

Phase Diagrams, IMF's & Solids

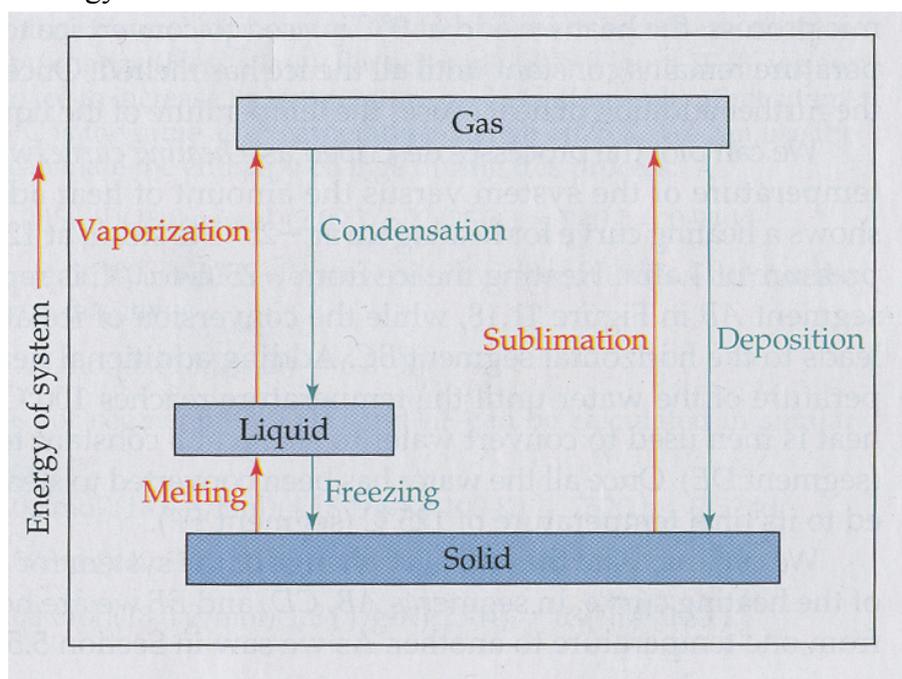
IMF's, Phase Diagrams and Solids

Practical Applications

- Intermolecular forces can be used to explain many of the unique properties of solids, liquids, and gases

