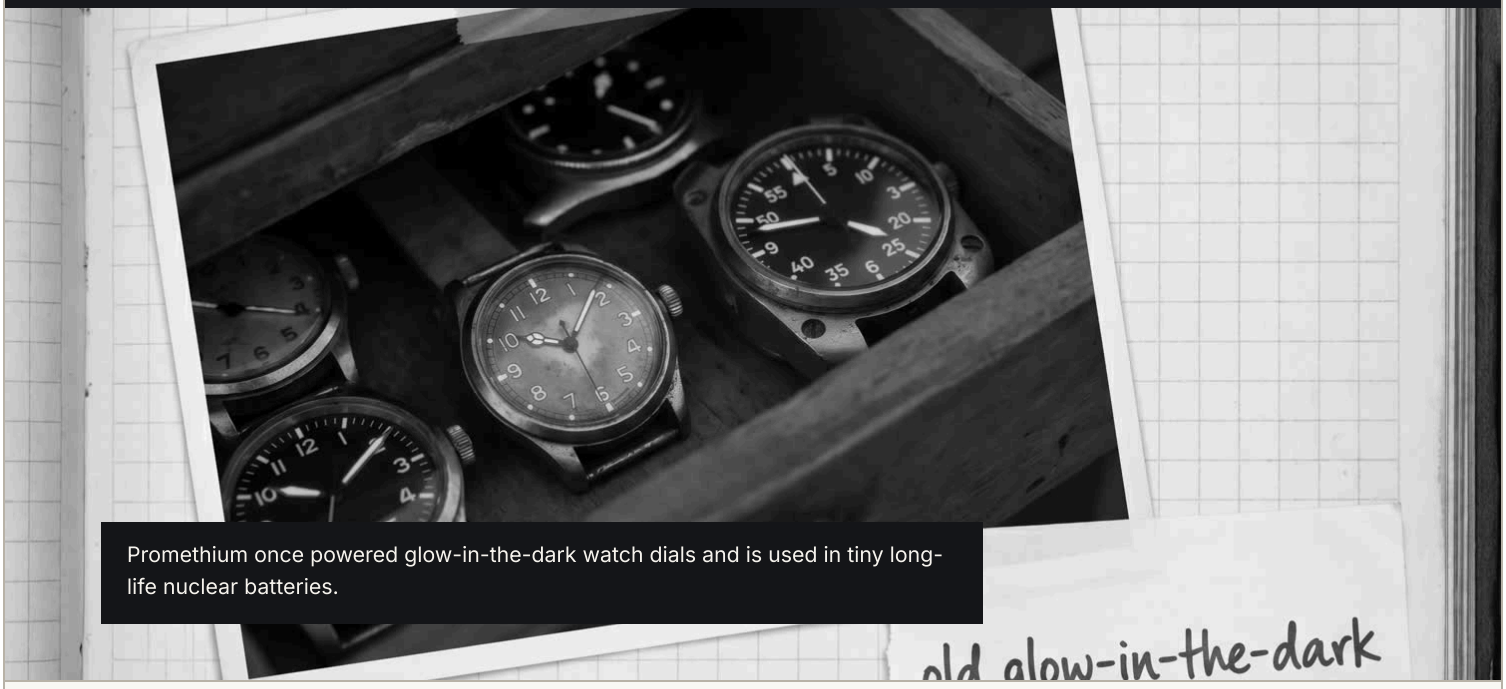
Neodymium makes the strongest permanent magnets, found in headphones and motors.

Pm

PROMETHIUM

NO STABLE ISOTOPES - VANISHINGLY RARE ON EARTH

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[145]	[Xe] $4f^5\ 6s^2$	3000 °C	+3	4/5 Severe



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

Sm

SAMARIUM

SMCO MAGNETS WORK HOT WHERE NDFEB FAILS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
150.36	[Xe] $4f^6$ $6s^2$	1794 °C	+3	1/5 Low risk

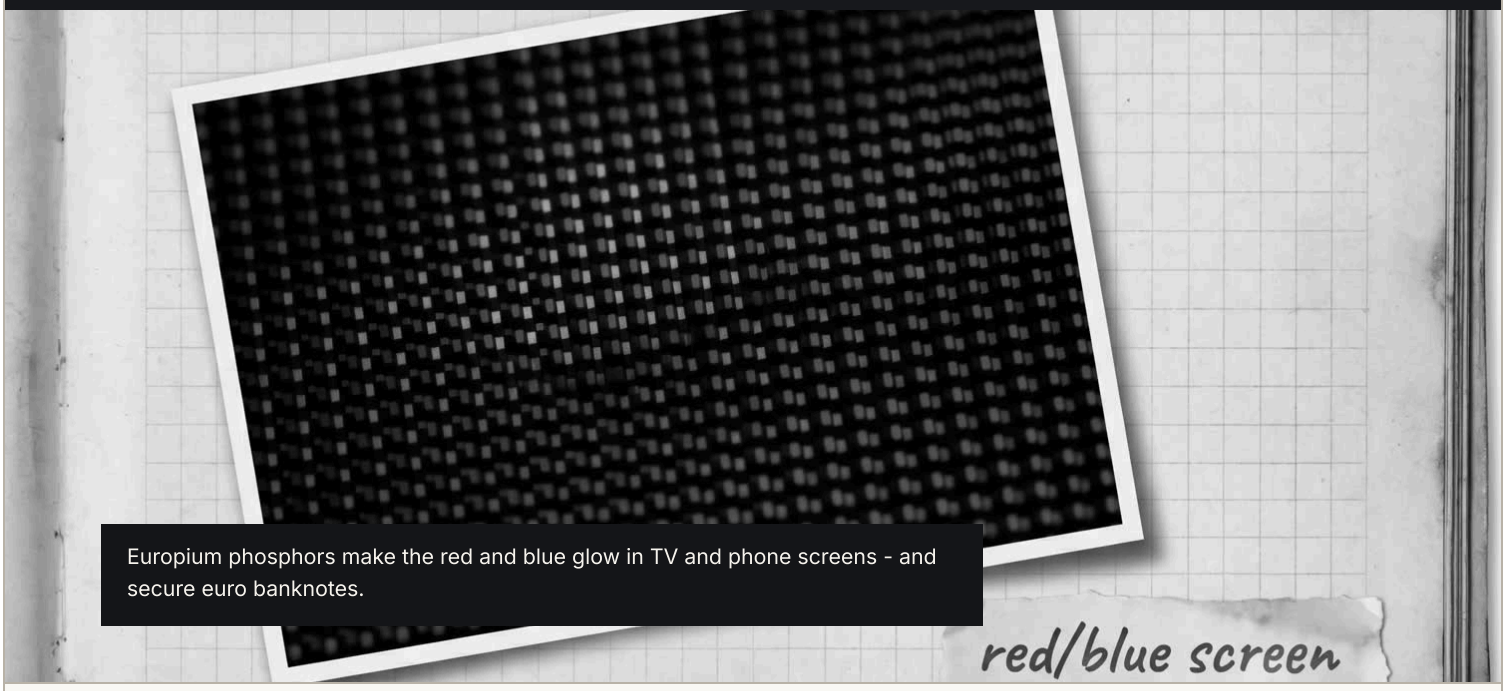
Samarium-cobalt magnets stay strong at high temperatures, so they run motors and precision devices.

