

Guiding Question: How does the number of electrons in the outershell help up predict how elements will bond to make molecules?

Learning Goal: Explain how elements bond to make molecules using the electrons in the outer shell of an element.

### Agenda

- 1) Review the Bohr model activity on board
- 2) Finish Energy Level C-notes
- 3) Drawing Lewis Diagrams
- 4) The octet rule and making molecules Notes
- 5) Practice the octet rule activity
- 6) Exit Ticket

Words of the day  
Molecule

**Making Molecules**

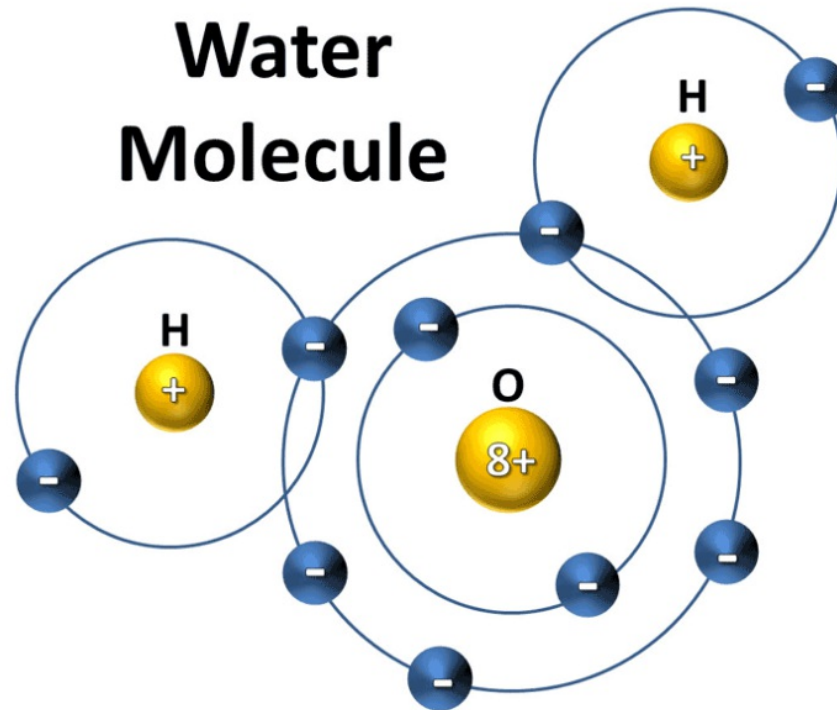
# LEWIS DOT DIAGRAMS ELEMENTS 1-20

HYDROGEN 1  <b>H</b>  1.01							HELIUM 2  <b>He</b>  4.00
LITHIUM 3  <b>Li</b>  6.94	BERYLLIUM 4  <b>Be</b>  9.01	BORON 5  <b>B</b>  10.81	CARBON 6  <b>C</b>  12.01	NITROGEN 7  <b>N</b>  14.01	OXYGEN 8  <b>O</b>  16.00	FLUORINE 9  <b>F</b>  19.00	NEON 10  <b>Ne</b>  20.18
SODIUM 11  <b>Na</b>  22.99	MAGNESIUM 12  <b>Mg</b>  24.31	ALUMINUM 13  <b>Al</b>  26.98	SILICON 14  <b>Si</b>  28.09	PHOSPHORUS 15  <b>P</b>  30.97	SULFUR 16  <b>S</b>  32.07	CHLORINE 17  <b>Cl</b>  35.45	ARGON 18  <b>Ar</b>  39.95
POTASSIUM 19  <b>K</b>  39.10	CALCIUM 20  <b>Ca</b>  40.08						

