1. **8 Dominant Elements** — There are 8 domianat elements that make up 98.5% of the Earth's crust, they are:
oxygen (O), 46.0 %
silicon (Si), 27.5 %
aluminum (Al), 8.0 %
iron (Fe), 5.0 %
calcium (Ca), 4.0 %
sodium (Na), 3.0 %
potassium (K), 3.0 %
magnesium (Mg), 2.0%
2. **Alkali Metals** — the elements of the first group (column) are called the alkali metals and tend to give up an electron, resulting in a characteristic +1 valence charge. Li, Na, K, Rb, Cs, Fr.
3. **Alkaline Earth Metals** — The elements of the second column are collectively called the alkaline earth metals. These elements usually lose two electrons, resulting in a characteristic +2 valence charge. Be, Mg, Ca, Sr, Ba, Ra.
4. **Angstroms** — Used to measure the distance between the nucleus and electron clouds of an atom. Equal to 1/10 of a nanometre.
5. **Anions** — Anions are atoms that have extra electrons, a negative charge.
6. **Asthenosphere** — The upper mantle material acts as a relatively soft, lubricating layer over which the crustal lithospheric plates move.
7. **Atomic Mass** — The total number of neutrons and protons defines the atomic mass of an atom. The weights of atoms are given in atomic mass units, or amu, where both protons and neutrons have an amu equal to 1. Helium has 2 protons and almost always 2 neutrons. Its atomic mass, therefore, is 4 amu. The atomic mass of an element is important because as atomic mass increases so does the density of the material that the atom is in.
8. **Base Metals** — Metals that react with oxygen in the air to form a metal oxide (Fe and Cu). Base metals are normally found in nature either as oxide minerals (chemically bonded to O) or sulfide minerals (chemically bonded to sulfur) but in special cases, can be present as native metals.
9. **Cations** — Cations are atoms that have missing electrons, a positive charge.
10. **Chemical Bonds** — Form when outer electrons from two or more atoms interact resulting in their atoms becoming "joined". The two main types of bonding seen in nature are covalent and ionic.
11. **Chemical Formula** — The formula includes the component elements and the number of atoms of each element written as a subscript.
12. **Chromophores** — Elements that cause colour in minerals. Often found in trace amounts.
13. **Cleavage** — Crystal cleavage is a smooth break producing what appears to be a flat crystal face.
14. **Composition on Atomic Basis** — SiO_2 has 3 apfu: 1 atom of Si and 2 atoms of O. That means that on an atom basis, it is 33% Si (1 Si for every 3 total atoms), and 66% O (2/3) per formula unit.
15. **Composition on Atomic Weight Basis** — The total atomic weight of SiO_2 is simply the sum of the weights of its components:
28 amu (Si)
+16 amu (O)
+16 amu (O) = 60 amu
Calculating the relative weights:
Si- 28/ 60 x 100= 46%
O- (16+16)/ 60 x 100= 54%
This means that for quartz, Si contributes 46% while O contributes 54% of the atomic weight.
16. **Composition on Oxide Weight Basis** — The techniques originally used in mineralogy involved dissolving a mineral into an acid (i.e., a wet chemical analysis) and then forcing the dissolved cations to react with oxygen and form a solid. This solid, which comprises the dissolved material and oxygen, was then measured and recorded as the "weight of the element's oxide".
17. **Compounds** — Elements combine and interact through chemical bonds. When two or more elements join together they form a compound. A compound is represented by symbols called chemical formula. Water (H_2O) composed of hydrogen, salt (NaCl) composed of sodium (Na) and chlorine (Cl).

