POLAR OR NON-POLAR MOLECULES YEAR 11

Identify chemical properties of these following compounds.

COMPOUND FORMULA	MOLECULE SHAPE	POLAR / NON-POLAR?	Explanation
O_2			**GOOD:** The electron cloud is evenly distributed over the entire molecule. **OR** Both elements have the same electronegativity.
HCl			**GOOD:** Chlorine has a significant pull on the electrons within the covalent bond. **OR** The electron distribution is in the favour of chlorine as it is more electronegative.
BF_3			**BEST:** All three fluorine atoms have an equal and opposite electronegative effect on the electrons so they are evenly distributed.
CH_4			
H_2O			
HCN			

C_2H_6 Ethane			
C_2H_4 Ethene			
$COCl_2$ Dichloro- methanal			
NH_3			
H_2S			
PCl_3			
CH_3OH Methanol			

POLAR OR NON-POLAR MOLECULES YEAR 11

Identify chemical properties of these following compounds.

COMPOUND FORMULA	MOLECULE SHAPE	POLAR / NON-POLAR?	Explanation
O_2	linear	non	**GOOD:** The electron cloud is evenly distributed over the entire molecule. **OR** Both elements have the same electronegativity.
HCl	linear	polar	**GOOD:** Chlorine has a significant pull on the electrons within the covalent bond. **OR** The electron distribution is in the favour of chlorine as it is more electronegative.
BF_3	triangular planar	non	**BEST:** All three fluorine atoms have an equal and opposite electronegative effect on the electrons so they are evenly distributed.
CH_4	tetrahedral	non	
H_2O	V - or bent	polar	
HCN	linear	polar	

C_2H_6 Ethane	linear	non	
C_2H_4 Ethene	linear	non	
$COCl_2$ Dichloro-methanal	triangular planar	polar	
NH_3	pyramidal	polar	
H_2S	V-shaped bent	polar	
PCl_3	pyramidal	polar	
CH_3OH Methanol	tetrahedral	polar	

VSEPR Worksheet

1) What is the main idea behind VSEPR theory?

2) For each of the following compounds, determine the bond angles, molecular shapes, and hybridizations for all atoms:

   a) carbon tetrachloride

   b) BH_3

   c) silicon disulfide

   d) C_2H_2

   e) PF_3

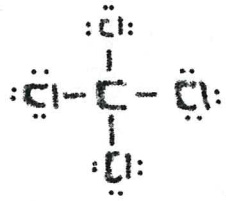
VSEPR Worksheet - Solutions

1) What is the main idea behind VSEPR theory?

The main idea is that electrons don't like to hang around near each other because they repel each other. As a result, the atoms in a molecule tend to separate as far as they can because their bonds repel each other.

2) For each of the following compounds, determine the bond angles, molecular shapes, and hybridizations for all atoms:

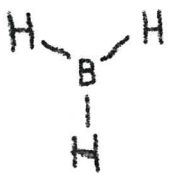
a) carbon tetrachloride



Carbon is tetrahedral, 109.5^0 bond angle, and sp^3 hybridized

Chlorine is linear, has no bond angle, and is sp^3 hybridized

b) BH_3



Boron is trigonal planar, 120^0 bond angle, and sp^2 hybridize

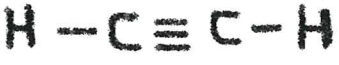
Hydrogen is linear, has no bond angle, and no hybridizatio

c) silicon disulfide

Silicon is linear, has a 180^0 bond angle, and is sp

Sulfur is linear, has no bond angle, and is sp^2 hyb

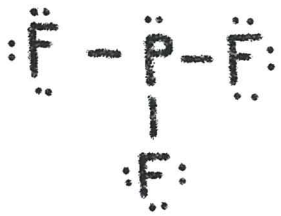
d) C_2H_2



Carbon is linear, has a 180^0 bond angle, and is sp

Hydrogen is linear, has no bond angle, and no hy

e) PF_3



Phosphorus is trigonal pyramidal, has a bond angle of 10
hybridized.

