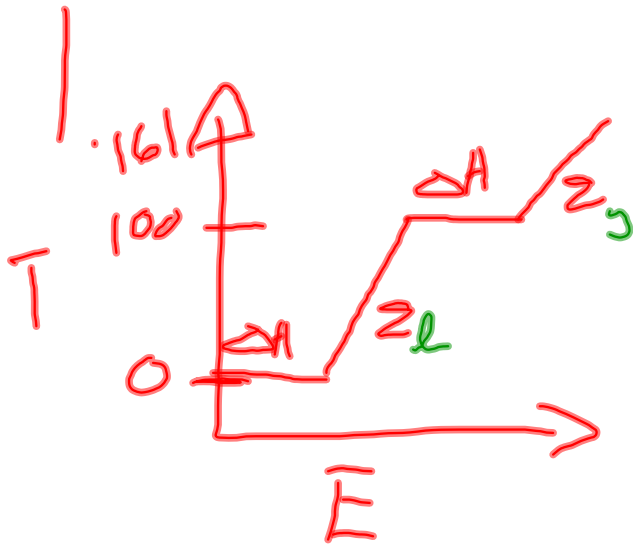Between 0°C and 100°C, what state is water?

liquid

$$\Delta H_{fus} = n H_{fus}$$

$$= \left(\frac{400}{18.02}\right)(6.01)$$

$$= 133.41 \text{ kJ}$$

$$2\ell = (400)(4.19)(100)$$

$$= 167,600 \text{ J}$$

$$\Delta H_{vap} = \left(\frac{400}{18.02}\right)(40.7)$$

$$= 903.44 \text{ kJ}$$

$$2g = (400)(2.01)(61) = 49,044 \text{ J}$$

$$E_T = 1,250,000 \text{ J}$$
$$1,250 \text{ kJ}$$
$$1.25 \text{ MJ}$$

Calorimetry

<u>CALORIMETRY</u> - is the technological process of measuring energy changes using an **isolated system** called a calorimeter.

In the calorimeter the system being studied is surrounded by a known quantity of water. Energy is then transferred between the chemical system and the water. The heat gained or lost by the water can be determined and thus equals the heat lost or gained by the system.

<u>ASSUMPTIONS IN CALORIMETRY</u>
1. no heat is transferred between the calorimeter and the outside environment.
2. any heat absorbed or released by the calorimeter materials is negligible.
3. a dilute aqueous solution has the same density and specific heat capacity as pure water.

Assumption #2 implies

$$\Delta H_{system} = - q_{calorimeter}$$

Tentative date for the midterm:
Tuesday, November 6

Your lab that we are doing on Monday will be due on Tuesday at the beginning of class.
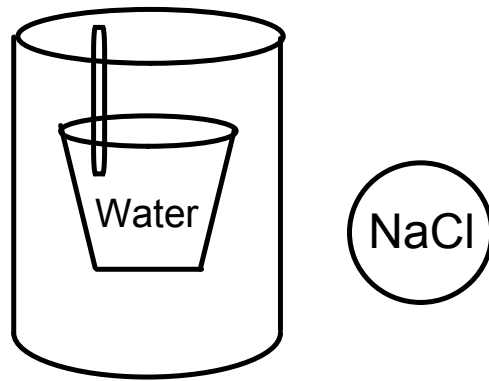
Types of Systems:

open system $m + E$ in/out

isolated system nothing in/out

closed system E in/out

calorimeter

Water

NaCl

Example

4.24 g of lithium chloride is dissolved in 100. mL of water at an initial temperature of 16.3°C. The final temperature of the solution is 25.1°C. Calculate the molar enthalpy of solution, H_s, for lithium chloride.

$$\Delta H_s = -q$$

System: LiCl

m = 4.24 g
H_s = ?

Surroundings: H_2O
100. mL
T_i = 16.3°C
T_f = 25.1°C

System | Surroundings

$$nH_s = -V C \Delta T$$

$$\left(\frac{4.24}{42.39}\right) H_s = -(0.100)(4.19)(8.8)$$

$$0.1 \text{ mol } H_s = -3.6872 J$$

$$H_s = -36.9 kJ/mol$$

the amount of enthalpy
gained or lost by the systes
is equal to (but opposite
of) the around of heat
lost or gained by the snrroninhdg,

A block of aluminum at 95.0°C is placed into 500. g of water at 21.5°C. The final temperature of the water and aluminum is 28.0°C. Determine the mass of the aluminum.

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

$$mC\Delta T = -mC\Delta T$$

Al

$T_i = 95.0°C$

$m = ?$

$T_f = 28.0°C$

H_2O

$M = 500.g$

$T_i = 21.5°C$

$T_f = 28.0°C$

$$m(0.900 \text{ J/g·°C})(-67.0°C) = -(500.g)(4.19 \text{ J/g·°C})(6.5)$$

$$m(-60.3 \text{ J/g}) = -13617.5 \text{ J}$$

$$m = 226 \text{ g Al}$$

Homework

Worksheet