

Syllabus

Chemistry B

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 B, you will learn about key types of chemical relationships and reactions, including solutions, reversible reactions, acid-base reactions, thermochemical systems, and electrochemical systems. You will use your knowledge to analyze new situations and make qualitative and quantitative predictions. Finally, you will extend your chemical knowledge into the areas of nuclear chemistry, organic chemistry, and biochemistry.

Course Goals

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

- Describe the dissolving process and be able to apply your understanding of the mechanisms, variables, and calculations associated with chemical solutions.
- Describe the variables that affect reaction rates and apply your understanding quantitatively for reactions in one direction as well as reversible reactions and systems in chemical equilibrium.
- Describe acids and bases by their properties and from a theoretical perspective and be able to make quantitative calculations and predictions about acids, bases, and the reactions between them.
- Analyze and use key thermochemical values (heat, entropy, enthalpy, and free energy) to make predictions about chemical interactions.
- Apply your knowledge of oxidation and reduction to analyze and make predictions about potential chemical interactions.
- Apply your knowledge of nuclear reactions and nuclear forces to solve real-world problems. You will also learn to recognize, name, and understand the properties of basic organic and biochemical structures and molecules.

Math and Science Skills

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

Successful completion of Chemistry A (or its equivalent) is required for Chemistry B. This includes an understanding of the atomic and molecular structures of matter and the concepts and tools that enable you to predict chemical properties and chemical reactions.

You should also 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 B 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: Solutions

Summary

In this unit, you will be able to describe the dissolving process and be able to apply your understanding of the mechanisms, variables, and calculations associated with chemical solutions.

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	The Dissolving Process <i>Learner will Describe the dissolving process.</i>	Lesson
2 days: 4–5	Rate of Dissolution <i>Learner will identify factors that affect rate of dissolution.</i>	Lesson
2 days: 6–7	Degrees of Saturation <i>Learner will identify different types of solutions based on degrees of saturation.</i>	Lesson
2 days: 8–9	Molarity of a Solution <i>Learner will calculate concentrations for solutions in terms of molarity.</i>	Lesson
2 days: 10–11	Dilution and Stoichiometry Calculations <i>Learner will use concentrations to perform dilutions and solution stoichiometry.</i>	Lesson
2 days: 12–13	Colligative Properties of a Solution <i>Learner will identify and describe colligative properties of solutions.</i>	Lesson
2 days: 14–15	Unit Activity and Discussion—Unit 1	Unit Activity Discussion
1 day: 16	Posttest—Unit 1	Assessment

Unit 2: Reaction Rates

Summary

In this unit, you will be able to describe the variables that affect reaction rates and apply your understanding quantitatively for reactions in one direction as well as reversible reactions and systems in chemical equilibrium.

Day	Activity/Objective	Type
2 days: 17–18	Reaction Rates <i>Learner will describe reaction rates and identify factors that affect them.</i>	Lesson
2 days: 19–20	Activation Energy <i>Learner will understand activation energy and describe how catalysts affect it.</i>	Lesson
2 days: 21–22	Chemical Equilibrium <i>Learner will describe chemical equilibrium.</i>	Lesson
2 days: 23–24	Equilibrium Constants <i>Learner will write and evaluate equilibrium constant expressions.</i>	Lesson
2 days: 25–26	Le Chatelier's Principle <i>Learner will identify Le Chatelier's principle and explain how stressors affect chemical equilibrium.</i>	Lesson
2 days: 27–28	Rate Law for a Reaction <i>Learner will write a rate law for a reaction based on experimental data.</i>	Lesson
2 days: 29–30	Unit Activity and Discussion—Unit 2	Unit Activity Discussion
1 day: 31	Posttest—Unit 2	Assessment

Unit 3: Acids and Bases

Summary

In this unit, you will be able to describe acids and bases by their properties and from a theoretical perspective. You will also be able to make quantitative calculations and predictions about acids, bases, and reactions between them.

Day	Activity/Objective	Type
2 days: 32–33	Properties of Acids and Bases <i>Learner will identify properties of acids and bases.</i>	Lesson
2 days: 34–35	Types of Acids and Bases <i>Learner will differentiate among the three types of acids and bases.</i>	Lesson
2 days: 36–37	The pH Scale <i>Learner will describe the autoionization of water and calculate pH.</i>	Lesson
2 days: 38–39	Strong and Weak Acids and Bases <i>Learner will identify strong and weak acids and bases.</i>	Lesson
2 days: 40–41	Neutralization Reactions <i>Learner will identify and describe neutralization reactions.</i>	Lesson
2 days: 42–43	Titration Calculations <i>Learner will use titrations to calculate concentrations.</i>	
2 days: 44–45	Unit Activity and Discussion—Unit 3	Unit Activity Discussion
1 day: 46	Posttest—Unit 3	Assessment

Unit 4: Energy

Summary

In this unit, you will learn about key thermochemical values (heat, entropy, enthalpy, and free energy) and use these values to make predictions about chemical interactions.

Day	Activity/Objective	Type
2 days: 47–48	Entropy <i>Learner will describe the concept of entropy.</i>	Lesson
2 days: 49–50	Thermochemical Calculations <i>Learner will use calorimetry and thermochemical equations to solve problems involving heat.</i>	Lesson
2 days: 51–52	Energy Diagrams for Reactions <i>Learner will draw an energy profile for a reaction.</i>	Lesson
2 days: 53–54	Hess's Law <i>Learner will calculate enthalpy changes using Hess's law.</i>	Lesson
2 days: 55–56	The Gibbs Free Energy Equation <i>Learner will describe the Gibbs free energy equation.</i>	Lesson
2 days: 57–58	Unit Activity and Discussion—Unit 4	Unit Activity Discussion
1 day: 59	Posttest—Unit 4	Assessment

Unit 5: Oxidation-Reduction Reactions

Summary

In this unit, you will use your knowledge of oxidation and reduction to analyze and make predictions about potential chemical interactions.

