

General Chemistry with Doc M8

Monday / 11/30/15

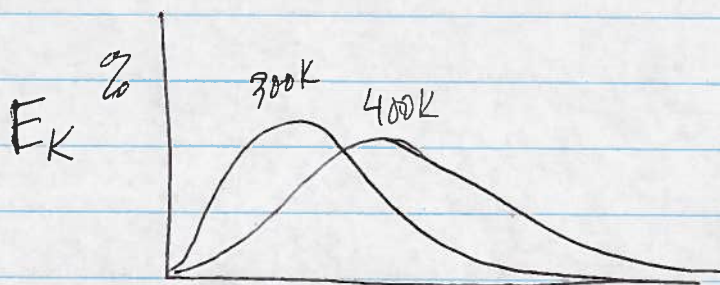
Today: 11.1-11.3

Finish Chp 10 problems

Tuesday: Labs due at end of lab period
Online stuff "

Wednesday: 11.4, 11.6, 11.7

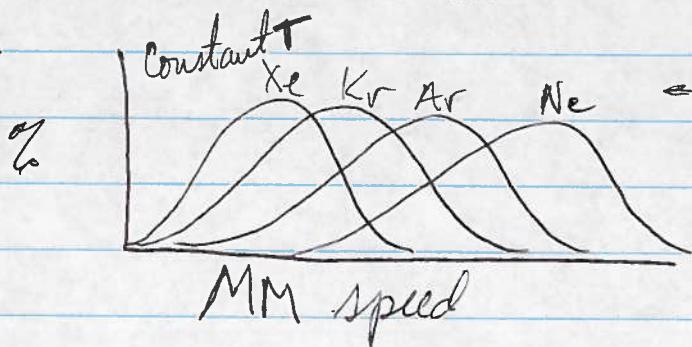
Friday: 11.8-11.9



$$E_K \propto T$$

where

$$E_K = \frac{3RT}{2N_A}$$



← all have same E_K

$$\text{speed} = u = \sqrt{\frac{3RT}{M}}$$

kg/mol molar mass

$$u = \sqrt{\frac{3 \times 8.314 \text{ J} \cdot 294 \text{ K}}{\text{mol} \cdot .044 \text{ kg}}}$$

$$1 \text{ J} = 1 \text{ kg} \cdot \text{m}^2 / \text{s}^2$$

$$u = \sqrt{\frac{3 \times 8.314 \frac{\text{kg} \cdot \text{m}^2}{\text{s}^2} \cdot 294}{.044 \text{ kg}}} = \sqrt{\frac{\text{m}^2}{\text{s}^2}} = \frac{\text{m}}{\text{s}}$$

Graham's Law

$$\frac{u_{\text{fast}}}{u_{\text{slow}}} = \sqrt{\frac{MM_{\text{heavy}}}{MM_{\text{light}}}}$$

$$\frac{u_{\text{NH}_3}}{u_{\text{N}_2}} = \sqrt{\frac{28}{17}} = 1.28$$

NH₃ is 128% of the speed of N₂

NH₃ is 1.28 times faster than N₂

Chp 11

Viscosity

direct results of intermolecular forces

Surface Tension

H₂O .00100 N s/m²

7.29 x 10⁻² J/m²

(C₅H₁₂) pentane

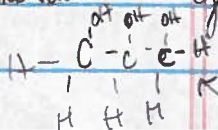
.00024

1.61 x 10⁻²

effectively nonpolar

"ake tears" glycerol 1.49

6.34 x 10⁻²

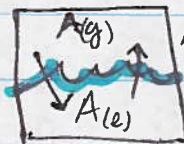


← stronger H bond

$l \rightarrow g$	vaporization	$\Delta H > 0$ endothermic	$\Delta S > 0$ entropy favored
$g \rightarrow l$	condensation	$\Delta H < 0$ exothermic	$\Delta S < 0$ entropy not favored
$s \rightarrow l$	fusion		
$l \rightarrow s$	freezing		
$s \rightarrow g$	sublimation		
$g \rightarrow s$	deposition		

