

## Syllabus

# Chemistry A

## Course Overview

Chemistry is the study of how a set of substances with particular physical properties—like solid paper and the oxygen in the air—can react with each other to form different substances with entirely different properties—like gaseous water and carbon dioxide. In most cases, these chemical changes result in an energy change as well, either giving off energy or absorbing energy.

Chemistry is considered one of the core scientific disciplines because it is so practical and widely useful in the modern world. The development of new types of materials, new methods of producing or storing energy, or new methods of interacting with genetic material all depend upon a knowledge of chemistry.

In Chemistry A, you will learn some of the “basics” of chemistry: the atomic and molecular structures that result in different chemical properties and the concepts and tools that will enable you to predict chemical properties and chemical reactions.

## Course Goals

By the end of this course, you will be able to do the following:

- Understand the difference between a chemical change and a physical change and understand the basics of atomic theory, which underlies the study of chemistry.
- Be able to use the periodic table to understand atomic structure and predict the chemical behavior of substances.
- Understand the different types of chemical bonding and how they may result in different molecular structures and different chemical properties.
- Understand how quantitative chemical results in the “real world” are based on reactions that occur on the atomic and molecular scale.
- Carry out activities used in real-world chemistry, including predicting the products of a chemical reaction and predicting the amounts of products you would expect from an initial quantity of chemical substances.
- Investigate the relationships between energy and matter, including phase changes and the effects of changing the volume, pressure, or temperature of a gas.

## Math and Science Skills

Successful completion of Algebra 1 provides the mathematical skills you'll need for Chemistry A.

In addition, you should have a good working understanding of inquiry science methods, including:

- Experimental design, including the importance of experimental controls.
- Basic data analysis skills, including the ability to interpret mathematical patterns from data tables and graphs.
- The ability to use experimental results and/or real data sets to propose general rules.

## General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word processing software, such as Microsoft Word or Google Docs.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

*For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Plato Student Orientation document, found at the beginning of this course.*

## Credit Value

Chemistry A is a 0.5-credit course.

## Course Materials

- Computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- *Test and Study References* found at the end of this syllabus. They include a periodic table for testing purposes and a periodic table for student study.
- Notebook

## Course Pacing Guide

This course description and pacing guide is intended to help you keep on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

### Unit 1: Matter and Atomic Structure

#### Summary

In this unit, you will be introduced to the concept of chemical change as opposed to physical change and you will review atomic theory, which underlies the study of chemistry.

Day	Activity/Objective	Type
1 day: 1	<b>Syllabus and Plato Student Orientation</b> <i>Review the Plato Student Orientation and Course Syllabus at the beginning of this course.</i>	Course Orientation
2 days: 2–3	<b>Types of Matter</b> <i>Learner will identify different types of matter.</i>	Lesson
2 days: 4–5	<b>Physical Changes Versus Chemical Changes</b> <i>Learner will identify physical and chemical properties and changes.</i>	Lesson
2 days: 6–7	<b>Models of the Atom</b> <i>Learner will describe the experimental basis for the atom and identify the parts of the atom.</i>	Lesson
2 days: 8–9	<b>Isotopes and Atomic Mass</b> <i>Learner will calculate average atomic mass from isotopic information.</i>	Lesson
2 days: 10–11	<b>Unit Activity and Discussion—Unit 1</b>	Unit Activity Discussion
1 day: 12	<b>Posttest—Unit 1</b>	Assessment

## Unit 2: The Periodic Table

### Summary

In this unit, you will explore the periodic table which helps us understand atomic structure and predict the chemical behavior of substances.

Day	Activity/Objective	Type
2 days: 13–14	<b>The Periodic Table</b> <i>Learner will use the periodic table to identify information about an element and to predict element properties.</i>	Lesson
2 days: 15–16	<b>Electron Configurations</b> <i>Learner will write electron configurations.</i>	Lesson
2 days: 17–18	<b>Periodic Trends</b> <i>Learner will identify and compare periodic trends from the periodic table.</i>	Lesson
2 days: 19–20	<b>Electromagnetic Radiation</b> <i>Learner will describe electromagnetic radiation and perform appropriate calculations.</i>	Lesson
2 days: 21–22	<b>Spectral Lines</b> <i>Learner will identify spectral lines for elements.</i>	Lesson
2 days: 23–24	<b>Unit Activity and Discussion—Unit 2</b>	Unit Activity Discussion
1 day: 25	<b>Posttest—Unit 2</b>	Assessment

## Unit 3: Bonding

### Summary

In this unit, you will learn about chemical bonding and explore how different types of bonds result in different molecular structures and different chemical properties.

