Chapter 6 - Lecture Worksheet 2 - Enthalpy of Reaction

From Exam 1 Spring 06

14. In the lab it is fairly easy to obtain heats of combustion. Use this information and information from the other two reactions to determine the heat of formation of glucose (Reaction D).
   (If you are running out of time you may just show the calculation and answer for this question. No detailed work necessary)

   (A.) \( \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) \quad \Delta H^\circ = -2808 \text{ kJ} \)

   (B.) \( \text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) \quad \Delta H^\circ = -394 \text{ kJ} \)

   (C.) \( 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{O}_2(\text{g}) + 2\text{H}_2(\text{g}) \quad \Delta H^\circ = 572 \text{ kJ} \)

   (D.) \( 6\text{C}(\text{s}) + 3\text{O}_2(\text{g}) + 6\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) \quad \Delta H^\circ = ? \)

   Reverse Rxn A: \( 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \quad -(−2808 \text{ kJ}) \)

   6 x Rxn B: \( 6\text{C}(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) \quad 6(−394 \text{ kJ}) \)

   Reverse Rxn C x 3: \( 3\text{O}_2(\text{g}) + 6\text{H}_2(\text{g}) \rightarrow 6\text{H}_2\text{O}(\text{l}) \quad (−3)(572 \text{ kJ}) \)

   Add: \( 6\text{C}(\text{s}) + 3\text{O}_2(\text{g}) + 6\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) \quad −1272 \text{ kJ} \)

   (1) −1016 kJ  (2) 1272 kJ  (3) −1272 kJ  (4) −3456 kJ  (5) 3456 kJ  (6) 3774 kJ  (7) −1016 kJ

Define: Standard Formation Reaction:

A chemical reaction in which one mole of a substance in its standard state is made from its elements in their standard states.

Write the standard formation reaction for \( \text{H}_2\text{SO}_4(\text{l}) \)

\( \text{H}_2(\text{g}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{SO}_4(\text{l}) \)

Which of the following represent standard formation reactions?

(1) \( 2\text{C}(\text{s}) + 3\text{H}_2(\text{g}) + 1/2\text{O}_2(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{l}) \)
(2) \( \text{CaO}(\text{s}) + \text{CO}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) \)
(3) \( \text{Pb}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{PbCO}_3(\text{s}) \)
(4) \( \text{C}_2\text{H}_5\text{OH} \rightarrow 2\text{C}(\text{s}) + 3\text{H}_2(\text{g}) + 1/2\text{O}_2(\text{g}) \)
(5) \( 2\text{Fe}(\text{s}) + 3/2\text{O}_2(\text{g}) \rightarrow \text{Fe}_2\text{O}_3(\text{s}) \)
(6) 1 and 2
(7) 1, 2, 3, and 5
(8) 1, 3, and 5
(9) 1 and 5
(0) All of the reactions, 1-5 represent standard formation reactions.