Ch. 12 - Liquids & Solids

III. Changes of State

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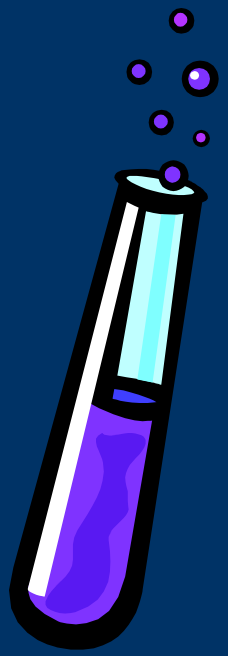
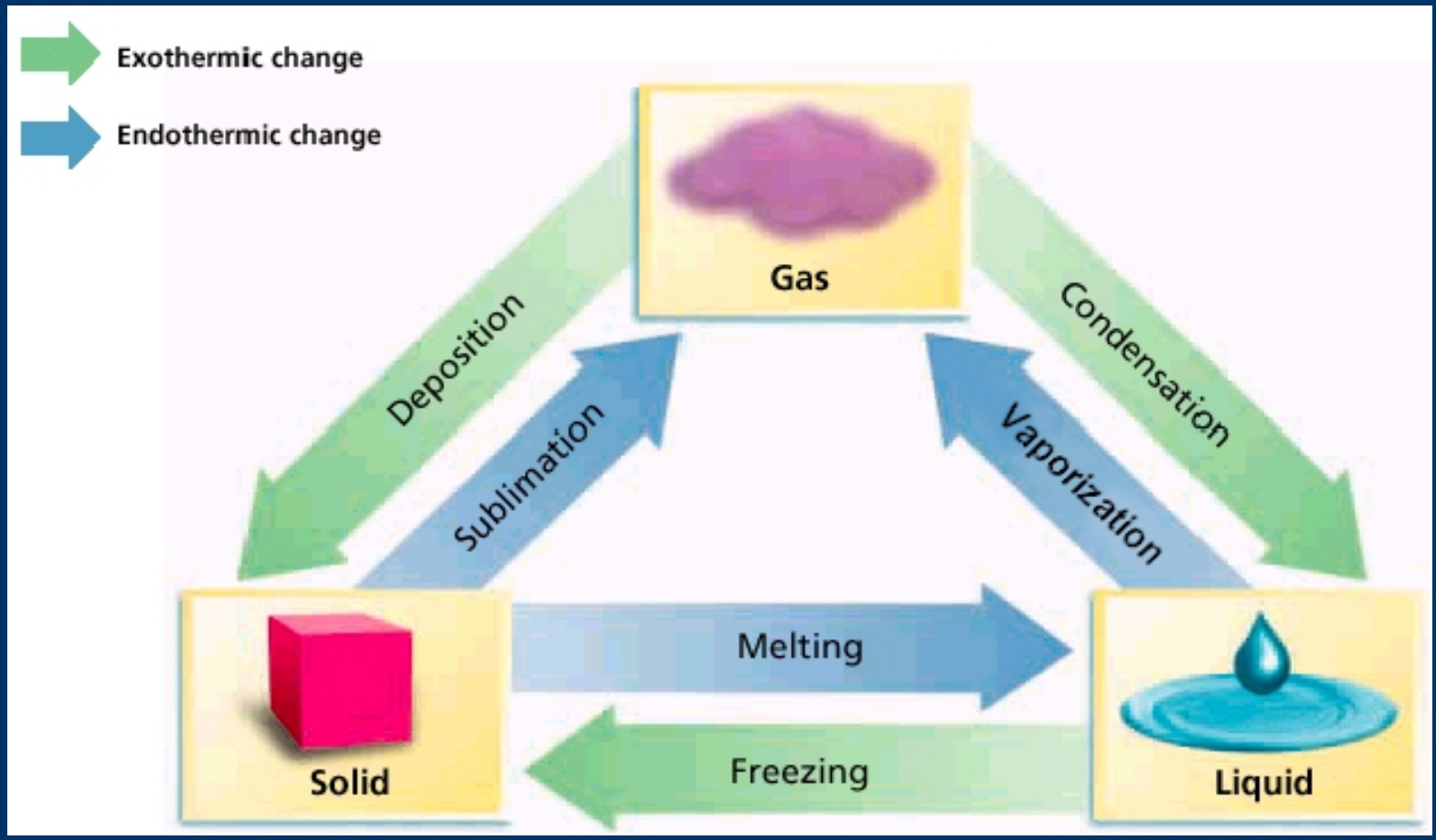