**WOD**

## **Molecules**

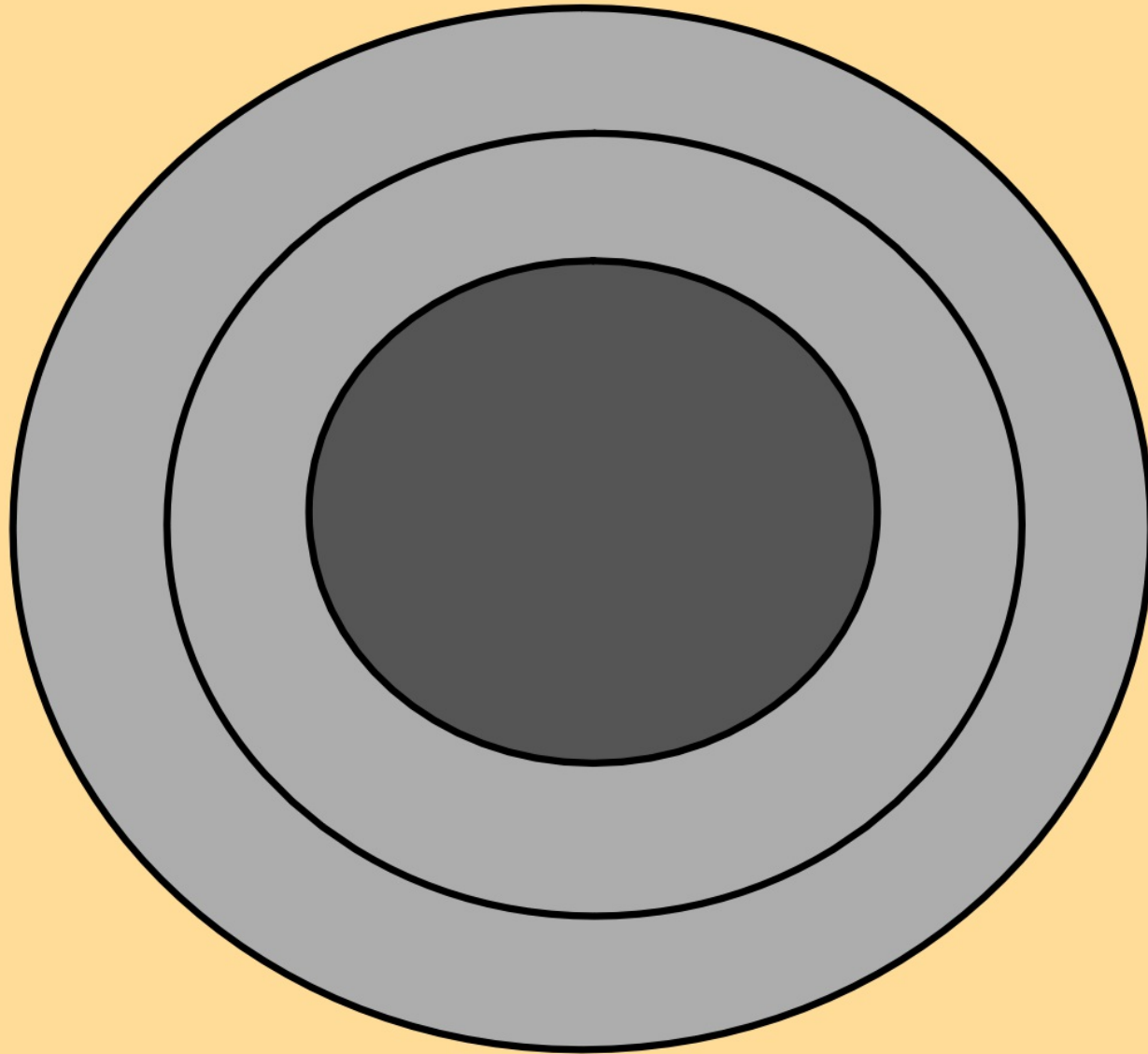
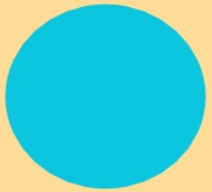
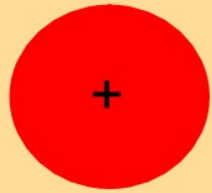
**One or more atoms bonded together**



