January 23, 2002

- **Weekly Review/Problem Session**
  - The votes are in:
  - *Monday, 3 - 4 pm,* room TBA
- **Problem Set #1 solutions** will be online tomorrow
- **Quiz #1: Friday**
- **Demo today!**

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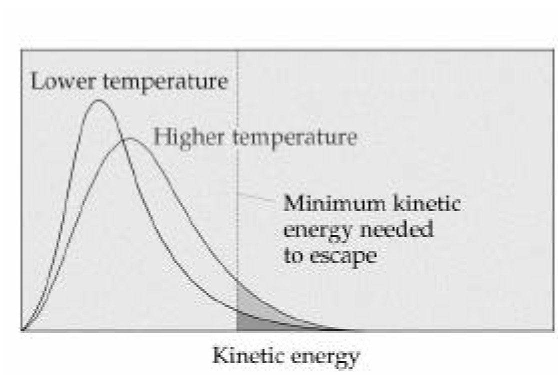
Vapor Pressure is Temperature Dependent

- Fraction of molecules with sufficient K.E. to escape surface *increases with temperature:*



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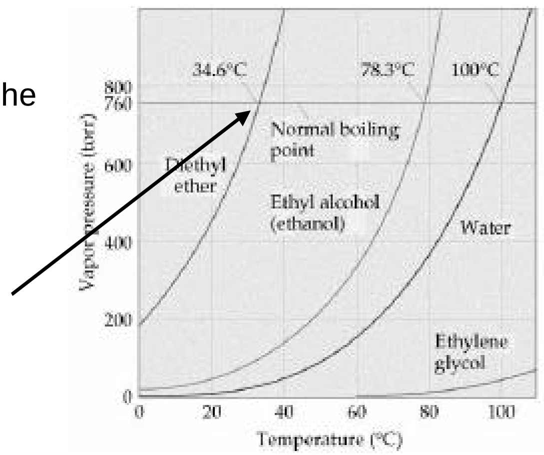
Temp Dependence of VP

- We define the ***boiling point*** as the *temperature at which:*

  VP = P_{ext}

- At P_{ext} = 1 atm, this is called the ***Normal BP***



Clausius-Clapeyron Equation

- The relationship between VP and temperature can be quantified by the equation:

$$\text{Ln } P = (-\Delta H_{vap}/RT) + C$$

- Thus, a plot of *Ln P versus 1/T* will be a straight line with a slope = $-\Delta H_{vap}/R$

-convenient way to: determine value of ΔH_{vap}
determine VP at any temp T

Solutions

Chem 36

Spring 2002

What is a Solution?

➢ Definition:

"A <u>homogeneous</u> mixture of a *solute* distributed through a *solvent*."

Examples:

- **Air** (gas/gas)
- **Soft Drink** (gas/liquid)
- **Vodka** (liquid/liquid)
- **Ocean Water** (solid/liquid)
- **Metal Alloy** (solid/solid)
- **Hg Amalgam** (liquid/solid)

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Liquid Solvent Solution Concentrations

Focus on # *moles solute (n):*

1) Mole Fraction (χ)

$$\chi = \frac{\text{mol solute}}{\text{total mol}}$$

→ Need to know complete solution composition

NOTE: $n_{total} = n_1 + n_2 + \ldots n_i$

and $1 = \chi_1 + \chi_2 + \ldots \chi_i$

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More Concentrations

2) Molarity (M)

$$M = \frac{\text{mol solute}}{\text{liters sol'n}}$$

→ *Total volume* of solution

- Most commonly used concentration unit

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Yet *another* concentration definition . . .

3) Molality (*m*)

$$m = \frac{\text{mol solute}}{\text{kg solvent}}$$

kg solvent → ***Mass*** of **solvent** (not solution!)

- Why/when use molality instead of molarity?
  - ✓ *Volume* is temperature dependent
  - ✓ *Mass* is temperature *in*dependent

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Molality versus Molarity

- For a *dilute, aqueous solution:*

1 liter sol'n ≈ 1 kg solvent

(so, molarity ≈ molality)

- What happens at higher solute levels?

$$\frac{\text{mol solute}}{\text{L sol'n}} \quad \textit{versus} \quad \frac{\text{mol solute}}{\text{kg solvent}}$$

kg solvent → unchanged

Molarity	<	Molality

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Characterizing Solubility

- How much *solute* can be dissolved in a liquid **solvent**?

Three Cases:

1) *Un*saturated Solution (all solute dissolved)

2) Saturated Solution (some undissolved solute)
(*equilibrium* between solid and dissolved solid)

3) **Super**saturated Solution
(all solute dissolved . . . *unstable!*)

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