Day	Activity/Objective	Type
2 days: 26–27	<b>Ionic, Covalent, and Metallic Bonds</b> <i>Learner will identify ionic, covalent, and metallic substances and describe their bonding.</i>	Lesson
2 days: 28–29	<b>Compound Names</b> <i>Learner will use rules for naming compounds.</i>	Lesson
2 days: 30–31	<b>Lewis Structures</b> <i>Learner will draw Lewis structures.</i>	Lesson
2 days: 32–33	<b>Electronegativity</b> <i>Learner will differentiate between ionic, polar covalent, and nonpolar covalent bonds.</i>	Lesson
2 days: 34–35	<b>Three-Dimensional Molecules</b> <i>Learner will predict the three-dimensional bond shape of a molecule.</i>	Lesson
3 days: 36–37	<b>Molecular Polarity</b> <i>Learner will predict molecular polarity.</i>	
2 days: 38–39	<b>Intermolecular Forces</b> <i>Learner will identify intermolecular forces.</i>	
3 days: 40–42	<b>Unit Activity and Discussion—Unit 3</b>	Unit Activity Discussion
1 day: 43	<b>Posttest—Unit 3</b>	Assessment

## Unit 4: The Mole Concept

### Summary

In this unit, you will learn about how quantitative chemical results in the “real world” are based on reactions occurring on the atomic and molecular scale.

Day	Activity/Objective	Type
2 days: 44–45	<b>Moles and Molar Mass</b> <i>Learner will identify a mole and calculate molar mass.</i>	Lesson
2 days: 46–47	<b>Mole Calculations</b> <i>Learner will calculate representative particles, mass, volume, and moles from given data.</i>	Lesson
2 days: 48–49	<b>Percent Composition</b> <i>Learner will calculate percent composition.</i>	Lesson
2 days: 50–51	<b>Empirical and Molecular Formulas</b> <i>Learner will determine empirical and molecular formulas.</i>	Lesson
2 days: 52–53	<b>Unit Activity and Discussion—Unit 4</b>	Unit Activity Discussion
1 day: 54	<b>Posttest—Unit 4</b>	Assessment

## Unit 5: Chemical Reactions

### Summary

In this unit, you will carry out activities used in real-world chemistry, including predicting the products of a chemical reaction and predicting the amounts of products you would expect from an initial quantity of chemical substances.

Day	Activity/Objective	Type
2 days: 55–56	<b>Balancing Chemical Equations</b> <i>Learner will balance chemical equations.</i>	Lesson
2 days: 57–58	<b>Types of Reactions</b> <i>Learner will identify different types of chemical reactions.</i>	Lesson
2 days: 59–60	<b>Predicting Chemical Products</b> <i>Learner will predict products for simple chemical reactions.</i>	Lesson
2 days: 61–62	<b>Mole Ratios and Stoichiometry</b> <i>Learner will determine mole ratios from balanced chemical equations and perform mole to mole stoichiometry problems.</i>	Lesson
2 days: 63–64	<b>Mass and Volume Stoichiometry</b> <i>Learner will calculate stoichiometry problems involving mass and volume.</i>	Lesson
2 days: 65–66	<b>Percent Yield</b> <i>Learner will calculate percent yield for chemical reactions.</i>	Lesson
3 days: 67–69	<b>Unit Activity and Discussion—Unit 5</b>	Unit Activity Discussion
1 day: 70	<b>Posttest—Unit 5</b>	Assessment

## Unit 6: Kinetic Molecular Theory and Gas Law

### Summary

In this unit, you will investigate the relationships between energy and matter, including phase changes and the effects of changing the volume, pressure, or temperature of a gas.

Day	Activity/Objective	Type
2 days: 71–72	<b>Energy and Chemical Reactions</b> <i>Learner will identify different forms of energy and how they relate to chemical reactions.</i>	Lesson
2 days: 73–74	<b>Endothermic and Exothermic Reactions</b> <i>Learner will differentiate between endothermic and exothermic processes.</i>	Lesson
2 days: 75–76	<b>Kinetic Theory</b> <i>Learner will describe the kinetic theory.</i>	Lesson
2 days: 77–78	<b>States of Matter</b> <i>Learner will differentiate between the states of matter.</i>	Lesson
2 days: 79–80	<b>Heating Curves and Phase Changes</b> <i>Learner will understand a heating curve and describe heat changes during phase changes.</i>	Lesson
2 days: 81–82	<b>Gas Law Calculations</b> <i>Calculate problems using gas laws.</i>	Lesson
2 days: 83–84	<b>Ideal Gas Law</b> <i>Learner will identify an ideal gas and use the ideal gas law.</i>	Lesson
2 days: 85–86	<b>Dalton's Law and Graham's Law</b> <i>Learner will use Dalton's law of partial pressures and Graham's law of effusion to describe gases.</i>	Lesson
2 days: 87–88	<b>Unit Activity and Discussion—Unit 6</b>	Unit Activity Discussion
1 day: 89	<b>Posttest—Unit 6</b>	Assessment
1 day: 90	<b>End of Semester Test</b>	Assessment



