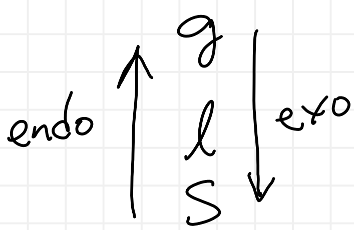
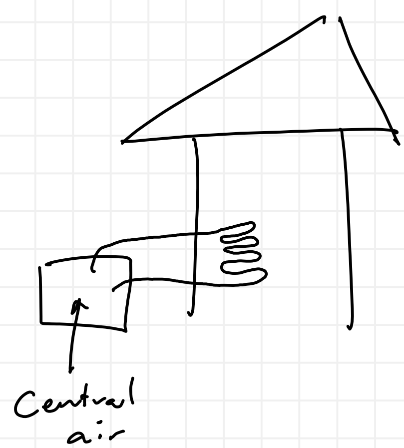
Chem 1062

Note Title 7/9/2008

Reminders

* Complete email assignment by tomorrow.
* Log on to D2L ASAP to make sure you can sign on.
* D2L Downtime → 10pm Fri to 10am Sat
* D2L does not count an attempt until you submit a quiz.
* As of right now, it appears that problems with randomized numerical values will change on a second attempt.
* Demos





$$\Delta H_{fusion} = (+)$$

$$\Delta H_{vaporization} = (+)$$

For H_2O ⟹ $\Delta H_{fusion} = +6.01 \frac{kJ}{mol}$

$$\Delta H_{vaporization} = 40.7 \frac{kJ}{mol}$$

Convert the ΔH_{vap} of water to J/g

$$40.7\,\frac{\text{kJ}}{\text{mol}} \times \frac{1000\text{ J}}{\text{kJ}} \times \frac{1\text{ mol}}{18.0\text{ g}} = 2260\,\frac{\text{J}}{\text{g}}$$

Compare this amount of energy to the amount of energy required to raise the temp of 1.00 g H_2O from 0°C to 100°C.

$$\Delta H = q_p = m s \Delta t$$

equal @ const. pressure

$$= (1.00\text{ g})\left(4.18\,\frac{\text{J}}{\text{g}\cdot{}^\circ\text{C}}\right)(100^\circ\text{C}) = 418\text{ J}$$

$$418\,\frac{\text{J}}{\text{g}}$$

What mass of ice @ 0°C would be needed to lower the temperature of 250.0 mL of coffee at 95°C to a temp of 40°C? Assume no loss of heat to surroundings.

$$\Delta H_{fus} = \frac{6.01\text{ kJ}}{\text{mol}} \times \frac{1000\text{ J}}{1\text{ kJ}} \times \frac{1\text{ mol}}{18.0\text{ g}} = 334\,\frac{\text{J}}{\text{g}}$$

250.0 mL coffee → ~250 g coffee

$$q_{system} = -q_{surroundings}$$

$$q_{ice} = -q_{coffee}$$

energy of phase transition; energy required to warm ice water

$$(m_i)(\Delta H_{fus}) + m_i s_i \Delta t_i = -m_c s_c \Delta t_c$$

Δt_i: 40°C − 0°C; Δt_c: 40°C − 95°C

$$m_i\left(334\,\frac{\text{J}}{\text{g}}\right) + m_i\left(4.18\,\frac{\text{J}}{\text{g}\cdot{}^\circ\text{C}}\right)(40^\circ\text{C}) = -(250\text{ g})\left(4.18\,\frac{\text{J}}{\text{g}\cdot{}^\circ\text{C}}\right)(-55^\circ\text{C})$$

$$334 m_i + 167.2 m_i = 57475$$

$$\frac{\cancel{501.2}\, m_i}{\cancel{501.2}} = \frac{57475}{501.2} = 114.7\text{ g}$$

$$= \boxed{110\text{ g} \approx 1.1\times10^{2}\text{ g}}$$

Phase diagrams – p. 431

triple point

critical point – defined by the <u>critical temperature</u> & <u>critical pressure</u>

critical temp – temp above which the liquid phase cannot exist regardless of pressure

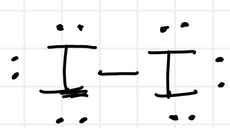
critical pressure – minimum pressure @ the critical temperature

supercritical fluid

Intermolecular Forces – "likes dissolve likes"