Eu

EUROPIUM

THE RED PHOSPHOR IN OLD CRT TV TUBES

MASS	ELECTRONS	BOILS	CHARGE	DANGER
151.96	[Xe] $4f^7$ $6s^2$	1529 °C	+3	2/5 Caution



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

Gd

GADOLINIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
157.25	[Xe] $4f^7$ $5d^1$ $6s^2$	3273 °C	+3	1/5 Low risk

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

Tb

TERBIUM

GREEN PHOSPHOR IN FLUORESCENT LAMPS AND TRICHROMATIC LEDS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
158.93	[Xe] $4f^9$ $6s^2$	3230 °C	+3	1/5 Low risk

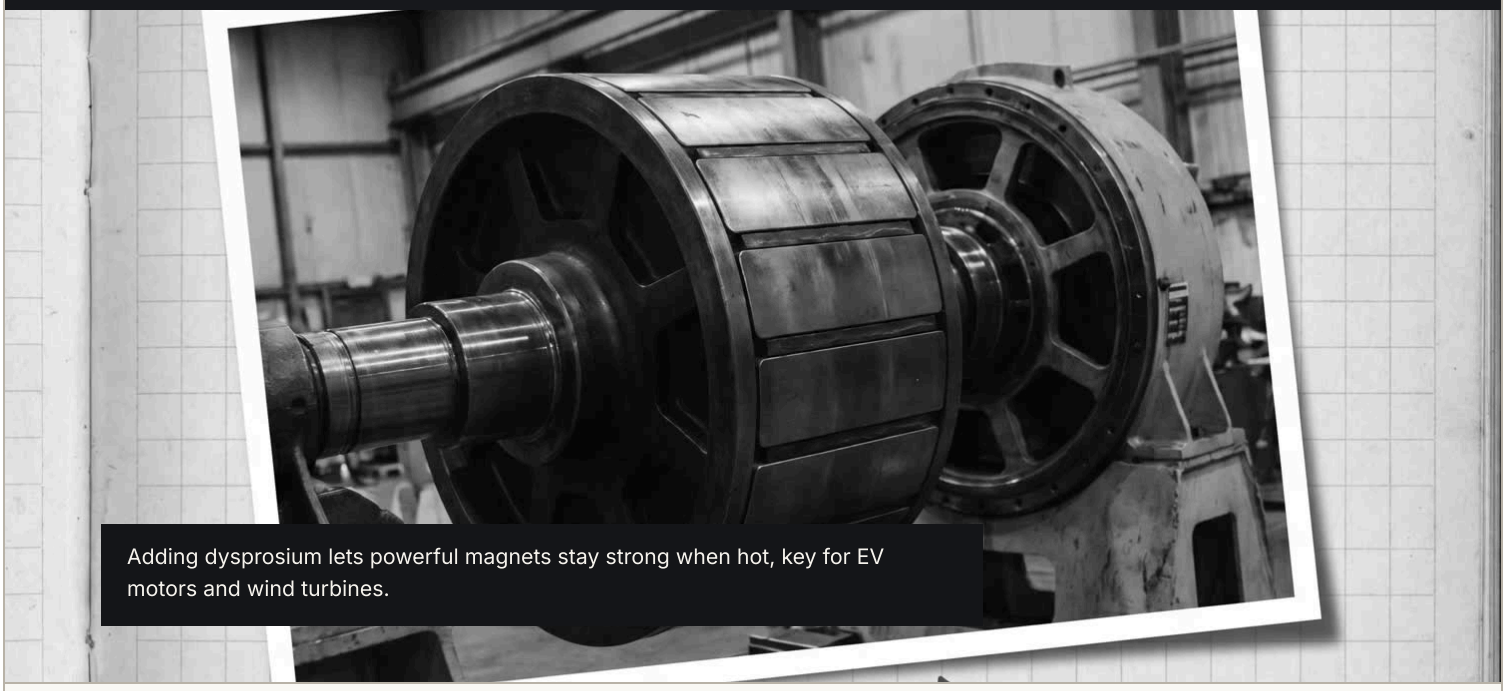
Terbium is the green phosphor in fluorescent lamps and many color displays.

