

17.2

MEASURING AND EXPRESSING ENTHALPY CHANGES

Section Review

Objectives

- Construct equations that show the enthalpy changes for chemical and physical processes
- Calculate enthalpy changes in chemical and physical processes

Vocabulary

- calorimetry
- calorimeter
- enthalpy, (H)
- thermochemical equation
- heat of reaction
- heat of combustion

Key Equation

- $q_{\text{sys}} = \Delta H - q_{\text{surr}} = -m \times C \times \Delta T$, where $\Delta T = T_f - T_i$

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.

A 1 is a device used to measure the absorption or release of heat in chemical and physical processes. For systems at constant pressure, the heat changes that occur are the same as changes in 2, symbolized as 3. To measure the enthalpy change for a reaction in aqueous solution, it is necessary to measure the 4 and 5 temperatures of the system and the 6 of the water in the system.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Part B True-False

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

- _____ 7. When a substance dissolves in water, heat is released.
- _____ 8. The sign of ΔH is negative for an exothermic reaction.
- _____ 9. If 129 kJ of heat is required to decompose 2 moles of NaHCO_3 , then 258 kJ is required to decompose 4 moles of NaHCO_3 .

- _____ 10. The physical state of the reactants and products in a thermochemical reaction are not important when calculating ΔH of the reaction.
- _____ 11. In endothermic reactions, the potential energy of the product(s) is higher than the potential energy of the reactants.
- _____ 12. The equation $\text{CaO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Ca}(\text{OH})_2(s) \quad \Delta H = 65.2 \text{ kJ}$ is an example of a thermochemical equation.

Part C Matching

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

Column A

- _____ 13. enthalpy (H)
- _____ 14. heat of combustion
- _____ 15. thermochemical equation
- _____ 16. calorimetry
- _____ 17. bomb calorimeter

Column B

- a. the heat of reaction for the complete burning of 1 mole of a substance
- b. a chemical equation that includes the enthalpy change (ΔH)
- c. the accurate and precise measurement of heat changes for chemical and physical processes
- d. an insulated device containing a sealed vessel that is used to measure the heat released during a combustion reaction
- e. the amount of heat that a system has at a constant pressure

Part D Questions and Problems

Answer the following in the space provided.

18. When 2 moles of nitric oxide, NO , burn in air to produce 2 moles of nitrogen dioxide, 113.04 kJ of heat is produced. Write a balanced thermochemical equation for this reaction.
19. Calculate the amount of heat produced when 34.8 g of methane, CH_4 , burns in an excess of oxygen, according to the following equation.