A. Phase Changes

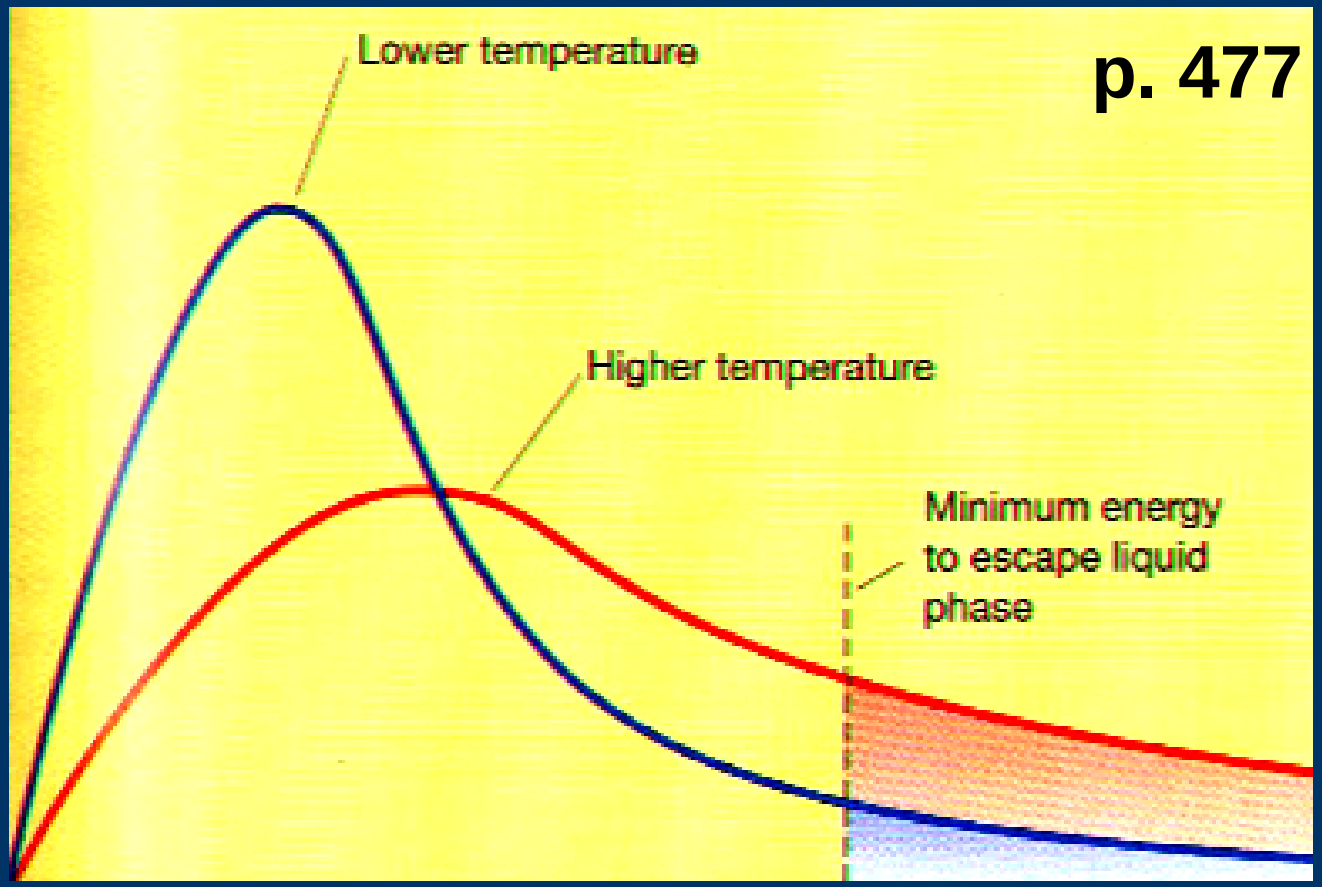


A. Phase Changes

- **Evaporation**
  - molecules at the surface gain enough energy to overcome IMF
- **Volatility**
  - measure of evaporation rate
  - depends on temp & IMF