Dy

DYSPROSIUM

HARD DRIVE HEADS, WIND TURBINE MAGNETS, ELECTRIC VEHICLE MOTORS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
162.5	[Xe] $4f^{10}$ $6s^{2}$	2567 °C	+3	1/5 Low risk



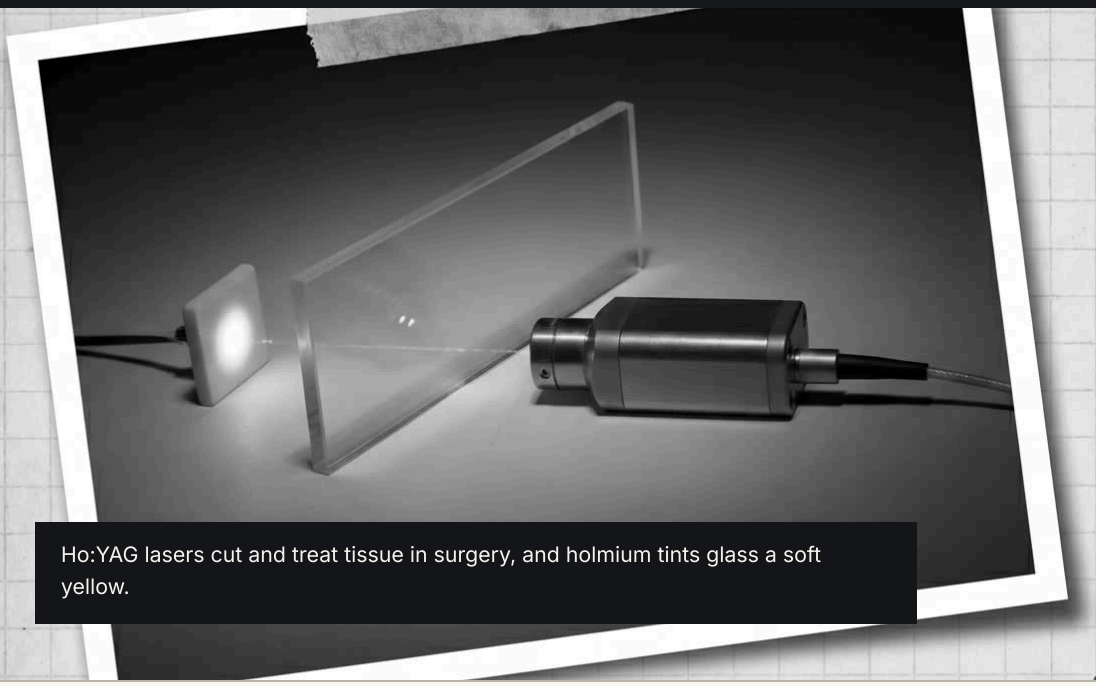
Adding dysprosium lets powerful magnets stay strong when hot, key for EV motors and wind turbines.

Ho

HOLMIUM

THE HO:YAG LASER VAPORIZES KIDNEY STONES AND PROSTATE TISSUE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
164.93	[Xe] $4f^{11}$ $6s^2$	2600 °C	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
167.26	[Xe] $4f^{12}$ $6s^2$	2868 °C	+3	1/5 Low risk

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

Tm

THULIUM

PORTABLE X-RAY SOURCES FOR INDUSTRIAL AND MEDICAL IMAGING

MASS	ELECTRONS	BOILS	CHARGE	DANGER
168.93	[Xe] $4f^{13}$ $6s^2$	1950 °C	+3	1/5 Low risk

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

Yb

YTTERBIUM

YTTERBIUM ATOMIC CLOCKS BEAT CESIUM FOR PRECISION

MASS	ELECTRONS	BOILS	CHARGE	DANGER
173.05	[Xe] $4f^{14}$ $6s^{2}$	1196 °C	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
174.97	[Xe] $4f^{14}$ $5d^{1}$ $6s^{2}$	3402 °C	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
178.49	[Xe] $4f^{14}$ $5d^{2}$ $6s^{2}$	4603 °C	+4	1/5 Low risk

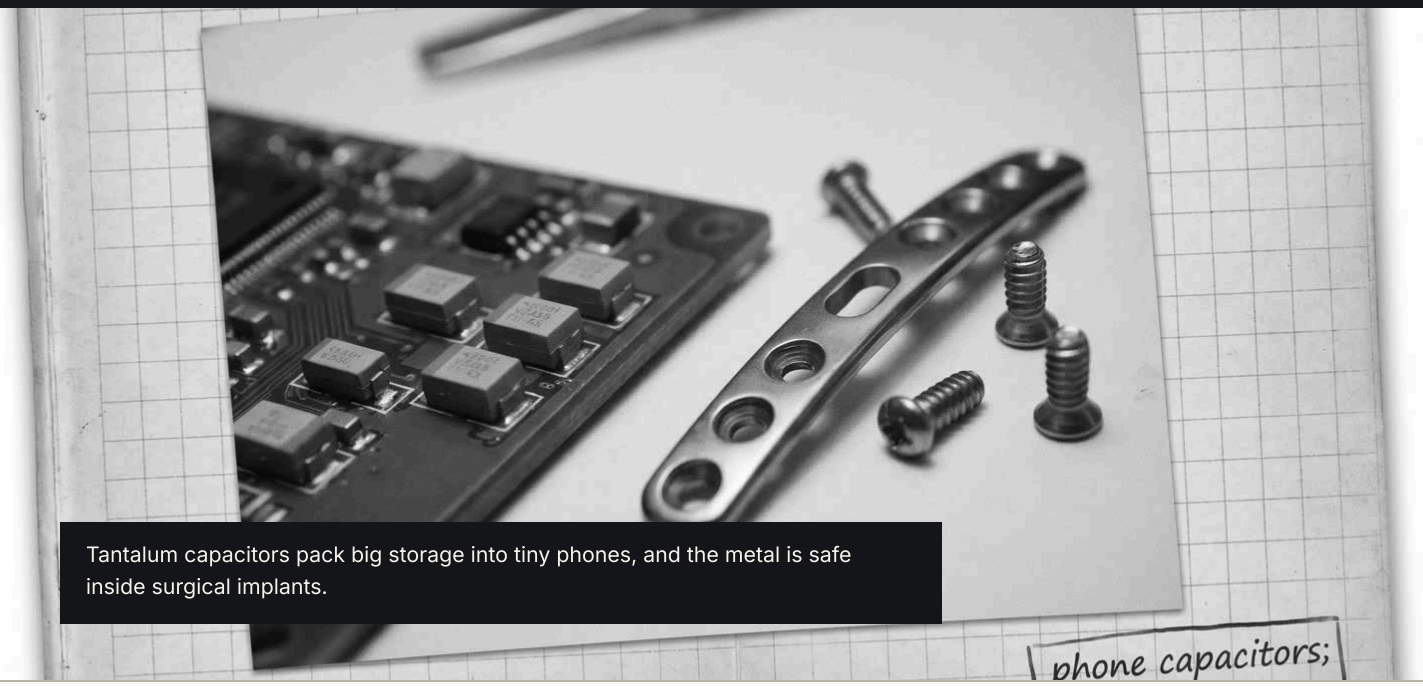
Hafnium soaks up neutrons in reactor control rods and helps tiny transistors switch in chips.