# Test and Study References

**Periodic Table of the Elements**  
**TESTING AND ASSESSMENT Reference**

1 <b>H</b> 1.008																	2 <b>He</b> 4.00														
3 <b>Li</b> 6.941	4 <b>Be</b> 9.01															10 <b>Ne</b> 20.18															
11 <b>Na</b> 22.99	12 <b>Mg</b> 24.30															18 <b>Ar</b> 39.95															
19 <b>K</b> 39.10	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.956	22 <b>Ti</b> 47.867	23 <b>V</b> 50.942	24 <b>Cr</b> 51.996	25 <b>Mn</b> 54.94	26 <b>Fe</b> 55.85	27 <b>Co</b> 58.93	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.55	30 <b>Zn</b> 65.39	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.64	33 <b>As</b> 74.92	34 <b>Se</b> 78.96	35 <b>Br</b> 79.90	36 <b>Kr</b> 83.8														
37 <b>Rb</b> 85.47	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.91	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.91	42 <b>Mo</b> 95.94	43 <b>Tc</b> 98	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.91	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.87	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.71	51 <b>Sb</b> 121.76	52 <b>Te</b> 127.6	53 <b>I</b> 126.91	54 <b>Xe</b> 131.293														
55 <b>Cs</b> 132.91	56 <b>Ba</b> 137.33	57 <b>La</b> 138.91	58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.91	60 <b>Nd</b> 144.24	61 <b>Pm</b> 145	62 <b>Sm</b> 150.36	63 <b>Eu</b> 151.964	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.93	66 <b>Dy</b> 162.5	67 <b>Ho</b> 164.93	68 <b>Er</b> 167.26	69 <b>Tm</b> 168.93	70 <b>Yb</b> 173.04	71 <b>Lu</b> 174.97	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.94	74 <b>W</b> 183.84	75 <b>Re</b> 186.207	76 <b>Os</b> 190.23	77 <b>Ir</b> 192.217	78 <b>Pt</b> 195.078	79 <b>Au</b> 196.97	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.38	82 <b>Pb</b> 207.2	83 <b>Bi</b> 208.98	84 <b>Po</b> 209	85 <b>At</b> 210	86 <b>Rn</b> 222
87 <b>Fr</b> 223	88 <b>Ra</b> 226	89 <b>Ac</b> 227.03	90 <b>Th</b> 232.04	91 <b>Pa</b> 231.04	92 <b>U</b> 238.03	93 <b>Np</b> 237	94 <b>Pu</b> 244	95 <b>Am</b> 243	96 <b>Cm</b> 247	97 <b>Bk</b> 247	98 <b>Cf</b> 251	99 <b>Es</b> 252	100 <b>Fm</b> 257	101 <b>Md</b> 258	102 <b>No</b> 259	103 <b>Lr</b> 262	104 <b>Rf</b> 261	105 <b>Db</b> 262	106 <b>Sg</b> 266	107 <b>Bh</b> 264	108 <b>Hs</b> 277	109 <b>Mt</b> 268	110 <b>Ds</b> 271	111 <b>Rg</b> 272							

