AP Chemistry

Intermolecular Attractions

The purpose of this activity is to compare and contrast the different types of intermolecular attractions. Students will work in expert groups to learn about one type of intermolecular attraction, and then teach about that intermolecular attraction to the other students in their base groups. At the end of class, you should be able to determine the types of intermolecular attractions that are possible for a particular compound and use this information to predict physical properties such as boiling points or melting points.

Base Group: _____ _____

_____ _____

Intermolecular forces are the attractions between molecules. They hold stable molecules or compounds to each other. Unlike chemical bonds, you can overcome them by adding energy to the system without changing the chemical nature of the substance. Ice, liquid water and steam are all chemically H_20. The differences in their states of matter are possible because of energy's effect on the intermolecular forces that attract individual water molecules to each other. Watch a quick video recap

---

Split up into expert groups:

Expert Group: _____ _____

_____ _____

As a group, use the available resources to prepare a description of the intermolecular attraction, an illustration of the attraction, and answers to the key questions. It isn't necessary to use all of the available resources; however, you may find additional resources if needed! When you are done, return to your base groups. Base group members will take turns teaching about each of the intermolecular attractions. Then, group members will work together to complete the application questions.

Expert Group 1: Dipole-Dipole Attractions

Resources:

http://www.chem.purdue.edu/gchelp/liquids/disperse2.html

http://www.cengage.com/chemistry/discipline_content/dvd/Power_Lectures/General_Chemistry/dswmedia/hmswf/flv/act081_media1.html

http://chemwiki.ucdavis.edu/Physical_Chemistry/Physical_Properties_of_Matter/Intermolecular_Forces/Dipole-Dipole_Interactions

http://socratic.org/questions/how-do-dipole-dipole-interactions-affect-solubility

http://chemistry.elmhurst.edu/vchembook/163boilingpt.html

Illustration:

1. What type of attraction is the basis for your IMF?

2. Is your IMF weak, strong or somewhere in between? WHY?

3. What types of common substances are held together by your IMF? (Common, real world example, please!)

4. How does your IMF directly affect and/or explain a substance's physical properties?

Expert Group 2: Hydrogen Bonding
Resources:
http://www.chemguide.co.uk/atoms/bonding/hbond.html
http://www.chem.purdue.edu/gchelp/liquids/hbond2.html
http://www.cengage.com/chemistry/discipline_content/dvd/Power_Lectures/General_Chemistry/dswmedia/hmswf/flv/act082_media1.html
http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/matters/H-bonding.html
http://chemistry.elmhurst.edu/vchembook/163boilingpt.html
Illustration:

1. What type of attraction is the basis for your IMF?

2. Is your IMF weak, strong or somewhere in between? WHY?

3. What types of common substances are held together by your IMF? (Common, real world example, please!)

4. How does your IMF directly affect and/or explain a substance's physical properties?

Expert Group 3: Dipole-Induced Dipole Attractions

Resources:
http://www.chem.purdue.edu/gchelp/liquids/inddip.html
http://abetterchemtext.com/Condensed/dip_induc.htm
http://employees.oneonta.edu/viningwj/modules/CI_dipoleinduced_dipole_forces_13_5a.html
Illustration:

1. What type of attraction is the basis for your IMF?

2. Is your IMF weak, strong or somewhere in between? WHY?

3. What types of common substances are held together by your IMF? (Common, real world example, please!)

4. How does your IMF directly affect and/or explain a substance's physical properties?

Expert Group 4 London forces (induced dipole-induced dipole)
Resources
https://www.chem.wisc.edu/deptfiles/genchem/netorial/rottosen/tutorial/modules/intermolecular_forces/02imf/imf4.htm
http://www.chem.purdue.edu/gchelp/liquids/disperse.html
http://www.cengage.com/chemistry/discipline_content/dvd/Power_Lectures/General_Chemistry/dswmedia/QuickTime_Movies/flv/13m05an3.html
http://chemsite.lsrhs.net/bonding/LondonDispersion.html
http://www.chemhelper.com/molatt.html
Illustration:

1. What type of attraction is the basis for your IMF?

2. Is your IMF weak, strong or somewhere in between? WHY?

3. Key term: What is polarizability, and how does it relate to London forces?

4. What types of common substances are held together by your IMF? (Common, real world example, please!)

5. How does your IMF directly affect and/or explain a substance's physical properties?

Need more information?
http://chemistry.elmhurst.edu/vchembook/160Aintermolec.html
https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/physprop.htm
http://chemistry.bd.psu.edu/jircitano/IMforces.html
http://www.docbrown.info/page07/equilibria8a.htm

Application Questions

1. Skim the following article. Why is this so exciting to chemists?

http://www.rsc.org/chemistryworld/2013/09/first-pictures-hydrogen-bonds-unveiled-afm

2. Consider the following six choices below:

A. ionic bond	D. dispersion (London) forces	G. metallic bond
B. polar covalent bond	E. dipole-dipole forces	H. ion-dipole forces
C. nonpolar covalent bond	F. hydrogen bond	

Give the letter(s) for the type of bond or intermolecular force described for each of the following. A choice may be used once, more than once, or not at all.

i. _____What holds two I_2 molecules together in a sample of I_2*(s)*?
ii. _____What holds atoms together in HF?
iii. _____What holds atoms together in a hydrogen molecule?
iv. _____What holds atoms together in AgCl?
v. _____What holds two fluorine molecules together in a sample of liquid fluorine?
vi. _____What holds two ammonia molecules together in a sample of liquid NH_3?
vii. _____What must be broken to boil water?
viii. _____What must be broken to melt Al_2O_3*(s)*?
ix. _____Dry ice is CO_2*(s)*. Because dry ice does not exist as a liquid under normal conditions, it sublimes when heated. What must be broken when dry ice sublimes?

3. Circle the ***all*** of the intermolecular forces that exist between molecules for the following samples:

i.	water:	London forces	dipole-dipole forces	hydrogen bonds
ii.	methane:	London forces	dipole-dipole forces	hydrogen bonds
iii.	CH_2O:	London forces	dipole-dipole forces	hydrogen bonds
iv.	SF_4:	London forces	dipole-dipole forces	hydrogen bonds
v.	CH_2F_2:	London forces	dipole-dipole forces	hydrogen bonds

4. Rank the following substances in terms of increasing boiling point:

water, CH_2O, methane, CO_2

_____ < _____ < _____ <
lowest b.p. highest b.p.