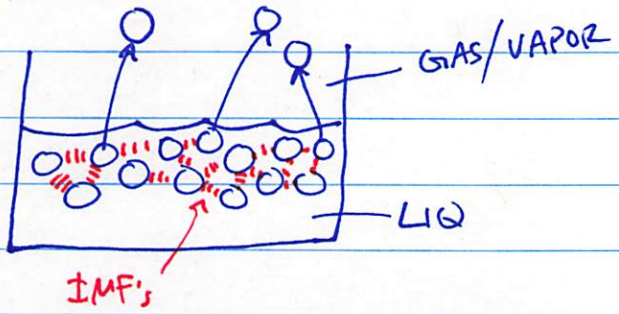
11.5 Vaporization + Vapor Pressure (vp)



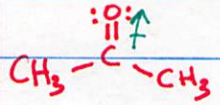
- molecules in liq v const motion!
- @ surface, can break free + form vapor.
  ↳ break IMFs!
- ENDOTHERMIC!
  ↑ liq has to absorb heat energy to break IMF.
- feels cold.

1/23/2014

rate of vaporization $\propto$ T
$\propto$ surface area
$\propto$ 1 / IMF strength.

Can measure ΔH for 1 mol liq → gas: ΔH_{vap}

@25°C $H_2O(l) \rightarrow H_2O(g)$; $\Delta H_{vap} = +44.0\ kJ/mol$

LDF, d-d
acetone →

$C_3H_6O(l) \rightarrow C_3H_6O(g)$; $\Delta H_{vap} = +31.0\ kJ/mol$

"lighter fluid" LDF $C_5H_{12}(l) \rightarrow C_5H_{12}(g)$; $\Delta H_{vap} = +26.4\ kJ/mol$
pentane

Q: Estimate how much heat we lose when 5.0 g of "sweat" (H_2O) evaporates. $\Delta H_{vap}(H_2O) = +44.0\ kJ/mol$ (25°C)

$$44.0\ kJ + H_2O(l) \longrightarrow H_2O(g)$$

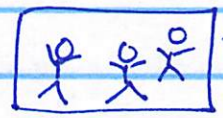
$$5.0\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} \times \frac{44.0\ kJ}{1\ mol\ H_2O} = 12.2\ kJ$$

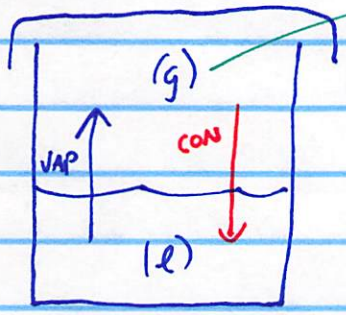
↳ heat gained by H_2O, or heat lost by us.

Vapor pressure + dynamic equilibrium (eq^m)

(vp)

Static eq^m (no motion: )