# Periodic Table of the Elements

## Student Study Reference

1A 1 <b>H</b> 1.008 Hydrogen	2A 4 <b>Be</b> 9.01 Beryllium	3A 5 <b>B</b> 10.81 Boron	4A 6 <b>C</b> 12.01 Carbon	5A 7 <b>N</b> 14.007 Nitrogen	6A 8 <b>O</b> 15.999 Oxygen	7A 9 <b>F</b> 18.998 Fluorine	8A 2 <b>He</b> 4.00 Helium																								
3 11 <b>Na</b> 22.99 Sodium	12 <b>Mg</b> 24.30 Magnesium	13 <b>Al</b> 26.98 Aluminum	14 <b>Si</b> 28.09 Silicon	15 <b>P</b> 30.97 Phosphorus	16 <b>S</b> 32.06 Sulfur	17 <b>Cl</b> 35.45 Chlorine	18 <b>Ar</b> 39.95 Argon																								
4 19 <b>K</b> 39.10 Potassium	20 <b>Ca</b> 40.08 Calcium	21 <b>Sc</b> 44.956 Scandium	22 <b>Ti</b> 47.867 Titanium	23 <b>V</b> 50.942 Vanadium	24 <b>Cr</b> 51.996 Chromium	25 <b>Mn</b> 54.94 Manganese	26 <b>Fe</b> 55.85 Iron	27 <b>Co</b> 58.93 Cobalt	28 <b>Ni</b> 58.69 Nickel	29 <b>Cu</b> 63.55 Copper	30 <b>Zn</b> 65.39 Zinc	31 <b>Ga</b> 69.72 Gallium	32 <b>Ge</b> 72.64 Germanium	33 <b>As</b> 74.92 Arsenic	34 <b>Se</b> 78.96 Selenium	35 <b>Br</b> 79.90 Bromine	36 <b>Kr</b> 83.8 Krypton														
5 37 <b>Rb</b> 85.47 Rubidium	38 <b>Sr</b> 87.62 Strontium	39 <b>Y</b> 88.91 Yttrium	40 <b>Zr</b> 91.22 Zirconium	41 <b>Nb</b> 92.91 Niobium	42 <b>Mo</b> 95.94 Molybdenum	43 <b>Tc</b> 98 Technetium	44 <b>Ru</b> 101.07 Ruthenium	45 <b>Rh</b> 102.91 Rhodium	46 <b>Pd</b> 106.42 Palladium	47 <b>Ag</b> 107.87 Silver	48 <b>Cd</b> 112.41 Cadmium	49 <b>In</b> 114.82 Indium	50 <b>Sn</b> 118.71 Tin	51 <b>Sb</b> 121.76 Antimony	52 <b>Te</b> 127.6 Tellurium	53 <b>I</b> 126.91 Iodine	54 <b>Xe</b> 131.293 Xenon														
6 55 <b>Cs</b> 132.91 Cesium	56 <b>Ba</b> 137.33 Barium	57 <b>La</b> 138.91 Lanthanum	58 <b>Ce</b> 140.12 Cerium	59 <b>Pr</b> 140.91 Praseodymium	60 <b>Nd</b> 144.24 Neodymium	61 <b>Pm</b> 145 Promethium	62 <b>Sm</b> 150.36 Samarium	63 <b>Eu</b> 151.964 Europium	64 <b>Gd</b> 157.25 Gadolinium	65 <b>Tb</b> 158.93 Terbium	66 <b>Dy</b> 162.5 Dysprosium	67 <b>Ho</b> 164.93 Holmium	68 <b>Er</b> 167.26 Erbium	69 <b>Tm</b> 168.93 Thulium	70 <b>Yb</b> 173.04 Ytterbium	71 <b>Lu</b> 174.97 Lutetium	72 <b>Hf</b> 178.49 Hafnium	73 <b>Ta</b> 180.94 Tantalum	74 <b>W</b> 183.84 Tungsten	75 <b>Re</b> 186.207 Rhenium	76 <b>Os</b> 190.23 Osmium	77 <b>Ir</b> 192.217 Iridium	78 <b>Pt</b> 195.078 Platinum	79 <b>Au</b> 196.97 Gold	80 <b>Hg</b> 200.59 Mercury	81 <b>Tl</b> 204.38 Thallium	82 <b>Pb</b> 207.2 Lead	83 <b>Bi</b> 208.98 Bismuth	84 <b>Po</b> 209 Polonium	85 <b>At</b> 210 Astatine	86 <b>Rn</b> 222 Radon
7 87 <b>Fr</b> 223 Francium	88 <b>Ra</b> 226 Radium	89 <b>Ac</b> 227.03 Actinium	90 <b>Th</b> 232.04 Thorium	91 <b>Pa</b> 231.04 Protactinium	92 <b>U</b> 238.03 Uranium	93 <b>Np</b> 237 Neptunium	94 <b>Pu</b> 244 Plutonium	95 <b>Am</b> 243 Americium	96 <b>Cm</b> 247 Curium	97 <b>Bk</b> 247 Berkelium	98 <b>Cf</b> 251 Californium	99 <b>Es</b> 252 Einsteinium	100 <b>Fm</b> 257 Fermium	101 <b>Md</b> 258 Mendelevium	102 <b>No</b> 259 Nobelium	103 <b>Lr</b> 262 Lawrencium	104 <b>Rf</b> 261 Rutherfordium	105 <b>Db</b> 262 Dubnium	106 <b>Sg</b> 266 Seaborgium	107 <b>Bh</b> 264 Bohrium	108 <b>Hs</b> 277 Hassium	109 <b>Mt</b> 288 Meitnerium	110 <b>Ds</b> 271 Darmstadtium	111 <b>Rg</b> 272 Roentgenium	112 <b>Cn</b> 285 Copernicium	113 <b>Nh</b> 284 Nihonium	114 <b>Fl</b> 289 Flerovium	115 <b>Mc</b> 288 Moscovium	116 <b>Lv</b> 293 Livermorium	117 <b>Ts</b> 294 Tennessine	118 <b>Og</b> 294 Oganesson