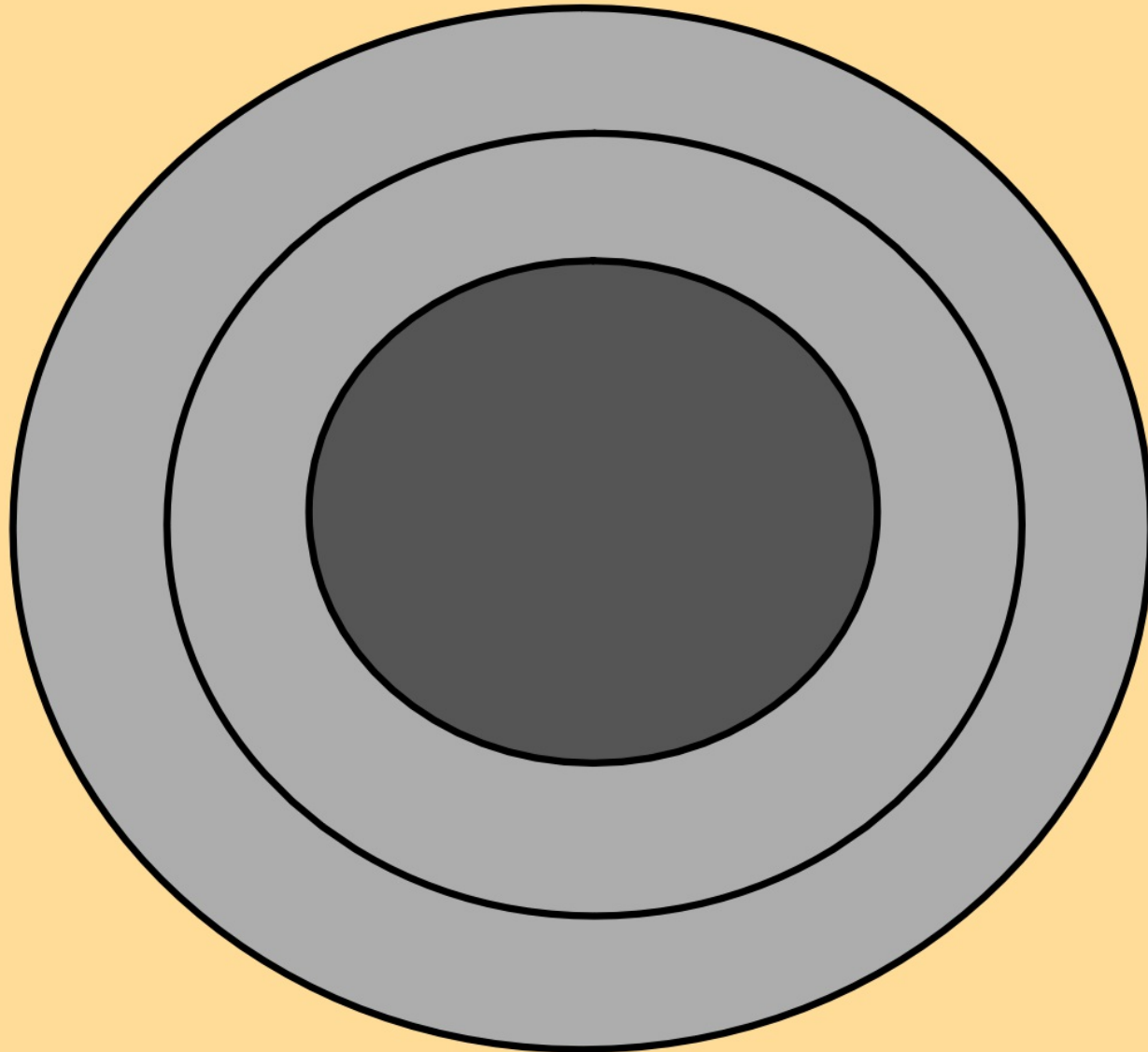
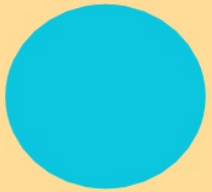
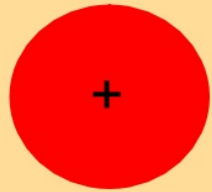
NO DSR Today







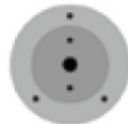

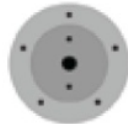
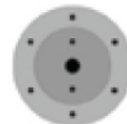
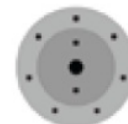
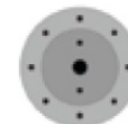

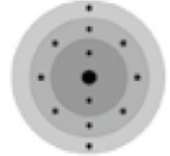
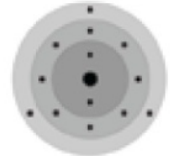

