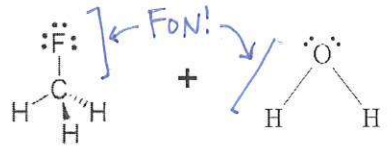
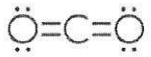
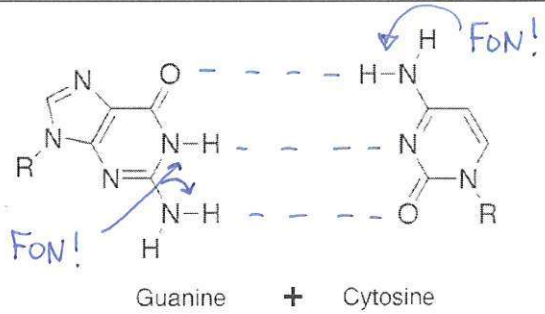
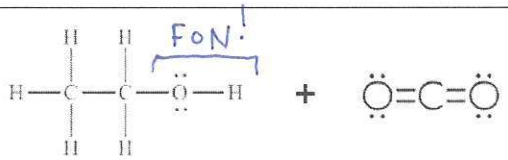
 polar polar	hydrogen bonding, dipole to dipole, LDFs (dipole-induced dipole exist, but not needed)
 non-polar	LDFs
 Guanine + Cytosine	hydrogen bonding, dipole to dipole, LDFs (dipole-induced dipole exists but does not need to be included)
 polar non-polar	hydrogen bonding (yup! even though CO_2 is non-polar), dipole-induced dipole, LDFs

Multiple Choice Practice

1. The forces of attraction between the permanent partially positive regions of one molecule and permanent partially negative regions of another nearby molecule are called _____.

   a. covalent bonds
   b. hydrogen bonding
   c. London dispersion forces
   (d.) dipole–dipole forces

2. A polar molecule is one in which:

   a. ions exist
   b. only london dispersion forces exist
   c. it has a VSEPR structure that is symmetrical
   (d.) electron density is unequally distributed

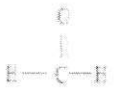
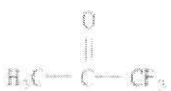
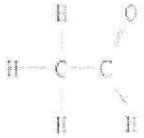
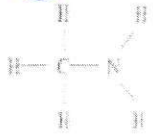
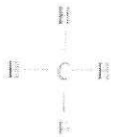
3. Which of the following processes involves breaking intermolecular forces? ⇒ physical change

   a. $H_2(g) + Cl_2(g) \rightarrow 2\ HCl(g)$
   b. $2\ C_2H_6(g) + 7\ O_2(g) \rightarrow 4\ CO_2(g) + 6\ H_2O(g)$
   c. $I_2(g) \rightarrow 2\ I(g)$
   (d.) $H_2O(s) \rightarrow H_2O(l)$

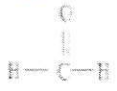
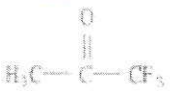
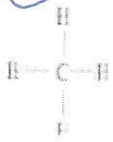
4. What is the dominant intermolecular force in CH_3OH? polar

   a. London dispersion forces
   b. Ion-dipole attraction
   (d.) Dipole-dipole attraction
   e. Hydrogen bonding

5. Which one of the following substances will have hydrogen bonding as one of its intermolecular forces?

(A) 
(B) 
(C) 
(D) 
(E) 

6. Circle ALL of the following substances which cannot hydrogen bond with another molecule of the **same** substance, but would be capable of hydrogen bonding with a **different** molecule that has H directly bonded to fluorine, oxygen, or hydrogen.

(A) 
(B) 
(C) 
(D) 
(E) 

The Language of IMFs (i.e. How to FR)

Notes about Language: Talking about IMFs can be tricksy! And of course, IMF-based questions are VERY common on free response portion of the AP test, so it's essential to carefully choose your language to avoid losing points.

Most IMF points are lost when student inadvertently imply (or, worse, directly state) that during state changes:

Wrong!

1. Chemical bonds are being broken during state changes (NOPE!)
2. Molecules are being broken apart (NOPE!)

How to Talk about IMFS	How to Talk about Bonds

• Overcome IMFs
  ○ Avoid breaking IMFs
• Separate molecules
  ○ NEVER break apart molecules
• IMFs are between molecules
	• Break bonds
	• Bonds are within molecules

Free Response Practice: What **type** of intermolecular OR intramolecular attractive forces must be overcome for each of the following processes to occur?

1. $CO_2(g) \rightarrow C(s) + O_2(g)$, $\Delta H = 393.5$ kJ/mol

chemical change ⇒ intramolecular force broken, type = covalent bond

★IMFs also overcome, but they're so much weaker than chemical bonds they're negligible.

2. $CO_2(s) \rightarrow CO_2(g)$, $\Delta H = 25.2$ kJ/mol

state change ⇒ intermolecular force overcome, type = LDF (or dispersion forces)