



General, Organic, and Biochemistry



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Alta General, Organic, and Biochemistry is a one- or two-semester course intended for students whose professional goals require an understanding of chemistry, but not a mastery of it. Many students studying health-related majors will take this course. To develop this course, Knewton used several sources, including a Chemistry professor with a graduate degree from Cal State Northridge who has taught in various undergraduate settings but specializes in organic chemistry, along with a team of Subject Matter Experts (SMEs). The SMEs come from diverse backgrounds and are all accomplished academics in the Chemistry field.

Alta General, Organic, and Biochemistry has at least two instructional sequences for every learning objective, giving students multiple opportunities to learn new concepts. Between our instructional texts, videos, and SMEs, we were able to solicit ideas from chemistry instructors and students. Alta General, Organic, and Biochemistry covers the typical breadth of chemistry topics, and also provides the necessary depth to ensure the course is manageable and engaging for instructors and students alike.

General, Organic, and Biological Chemistry | Table of Contents

Chapter 1: Chemistry: The Science of Matter

1.1 Matter, Chemicals, and the Science of Chemistry

- Understand the scope, importance, and aim of chemistry
- Identify examples of chemistry encountered in daily life

1.2 The Scientific Method

- Understand the scientific method

Chapter 2: Measurements in Science

2.1 Metric and SI Systems

- Understand how to use the SI system for units names and abbreviations
- Identify and use SI units for length, volume, and mass
- Identify and use the SI units for time and temperature

2.2 Significant Figures

- Determine the number of significant figures in measurements
- Use significant figures when performing calculations

2.3 Prefixes and Scientific Notation

- Express numbers in standard notation using prefixes and in scientific notation

2.4 Conversion Factors

- Solve unit conversion problems using dimensional analysis: single step

2.5 Density and Specific Gravity

- Perform specific gravity and density calculations

Chapter 3: Properties of Matter and Energy

3.1 Types of Matter

- Classify matter as elements or compounds

3.2 Solids, Liquids, and Gases: Properties

- Compare and contrast the three states of matter

3.3 Temperature Scales

- Use Celsius, Fahrenheit, and Kelvin temperature scales and convert between them

3.4 Kinetic and Potential Energy

- Define the types of energy

3.5 Application of Energy Units in the Field of Nutrition

- Understand how to calculate caloric value of food

3.6 Specific Heat

- Understand how to use specific heat in heat changes in calculations

3.7 Transitions Between Different States of Matter

- Understand physical properties and physical changes
 - Understand chemical properties and chemical changes
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Chapter 4 : Atomic Structure and the Periodic Table of Elements

4.1 Symbols and Names of Elements

- Read and identify chemical symbols

4.2 The Periodic Table of Elements

- Read and interpret element blocks on the periodic table
- Identify the group on the periodic table an element belongs to
- Understand how elements are arranged in the periodic table

4.3 Structure of Atom

- Identify and describe the subatomic particles that make up an atom
- Understand Dalton's Atomic Theory

4.4 Atomic Number and Mass Number

- Determine the number of protons, electrons, and neutrons in the atom by using the atomic and mass numbers

4.5 Isotopes

- Determine the number of protons, electrons, and neutrons in the isotope from the atomic symbol and write the atomic symbol for the specific isotope
- Identify the most abundant isotope

4.6 Electron Arrangement and Energy Levels

- Write electron arrangement for the first twenty elements in the Periodic Table of Elements

4.7 Electron Arrangement and Property Trends

- Determine the electron configuration of an element

Chapter 5: Radioactivity and Nuclear Processes

5.1 Types of Radiation

- Compare and contrast alpha, beta, gamma, and positron radiation

5.2 Nuclear Reactions and Equations

- Write and balance equations for alpha, beta, positron, and gamma decay

5.3 Radiation Measurements, Exposure, and Safety

- Understand how radiation activity is measured
- Convert between the different units of radiation activity
- Understand health effects of exposure to radiation

5.4 Nuclear Decay and Dating

- Understand how to determine the age of an object by using radioisotopes
- Conduct calculations involving half-life of a radioisotope

5.5 Nuclear Medicine

- Understand how nuclear decay is used in modern medicine

5.6 Nuclear Power

- Describe nuclear fission
 - Describe nuclear fusion
 - Understand the operation of a nuclear power plant
-

