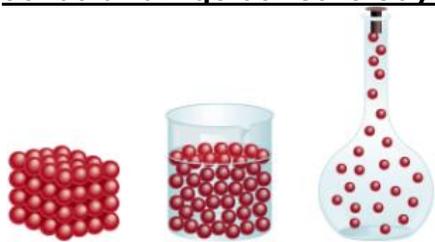


Solids and Liquids Test Study Guide



- Gas – **low density**, high compressibility, fill container
- Solid – **high density(dense)**, very slightly compressible, and are rigid -
-- solid **molecule is closer together w/ attractive forces on each other.**

****Much more energy required to change from liquid to gas than solid to liquid – in liquid the particles/molecule are still close together with most IMF's still present. When go from l→g, they must be moved far apart. Virtually all of the IMF's must be overcome to separate the molecules. This requires a large amt. of energy.**

So solid and liquid states most similar (than l and g)- solid and liquid have similar densities, gas much less dense

Solids and Liquids

Solid state – **closely packed, highly ordered particles compared to gas with widely spaced, randomly arranged particles.**

***For all except water, solids have a higher density than liquids.**

Water – ice has empty spaced and is less dense than liquid water.

Liquid state – lies in between, but its properties indicate it more closely resembles solid than gas. The particles are close together but with disordered arrangement compared to solid w/ empty spaces.

When heating liquid water that reaches 100 degrees Celsius it stays at 100 degrees until all the water has changed to vapor and when done then temperature rises a again. 100°C is normal boiling point of water at 1 atm. Also when cooling, the temperature decreases until it reaches 0°C until all the liq. water changes to ice and then beings to drop again. 0°C is the normal freezing/melting point of water at 1 atm.

Water expands when it is freezes, which can cause problems. It explains why ice floats. Density of one gram of ice is less then the density of one

gram of water because $d=m/v$ and a slightly larger volume is being divided by.

Changes from $s \rightarrow l$ and $l \rightarrow g$ are physical changes (no chem. bonds broken)

Intramolecular forces (within molecule)– the bonding forces that hold the atoms of a molecule together

Intermolecular forces (between molecules)– forces that occur among molecules that cause them to aggregate to form a solid or liquid. Weaker than intramolecular forces.

It takes energy to melt ice and to vaporize water to overcome the intermolecular forces between water molecules. (It takes much more energy to overcome covalent bonds and decompose water molecules into their component atoms.)

Molar heat of fusion (ΔH_{fusion}) – energy required to melt a mol of substance. It is **6.02 kJ/mol**.

Molar heat of vaporization ($\Delta H_{\text{vaporization}}$) – energy required to change 1 mol of liq to its vapor. It is **40.7 kJ/mol** at 100 degrees Celsius.

Vapor pressure – the pressure of the vapor present at equilibrium with its liquid.

- Rate of condensation equals rate of evaporation. A system at equilibrium with equal liquid and vapor balance each other out.
- Liquids with high vapor pressures are volatile (they evaporate rapidly/easily)
- Liquids with strong/large IMF's have low vapor pressures because the molecules need high energies to escape the vapor phase.
- **Boiling point- temp at which vapor pressure of the liquid is equal to the external pressure**
- **Increase in temp, increase in vapor pressure**