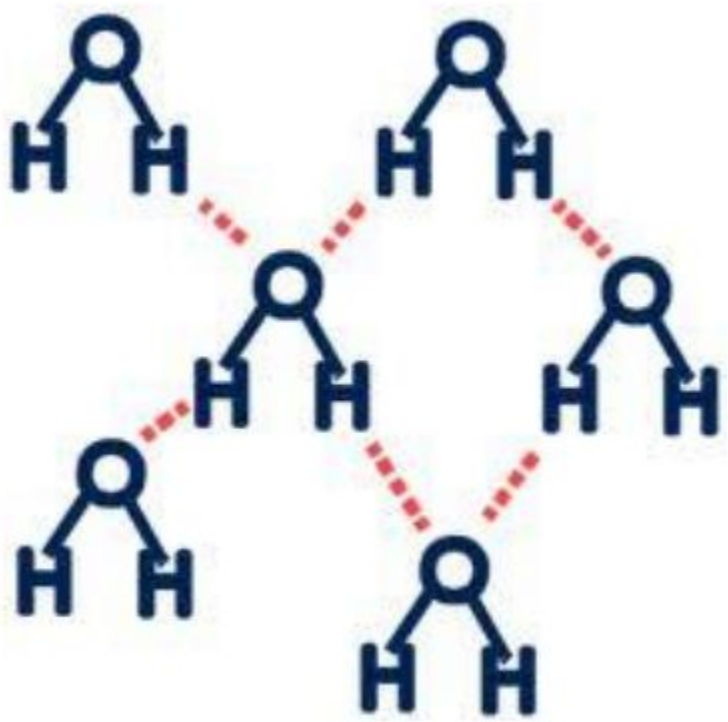
4.7 INTERMOLECULAR FORCES

INTRA VS. INTER

An intramolecular bond is the chemical bond within a molecule.

An intermolecular force is a force that occurs between molecules.