dynamic eq^m 

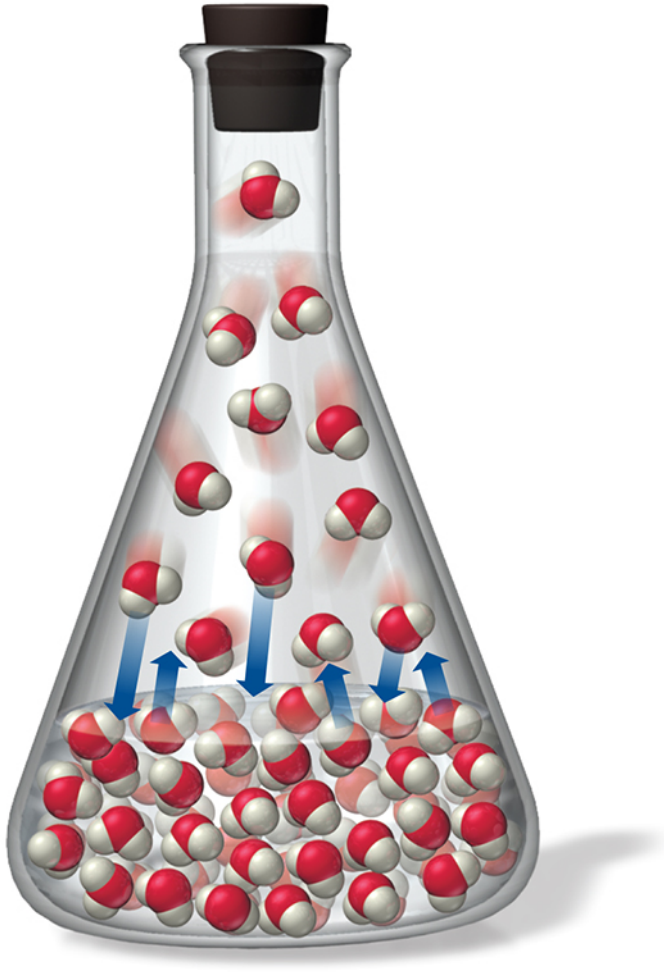


P = V.P. of liquid (@ temp T)

dynamic eq^m

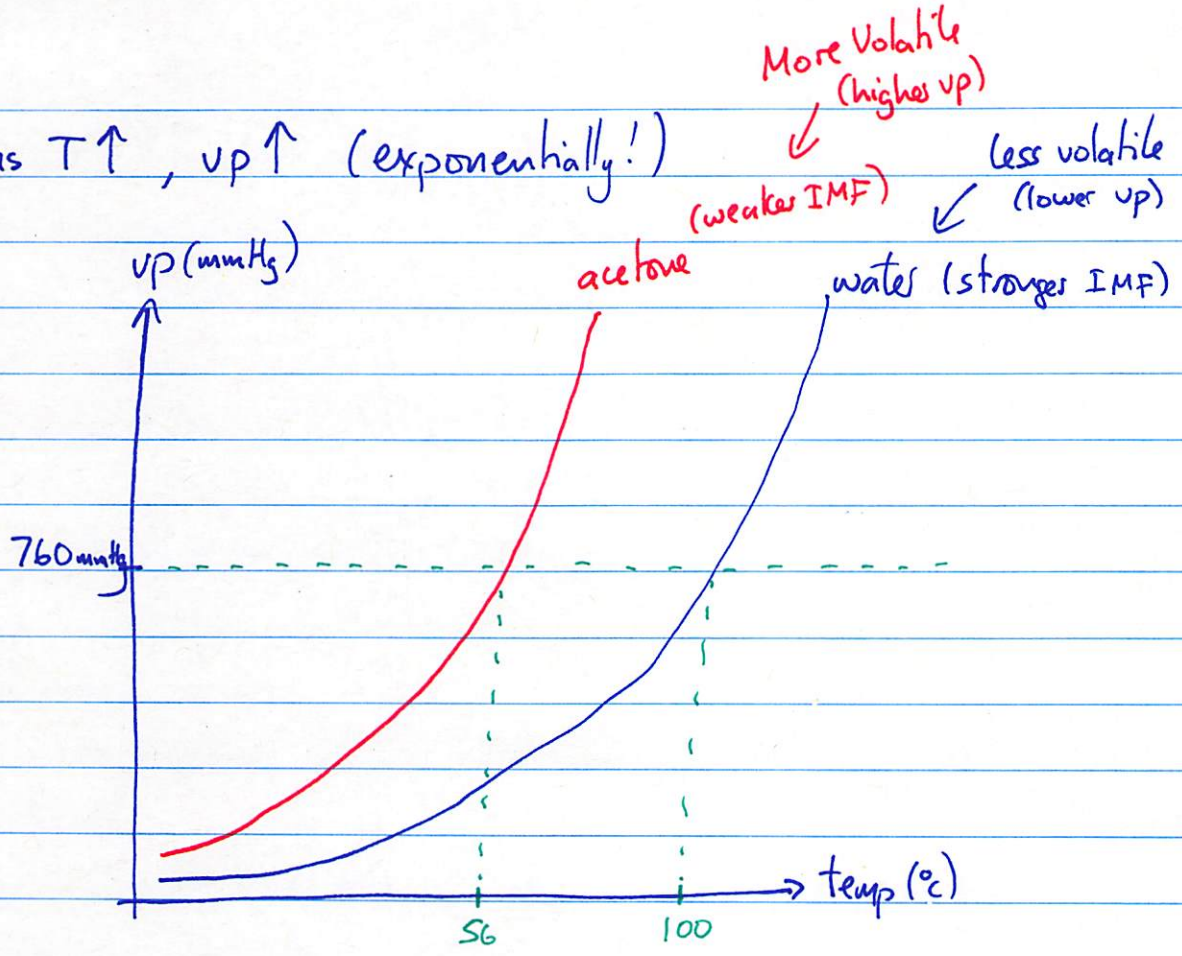
↳ rate of vaporization = rate of condensation @ eq^m

