

## Common names on the periodic table:

A column is called a group or family.

A row is called a period.

|                    |                    |                      |                     |                    |                    |                    |                    |                    |                    |                     |                     |                     |                    |                    |                    |                    |                    |                    |                    |                   |                   |                    |                    |
|--------------------|--------------------|----------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|---------------------|---------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|-------------------|--------------------|--------------------|
| 1                  |                    |                      |                     |                    |                    |                    |                    |                    |                    |                     |                     |                     |                    |                    |                    |                    | 8                  |                    |                    |                   |                   |                    |                    |
| 2                  |                    |                      |                     |                    |                    |                    |                    |                    |                    |                     |                     |                     |                    |                    |                    |                    | 3                  | 4                  | 5                  | 6                 | 7                 | 8                  |                    |
| H<br>1<br>1.0079   | He<br>2<br>4.0026  |                      |                     |                    |                    |                    |                    |                    |                    |                     |                     |                     |                    |                    |                    |                    |                    | B<br>5<br>10.811   | C<br>6<br>12.011   | N<br>7<br>14.007  | O<br>8<br>15.999  | F<br>9<br>18.998   | Ne<br>10<br>20.180 |
| Li<br>3<br>6.941   | Be<br>4<br>9.0122  | ← variable valence → |                     |                    |                    |                    |                    |                    |                    |                     |                     |                     |                    |                    |                    |                    |                    | Al<br>13<br>26.982 | Si<br>14<br>28.086 | P<br>15<br>30.974 | S<br>16<br>32.065 | Cl<br>17<br>35.453 | Ar<br>18<br>39.948 |
| K<br>19<br>39.098  | Ca<br>20<br>40.078 | Sc<br>21<br>44.956   | Ti<br>22<br>47.867  | V<br>23<br>50.942  | Cr<br>24<br>51.996 | Mn<br>25<br>54.938 | Fe<br>26<br>55.845 | Co<br>27<br>58.933 | Ni<br>28<br>58.693 | Cu<br>29<br>63.546  | Zn<br>30<br>65.39   | Ga<br>31<br>69.723  | Ge<br>32<br>72.61  | As<br>33<br>74.922 | Se<br>34<br>78.96  | Br<br>35<br>79.904 | Kr<br>36<br>83.80  |                    |                    |                   |                   |                    |                    |
| Rb<br>37<br>85.468 | Sr<br>38<br>87.62  | Y<br>39<br>88.906    | Zr<br>40<br>91.224  | Nb<br>41<br>92.906 | Mo<br>42<br>95.94  | Tc<br>43<br>[98]   | Ru<br>44<br>101.07 | Rh<br>45<br>102.91 | Pd<br>46<br>106.42 | Ag<br>47<br>107.87  | Cd<br>48<br>112.41  | In<br>49<br>114.82  | Sn<br>50<br>118.71 | Sb<br>51<br>121.76 | Te<br>52<br>127.60 | I<br>53<br>126.90  | Xe<br>54<br>131.29 |                    |                    |                   |                   |                    |                    |
| Cs<br>55<br>132.91 | Ba<br>56<br>137.33 | *<br>57-70           | Lu<br>71<br>174.967 | Hf<br>72<br>178.49 | Ta<br>73<br>180.95 | W<br>74<br>183.84  | Re<br>75<br>186.21 | Os<br>76<br>190.23 | Ir<br>77<br>192.22 | Pt<br>78<br>195.08  | Au<br>79<br>196.97  | Hg<br>80<br>200.59  | Tl<br>81<br>204.38 | Pb<br>82<br>207.2  | Bi<br>83<br>208.98 | Po<br>84<br>[209]  | At<br>85<br>[210]  | Rn<br>86<br>[222]  |                    |                   |                   |                    |                    |
| Fr<br>87<br>[223]  | Ra<br>88<br>[226]  | **<br>89-102         | Lr<br>103<br>[260]  | Rf<br>104<br>[261] | Db<br>105<br>[262] | Sg<br>106<br>[263] | Bh<br>107<br>[264] | Hs<br>108<br>[265] | Mt<br>109<br>[266] | Uun<br>110<br>[271] | Uuu<br>111<br>[272] | Uub<br>112<br>[273] |                    |                    |                    |                    |                    |                    |                    |                   |                   |                    |                    |