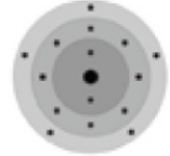


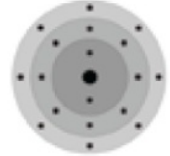
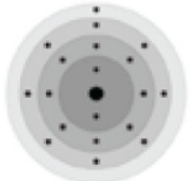
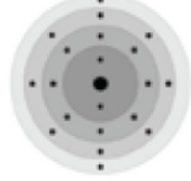
**Model Fluorine - atomic number 9**  
**Atomic mass - 18.99**



**Model Beryllium- atomic number 4  
atomic mass 9.01**



# ENERGY LEVELS ELEMENTS 1-20

<p>HYDROGEN 1</p>  <p>1.01</p>							<p>HELIUM 2</p>  <p>4.00</p>
<p>LITHIUM 3</p>  <p>6.94</p>	<p>BERYLLIUM 4</p>  <p>9.01</p>	<p>BORON 5</p>  <p>10.81</p>	<p>CARBON 6</p>  <p>12.01</p>	<p>NITROGEN 7</p>  <p>14.01</p>	<p>OXYGEN 8</p>  <p>16.00</p>	<p>FLUORINE 9</p>  <p>19.00</p>	<p>NEON 10</p>  <p>20.18</p>
<p>SODIUM 11</p>  <p>22.99</p>	<p>MAGNESIUM 12</p>  <p>24.31</p>	<p>ALUMINUM 13</p>  <p>26.98</p>	<p>SILICON 14</p>  <p>28.09</p>	<p>PHOSPHORUS 15</p>  <p>30.97</p>	<p>SULFUR 16</p>  <p>32.07</p>	<p>CHLORINE 17</p>  <p>35.45</p>	<p>ARGON 18</p>  <p>39.95</p>
<p>POTASSIUM 19</p>  <p>39.10</p>	<p>CALCIUM 20</p>  <p>40.08</p>						

Write the number of electrons in the OUTER Shell for every element.

## Patterns in Periodic Table

Groups/Families:

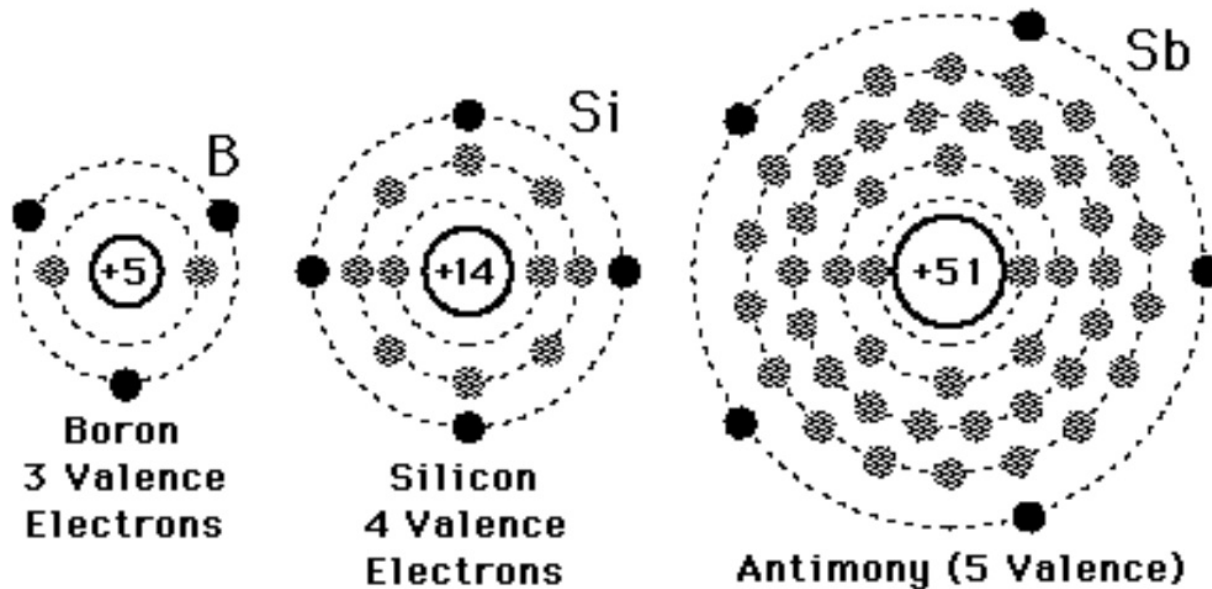
Periods:



# Valence Electrons

Number of electrons in the outermost shell

Examples





# Lets put the patterns on the Periodic Table

Valence Electrons

Energy Level

The Periodic Table of the Elements

1 <b>H</b> Hydrogen 1.00794																	2 <b>He</b> Helium 4.003
3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012182											5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.0107	7 <b>N</b> Nitrogen 14.00674	8 <b>O</b> Oxygen 15.9994	9 <b>F</b> Fluorine 18.9984032	10 <b>Ne</b> Neon 20.1797
11 <b>Na</b> Sodium 22.989770	12 <b>Mg</b> Magnesium 24.3050	← <b>Skip</b> →										13 <b>Al</b> Aluminum 26.981538	14 <b>Si</b> Silicon 28.0855	15 <b>P</b> Phosphorus 30.973761	16 <b>S</b> Sulfur 32.066	17 <b>Cl</b> Chlorine 35.4527	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 44.955910	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938049	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.9332	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.39	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.61	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 83.80
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 95.94	43 <b>Tc</b> Technetium (98)	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 131.29
55 <b>Cs</b> Cesium 132.90545	56 <b>Ba</b> Barium 137.327	57 <b>La</b> Lanthanum 138.9055	58 <b>Ce</b> Cerium (140)	59 <b>Pr</b> Praseodymium 140.90765	60 <b>Nd</b> Neodymium 144.24	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 158.92534	66 <b>Dy</b> Dysprosium 162.50	67 <b>Ho</b> Holmium 164.93032	68 <b>Er</b> Erbium 167.26	69 <b>Tm</b> Thulium 168.93421	70 <b>Yb</b> Ytterbium 173.04	71 <b>Lu</b> Lutetium 174.967	
87 <b>Fr</b> Francium (223)	88 <b>Ra</b> Radium (226)	89 <b>Ac</b> Actinium (227)	90 <b>Th</b> Thorium 232.0381	91 <b>Pa</b> Protactinium 231.036	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)	

1995 IUPAC masses and Approved Names from <http://www.chem.gmu.ac.uk/iupac/1995/>  
 masses for 107-111 from C&EN, March 13, 1995, p. 35  
 112 from <http://www.gsi.de/z112e.html>

# Drawing Lewis Diagrams

Step 1: Write the symbol for the element

Example

**Cl**

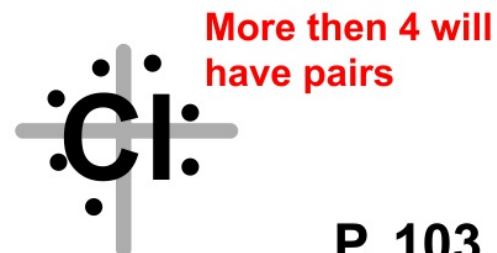
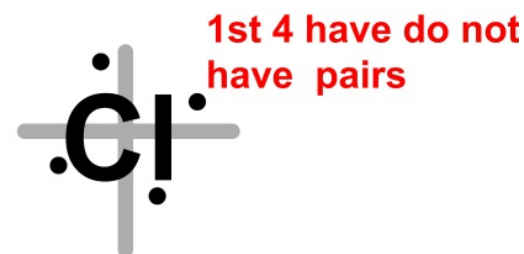
Step 2: Find the valence electrons you wrote on the periodic table

**Cl has 7 valance electrons**

Step 3: Make a light cross on the element symbol



Step 4: Put one electron on each side in a counter-clockwise direction until you have all of the valance electrons as dots. NO MORE THEN 2 ELECTRONS PER SIDE.