18.	**Convergent or Destructive Plate Boundaries**	At convergent boundaries, two plates move toward each other and collide. The Himalaya mountain range was formed when two continental plates, the Indian and Eurasian plates, collided (continental-continental collision). When two oceanic plates or an oceanic plate and a continental plate are in collision, one plate is pushed under or subducted below the other. When two oceanic plates collide, a chain of volcanic islands develops above the zone of subduction. In the case of oceanic-continental plate collision, the oceanic plate is always subducted below the continental plate because oceanic crust is denser than continental material.
19.	**Coupled Substitution**	In certain substitutions, more than two elements are involved in what is called a coupled substitution.
20.	**Covalent Bonding**	Covalent bonding occurs when atoms "share" valence (or outermost) electrons between them. Covalent bonding is more common in organic compounds (form living matter). In the gem world, this type of bonding is best observed in diamond. Diamond is a compound made up of carbon (C). The carbon atoms share electrons between them in a tight 3D network forming "molecules" of interconnected C atoms. These covalent bonds are very strong and give diamond its hardness and strength.
21.	**Diamonds**	Diamonds form deep within the Earth in the region called the Upper Mantle where the great pressures and temperatures allow the mineral to grow.
22.	**Divergent or Constructive Plate Boundaries**	Tectonic plates move away from each other at these boundaries and new crust is produced ("constructed"). An example of a constructive plate boundary is the Mid-Atlantic Ridge (MAR). This feature has been widening the Atlantic Ocean at an average rate of about 2.5 cm per year. One of the few that can be observed on land.
23.	**Earth System Science**	Earth System Science views the Earth as a working system, each part having an impact and an effect on the other.
24.	**Electrons**	Compared to protons and neutrons, electrons are much much smaller in size. Each electron carries a single negative electric charge. On the valence shell.
25.	**Element Groups**	A group is a column of elements in the Periodic Table. Elements within a group have similar chemical behavior because of the similarity in the distribution of their electrons, especially in the valence (outermost) shell.
26.	**Elements**	Elements are the basic building blocks of matter. Elements are composed of identical atoms.
27.	**Fluorescence**	The fluorescent minerals are those that emit visible light when activated by invisible ultraviolet light (UV), X-rays and/or electron beams. Certain electrons in the mineral absorb the energy from these sources and jump to a higher energy state. The fluorescent light is emitted when those electrons drop down to a lower energy state and emit a light of their own.
28.	**Fracture**	Fracture is a description of the way a mineral tends to break. It is different from cleavage and parting which are generally clean flat breaks along specific directions.
29.	**Gem, Gemstone**	A gemstone is any mineral that is highly valued for its beauty, durability, and rarity. Included in the mineral-focused gemstone definition are non-mineral gemstones that are organic or biological in origin, such as pearls and amber.
30.	**Geochemistry**	Characteristic elemental content of a specific rock.
31.	**Goldilocks Principle**	Minor and trace elements can substitute for major elements in a mineral as long as they have similar a similar charge and ionic radius (Å).
32.	**Grams**	1000 milligrams = 1 gram, 1000 grams= 1 Kilogram.
33.	**Halogens**	The Halogen group includes: F, Cl, Br, I, At. They will almost always have a -1 charge. They are elements numbered: 9, 17, 35, 53, 85.
34.	**Hardness**	Hardness is one measure of the strength of the structure of the mineral relative to the strength of its chemical bonds. It is not the same as brittleness.
35.	**Igneous Rock**	Igneous rocks crystallize (a process sometimes called solidification) from a molten material (called a melt or magma) to form a rock composed of interlocking crystals. The melt is generated from a process called "partial melting" of mantle material or of rocks deep in the crust.
36.	**Inner Core**	This layer is a solid and has a metallic composition.
37.	**Ionic Bonding**	Ionic bonding occurs between two atoms, one with a strong tendency to gain electrons (the anion) and the other with a strong tendency to lose electrons (the cation).

38. **Ionic Radius** — The distance from the nucleus of an atom to the edge of the electron cloud. Measured in Angstroms.

39. **Ions** — Atoms that are prone to gaining or losing electrons.

40. **Ions** — Charged atoms, either with missing or extra electrons, resulting in a positive or negative charge.

41. **Karats** — NOT THE SAME AS CARATS (weight)! Purity, or fineness, of gold is described in karats with 24-karat (24K) gold being pure gold (100%). Most jewellery is actually 14 karat gold, meaning that it is 14 parts gold and the remaining 10 parts can be anything else (58% pure). Similarly, 18K gold is 18 parts gold and 6 parts something else (75% pure). 22K gold is 22 parts gold and 2 parts something else (92% pure).

42. **Lithosphere** — The lithosphere consists of continental and oceanic crust and the uppermost part of the mantle. This layer is fractured into a number of rigid sections or plates. Continental crust and oceanic crust have different overall compositions; continental crust is much richer in minerals containing silicon (Si) while oceanic crust has a higher iron (Fe) content. Continental crust also tends to be much thicker than oceanic crust.

