

Chemistry 20: Bonding Unit  
Lewis, Structural and Shape Diagram WS

Name: KEY

For the following compounds, draw the Lewis Dot diagram, the structural diagram and the Shape Diagram. Also, indicate the name of the shape and the shape code in the same box as the shape diagram.

	Lewis Diagram	Structural Diagram	Shape Diagram & Name
SO	$:\ddot{S}::\ddot{O}:$	$S=O$	$S=O$ linear
CHCl <sub>3</sub>	$\begin{array}{c} H \\   \\ :\ddot{C}:\ddot{C}:\ddot{Cl}: \\   \\ :\ddot{Cl}: \\   \\ :\ddot{Cl}: \end{array}$	$\begin{array}{c} H \\   \\ C \\ / \quad \backslash \\ Cl \quad Cl \\   \\ Cl \end{array}$	$\begin{array}{c} H \\   \\ Cl-C-Cl \\   \\ Cl \end{array}$ tetrahedral
NCl <sub>3</sub>	$\begin{array}{c} :\ddot{Cl}:\ddot{N}:\ddot{Cl}: \\   \\ :\ddot{Cl}: \end{array}$	$\begin{array}{c} Cl-N-Cl \\   \\ Cl \end{array}$	$\begin{array}{c} \ddot{N} \\ / \quad \backslash \\ Cl \quad Cl \\   \\ Cl \end{array}$ trigonal pyramidal
HCl	$H:\ddot{Cl}:$	$H-Cl$	$H-Cl$ linear

	Lewis Diagram	Structural Diagram	Shape Diagram, Name
$\text{OF}_2$			 V-shape
$\text{CH}_3\text{CN}$			 tetrahedral linear
$\text{C}_2\text{H}_6$			 2x tetrahedral
$\text{H}_2\text{S}$			 V-shape

Melting Points and Boiling Points of Substances with Similar Formula Weights			
Substance	FW (g/mol)	mp (°C)	bp (°C)
F <sub>2</sub>	38	-220	-188
NO	30	-164	-152
CH <sub>3</sub> OH	32	-94	65

6. All the substances in this table have similar formula weights thus they have similar London forces. If the only attractions between substances have to do with size, then they should have similar melting points and boiling points. This is not the case.

Explain why the pairs of compounds below have different m.p. and b.p.

**a. Fluorine and Nitrogen Monoxide**

NO has LD + DD

F<sub>2</sub> only has LD

**b. Nitrogen Monoxide and Methanol**

CH<sub>3</sub>OH has LD, DD, HB

NO only has LD + DD

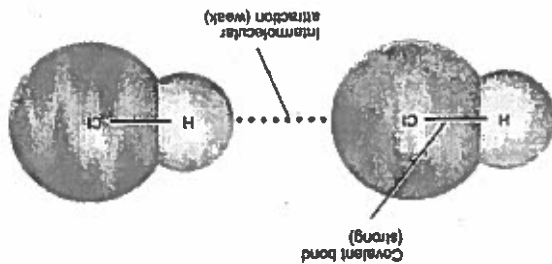
7. Which of the following compounds are likely to dissolve in water? Which of the following will dissolve in C<sub>6</sub>H<sub>14</sub> (hexane)?

- SCl<sub>2</sub> H<sub>2</sub>O
- O<sub>2</sub> hexane
- NaCl H<sub>2</sub>O
- CO<sub>2</sub> hexane
- PH<sub>3</sub> H<sub>2</sub>O

polar dissolves in polar (water)

non-polar dissolves in non-polar (hexane)

Name: /  
KEY

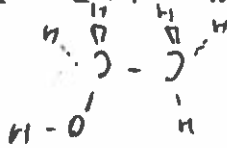
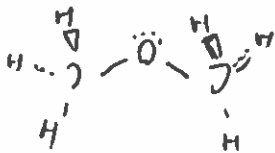


1. Which has a higher boiling point,  $I_2$  or  $Br_2$ ? Why?

$I_2$ , both are non-polar so only have  $L_0$  forces. Because  $I_2$  has more  $p^+$  and  $e^-$ , it has more  $L_0$ .

2. Ethanol  $C_2H_5OH$  and methyl ether  $CH_3OCH_3$  have the same molar mass. Which has a higher boiling point? Explain why? Draw a shape diagram of each.

same  $p^+$  and  $e^-$



3. Which has the higher boiling point,  $Br_2$  or  $ICl$ ? Why?

$ICl$ , it is polar, so has  $L_0 + D$

4. Rank the strength of the intermolecular forces found between molecules of following compounds (from strongest to weakest)  $PCl_3$ ,  $NiCl_2$ ,  $I_2$ ,  $HF$

$NiCl_2$ ,  $HF$ ,  $PCl_3$ ,  $I_2$

5. Rank the following from strongest to weakest intermolecular forces.

$5CO_2$ ,  $Cl_2$ ,  $CO_2$ ,  $BF_3$ ,  $CH_4$

1) Is fluorine or iodine more reactive? Why?

