Dougherty Valley • AP Chemistry

IMF's, Liquids, & Solids

S-64

STUDY LIST From Paul Groves

I can…

Types of Solids

- ☐ classify any substance into the four solids:
  - molecular
  - metals
  - ionic
  - covalent network
- ☐ list the eight examples of covalent network solids
- ☐ determine whether a molecule is polar or nonpolar from its formula & structure
- ☐ explain that acids (e.g. HCl) are a **molecular** substance (not an ionic substance) even though they form ions in solution

Bonding and Properties

- ☐ describe the bonding in:
  - metals
  - ionic solids, and
  - covalent network solids
- ☐ list and explain the properties of the above three types of substances, including
  - melting point/boiling point
  - conductivity as (s), (l), (g), & (aq)
  - brittleness or malleability
- ☐ give examples of each of the types of solids
- ☐ use lattice energy ideas to compare the strength of bonding in various ion pairs

Intermolecular Forces of Attraction

- ☐ make the distinction between inter- and intra-molecular forces of attraction such as in a gaseous sample of HCl.
- ☐ list and describe the IMF's associated with polar molecules, non-polar molecules, and noble gases
  - London dispersion forces (LDF)
  - dipole-dipole attractions
  - hydrogen bonding
- ☐ state how the strength of IMF is related to MP, BP, ΔH_{vap}, ΔH_{fus}, & vapor pressure
- ☐ predict the strength of London dispersion forces (LDF) in terms of the "polarizable electron clouds" available in the two molecules.
- ☐ predict the strength of dipole-dipole interactions based on the polarity of the bonds in two polar molecules
- ☐ explain why H-O, H-N, and H-F are placed in a separate category called "hydrogen bonding" (i.e., why N, O, and F).
- ☐ explain that during a phase change, the IMF's are broken, not the *intra*-molecular bonds.
- ☐ predict the miscibility of two substances based on the similarity or differences between their IMF's.
- ☐ explain that the stronger a molecule's IMF, the more it deviates from ideal behavior.

Vapor Pressure & Boiling

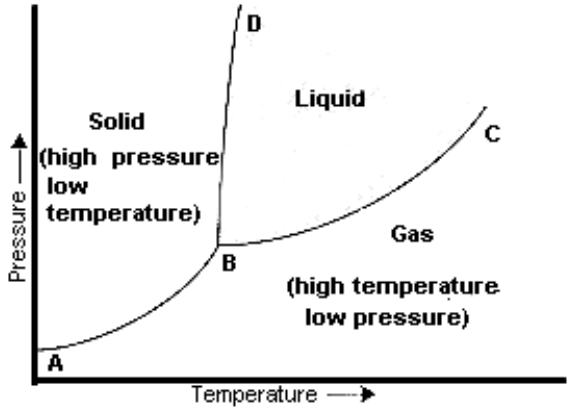
- ☐ explain that equilibrium vapor pressure is associated with the liquid-vapor dynamic equilibrium measured in a closed container
- ☐ state that temperature is the only variable that changes the vapor pressure of any liquid (not the amount of liquid, pressure above the liquid, or volume of the closed container)
- ☐ infer the relative strength of IMF's of two liquids given their vapor pressures
- ☐ explain that a liquid will boil when its vapor pressure matches the pressure above the liquid
- ☐ explain that a liquid can be made to boil by heating the liquid or by reducing the pressure above the liquid
- ☐ define "normal boiling point" as the temperature at which a liquid will boil at sea level (1 atm = 760 mmHg = 101.3 kPa, etc.)
- ☐ explain that vapor pressure is a result of the balance between the kinetic energy of the molecules and the strength of their IMF's.

Phase Changes

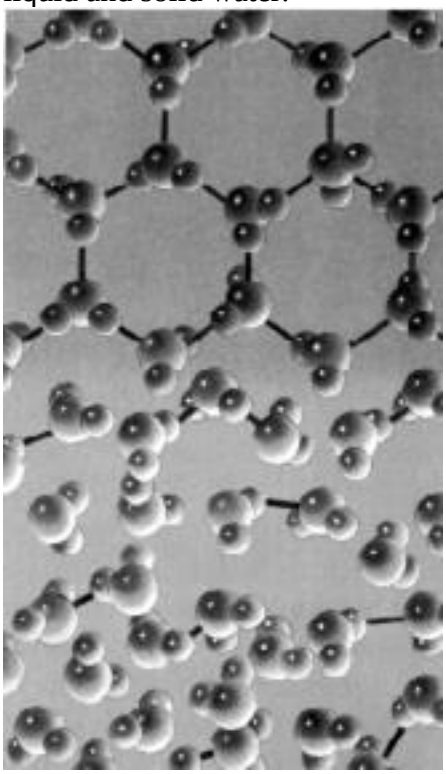
☐ list the names of the phase changes between (s), (l), and (g)

☐ sketch a "phase diagram" for a substance and label

- the three phases
- the triple point
- the critical point

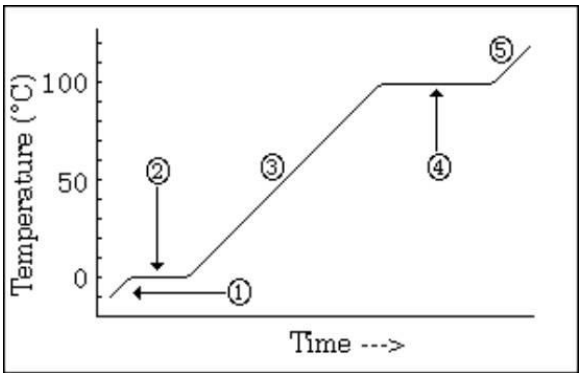


☐ explain why water's solid-liquid line has a negative slope in terms of the density of liquid and solid water.



☐ calculate the energy involved in a phase change given values for ΔH_{vap} and ΔH_{fus}.

☐ list the type of energy change (kinetic or potential) that occurs during each section of a heating curve. Label the phase(s) present in each section.



Surface Tension

☐ explain that a non-surface molecule is more stable (lower potential energy) than a surface molecule because it has the maximum number of neighbors. Liquids tend to minimize the number of high-energy surface molecules. This is called surface tension. The shape with the minimum surface area for its volume is a sphere.