Chapter 6: Ions, Compounds, and Molecules

6.1 Simple Ions

- Define ions and distinguish between monatomic and polyatomic ions
- Understand physiological and metabolic functions of biologically important ions

6.2 Ionic Compounds with Simple Ions

- Describe the properties of ionic compounds
- Write the name and formula of an ionic compound with a simple ion

6.3 Ionic Compounds with Polyatomic Ions

- Write the name and formula of a polyatomic ion or compound containing it

6.4 Covalent Bonding and Molecular Compounds

- Understand the type of bonding between atoms in a molecular compound
- Write the name and formula of a molecular compound

6.5 Lewis Structures

- Read and draw Lewis structures for an atom
- Understand how to use the octet rule to draw Lewis structures for covalent compounds

6.6 Types of Bonds and Electronegativity of Atoms

- Determine the type of bond by evaluating electronegativity
- Compare and contrast covalent non-polar, covalent polar, and ionic bonds

6.7 VSEPR Theory and Molecular Geometry

- Understand how to use VSEPR theory to determine molecular shape

6.8 Molecular Geometry and Polarity

- Understand the role that molecular geometry plays in the polarity of a compound

6.9 Intramolecular Forces and Properties of a Compound

- Compare and contrast intermolecular and intramolecular forces
- Define, identify, and describe dipole-dipole attractions between molecules
- Understand the relationship between the intermolecular forces and the melting point of a compound
- Define, identify, and describe hydrogen bonding

Chapter 7: Chemical Reactions and Mass Relationships

7.1 Avogadro's Number and the Mole

- Understand the mole as a unit in measurements
- Convert moles to grams and grams to moles for elements and compounds

7.2 Calculating Atoms, Moles, and Mass

- Derive the number of atoms from an element's mass

7.3 Chemical Equations

- Understand how to represent chemical reactions using an equations
 - Write and balance chemical reactions
-

7.4 Types of Chemical Reactions

- Understand solubility rules and precipitation reactions
- Write balanced chemical equations for acid-base reactions
- Understand oxidation and reduction

7.5 Molar Ratios in Chemical Equations

- Calculate the molar ratios from balanced equations

7.6 Mass Ratios in Chemical Equations

- Calculate the mass of a product or a reactant given a balanced chemical equation

7.7 Exothermic and Endothermic Reactions

- Compare and contrast endothermic and exothermic reactions

Chapter 8: Properties of Gases

8.1 Kinetic Molecular Theory of Gases

- Understand postulates of the kinetic molecular theory of gases

8.2 Boyle's Law

- Perform calculations with Boyle's Law

8.3 Charles's Law

- Perform calculations with Charles's Law

8.4 Gay-Lussac's Law

- Perform calculations with Gay-Lussac's Law

8.5 The Ideal Gas Law

- Apply the ideal gas law in calculations

8.6 Avogadro's Law

- Perform calculations using Avogadro's law

8.7 Dalton's Law

- Perform calculations with Dalton's Law

Chapter 9: Chemical Solutions and Their Constituents

9.1 Solutions

- Recognize solutions and distinguish between solute and solvent
- Describe the formation and properties of solutions

9.2 Solutions of Electrolytes and Nonelectrolytes

- Classify solutes in aqueous solution as strong, weak, and nonelectrolytes
- Describe the characteristics of ionic electrolytes
- Describe covalent electrolytes

9.3 Saturated and Unsaturated Solutions

- Explain the differences between saturated, unsaturated, and supersaturated

9.4 Solubility

- Understand factors that affect solubility
 - Compare and contrast soluble and insoluble ionic compounds
-

9.5 Concentration Units

- Calculate the mass percentage of a component of a solution
- Calculate percent by volume
- Calculate percent by mass-volume

9.6 Dilutions

- Understand how to calculate concentrations of diluted solutions

9.7 Solutions, Colloids, and Suspensions

- Compare and contrast properties of solutions, colloids, and suspensions

9.8 Osmosis and Dialysis

- Classify solutions as isotonic, hypotonic, and hypertonic
- Understand processes of osmosis and dialysis

Chapter 10: Acids and Bases

10.1 Acids, Bases, and Conjugate Pairs

- Identify acids and bases given physical properties and recognize common acids and bases
- Identify acids and bases using the Bronsted-Lowry definition

10.2 Strong and Weak Acids and Bases

- Explain K_a and acid strength
- Explain the relationship between conjugate acid-base pairs