Ta

TANTALUM

CAPACITORS IN EVERY SMARTPHONE (TA_2O_5 DIELECTRIC)

MASS	ELECTRONS	BOILS	CHARGE	DANGER
180.95	[Xe] $4f^{14}$ $5d^3$ $6s^2$	5458 °C	+5	0/5 Safe to handle



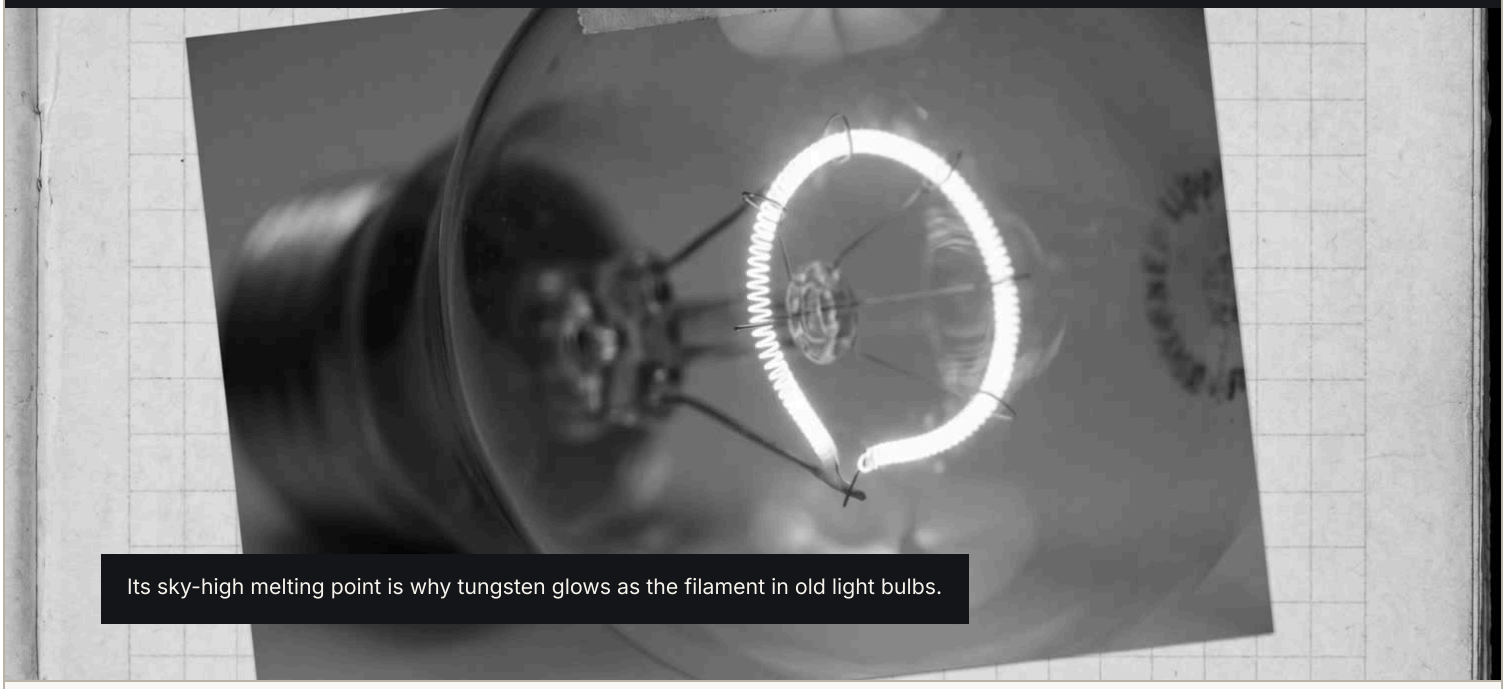
Tantalum capacitors pack big storage into tiny phones, and the metal is safe inside surgical implants.

W

TUNGSTEN

HIGHEST MELTING POINT OF ANY ELEMENT (3422°C)

MASS	ELECTRONS	BOILS	CHARGE	DANGER
183.84	[Xe] $4f^{14}$ $5d^{4}$ $6s^{2}$	5930 °C	+4, +6	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	ELECTRONS	BOILS	CHARGE	DANGER
186.21	[Xe] $4f^{14}$ $5d^{5}$ $6s^{2}$	5596 °C	+4, +7	1/5 Low risk