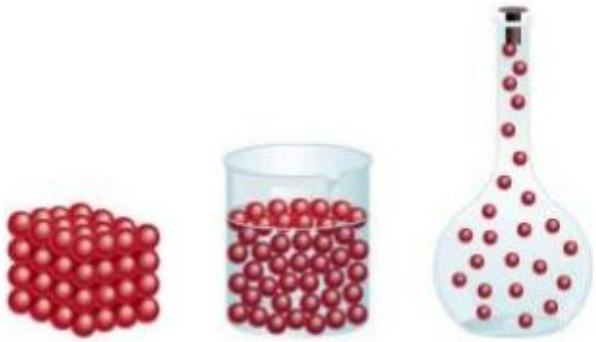


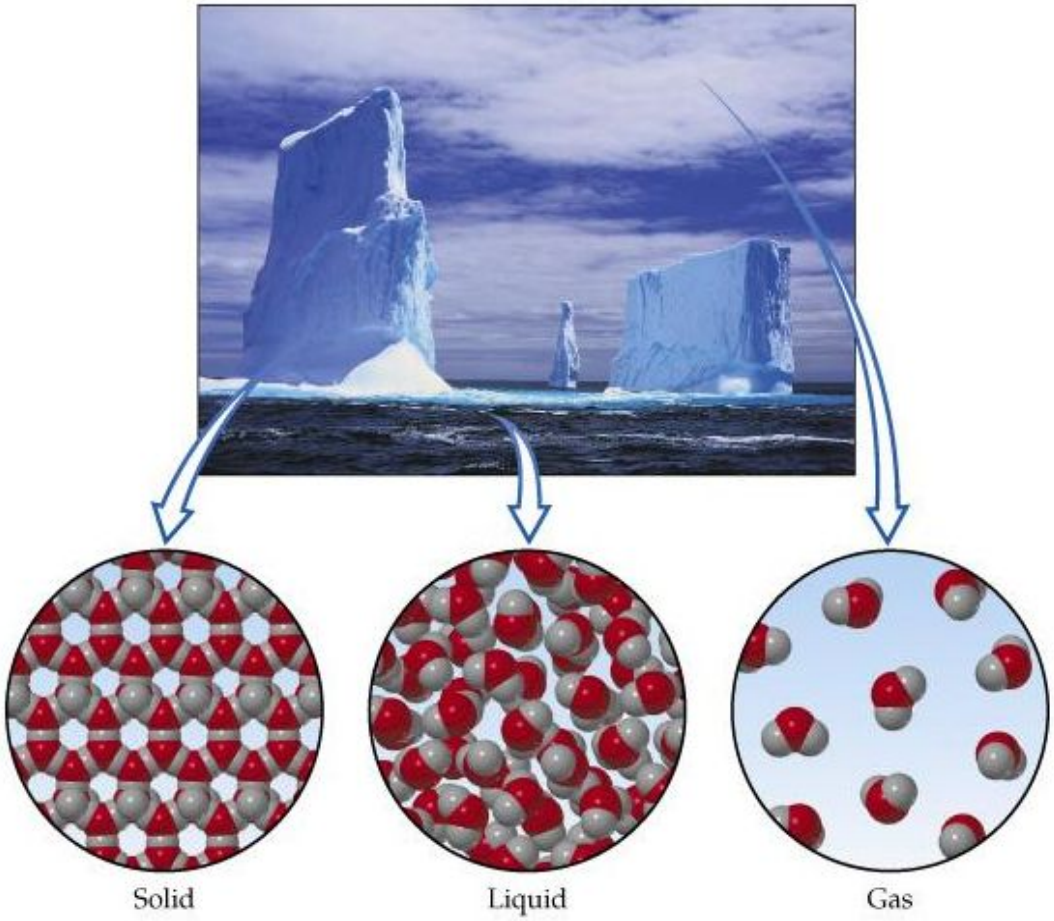
van der Waals forces

- observed by Johannes van der Waals in 1873

- a combination of many types of intermolecular forces including dipole-dipole, London dispersion forces, and hydrogen bonding (described later)

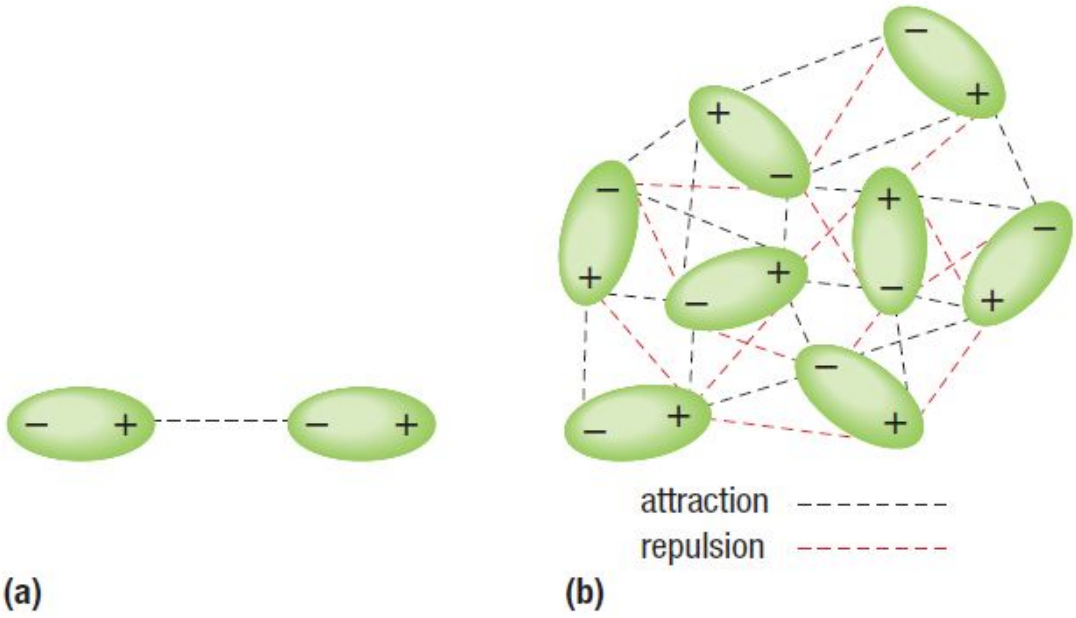
THINK OF WATER CHANGING STATE...





