Enthalpy #3 **Name:** Answers.

1. Athletes often use instant cold and hot packs as first-aid devices to treat injuries. These packs work by using the heat of solution concept discussed in class (ΔH_{soln}). Most packs consist of a plastic bag containing a granular dry chemical and a pouch of water. The dissolution reactions that occur in most packs are shown bellow.
   a. Find the ΔH_{soln}/mol of each equation.
   b. State which is the hot pack and which is the cold pack. Provide an explanation for your reasoning based on the value of ΔH_{soln}.

-795.0 -543.0 -167.4

$CaCl_{2\,(s)} \rightarrow Ca^{+2}_{(aq)} + 2Cl^{-}_{(aq)}$

ΔH = products - reactants

$= (2(-167.4) + (-543.0)) - (-795.0)$

$= (-877.8) - (-795.0)$

$\Delta H = -82.8$ kJ/mol

-365.1 -132.8 -206.6

$NH_4NO_{3\,(s)} \rightarrow NH_4^{+}_{(aq)} + NO_3^{-}_{(aq)}$

ΔH = products - reactants

$= (-132.8 + (-206.6)) - (-365.1)$

$= (-339.4) - (-365.1)$

$\Delta H = 25.7$ kJ/mol

Hot pack → EXOthermic Cold pack → ENDOthermic

2. The burning of gasoline contains ethanol (C_2H_5OH) which burns in the presence of O_2 to produce CO_2 and water. $C_2H_5OH_{(l)} + 3\,O_{2\,(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(g)}$
   a. How much heat is produced per mole of ethanol?

-277.6 0 -393.5 -241.8

ΔH = products - reactants.

$= (2(-393.5) + 3(-241.8)) - (-277.6)$

$= -1512.4 - (-277.6)$

$\Delta H = -1234.8$ kJ/mol

   b. How much heat is produced when 12.5 g of ethanol are burned?

$\frac{1 \text{ mol } C_2H_5OH}{x} = \frac{46.08}{12.5}$ $x = 0.271$ mol

$\Delta H = \frac{Q}{n}$

$-1234.8 \text{ kJ} = \frac{Q}{0.271 \text{ mol}}$

$Q = -335$ kJ