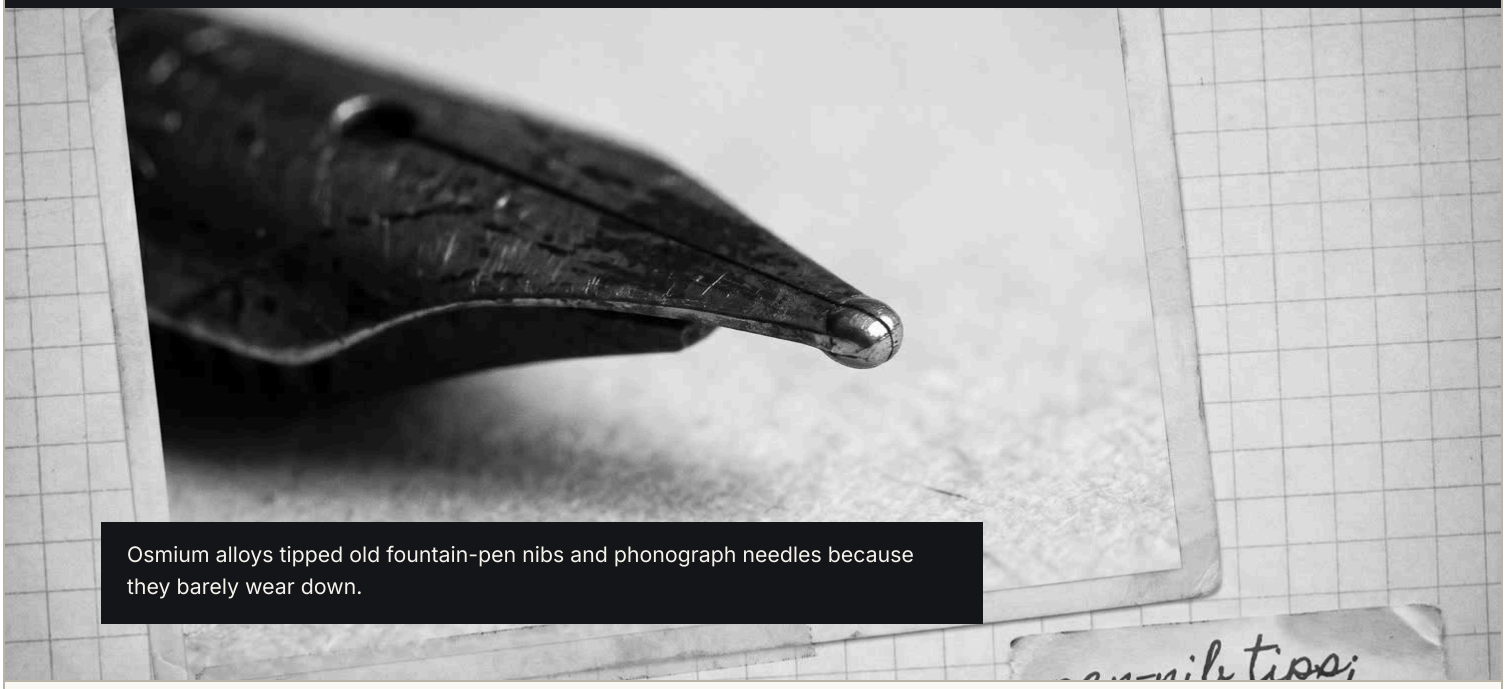
Rhenium goes into the superalloys of jet-engine turbine blades, where metals must survive blistering heat.

Os

OSMIUM

DENSEST STABLE ELEMENT (22.59 G/CM³)

MASS	ELECTRONS	BOILS	CHARGE	DANGER
190.23	[Xe] $4f^{14}$ $5d^{6}$ $6s^{2}$	5012 °C	+4, +8	3/5 Hazardous



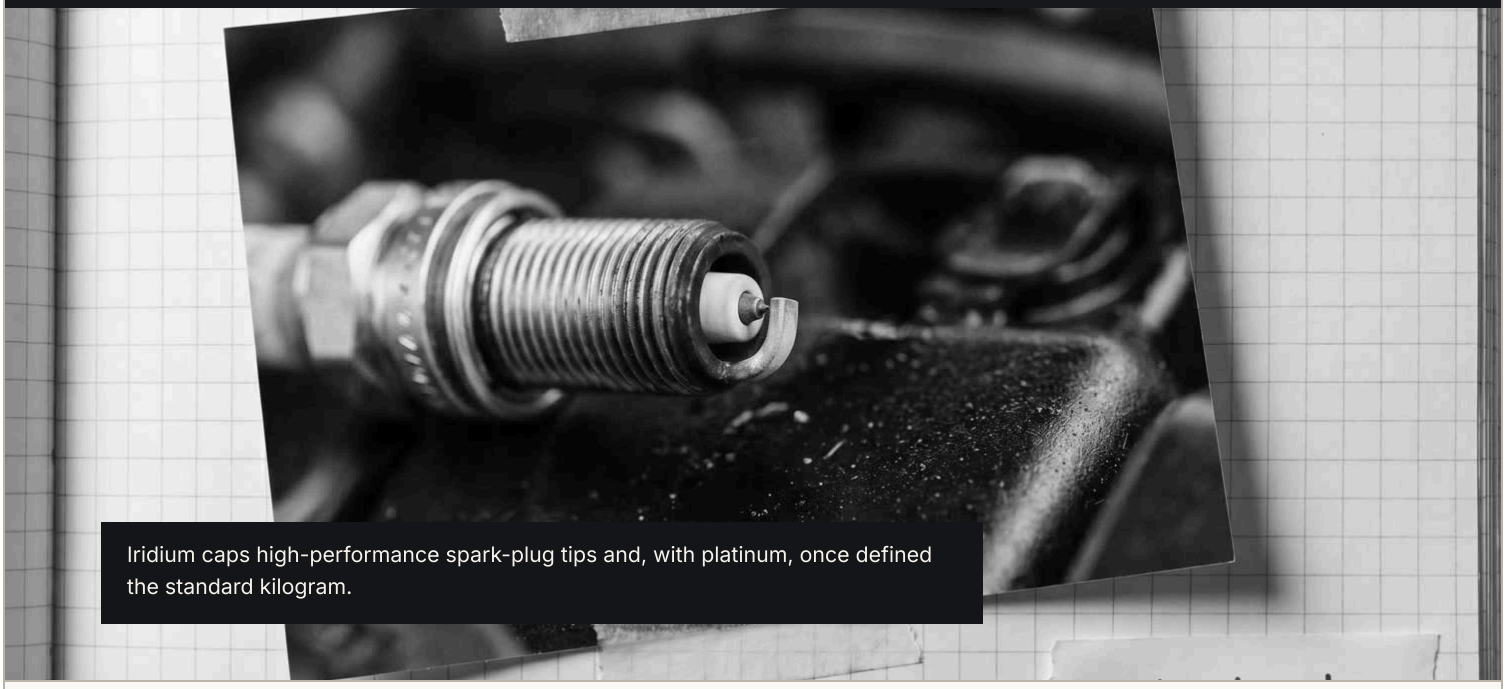
Osmium alloys tipped old fountain-pen nibs and phonograph needles because they barely wear down.

