A **Thermochemical Equation** is a balanced \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chemical equation that includes the ­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_, ΔH.

* \_\_\_\_\_\_\_\_\_\_\_\_\_ (H) is the transfer of \_\_\_\_\_\_\_\_\_ in a reaction (for chemical reactions it is in the form of \_\_\_\_\_\_\_\_) and ΔH is the change in \_\_\_\_\_\_\_\_\_\_\_\_.
  + By definition, ΔH = Hproducts – Hreactants
    - * + Hproducts < Hreactants, ΔH is \_\_\_\_\_\_\_\_\_\_\_
        + Hproducts > Hreactants, ΔH is \_\_\_\_\_\_\_\_\_\_\_
* In working with thermochemical equations, you will find the following rules helpful.
  + When a thermochemical equation is multiplied by a ­­­\_\_\_\_\_\_\_\_, the value of H for the new equation is obtained by multiplying the \_\_\_\_\_\_ \_\_\_ \_\_ by the same \_\_\_\_\_\_\_\_\_\_\_.
  + When a chemical equation is \_\_\_\_\_\_\_\_\_\_\_\_, the sign of H is \_\_\_\_\_\_\_\_\_\_\_\_.

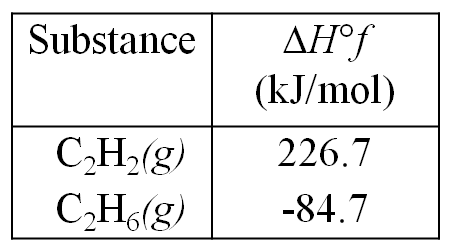
**Writing Thermochemical Equations**

* Thermochemical equations show the \_\_\_\_\_\_\_\_\_\_\_\_\_ of heat in a chemical reaction.
  + For example, Burning one mole of wax releases \_\_\_\_\_\_\_\_\_\_ kJ of heat energy.
    - This could be written as:
    - Instead we usually write:

**Practice**

Write the following thermochemical equations showing ∆H.

* Reacting 2 moles of solid sodium with 2 moles of water to produce 2 mole of aqueous sodium hydroxide and 1 mole of hydrogen gas will release 367 kJ of energy
* 184.6 kJ of energy is needed to produce 1 mole of hydrogen gas and 1 mole of chlorine gas from 2 moles of hydrogen chloride gas.



**Thermochemical equations using Standard Heat of Formations**

C2H2*(g)* + 2 H2*(g)* → C2H6*(g)*

* + Information about the substances involved in the reaction represented above is summarized in the following tables.
  + Write the equation for the heat of formation of C2H6(g)

Solve for the ΔHrx and write the following thermochemical equations.

* 1. What is the ΔHrx for the process used to make lime (CaO)?
  + CaCO3(s) → CaO(s) + CO2(g)
* 2. What is the ΔHrx for the combustion of C4H10(g)?
  + 2 C4H10 (g) + 13 O2 (g) → 10 H2O (g) + 8 CO2 (g)

**Thermochemical & Endothermic/ Exothermic equations**

* In the previous slides, we saw how \_\_\_\_\_\_ could be both \_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_.
* Depending on the sign of ΔH°, the reaction can either be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reactions ***\_\_\_\_\_\_\_\_\_\_*** heat from the system to the surroundings so the temperature will \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + ΔH° will be \_\_\_\_\_\_\_\_\_\_\_because the reaction loses heat.
  + ΔH° can be written into the chemical equation as a ­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reactions ***\_\_\_\_\_\_\_\_\_\_\_*** heat from the surroundings into the system so the temperature will \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + ΔH° will be \_\_\_\_\_\_\_\_\_\_\_\_ because the reaction absorbs heat.
  + ΔH° can be written into the chemical equation as a **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.

**Classify the following as endothermic or exothermic**

* Ice melting
* 2 C4H10(g) + 13 O2(g) → 10 H2O(g) + 8 CO2(g) ΔHrx = -5506.2 kJ/mol
* 2 HCl(g) + 184.6 kJ → H2(g) + Cl2(g)
* Water vapor condensing

**Exothermic vs. Endothermic**