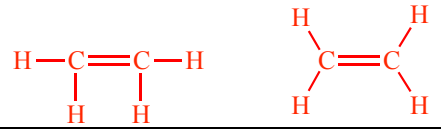
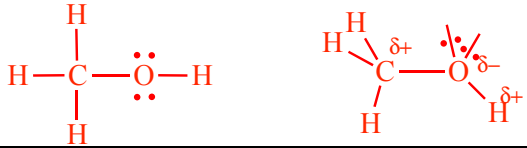
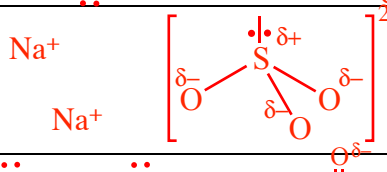
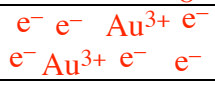
Review –Chem H ***Name*** Answer Key
Unit 10: Polarity ***Date*** _____ ***Period*** _____

Topics covered on test:

- Determine the type of substance (ionic, polar covalent molecular, nonpolar covalent molecular, network covalent or metallic) given its chemical formula. (Must be able to write in all partial or full charges.)
- Identify types and relative strengths of attractions holding particular molecules/atoms/ions together (dispersion, dipole-dipole, hydrogen bonding, ionic, metallic, covalent).
- Explain the relative melting points and boiling points of different substances comparing strengths of attractions. *(Remember, substances with larger electron clouds exhibit stronger dispersion attractions.)*
- Know the structures and properties (hardness, slipperiness and conductivity) of diamond and graphite
- Have a basic understanding of the structure of fullerenes and the conductivity properties of metallics, ionics (as solids or as liquids), and aqueous solutions.
- Understand the concepts of surface tension and capillary action.
- Interpret experimental mixing (solubility) data and relate to polarity. (Situations similar to Polarity Lab)
- Explain the unique properties of water--what they are due to and why these properties are important to life, the environment and scientists.

Review Practice:

1) Fill in this chart as asked.

Chemical Formula	**Structure** • For all covalent molecules, draw Lewis Dot and 3D structures. Show any permanent partial charges. • For all others, draw a few of the particles that make up the substance. (Show any full charges.)	**type of substance** NPC molecular, PC Molecular, Ionic, Metallic, Network Covalent.	**Strongest attractive force** (the attraction that must break if boiled)
a) C_2H_4		NPC	Dispersion
b) CH_3OH		PC	Hydrogen Bonding
c) PCl_3		PC	Dipole-Dipole
d) Na_2SO_3		Ionic	Ion-Ion
e) SO_3		NPC	Dispersion
f) Au		Metallic	Metallic
g) SO_2		PC	Dipole-Dipole

2) Suppose a small drop each of three substances were placed on a lab bench and the following results were obtained. Given that the substances were Br_2 (l), Hg (l) and HF (l). Label each picture below with the correct substance. Explain your determination.

HF
H-bond

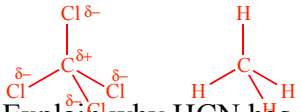
Br_2
dispersion

Hg
metallic

Substances with stronger attractions have higher surface tension because particles pull together more strongly.
dispersion< dipole-dipole < H-bonding < metallic or ionic

3) Explain how it is possible for two non-polar covalent molecules to be attracted to each other.
By chance, more electron density can be found on one side of a molecule. Thus, an instantaneous dipole forms. This instantaneous dipole induces another dipole in a neighboring molecule (e^- are repelled to other side). Now the two molecules attract due to partial charges. However, it is only a temporary attraction.

4) Which substance would have the higher boiling point--CCl_4 or CH_4? Explain why.



Both substances are non-polar covalent molecules, so both have weak dispersion attractions. However, CCl_4 has stronger dispersion attractions because it has more electrons. Thus, its larger electron cloud can shift more easily and more easily form temporary dipoles.

5) Explain why HCN has a much lower boiling point (about 120°C lower) than H_2O.

Both molecules are PC, but in HCN relatively weaker dip-dip forces must be broken. In H_2O, stronger H-bonds must be broken.

6) Why does NaCN have a higher boiling point than HCN?
As above, HCN is a polar molecule with relatively weak dip-dip attractions that must broken, but NaCN is ionic, so much stronger ionic bonds must be broken.

7) Would NaCN most likely dissolve in water? Yes Would HCN? Yes Explain choices.
NaCN would dissolve in water because ionic NaCN has a similar polarity to very polar water.
HCN would dissolve in water because polar HCN has a similar polarity to very polar water.

8) The melting point of SiO_2 is much higher than the melting point of CO_2. Explain why
SiO_2 is a network covalent substance (It is quartz, one of the three listed on your Conductivity demo.). CO_2 is a nonpolar covalent molecular substance. It takes more heat to melt SiO_2 because strong covalent bonds must be broken compared to only weak dispersion bonds for CO_2.

9) If an unknown substance mixes with nonpolar, slightly polar and polar covalent molecular substances, this unknown substance would best be characterized as being **(nonpolar covalent molecular, slightly polar covalent molecular, polar covalent molecular, ionic).**

10) Why don't polar liquids mix with nonpolar liquids? (Discuss attractions and entropy.)
Molecules try to mix, but they separate back out because all of the polar mc's are attracted to each other. Thus, the polar mc's stick together and leave the non-polar mc's on their own. The substances prefer to mix and get more disordered (more entropy), but they can't because of attractions b/w polar mc's.

11) Should an aqueous solution of MgF_2 conduct electricity? Yes Why or Why not?
MgF_2 is ionic. Thus, it consists of the ions, Mg^{+2} and F^-. When MgF_2 is dissolved in water, the water mc's are attracted to the ions and they pull the ions out of the crystal lattice. Now all of the ions are free to move, so the solution conducts electricity. (There are mobile charges in the solution.)

12) Why is graphite a good lubricant?
Graphite consists of layers consisting of covalently bonded carbon atoms. However, there are only weak dispersion attractions between the layers. Thus, the layers are able to slide over each other. This makes graphite slippery, so it is a good lubricant.

13) Why do ionic compounds have higher melting points than polar covalent molecules? (HINT: charges)
To melt ionic compounds, ionic bonds must be broken. These are strong bonds because it is an attraction between full charges. To melt polar covalent substances, dipole-dipole bonds or H-bonds must be broken. These are weaker attractions because it is an attraction between partial charges.

14) Three important properties of water are listed below. Give basic reasons for each important property. Then, explain why each property is so important to life, the environment and to scientists.

a) Water has a relatively high boiling point compared to other similarly sized covalent molecules.
- Compared to other covalent molecules, water has relatively strong intermolecular forces. It does H-bonding which is stronger than dipole-dipole and dispersion.
- Having a high boiling point makes it a liquid at room temperature. It is beneficial to have water as a liquid because liquids are great for transport and great as solvents.

b) Ice is less dense than liquid water.
- When water mc's come together in a solid, they arrange themselves in a "hexagonal" pattern because this allows the most H-bonds. This pattern makes the mc's spread out from each other, so ice is less dense than liquid water.
- Ice floats on liquid water. Thus, the top layer of ice can insulate the water below and keep it from freezing. This prevents our lakes from freezing solid each winter.

c) Water dissolves a large variety of substances (It is often called the "universal" solvent.)
- Water is very polar, so it dissolves everything except non-polars. (It dissolves ionics and polars)
- Since so many compounds dissolve in water, water is useful for transporting nutrients (in bodies and oceans); water is a great solvent for industrial processes (Ex: chemical reactions); and water is easily contaminated by toxins.