

## Intermolecular Forces Worksheet

2. List all types of IMFs that would occur in each of the following (you should have a good enough understanding of electronegativities to answer all of these, except maybe  $\text{SO}_2$ , without look up the electronegativity numbers).

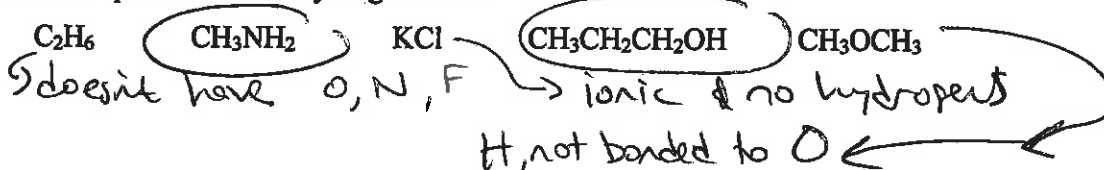
- a.  $\text{CH}_3\text{CF}_3$  dispersion, dipole-dipole  
 b.  $\text{CCl}_4$  dispersion  
 c.  $\text{SO}_2$  dispersion, dipole-dipole  
 d.  $\text{BrF}$  dispersion, dipole-dipole  
 e.  $(\text{CH}_3)_3\text{N}$  dispersion, dipole-dipole  
 f.  $\text{PCl}_5$  dispersion

3.  $\text{H}_2\text{S}$ ,  $\text{O}_2$  and  $\text{CH}_3\text{OH}$  all have comparable molecular masses. List the dominant type of IMF for the pure substances, then rank the strength of each compound based on IMFs within the samples.

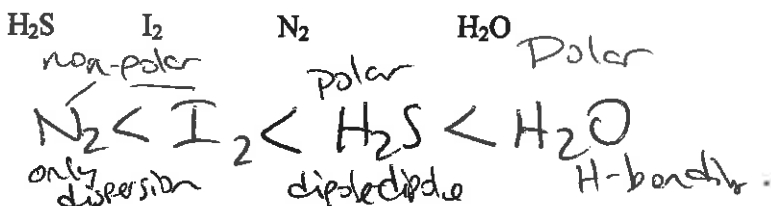
(1 = strongest, 2 = in between, 3 = weakest).

Substance	IMF	Relative Strength
HBr	dipole-dipole	2
$\text{O}_2$	dispersion	3
$\text{CH}_3\text{OH}$	H-bonding	1

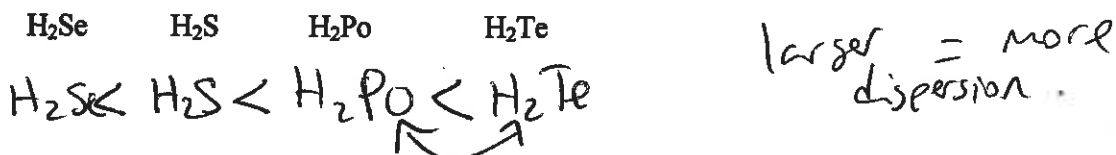
4. Circle all of the species below that can form a hydrogen bond in its pure form. Explain why the other species couldn't hydrogen bond.



5. Rank the following compounds from weakest intermolecular forces to strongest. Justify your answers.



6. Rank the following from weakest intermolecular forces to strongest. Justify your answers.



7. Create a diagram showing how intermolecular forces in water can result in:

- a) surface tension.
- b) attraction to a charged object

# SHAPES OF MOLECULES

Name \_\_\_\_\_

- ① Determine the best Lewis structure for each, & determine the geometry  
 ② Using VSEPR Theory, name and sketch the shape of the following molecules.

<p>1. N<sub>2</sub></p> <p><math>\text{:N}\equiv\text{N:}</math></p> <p>linear</p>	<p>7. HF</p> <p><math>\text{H}-\text{F:}</math> linear</p>
<p>2. H<sub>2</sub>O</p> <p>G = tetrahedral S = bent</p> <p><math>\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}}-\text{H}</math></p>	<p>8. CH<sub>3</sub>OH</p> <p>tetrahedral</p> <p><math>\text{H}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\cdot\cdot}{\text{O}}-\text{H}</math></p>
<p>3. CO<sub>2</sub></p> <p><math>\text{:}\overset{\cdot\cdot}{\text{O}}=\text{C}=\overset{\cdot\cdot}{\text{O}}\text{:}</math> linear</p>	<p>9. H<sub>2</sub>S</p> <p>G = tetrahedral S = bent</p> <p><math>\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{S}}}-\text{H}</math></p>
<p>4. NH<sub>3</sub></p> <p>G = tetrahedral S = pyramidal</p> <p><math>\text{H}-\overset{\cdot\cdot}{\underset{\text{H}}{\text{N}}}-\text{H}</math></p>	<p>10. I<sub>2</sub></p> <p><math>\text{:}\overset{\cdot\cdot}{\text{I}}-\overset{\cdot\cdot}{\text{I}}\text{:}</math> linear</p>
<p>5. CH<sub>4</sub></p> <p>G/S = tetrahedral</p> <p><math>\text{H}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\text{H}</math></p>	<p>11. CHCl<sub>3</sub></p> <p>tetrahedral</p> <p><math>\text{:}\overset{\text{H}}{\text{C}}-\overset{\cdot\cdot}{\text{C}}-\overset{\cdot\cdot}{\text{Cl}}\text{:}</math></p>
<p>6. SO<sub>3</sub></p> <p>Trigonal planar</p> <p><math>\left[ \overset{\cdot\cdot}{\text{O}}-\overset{\cdot\cdot}{\text{S}}=\overset{\cdot\cdot}{\text{O}} \right] \leftrightarrow \left[ \overset{\cdot\cdot}{\text{O}}-\overset{\cdot\cdot}{\text{S}}-\overset{\cdot\cdot}{\text{O}} \right] \leftrightarrow \left[ \overset{\cdot\cdot}{\text{O}}-\overset{\cdot\cdot}{\text{S}}-\overset{\cdot\cdot}{\text{O}} \right]</math></p>	<p>12. O<sub>2</sub></p> <p>linear</p> <p><math>\text{:}\overset{\cdot\cdot}{\text{O}}=\overset{\cdot\cdot}{\text{O}}\text{:}</math></p>

