Kolbe Academy
Home School

Pearson
CHEMISTRY WITH LAB
HIGH SCHOOL SCIENCE

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Kolbe Academy
Home School

♦ SYLLABUS ♦

Chemistry (K)
High School Science

COURSE TITLE: Chemistry

COURSE DESCRIPTION:

This course is designed to give students an appreciation of creation and of the order and complexity of atoms and their interactions with each other. This course provides an introduction to chemistry suitable for students in a college preparatory program.

COURSE TEXTS AND MATERIALS:

- Wilbraham, Antony C., Dennis D. Staley, Michael S. Matta and Edward L. Waterman. *Pearson Chemistry*. Boston: Pearson, 2012
- *Chemistry Answer Key*. Napa, CA: Kolbe Academy Press, 2017 (optional)
- *eText and Online Student Access.* (optional)
- *Virtual Chemistry Lab*. Labster. (digital)
- *Lab Report Writing Guide*. Napa, CA: Kolbe Academy Press, 2008 (optional)
- *Supplemental Chapter Quizzes*. Napa, CA: Kolbe Academy Press, 2016 (digital download – optional)

SUPPLEMENTAL TEXTS AND MATERIALS:

There are supplemental workbooks available for the text. Students who speak English as a foreign or second language may find *Pearson Chemistry Guided Reading and Study Workbook* ISBN 0132525887 helpful; students with weaker math skills may wish to use *Pearson Chemistry Skills and Math Workbook*, ISBN 0133204499.

If parents wish to supplement the virtual lab with small-scale chemistry experiments there are several options available. Home Science Tools offers a wide variety of kits and equipment. Such supplements are not at all necessary, but some parents prefer hands on activities to virtual labs, and such substitution is acceptable for either the K or H designation so long as lab reports are submitted in reporting packets. A basic and an AP microchemistry kit are available from Quality Science Labs, LLC. The author of Make Magazine's Illustrated Guide to Home Chemistry Experiments offers an all in one kit as well at his site, The Home Scientist, LLC. Parents interested in hands on lab work at home should be able to find a kit that has a price and risk factor they find acceptable.

A number of excellent web sites from chemical organizations and museums can be very helpful. The Chemical Heritage Foundation http://www.chemheritage.org/ offers a wealth of historical information about the discoverers of the chemical principles found in the text

The University of Nottingham, UK in partnership with documentary maker Brady Haran has produced a number of videos on chemistry including a short film on each element in the periodic table. The project may be found at http://www.periodicvideos.com; the site also has a YouTube channel with a helpful playlist of the elements.

Numerous other Internet resources can help students understand chemistry better including the well-known Khan Academy, the Fuse School, or Tyler DeWitt's YouTube Videos. Check URLs as they may change.

SCOPE AND SEQUENCE:

Chemistry

- Chapter 1 Introduction to Chemistry
- Chapter 2 Matter and Change
- Chapter 3 Scientific Measurement
- Chapter 4 Atomic Structure
- Chapter 5 Electrons in Atoms
- Chapter 6 Periodic Table
- Chapter 7 Ionic and Metallic Bonding
- Chapter 8 Covalent Bonding
- Chapter 9 Chemical Names and Formulas
- Chapter 10 Chemical Quantities
- Chapter 11 Chemical Reactions
- Chapter 12 Stoichiometry
- Chapter 13 States of Matter
- Chapter 14 The Behavior of Gases
- Chapter 15 Water and Aqueous Systems
- Chapter 16 Solutions
- Chapter 17 Thermochemistry
- Chapter 18 Reaction Rates and Equilibrium
- Chapter 19 Acids, Bases, and Salts
- Chapter 20 Oxidation-Reduction Reactions
- Chapter 21 Electrochemistry
- Chapter 22 Hydrocarbon Compounds
- Chapter 23 Functional Groups
- Chapter 24 Chemistry of Life [honors only]
- Chapter 25 Nuclear Chemistry [optional]

COURSE PLAN "AT A GLANCE" OUTLINE:

