The ΔH

Lesson 1a.- What to do with the ΔH of thermochemical equations.

When multiplying the equation by X then multiply the ΔH by X as well (sign stays the same).

For example take the equation below of the combustion of glucose.

$C_6H_{12}O_6(aq) + 6O_2(g) \Rightarrow 6CO_2(g) + 6H_2O(l)$ $\Delta H = -2803$ kJ mol$^-$

½ X ($C_6H_{12}O_6(aq) + 6O_2(g) \Rightarrow 6CO_2(g) + 6H_2O(l)$ $\Delta H = -2803$ kJ mol$^-$)
$\Rightarrow$ ½ $C_6H_{12}O_6(aq) + 3O_2(g) \Rightarrow 3CO_2(g) + 3H_2O(l)$ $\Delta H = -1401.5$ kJ mol$^-$

3 X ($C_6H_{12}O_6(aq) + 6O_2(g) \Rightarrow 6CO_2(g) + 6H_2O(l)$ $\Delta H = -2803$ kJ mol$^-$)
$\Rightarrow 3C_6H_{12}O_6(aq) + 18O_2(g) \Rightarrow 18CO_2(g) + 18H_2O(l)$ $\Delta H = -8409$ kJ mol$^-$

When flipping the equation, change the sign of the ΔH.
For example.

$6CO_2(g) + 6H_2O(l) \Rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$ $\Delta H = +2803$ kJ mol$^-$

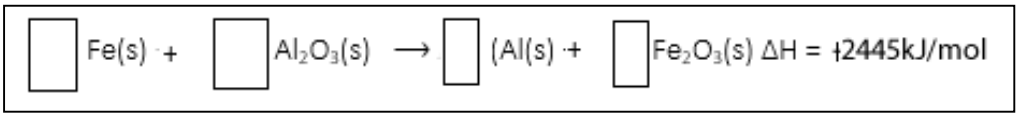
$3CO_2(g) + 3H_2O(l) \Rightarrow$ ½ $C_6H_{12}O_6(aq) + 3O_2(g)$ $\Delta H = +1401.5$ kJ mol$^-$

1. Consider the equation shown below of aluminium reacting with iron(III) oxide.
   2Al(s)+Fe2O3(s)⟶2Fe(s)+Al2O3(s) ΔH = -815.5kJmol$^-$
   Give the ΔH for the following thermochemical equations.
   a. $4Al(s) + 2Fe_2O_3(s) \longrightarrow 4Fe(s) + 2Al_2O_3(s)$ $\Delta H =$

   b. $2Fe(s) + Al_2O_3(s) \longrightarrow 2Al(s) + Fe_2O_3(s)$ $\Delta H =$

   c. $Fe(s) +$ ½ $Al_2O_3(s) \longrightarrow Al(s) +$ ½ $Fe_2O_3(s)$ $\Delta H =$

2. Fill in the boxes to complete the thermochemical equation below.



3. Consider the equation below showing the complete combustion of methane in oxygen gas.
   $CH_4(g)+2O_2(g) \rightarrow CO_2(g)+2H_2O(l)$ $\Delta H = -890$kJ mol$^-$

   Transform this equation to obtain balanced thermochemical equations that produce the following ΔH values.
   a. _____ *ΔH= +890kJ mol$^-$ $^-$*

   b. _____ *ΔH= –445kJ mol$^-$*

   c. _____*ΔH= +222.5kJ mol$^-$*

4. Methane burns in oxygen according to the equation below.
   $CH_4(g)+2O_2(g)\rightarrow CO_2(g)+2H_2O(l)$ $\Delta H= -890kJ\ mol^{-}$
   a. What amount, in mol, of carbon dioxide gas is produced when 1780kJ of energy is released during the complete combustion of methane .

   b. What amount, in mol, of oxygen gas is used to produce 445 kJ of energy when methane is burnt in oxygen

   c. What mass, in grams, of methane is needed to produce 1780 kJ of energy?

5. Consider the combustion of octane in atmospheric oxygen at SLC.
   a. Write the thermochemical equations for the complete combustion, at SLC, of octane in atmospheric oxygen (O_2). Include states.

   b. What volume, in litres, of CO_2 gas is produced if 80.0 megajoules of heat energy is delivered by the combustion octane in atmospheric oxygen? Express your answer to the right number of significant figures.

Solutions