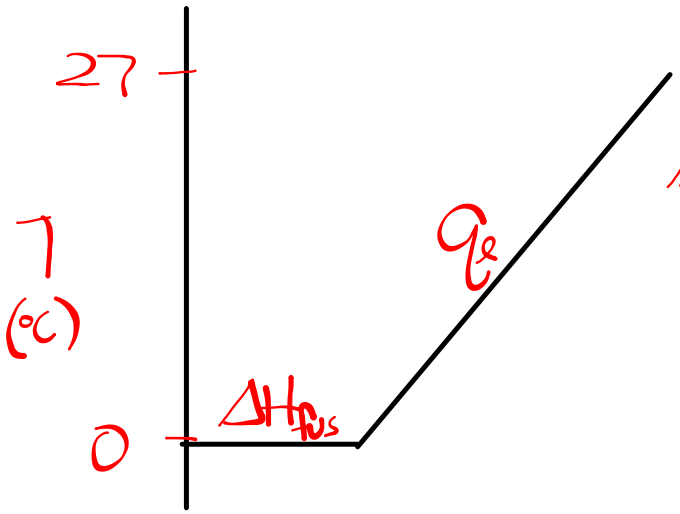
Energy Changes

- Heat ($q = mC\Delta T$ or $q = vC\Delta T$) temp. change
- Enthalpy changes ($\Delta H = nH$) phase change
- Phase changes (+) fus, vap (−) solid, cond.
- Total Energy changes
- Heating / Cooling curves
- Calorimetry → $\Delta H = -q$ / $q = -q$
- Lab - Molar Enthalpy of Solutions

↓ Isolated

Calculate the amount of energy required to heat 44.5 g of ice at 0.0°C to water at 27°C.



$\Delta E_T = \Delta H_{fus} + q_\ell$

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

$\Delta H_{fus} = \left(\frac{44.5\,g}{18.02\,g/mol}\right)\left(6.03\,\frac{kJ}{mol}\right)$

$q_\ell = mC\Delta T$

$q_\ell = (44.5\,g)\left(4.19\,\frac{J}{g\cdot°C}\right)(27°C)$

20.0 g of KNO_3 is added to a calorimeter containing 100. mL of water. The temperature of the water increased from 21.6°C to 24.8°C. Calculate the molar enthalpy of solution.

KNO_3

$m = 20.0\,g$

$H_s = ?$

H_2O

$V = 100.\,mL$

$T_i = 21.6°C$

$T_f = 24.8°C$

$\Delta H_s = -q$

$n H_s = -vC\Delta T$ (C: $\frac{MJ}{m^3 \cdot °C}$)

$$\left(\frac{20.0\,g}{101.11\,g/mol}\right) H_s = -(0.100\,L)\left(4.19\,\frac{kJ}{L \cdot °C}\right)(3.2°C)$$

$$H_s = -6.78\,\frac{kJ}{mol}$$

A 74.0 g block of tin at 112°C is added to 500.g of water at 21.0°C. Determine the final temperature of the system.

Sn
$m = 74.0\,g$
$T_i = 112°C$

H_2O
$m = 500.\,g$
$T_i = 21.0°C$

$$q_{Sn} = -q_{H_2O}$$

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

$$(74.0\,g)\left(0.213\,\frac{J}{g\cdot°C}\right)(T_f - 112°C) = -(500\,g)\left(4.19\,\frac{J}{g\cdot°C}\right)(T_f - 21.0°C)$$

$$15.762(T_f - 112°C) = -2095(T_f - 21.0°C)$$

$$15.762\,T_f - 1765.344 = -2095\,T_f + 43995$$

$$15.762\,T_f + 2095\,T_f = 43995 + 1765.344$$

$$2110.762\,T_f = 45760.344$$

$$T_f = 21.7°C$$

Energy Changes Worksheet