**Matter Notes:**

**Unit 1: Materials and Processes that Shape a Planet**

**Mini-Unit:** Chemistry of the Earth

**Goal 2**: The student will demonstrate the ability to describe and classify materials that make up Earth

**Objectives – The student will be able to:**

* Illustrate the chemical structure of the atom and describe characteristics of protons, neutrons, electrons, and the nucleus
* Distinguish among compounds, mixtures, molecules, and isotopes

**Textbook:** Chapter 4, Page 80

Matter:

Matter – anything that takes up space and has mass

Mass – the measure of the amount of matter in an object

Properties of Matter:

1. Physical Properties – characteristics that can be observed without changing the compositions of the substance

Ex: density, color, hardness, freezing point, boiling point, and the ability to conduct an electrical current

1. Chemical Properties – characteristics that describe how a substance reacts with other substances to produce different substances

Ex: ability to form rust, ability to form/not form certain compounds

Density – the amount of matter/mass in a given amount of volume

Atom – the smallest unit of an element that maintains the chemical properties of that element; cannot be broken down into smaller units that still have the same chemical and physical properties of that atom

Atomic Structure:

Atoms are made up of subatomic particles

1. Nucleus – dense region of matter and mass found in the center of the atom
2. Protons – positively charged subatomic particles found in the nucleus, the number of protons determines the atomic number and the identity of the element
3. Neutrons – a subatomic particle with no charge and is located in the nucleus of the atom
4. Electrons – subatomic particle with a negative charge found in a certain region of space around the nucleus called the electron cloud; kept close to the atom due to the attraction between the opposite charges of the electron and proton

Element – a substance consisting of only one type of atom, cannot be broken down or separated into simpler substances by chemical means; all elements have the same atomic number

Atomic Number – the number of protons in a nucleus; all atoms of any given elements have the same atomic number; because an uncharged atom has the same number of protons and electrons, typically the number of electrons is the same as the atomic number

Atomic Mass – the sum of the number of protons and neutrons in an atom; expressed in atomic mass units (amu) where a proton and a neutron both have a mass of 1 amu; electrons (1/1840 amu) are ignored when determining atomic mass

Periodic Table – a chart that classifies the elements into columns, where elements in the same columns have similar electron arrangements thus they have similar chemical properties

Isotopes – an atom that has the same number of protons (or the same atomic number) as the other atoms of the same element do but that has a different number of neutrons (and thus a different atomic mass)

Combinations of Atoms:

Compound – A substance made up of atoms of two or more different elements joined by chemical bonds

Molecule – A group of atoms that are held together by chemical forces; the smallest unit of matter that can exist by itself and retain all of a substance’s chemical properties

Atoms 🡪 Elements 🡪 Molecules 🡪 Compounds

A chemical formula is a combination of letters and numbers which show what elements and how many atoms of each element make up a compound.

Ex: H2O – chemical formula for water; H2 tells you have two hydrogen atoms while the O tells you have one atom of oxygen

A chemical equation is a series of letters and numbers which show you the reactants and products of a chemical reaction

Ex: CH4 + 2O2 🡪 CO2 + 2H2O, One molecule of methane reacts with two atoms of oxygen to create/yield one molecule of carbon dioxide and two atoms of water

Chemical Bonds:

Chemical Bonds – forces that hold atoms together; done by sharing and transferring electrons

Ions – an atom or molecule that has gained or lost one or more electrons and has a negative or positive charge

Ex: if an atom gains an electron it becomes a negative ion, if it loses an electron it becomes a positive ion

Ionic Bond – once two atoms exchange an electron, one is positively charged (lost the electron) and the other is negatively charged (gained the electron), the opposite charges attract forming an ionic bond

Covalent Bond – a bond formed with atoms share one or more pairs of electrons

Polar Bonds – unequal sharing of electrons leads a molecule to have a slightly positive end and a slightly negative end