A. Phase Changes

Boltzmann Distribution



# of Particles

Kinetic Energy

temp

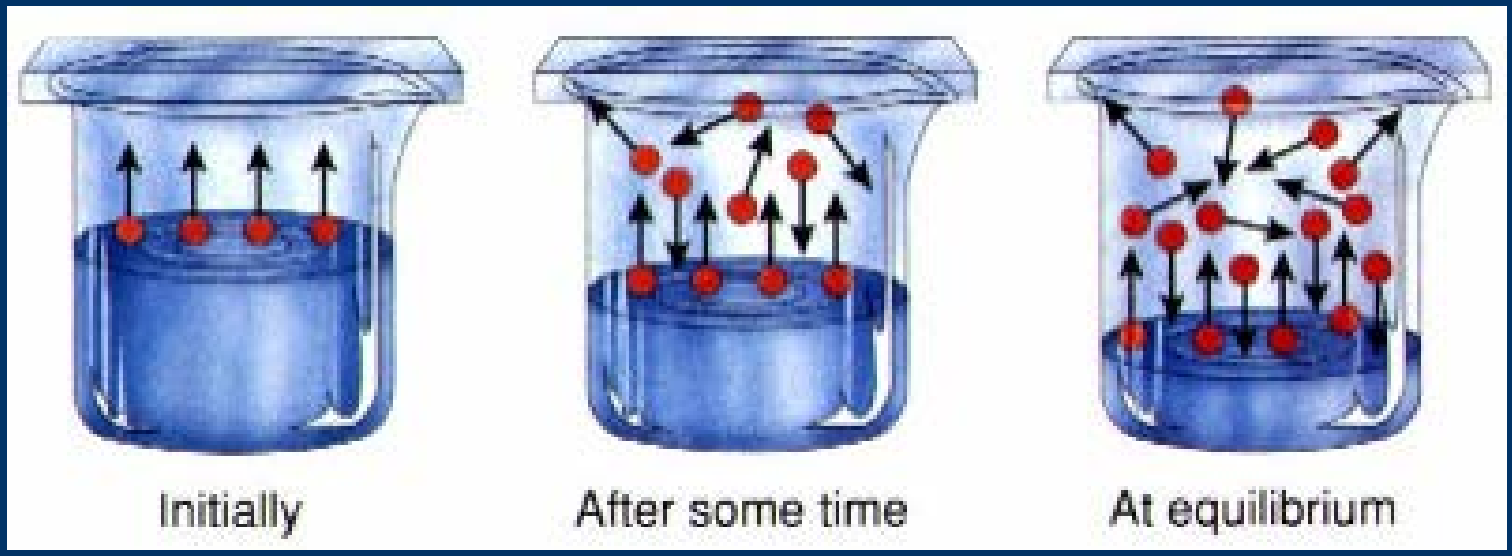
volatility

IMF

volatility

A. Phase Changes

- **Dynamic Equilibrium**
  - trapped molecules reach a balance between evaporation & condensation



A. Phase Changes

- **Vapor Pressure**
  - pressure of vapor above a liquid at equilibrium
  - depends on temp & IMF
  - directly related to volatility

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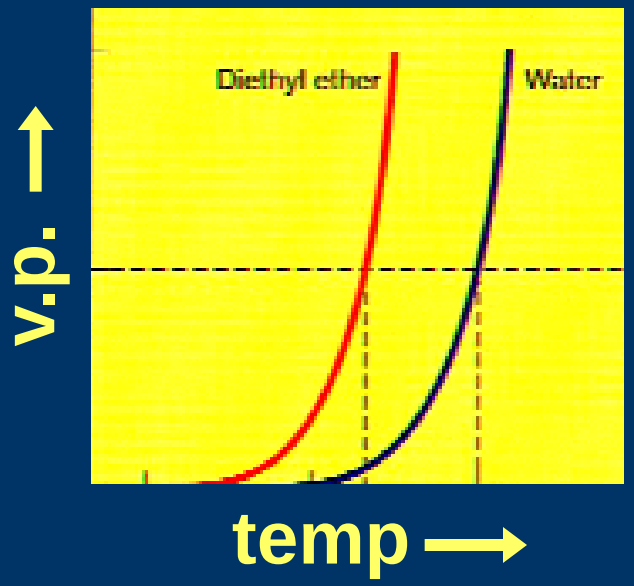
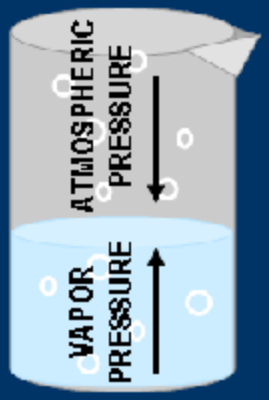


↑ temp ↑ v.p.

