Hydrogen

1

H

Used as rocket fuel and in hydrogen cars

Hydrogen is the lightest element and makes up 73.9% of the universe's visible matter

1.008 **Fuel**

Helium

2

He

Used in balloons and as inert atmosphere for welding

Helium has the lowest boiling point (-269°C) and becomes superfluid with zero viscosity

4.0026 **Balloons**

Lithium

3

Li

Used in rechargeable batteries and mood stabilizers

Lithium is the lightest metal that can float on water while violently reacting with it

6.94 **Batteries**

Beryllium

4

Be

Used in aerospace alloys and nuclear reactors

Beryllium is 6 times stronger than steel but weighs only 25% as much, yet highly toxic

9.0122 **Alloys**

Boron

5

B

Used in ceramics, glass, and as neutron absorber

Boron is the 5th element but essential for plants and harder than most metals when pure

10.81 **Ceramics**

Carbon

6

C

Essential for all life and used in steel production

Carbon is highest for 2 hundred million compounds, melting point of 3823K, and over 500 allotropes

12.011 **Steel**

Nitrogen

7

N

Used in fertilizers and as liquid nitrogen coolant

Nitrogen makes up 78% of Earth's atmosphere but is completely inert at room temperature

14.007 **Fertilizers**

Oxygen

8

O

Essential for breathing and used in steel production

Oxygen is Earth's most abundant element at 46% of crust mass and paramagnetic liquid

15.999 **Breathing**

Fluorine

9

F

Used in toothpaste and water fluoridation

Fluorine is the most reactive element that can corrode glass and concrete on contact

18.998 **Toothpaste**

Neon

10

Ne

Used in neon signs and as inert gas in lighting

Neon produces the most intense light discharge creating the classic orange-red glow

20.18 **Signs**

Sodium

11

Na

Used in table salt and street lighting

Sodium lamps are so efficient that one can outshine 100 incandescent bulbs combined

22.99 **Salt**

Magnesium

12

Mg

Used in flares, alloys, and as dietary supplement

Magnesium burns with 3000K white light so bright it can cause permanent eye damage

24.305 **Flares**

Aluminum

13

Al

Used in beverage cans, foil, and aircraft parts

Aluminum was worth more than gold until 1890s before efficient electrolytic extraction

26.982 **Cans**

Silicon

14

Si

Used in computer chips, glass, and construction

Silicon makes up 27% of Earth's crust and enabled the entire computer age revolution

28.085 **Glass**

Phosphorus

15

P

Used in fertilizers, matches, and DNA structure

White phosphorus glows green in darkness but is essential for life despite being toxic

30.974 **Matches**

Sulfur

16

S

Used in rubber vulcanization and gunpowder

Sulfur is second for forming 30+ allotropes and creates yellow crystals in volcanic regions

32.06 **Rubber**

Chlorine

17

Cl

Used in pool disinfection and PVC production

Chlorine has the highest electron affinity (349 kJ/mol) and was WWI's first poison gas

35.45 **Pools**

Argon

18

Ar

Used in welding and incandescent light bulbs

Argon was Earth's first isolated noble gas and makes up nearly 1% of our atmosphere

39.948 **Welding**

Potassium

19

K

Used in fertilizers and soap production

Potassium is so violently reactive it ignites spontaneously and must be stored in oil

39.098 **Fertilizer**

Calcium

20

Ca

Used in bones, teeth, and concrete production

Calcium phosphate comprises 70% of bone mass giving vertebrates their rigid structure

40.078 **Bones**

Scandium

21

Sc

Used in aerospace alloys and baseball bats

Scandium is paradoxically rarer than many 'rare earth' elements despite being lighter

44.956 **Aerospace**

Titanium

22

Ti

Used in aircraft, medical implants, and paints

Titanium has the highest strength-to-weight ratio of all metals at 45% lighter than steel