Ir

IRIDIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
192.22	[Xe] $4f^{14}$ $5d^{7}$ $6s^{2}$	4428 °C	+3, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
195.08	[Xe] $4f^{14}$ $5d^{9}$ $6s^{1}$	3825 °C	+2, +4	0/5 Safe to handle

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

Au

GOLD

SOFT, DENSE, ALMOST CHEMICALLY INERT AT ROOM TEMPERATURE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
196.97	[Xe] $4f^{14}$ $5d^{10}$ $6s^{1}$	2856 °C	+1, +3	0/5 Safe to handle

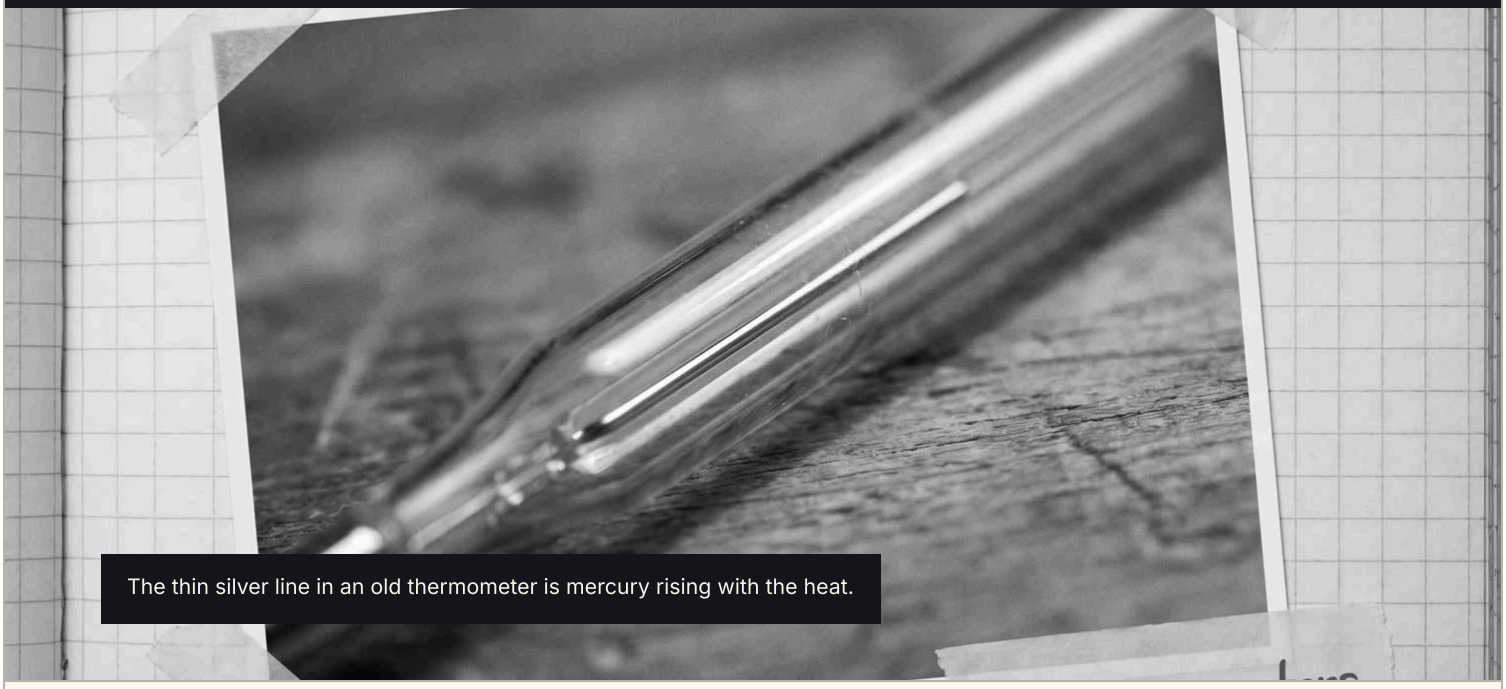
Because it barely reacts, gold jewelry keeps its shine for centuries.

Hg

MERCURY

THE ONLY METAL LIQUID AT ROOM TEMPERATURE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
200.59	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$	357 °C	+1, +2	3/5 Hazardous