↑ IMF ↓ v.p.

A. Phase Changes

- **Boiling Point**
  - temp at which v.p. of liquid equals external pressure
  - depends on P_{atm} & IMF
  - <u>Normal B.P.</u> - b.p. at 1 atm



↑ P_{atm} ↑ b.p.

↑ IMF ↑ b.p.

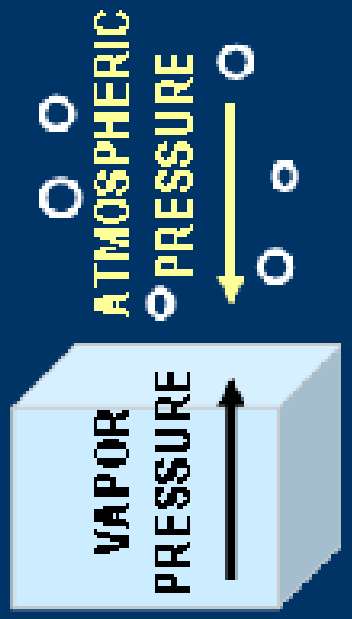
A. Phase Changes

- **Melting Point**
  - equal to freezing point

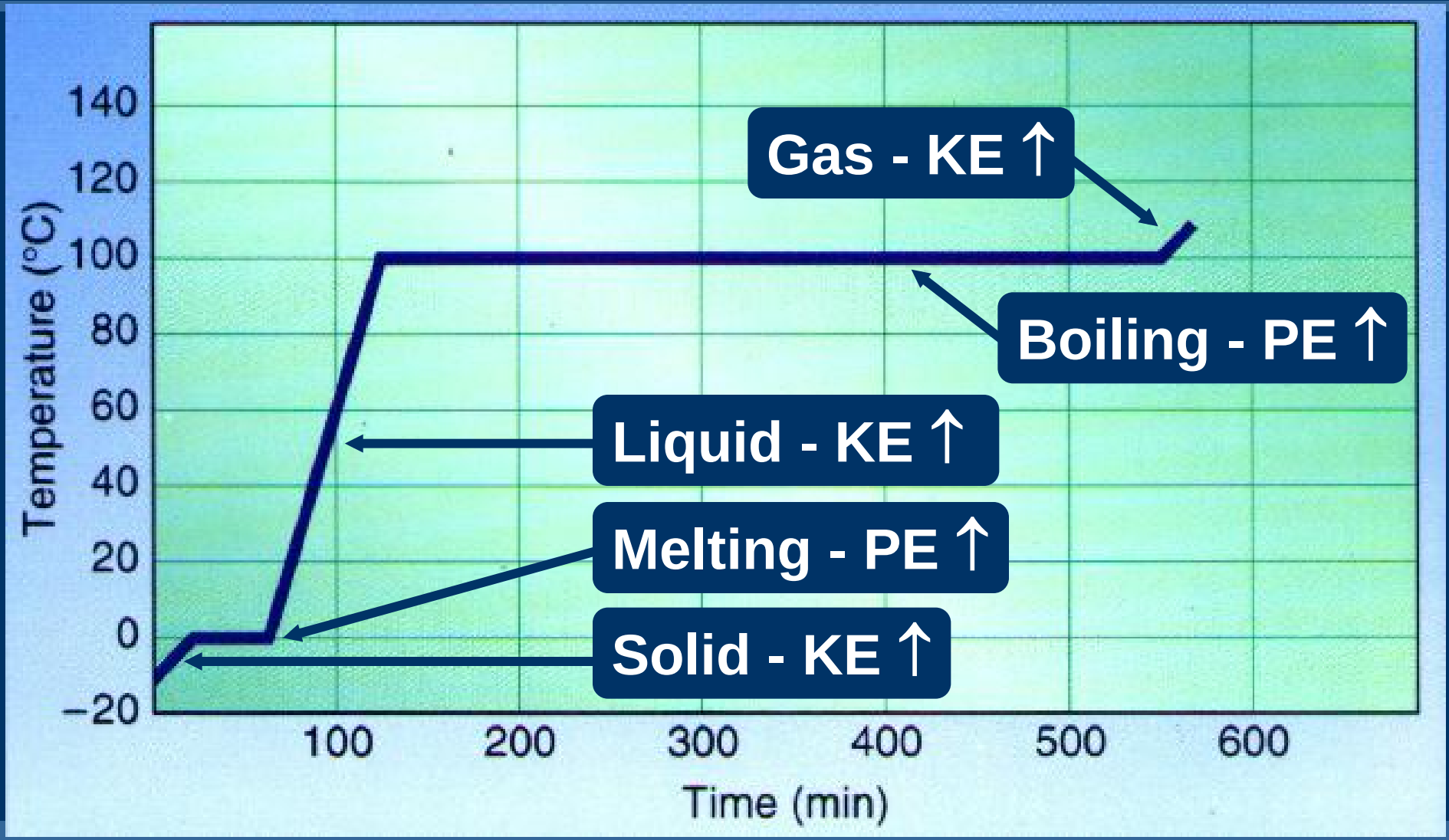
- Which has a higher m.p.?
  - polar or nonpolar? polar
  - covalent or ionic? ionic

