

Atoms, Elements and Compounds

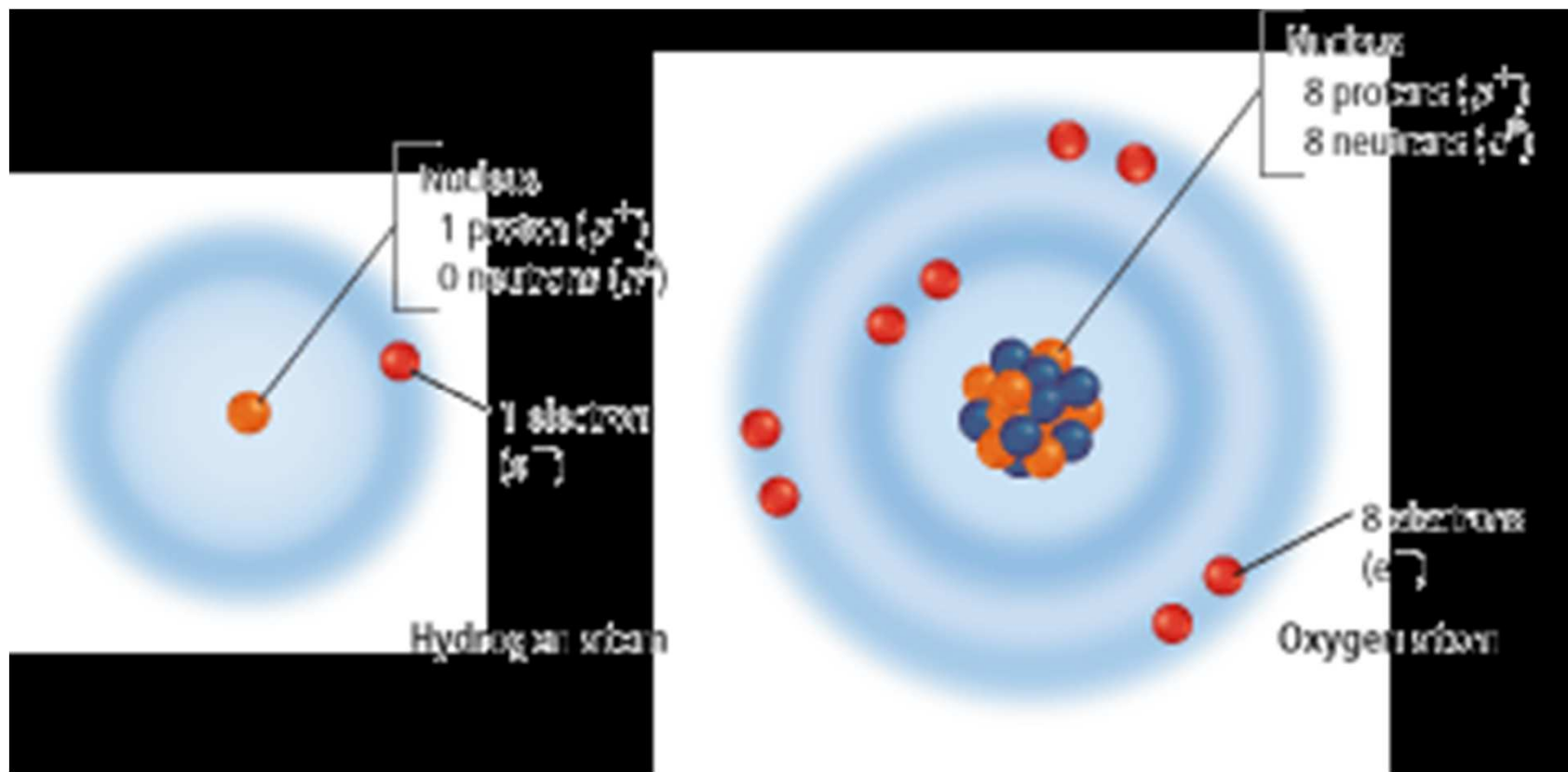
Section 6.1



Atoms

- Chemistry studies matter – its composition and properties
- Matter – has mass and takes up space
- All organisms in biology are MADE of matter
- Atoms make up all matter
 - So small that billions fit on the head of a pin
 - Made of two parts:
 - Nucleus (center)
 - Electron cloud (outside the nucleus)

Atoms



Protons, Electrons and Neutrons

Protons

- Positive charge
- Located in center of the atom (nucleus)
- Symbol: p^+
- Attracted to electrons
- Make up part of the atom's mass
- Tell the identity of the atom
 - Number on the periodic table