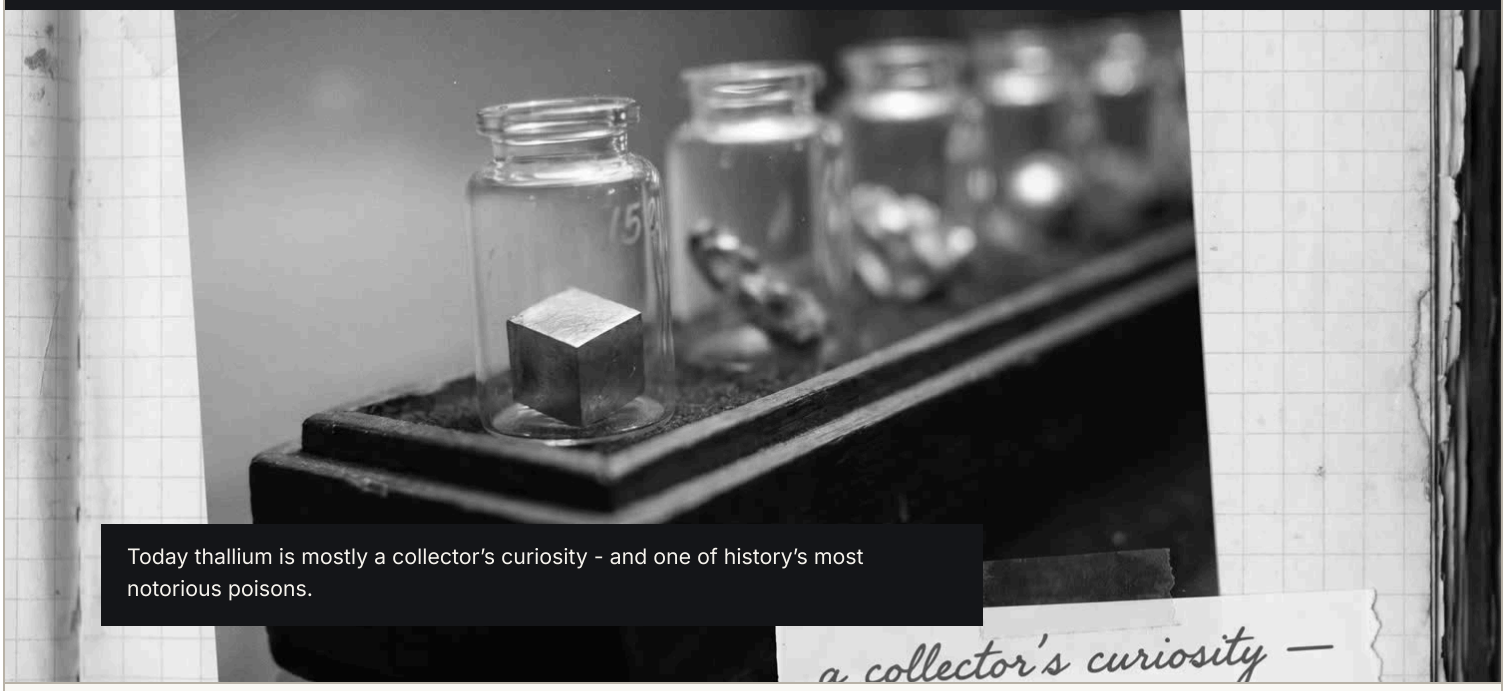
The thin silver line in an old thermometer is mercury rising with the heat.

Tl

THALLIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
204.38	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{1}$	1473 °C	+1, +3	4/5 Severe



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

Pb

LEAD

DENSE, SOFT, TOXIC

MASS	ELECTRONS	BOILS	CHARGE	DANGER
207.2	[Xe] $4f^{14}$ $5d^{10}$ $6s^2$ $6p^2$	1749 °C	+2, +4	3/5 Hazardous

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

Bi

BISMUTH

PEPTO-BISMOL (BISMUTH SUBSALICYLATE) COATS YOUR STOMACH PINK

MASS	ELECTRONS	BOILS	CHARGE	DANGER
208.98	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{3}$	1564 °C	+3, +5	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	ELECTRONS	BOILS	CHARGE	DANGER
[209]	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{4}$	962 °C	-2, +2, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
[210]	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{5}$	337 °C	-1, +1, +3, +5, +7	5/5 Extreme

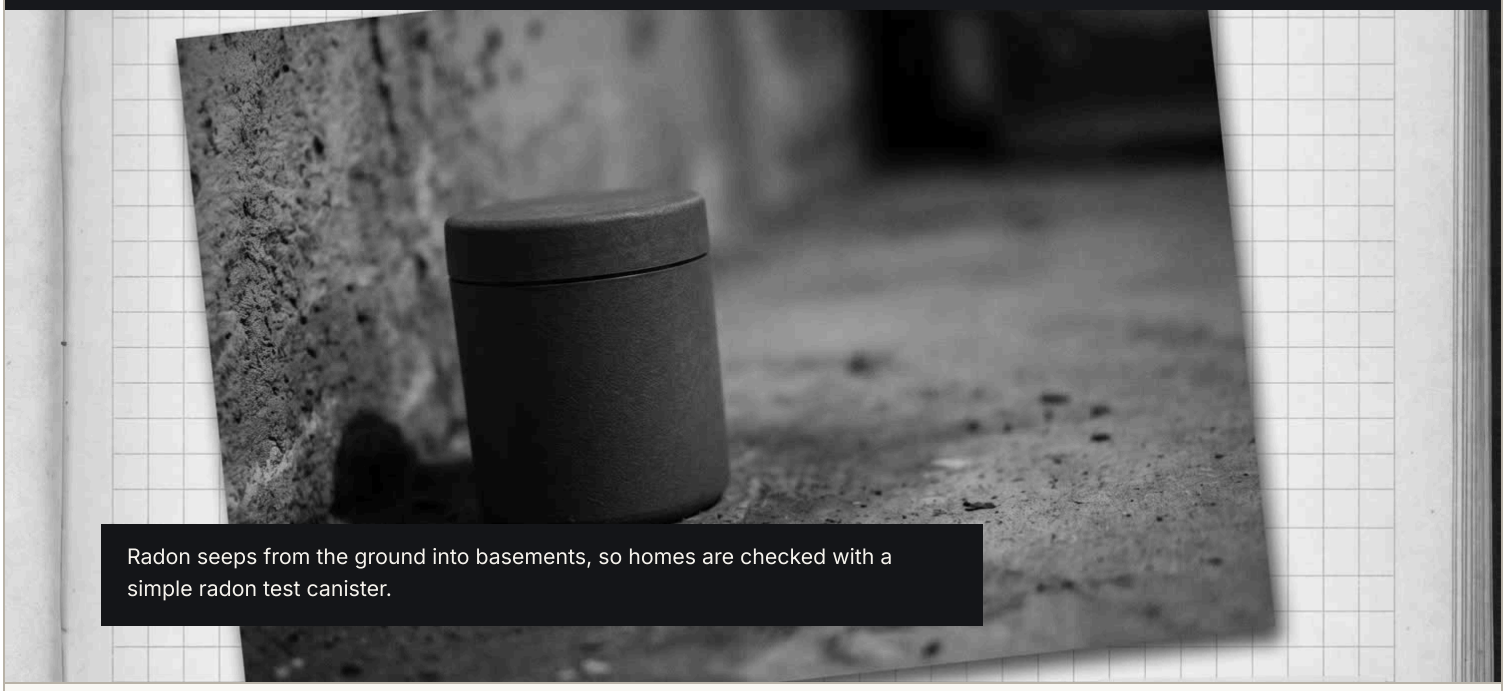
Why no photograph? Astatine is the rarest naturally occurring element. It is so radioactive that any visible amount would instantly boil away in its own heat - no one has ever seen it.

