Chapter 6 Reading Guide **Name:**

AP Chemistry 2016-2017 **Date:** **Period:**

Concepts in the AP Chemistry curriculum found in chapter 6 include the energy changes in Big Idea 3 (learning objective 3.11) and the thermochemistry concepts in Big Idea 5. As in previous chapters, many cross domain examples are use, which relates to science practice 7 in the curriculum.

6.1 Chemical Handwarmers

1. What is thermochemistry?

2. How does the temperature of the surroundings change in an exothermic reaction?

3. Write the chemical equation frequently used in handwarmers.

6.2 The Nature of Energy: Key Definitions

4. Define each of the following in your own words
    a. Heat

    b. Kinetic energy

    c. Thermal Energy

    d. Potential Energy

    e. Chemical Energy

    f. Law of Conservation of Energy.

5. What is the difference between a system and its surroundings?

6. During an energy exchange between a system and its surrounds, what happens?

7. How many joules are in one calorie? How many calories in one joule?

6.3 The First Law of Thermodynamics: There Is No Free Lunch (NOTE: You are not responsible for state functions)

8. Define a thermodynamic system.

9. What does the first law of thermodynamics state?

10. Define "internal energy".

11. Draw an energy diagram in which the reactants have a higher internal energy than the products. What direction does the energy flow in this diagram? What is the sign of ΔE? What is this kind of reaction called?

12. Draw an energy diagram in which the reactants have a lower internal energy than the products. What direction does the energy flow in this diagram? What is the sign of ΔE? What is this kind of reaction called?

13. If a system gains thermal energy, what is the sign of q? Where does the thermal energy come from?

14. If a system loses thermal energy, what is the sign of q? Where does the thermal energy come from?

15. What is the sign of ΔE when energy flows into a system? Out of a system?

6.4 Quantifying Heat and Work

16. How are heat and temperature different? Use an example in your explanation.

17. Explain the concept of thermal equilibrium.

18. Define and give the symbol for heat capacity. If two different substances each have 50 J of energy added, which substance will have the greater temperature change?

19. Define and give the symbol for specific heat. Explain the difference between specific heat and heat capacity.

20. In the equation $q = MC_s\Delta T$, identify what each symbol represents and the units used for each:
    a. q
    b. M
    c. C_s
    d. ΔT

21. If two objects are at different temperatures, what will happen when they come into contact with each other?

22. Give an example of pressure-volume work.

6.5 Measuring ΔE for Chemical Reactions: Constant Volume Calorimetry

23. Define calorimetry. Why are calorimetry experiments useful?

6.6 Enthalpy: The Heat Evolved in a Chemical Reaction at Constant Pressure

24. Define enthalpy (H) in your own words, and explain the difference between H and ΔH.

25. How is ΔE different from ΔH?

26. What does a +ΔH indicate? What is the term used for a reaction with this sign of change?

27. What does a −ΔH indicate? What is the term used for a reaction with this sign of change?

28. If an endothermic reaction absorbs heat, why does the reaction container feel cold?

29. What factors determine the magnitude of the enthalpy change of a chemical reaction? How is this usually indicated in a chemical reaction equation statement?

6.7 Constant-Pressure Calorimetry: Measuring ΔH_{rxn}

30. Draw a simple coffee-cup calorimeter and explain how it works. Be sure to explain why this is considered a constant-pressure calorimeter.

31. Write the equation used to determine how the heat lost is related to the heat gained by physical or chemical processes in a coffee-cup calorimeter.

6.8 Relationships Involving ΔH_{rxn}

32. If the chemical reaction $2H_2 + O_2 \rightarrow 2H_2O$ is instead written as $4H_2 + 2O_2 \rightarrow 4H_2O$, what should be done to the value of ΔH_{rxn}?

33. If a chemical reaction reverses to $2H_2O \rightarrow 2H_2 + O_2$, what should be done to the value of ΔH_{rxn}?

34. If a chemical reaction can be expressed as the sum of several equations, then how can the ΔH_{rxn} be found?

35. Use the following two equations and a Hess's law energy level diagram to explain how to solve for the ΔH_{rxn} of $3H_2(g) + O_3(g) \rightarrow 3H_2O(g)$:

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ $\quad \Delta H = -483.6$ kJ

$3O_2(g) \rightarrow 2O_2(g)$ $\quad \Delta H = +285.4$ kJ

6.9 Determining Enthalpies of Reaction from Standard Enthalpies of Formation

36. Explain the concept of standard state for a gas, a liquid, a solid and a substance in solution.

37. What is the standard enthalpy change, and what are the conditions for a standard enthalpy change?

38. What is the standard enthalpy of formation?

39. Write the equation for the standard enthalpy of formation of water.

40. How are standard enthalpy change and standard enthalpy of formation different?

41. Explain how a table of standard enthalpies of formation can be used to find the enthalpy of a reaction.