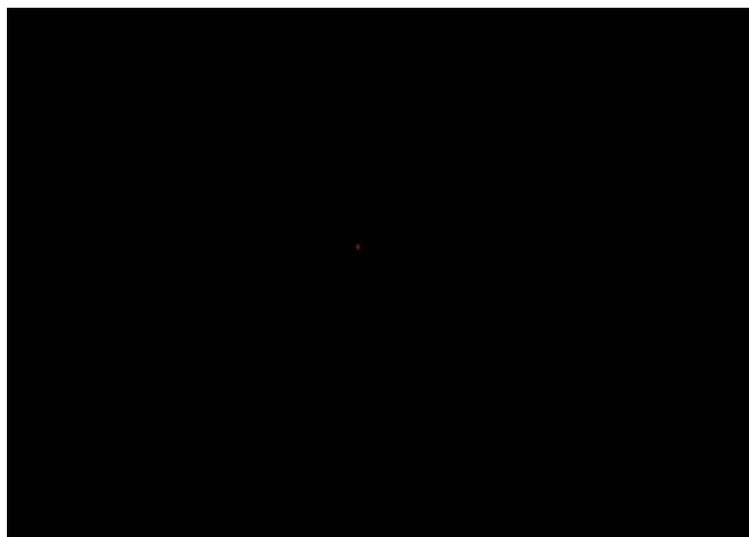
IMF's, Phase Diagrams and Solids

Terminology



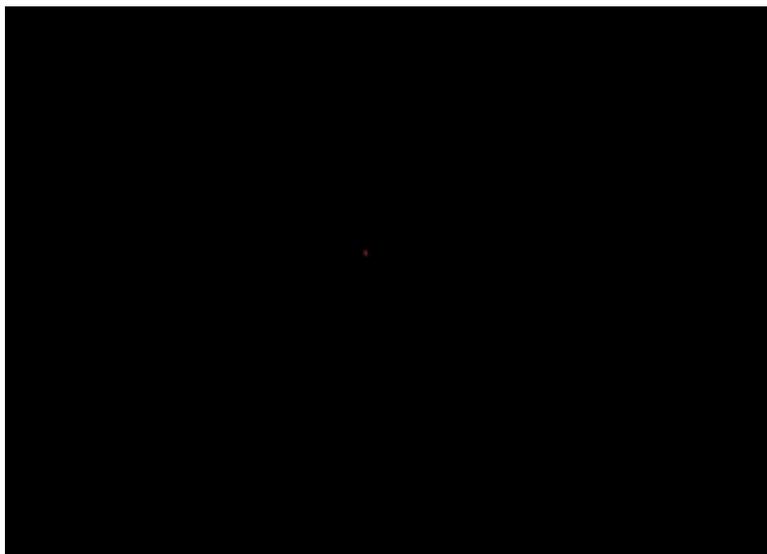
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A Visual Representation - Ice



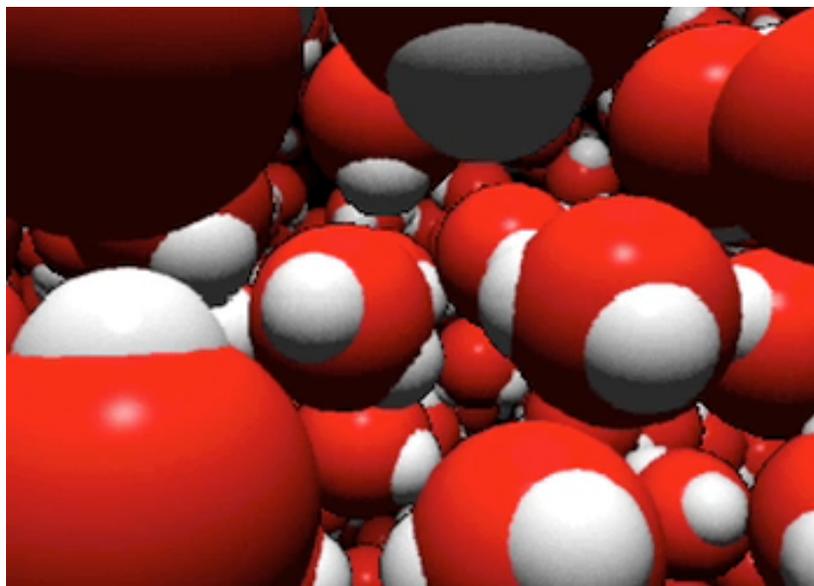
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A Visual Representation - Melting



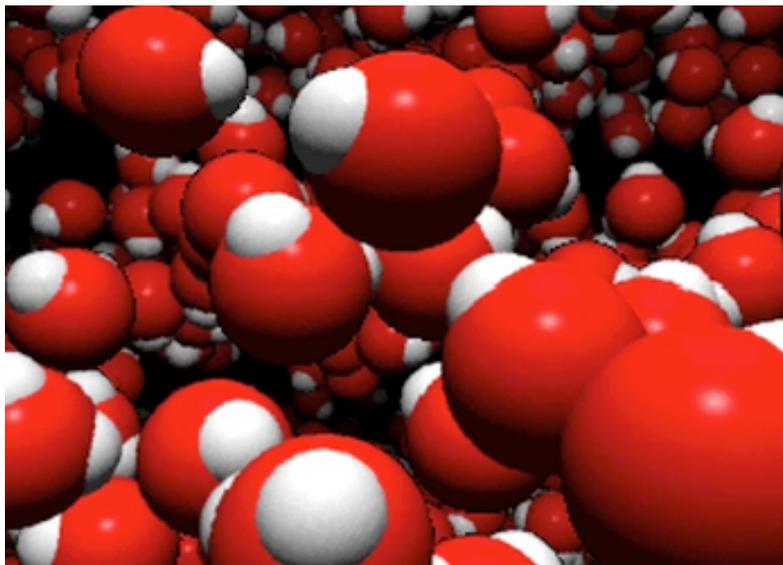
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A Visual Representation - Liquid Water



