

## CHAPTER OVERVIEW

### 3: Using Chemical Equations in Calculations

The following sections are concerned with the amounts of substances which participate in chemical reactions, the quantities of heat given off or absorbed when reactions occur, and the volumes of solutions which react exactly with one another. These seemingly unrelated subjects are discussed together because many of the calculations involving them are almost identical in form. The same is true of the density calculations and of the calculations involving molar mass and the Avogadro constant.

#### 3.1: Prelude to Chemical Equations

#### 3.2: Equations and Mass Relationships

- 3.2.1: Cultural Connections- Berthollides- A Challenge to Chemical Stoichiometry
- 3.2.2: Environment- Atom Efficiency and the 2006 Presidential Green Chemistry Award
- 3.2.3: Everyday Life- Why Fats Don't Add Up on Food Nutrition Labels
- 3.2.4: Food- Let's Cook!
- 3.2.5: Foods- Metabolism of Dietary Sugar
- 3.2.6: Lecture Demonstrations
- 3.2.7: Sports, Physiology, and Health- Hydrogen Powered Bicycles "Run on Water"

#### 3.3: The Limiting Reagent

- 3.3.1: Cultural Connections- Anthropology and Protein Stoichiometry
- 3.3.2: Environment- TSP, Ecological Stoichiometry, and Algal Blooms
- 3.3.3: Everyday Life- Grilled Cheese Sandwiches and Omelets
- 3.3.4: Everyday Life - Sodium Silicide Fueled Bicycles
- 3.3.5: Foods- Protein Nutrition
- 3.3.6: Forensics- Gunpowder Stoichiometry
- 3.3.7: Geology- Using the Acid Test to Distinguish the Minerals in "Calomine"
- 3.3.8: Lecture Demonstrations
- 3.3.9: Physics- Rocket Propellants
- 3.3.10: Sports, Physiology, and Health- Sodium Silicide Fueled Bicycles

#### 3.4: Percent Yield

- 3.4.1: Environment- Synthesis of Biodiesel Fuel
- 3.4.2: Foods - Vegetable Oil Hydrogenation, Trans Fats, and Percent Yield

#### 3.5: Analysis of Compounds

- 3.5.1: Foods- Burning or Metabolizing Fats and Sugars

#### 3.6: Thermochemistry

#### 3.7: Energy

#### 3.8: Thermochemical Equations

- 3.8.1: Biology- Weight of Food and Energy Production
- 3.8.2: Environment- Gas
- 3.8.3: Foods- Energy from Fats and Sugars
- 3.8.4: Geology- Heat Engine at Lost City

#### 3.9: Hess' Law

- 3.9.1: Biology- Anaerobic Fermentation in Beer and Lactic Acid in Muscles
- 3.9.2: Environment- Heating Values of Various Fuels
- 3.9.3: Foods- Fat vs. Sugar Metabolism
- 3.9.4: Geology- Iron and its Ores

3.9.5: Lecture Demonstration- Carbide Cannon

3.9.6: Sports, Physiology, and Health- Aerobic vs Anaerobic Energy in Exercise

3.10: Standard Enthalpies of Formation

3.10.1: Biology- Muscle Energy from ATP

3.10.2: Foods- Energy in a Marshmallow

3.10.3: Geology- Calculating the Heat Released by Serpentinization in the "Lost City"

3.10.4: Sports, Physiology, and Health- Muscle Energy from ATP

3.11: Solution Concentrations

3.11.1: Biology- Solution Concentrations and Cells

3.11.2: Environment- Determining Safe Mercury Concentrations in Drinking Water

3.11.3: Environment- Determining Water Purity via Biological Oxygen Demand

3.11.4: Foods- Low Glycemic Index Foods and Blood Glucose Concentration

3.11.5: Lecture Demonstration

3.12: Diluting and Mixing Solutions

3.13: Titrations

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