Semester 1	Material Covered:	Exam Schedule:
Week 1	Chapter 1/2: 1.1 through 2.4	
Week 2	Chapter 3: 3.1 through 3.2	
Week 3	Chapter 3/4: 3.3 through 4.1	
Week 4	Chapter 4: 4.2 through 4.3	
Week 5	Chapter 5: 5.1 through 5.3	
Week 6	Review Chapters 1 through 5	Exam I: Chapters 1-5
Week 7	Chapter 6: 6.1 through 6.3	
Week 8	Chapter 7: 7.1-7.3	
Week 9	Chapter 8: 8.1 through 8.2	
Week 10	Chapter 8: 8.3 through 8.4	
Week 11	Review Chapters 6 through 8	Exam II: Chapters 6-8
Week 12	Chapter 9: 9.1 through 9.2	
Week 13	Chapter 9: 9.3 through 9.5	
Week 14	Chapter 10: 10.1 through 10.3	
Week 15	Chapter 11: 11.1 through 11.3	
Week 16	Chapter 12: 12.1 through 12.3	
Week 17	Review Chapters 9 through 12	Exam III: Chapters 9-12
Week 18	Chapter 13: 13.1 through 13.2	

Semester 2	Material Covered:	Exam Schedule:
Week 1	Chapter 13: 13.3 through 13.4	
Week 2	Chapter 14: 14.1 through 14.4	
Week 3	Chapter 15: 15.1 through 15.3	
Week 4	Chapter 16: 16.1 through 16.2	
Week 5	Chapter 16: 16.3 through 16.4	
Week 6	Review Chapters 13 through 16	Exam IV: Chapters 13-16
Week 7	Chapter 17: 17.1 through 17.4	
Week 8	Chapter 18: 18.1 through 18.5	
Week 9	Chapter 19: 19.1 through 19.5	
Week 10	Chapter 20: 20.1 through 20.3	
Week 11	Chapter 21: 21.1 through 21.3	
Week 12	Review Chapters 17 through 21	Exam V: Chapters 17-21
Week 13	Chapter 22: 22.1 through 22.3	
Week 14	Chapter 22: 22.4 through 22.5	
Week 15	Chapter 23: 23.1 through 23.5	
Week 16	Chapter 23/24: 23.4 through 24.2	
Week 17	Chapter 24: 24.3 through 24.6	
Week 18	Review Chapters 22 through 24	Exam VI: Chapters 22-24

COURSE PLAN METHODOLOGY:

There are 30 supplemental/optional chapter quizzes that may be purchased in the Kolbe Academy Bookstore. Students should do the assigned readings and problems, have their answers corrected, and then review the chapter before taking the chapter quiz. These short tests check the student's mastery of each chapter. There are also 6 exams incorporated into the chemistry course which may be found in the exam packet at the end of this course plan. These exams reflect the content of what was assigned in the weekly course plans. If students do the work assigned during the week, they should be adequately prepared for any question that arrives on the exams. The exams consist of many different types of questions including matching, multiple choice, and essays. Students wishing to receive the Kolbe Core (K) course designation must fully complete the exams labeled "Core Chemistry". Students may not skip or alter questions on the exams except when specified by the directions within the exam itself if they wish to receive the (K) designation for this course. As parents are the primary educator, they may alter the course plan or exams as needed if the student does not desire the (K) designation on the transcript.

Lab work is suggested throughout the lesson plan through the use of the Virtual Lab and labs in the textbook that do not require extensive materials. To qualify the course as a lab science, students should spend an average of one hour per week doing some type of lab work. This may include quick labs, micro-labs, or a virtual laboratory. Students may receive lab credit by other means than following the course plan suggestions such as a home school co-op, hands-on lab at home, college lab course etc. A separate grade should NOT be given for the lab work, but should be incorporated into the overall grade given for the course. Parents may determine the weight the lab component will have on the final grade, but typical values ranges from 15-25% of the total grade. Two written lab reports (formal or informal) are needed per semester for lab credit on the transcript; however, students are encouraged to write an informal lab report for the majority of the labs in this course.

The following key will help the parent and student understand how each week's assignments are laid out:

Reading: Includes pages from the specified chapter in the Pearson *Chemistry* textbook or other specified outside reading.

Section Assessment: Suggested questions from the text at the end of each section. Answers to these questions are provided in the Kolbe Academy Answer Key to the Pearson Chemistry text.