Dynamic equilibrium:
Rate of evaporation =
rate of condensation



(c)

as T↑, vp↑ (exponentially!)



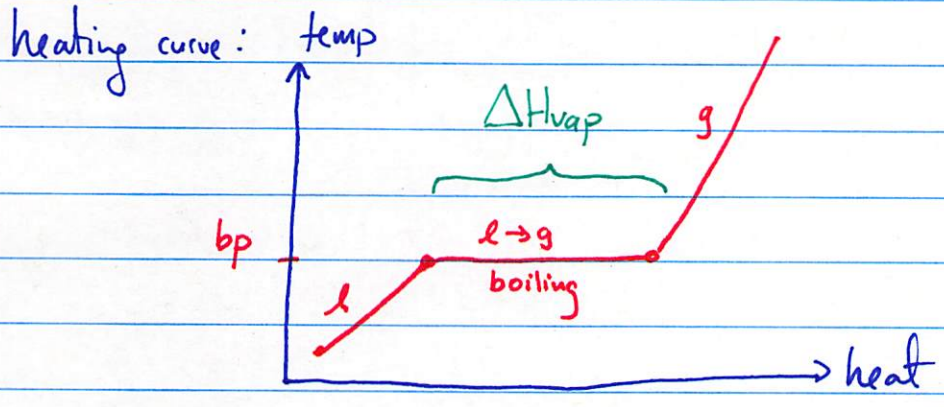
When vp = external/atmospheric pressure, we get BOILING!

