## MATTER

2.1

Have you ever wondered why water is a liquid, oxygen is a gas, and sugar is a solid? Or, have you wondered why chlorine gas will kill you if you breathe it but when chlorine is combined with sodium, it is necessary for normal body function and we would die without it? What about fats? Why won't they dissolve in water while salt and sugar do? In the following reading, we will try to answer these and other questions dealing with the chemicals that make up our bodies.

All living and non-living things are composed of **matter**. Using one of its most simple definitions, "Matter is anything that occupies space and has **mass**". Mass is simply the amount of matter that an object contains. Oft times, mass and weight are confused. Weight is a function of gravity pulling on matter. For example, your body is composed of a certain quantity of matter that, when acted upon by gravity, results in your weight of say 150 pounds. If you took that same amount of matter to the moon where the gravitational force is only 1/6 of that of the earth, you would only weigh 25 pounds.

Matter is composed of **elements**. Chemists define elements as "substances that cannot be broken down into simpler materials by chemical processes". Some common elements that you have probably heard of are carbon, hydrogen, oxygen, and nitrogen. The building blocks for elements are atoms, which we will discuss in more detail later. In nature, there are 92 naturally occurring elements. In addition to these, a number have been artificially produced. Based on their chemical properties, these elements can be organized into what is referred to as the **periodic table of the elements**. We will refer back to this table frequently as we discuss the basic chemistry of the elements.

1 1.007 3 Li 6.941 11 Na 22.989	4 Be 9.012 12 Mg 24.305		P	eri		c Ta lem		5 B 10.811 13 AI 26.981	6 12.010 14 Si 28.085	7 N 14.006 15 P 30.973	8 0 15.999 16 S 32.065	9 <b>F</b> 8.998 17 <b>CI</b> 35.453	He 4.002 Ne 20.179 Ar 39.948				
19 <b>K</b> 39.098	20 Ca 40.078	21 Sc 44.955	22 <b>Ti</b> 47.867	23 V 50.941	24 <b>Cr</b> 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 <b>Zn</b> 65.38	31 Ga 69.723	32 Ge 72.64	33 As 74.921	34 Se 78.96	35 <b>Br</b> 79.904	<b>Kr</b> 83.798
37 <b>Rb</b> 85.467	38 Sr 87.62	39 <b>Y</b> 88.905	40 <b>Zr</b> 91.224	41 Nb 92.906	42 Mo 95.96	43 <b>Tc</b> 97.907	44 Ru 101.07	45 <b>Rh</b> 102.905	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 <b>In</b> 114.818	50 <b>Sn</b> 118.710	51 <b>Sb</b> 121.760	52 <b>Te</b> 127.60	53   126.904	Xe 131.293
55 Cs 132.905	56 Ba 137.327		72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.947	74 W 183.84	75 <b>Re</b> 186.207	76 Os 190.23	i 77 Ir 192.217	78 Pt 195.084	79 Au 196.966	80 Hg 200.59	81 <b>TI</b> 204.383	82 Pb 207.2	83 Bi 208.980	84 Po 208.982	85 At 209.987	8 <b>Rn</b> 222.017
87 Fr 223	88 <b>Ra</b> 226		104 <b>Rf</b> 261	105 <b>Db</b> 262	106 Sg 266	107 Bh 264	108 HS 277	109 Mt 268	110 Ds 271	111 <b>Rg</b> 272	112 Uub 285	113 Uut 284	114 Uuq 289	115 Uup 288	116 Uuh 292	Uus <sup>117</sup>	11 Uuo 294
		57 La	58 Ce	59 Pr	60 Nd	61 Pm	Sm 62	63 Eu	Gd 64	65 Tb		67 <b>Ho</b>	68 Er	59 Tm	70 Yb	71 Lu	
		138.905 89 AC 227	140.116	140.907	144.242 92	145	150.36	151.964	157.25	158.925	Dy 162.500 98 Cf 251	164.930	167.259	168.934	173.054 102 <b>NO</b> 259	174.966	6

## Periodic Table of the Elements, created by BYU-I student Hannah Crowder, Spring 2011

The figure above is a "Periodic Table of the Elements." The elements highlighted in yellow make up 96% of our body weight. The nine elements highlighted in green, along with those in yellow, are considered major essential elements. The elements highlighted in blue are considered minor essential elements and are required only in trace amounts in the body. Notice that each element is represented by a 1 or 2 letter symbol. Often, these symbols are the first letter or letters in the name of the element: **H** for hydrogen, C for carbon, and **He** for helium. Occasionally, however, the symbols represent the Latin name for the element; hence, the symbol for sodium is **Na** for the Latin Natrium, and the symbol for Potassium is **K** for the Latin Kalium.

Of the 92 naturally occurring elements, four make up roughly 96% of our body weight, namely **Carbon** (C), **Hydrogen** (H), **Oxygen** (O) and **Nitrogen** (N) (Figure above, yellow highlight). In addition to these four, there are a number of other important, but less abundant, elements found in the body. These include Phosphorus (P), Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulfur (S), Chlorine (Cl), Iron (Fe), and Iodine (I) (Figure above, green highlight). Having a solid understanding of the elements highlighted in yellow and green will be important as we continue in the study of the human body and cell processes. The elements that are required in trace amounts for normal functioning include Vanadium (V), Chromium (Cr), Manganese (Mn), Cobalt (Co), Molybdenum (Mo), Zinc (Zn), Silicon (Si), Fluorine (F), Selenium (Se) and Tin (Sn) (Figure above, blue highlight).

Subatomic Particles

**Electron Configurations** 

Chemical Bonds

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