$$\Delta G = \Delta H - T\Delta S$$

at eq, $\Delta G = 0$



rates are equal at equilibrium

$$0 = \Delta H - T\Delta S$$

$$\Delta H = T\Delta S \Rightarrow T = \frac{\Delta H}{\Delta S}$$

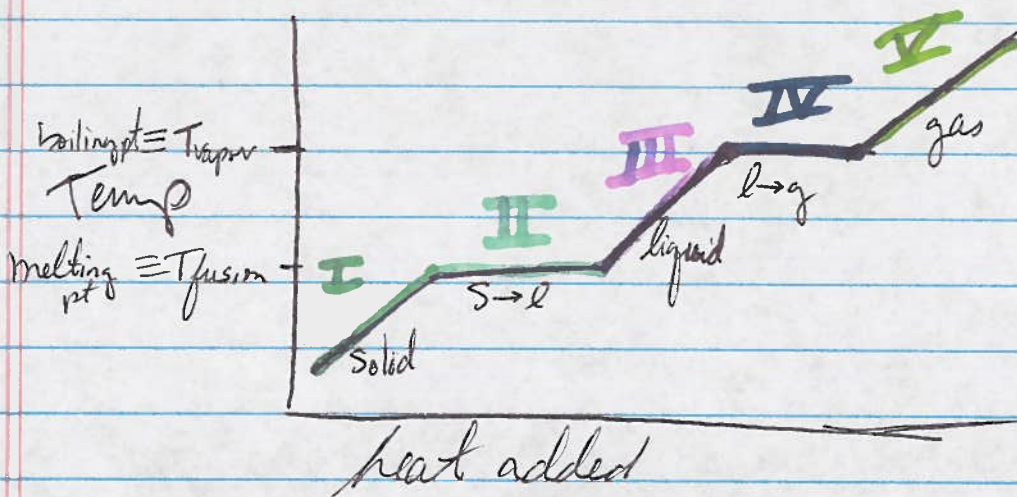
$$q_{cat} = S_{H_{sol'n}} * m_{sol'n} * \Delta T_{sol'n}$$

$$= \left(\frac{J}{g \cdot deg} \right) (g) (deg)$$

$$q_{cat} = C_m * n * (deg)$$

molar heat capacity

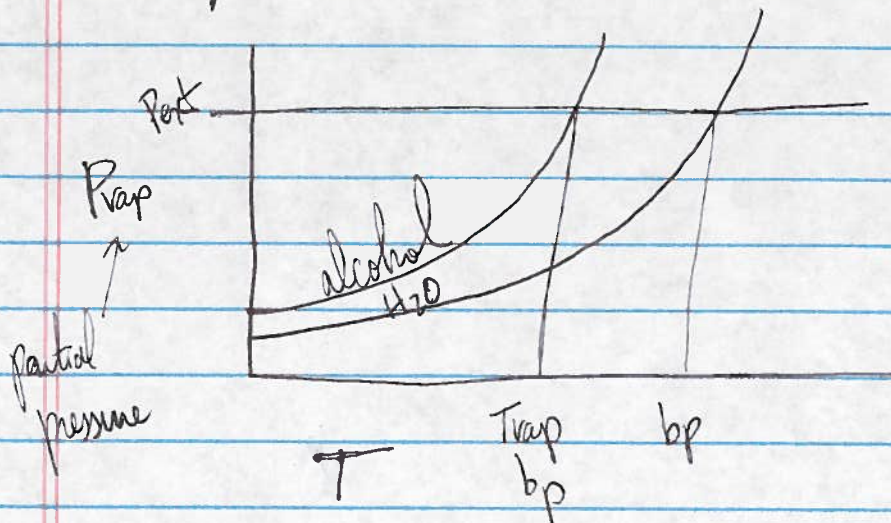
$$= \left(\frac{J}{mol \cdot deg} \right) (mol) (deg) = J$$



I $q_{cal} = C_{ice} * \text{Moles water} * \Delta T = 36.7 J$

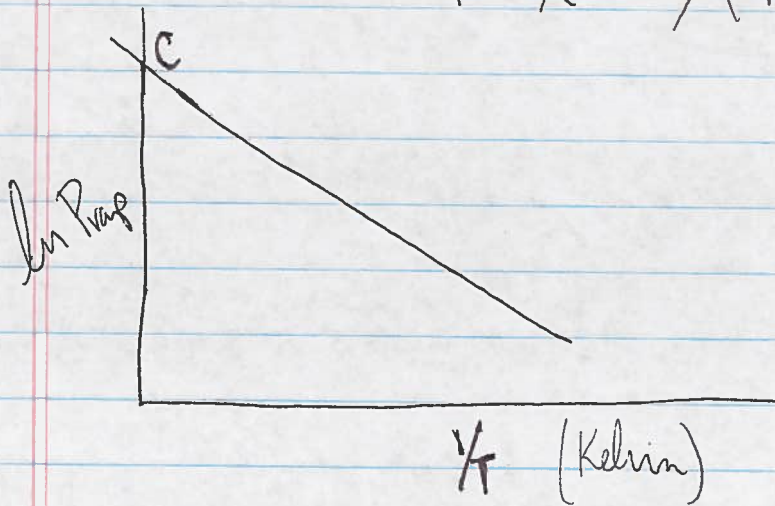
II $q = \Delta H_{fusion} * N = \frac{6.01 kJ}{mol H_2O} * N_{H_2O}$

Vapor Pressure



$$y = mx + b$$

$$\ln P_{\text{vap}} = \left(\frac{-\Delta H_{\text{vap}}}{R} \right) \left(\frac{1}{T} \right) + C$$



Clausius - Clapeyron Eqn

$$\ln \left(\frac{P_1}{P_2} \right) = \frac{\Delta H_{\text{vap}}}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$R = 8.314 \text{ J/molK}$$