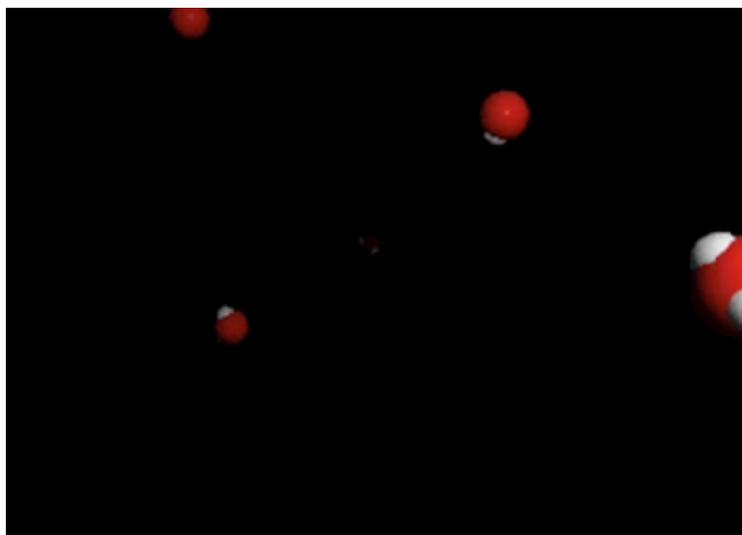
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A Visual Representation - Boiling



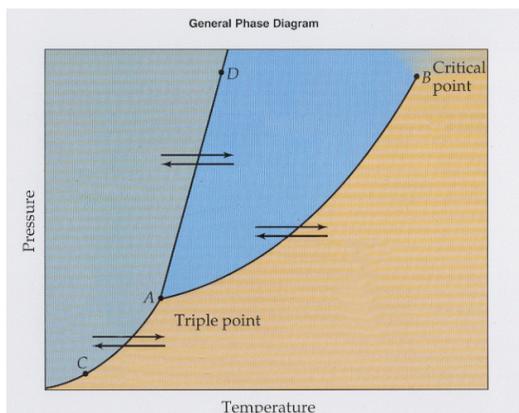
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A Visual Representation - Water Vapor



IMF's, Phase Diagrams and Solids

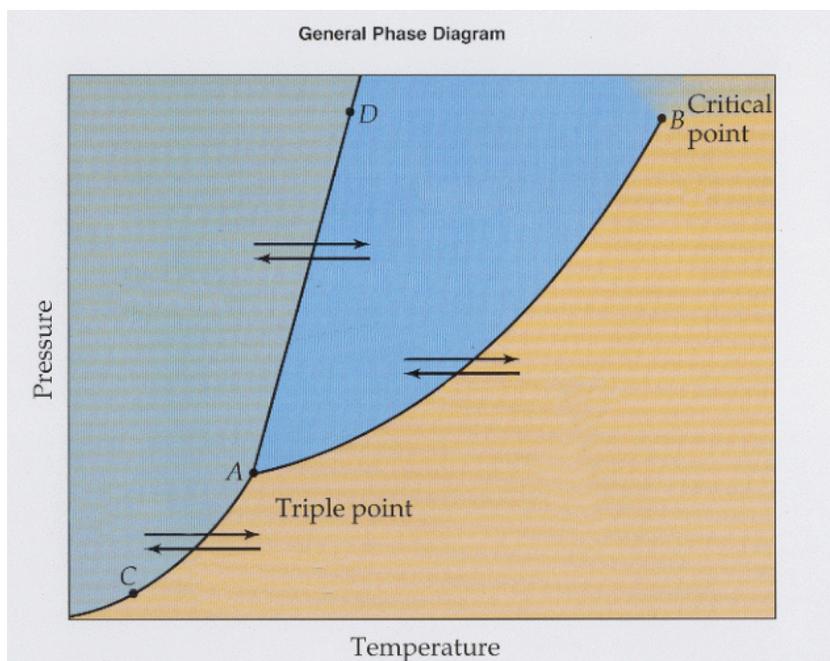
Phase Diagrams



- A phase diagram is a graphical way to represent the temperature and pressure conditions under which phase equilibria exist for a substance
- The lines represent the conditions at which the various phases can coexist at equilibrium