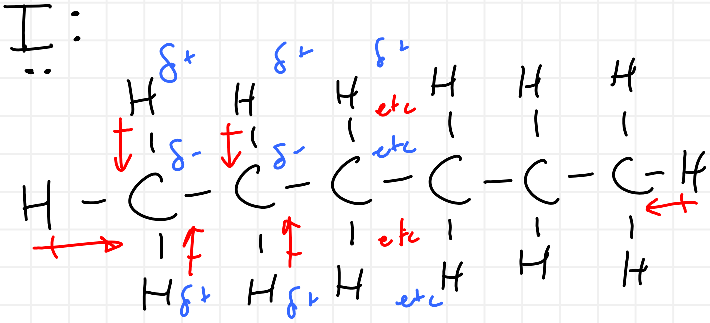
I_2 =

nonpolar molecule



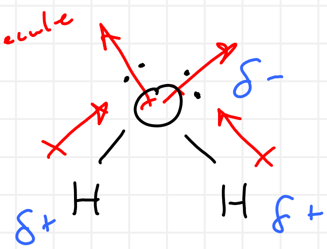
nonpolar molecule

C_6H_{14} =



dipole = polar molecule

H_2O =



C = 2.5
H = 2.1
O = 3.5

Intermolecular Forces – forces of attraction that act between molecules

* van der Waals forces
    * dipole-dipole forces
    * London forces (dispersion forces)
* hydrogen bonds

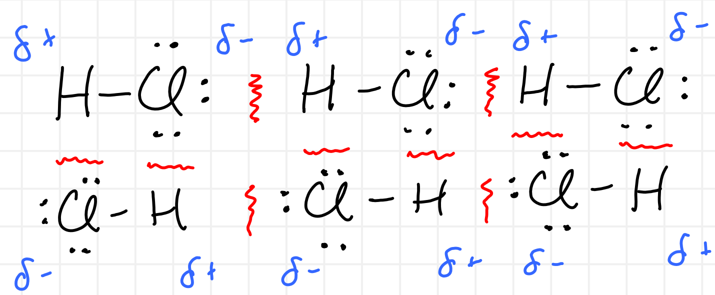
---

dipole-dipole forces

forces that act between polar molecules

Example: HCl

H = 2.1
Cl = 3.0

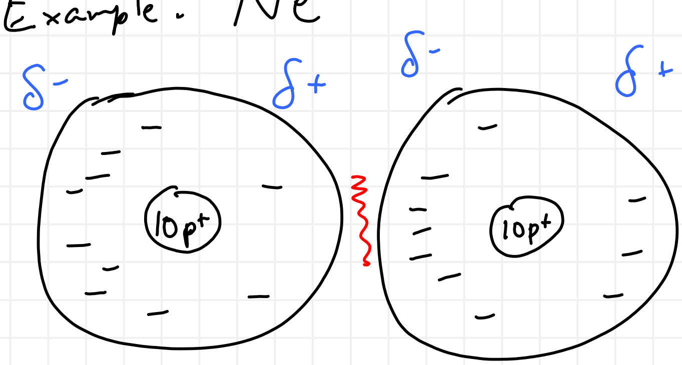


London forces

* present in all molecules, but they are the only intermolecular force present in nonpolar molecules

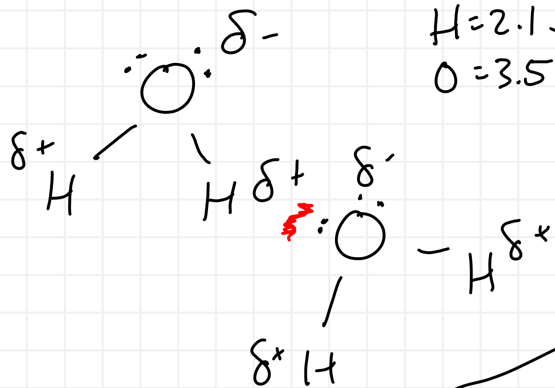
Example: Ne

induced dipole



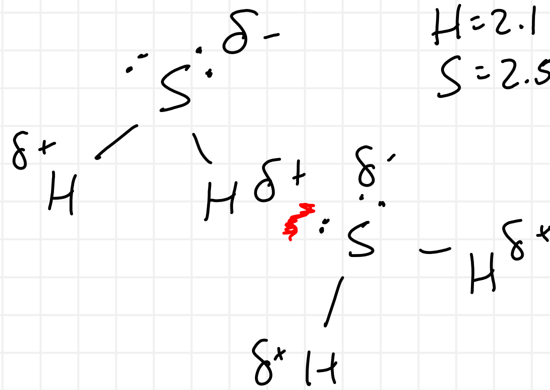
Hydrogen bonding

* special type of dipole-dipole force that is <u>very</u> strong
* exists in molecules where H is directly bonded to N, O, or F.



H = 2.1
O = 3.5
> 1.4

H_2S



H = 2.1
S = 2.5
> 0.4