

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	Syllabus and Plato Student Orientation <i>Review the Plato Student Orientation and Course Syllabus at the beginning of this course.</i>	Course Orientation
2 days: 2–3	Types of Matter <i>Learner will identify different types of matter.</i>	Lesson
2 days: 4–5	Physical Changes Versus Chemical Changes <i>Learner will identify physical and chemical properties and changes.</i>	Lesson
2 days: 6–7	Models of the Atom <i>Learner will describe the experimental basis for the atom and identify the parts of the atom.</i>	Lesson
2 days: 8–9	Isotopes and Atomic Mass <i>Learner will calculate average atomic mass from isotopic information.</i>	Lesson
2 days: 10–11	Unit Activity and Discussion—Unit 1	Unit Activity Discussion
1 day: 12	Posttest—Unit 1	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	The Periodic Table <i>Learner will use the periodic table to identify information about an element and to predict element properties.</i>	Lesson
2 days: 15–16	Electron Configurations <i>Learner will write electron configurations.</i>	Lesson
2 days: 17–18	Periodic Trends <i>Learner will identify and compare periodic trends from the periodic table.</i>	Lesson
2 days: 19–20	Electromagnetic Radiation <i>Learner will describe electromagnetic radiation and perform appropriate calculations.</i>	Lesson
2 days: 21–22	Spectral Lines <i>Learner will identify spectral lines for elements.</i>	Lesson
2 days: 23–24	Unit Activity and Discussion—Unit 2	Unit Activity Discussion
1 day: 25	Posttest—Unit 2	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	Ionic, Covalent, and Metallic Bonds <i>Learner will identify ionic, covalent, and metallic substances and describe their bonding.</i>	Lesson
2 days: 28–29	Compound Names <i>Learner will use rules for naming compounds.</i>	Lesson
2 days: 30–31	Lewis Structures <i>Learner will draw Lewis structures.</i>	Lesson
2 days: 32–33	Electronegativity <i>Learner will differentiate between ionic, polar covalent, and nonpolar covalent bonds.</i>	Lesson
2 days: 34–35	Three-Dimensional Molecules <i>Learner will predict the three-dimensional bond shape of a molecule.</i>	Lesson
3 days: 36–37	Molecular Polarity <i>Learner will predict molecular polarity.</i>	
2 days: 38–39	Intermolecular Forces <i>Learner will identify intermolecular forces.</i>	
3 days: 40–42	Unit Activity and Discussion—Unit 3	Unit Activity Discussion
1 day: 43	Posttest—Unit 3	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	Moles and Molar Mass <i>Learner will identify a mole and calculate molar mass.</i>	Lesson
2 days: 46–47	Mole Calculations <i>Learner will calculate representative particles, mass, volume, and moles from given data.</i>	Lesson
2 days: 48–49	Percent Composition <i>Learner will calculate percent composition.</i>	Lesson
2 days: 50–51	Empirical and Molecular Formulas <i>Learner will determine empirical and molecular formulas.</i>	Lesson
2 days: 52–53	Unit Activity and Discussion—Unit 4	Unit Activity Discussion
1 day: 54	Posttest—Unit 4	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	Balancing Chemical Equations <i>Learner will balance chemical equations.</i>	Lesson
2 days: 57–58	Types of Reactions <i>Learner will identify different types of chemical reactions.</i>	Lesson
2 days: 59–60	Predicting Chemical Products <i>Learner will predict products for simple chemical reactions.</i>	Lesson
2 days: 61–62	Mole Ratios and Stoichiometry <i>Learner will determine mole ratios from balanced chemical equations and perform mole to mole stoichiometry problems.</i>	Lesson
2 days: 63–64	Mass and Volume Stoichiometry <i>Learner will calculate stoichiometry problems involving mass and volume.</i>	Lesson
2 days: 65–66	Percent Yield <i>Learner will calculate percent yield for chemical reactions.</i>	Lesson
3 days: 67–69	Unit Activity and Discussion—Unit 5	Unit Activity Discussion
1 day: 70	Posttest—Unit 5	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	Energy and Chemical Reactions <i>Learner will identify different forms of energy and how they relate to chemical reactions.</i>	Lesson
2 days: 73–74	Endothermic and Exothermic Reactions <i>Learner will differentiate between endothermic and exothermic processes.</i>	Lesson
2 days: 75–76	Kinetic Theory <i>Learner will describe the kinetic theory.</i>	Lesson
2 days: 77–78	States of Matter <i>Learner will differentiate between the states of matter.</i>	Lesson
2 days: 79–80	Heating Curves and Phase Changes <i>Learner will understand a heating curve and describe heat changes during phase changes.</i>	Lesson
2 days: 81–82	Gas Law Calculations <i>Calculate problems using gas laws.</i>	Lesson
2 days: 83–84	Ideal Gas Law <i>Learner will identify an ideal gas and use the ideal gas law.</i>	Lesson
2 days: 85–86	Dalton's Law and Graham's Law <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	Unit Activity and Discussion—Unit 6	Unit Activity Discussion
1 day: 89	Posttest—Unit 6	Assessment
1 day: 90	End of Semester Test	Assessment