# LEWIS DOT DIAGRAMS ELEMENTS 1-20

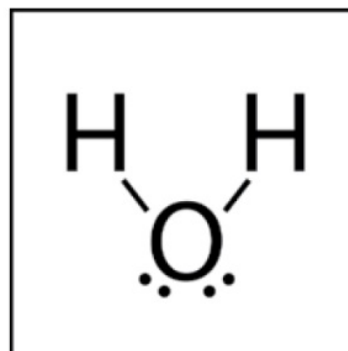
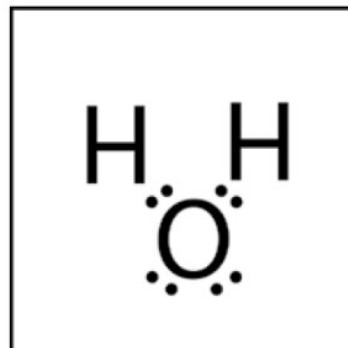
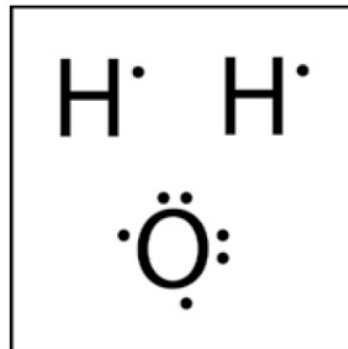
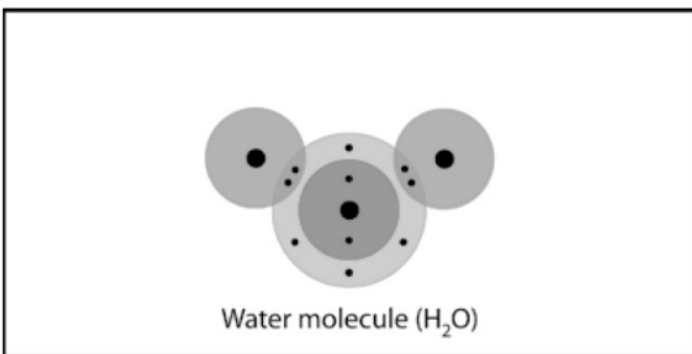
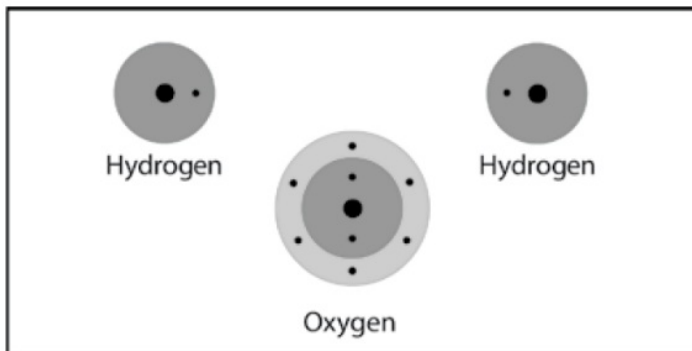
<p>HYDROGEN 1</p> <p><b>H</b></p> <p>1.01</p>							<p>HELIUM 2</p> <p><b>He</b></p> <p>4.00</p>
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<p>SODIUM 11</p> <p><b>Na</b></p> <p>22.99</p>	<p>MAGNESIUM 12</p> <p><b>Mg</b></p> <p>24.31</p>	<p>ALUMINUM 13</p> <p><b>Al</b></p> <p>26.98</p>	<p>SILICON 14</p> <p><b>Si</b></p> <p>28.09</p>	<p>PHOSPHORUS 15</p> <p><b>P</b></p> <p>30.97</p>	<p>SULFUR 16</p> <p><b>S</b></p> <p>32.07</p>	<p>CHLORINE 17</p> <p><b>Cl</b></p> <p>35.45</p>	<p>ARGON 18</p> <p><b>Ar</b></p> <p>39.95</p>
<p>POTASSIUM 19</p> <p><b>K</b></p> <p>39.10</p>	<p>CALCIUM 20</p> <p><b>Ca</b></p> <p>40.08</p>						

## **The Octet Rule to Making Molecules**

- 1. Atoms want to have 8 electrons in their outer shell**
- 2. Atoms will either GAIN or LOOSE electrons to get to 8**  
**If valence Electrons < 4 then they will LOOSE**  
**If valence electrons are >4 they will GAIN**
- 3. Atoms bond together to make a molecule. They bond in a way that all atoms have 8 electrons in the outer shell.**
- 4. EXCEPTION TO THE RULE: Hydrogen want to have 2 electrons NOT 8.**

## Example H<sub>2</sub>O

Covalent bonding in the water molecule, H<sub>2</sub>O



<http://www.middleschoolchemistry.com/multimedia/chapter4/lesson4>



# Let's Model this with Marshmallows



**Purpose:** To demonstrate how atoms combine to form molecules or compounds.

**Materials:**

- 5-10 Toothpicks
- Large Marshmallows - Nucleus of the atom
- Small marshmallows-electrons for OUTER SHELL of atom

**Step 1: Draw the Lewis dots for each element**

Atom	# of Valence Electrons	Draw the Lewis Dot Diagram	Number of Electrons to get to 8	Will it gain or lose to get to 8?
Oxygen				
Hydrogen				
Carbon				
Chlorine				
Nitrogen				

**Step 2: Make the marshmallow model for each of the atoms above,**

1. Get a large marshmallow to represent the nucleus
2. Put the OUTER SHELL electrons around the marshmallow with tooth picks.
3. Repeat until you have made every atom at least once (Be prepared to destroy them in the next step.)