Name: \_\_\_\_\_

ID: A

35. The following molecules contain polar bonds. The only nonpolar molecule is
- a. HCl.
  - b. H<sub>2</sub>O.
  - c. CO<sub>2</sub>.
  - d. NH<sub>3</sub>.

**Short Answer**

36. In terms of the periodic table trends, explain why Francium (atomic number 87) and Fluorine (atomic number 9) are the most reactive elements.

37. How has the model of the atom changed over time? Include as much detail as possible.

see previous quiz

38. Arrange the following bonding pairs in order of increasing polarity.

H-F, C-C, O-Cl, O-P

0.28      1.25

C-C < O-P < O-Cl < H-F



Name: \_\_\_\_\_

ID: A

20 35

12. Bromine, atomic number 35, belongs to Group 17. How many electrons does bromine have in its outermost energy level?  
a. 7  
b. 17  
c. 18  
d. 35
13. The most reactive group of the nonmetals are the  
a. lanthanides.  
b. transition elements.  
c. halogens.  
d. rare-earth elements.
14. The group of soft, silvery active metals, all of which have one electron in an *s* orbital, is known as the  
a. alkaline-earth metals.  
b. transition metals.  
c. alkali metals.  
d. metalloids.
15. A measure of the ability of an atom in a chemical compound to attract electrons is called  
a. electron affinity.  
b. electron configuration.  
c. electronegativity.  
d. ionization potential.
16. The element that has the greatest electronegativity is  
a. oxygen.  
b. sodium.  
c. chlorine.  
d. fluorine.
17. A negative ion is known as a(n)  
a. ionic radius.  
b. valence electron.  
c. cation.  
d. anion.
18. As the atomic number of the metals of Group 1 increases, the ionic radius  
a. increases.  
b. decreases.  
c. remains the same.  
d. cannot be determined.
19. Which is the best reason that the atomic radius generally increases with atomic number in each group of elements?  
a. The nuclear charge increases.  
b. The number of neutrons increases.  
c. The number of energy levels increases.  
d. A new octet forms.
20. The energy required to remove an electron from an atom \_\_\_\_\_ as you move left to right from potassium through iron.  
a. generally increases  
b. generally decreases  
c. does not change  
d. varies unpredictably
21. The number of valence electrons in Group 17 elements is  
a. 7.  
b. 8.  
c. 17.  
d. equal to the period number.
22. The first electrons to be removed when *d*-block elements form ions are the  
a. *d* electrons.  
b. *p* electrons.  
c. *s* electrons.  
d. *f* electrons.
23. Atoms are \_\_\_\_\_ when they are combined.  
a. more stable  
b. less stable  
c. not bound together  
d. at a high potential energy

# PERIODIC TABLE WORKSHEET

Name \_\_\_\_\_

1. Where are the most active metals located? lower left
2. Where are the most active nonmetals located? upper right
3. As you go from left to right across a period, the atomic size ( decreases / increases ). Why? decreases - increased (+) nuclear charge
4. As you travel down a group, the atomic size ( decreases / increases ). Why? increases - additional principle energy levels
5. A negative ion is ( larger / smaller ) than its parent atom.
6. A positive ion is ( larger / smaller ) than its parent atom.
7. As you go from left to right across a period, the first ionization energy generally ( decreases / increases ). Why? increases - increased (+) nuclear charge
8. As you go down a group, the first ionization energy generally ( decreases / increases ). Why? decreases - outer  $e^-$  are further from nucleus
9. Where is the highest electronegativity found? upper right (F)
10. Where is the lowest electronegativity found? lower left (Fr)
11. Elements of Group 1 are called alkali metals
12. Elements of Group 2 are called alkaline earth metals
13. Elements of Group 3-12 are called transition metals
14. As you go from left to right across the periodic table, the elements go from ( metals / nonmetals ) to ( metals / nonmetals ).
15. Group 17 elements are called halogens
16. The most active element in Group 17 is fluorine
17. Group 18 elements are called noble gases
18. What sublevels are filling across the Transition Elements? d & f
19. Elements within a group have a similar number of valence  $e^-$
20. Elements across a series have the same number of principle energy levels
21. A colored ion generally indicates a transition element
22. As you go down a group, the elements generally become ( more / less ) metallic.
23. The majority of elements in the periodic table are ( metals / nonmetals ).
24. Elements in the periodic table are arranged according to their atomic #
25. An element with both metallic and nonmetallic properties is called a Semi metal or metalloid