A. Phase Changes

- **Sublimation**
  - solid → gas
  - v.p. of solid equals external pressure
- EX: dry ice, mothballs, solid air fresheners



B. Heating Curves



B. Heating Curves

- **Temperature Change**
  - change in KE (molecular motion)
  - depends on heat capacity
- **Heat Capacity**
  - energy required to raise the temp of 1 gram of a substance by 1°C
  - “Volcano” clip - water has a very high heat capacity

B. Heating Curves

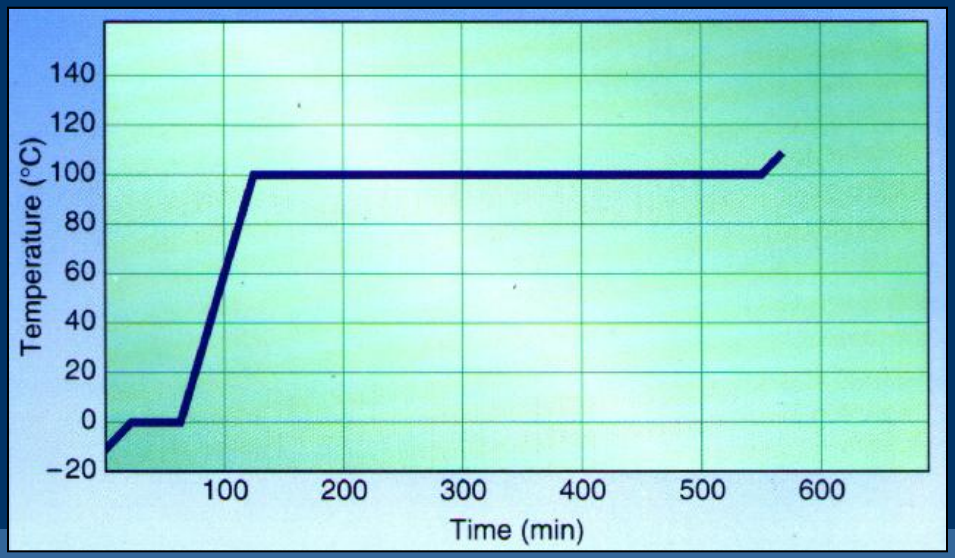
- **Phase Change**
  - change in PE (molecular arrangement)
  - temp remains constant

- **Heat of Fusion** (ΔH_{fus})
  - energy required to melt 1 gram of a substance at its m.p.

B. Heating Curves

- **Heat of Vaporization** (ΔH_{vap})
  - energy required to boil 1 gram of a substance at its b.p.
  - usually larger than ΔH_{fus}…why?

- EX: sweating, steam burns, the drinking bird



C. Phase Diagrams

- Show the phases of a substance at different temps and pressures.