47.867 **Implants**

Vanadium

23

V

Used in steel alloys and as catalyst

Vanadium can exist in 5 different oxidation states creating rainbow-colored solutions

50.942 **Steel**

Chromium

24

Cr

Used in stainless steel and chrome plating

Chromium gives rubies red and emeralds green color while being the hardest pure metal

51.996 **Stainless**

Manganese

25

Mn

Used in steel production and battery electrodes

Manganese nodules carpet vast ocean floors containing trillions of tons of the element

54.938 **Batteries**

Iron

26

Fe

Used in construction, tools, and magnets

Iron comprises 32.1% of Earth's total mass with most concentrated in the molten core

55.845 **Magnets**

Cobalt

27

Co

Used in magnets, catalysts, and blue glass

Cobalt blue glass has been prized for 4000 years and retains color at 1000°C heat

58.933 **Motors**

Nickel

28

Ni

Used in coins, batteries, and stainless steel

Nickel-iron meteorites delivered much of Earth's accessible nickel from space impacts

58.693 **Coins**

Copper

29

Cu

Used in electrical wiring and plumbing pipes

Copper naturally kills bacteria and viruses within hours making it self-sterilizing

63.546 **Wire**

Zinc

30

Zn

Used in galvanizing steel and brass alloys

Zinc deficiency causes loss of taste/smell and affects 2 billion people worldwide

65.38 **Galvanizing**

Gallium

31

Ga

Used in semiconductors and LEDs

Gallium melts at 29.8°C in hand temperature but boils at 2400°C with the widest liquid range

69.723 **Electronics**

Germanium

32

Ge

Used in fiber optics and transistors

Germanium was predicted by Mendeleev 15 years before discovery with exact properties

72.63 **Semiconductors**

Arsenic

33

As

Used in wood preservatives and semiconductors

Arsenic has been humanity's poison of choice for over 2000 years earning 'King of Poisons'

74.922 **Pesticides**

Selenium

34

Se

Used in photocopiers and glass coloring

Selenium deficiency causes fatal white muscle disease and is toxic in excess amounts

78.971 **Glass**

Bromine

35

Br

Used as antiseptic and in flame retardants

Bromine is the only liquid non-metal but it evaporates quickly from 1 mL to 3 liters of toxic gas

79.904 **Antiseptic**

Krypton

36

Kr

Used in energy-efficient windows and lasers

Krypton was used in ultra-bright airport runway lighting systems and old camera flashes

83.798 **Lasers**

Rubidium

37

Rb

Used in atomic clocks and medical tracers

Rubidium ignites spontaneously in air and was used in early vacuum tubes for electronics

85.468 **Atomic**

Strontium

38

Sr

Used in fireworks and flares for red color

Strontium-90 fallout creates the brilliant red in fireworks but is dangerously radioactive

87.62 **Fireworks**

Yttrium

39

Y

Used in lasers and as cancer treatment

Yttrium with barium carbon oxide named YBCO makes the highest temperature superconductors at 92K

88.906 **Catalysts**

Zirconium

40

Zr

Used in nuclear reactors and ceramics

Zirconium is virtually immune to corrosion up to 1270K and used in nuclear reactors

91.224 **Jet**

Niobium

41

Nb

Used in jet engines and MRI scanners

Niobium is superconducting below 9K and was originally called columbium in America

92.906 **Steel**

Molybdenum

42

Mo

Used in steel alloys and high-temp lubricants

Molybdenum has the 6th highest melting point at 2896K and strengthens steel dramatically

95.95 **Lubricants**

Technetium

43

Tc

Used in medical imaging and as tracer

Technetium was the first artificially created element filling Mendeleev's predicted gap

98 **Medicine**

Ruthenium

44

Ru

Used in electrical contacts and hard disks

Ruthenium is the scarcest platinum group metal and costs $1600 per troy ounce

101.07 **Electronics**

Rhodium

45

Rh

Used in catalytic converters and jewelry

Rhodium is the most expensive precious metal at $14,000+ per ounce, rarer than gold