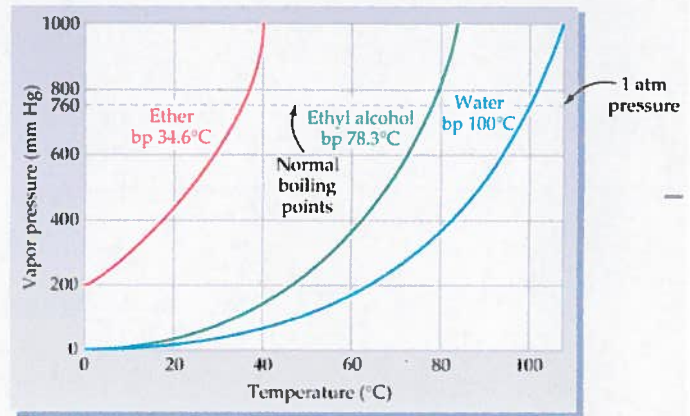
Folder Activity Chapter 11 Number 1

30 November 2015

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Chm 203 Student number: TA

- Which liquid ...
 - ... has the highest vapor pressure at any temperature? *Ether*
 - ... has the highest boiling point? *Water*
 - ... has the strongest intermolecular forces? *Water*
 - ... would evaporate the fastest in an open container? *Ether*

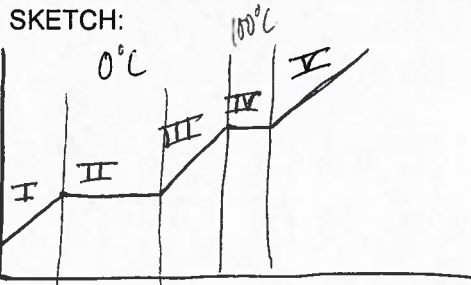


- Estimate the boiling point of water if the external pressure is 400 mmHg? $\approx 83^\circ\text{C}$

- At what temperature at 1 atm one substance entirely a gas and the other two are still liquids? *Temp is above 34.6°C and below 78.3°C*

- Sketch a heating curve for water (see notes). Label the regions I, II, III, IV, and V like we did in class. Which value would you need for each region? (Values given are for water.) = 6.01 kJ/mol

- | | |
|---------------------|--|
| <u>C</u> Region I | A $\Delta H_{\text{fus}} = 6.01 \text{ kJ/mol}$ |
| <u>A</u> Region II | B $\Delta H_{\text{vap}} = 40.67 \text{ kJ/mol}$ |
| <u>D</u> Region III | C $C_{m, \text{H}_2\text{O}(s)} = 36.7 \text{ J/mol deg}$ |
| <u>B</u> Region IV | D $C_{m, \text{H}_2\text{O}(l)} = 75.4 \text{ J/mol deg}$ |
| <u>E</u> Region V | E $C_{m, \text{H}_2\text{O}(g)} = 33.6 \text{ J/mol deg}$ |



- What regions from the picture in Question 4 (I, II, III, IV, V) would you need to calculate the heat transferred when H_2O is...

- Raised in temperature from -10°C to $+50^\circ\text{C}$
- Lowered in temperature from 90°C to 50°C
- Lowered in temperature from 10°C to -30°C
- Raised in temperature from -10°C to $+110^\circ\text{C}$
- Raised in temperature from -10°C to -5°C

- Circle the regions: I II III IV V
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- Which of the above situations (in Question 5) is exothermic? A B C D E

- How much heat is required to warm ice at -25°C to water vapor at 120°C ? *with 52g ice* $\frac{1 \text{ mol H}_2\text{O}}{18 \text{ g H}_2\text{O}} = 2.89 \text{ mol}$
- $25^\circ\text{C} \rightarrow 0^\circ\text{C}$ $C_{\text{ice}} \times \text{mol} \times \Delta T = 36.7 \text{ J/mol deg} \times 2.89 \text{ mol} \times 25 = 2,652 \text{ J} = 2.652 \text{ kJ}$
 $\Delta H_{\text{fus}} \times \text{mol} = 6.01 \text{ kJ/mol} \times 2.89 \text{ mol} = 17.37 \text{ kJ}$
 $0 \rightarrow 100^\circ\text{C} = 75.4 \text{ J/mol deg} \times 2.89 \text{ mol} \times 100 = 21,790 \text{ J} = 21.790 \text{ kJ}$
 $\Delta H_{\text{vap}} \times \text{mol} = 40.67 \text{ kJ/mol} \times 2.89 \text{ mol} = 13.5 \text{ kJ}$
 $33.6 \text{ J/mol deg} \times 2.89 \text{ mol} \times 20 = 1,942 \text{ J} = 1.942 \text{ kJ}$
 $2.652 + 17.37 + 21.79 + 13.5 + 1.942 = 57.254 \text{ kJ}$

- Use the Clausius-Clapyron equation (page 419) to estimate ΔH_{vap} for bromine, given that bromine has a vapor pressure of 400 mmHg at 41.0°C and a normal boiling point of 331.9 mmHg.

$$\ln(P_{\text{vap}}) = -\frac{\Delta H_{\text{vap}}}{R} \left(\frac{1}{T}\right) + C$$

Wrong info \Rightarrow practice problem
115