Energy Changes

- Heat ($q = mC\Delta T$ or $q = vC\Delta T$)
- Enthalpy changes ($\Delta H = nH$)
- Phase changes
- Total Energy changes
- Heating / Cooling curves
- Calorimetry
- Lab - Molar Enthalpy of Solutions

Calculate the amount of energy required to solidify 17.0 g of water at 0.0°C.

$m = 17.0\,g$

$n = \frac{m}{MM}$

$= \frac{17.0\,g}{18.02\,g/mol}$

$= 0.9433\,mol$

$\Delta H_{solid} = n\,\Delta H_{solid}$

$= (0.9433\,mol)(-6.03\,kJ/mol)$

$= -5.69\,kJ$

Calculate the amount of energy required to heat 29.0 g of aluminum from 24°C to 73°C.

$m = 29.0\,g$

$T_i = 24°C$

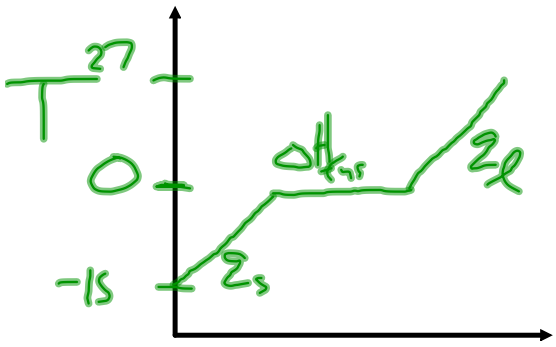
$T_f = 73°C$

$q = mC\Delta T$

$= (29.0\,g)(0.900\,J/g{\cdot}°C)(49°C)$

$= 1300\,J$

Calculate the amount of energy required to heat 44.5 g of ice at -15.0°C to water at 27°C.



$q_s = mC\Delta T$ $\Delta T = 15°C$

$= (44.5\,g)(2.01\,J/g{\cdot}°C)(0-(-15))$

$= 1{,}341.675\,J$

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

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

$= 14.891\,kJ$

$q_l = mC\Delta T$

$= (44.5\,g)(4.19\,J/g{\cdot}°C)(27°C)$

$= 5034.285\,J$

$E_T = 1{,}341.675\,J + 14{,}891\,J + 5034.285\,J$

$= 21{,}000\,J$ or $21\,kJ$

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.

$\Delta H_s = -q$

$n = \frac{20.0\,g}{101.11\,g/mol}$

$= 0.1978\,mol$

$n H_s = -VC\Delta T$

$0.1978\,mol\ H_s = -(0.100L)\left(4.19\,\frac{kJ}{°C}\right)(3.2°C)$

$H_s = -6.78\,kJ/mol$

Energy Changes Worksheet