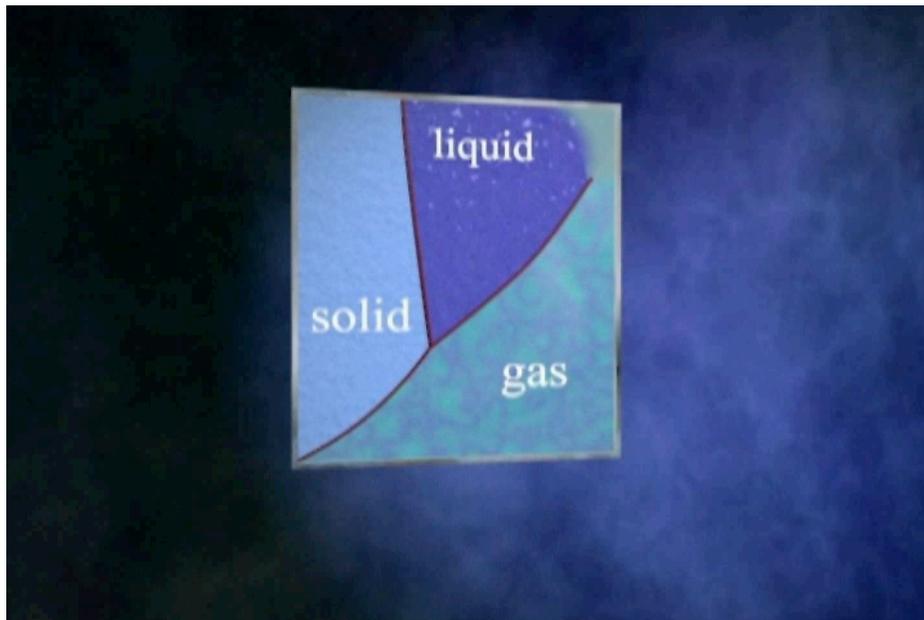
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Phase Diagrams



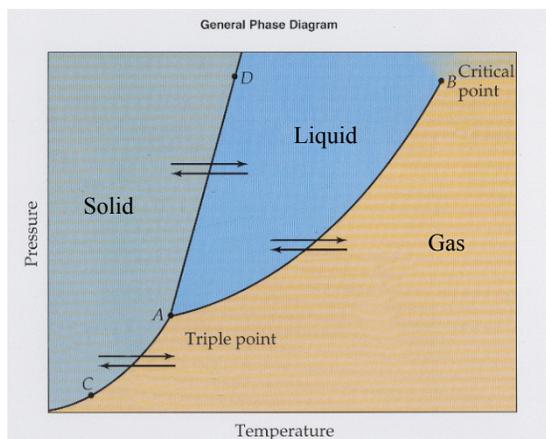
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Phase Diagrams



IMF's, Phase Diagrams and Solids

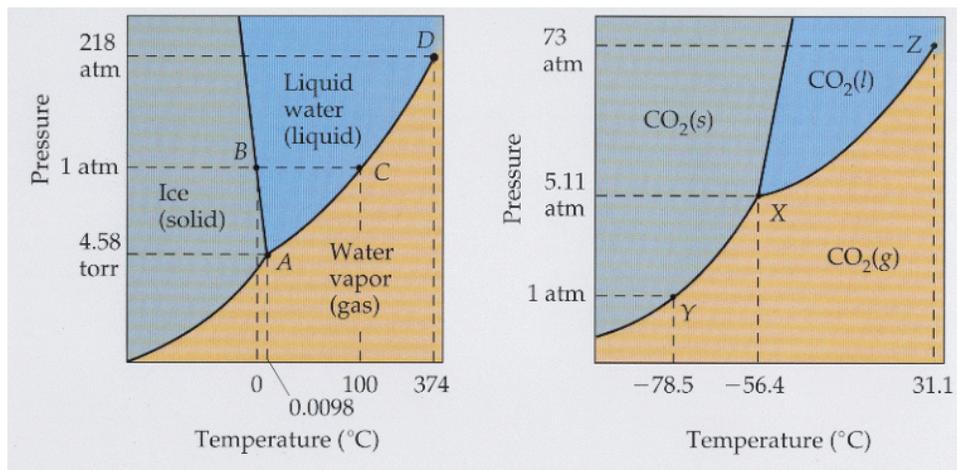
Phase Diagrams



- The critical point is the point beyond which the liquid and gas phase are indistinguishable
- The triple point is the temperature and pressure at which all three phases are in equilibrium