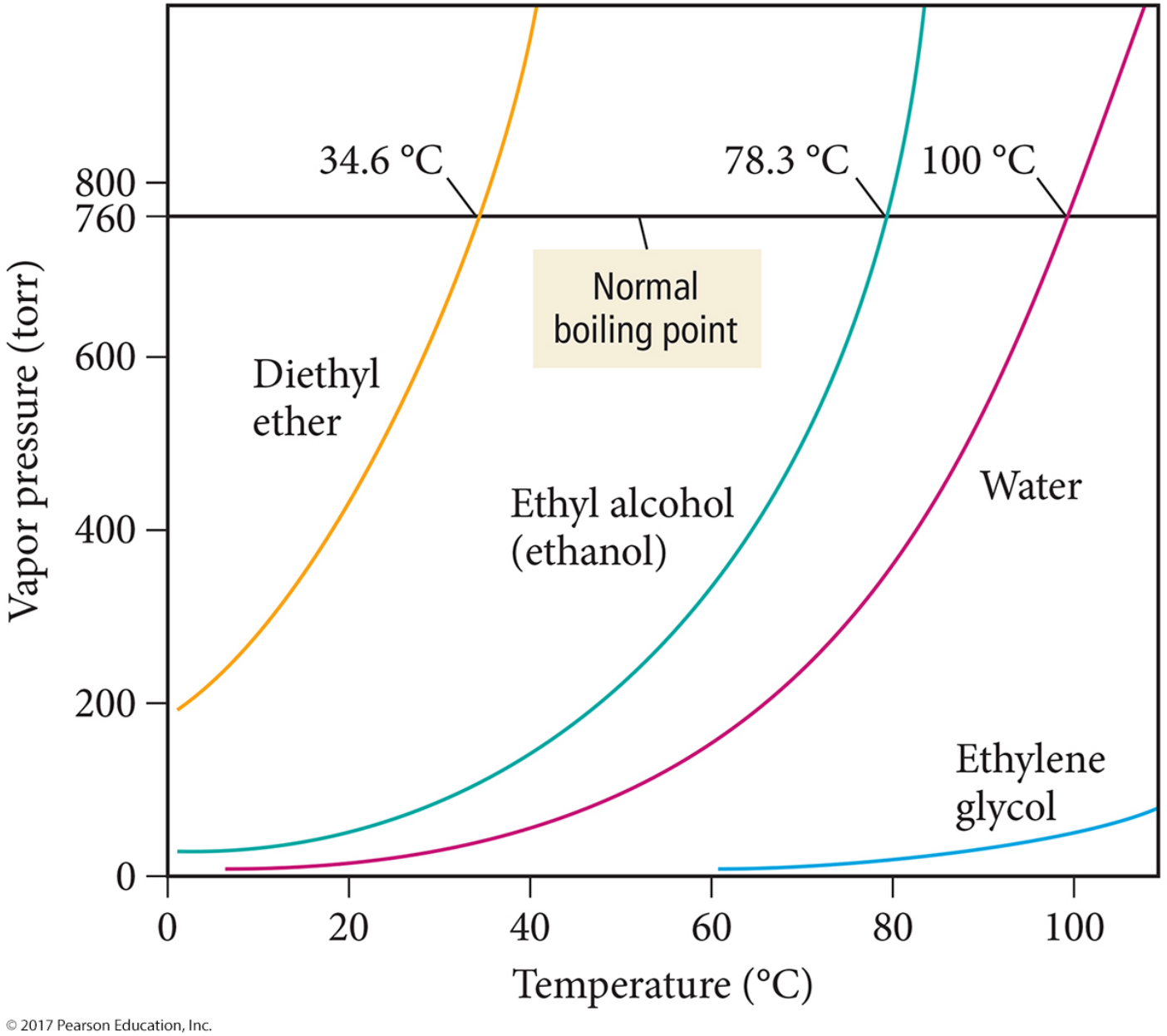
Normal bp = nbp = bp temp when P_{AIR} = 1 atm = 760 mmHg = 101,325 Pa

Denver, CO , $P_{air} \approx 0.83$ atm , b.p. of water : 94°C

1 mile elevation

heating curve : temp

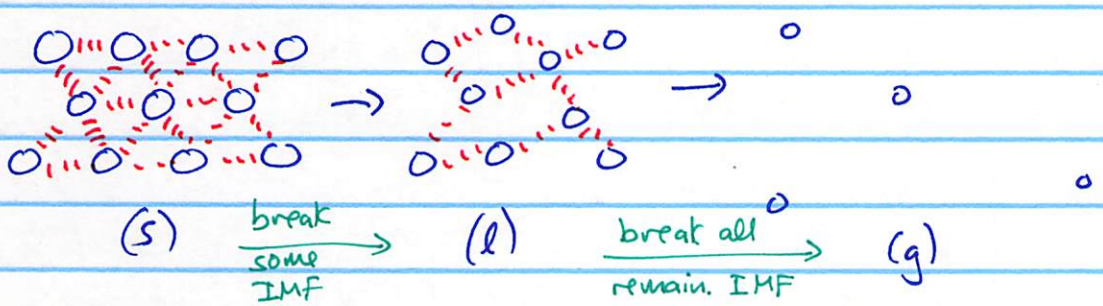




Fusion (melting)

$s \rightarrow l$; ΔH_{fus}, endothermic (ΔH = +ve) ← positive

- have to break some IMF



in general: $\Delta H_{fus} < \Delta H_{vap}$

H_2O: $\Delta H_{fus} = +6.01$ kJ/mol

$\Delta H_{vap} = +40.71$ kJ/mol

1/25/2019

Heating curve: