

The Periodic Table of the Elements, in Words

Hydrogen belongs to no definite group. It forms compounds by either donating an electron like an alkali metal or accepting an electron like a halogen.

Periods

Group 1

H Hydrogen 1
lightest element; 90% of atoms in the universe, sun and stars, water (H₂O), life's organic molecules

Alkali Metals are very reactive and readily form compounds but are not found free in nature. They form salts and alkali (acid-neutralizing) compounds such as baking soda. In pure form, they are very soft metals which catch fire on contact with water.

Group 2

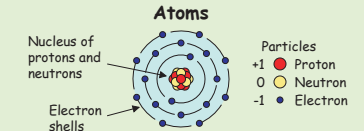
Alkali Earth Metals are reactive and readily form compounds but are not found free in nature. Their oxides are called alkali earths. In pure form, they are soft and somewhat brittle metals.

Li Lithium 3
lightest metal, soft, reactive; lightweight aluminum alloys, batteries, impact-resistant ceramic cookware, mood stabilizer

Be Beryllium 4
lightweight metal; non-sparking copper alloy tools, aerospace, X-ray windows, beryl gems; emeralds and aquamarines

Na Sodium 11
soft metal, reactive; salt (NaCl), nerves, baking soda, antacids, eye soap, soda ash, glass, papermaking, street lamps

Mg Magnesium 12
lightweight metal; chlorophyll in green plants, talc, basalt, aluminum alloys, cars, planes, bikes, flares, sparklers, antacids



An atom has a nucleus, made of protons and neutrons, surrounded by electrons orbiting in cloud-like shells. Smaller shells are surrounded by larger shells.

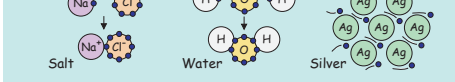
The atomic number is the number of protons in an atom. This determines the chemical properties of the atom. Protons have positive electric charge, neutrons are neutral, and electrons are negative. Normally, an atom has equal numbers of protons and electrons. An ion is a charged atom with more or fewer electrons than protons.

The atomic weight of an element is the average number of protons plus neutrons. You can easily estimate the atomic weight: it is usually 2 to 2.5 times the atomic number.

An element is a substance made from one or more atoms of the same atomic number. A compound is a substance made from two or more elements chemically bonded.

Chemical Bonding

Atoms form molecules by bonding together. Atoms give, take, or share electrons to achieve full outer electron shells.



Groups
Elements in the same group, or column, are similar because they typically have the same number of outer electrons. This table shows some easy-to-remember common numbers for each group.

Group number	1	2	3-12	13	14	15	16	17	18
Outer electrons*	1	2	3	4	5	6	7	8	0
Valence number*	+1	+2	+2	+3	+4, -4	-3	-2	-1	0

* typical The valence number is the number of electrons given (+) or taken (-) when bonding.

Transition Metals are typical metals: they are strong, shiny, malleable (they can be hammered into shape), flexible (in thin sheets or wires), and they conduct both heat and electricity.

Poor Metals are usually soft and have low melting temperatures.

Metalloids are partly like metals and partly like nonmetals. For example, they are semiconductors, which means they conduct electricity in some conditions.

Nonmetals, in their solid state, are usually brittle (they break rather than bend) and they are insulators of both heat and electricity.

Halogens are reactive nonmetals and readily form compounds but are not found free in nature. They combine with alkali metals to form salts (halogen means salt-former).