Chapter Assessment: Suggested questions from the text at the end of each chapter. The suggested questions will help the student prepare well for each exam provided by Kolbe Academy. Answers to these questions are provided in the Kolbe Academy Answer Key to the Pearson Chemistry text. Review questions for previous sections are also included

Go Online: The text has a supplemental website provided by Pearson that you may gain access to by purchasing the Student Online Access in the Kolbe Academy Bookstore: https://www.pearsonrealize.com/index.html#/. The material assigned in the "Go Online" is meant to be supplemental in nature and is not absolutely necessary to do well on the exams. However, it does provide additional assessment and demonstration of the concepts in the text.

Lab Work: The lab work assignments come from Labster Labs. The labs chosen from the text need little or no equipment to be completed at home (such the Quick Labs or Inquiry activities), and all Labster Lab assignments use just computer software. Any Quick Labs or Inquiry activities listed in the course plan are optional for lab credit but do allow students using the Labster Lab software to get some occasional hands-on lab experience. Note that virtual labs have been placed in the most relevant week possible, but sometimes a lab covering a certain topic is postponed to a later week so as not to overwhelm the student.

Key Terms: This is a list of important vocabulary terms to look out for as the student reads the chapter.

Important Concepts: The most important concepts for the student to understand are described in this section.

Quiz: A short supplemental/optional quiz on the current chapter. The quizzes are available for purchase as a download in the Kolbe Academy bookstore.

Optional: Suggestions for additional reading or research

Exam: There are six exams. Each exam covers several weeks of related material

GUIDELINES FOR WRITTEN LAB REPORT SAMPLES:

Kolbe Core (K) guidelines: Students seeking the Kolbe Core designation for a lab credit with this science course should complete a **Kolbe Academy Lab Report Worksheet** or keep other comparably detailed, organized notes for each lab completed. Kolbe Core students must submit two lab reports (formal or informal) each semester. The Kolbe Academy Lab Report Worksheet (or another comparably detailed, organized written sample) may be submitted as an informal lab report. The Kolbe Academy Lab Report Worksheet may be found in the Appendix of this course plan and may be reproduced or printed as needed.

General guidelines: Students not seeking the Kolbe Core (K) designation for a lab credit with this science course are encouraged to complete a Lab Report Worksheet or keep other comparably detailed, organized notes for each lab completed. They must submit 2 written lab samples each semester (any sample of lab work will suffice).

The **Kolbe Lab Report Writing Guide**, which is available in the Kolbe Academy Bookstore, explains how to write a formal lab report. This guide is optional, however, you should seek out a reputable source on writing lab reports if you do not have access to it.

Kolbe Academy
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♦ SYLLABUS ♦

Chemistry (K)
High School Science

DIPLOMA REQUIREMENTS:

Summa Cum Laude diploma candidates are required to follow either the Kolbe Core course (K) or Kolbe Honors course (H) track and are required to fulfill a laboratory component for this chemistry course. ***Magna Cum Laude*** and ***Standard*** diploma candidates may choose to pursue the (H) or (K) designation, but are not required to do so, and instead have the option of altering the course plan as they choose. ***Summa*** students must complete 4 years of science during their high school course of study including Biology with Lab, Chemistry with Lab, Physics with Lab, and a pre-approved science elective. ***Magna*** students must complete 3 years of science during their high school course of study including Biology, Chemistry, and a physical science. ***Standard*** diploma students must complete 2 years of science including a biological and physical science. For a student pursuing the ***Magna Cum Laude*** diploma, the science requirement dictates that lab work is incorporated into Biology and Chemistry. There is no lab requirement for the ***Standard*** diploma. Please see the information below and on the next page for specific course titles, semester reporting requirements and transcript designations for chemistry.

KOLBE CORE (K) HIGH SCHOOL COURSES:

- Students pursuing the Kolbe Core (K) designation should do the readings and assignments indicated and use the exams provided.
- To receive the Kolbe Core (K) designation on the high school transcript, be sure to turn in the appropriate sample work, as outlined below.

