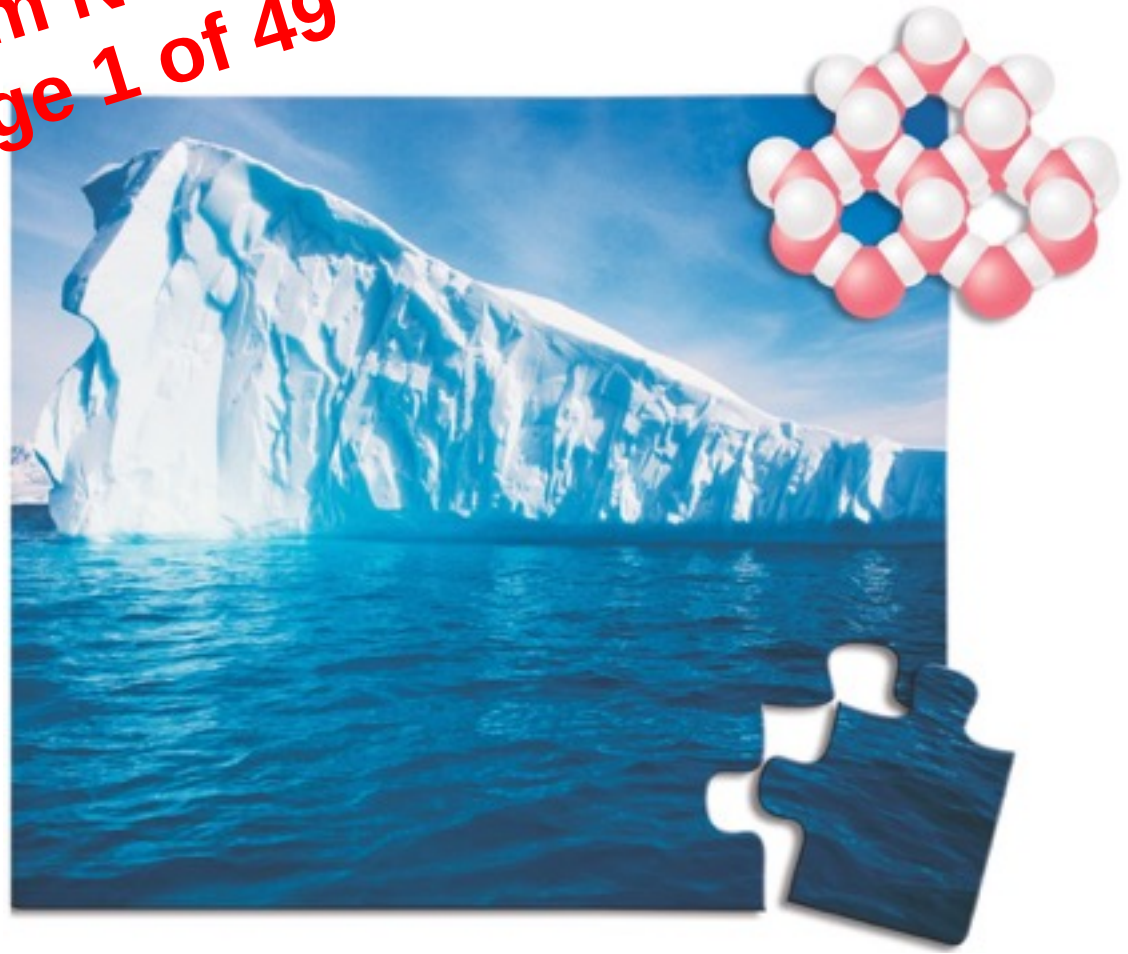
INTRODUCTORY CHEMISTRY

Liquids and Solids

(Ch. 11)



Polar vs Nonpolar vs Ionic Bonds

We can compare electronegativities of two atoms to determine what type of bond is present:

Electronegativity Difference	Bond Type	Example
0 - 0.4	nonpolar covalent	Cl_2
0.5 - 2.0	polar covalent	HF
2.0+	ionic	NaCl

Intermolecular Bonds

- Recall, that a ***polar molecule*** has positive and negative charges concentrated in different regions due to unequal sharing of electrons in bonds.
- This uneven distribution of electrons in a molecule is called a ***dipole***.
- Intermolecular attractions result from temporary or permanent dipoles in molecules.

Intermolecular Bonds Cont'd

There are three types of intermolecular forces:

1. **Dispersion forces** (also called London dispersion forces)
2. **Dipole forces**
3. **Hydrogen bonds**

Intermolecular Forces Exercise

- Rank the three types of Intermolecular forces (dispersion forces, dipole forces, and hydrogen bonds) in order from weakest to strongest. Where do covalent bonds fit into this ranking?

- 1. dispersion forces (weakest)
- 2. dipole forces
- 3. hydrogen bonds

- covalent would be the strongest (strongest)- intra not inter: if you break the bond you change its identity

Physical Property Predictions

- If we are comparing two compounds: pentane, C_5H_{12}, and isopropyl alcohol, C_3H_7OH, predict which liquid has the **higher** value for each of the following: (hint: first decide which compound has stronger intermolecular forces ie. which one is more polar?)
- isopropyl alcohol is polar……pentane is non polar

a) Vapor pressure- C5H15

b) Boiling point- C3H7OH

c) Viscosity- C3H7OH

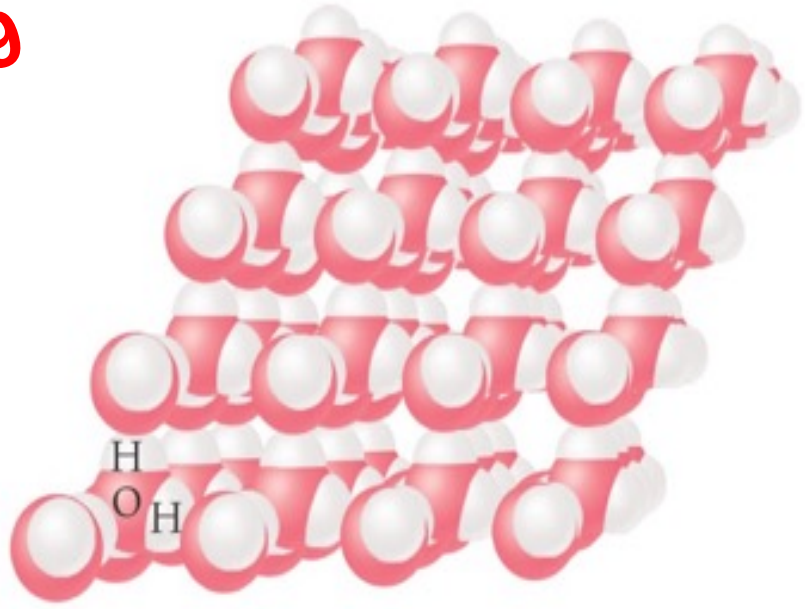
d) Surface Tension- C3H7OH

Properties of Solids Continued

3. Solids do not compress or expand to any degree
   - Assuming no change in physical state, temperature and pressure have a negligible effect on the volume of a solid. Molecules do not move
4. Solids have a slightly higher density than their corresponding liquid
   - One important exception is water; ice is less dense than liquid water.
5. Solids do not mix by diffusion
   - The particles are not free to diffuse in a solid heterogeneous mixture.

Molecular Solids

- A crystalline ***molecular solid*** has molecules arranged in a particular conformation.
- In water, H_2O, the molecules are arranged in a regular three-dimensional structure.



- Other examples of crystalline molecular solids are table sugar, $C_{12}H_{22}O_{11}$, and sulfur, S_8.