DIPOLE-DIPOLE FORCES

- caused when the dipoles of polar molecules position their positive and negative ends near each other
- stronger than LDF's (but only 1% as strong as covalent or ionic bonds)

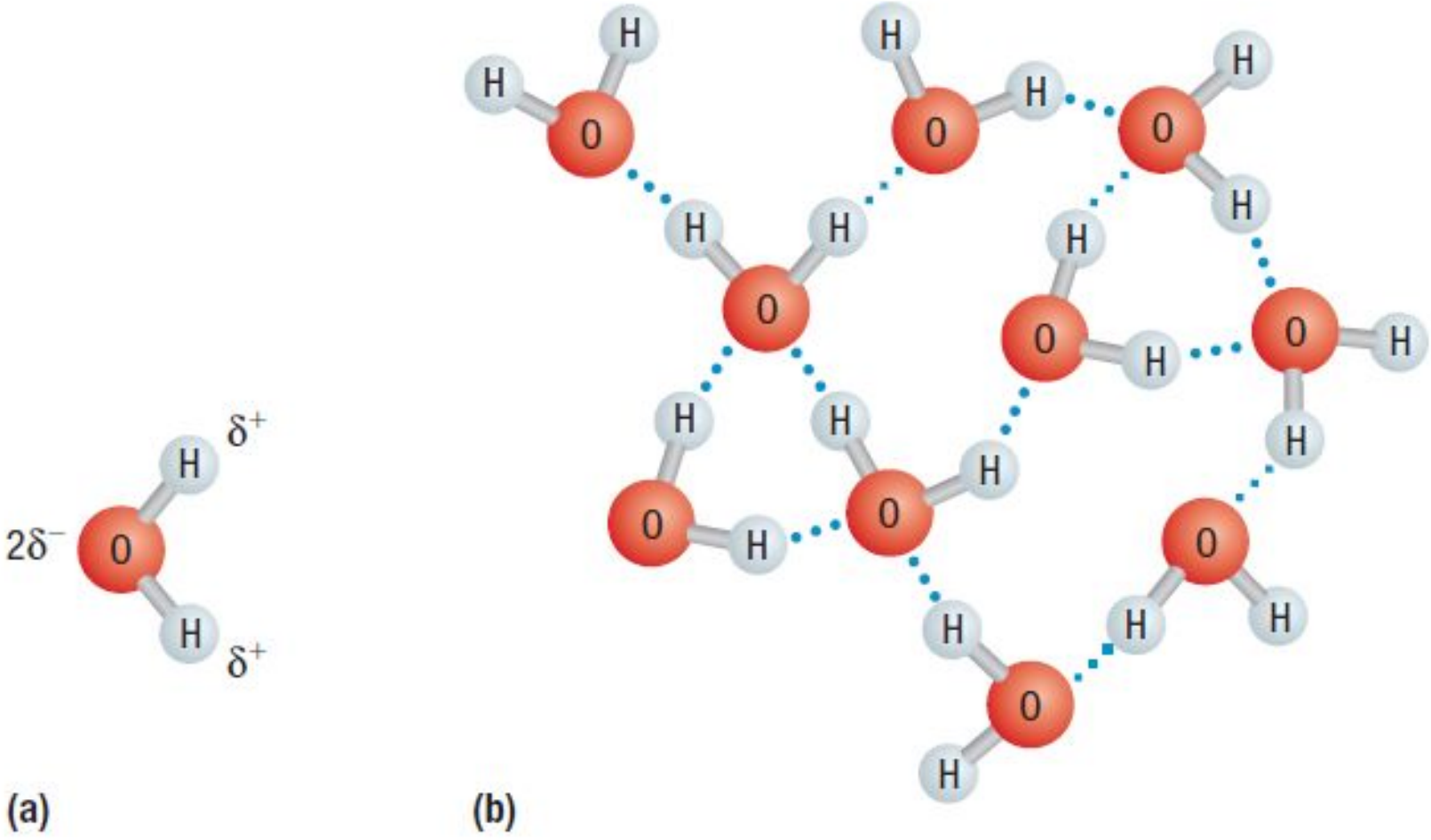


HYDROGEN BONDS

A hydrogen bond is the strong dipole-dipole interaction that occurs when a hydrogen atom bonded to a small highly electronegative atom (oxygen, nitrogen, or fluorine) is attracted to a partially negative atom on a nearby molecule.