10.3 Acid-Base Equilibrium

- Explain acid-base equilibrium using the concept of reversible reactions

10.4 The Effects of Change on Equilibrium

- Understand the effect that changes in concentration have on equilibrium
- Understand the effect that changes in pressure have on equilibrium
- Understand the effect that changes in temperature have on equilibrium
- Understand how catalysts affect equilibrium

10.5 Water as an Acid and Base

- Read and write equations for the self ionization of water and for acid and base ionization reactions
- Calculate concentrations of hydronium and hydroxide ions

10.6 Hydronium Ions, Hydroxide Ions, and the pH Scale

- Classify solutions as an acidic, basic, or neutral based on pH or hydronium/hydroxide concentrations
- Perform calculations that relate pH and pOH

10.7 Reactions of Acids and Bases

- Understand how acids react with metals, carbonates/bicarbonates, and bases
 - Use titration to determine the molar concentration of an unknown solution
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10.8 Acid-Base Buffers

- Explain buffers and how they work
- Calculate the pH of a buffer solution using the Henderson Hasselbalch equation
- Understand the role of buffers in the control of blood pH

Chapter 11: Hydrocarbons

11.1 The Chemistry of Carbon

- Compare and contrast properties of organic and inorganic compounds

11.2 Structure and Physical Properties of Alkanes

- Recognize chemical and physical properties of alkanes
- Understand how to name alkanes and write their formulas

11.3 Reactions Involving Alkanes

- Write balanced equations for reactions involving alkanes

11.4 Structure and Physical Properties of Alkenes

- Name and write formulas for alkenes, recognize physical properties of alkenes, and identify their isomers

11.5 Structure and Physical Properties of Alkynes

- Name and write formulas for alkynes and their recognize physical properties

11.6 Reactions Involving Alkenes and Alkynes

- Write balanced equations for reactions involving alkenes and alkynes

11.7 Structure and Properties of Aromatic Compounds

- Name and write formulas for aromatic compounds and recognize their physical and chemical properties

Chapter 12: Compounds with Hydroxyl and Carbonyl Functional Groups

12.1 Compounds with Hydroxyl Group

- Understand how to name and write formulas for compounds with hydroxyl groups

12.2 Structure, Properties, and Reactions of Alcohols

- Classify alcohols as primary, secondary, and tertiary
- Recognize physical and chemical properties of alcohols
- Understand the relationship between the structure of alcohol and their physical properties
- Write balanced equations for reactions involving alcohols

12.3 Structure, Properties, and Reactions of Phenols

- Recognize physical and chemical properties of phenols
- Understand the relationship between the structure and acidity of phenols
- Write balanced equations for reactions involving phenols

12.4 Structure, Properties, and Reactions of Ethers

- Recognize chemical and physical properties of ethers

12.5 Compounds with Carbonyl Group

- Identify the characteristics of ketones and aldehydes
-

12.6 Structure, Properties, and Reactions of Aldehydes

- Write balanced equations for reactions involving aldehydes
- Recognize physical and chemical properties of aldehydes

12.7 Structure, Properties, and Reactions of Ketones

- Understand the relationship between the structure of ketones and their physical properties
- Write balanced equations for reactions involving ketones
- Recognize physical and chemical properties of ketones

Chapter 13: Carbohydrates

13.1 Overview of Carbohydrates

- Understand the basic structure of different carbohydrates and their biological importance

13.2 Carbohydrates as Chiral Molecules

- Understand the concept of chirality and distinguish chiral carbons from achiral carbons

13.3 Fischer Projections: Spatial Depictions of Linear Monosaccharides

- Draw Fischer projections and understand the numbering of the carbon atoms in a Fischer projection

13.4 Haworth Structures: Spatial Depictions of Cyclic Monosaccharides

- Distinguish open-chain monosaccharides from cyclic forms and draw Haworth structures

13.5 Carbohydrates in Redox Reactions

- Identify redox reactions involving sugars and determine whether a carbohydrate is a reducing sugar

13.6 Glycosidic Linkages: Linking Monosaccharides

- Identify glycosidic linkages between monosaccharides and distinguish between alpha and beta linkages

13.7 Polysaccharides: Carbohydrate Macromolecules

- Understand the functional distinction between a storage polysaccharide and a structural polysaccharide