102.91 **Catalysts**

Palladium

46

Pd

Used in catalytic converters and dentistry

Palladium can absorb 900 times its volume in hydrogen like a metallic sponge

106.42 **Jewelry**

Silver

47

Ag

Used in jewelry, mirrors, and photography

Silver has the highest electrical conductivity of all elements at room temperature

107.87 **Mirrors**

Cadmium

48

Cd

Used in batteries, pigments, and solar panels

Cadmium red paint was banned after causing severe poisoning in artists for decades

112.41 **Batteries**

Indium

49

In

Used in semiconductors and LCD screens

Indium is softer than lead and can be scratched with a fingernail despite being metal

114.82 **Semiconductors**

Tin

50

Sn

Used in solder, cans, and bronze alloys

Tin produces a distinctive 'tin cry' scream when bent due to crystal twinning

118.71 **Solder**

Antimony

51

Sb

Used in flame retardants and semiconductors

Fluoroantimonic acid is 10 quintillion times stronger than sulfuric acid - the strongest known

121.76 **Flame**

Tellurium

52

Te

Used in solar panels and rubber vulcanization

Tellurium-128 has the longest known half-life at 2.2 septillion years - nearly stable

127.6 **Solar**

Iodine

53

I

Used as antiseptic and in photography

Iodine deficiency affects 2 billion people causing goiter and developmental disability

126.9 **Antiseptic**

Xenon

54

Xe

Used in ion drives and medical anesthesia

Xenon is the rarest gas with 90 grams per million kilograms of air

131.29 **Anesthesia**

Cesium

55

Cs

Used in atomic clocks and oil drilling

Caesium is the softest metal and its hydroxide is the strongest base ever discovered

132.91 **Atomic**

Barium

56

Ba

Used in X-ray imaging and drilling fluids

Barium compounds create brilliant green fireworks but are lethally toxic if ingested

137.33 **X-rays**

Lanthanum

57

La

Used in lighter flints and camera lenses

Lanthanum remained undiscovered in 'pure' cerium samples for 83 years of confusion

138.91 **Lighter**

Cerium

58

Ce

Used in catalysts and glass polishing

Cerium is the most abundant rare earth comprising 0.006% of Earth's crust mass

140.12 **Catalysts**

Praseodymium

59

Pr

Used in aircraft engines and magnets

Praseodymium means 'green twin' creating emerald-green compounds and yellow metal

140.91 **Magnets**

Neodymium

60

Nd

Used in powerful permanent magnets

Neodymium creates the strongest permanent magnets lifting 1000 times their own weight

144.24 **Magnets**

Promethium

61

Pm

Used in nuclear batteries and research

Promethium is the only radioactive rare earth and powers space missions for decades

145 **Batteries**

Samarium

62

Sm

Used in magnets and cancer treatment

Samarium magnets work at 350°C and have the highest neutron absorption cross-section

150.36 **Magnets**

Europium

63

Eu

Used in red phosphors for TV screens

Europium is the softest rare earth and the most reactive, tarnishing rapidly in air

151.96 **Phosphors**

Gadolinium

64

Gd

Used in MRI contrast agents and neutron capture

Gadolinium has the highest magnetic moment and is used in MRI contrast enhancement

157.25 **MRI**

Terbium

65

Tb

Used in green phosphors and magnets

Terbium glows intense green under UV and is essential for energy-efficient lighting

158.93 **Magnets**

Dysprosium

66

Dy

Used in lasers and hard disk drives

Dysprosium becomes strongly magnetic only below -180°C with highest magnetic strength

162.5 **Lasers**

Holmium

67

Ho

Used in magnets and medical devices

Holmium possesses the strongest magnetic field of any element at 4.5 Tesla saturation

164.93 **Magnets**

Erbium

68

Er

Used in fiber optic amplifiers and lasers

Erbium amplifies light in fiber optic cables enabling global internet communications

