

# Campus Academic Resource Program

## Understanding the Periodic Table of Elements

This handout will:

- Introduce the concept of an element.
- Cover the various components contained within each element.
- Provide a description for how to read the Periodic Table.
- Explain how the Periodic Table can be used to find information about each element.

The chart below is known as the Periodic Table, which can be used to find useful information regarding each element. Before looking at how this table can be used, it will be important to familiarize ourselves with the basic properties of elements.

# Periodic Table of Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																		
1 <b>H</b> Hydrogen 1.00794	<table border="0"> <tr> <td><b>C</b> Solid</td> <td><b>Hg</b> Liquid</td> <td><b>H</b> Gas</td> <td><b>Rf</b> Unknown</td> </tr> </table>																<b>C</b> Solid	<b>Hg</b> Liquid	<b>H</b> Gas	<b>Rf</b> Unknown	2 <b>He</b> Helium 4.002602														
<b>C</b> Solid	<b>Hg</b> Liquid	<b>H</b> Gas	<b>Rf</b> Unknown																																
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182	<table border="1"> <tr> <th colspan="2">Metals</th> <th colspan="2">Nonmetals</th> </tr> <tr> <td>Alkali metals</td> <td>Alkaline earth metals</td> <td>Lanthanoids</td> <td>Transition metals</td> <td>Poor metals</td> <td>Other nonmetals</td> <td>Noble gases</td> </tr> <tr> <td></td> <td></td> <td>Actinoids</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>										Metals		Nonmetals		Alkali metals	Alkaline earth metals	Lanthanoids	Transition metals	Poor metals	Other nonmetals	Noble gases			Actinoids					5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.0107	7 <b>N</b> Nitrogen 14.0067	8 <b>O</b> Oxygen 15.9994	9 <b>F</b> Fluorine 18.9984032	10 <b>Ne</b> Neon 20.1797
Metals		Nonmetals																																	
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		Actinoids																																	
11 <b>Na</b> Sodium 22.98976928	12 <b>Mg</b> Magnesium 24.3050	13 <b>Al</b> Aluminum 26.9815386	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973762	16 <b>S</b> Sulfur 32.065	17 <b>Cl</b> Chlorine 35.453	18 <b>Ar</b> Argon 39.948																												
19 <b>K</b> Potassium 39.0983	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.955912	22 <b>Ti</b> Titanium 47.887	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938045	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933195	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.38	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.64	33 <b>As</b> Arsenic 74.92160	34 <b>Se</b> Selenium 78.96	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.798																		
37 <b>Rb</b> Rubidium 85.4678	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.90585	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.90638	42 <b>Mo</b> Molybdenum 95.96	43 <b>Tc</b> Technetium (97.9072)	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.60	53 <b>I</b> Iodine 126.90447	54 <b>Xe</b> Xenon 131.293																		
55 <b>Cs</b> Cesium 132.9054519	56 <b>Ba</b> Barium 137.327	57-71		72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.94738	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78 <b>Pt</b> Platinum 195.084	79 <b>Au</b> Gold 196.966569	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.3833	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98040	84 <b>Po</b> Polonium (209.9824)	85 <b>At</b> Astatine (208.9871)	86 <b>Rn</b> Radon (222.0176)																	
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89-103		104 <b>Rf</b> Rutherfordium (261)	105 <b>Db</b> Dubnium (262)	106 <b>Sg</b> Seaborgium (266)	107 <b>Bh</b> Bohrium (264)	108 <b>Hs</b> Hassium (277)	109 <b>Mt</b> Meitnerium (268)	110 <b>Ds</b> Darmstadtium (271)	111 <b>Rg</b> Roentgenium (272)	112 <b>Uub</b> Ununbium (286)	113 <b>Uut</b> Ununtrium (284)	114 <b>Uuq</b> Ununquadium (289)	115 <b>Uup</b> Ununpentium (288)	116 <b>Uuh</b> Ununhexium (282)	117 <b>Uus</b> Ununseptium	118 <b>Uuo</b> Ununoctium (294)																	

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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57 <b>La</b> Lanthanum 138.90547	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.90765	60 <b>Nd</b> Neodymium 144.242	61 <b>Pm</b> Promethium (145)	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.92535	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.054	71 <b>Lu</b> Lutetium 174.967
89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.0376	91 <b>Pa</b> Protactinium 231.03688	92 <b>U</b> Uranium 238.02891	93 <b>Np</b> Neptunium (237)	94 <b>Pu</b> Plutonium (244)	95 <b>Am</b> Americium (243)	96 <b>Cm</b> Curium (247)	97 <b>Bk</b> Berkelium (247)	98 <b>Cf</b> Californium (251)	99 <b>Es</b> Einsteinium (252)	100 <b>Fm</b> Fermium (257)	101 <b>Md</b> Mendelevium (258)	102 <b>No</b> Nobelium (259)	103 <b>Lr</b> Lawrencium (262)

<sup>1</sup> <http://www.ptable.com/Images/periodic%20table.png>

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### Understanding the Periodic Table of Elements