Electrons

- Negative charge
- Located around the nucleus in a "cloud"
- Symbol: e^-
- Attracted to protons
- Have very little mass
- Are involved with bonding and reactions

Neutrons

- No charge
- Located in center of the atom (nucleus)
- Symbol: n^0
- No attraction
- Make up part of the atom's mass



Elements

- Pure substance
- Cannot be broken down into simpler things
- Over 100 known elements
 - 92 occur naturally
 - All others are manmade in a lab
- Have unique names and symbols
- All information is collected on the periodic table of elements

Periodic Table of Elements

Element Hydrogen
 Atomic number: 1
 Symbol: H
 Atomic mass: 1.008
 State of matter: Gas
 Classification: Metal

Legend:
 Metal (Blue)
 Metalloid (Green)
 Nonmetal (Yellow)
 Recently discovered (Grey)

States of Matter:
 Gas (Red circle)
 Liquid (Blue circle)
 Solid (White circle)
 Synthetic (Black circle)


1A 1 Hydrogen H 1.008	2A 2 Helium He 4.003											3A 13 Boron B 10.811	4A 14 Carbon C 12.011	5A 15 Nitrogen N 14.007	6A 16 Oxygen O 15.999	7A 17 Fluorine F 18.998	8A 18 Neon Ne 20.180														
2 3 Lithium Li 6.941	4 Beryllium Be 9.012											5 Aluminum Al 26.982	6 Silicon Si 28.086	7 Phosphorus P 30.974	8 Sulfur S 32.065	9 Chlorine Cl 35.453	10 Argon Ar 39.948														
3 11 Sodium Na 22.990	12 Magnesium Mg 24.305	3B 3 Scandium Sc 44.956	4B 4 Titanium Ti 47.867	5B 5 Vanadium V 50.942	6B 6 Chromium Cr 51.996	7B 7 Manganese Mn 54.938	8B 8 Iron Fe 55.845	9 Cobalt Co 58.933	10 Nickel Ni 58.693	11 Copper Cu 63.546	12 Zinc Zn 65.39	13 Gallium Ga 69.723	14 Germanium Ge 72.64	15 Arsenic As 74.922	16 Selenium Se 78.96	17 Bromine Br 79.904	18 Krypton Kr 83.80														
4 19 Potassium K 39.098	20 Calcium Ca 40.078	21 Scandium Sc 44.956	22 Titanium Ti 47.867	23 Vanadium V 50.942	24 Chromium Cr 51.996	25 Manganese Mn 54.938	26 Iron Fe 55.845	27 Cobalt Co 58.933	28 Nickel Ni 58.693	29 Copper Cu 63.546	30 Zinc Zn 65.39	31 Gallium Ga 69.723	32 Germanium Ge 72.64	33 Arsenic As 74.922	34 Selenium Se 78.96	35 Bromine Br 79.904	36 Krypton Kr 83.80														
5 37 Rubidium Rb 85.468	38 Strontium Sr 87.62	39 Yttrium Y 88.906	40 Zirconium Zr 91.224	41 Niobium Nb 92.906	42 Molybdenum Mo 95.94	43 Technetium Tc (98)	44 Ruthenium Ru 101.07	45 Rhodium Rh 102.906	46 Palladium Pd 106.42	47 Silver Ag 107.868	48 Cadmium Cd 112.411	49 Indium In 114.818	50 Tin Sn 118.710	51 Antimony Sb 121.760	52 Tellurium Te 127.60	53 Iodine I 126.904	54 Xenon Xe 131.293														
6 55 Cesium Cs 132.905	56 Barium Ba 137.327	57 Lanthanum La 138.906	58 Cerium Ce 140.12	59 Praseodymium Pr 140.908	60 Neodymium Nd 144.24	61 Promethium Pm (145)	62 Samarium Sm 150.36	63 Europium Eu 151.964	64 Gadolinium Gd 157.25	65 Terbium Tb 158.925	66 Dysprosium Dy 162.50	67 Holmium Ho 164.930	68 Erbium Er 167.259	69 Thulium Tm 168.934	70 Ytterbium Yb 173.04	71 Lutetium Lu 174.967															
7 87 Francium Fr (223)	88 Radium Ra (226)	89 Actinium Ac (227)	104 Rutherfordium Rf (261)	105 Dubnium Db (262)	106 Seaborgium Sg (266)	107 Bohrium Bh (264)	108 Hassium Hs (277)	109 Meitnerium Mt (268)	110 Darmstadtium Ds (281)	111 Roentgenium Rg (272)	112 Copernicium Cn (285)	113 Nihonium Nh (284)	114 Flerovium Fl (289)	115 Moscovium Mc (288)	116 Livermorium Lv (293)	117 Tennessine Ts (294)	118 Oganesson Og (294)														