167.26 **Fiber**

Thulium

69

Tm

Used in X-ray sources and portable equipment

Thulium is the least abundant rare earth metal and possibly the most useless natural element

168.93 **X-rays**

Ytterbium

70

Yb

Used in lasers and stress gauges

Ytterbium expands 26% during phase transition and is used in atomic clocks

173.05 **Lasers**

Lutetium

71

Lu

Used in catalysts and medical imaging

Lutetium is the hardest, densest rare earth and was the last lanthanide discovered

174.97 **Catalysts**

Hafnium

72

Hf

Used in tungsten carbide and nuclear reactors

Hafnium has nearly identical properties to zirconium due to lanthanide contraction

178.49 **Carbide**

Tantalum

73

Ta

Used in electronics and surgical instruments

Tantalum is virtually immune to all acids except hydrofluoric at high temperatures

180.95 **Electronics**

Tungsten

74

W

Used in light bulb filaments and X-ray tubes

Tungsten has the highest melting point at 3695K and tensile strength of all metals

183.84 **Bulbs**

Rhenium

75

Re

Used in catalysts and jet engine parts

Rhenium has the highest boiling point at 5869K and is the last stable element found

186.21 **Catalysts**

Osmium

76

Os

Used in fountain pen tips and electrical contacts

Osmium is the densest element at 22.6 g/cm³ and costs $400 per troy ounce

190.23 **Fountain**

Iridium

77

Ir

Used in spark plugs and cancer treatment

Iridium is the most corrosion-resistant element and 2nd densest element at 22.42 g/cm³

192.22 **Catalysts**

Platinum

78

Pt

Used in jewelry, catalysts, and electronics

Platinum is 30 times rarer than gold and catalyzes 20% of all chemical processes

195.08 **Jewelry**

Gold

79

Au

Used in jewelry, electronics, and dentistry

Gold is so chemically inert it never tarnishes and has been treasured for 6000 years

196.97 **Electronics**

Mercury

80

Hg

Used in thermometers, dental fillings, and switches

Mercury is the only metal liquid at room temperature and expands linearly with heat

200.59 **Thermometers**

Thallium

81

Tl

Used in electronics and medical imaging

Thallium is 10 times more toxic than lead and was once sold as rat poison

204.38 **Electronics**

Lead

82

Pb

Used in car batteries, bullets, and radiation shielding

Lead's toxicity may have contributed to the fall of Rome through poisoned water pipes

207.2 **Batteries**

Bismuth

83

Bi

Used in medicine and cosmetics

Bismuth forms spectacular rainbow-colored oxide crystals and expands when solidifying

208.98 **Medicine**

Polonium

84

Po

Used in antistatic devices and neutron sources

Polonium is 250 billion times more toxic than cyanide and the most radioactive natural element

209 **Detectors**

Astatine

85

At

Used in medicine and scientific research

Astatine is Earth's rarest element with less than 1 gram existing at any time

210 **Medicine**

Radon

86

Rn

Used as tracer gas and in dating

Radon gas seepage causes 21,000 lung cancer deaths annually in the US alone

222 **Gas**

Francium

87

Fr

Used in research and atomic clocks

Francium is the most reactive metal with largest atomic radius and shortest half-life of 22 minutes

223 **Research**

Radium

88

Ra

Used in cancer treatment and luminous paints

Radium was worth more than gold and glowed green due to intense radioactive decay

226 **Medicine**

Actinium

89

Ac

Used in cancer treatment and neutron sources

Actinium glows blue-white in darkness and is 150 times more radioactive than radium

227 **Medicine**

Thorium

90

Th

Used in gas mantles and nuclear fuel

Thorium is 3 times more abundant than uranium and could power civilization for millennia

232.04 **Gas**

Protactinium

91

Pa

Used in nuclear research and dating

Protactinium costs $280/gram making it one of the most expensive elements to obtain

