Name _____ Date _____ Class _____

# 17.4 CALCULATING HEATS OF REACTION

## Section Review

### Objectives

- Apply Hess's law of heat summation to find enthalpy changes for chemical and physical processes
- Calculate enthalpy changes using standard heats of formation

### Vocabulary

- Hess's law of heat summation
- standard heat of formation

### Key Equation

- $\Delta H^0 = \Delta H_f^0$ (products) $- \Delta H_f^0$ (reactants)

### Part A Completion

*Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.*

Hess's law of heat summation states that for a chemical equation that can be written as the ___1___ of two or more steps, the ___2___ change for the final equation equals the sum of the enthalpy changes for the individual steps. Hess's law makes it possible to measure the heat of a reaction ___3___. When a reaction is reversed, the sign of $\Delta H$ must be ___4___.

Sometimes it is hard to measure the heat for a reaction. In such cases, the ___5___ is used to calculate heats of reaction at standard conditions. The standard heat of formation of a compound is the ___6___ in enthalpy that accompanies the formation of ___7___ mole of a compound from its elements. The symbol used for standard heat of formation is ___8___. The standard heat of formation of a free element in its standard state is ___9___. The standard heat of reaction is determined by ___10___ the $\Delta H_f^0$ of all the reactants from the $\Delta H_f^0$ of all the products.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

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## Part B True-False

*Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.*

_____ **11.** The standard heat of formation for a substance is determined at 100°C.

_____ **12.** Hess's law of heat summation is not related to the law of conservation of energy.

_____ **13.** When using Hess's law of heat summation, intermediate reactions are summed and terms are canceled, as in algebra, to arrive at a final equation.

_____ **14.** The $\Delta H_f^0$ for $I_2(g)$ is zero.

_____ **15.** The $\Delta H_f^0$ for $H_2O(l)$ and $H_2O(s)$ are the same.

## Part C Matching

*Match each description in Column B to the correct term in Column A.*

| Column A | Column B |
|---|---|
| _____ **16.** standard heat of formation | **a.** symbol for the standard heat of formation |
| _____ **17.** Hess's law of heat summation | **b.** the change in enthalpy that accompanies the formation of 1 mole of a compound from its elements |
| _____ **18.** $\Delta H_f^0$ | **c.** in going from a particular set of reactants to a particular set of products, the enthalpy change is the same whether the reaction takes place in one step or in a series of steps |
| _____ **19.** $\Delta H^0$ for $Br_2(g) \rightarrow Br_2(l)$ | **d.** $-30.91$ kJ |
| _____ **20.** zero | **e.** $\Delta H_f^0$ of $Cl_2(g)$ |

## Part D Questions and Problems

*Answer the following in the space provided.*

**21.** Determine the heat of reaction for the following reaction.

$$CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(g)$$

Use the following thermochemical equations.

**1)** $CuO(s) \rightarrow Cu(s) + \frac{1}{2}O_2(g) \quad \Delta H = 155$ kJ

**2)** $H_2O(g) \rightarrow H_2(g) + \frac{1}{2}O_2(g) \quad \Delta H = 242$ kJ

**22.** Calculate the change in enthalpy for the following reaction using standard heats of formation. (Refer to Table 17.4 in your textbook.)

$$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$$