H bonds are the strongest type of intermolecular force. (but still only 10% as strong as ionic/covalent)

HYDROGEN BONDS

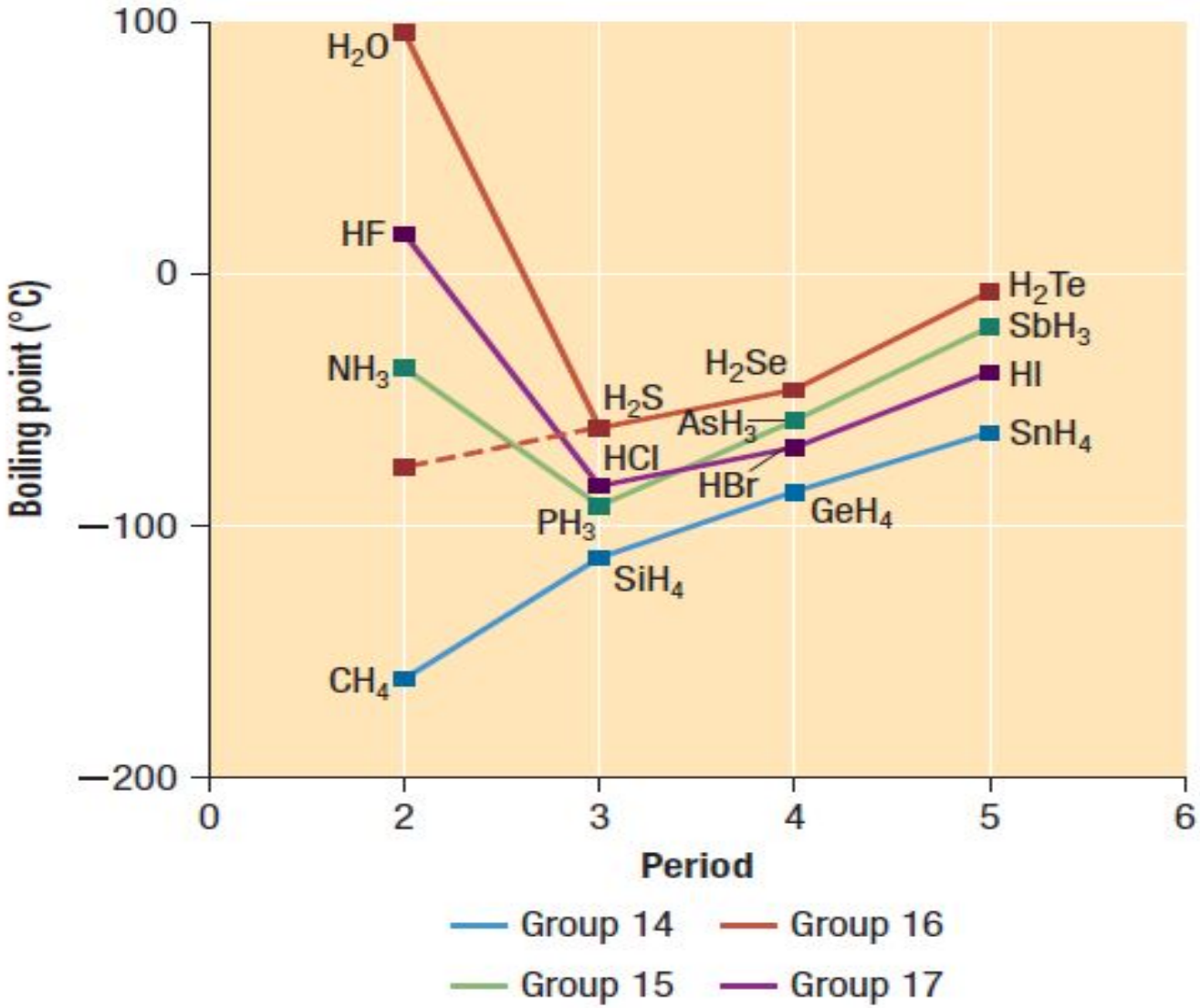


INTERMOLECULAR FORCES AND PHYSICAL PROPERTIES

The stronger the intermolecular forces are, the more energy it will require to pull the molecules apart.