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He Helium 2
inert gas, second lightest element; fuel for nuclear fusion in sun and stars, balloons, lasers, supercold refrigerator

K Potassium 19 soft metal, reactive; salts, nerves, nutrients in fruits and vegetables, soap, fertilizer, potash, matches, gunpowder	Ca Calcium 20 soft metal; bones, teeth, milk, leaves, vegetables, shells, coral, limestone, chalk, gypsum, plaster, mortar, cement, marble, antacids	Sc Scandium 21 soft lightweight metal; aluminum alloys, racing bikes, stadium lamps, furnace bricks, aquamarines	Ti Titanium 22 strongest lightweight metal; heat-resistant; aerospace, racing bikes, artificial joints, white paint, blue sapphires	V Vanadium 23 hard metal; hard strong resilient steel, structures, vehicles, springs, driveshafts, tools, aerospace, violet sapphires	Cr Chromium 24 hard shiny metal; stainless steel (Fe-Cr-Ni), kitchenware, nichrome heaters, car trim, paints, recording tape, emeralds & rubies	Mn Manganese 25 hard metal; hard tough steel, rock crushers, rail, tools, axes, batteries, fertilizer, amethysts	Fe Iron 26 medium-hard metal, magnetic; steel alloys are mostly iron, structures, vehicles, magnets, earth's core, red rocks, blood	Co Cobalt 27 hard metal, magnetic; hard strong steel, cutting tools, turbines	Ni Nickel 28 nickel-hard metal, magnetic; stainless steel (Fe-Cr-Ni), kitchenware, nichrome heaters, nicad batteries, coins, earth's core	Cu Copper 29 colored metal, conducts heat and electricity well; wires, cookware, brass (Cu-Zn), bronze (Cu-Sn), coins, pipes, blue crab blood	Zn Zinc 30 non-corroding metal; galvanized steel, brass (Cu-Zn), batteries, white paint, phosphors in TVs and lamps, fertilizer	Ga Gallium 31 soft metal, melts on a hot day; semiconductors, light-emitting diodes (LEDs) (GaAs), signal lights, tiny lasers	Ge Germanium 32 brittle metalloid; semiconductors, transistors, rectifiers, diodes, photovoltaic cells, lenses, infrared windows	As Arsenic 33 brittle metalloid; poisons, semiconductors, light-emitting diodes (LEDs) (GaAs), signal lights, tiny lasers	Se Selenium 34 brittle gray solid; photocopiers, laser printers, photo cells, red glass, dandruff shampoo, rubber	Br Bromine 35 dark red liquid; disinfectant, pools and spas, photo film, flame retardant, leaded gasoline, sedatives	Kr Krypton 36 inert gas; high-intensity lamps, headlights, flashlights, lanterns, "neon" tubes, lasers
Rb Rubidium 37 soft metal, reactive; atomic clocks, global navigation (GPS), vacuum tube scavenger	Sr Strontium 38 soft metal; red fireworks, flares, phosphors, nuclear batteries, medical diagnostic tracer, nuclear fallout	Y Yttrium 39 soft metal; phosphors in color TVs, lasers (YAG, YLF), furnace bricks, high-temperature superconductors	Zr Zirconium 40 non-corroding neutron-resistant metal; chemical pipelines, nuclear reactors, furnace bricks, abrasives, zircon gems	Nb Niobium 41 high-melting-point non-corroding metal; chemical pipelines, superconductors, magnetic levitation trains, MRI magnets	Mo Molybdenum 42 high-melting-point metal; hard steel, cutting tools, drill bits, armor plate, gun barrels, fertilizer	Tc Technetium 43 radioactive, long-lived; first human-made element, only traces on earth, found in stars, medical diagnostic tracer	Ru Ruthenium 44 non-corroding hard metal; electric contacts, leaf switches, pen tips, catalyst, hydrogen production	Rh Rhodium 45 non-corroding hard shiny metal; labware, reflectors, electric contacts, thermocouples, catalyst, pollution control	Pd Palladium 46 non-corroding hard metal, absorbs hydrogen; labware, electric contacts, dentistry, catalyst, pollution control	Ag Silver 47 soft shiny metal, conducts electricity best of all elements; jewelry, silverware, coins, dentistry, photo film	Cd Cadmium 48 non-corroding soft metal, toxic; electroplated steel, nicad batteries, lead and yellow paints, fire sprinklers	In Indium 49 soft metal; solders, glass seals, liquid crystal