Thermochemistry topics list:

1 body problems: q=m x ΔT x C

2 body problems: calorimetry. Solve for the specific heat of a metal.

Energy diagrams: endothermic or exothermic reactions.

Phase change energy and calculating the energy needed to increase or decrease water from one temp to another.

Heat of solution: use calorimetry to determine the energy change when a compound is dissolved in water.

Create a thermochemical equation from experimental data.

Thermochemical Equations: determine the heat exchanged of a system based on the thermochemical equation.

Thermochemical equations: Solve each question for q. Also, state weather the reaction is endothermic or exothermic.

How much heat will be produced when 13.7g of nitrogen reacts with excess O_2 according to the following equation?

$N_2 + O_2 \rightarrow 2NO + 180kJ$

$\frac{13.7 g N_2}{1} \cdot \frac{1 mol N_2}{28 g N_2} \cdot \frac{180 kJ}{1 mol N_2} = 83.57 kJ$

How much heat will be transferred when 14.9g of ammonia reacts with excess O_2 according to the following equation?

$4NH3 + 5O2 \rightarrow 4NO + 6H2O -1770kJ$

$\frac{14.9 g NH_3}{1} \cdot \frac{1 mol NH_3}{17 g NH_3} \cdot \frac{-1770 kJ}{4 mol NH_3} = +/- 387.8 kJ$

How much heat will be transferred when 5.81g of graphite reacts with excess H_2 according to the following equation? 6C (graphite) + 3H2 → C6H6 + 49.03kJ

$\frac{5.81 g C}{1} \cdot \frac{1 mol C}{12 g C} \cdot \frac{49.03 kJ}{6 mol C} = 3.96 kJ$

Specific heats: $H_2O(s)$: 2.06J/g°C H20(l): 4.18J/g°C H2O(g): 2.02J/g°C

Heat of fusion: 6.02kJ/mol Heat of vaporization: 40.7kJ/mol

Calculate the amount of energy required to change 150g of water at 20oC to 125°C.

liquid: $150\,g \cdot 80^{\circ}C \cdot 4.18\ J/g^{\circ}C = 50,160\,J$

ΔH_{vap}: $\frac{150\,g}{1} \cdot \frac{1\,mol}{18\,g} \cdot \frac{40.7\,kJ}{1\,mol} \cdot \frac{1000\,J}{1\,kJ} = 339,167\,J$

Vapor: $150\,g \cdot 25^{\circ} \cdot 2.02\ J/g^{\circ}C = 7575\,J$

total $50,160\,J + 339,167\,J + 7,575\,J = 396,902\,J$

Calculate the amount of energy released when 50g of steam at 140°C cools to -15°C.

Vapor: $50\,g \cdot 40^{\circ}C \cdot 2.02\ J/g^{\circ}C = 4040\,J$

ΔH_{vap}: $\frac{50\,g}{1} \cdot \frac{1\,mol}{18\,g} \cdot \frac{40.7\,kJ}{1\,mol} \cdot \frac{1000\,J}{1\,kJ} = 113,055\,J$

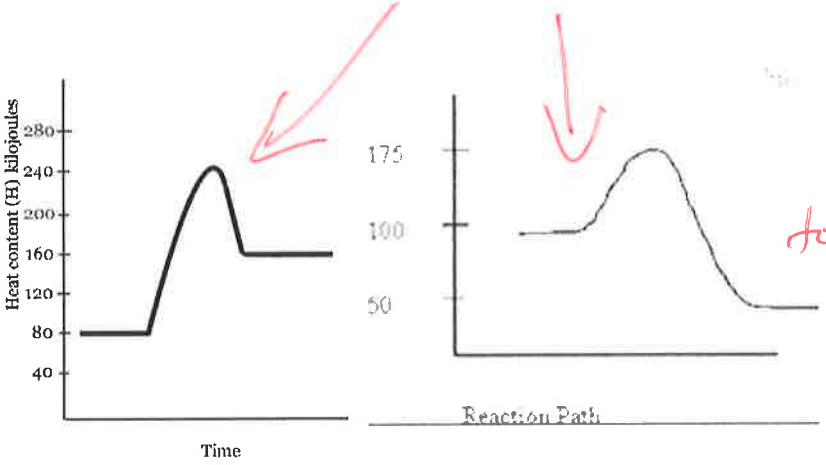
liquid: $50\,g \cdot 100^{\circ}C \cdot 4.18\ J/g^{\circ}C = 20,900\,J$

ΔH_{fus}: $\frac{50\,g}{1} \cdot \frac{1\,mol}{18\,g} \cdot \frac{6.02\,kJ}{1\,mol} \cdot \frac{1000\,J}{1\,kJ} = 16,722\,J$

solid: $50\,g \cdot 15^{\circ}C \cdot 2.06\,J = 1,545\,J$

total = 156,262 J

These are graphs of a system. Endothermic or exothermic? Defend your answer.



Heat of Solution

When 28.7g of KI are dissolved in 60g of water, the temperature of the water drops from 27.2°C to 13.2°C.

Calculate the heat absorbed per mole. This is the heat of solution for KI.

water: $q = 60_g \cdot (-14^{\circ}C) \cdot 4.18\ J/g^{\circ}C = -3,511.2\,J$

KI: $\frac{3,511.2\,J}{28.7\,g} \cdot \frac{166\,g}{1\,mol} = \frac{20.3\,kJ}{1\,mol}$

$\Delta H = +23.3\ kJ/mol$

Write an equation to show this dissolving process.

$KI_{(s)} \longrightarrow K^{+}_{(aq)} + I^{-}_{(aq)} - 23.3\,kJ$

Use the thermochemical equation $3CO + Fe_2O_3 \rightarrow 2Fe + 3CO_2 + 24.7kJ$ to calculate the heat transferred when 56g of CO reacts with excess Fe_2O_3.

$\frac{56\,g\,CO}{1} \cdot \frac{1\,mol\,CO}{28\,g\,CO} \cdot \frac{24.7\,kJ}{3\,mol\,CO} = 14.46\,kJ$