Fluorine is linear, has no bond angle, and is sp^3 hybridize

Lewis Structures, VSEPR, Polarity, IM Forces

For each of the following molecules, draw the Lewis structure (with any resonance structures, if applicable), indicate the molecular shapes and bond angles, indicate the molecular polarity (if any), and identify the major intermolecular force in each compound. Hint – in this worksheet, as in all chemistry problems you'll see, polyatomic ions aren't drawn as big lines of atoms.

1) carbon tetrafluoride

2) BF_3

3) NF_3

4) H_2CS

5) carbonate ion

6) CH_2F_2

7) nitrate ion

8) O_2

9) PF_3

10) H_2S

Types of Intermolecular Forces

What is the strongest intermolecular force present for each of the following compounds?

1) water _____

2) carbon tetrachloride _____

3) ammonia _____

4) carbon dioxide _____

5) phosphorus trichloride _____

6) nitrogen _____

7) ethane (C_2H_6) _____

8) acetone (CH_2O) _____

9) methanol (CH_3OH) _____

10) borane (BH_3) _____

More Intermolecular Force Practice Problems

1) For each of the following compounds indicate which intermolecular force is most important:

   a) FCN _____

   b) HCN _____

   c) C_2H_6 _____

   d) CF_2H_2 _____

2) Explain why ethyl alcohol (C_2H_5OH) has a higher boiling point (78.4^0 C) than methyl alcohol (CH_3OH; 64.7^0 C).

3) Rank the following by from lowest to highest anticipated boiling point: C_2H_4, CH_4, Ne, H_3COCH_3.

4) Motor oil largely consists of molecules that consist of long chains of carbon atoms with hydrogen atoms attached to them. Using your knowledge of intermolecular forces, why wouldn't it be better to use a compound like glycerol. The formula of glycerol is $CHOH(CH_2OH)_2$.

Ranking Molecules by Increasing Polarity

In each of the following problems, rank the molecules from lowest to highest polarity:

1) PF_3, LiOH, SF_2, NF_3

2) $Ni(OH)_3$, N_2H_2, CH_3OH, C_2H_5OH

3) B_2F_4, $H_2C_2O_4$, $CuCl_2$, CF_2O

4) PH_3, PF_3, NH_3, NF_3

5) H_2O, H_2S, HF, H_2

Lewis Structures Practice Worksheet

Draw the Lewis structures for the following compounds:

1) PBr_3

2) N_2H_2

3) CH_3OH

4) NO_2^{-1}

5) C_2H_4

Yet More Lewis Structures

For those of you that enjoy such things, some more Lewis structures to draw:

1) BSF

2) HBr

3) C_2H_5OH (ethanol)

4) N_2F_4

5) SF_6

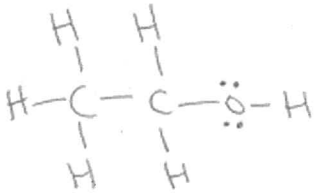
Yet More Lewis Structures – Answers

For those of you that enjoy such things, some more Lewis structures to draw:

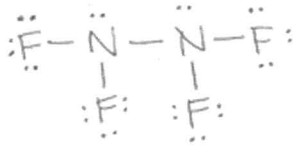
1) BSF

2) HBr

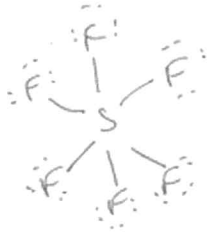
3) C_2H_5OH (ethanol)



4) N_2F_4



5) SF_6



Lewis Structures Practice Worksheet

Draw the Lewis structures for the following compounds:

1) PBr_3

2) N_2H_2

3) CH_3OH

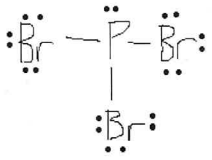
4) NO_2^{-1}

5) C_2H_4

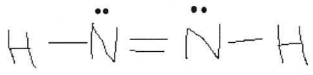
Lewis Structures Practice Worksheet - Solutions

Please forgive my very poor drawing skills!

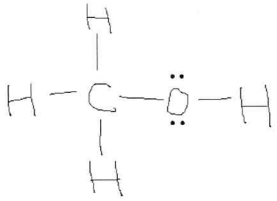
1) PBr_3



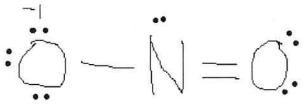
2) N_2H_2



3) CH_3OH



4) NO_2^{-1}



5) C_2H_4