higher electronegativity

2) Is francium or lithium more reactive? Why?

lower electronegativity

3) Write the half reaction equation for each of the following elements and classify the reaction as oxidation or reduction.

a. nitrogen



b. potassium



c. magnesium

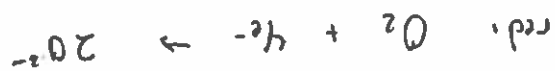


d. bromine

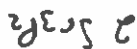
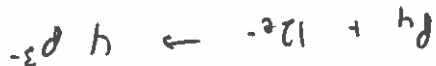
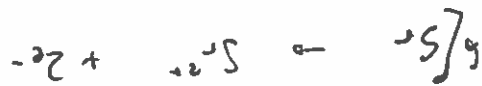


4) Write the oxidation, reduction and net equation for each reaction and compound.

a. hydrogen gas + oxygen gas



b. Sr<sub>3</sub>P<sub>2</sub>(s)



5) Draw the Lewis Dot diagram for each element.

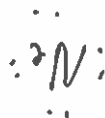
a. phosphorus



b. calcium



c. neon



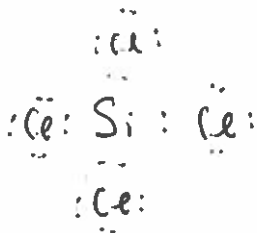
6) Draw the Lewis Dot diagram for each substance. Some are ionic and some are molecular!

key

a. NaCl



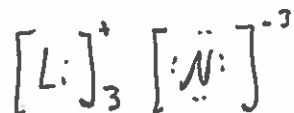
b. SiCl<sub>4</sub>



c. CO<sub>2</sub>



d. Li<sub>3</sub>N



7) What is the bonding capacity of the following elements?

a. carbon

4

b. argon

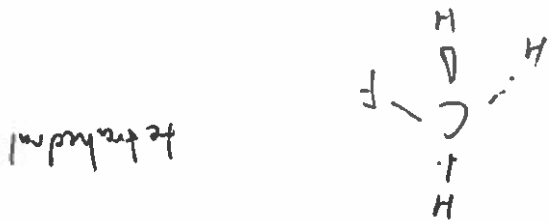
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c. bromine

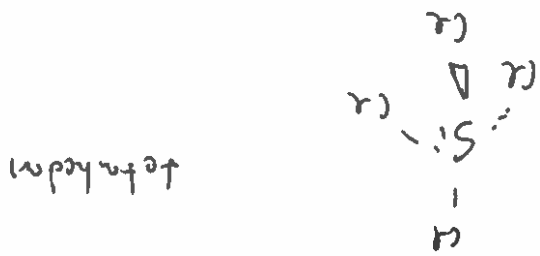
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8) Draw the ~~structural~~ ~~and~~ shape diagrams for each of the following molecules. Write the ~~shape~~ ~~and~~ ~~shape~~ name, as well.

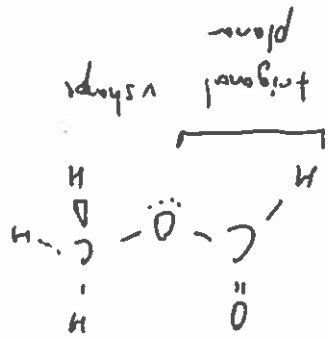
a.  $\text{CH}_3\text{F}$



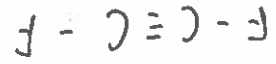
b.  $\text{SiCl}_4$



c.  $\text{HCOOH}_3$



d.  $\text{CF}_2$



linear  $\times 2$

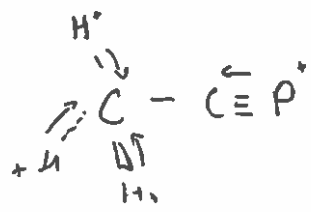


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9) Identify each of the following molecules as polar, non-polar or ionic. Draw the bond diagram for each.

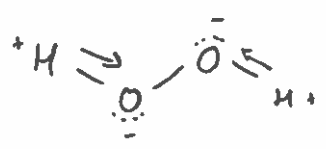
polarity

a.  $\text{CH}_3\text{CP}$



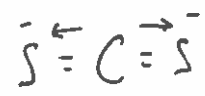
non-polar

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



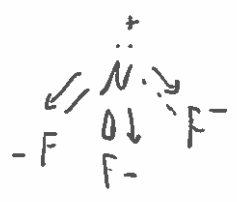
polar

c.  $\text{CS}_2$



non-polar

d.  $\text{NF}_3$



polar

10) Is the following equation (for cellular respiration) endothermic or exothermic? Explain, making reference to bond energy.



11) Identify the intermolecular forces acting on each molecule.

a.  $CS_2$

LO

b.  $H_2O_2$

LO

OO

H~~B~~

c.  $C_2H_5OH$

LO

OO

H~~B~~

d. HF

LO

OO

H~~B~~