Common Element families:

(Periods go left right, while Groups are vertical)

Hydrogen

Hydrogen is the most abundant of all elements, making up about 75% of all matter (by mass), and about 90% of all atoms. You’ll find that most Hydrogen is found bound to Oxygen atoms to make WATER. It is also very common in the compounds that make life possible (sugars and carbohydrates). It is the Hydrogen in water molecules that make water such an excellent solvent. Hydrogen is also important in nuclear reactions.

Alkali Metals (Lithium, Sodium, Potassium, Rubidium, Caesium, and Francium.)

Left column of the Periodic Table.

 These elements are ‘very similar’ to each other. All of them are soft and shiny metals that are very reactive. They all need to be kept away from oxygen or they will react (oxidize, and sometimes burn) very quickly. These elements easily form ionic compounds, especially with the HALOGENS (right side column with Fluorine, Chlorine, Bromine, Iodine, etc.). Sodium Chloride is a common compound (table salt) from this pairing.

They all react with WATER (H2O) by replacing the hydrogen atoms, releasing hydrogen gas in the process.

 Lithium

Least dense solid element. Very ractive metal. Used in batteries, glass, ceramics (reducing the melting point of the other ingredients), increases the heat resistance of glass and ceramics. Also found in some medicines. Also used to remove CO2 from the air in spacecrafts and so on.

 Sodium

Very common in the Earth’s crust. Common in SALT. Has many industrial uses, from lighting (sodium lamps) to cooling (pure liquid sodium). Needed by nerve cells.

 Potassium

In its pure form will burn hot and fast when in contact with water. In a compound known as Potash. Nerves need it to support the transmission of impulses.

Alkaline Earth Metals (Magnesium, Calcium, Radium and others)

Next to the Alkali on the left side of the Periodic Table.

These elements react with water and acids to produce hydrogen gas. They will react with water only if the water is very hot. They are never found in their pure state in nature.

Magnesium

Very common on Earth. Lots of it in sea water too. Key element in Chlorophyll. A dull grey light weight metal that burns with a bright white flame. It is used in fireworks, and talcum powder.

Calcium

Very common element on Earth, never found in its pure form in nature. Common in Calcium Carbonate (Limestone and Chalk). Used to ‘drive off’ CO2 in kilns and other high heat processes. Also in cement, hand creams, toothpastes, and so on.

 Radium

Very radioactive. Marie Curie discovered it, and she died from its effects! Originally used in paints that glowed in the dark, but it was discovered to be too radioactive to use that way!

“D – Block” (that huge chunk from “column” #3 to “column” #10 that are ‘short’), things get weird here – you may learn about this chunk in detail later on in life, or you may not. They begin with PERIOD 4 elements. (The beginning of ‘d’ orbitals). “Transition” metals. Except for gold and copper they are all shiny and silver/grey in colour, and they are all good conductors of both heat and electricity. They can be shaped and stretched (malleable and ductile). they combine with other elements to make colourful compounds, some of which we consider ‘semi-precious gems’. Transition metals like to combine with each other.

 Titanium

Common in igneous rocks. It quickly reacts with oxygen to form a thin layer of titanium oxide, which prevents further oxidation, and it is strong and light so it is used in medical implants (hips and knees). In powdered form it is used in fireworks as it burns very white. A common metal when lightness is required.

 Zirconium

Combined to make Zirconium Silicate (ZrSiO4) it is a semi-precious stone. As a metal alloyed with others, it is resistant to softening at high heat.

 Chromium

In compounds used to tan leather. In another compound it improves the action of insulin. Commonly used to plate metals (chrome!) that protects against the oxidation (rusting) of the underlying metal. It is also used in stainless steel.

 Tungsten

The highest melting point (and boiling point) of any metal. Mostly used to make a very hard metal – tungsten carbide.

 Iron

 Usually found in combination of oxygen in nature (‘iron oxide).

 Nickel

Often used with copper to make alloys. Resistant to corrosion. Also used in magnets (Alnico), stainless steel, heating elements, batteries, pigments, and engines.

 Platinum

Precious metal – worth more than gold. Used in jewelry. Rare on Earth. Used in Catalytic Converters as a catalyst to improve a chemical reaction. Very malleable, so it can be formed into very fine wires.

 Copper

 Second highest electrical conductivity of all metals (Silver is the best).

 Silver

(Group 11 like copper and gold). Can be found on Earth in its pure form. Very unreactive with the compounds water and the element oxygen. Combines with other elements to create light-sensitive compounds that were used in photographic films. It is used in solar cells (wires) and in electronic switches and medicine, as it is toxic to many micro-organisms.

 Gold

 Zinc

Needed in our bodies(digestion, skin health, etc.) Mostly used in compounds and coatings to protect metals against corrosion. (galvanization). Zinc [II] Oxide (ZnO) is a white pigment used in paints (artist paints).

 Mercury

Only metal liquid at NORMAL ROOM TEMPERATURE. Strong toxin. It was once common in thermometers and electrical circuits (gravity switches). A very cool element with a great history in the study of chemistry. It is used in mercury vapour lamps and in energy-saving fluorescent bulbs.

“F” block elements

These are the ones at the bottom of the chart that seem to be separated from all the others. They are placed this way because they really fit in between Barium (#56) and Hafnium (#72) and if put there, the table would get really WIDE!!!!!. And these elements are not found “in nature”, they contain the radioactive elements (Atomic number > 92). They are connected by a type of electron orbital that they have, an “f” orbital. Complicated by far.

 Neodymium

 Needed to make super-strong magnets. “rare-earth” magnets.

 Uranium

Radioactive element. U-234, U-235, and U238. U 235 is used in creating self-sustaining nuclear reactions. Very complicated stuff here.