43. **Lustre** — The way light interacts with a surface of a rock.

44. **Major Elements** — Major elements are fundamental in a mineral's crystal structure and have a major impact on the resulting bulk properties. They are always part of a mineral's chemical formula. Major elements of minerals are always reported in weight percent of the oxide.

45. **Mantle** — A relatively hot viscous "taffy-like" layer. The mantle is in continual motion with hot mantle material rising from the depth and cooler upper mantle material sinking to the lower areas. These motions are called convection currents and may in part help drive the motion of the lithospheric plates.

46. **Metallic Bonding** — A third type of bonding that is less common in nature, but commonly studied by scientists, are metallic bonds. This is the type of bonding, which not surprisingly, is typical in metals such as silver, gold, and copper. Valence electrons in metallically bonded compounds are shared throughout the entire material (not simply between two atoms) and are free to move about. This is why electricity generated from power plants is transferred along metal power lines.

47. **Metalloids** — The metaloids group includes: Si, Ge, As, Sb, Te, Po. They are elements numbered: 5, 14, 32, 33, 51, 52, 84.

48. **Metamorphic Rocks** — Metamorphic rocks are formed by the alteration of pre-existing rocks (igneous, metamorphic, and sedimentary) via metamorphism. The processes that transform or metamorphose rocks involve heat and/or pressure and very often fluids percolating through the subsurface.

49. **Mineral** — A mineral is a naturally occurring homogeneous solid with a definite (but generally not fixed) chemical composition and a crystalline structure. It is usually formed by inorganic processes

50. **Minor Elements** — Minor elements are present in smaller amounts and commonly replace major elements in a mineral. They are sometimes a part of a mineral's chemical formula. Minor elements are usually reported in weight percent of the oxide.

51. **Mixtures** — A mixture is comprised of two or more compounds that are not interacting through chemical bonding, held together through an interlocking physical network of mineral grains.

52. **Native Metals** — Gold, silver, copper, and platinum are the four primary native metals and are characterized by metallic bonds. Common traits of native metal minerals that differentiate them from most other minerals include good electrical conductivity, good thermal conductivity, high densities, malleability, ductility, and a metallic luster.

53. **Native State** — When elements occurr by themselves in rock. About 20 elements occur in their native state (not including gases); all are either metals, semi-metals, or non-metals, and are considered to be minerals.

54. **Neutrons** — Usually there are about equal number of neutrons as protons in an atom. However, larger atoms (those with more protons) generally have a greater number of neutrons than protons. Neutrons carry no electric charge. In the nucleus.

55. **Noble Gases** — These elements will not combine with other elements and include: He, Ne, Ar, Kr, Xe, Re. They are elements numbered: 2, 10, 18, 36, 54, 86.

56. **Noble Metals** — Metals that do not react with oxygen (Au and Pt).

57. **Nonmetals** — The non-metal group inclides: C, N, O, P, S, Se. They are lements numbered 6, 7, 8, 13, 16, 34.