Lanthanide series		<table border="1"> <tr> <td>Cerium Ce 140.116</td> <td>Praseodymium Pr 140.908</td> <td>Neodymium Nd 144.24</td> <td>Promethium Pm (145)</td> <td>Samarium Sm 150.36</td> <td>Europium Eu 151.964</td> <td>Gadolinium Gd 157.25</td> <td>Terbium Tb 158.925</td> <td>Dysprosium Dy 162.50</td> <td>Holmium Ho 164.930</td> <td>Erbium Er 167.259</td> <td>Thulium Tm 168.934</td> <td>Ytterbium Yb 173.04</td> <td>Lutetium Lu 174.967</td> </tr> </table>																Cerium Ce 140.116	Praseodymium Pr 140.908	Neodymium Nd 144.24	Promethium Pm (145)	Samarium Sm 150.36	Europium Eu 151.964	Gadolinium Gd 157.25	Terbium Tb 158.925	Dysprosium Dy 162.50	Holmium Ho 164.930	Erbium Er 167.259	Thulium Tm 168.934	Ytterbium Yb 173.04	Lutetium Lu 174.967
Cerium Ce 140.116	Praseodymium Pr 140.908	Neodymium Nd 144.24	Promethium Pm (145)	Samarium Sm 150.36	Europium Eu 151.964	Gadolinium Gd 157.25	Terbium Tb 158.925	Dysprosium Dy 162.50	Holmium Ho 164.930	Erbium Er 167.259	Thulium Tm 168.934	Ytterbium Yb 173.04	Lutetium Lu 174.967																		
Actinide series		<table border="1"> <tr> <td>Thorium Th 232.038</td> <td>Protactinium Pa 231.036</td> <td>Uranium U 238.029</td> <td>Nepthunium Np (237)</td> <td>Plutonium Pu (244)</td> <td>Americium Am (243)</td> <td>Curium Cm (247)</td> <td>Berkelium Bk (247)</td> <td>Californium Cf (251)</td> <td>Einsteinium Es (252)</td> <td>Fermium Fm (257)</td> <td>Mendelevium Md (258)</td> <td>Nobelium No (259)</td> <td>Lawrencium Lr (262)</td> </tr> </table>																Thorium Th 232.038	Protactinium Pa 231.036	Uranium U 238.029	Nepthunium Np (237)	Plutonium Pu (244)	Americium Am (243)	Curium Cm (247)	Berkelium Bk (247)	Californium Cf (251)	Einsteinium Es (252)	Fermium Fm (257)	Mendelevium Md (258)	Nobelium No (259)	Lawrencium Lr (262)
Thorium Th 232.038	Protactinium Pa 231.036	Uranium U 238.029	Nepthunium Np (237)	Plutonium Pu (244)	Americium Am (243)	Curium Cm (247)	Berkelium Bk (247)	Californium Cf (251)	Einsteinium Es (252)	Fermium Fm (257)	Mendelevium Md (258)	Nobelium No (259)	Lawrencium Lr (262)																		

The number in parentheses is the mass number of the longest lived isotope for that element. * Names not officially assigned. Discovery of element 114 recently reported. Further information not yet available.

- Organized in rows and columns
 - Rows – periods (7)
 - Columns – groups (18)
- Every block is an element
- Blocks in the same group have similar properties
- Each block gives specific information about the element

Periodic Table of Elements

The image shows a 3D-style periodic table. A callout box for Krypton is highlighted in yellow. The callout box contains the following information:

Krypton	
36	
Kr	
83.80	

The periodic table itself is shown in a grid format with a color-coded layout: light blue for most elements, green for halogens, yellow for noble gases, and grey for transition metals. A dashed line indicates the continuation of the table.

- Name
 - Always spelled out
 - Named after Greek, Latin, towns, people, etc
- Atomic Number
 - Whole number
 - Equals the number of p+
- Symbol
 - Always starts with a capital letter
- Atomic Mass
 - The mass of the element
 - Equals the $p^+ + n^0$