231.04 **Nuclear**

Uranium

92

U

Used in nuclear fuel and weapons

Uranium-235's 1 gram releases energy equal to burning 3 tons of coal completely

238.03 **Fuel**

Neptunium

93

Np

Used in smoke detectors and research

Neptunium was the first transuranium element created and is named after planet Neptune

237 **Detectors**

Plutonium

94

Pu

Used in nuclear weapons and power

Plutonium feels warm due to radioactive decay and is illegal for civilians to possess

244 **Weapons**

Americium

95

Am

Used in smoke detectors and neutron sources

Americium is the only man-made element available to the public in stores

243 **Detectors**

Curium

96

Cm

Used in research and space missions

Curium glows purple-blue in darkness due to intense radioactivity and rapid decay

247 **Research**

Berkelium

97

Bk

Used in research and as electron source

Berkelium was first synthesized at UC Berkeley using the 60-inch cyclotron in 1949

247 **Research**

Californium

98

Cf

Used in research and neutron sources

Californium costs $27 million per gram and is used to start nuclear reactors

251 **Research**

Einsteinium

99

Es

Used in research and medical applications

Einsteinium was discovered in hydrogen bomb debris from the first H-bomb test in 1952

252 **Research**

Fermium

100

Fm

Used in research only

Fermium was found in H-bomb fallout like einsteinium and named after physicist Enrico Fermi

257 **Research**

Mendelevium

101

Md

Used in research only

Mendelevium was the first element created one atom at a time using particle accelerators

258 **Research**

Nobelium

102

No

Used in research only

Nobelium discovery was disputed for decades with Soviet, American, and Swedish claims

259 **Research**

Lawrencium

103

Lr

Used in research only

Lawrencium completes the actinide series and was synthesized at Berkeley in 1961

262 **Research**

Rutherfordium

104

Rf

Used in research only

Rutherfordium was claimed by both Soviet and American teams causing naming disputes

267 **Research**

Dubnium

105

Db

Used in research only

Dubnium was named after Dubna, Russia where Soviet scientists first claimed discovery

270 **Research**

Seaborgium

106

Sg

Used in research only

Seaborgium honors Glenn Seaborg, the only living person to have an element named for them

271 **Research**

Bohrium

107

Bh

Used in research only

Bohrium was named after Niels Bohr who developed quantum mechanical model of atoms

270 **Research**

Hassium

108

Hs

Used in research only

Hassium was named after Hesse, Germany where GSI laboratory first synthesized it

277 **Research**

Meitnerium

109

Mt

Used in research only

Meitnerium honors Lise Meitner who discovered nuclear fission

276 **Research**

Darmstadtium

110

Ds

Used in research only

Darmstadtium was named after Darmstadt, the latest city to receive elemental recognition

281 **Research**

Roentgenium

111

Rg

Used in research only

Roentgenium honors X-ray discoverer Wilhelm Röntgen though it doesn't emit X-rays

282 **Research**

Copernicium

112

Cn

Used in research only

Copernicium was named after Copernicus who placed the Sun at the solar system's center

285 **Research**

Nihonium

113

Nh

Used in research only

Nihonium was named after Japan (Nihon) where RIKEN laboratory first synthesized it in 2004

286 **Research**

Flerovium

114

Fl

Used in research only

Flerovium honors Soviet physicist Flyorov who founded heavy element research in USSR

289 **Research**

Moscovium

115

Mc

Used in research only

Moscovium was named after Moscow where Russian scientists contributed to superheavy research

290 **Research**

Livermorium

116

Lv

Used in research only

Livermorium honors Lawrence Livermore Laboratory's contributions to superheavy elements

293 **Research**

Tennessine

117

Ts

Used in research only

Tennessine was named after Tennessee, discovered most recently in 2010 at Oak Ridge

294 **Research**

Oganesson

118

Og

Used in research only

Oganesson is the heaviest and most radioactive element with the shortest 0.7ms half-life

294 **Research**