- Molecules that have strong intermolecular forces also have high melting points and boiling points
- Intermolecular forces can also affect solubility

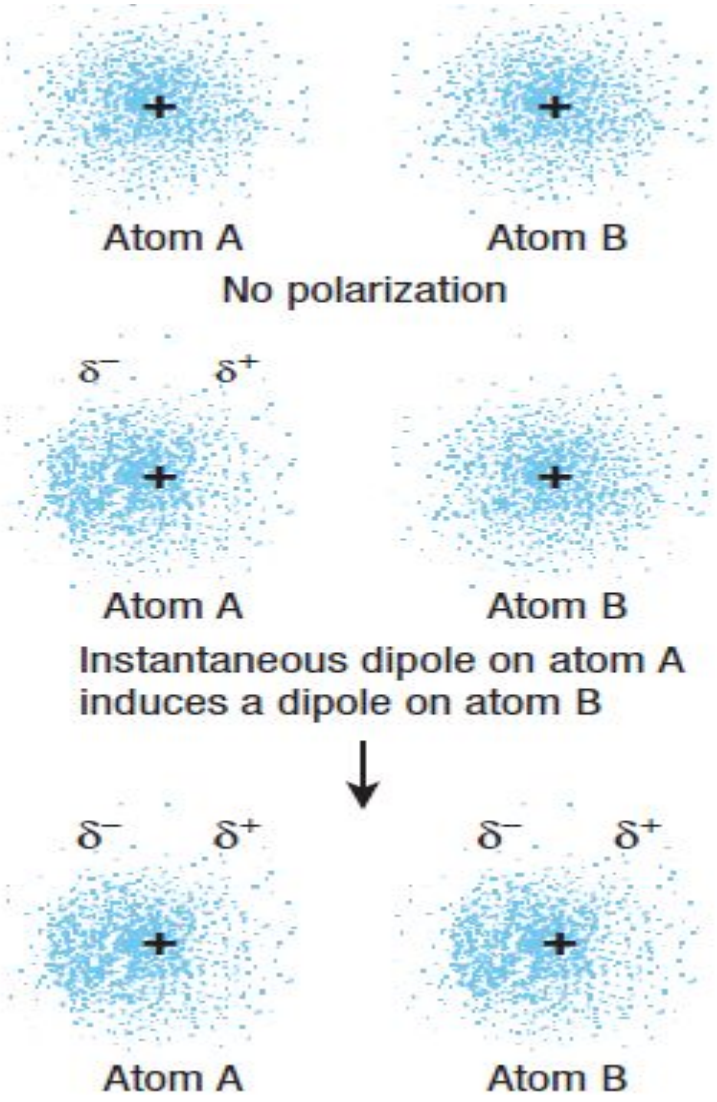
INTERMOLECULAR FORCES AND PHYSICAL PROPERTIES



LONDON DISPERSION FORCES

- Intermolecular force of attraction that exist between all molecules
- An atomic nucleus attracts electrons from neighbouring molecules as well as the electron in its own molecule.
- This type of attraction creates a temporary dipole in the atom or molecule
- The greater the number of electrons/atoms in a molecules the stronger the London force

LONDON DISPERSION FORCES



LONDON DISPERSION FORCES

- force is significant at low temperatures, explains why noble gases freeze at low temperatures
- increases down a group b/c of the larger no. of electrons and the ability to deform the valence electrons (ie. change the charge distribution.) This is called polarizability.

explain the trend

Element	Freezing point (°C)
helium	−269.7
neon	−248.6
argon	−189.4
krypton	−157.3
xenon	−111.9

explain the trend

Compound	Boiling point (°C)
CH_4	−164
SiH_4	−112
GeH_4	−89
SnH_4	−52

EX. 1: Predict which molecule has the highest boiling point.

H_2, I_2, F_2, Br_2, or Cl_2

HOMEWORK:

p. 244 #1, 2

Read and summarize "Physical Properties of Liquids" (p. 245-246)

p. 247 #1, 3, 4, 5, 6, 7