

UNIT 10 THERMODYNAMICS

Textbook References: *Chemistry Zumdahl 5th Edition Chapters 6 and 16*

1. define vocabulary
2. calculate the amount of heat required for change in temperature
3. solve Calorimetry problems
4. calculate the amount of heat required to change state (heat of vaporization and heat of fusion)
5. use Hess' Law to calculate change in enthalpy or heat of reaction
6. use heat of formation to determine the heat of reaction
7. state the three laws of thermodynamics
8. calculate ΔS , ΔG and ΔH from standard entropy, standard free energy of formations and standard enthalpy of formation
9. change in free energy of a reaction from change in entropy and enthalpy and temperature
10. determine if a reaction is spontaneous or not
11. calculate K or ΔG given the other

Vocabulary:

internal energy	surroundings	enthalpy of formation
joule	state function	calorimeter
calorie	exothermic	Entropy
heat	endothermic	Enthalpy
temperature	enthalpy	free energy
specific heat	ΔH	Gibbs equation
heat capacity	standard conditions	
system	Hess' Law	

AP Course Guide correlation:

III. Reactions

E. Thermodynamics

1. State functions
2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; Calorimetry
3. Second law: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes
4. Relationship of change in free energy to equilibrium constants and electrode potentials

IB Course Outline correlation:

- 5.1.1 Define the terms *exothermic reaction*, *endothermic reaction* and *standard enthalpy change of reaction* (ΔH°).
- 5.1.2 State that combustion and neutralization are exothermic processes.
- 5.1.3 Apply the relationship between temperature change, enthalpy change and the classification of a reaction as endothermic or exothermic.
- 5.1.4 Deduce, from an enthalpy level diagram, the relative stabilities of reactants and products, and the sign of the enthalpy change for the reaction.
- 5.2.1 Calculate the heat energy change when the temperature of a pure substance is changed.
- 5.2.2 Design suitable experimental procedures for measuring the heat energy changes of reactions.
- 5.2.3 Calculate the enthalpy change for a reaction using experimental data on temperature changes, quantities of reactants and mass of water.
- 5.2.4 Evaluate the results of experiments to determine enthalpy changes. 3 Students should be aware of the assumptions made and errors due to heat loss.
- 15.3.1 State and explain the factors that increase the entropy in a system.
- 15.3.2 Predict whether the entropy change (ΔS) for a given reaction or process is positive or negative.
- 15.3.3 Calculate the standard entropy change for a reaction using standard entropy values
- 15.4.1 Predict whether a reaction or process will be spontaneous by using the sign of ΔG°

15.4.2 Calculate ΔG° for a reaction using the equation $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ and by using values of the standard free energy change of formation, ΔG_f° .

15.4.3 Predict the effect of a change in temperature on the spontaneity of a reaction using standard entropy and enthalpy changes and the equation $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$