Boron Group (group 13)

 Boron

Rare. mostly found in the form of borax, used in detergents and cosmetics.

 Aluminium

3rd most common element on Earth. The reflective layer on many mirrors. In compounds it has many uses (catalyst, abrasive, antacids, antiperspirants, and more).

Carbon Group (Group 14)

Common in compounds due to their half-full outer electron shell. Very common group of compounds on Earth.

Carbon

4th most common element on Earth. Found mostly in carbonate minerals. Pure carbon can be found as diamond, graphite, graphene, amorphorous (without shape) carbon (soot, charcoal, etc.), and a few other weird forms. Diamonds are formed under high pressure and temperatures, conditions found about 150 km below the surface of the Earth. The form of elemental carbon takes depends solely on the type of bonds between the atoms of carbon. Graphite is conductive as it has a free electron, where in diamonds, the electron is used in the bonds with other carbon atoms. Graphite can be formed into very thin fibers (carbon fiber) that are very strong.

Carbon is key to all life processes., where it combines with elements such as hydrogen, oxygen, and nitrogen.

 Silicon

Second most common element on Earth (by mass). Usually found combined with oxygen. Pure Silicon is so neat that you need to look up its electrical properties! Found in quartz, (SiO2) and many other rocks.

 Tin

 Used in metal alloys such as bronze (copper and tin).

 Lead

 So much to learn – look lead up on its own.

Nitrogen Group (Group 15)

 Nitrogen

Critical to all life on Earth. Common in the ‘air’ we breathe, as it makes up about 80% of that air. Does not easily combine with other elements (but found as a molecule of nitrogen gas (N2)). Sodium Azide (NaN3) is an explosive that creates huge volumes of nitrogen gas that is used in automobile airbags. Nitrous Oxide (laughing gas) “N2O”. Look up all the many compounds containing nitrogen, like ammonia (NH3).

 Phosphorus

Combines easily with oxygen (glows in the process), white phosphorus ignites spontaneously at 30 degrees Celsius. Usually phosphorus is found in a phosphate ion. Common in DNA. Look it up!

 Arsenic

Can be found in a number of different combinations (like carbon). Used as a pigment, some anti-cancer drugs, and in electronics (LEDs).

Oxygen Group (Group 16)

Very common in naturally occurring metal ores (mostly oxygen and sulfur) .

 Oxygen

Makes up about 90% by mass of water. PLUS the amounts dissolved in water!! 21% of dry air. Needed by all living things. in the process of energy conversion (found in sugars and carbohydrates). There is so much to oxygen that you should research it on your own.

 Sulfur

Found in many forms in its pure state. Brimstone is an old name for sulfur (“fire and brimstone”, mentioned in both the Bible and the Qur’an). Creates acids when mixed with water, will oxidize hot enough to burn (used in match heads as a catalyst, and in gunpowder). It is commonly found in fossil fuels (the source of most industrial sulfur, as sulfur is removed from natural gas). Sulfur is the cause of *acid rain*. Look it up!

The Halogens (Group 17)

Highly reactive non-metals, rarely found in their pure state in nature. Because they react easily, they are dangerous in their pure state.

 Fluorine

Mineral Fluorite. Fluorite (in water and toothpastes to strengthen teeth), CFCs (Chlorofluorocarbons) used as a refrigerant, PTFEs (polytetrafluoroethylene) used as insulators, waterproof tapes, breathable fibers like Gore-Tex, Teflon. Also a component of many toxins and poisons.

 Chlorine

A highly reactive (and toxic) element in gaseous form. Used to make CFCs (chlorofluorocarbons), chloroform, PVC (polyvinyl chloride), and it is found in hydrochloric acid (naturally found in the human stomach), Chlorine is the active ingredient of bleach, where the chemical process is the oxidation process in the presence of the chlorine (the oxidation of the various pigments that come in contact with the chlorine). It is also a disinfectant as chlorine oxidizes compounds in cell membranes. Domestic bleach is a solution of sodium hypochlorite (NaClO). Chlorine usually ends up as chloride ions (1- charge). DDT contains a chlorine atom Chlorine is also found in PCBs (polychlorinated biphenyls) and so on.

 Bromine

Only one of two elements that are liquid at room temperature, mercury is the other one. See chlorine to get an idea about how reactive bromine is.

 Iodine

Has a role as an antiseptic and it is needed in small amount in most living things.

The Noble Gases (Group 18)

The name says so much about this group – they are ‘noble’, in that they are complete on their own. They are extremely ‘inert’, in that they do not react with other elements, and they are very stable as a result. (ok, Radon is highly radioactive). They are inert because all of their electron ‘shells’ are complete, no extras, no shortages, they are complete on their own.

 Helium

A lighter-than-air gas, so it is used in balloons because unlike hydrogen (also lighter-than-air), it will not burn/explode. Helium has the lowest melting/boiling point of any element. Hydrogen and helium were formed in the first few minutes of the Universe (this is slightly misleading as a fact, as in reality, only the nuclei were formed at that point). Helium is used in some high-intensity discharge lamps, as a coolant and as a protective gas used in some manufacturing processes.

Helium’s effect on your voice is a result of the fact that the speed of sound in helium is faster than in air, so that makes the higher frequencies in your voice resonant in your mouth and voice box more so than they do in air.

 Neon

 Rare on Earth. Used in Neon lights.

 Argon

Used in lights, as a shielding gas in welding, and in the process of making silicon crystals., and medical lasers.

 Krypton

Sorry Superman, this is not the same thing. Used in ‘neon’ lights, and fluorescent lights. In Arc-lamps, krypton produces a very white light.

 Xenon

 Xenon gas may one day power ion engines (for deep space travel)

 Radon

A naturally occurring radioactive gas (meaning it decomposes into other elements).