58.	**Ounces**	1 ounce= 28 grams, there are 16 ounces in a pound.
59.	**Outer Core**	This layer is a liquid.
60.	**Plate Boundaries**	Most geological activity (such as earthquakes, volcanic activity, and mountain building) that affects the surface of the Earth occurs at the plate boundaries whereas the central portions of the plates tend to be quite 'stable'. The three main types of plate boundaries are convergent, divergent, and transform.
61.	**Plutonic or Intrusive Rock**	If molten material cools to form a rock at the surface of the Earth, it is called volcanic or extrusive.
62.	**Protons**	The identity of an atom is determined by the number of protons it contains - this is also called the element's atomic number. For example, the first element of the Periodic Table is hydrogen (H), which has an atomic number of 1 - which means it has 1 proton. The second element of the periodic table is helium (He), which has an atomic number of 2 - which means it has 2 protons. Gold (Au) is an element with an atomic number of 79. Thus, each atom of gold has exactly 79 protons. Each protons carries a single positive electric charge. In the nucleus.
63.	**Purity**	Purity is described in percent, a scale of 1 to 1000 and karats, with 100% of a metal being pure, and 99.9% being essentially pure. Silver is commonly measured in fineness, with a value of 1 indicating 100% pure silver. The purity of platinum group metals is usually denoted on a scale of 1 to 1000, with 1000 being pure. Thus, platinum stamped with 900 will be 90% pure Pt.
64.	**Refractive Index**	The index of refraction is the geometric ratio of the angle at which light comes to the crystal (called the angle of incidence) by the angle at which light is bent as it enters a crystal (called the angle of refraction). Metallic minerals do not have an index of refraction because they do not allow light to enter the crystal in the first place.
65.	**Scientific Method**	Observations, Form hypothesis, Test hypothesis, Repeat testing, Form theory, Re-examinatrion of theory.
66.	**Sedimentary Rocks**	Sediments are transformed into rock via a process called diagenesis or lithification which physically cements the sedimentary grains together. Like metamorphism, this process involves heat, pressure, and percolating fluids but not to such a degree that the rocks mineralogy or structure is drastically transformed.
67.	**Semi Metals or Other Metals**	Semi or Other metals include: Al, Ga, In, Tl, Sn, Pb, Bi, 113. They are elements numbered: 13, 31, 49, 50, 81, 82, 83, 113.
68.	**Simple Substitution**	When one element substitutes for just one other element, the process is called a simple substitution.
69.	**Specific Gravity**	Specific Gravity is a measure of the density of a mineral. It is derived from the density of the mineral divided by the density of water and thus all units cancel.
70.	**States of Matter**	Matter exists in three fundamental states or phases: solid, liquid, and gas. Minerals and metals sometimes pass through the liquid state en route to being refined into a purer form. For example Gold is collected as a solid and then melted at 1065 degrees C and poured into a block.
71.	**Sterling Silver**	Sterling silver is a standard alloy and is 92.5% Ag and 7.5% Cu.
72.	**Streak**	Streak is closely related to color, but is a different property because the color of the mineral may be different than the color of the streak. Streak is actually the color of the powder of a mineral. It is called streak because the proper way to test for streak is to rub a mineral across a tile of white unglazed porcelain and to examine the color of the "streak" left behind.
73.	**Tenacity**	Tenacity describes the reaction of a mineral to stress such as crushing, bending, breaking, or tearing.
74.	**Theory of Plate Tectonics**	The Theory of Plate Tectonics is often called the geological Grand Unifying Theory. The theory describes how the plates and the continents they contain are pushed and pulled around the surface of the Earth.
75.	**Thr Rock Cycle**	Starting from the bottom: partial melting of mantle material forms magma; magma crystallizes to form igneous rocks; weathering and erosion of igneous and metamorphic rock produces sediments which lithify to form sedimentary rocks; some igneous and sedimentary rock undergo tectonic burial and metamorphism to form metamorphic rock.

76.	**Trace Elements**	Trace elements are found only in very small amounts and can either be a replacement for one of the major elements in a crystal structure or can be occupying "holes" in a crystal structure that are big enough for them to hide in. They are very rarely seen in a mineral's written chemical formula and when they are, it is for a very specific purpose. Trace elements are almost always reported in parts per million (ppm) but an atom basis. Trace elements are reported in ppm primarily to avoid long decimals and allow easier comparisons and interpretation of data.
77.	**Transform Plate Boundaries**	At transform boundaries the plates move past each other without the creation or significant destruction of crustal material. The most famous transform plate boundary is coincident with the feature known as the San Andreas Fault where the North American Plate is moving past the Pacific Plate.
78.	**Transition Metals**	The middle block of elements are called the transition metals. These elements can have variable valence charges, usually up to +4 but sometimes as high as +6.
79.	**Troy Ounces**	1 troy ounce= 31.1 grams, there are 12 troy ounces in a pound.
80.	**Unit Cell**	The building blocks of a crystal are what mineralogists call the unit cell. This is the smallest division of a crystal that is still represented by its overall chemical formula.
81.	**Valence or Valence State**	The charge of an atom resulting from loss or gain of electrons.
82.	**Volcanic or Extrusive Rocks**	If molten material cools to form a rock at the surface of the Earth, it is called volcanic or extrusive.
83.	**Weight Percent**	The weight of a cation in its oxide form. This representation takes into consideration the atomic weight of each element as opposed to the number of atoms per formula unit.