Chapter 14: Carboxylic Acids, Esters, Amines, and Amides

14.1 The Carboxyl Functional Group and Carboxylic Acids

- Explore the structure and nomenclature of carboxylic acids

14.2 Chemical Properties of Carboxylic Acids

- Explore important chemical properties of carboxylic acids

14.3 Esters: A Modification of the Carboxyl Group

- Distinguish an ester from other functional groups and explore nomenclature of ester compounds

14.4 Acid and Base Hydrolysis of Esters

- Distinguish between acid and base hydrolysis of esters

14.5 Amines: Nitrogenous Derivatives of Ammonia

- Explore the structural basis and nomenclature of amines
-

14.6 Amides: Nitrogenous Derivatives of Carboxylic Acids

- Understand the chemical relationship between carboxylic acids and amides

Chapter 15: Lipids

15.1 Overview of Lipids

- Understand lipid diversity and distinguish between the lipids as a group and the polymers

15.2 Fatty Acids: Basic Lipid Building Blocks

- Identify the carboxyl group and the hydrocarbon chain in a fatty acid and distinguish between saturated and unsaturated fatty acids

15.3 Waxes and Triacylglycerols

- Understand the components of a triacylglycerol and identify the ester bonds in a triacylglycerol
- Explore chemical properties of triacylglycerols and compare esterification, hydrolysis, hydrogenation, and saponification

15.4 Phospholipids

- Understand the structure, properties, and physiological functions of phospholipids

15.5 Steroids: Lipids with Ring Structures

- Understand cholesterol and cholesterol derivatives and compare cholesterol with non-animal sterols

15.6 Cell Membrane Transport and Infrastructure

- Understand the lipid bilayer structure and the importance of polarity
- Understand the fluid mosaic model and compare mechanisms of transport through membranes

Chapter 16: Proteins

16.1 Proteins: Polymers of Amino Acids

- Identify the structural components of an amino acid and understand the chemical diversity of amino acids

16.2 Amino Acids as Acids and Bases

- Understand protonation and deprotonation of carboxyl and amino groups in amino acids

16.3 Primary Protein Structure: Amino Acid Sequence

- Name and understand the structure of peptides

16.4 Secondary Protein Structure: Alpha Helices and Beta Sheets

- Understand alpha helices and beta pleated sheets

16.5 Higher Level Protein Structure: Tertiary and Quaternary

- Distinguish between the different levels of protein structure, including primary, secondary, tertiary, and quaternary

16.6 Enzymes: Biological Catalysts

- Recognize enzymes as catalysts and distinguish enzymes from substrate

16.7 Effects of Temperature and pH on Enzyme Activity

- Explore effects of temperature and pH on enzyme activity
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16.8 Inhibition of Enzymes

- Compare competitive and noncompetitive inhibition

Chapter 17: Nucleic Acids

17.1 Nucleic Acids: Polymers of Nucleotides

- Identify the three components of nucleotides and distinguish between purines and pyrimidines

17.2 Phosphodiester Bonds: Linking Nucleotides

- Identify the nucleotide components involved in phosphodiester bond formation

17.3 The Double Helical Structure of DNA

- Understand the complementarity of the DNA double helix

17.4 RNA: A Single-Stranded Nucleic Acid

- Understand RNA diversity and define transcription and translation

17.5 From DNA to RNA to Protein

- Understand functions of tRNA, rRNA, and mRNA during translation

17.6 Mutation: Altering DNA's Nucleotide Sequence

- Understand genetic mutation

17.7 Viruses and Reverse Transcription

- Understand viral diversity and reverse transcription

Chapter 18: Metabolism

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- Define metabolism

18.2 ATP: The Cell's Energy Currency

- Understand formation and hydrolysis of ATP

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- Understand the digestion of foods

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- Compare the components of nicotinamide adenine dinucleotide and flavin adenine dinucleotide

18.5 Glycolysis: Splitting Sugar

- Define glycolysis and understand glycolytic inputs and outputs

18.6 Fermentation: Recycling NAD when Oxygen is not Available

- Explain fermentation of pyruvate

18.7 The Citric Acid Cycle: Completing the Dismantling of the Fuel

- Understand the citric acid cycle, including its inputs and outputs

18.8 Oxidative Phosphorylation

- Understand electron transport and proton pumping
 - Understand chemiosmosis
 - Explain the interdependence between electron transport and chemiosmosis
-

18.9 Stored Fuels: Oxidation of Fatty Acids and Degradation of Amino Acids

- Understand oxidation of fatty acids
 - Understand degradation of amino acids
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