

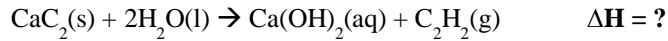
ANSWER TO EXAMPLE PROBLEM FROM STUDY SECTION 5.7 – HESS'S LAW

Example 5.7 – Hess's Law

Given the following data:

1. $\text{Ca(s)} + 2\text{C(graftite)} \rightarrow \text{CaC}_2\text{(s)} \quad \Delta H = -62.8 \text{ kJ}$
2. $\text{Ca(s)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{CaO(s)} \quad \Delta H = -635.5 \text{ kJ}$
3. $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} \quad \Delta H = -653.1 \text{ kJ}$
4. $\text{C}_2\text{H}_2\text{(g)} + 5/2\text{O}_2\text{(g)} \rightarrow 2\text{CO}_2\text{(g)} + \text{H}_2\text{O(l)} \quad \Delta H = -1300.0 \text{ kJ}$
5. $\text{C(graftite)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} \quad \Delta H = -393.5 \text{ kJ}$

Calculate ΔH for the following reaction by using Hess's law and manipulating the given reactions above:



Study Section 5.7
Indirect application of Hess's Law

Given:

	$\Delta_r H^\circ$
1) $\text{Ca(s)} + 2\text{C(graftite)} \rightarrow \text{CaC}_2\text{(s)}$	-62.8 kJ
2) $\text{Ca(s)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{CaO(s)}$	-635.5 kJ
3) $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)}$	-653.1 kJ
4) $\text{C}_2\text{H}_2\text{(g)} + 2\frac{5}{2}\text{O}_2\text{(g)} \rightarrow 2\text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$	-1300.0 kJ
5) $\text{C(graftite)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)}$	-393.5 kJ

* Calculate ΔH for:

ex. 6) $\text{CaC}_2\text{(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{C}_2\text{H}_2\text{(g)} \quad \Delta H = ?$

3) $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} \quad -653.1$

inverse 4) $2\text{CO}_2\text{(g)} + \text{H}_2\text{O(l)} \rightarrow \text{C}_2\text{H}_2\text{(g)} + 2\frac{5}{2}\text{O}_2\text{(g)} \quad +1300.0$

$\text{CaO(s)} + 2\text{H}_2\text{O(l)} + 2\text{CO}_2\text{(g)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{C}_2\text{H}_2\text{(g)} + 2\frac{5}{2}\text{O}_2\text{(g)}$
+646.9 kJ

add 1) 1) $\text{CaC}_2\text{(s)} \rightarrow \text{Ca(s)} + 2\text{C(g)} \quad +62.8 \text{ kJ}$
inverse)

~~$\text{Ca(s)} + 2\text{H}_2\text{O(l)} + 2\text{CO}_2\text{(g)} + \text{CaC}_2\text{(s)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{C}_2\text{H}_2\text{(g)} + 2\frac{5}{2}\text{O}_2\text{(g)} + \text{Ca(s)} + 2\text{C(graftite)}$~~
+709.7 kJ

add 2) $\text{Ca(s)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{CaO(s)} \quad -635.5 \text{ kJ}$

$\text{CaC}_2\text{(s)} + 2\text{H}_2\text{O(l)} + 2\text{CO}_2\text{(g)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{C}_2\text{H}_2\text{(g)} + 2\frac{5}{2}\text{O}_2\text{(g)}$
+74.2 kJ

add 5) $2\text{C(graftite)} + 2\text{O}_2\text{(g)} \rightarrow 2\text{CO}_2\text{(g)} \quad -787 \text{ kJ}$
+2

$\text{CaC}_2\text{(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{C}_2\text{H}_2\text{(g)}$
 $\Delta H = -712.8 \text{ kJ}$