#### What is an Element?

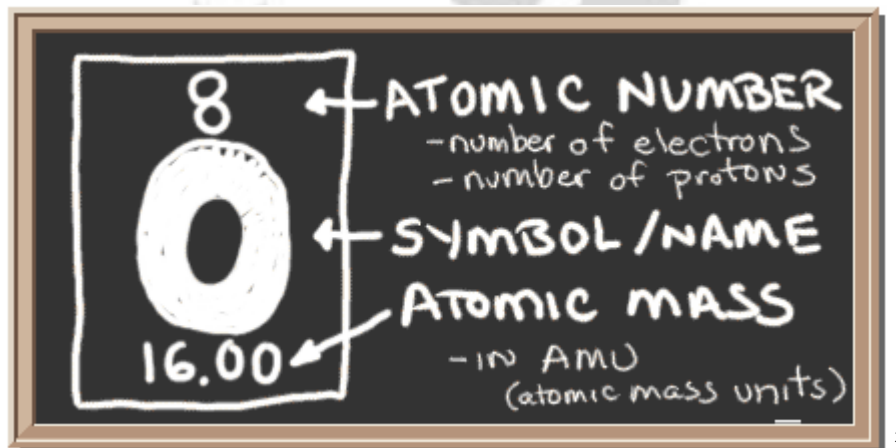
An **element** is a substance that cannot be broken down into any other substance through chemical processes. For example, oxygen is an element, but  $H^2O$  (also known as water) is not. This is because  $H^2O$  can be broken down into 2 H's (hydrogen) and an O (oxygen), both of which are elements.

#### Subparticles of Elements:

Elements are made out of three types of particles:

- **Electrons:** *negatively charged*, low mass particles.
- **Protons:** - *positively charged* particles that are more massive than electrons.
- **Neutrons:** - particles that have the same mass as protons, but have *no charge*.

Here's an example of the information that can be found on the periodic table. This is a closer look at the element oxygen:



<sup>2</sup> [https://encrypted-tbn1.gstatic.com/images?q=tbn:ANd9GcTK0lQqOFAPBXHEjJlIsoWaA1zBpwL9NXZvouA2bSYeWc\\_\\_3N-v](https://encrypted-tbn1.gstatic.com/images?q=tbn:ANd9GcTK0lQqOFAPBXHEjJlIsoWaA1zBpwL9NXZvouA2bSYeWc__3N-v)

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### Understanding the Periodic Table of Elements

#### Atomic Number and Atomic Mass:

Now is a good time to look at the periodic table at the beginning of this handout. Each box on the table contains information regarding a particular element. Within each box is a whole number, which is referred to as the **atomic number** of the element. The atomic number represents the number of protons and electrons in the element. (In this handout, the atomic number is always in the upper left corner)

Example: Boron (symbol B) has an atomic number of 5.

How many protons and electrons does Boron have?



*Answer: Boron has 5 electrons and 5 protons.*

The number at the bottom of each box is the element's **atomic mass**, where one atomic mass unit is equal to the mass of either a proton or neutron (both of which have about the same mass). Because electrons have such a low mass, the atomic mass indicates the total number of protons and neutrons. Therefore:

$$\text{Number of Neutrons} = \text{Atomic Mass} - \text{Atomic Number} \quad (1)$$

**\*\*Note:** If the mass number is not a whole number, round it either up or down to the nearest whole number for this calculation.\*\*

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<sup>3</sup> <http://sciencenotes.org/wp-content/uploads/2013/05/05-Boron-Tile.png>

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### Understanding the Periodic Table of Elements

Example: Find the number of protons, neutrons, and electrons in oxygen.

Oxygen (symbol O) has an atomic mass of 16. Since the atomic number is 8 (meaning there are 8 protons and 8 electrons), we can use equation (1) to find the number of neutrons.

$$\text{Number of Neutrons} = \text{Atomic Mass} - \text{Atomic Number}$$

We will use the following information in our equation:

Atomic mass = 16

Atomic number = 8

This gives:

$$\text{Number of Neutrons} = 16 - 8$$

$$\text{Number of Neutrons} = 8$$

Now that you know how to use the period table to find the number of protons, electrons, and neutrons in the element, fill out the following chart for the elements given:

Element	Atomic number	Mass number	Protons	Electrons	Neutrons
Ex: Oxygen	8	16	8	8	8
Chlorine					
Potassium					
Zinc					
Iron					
Magnesium					

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### Understanding the Periodic Table of Elements

#### Answer Key:

Element	Atomic number (smaller number given by period table)	Mass number (larger number given by periodic table)	Protons (same as atomic number)	Electrons (same as atomic number)	Neutrons (Mass number) – (Atomic Number)
Ex: Oxygen	8	16	8	8	8
Chlorine	17	35	17	17	18
Potassium	19	39	19	19	20
Zinc	30	65	30	30	35
Iron	26	56	26	26	30
Magnesium	12	24	12	12	12