\* Lanthanide series

|                    |                    |                    |                    |                   |                    |                    |                    |                    |                    |                    |                    |                    |                    |
|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| La<br>57<br>138.91 | Ce<br>58<br>140.12 | Pr<br>59<br>140.91 | Nd<br>60<br>144.24 | Pm<br>61<br>[145] | Sm<br>62<br>150.36 | Eu<br>63<br>151.96 | Gd<br>64<br>157.25 | Tb<br>65<br>158.93 | Dy<br>66<br>162.50 | Ho<br>67<br>164.93 | Er<br>68<br>167.26 | Tm<br>69<br>168.93 | Yb<br>70<br>173.04 |
|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|

\* Actinide series

|                   |                    |                    |                   |                   |                   |                   |                   |                   |                   |                   |                    |                    |                    |
|-------------------|--------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|
| Ac<br>89<br>[227] | Th<br>90<br>232.04 | Pa<br>91<br>231.04 | U<br>92<br>238.03 | Np<br>93<br>[237] | Pu<br>94<br>[244] | Am<br>95<br>[243] | Cm<br>96<br>[247] | Bk<br>97<br>[247] | Cf<br>98<br>[251] | Es<br>99<br>[252] | Fm<br>100<br>[257] | Md<br>101<br>[258] | No<br>102<br>[259] |
|-------------------|--------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|--------------------|--------------------|

Write the names of the family / groups below.

Group 1: Alkali Metals

Group 2: Alkaline Earth Metals

Group 7: halogens

Group 8: noble gases

The large middle section of metals on the periodic table are called transition metals

## Chemical bonding:

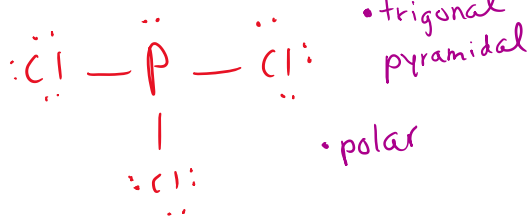
- Every atom on the periodic table wants a total of 8 valence electrons.
- The only group on the periodic table with 8 valence electrons are the noble gases.
- In order to be stable metals will lose electrons and form cations.
- In order to be stable nonmetals will gain electrons and form anions.
- An ionic bond is between metals and nonmetals. An ionic bond will transfer electrons between atoms.
- A covalent bond is between 2 or more nonmetals. A covalent bond will share electrons between atoms.
- Ionic bonds conduct electricity when dissolved.
- Predict the type of bond between each of these pairs of atoms:
  - Na and Cl ionic
  - F and O covalent
  - Fe and S ionic
  - Se and As covalent
  - Ca and (PO<sub>4</sub>)<sup>3-</sup> ionic
- Lewis structures are only drawn for molecules with covalent bonds.
- 1 bond shares 2 electrons.

## Drawing Lewis Structures:

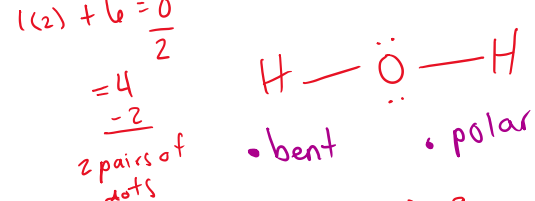
- Find the total number of valence electrons.
  - Multiply by subscripts in the formula.
- Divide the total number by 2.
- Put the atom that is farthest away from F in the middle (lowest electronegativity)
  - Hydrogen NEVER goes in the middle
- Place the other atoms around the outside.
- Draw 1 single bond from each outside atom to the central atom
- Subtract the number of bonds you drew
- Draw in "lone pairs" around each outside atom to satisfy the octet rule
  - Hydrogen NEVER has lone pairs
  - Left over pairs go on the center
- CHECK YOUR CENTER ATOM FOR AN OCTET BEFORE YOU ARE FINISHED
  - If center atom does not have octet:
    - Is it part of CNOPS? If yes erase a lone pair from your outside atoms and share with the central atom.
    - If not part of CNOPS leave it alone ☺

Examples:

