

## Section 16.4 Calculating Enthalpy Change

In your textbook, read about Hess's law and standard enthalpy (heat) of formation.

In the space at the left, write *true* if the statement is true; if the statement is false, change the italicized word or phrase to make it true.

- \_\_\_\_\_ 1. Hess's law states that if two or more thermochemical equations can be added to produce a final equation for a reaction, then the sum of all the enthalpy changes for the individual reactions is the enthalpy change for the *final reaction*.
- \_\_\_\_\_ 2. The standard enthalpy of formation is the change in enthalpy that accompanies the formation of *one gram* of a compound in its standard state from its constituent elements in their standard states.
- \_\_\_\_\_ 3. The standard state of iron is *solid*.
- \_\_\_\_\_ 4. For a pure gas, the standard state is the gas at a pressure of *one atmosphere*.
- \_\_\_\_\_ 5. The symbol used to represent standard enthalpy of formation is  $\Delta H_f^\circ$ .
- \_\_\_\_\_ 6. The standard state of a substance is the normal state of the substance at *0 K* and one atmosphere pressure.
- \_\_\_\_\_ 7. The standard enthalpy of formation of a free element in its standard state is *0.0 kJ*.
- \_\_\_\_\_ 8. A standard enthalpy of formation that has a *negative* value means that energy is absorbed during the reaction.
- \_\_\_\_\_ 9. The standard state of oxygen is *gas*.
- \_\_\_\_\_ 10. Standard enthalpies of formation provide data for calculating the enthalpies of reactions under standard conditions using *Hess's law*.
- \_\_\_\_\_ 11. The standard state of mercury is *solid*.

**Section 16.4** *continued*

Use the table to answer the following questions.

Compound	Formation Equation	$\Delta H_f^\circ$ (kJ/mol)
CH <sub>4</sub> (g)	C(graphite) + 2H <sub>2</sub> (g) → CH <sub>4</sub> (g)	75
CH <sub>3</sub> OH(g)	C(graphite) + 2H <sub>2</sub> (g) + $\frac{1}{2}$ O <sub>2</sub> (g) → CH <sub>3</sub> OH(g)	239
H <sub>2</sub> O(g)	$\frac{1}{2}$ O <sub>2</sub> (g) + H <sub>2</sub> (g) → H <sub>2</sub> O(g)	242

12. What does a formation equation show?

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13. What does the negative sign on the value of an enthalpy of formation indicate?

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14. Using the formation equations for CH<sub>4</sub>(g), CH<sub>3</sub>OH(g), and H<sub>2</sub>O(g), calculate  $\Delta H_{\text{rxn}}$  for the following equation. Show and explain all your work.