**Step 3: Make marshmallow molecules**

1. Make 3 Chlorine atoms
2. Put them together to make a BOND. With 8 electrons for each chlorine atom.
3. Draw the model in step 4
4. Repeat steps 1 and 2 for the following molecules
  - a. H<sub>2</sub>O-2 hydrogen and 1 oxygen
  - b. CO<sub>2</sub>- 1 carbon and 2 oxygen
  - c. CH<sub>4</sub>- 1 carbon and 4 hydrogens
  - d. NH<sub>3</sub>- 1 nitrogen and 3 hydrogens.

**Step 4: Draw a model of your marshmallow molecules**

$\text{Cl}_2$	$\text{H}_2\text{O}$	$\text{CO}_2$	$\text{CH}_4$	$\text{NH}_3$
Chlorine	Water	Carbon Dioxide	Methane	Ammonia

**Step 5: Draw the Lewis dot structures for the molecules**

$\text{Cl}_2$	$\text{H}_2\text{O}$	$\text{CO}_2$	$\text{CH}_4$	$\text{NH}_3$
Chlorine	Water	Carbon Dioxide	Methane	Ammonia

## Clean-up

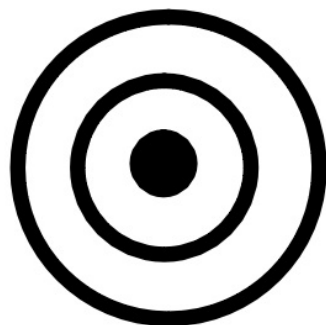
1. Get a baggies from the teacher
2. Put your period number and table number on the baggies
3. Put baggies in the tray on the front table.



## Exit Ticket the Bohr model

**Use your periodic table to answer the questions**

**1. Draw the Bohr model for Sodium (Na)**



**2. How many electrons do you predict are in the outer shell of Krypton. HINT: Use the patterns**

**3. How many valence electrons are there for Carbon?**

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<p>HYDROGEN 1</p> <p><b>H</b> ·</p> <p>1.01</p>							<p>HELIUM 2</p> <p>· <b>He</b> ·</p> <p>4.00</p>
<p>LITHIUM 3</p> <p><b>Li</b> ·</p> <p>6.94</p>	<p>BERYLLIUM 4</p> <p>· <b>Be</b> ·</p> <p>9.01</p>	<p>BORON 5</p> <p>· <b>B</b> ·</p> <p>10.81</p>	<p>CARBON 6</p> <p>· <b>C</b> ·</p> <p>12.01</p>	<p>NITROGEN 7</p> <p>· <b>N</b> ·</p> <p>14.01</p>	<p>OXYGEN 8</p> <p>· <b>O</b> ·</p> <p>16.00</p>	<p>FLUORINE 9</p> <p>· <b>F</b> ·</p> <p>19.00</p>	<p>NEON 10</p> <p>· <b>Ne</b> ·</p> <p>20.18</p>
<p>SODIUM 11</p> <p><b>Na</b> ·</p> <p>22.99</p>	<p>MAGNESIUM 12</p> <p>· <b>Mg</b> ·</p> <p>24.31</p>	<p>ALUMINUM 13</p> <p>· <b>Al</b> ·</p> <p>26.98</p>	<p>SILICON 14</p> <p>· <b>Si</b> ·</p> <p>28.09</p>	<p>PHOSPHORUS 15</p> <p>· <b>P</b> ·</p> <p>30.97</p>	<p>SULFUR 16</p> <p>· <b>S</b> ·</p> <p>32.07</p>	<p>CHLORINE 17</p> <p>· <b>Cl</b> ·</p> <p>35.45</p>	<p>ARGON 18</p> <p>· <b>Ar</b> ·</p> <p>39.95</p>
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