Rn

RADON

COLORLESS, ODORLESS, RADIOACTIVE GAS SEEPING OUT OF GRANITE

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[222]	[Xe] $4f^{14}$ $5d^{10}$ $6s^{2}$ $6p^{6}$	-62 °C	0, +2	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	ELECTRONS	BOILS	CHARGE	DANGER
[223]	[Rn] 7s¹	677 °C	+1	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	ELECTRONS	BOILS	CHARGE	DANGER
[226]	[Rn] $7s^2$	1737 °C	+2	5/5 Extreme

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

Ac

ACTINIUM

GLOWS BLUE IN THE DARK FROM THE RADIATION IT EMITS

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[227]	[Rn] $6d^1\ 7s^2$	3200 °C	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
232.04	[Rn] $6d^2$ $7s^2$	4788 °C	+4	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	ELECTRONS	BOILS	CHARGE	DANGER
231.04	[Rn] $5f^2$ $6d^1$ $7s^2$	4027 °C	+4, +5	 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	ELECTRONS	BOILS	CHARGE	DANGER
238.03	[Rn] $5f^3$ $6d^1$ $7s^2$	4131 °C	+3, +4, +5, +6	4/5 Severe

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

Np

NEPTUNIUM

FIRST ELEMENT BEYOND URANIUM SYNTHESIZED (1940)

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[237]	[Rn] $5f^4$ $6d^1$ $7s^2$	4000 °C	+3, +4, +5, +6, +7	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	ELECTRONS	BOILS	CHARGE	DANGER
[244]	[Rn] $5f^6$ $7s^2$	3228 °C	+3, +4, +5, +6	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	ELECTRONS	BOILS	CHARGE	DANGER
[243]	[Rn] $5f^7\ 7s^2$	2011 °C	+3, +4, +5, +6	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	ELECTRONS	BOILS	CHARGE	DANGER
[247]	[Rn] $5f^{7}$ $6d^{1}$ $7s^{2}$	3110 °C	+3, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
[247]	[Rn] $5f^9$ $7s^2$	2627 °C	+3, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
[251]	[Rn] $5f^{10}$ $7s^{2}$	1470 °C	+2, +3, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
[252]	[Rn] $5f^{11}$ $7s^{2}$	996 °C	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
[257]	[Rn] $5f^{12}$ $7s^{2}$	–	+2, +3	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

MENDELEVIUM

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

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[258]	[Rn] $5f^{13}$ $7s^{2}$	–	+2, +3	5/5 Extreme

Why no photograph? Mendelevium 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	ELECTRONS	BOILS	CHARGE	DANGER
[259]	[Rn] $5f^{14}$ $7s^{2}$	–	+2, +3	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	ELECTRONS	BOILS	CHARGE	DANGER
[266]	[Rn] $5f^{14}$ $7s^{2}$ $7p^{1}$	–	+3	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	ELECTRONS	BOILS	CHARGE	DANGER
[267]	[Rn] $5f^{14}$ $6d^{2}$ $7s^{2}$	–	+4	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	ELECTRONS	BOILS	CHARGE	DANGER
[268]	[Rn] $5f^{14}$ $6d^{3}$ $7s^{2}$	–	+5	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	ELECTRONS	BOILS	CHARGE	DANGER
[269]	[Rn] $5f^{14}$ $6d^{4}$ $7s^{2}$	–	+6	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	ELECTRONS	BOILS	CHARGE	DANGER
[270]	[Rn] $5f^{14}$ $6d^{5}$ $7s^{2}$	–	+7	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	ELECTRONS	BOILS	CHARGE	DANGER
[269]	[Rn] $5f^{14}$ $6d^{6}$ $7s^{2}$	–	+8	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	ELECTRONS	BOILS	CHARGE	DANGER
[278]	[Rn] $5f^{14}$ $6d^{7}$ $7s^{2}$	–	+3, +4, +6	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

DARMSTADTIUM

SYNTHESIZED AT GSI DARMSTADT IN 1994

MASS	ELECTRONS	BOILS	CHARGE	DANGER
[281]	[Rn] $5f^{14}$ $6d^{8}$ $7s^{2}$	–	+2, +4, +6	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	ELECTRONS	BOILS	CHARGE	DANGER
[282]	[Rn] $5f^{14}$ $6d^{9}$ $7s^{2}$	–	+3, +5	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	ELECTRONS	BOILS	CHARGE	DANGER
[285]	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$	–	+2	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	ELECTRONS	BOILS	CHARGE	DANGER
[286]	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{1}$	–	+1, +3, +5	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	ELECTRONS	BOILS	CHARGE	DANGER
[289]	[Rn] $5f^{14}$ $6d^{10}$ $7s^2$ $7p^2$	–	+2, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
[290]	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{3}$	–	+1, +3	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	ELECTRONS	BOILS	CHARGE	DANGER
[293]	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{4}$	–	+2, +4	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	ELECTRONS	BOILS	CHARGE	DANGER
[294]	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{5}$	–	-1, +1, +3, +5	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	ELECTRONS	BOILS	CHARGE	DANGER
[294]	[Rn] $5f^{14}$ $6d^{10}$ $7s^{2}$ $7p^{6}$	–	0, +2, +4	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.