Test and Study References

Periodic Table of the Elements
TESTING AND ASSESSMENT Reference

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

Periodic Table of the Elements

Student Study Reference

1A	2A	3A	4A	5A	6A	7A	8A
1 H 1.008 Hydrogen	4 Be 9.01 Beryllium	5 B 10.81 Boron	6 C 12.01 Carbon	7 N 14.007 Nitrogen	8 O 15.999 Oxygen	9 F 18.998 Fluorine	2 He 4.00 Helium
2 Li 1.941 Lithium	12 Mg 24.30 Magnesium	13 Al 26.98 Aluminum	14 Si 28.09 Silicon	15 P 30.97 Phosphorus	16 S 32.06 Sulfur	17 Cl 35.45 Chlorine	10 Ne 20.18 Neon
3 Na 22.99 Sodium	20 Ca 40.08 Calcium	31 Ga 69.72 Gallium	32 Ge 72.64 Germanium	33 As 74.92 Arsenic	34 Se 78.96 Selenium	35 Br 79.90 Bromine	18 Ar 39.95 Argon
4 K 39.10 Potassium	38 Sr 87.62 Strontium	39 Y 88.91 Yttrium	40 Zr 91.22 Zirconium	41 Nb 92.91 Niobium	42 Mo 95.94 Molybdenum	43 Tc 98 Technetium	36 Kr 83.8 Krypton
5 Rb 85.47 Rubidium	56 Ba 137.33 Barium	71 Lu 174.97 Lutetium	72 Hf 178.49 Hafnium	73 Ta 180.94 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	54 Xe 131.293 Xenon
6 Cs 132.91 Cesium	88 Ra 226 Radium	103 Lr 262 Lawrencium	104 Rf 261 Rutherfordium	105 Db 262 Dubnium	106 Sg 266 Seaborgium	107 Bh 264 Bohrium	86 Rn 222 Radon
7 Fr 223 Francium							
			B groups				
			29 Cu 63.55 Copper	28 Ni 58.69 Nickel	27 Co 58.93 Cobalt	26 Fe 55.85 Iron	
			30 Zn 65.39 Zinc	47 Ag 107.87 Silver	46 Pd 106.42 Palladium	45 Rh 102.91 Rhodium	
			48 Cd 112.41 Cadmium	79 Au 196.97 Gold	78 Pt 195.078 Platinum	77 Ir 192.217 Iridium	
			49 In 114.82 Indium	80 Hg 200.59 Mercury	110 Ds 271 Darmstadtium	109 Mt 268 Meitnerium	
			50 Sn 118.71 Tin	81 Tl 204.38 Thallium	111 Rg 272 Roentgenium	108 Hs 277 Hassium	
			51 Sb 121.76 Antimony	82 Pb 207.2 Lead		107 Bh 264 Bohrium	
			52 Te 127.6 Tellurium	83 Bi 208.98 Bismuth		106 Sg 266 Seaborgium	
			53 I 126.91 Iodine	84 Po 209 Polonium		105 Db 262 Dubnium	
			54 Xe 131.293 Xenon	85 At 210 Astatine		104 Rf 261 Rutherfordium	
						103 Lr 262 Lawrencium	
						102 Ni 259 Nobelium	
						101 Md 258 Mendelevium	
						100 Fm 257 Fermium	
						99 Es 252 Einsteinium	
						98 Cf 251 Californium	
						97 Bk 247 Berkelium	
						96 Cm 247 Curium	
						95 Am 243 Americium	
						94 Pu 244 Plutonium	
						93 Np 237 Neptunium	
						92 U 238.03 Uranium	
						91 Pa 231.04 Protactinium	
						90 Th 232.04 Thorium	
						89 Ac 227.03 Actinium	
						88 Ra 226 Radium	
						87 Fr 223 Francium	
						86 Rn 222 Radon	
						85 At 210 Astatine	
						84 Po 209 Polonium	
						83 Bi 208.98 Bismuth	
						82 Pb 207.2 Lead	
						81 Tl 204.38 Thallium	
						80 Hg 200.59 Mercury	
						79 Au 196.97 Gold	
						78 Pt 195.078 Platinum	
						77 Ir 192.217 Iridium	
						76 Os 190.23 Osmium	
						75 Re 186.207 Rhenium	
						74 W 183.84 Tungsten	
						73 Ta 180.94 Tantalum	
						72 Hf 178.49 Hafnium	
						71 Lu 174.97 Lutetium	
						70 Yb 173.04 Ytterbium	
						69 Tm 168.93 Thulium	
						68 Er 167.26 Erbium	
						67 Ho 164.93 Holmium	
						66 Dy 162.5 Dysprosium	
						65 Tb 158.93 Terbium	
						64 Gd 157.25 Gadolinium	
						63 Eu 151.964 Europium	
						62 Sm 150.36 Samarium	
						61 Pm 145 Promethium	
						60 Nd 144.24 Neodymium	
						59 Pr 140.91 Praseodymium	
						58 Ce 140.12 Cerium	
						57 La 138.91 Lanthanum	