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Phase Diagrams



- Identify and explain the difference between these diagrams

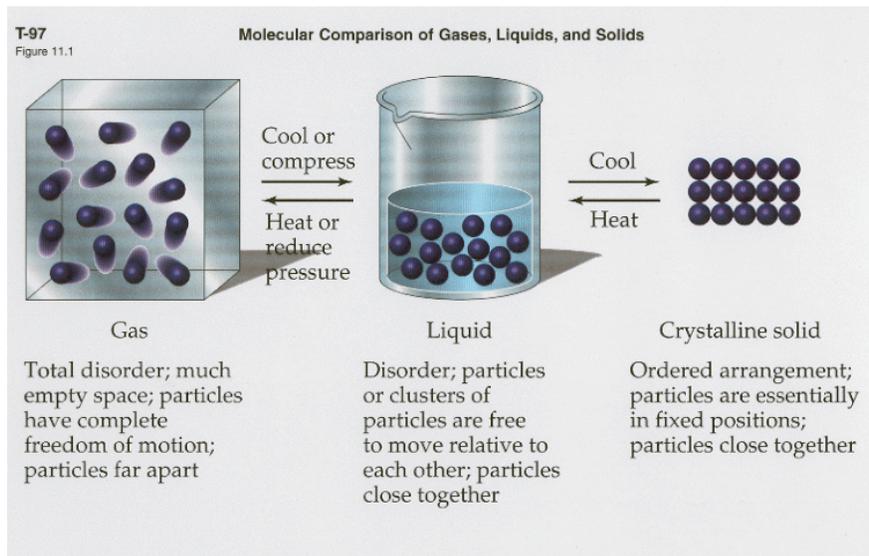
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Phase Characteristics

- Gases
 - Assume the volume and shape of container
 - Compressible
 - Rapidly diffuses
 - Readily flows
- Liquids
 - Assumes the shape of portion of container occupied by sample
 - Does not expand to fill container
 - Virtually incompressible
 - Diffusion occurs slowly
 - Readily flows
- Solids
 - Retains own shape and volume
 - Virtually incompressible
 - Diffusion occurs extremely slowly (if at all)
 - Does not flow

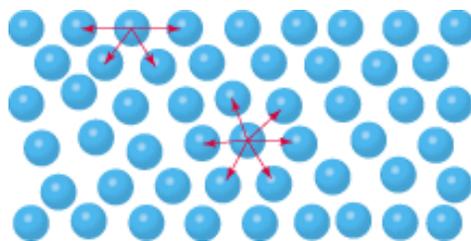
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Phases



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Practical Applications - Liquids



- Viscosity
 - The resistance of a liquid to flow
- Adhesive Forces
 - Intermolecular forces that bind a substance to another
 - Causes meniscus
- Cohesive Forces
 - Intermolecular forces that bind molecules to each other
 - Surface Tension

IMF's, Phase Diagrams and Solids

Practical Applications - Liquids

- Vapor Pressure
 - The pressure of the gas “supported” over a liquid
 - The vapor pressure of a gas is inversely related to the intermolecular forces within a liquid.
 - Higher intermolecular forces \Rightarrow
 - More energy needed to escape \Rightarrow
 - Lower vapor pressures \Rightarrow
 - Higher boiling point

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Practical Applications - Liquids

- Vapor Pressure
 - The pressure of the gas “supported” over a liquid
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 - Higher intermolecular forces \Rightarrow
 - More energy needed to escape \Rightarrow
 - Lower vapor pressures \Rightarrow
 - Higher boiling point
- Volatility
 - Liquids with high vapor pressures, which evaporate more readily, are said to be volatile
- Boiling Point
 - The point at which the vapor pressure of a liquid equals the pressure exerted externally on the liquid
 - The system does not reach equilibrium, but boils to dryness
 - Weaker IMF's = lower BP

IMF's, Phase Diagrams and Solids

Solids (12.1 & 12.2 - no more)

- Crystalline solids
 - Solids which have a well defined arrangement
 - Flat surfaces
 - Definite angles
 - Quartz & Diamond are examples
- Amorphous solids
 - No orderly structure
 - Lack well defined faces or angles
 - Rubber & Glass are examples

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Solids

- There are 4 types of crystalline solids
 - Molecular Solid
 - Covalent - Network Solid
 - Ionic Solid
 - Metallic Solid

IMF's, Phase Diagrams and Solids

Phase Diagrams

- 11.1 / 11.8 / 11.11 / 11.12 / 11.20 / 11.25 / 11.29 / 11.30 / 11.35 / 11.37 / 11.39 / 11.41 / 11.51 / 11.53 / 11.54 / 11.60 / 11.63 / 11.65