Day	Activity/Objective	Type
2 days: 60–61	Oxidation and Reduction <i>Learner will describe the process of oxidation and reduction.</i>	Lesson
2 days: 62–63	Redox Reactions <i>Learner will identify and describe oxidation-reduction reactions.</i>	Lesson
2 days: 64–65	Standard Reduction Potentials <i>Learner will describe and calculate standard reduction potentials.</i>	Lesson
2 days: 66–67	Voltaic and Electrochemical Cells <i>Learner will describe voltaic and electrochemical cells.</i>	Lesson
2 days: 68–69	Standard Cell Potentials <i>Learner will relate standard cell potentials to Gibbs free energy and equilibrium constants</i>	Lesson
3 days: 70–72	Unit Activity and Discussion—Unit 5	Unit Activity Discussion
1 day: 73	Posttest—Unit 5	Assessment

Unit 6: Nuclear Chemistry and Biochemistry

Summary

In this unit, you will apply your knowledge of nuclear reactions and nuclear forces to solve real-world problems. You will also learn to recognize, name, and understand the properties of basic organic and biochemical structures and molecules.

Day	Activity/Objective	Type
2 days: 74–75	Nuclear Forces <i>Learner will describe nuclear forces.</i>	Lesson
2 days: 76–77	Radioactive Decay <i>Learner will identify naturally occurring radioactive isotopes and the ways that they decay.</i>	Lesson
2 days: 78–79	Nuclear Fission and Fusion <i>Learner will describe nuclear fission and fusion.</i>	Lesson
2 days: 80–81	Hydrocarbons <i>Learner will use proper nomenclature to name basic hydrocarbons and organic molecules.</i>	Lesson
2 days: 82–83	Organic Functional Groups <i>Learner will identify organic functional groups.</i>	Lesson
2 days: 84–85	Biochemical Molecules <i>Learner will describe and identify basic organic molecules important to life.</i>	Lesson
3 days: 86–88	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	1 H 1.008 Hydrogen	2A	4 Be 9.01 Beryllium	3A	5 B 10.81 Boron	4A	6 C 12.01 Carbon	5A	7 N 14.007 Nitrogen	6A	8 O 15.999 Oxygen	7A	9 F 18.998 Fluorine	8A	2 He 4.00 Helium				
2	3 Li 1.941 Lithium													10 Ne 20.18 Neon					
3	11 Na 22.99 Sodium	12 Mg 24.30 Magnesium	B groups											18 Ar 39.95 Argon					
4	19 K 39.10 Potassium	20 Ca 40.08 Calcium												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	36 Kr 83.8 Krypton
5	37 Rb 85.47 Rubidium	38 Sr 87.62 Strontium												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	54 Xe 131.293 Xenon
6	55 Cs 132.91 Cesium	56 Ba 137.33 Barium												49 In 114.82 Indium	50 Sn 118.71 Tin	51 Sb 121.76 Antimony	52 Te 127.6 Tellurium	53 I 126.91 Iodine	86 Rn 222 Radon
7	87 Fr 223 Francium	88 Ra 226 Radium												81 Tl 204.38 Thallium	82 Pb 207.2 Lead	83 Bi 208.98 Bismuth	84 Po 209 Polonium	85 At 210 Astatine	
														29 Cu 63.55 Copper	30 Zn 65.39 Zinc	47 Ag 107.87 Silver	48 Cd 112.41 Cadmium	80 Hg 200.59 Mercury	
														28 Ni 58.69 Nickel	27 Co 58.93 Cobalt	46 Pd 106.42 Palladium	79 Au 196.97 Gold	111 Rg 272 Roentgenium	
														26 Fe 55.85 Iron	25 Mn 54.94 Manganese	45 Rh 102.91 Rhodium	78 Pt 195.078 Platinum	110 Ds 271 Darmstadtium	
														24 Cr 51.996 Chromium	23 V 50.942 Vanadium	44 Ru 101.07 Ruthenium	77 Ir 192.217 Iridium	109 Mt 288 Meitnerium	
														42 Mo 95.94 Molybdenum	41 Nb 92.91 Niobium	43 Tc 98 Technetium	76 Os 190.23 Osmium	108 Hs 277 Hassium	
			74 W 183.84 Tungsten	73 Ta 180.94 Tantalum	75 Re 186.207 Rhenium	107 Bh 264 Bohrium	286 Uue 286 Ununseptium												
			106 Sg 266 Seaborgium	105 Db 262 Dubnium	104 Rf 261 Rutherfordium	103 Lr 262 Lawrencium													
			59 Pr 140.91 Praseodymium	58 Ce 140.12 Cerium	60 Nd 144.24 Neodymium	61 Pm 145 Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.93 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.93 Holmium	68 Er 167.26 Erbium	69 Tm 168.93 Thulium	70 Yb 173.04 Ytterbium				
			91 Pa 231.04 Protactinium	90 Th 232.04 Thorium	92 U 238.03 Uranium	93 Np 237 Neptunium	94 Pu 244 Plutonium	95 Am 243 Americium	96 Cm 247 Curium	97 Bk 247 Berkelium	98 Cf 251 Californium	99 Es 252 Einsteinium	100 Fm 257 Fermium	101 Md 258 Mendelevium	102 No 259 Nobelium				