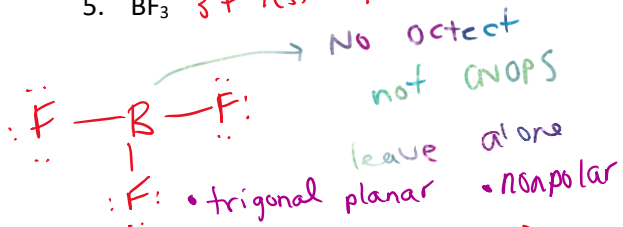
1.  $\text{PCl}_3$



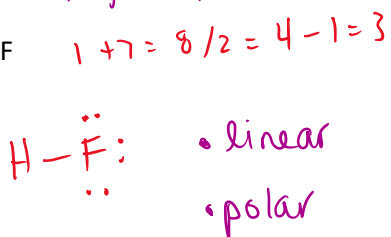
3.  $\text{H}_2\text{O}$



5.  $\text{BF}_3$   $3 + 7(3) = 24 / 2 = 12 - 3 = 9$



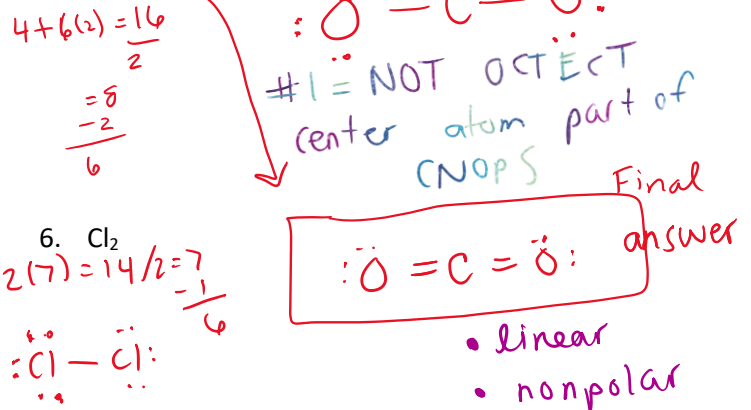
7.  $\text{HF}$



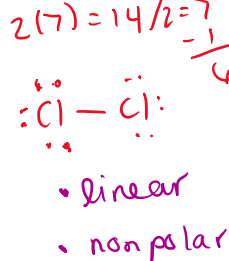
2.  $\text{CHCl}_3$






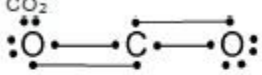
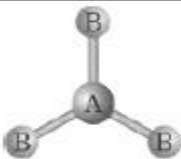
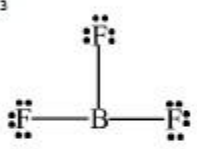

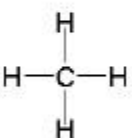
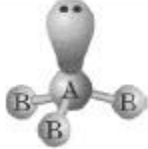
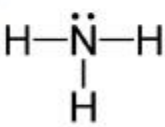
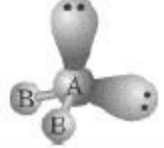
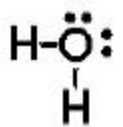
4.  $\text{CO}_2$



6.  $\text{Cl}_2$



Notes for Molecular Geometry:

| Bonds   | Lone Pairs | Name               | Geometry   | Lewis Structure  |
|---------|------------|--------------------|--|--|
| 2 atoms |            | linear             |   | $\text{Cl}_2$<br>         |
| 2       | 0          | linear             |   | $\text{CO}_2$<br>         |
| 3       | 0          | trigonal planar    |   | $\text{BF}_3$<br>         |
| 4       | 0          | tetrahedral        |   | $\text{CH}_4$<br>         |
| 3       | 1          | trigonal pyramidal |   | $\text{NH}_3$<br>         |
| 2       | 2          | bent               |  | $\text{H}_2\text{O}$<br> |

Notes for polarity:

- A polar molecule means there is a separation of charge – or one side is obviously positive and one side is obviously negative.
- You can tell if your Lewis structure is polar if:
  - 1. There are different types of atoms around the center atom
  - 2. There are lone pairs on the center atom
- If your molecule only has 2 atoms:
  - It is POLAR if there are 2 different atoms.
  - It is NONPOLAR if the 2 atoms are identical.