displays (LCDs), semiconductors, diodes, photocells	Sn Tin 50 non-corroding soft metal; solders, plated food cans, bronze (Cu-Sn), pewter cups, glassmaking, fire sprinklers	Sb Antimony 51 brittle metalloid; solders, lead hardener, batteries, bullets, semiconductors, photocells, matches, flame retardant	Te Tellurium 52 brittle metalloid; alloys, semiconductors, computer disks, thermo-electric coolers and generators	I Iodine 53 violet-black solid, disinfectant for wounds and drinking water, added to salt to prevent thyroid disease, photo film	Xe Xenon 54 inert gas; high-intensity lamps, headlights, stadium lamps, projectors, strobes, lasers, spacecraft ion engines
Cs Cesium 55 soft metal, melts on a hot day, reactive, largest stable atoms; atomic clocks, global navigation (GPS), vacuum tube scavenger	Ba Barium 56 soft metal, absorbs X-rays; stomach X-ray contrast enhancer, green fireworks, whitener and filler for paper, plastic, and rubber	71-80 Rare Earth Metals	Hf Hafnium 72 non-corroding metal, absorbs neutrons; nuclear reactor control rods in submarines, plasma torch electrodes	Ta Tantalum 73 highest-melting-point non-corroding metal; labware, surgical tools, artificial joints, capacitors, mobile phones	W Tungsten 74 dense metal; rocket engines, heater coils, lab filaments, electric contacts, thermocouples, catalyst	Os Osmium 76 non-corroding high-melting-point dense metal; densest element (same as iridium); electric contacts, pen tips, needles, fingerprint powder	Ir Iridium 77 non-corroding hard metal, densest element (same as osmium); labware, spark plugs, pen tips, needles	Pt Platinum 78 non-corroding dense metal; labware, spark plugs, catalyst, pollution control, petroleum cracking, processing fats	Au Gold 79 most malleable element, dense non-tarnishing colored metal; jewelry, coins, ultra-thin gold leaf, electric contacts	Hg Mercury 80 liquid metal, toxic; thermometers, barometers, thermostats, street lamps, fluorescent lamps, dentistry	Tl Thallium 81 soft metal, toxic; low-melting-point mercury alloys, low-temperature thermometers, undersea lamps, photocells	Pb Lead 82 dense, soft, non-corroding metal, toxic; weights, solders, batteries, bullets, crystal glass, old plumbing, radiation shield	Bi Bismuth 83 low-melting-point brittle metal; solders, fuses, fire sprinklers (plugs melt when hot), cosmetics pigment	Po Polonium 84 radioactive, long-lived; first radioactive element found in nature, small traces in nature, anti-static brushes, tobacco	At Astatine 85 radioactive, short-lived; small traces in nature, cancer medicine	Rn Radon 86 radioactive gas, short-lived; environmental hazard, surgical implants for cancer treatment	
Fr Francium 87 radioactive, short-lived; atoms larger than cesium; small traces in nature, studied in laser atom traps	Ra Radium 88 radioactive, long-lived; luminous watches (now banned), medical radon production, radiography, radwaste	89-103 Actinide Metals	Rf Rutherfordium 104	Db Dubnium 105	Sg Seaborgium 106	Bh Bohrium 107	Hs Hassium 108	Mt Meitnerium 109	Ds Darmstadtium 110	Rg Roentgenium 111	Cn Copernicium 112	Uut Ununtrium 113	Fl Flerovium 114	Uup Ununpentium 115	Lv Livermorium 116	Uus Ununseptium 117	Uuo Ununoctium 118

Rare Earth Metals are all soft metals. They are chemically similar to scandium and yttrium and are difficult to separate from each other.

Actinide Metals are all radioactive heavy metals. They are used mainly for their radioactive properties.

Radioactivity. Atoms with the same number of protons but different numbers of neutrons are called isotopes. Some isotopes are stable; others are radioactive — their nuclei eventually disintegrate. The radioactive half-life is the time for half the nuclei to disintegrate. On this chart, an element is called long-lived if the half-life of any of its isotopes is more than one year; otherwise it is called short-lived.

What is the last human-made element? For up-to-date information, search the web for "periodic table".