SEMESTER REPORTING REQUIREMENTS:

Designation*	**No Designation**		**K (Kolbe Core)**		**H (Honors)**
Course Title	**Chemistry**	**Chemistry w/ Lab**	**Chemistry**	**Chemistry w/ Lab**	Please use the Honors version of the Pearson Chemistry course plan if you would like to seek the Honors designation.
Semester 1	1. Any two written, graded samples.	1. Any two written, graded samples. 2. Two graded lab reports.	1. Exam I 2. Exam II 3. Exam III Each completed fully and graded.	1. Exam I 2. Exam II 3. Exam III Each completed fully and graded. 4. Two graded lab reports.	
Semester 2	1. Any two written, graded samples.	1. Any two written, graded samples. 2. Two graded lab reports.	1. Exam IV 2. Exam V 3. Exam VI Each completed fully and graded.	1. Exam IV 2. Exam V 3. Exam VI Each completed fully and graded. 4. Two graded lab reports.	

***Designation refers to designation type on transcript. K designates a Kolbe Academy Core course.**

If the student wishes to have the course distinguished on the transcript with a (K) as a Kolbe Academy Core course, please be sure to send the correct exams and components each semester for verification as specified above. If no designation on the transcript is desired, parents may alter the lesson plan and any written sample work is acceptable to receive credit for the course each semester.

♦♦♦ FIRST SEMESTER ♦♦♦

WEEK 1			
Reading	Chapter 1 Chapter 2	Sections1.1 pp. 2-5, 1.2 p. 8-9, 1.3 pp. 14-17 Sections 2.1 – 2.4	
Section Assessment	Chapter 1 Chapter 2	2-4, 14-15 1-4, 12-14,21,22-23, 32-33, 36-37	
Chapter Assessment	Chapter 1 Chapter 2	34,36, 39-40,53,55,57,60	
Go Online	Chapter 1 Chapter 2	1.3 Kinetic Art: Three-Dimensional Molecular Models 1.4 Chemistry Tutorial: Estimated Walking Time Ch. 1 Math Tutor: Equations 2.1 Kinetic Art: States of Matter	
Lab Work	**Labster**	Complete the "Chemistry Lab Safety" simulation and record the total score. The student does not need to complete a lab worksheet for this simulation.	
	Additional Assignments	Students should familiarize themselves with the scientific method and the basics of science writing. This can be done independently, or using *The Kolbe Academy Lab Report Guide*.	
Quiz	Weekly Quiz #1		
Optional	**End each day with a short periodic table video from the periodic table of videos by Brady Haran and the University of Nottingham staff. Start with Hydrogen, Helium and Lithium (the first three elements of the periodic table).**		
Key Terms	matter chemistry organic chemistry inorganic chemistry biochemistry analytical chemistry physical chemistry pure chemistry applied chemistry observation hypothesis experiment independent variable dependent variable model theory scientific law mass	manipulated variable solid liquid gas vapor mixture heterogeneous mixture homogeneous mixture solution phase filtration distillation element compound chemical change chemical symbol periodic table period	

	volume extensive property intensive property physical chemistry substance physical property	group chemical property chemical reaction reactant product precipitate law of conservation of mass Antoine Lavoisier
Important Concepts	Although there appears to be quite a bit of material covered, much of this week's readings are a review of concepts covered in previous science classes. All of the material either reviews previous science material or previews later chapters. Students should feel free to skim this week's reading for major concepts. Only one day need be spent on Chapter 1. **Students should concentrate more heavily on the concepts in Chapter 2**. If the student has not had an in-depth physical science background, it is important to concentrate on understanding the three physical states of matter (solid, liquid, and gas), as well as the differences between physical and chemical changes, and the differences between homogenous and heterogeneous mixtures. Students should get into the habit of reviewing the study guide at the end of each chapter as they read. The guide is divided into sections and includes vocabulary and key ideas. Students should take particular note of the Big Idea at the top of the page.	

WEEK 2		
Reading	Chapter 3	Sections 3.1-3.2
Section Assessment	3.1 3.2	1-11(students will find practice problems after each sample problem) 13-17 19-22, 28-31
Chapter Assessment	Chapter 3	57-60, 62-67
Go Online	3.1 3.2	3.1 Kinetic Art: Precision in Measurement 3.1 Chemistry Tutorial: Significant Figures Ch. 3 Concepts in Action: SI Units Exactly 3.2 Chemistry Tutorial: Converting between Temperature Scales Ch. 3 Directed Virtual Lab: Density of Solids and Liquids
Lab Work	**Labster**	Complete the "Matter and Phase Change" simulation and record the total quiz score. The student should complete a lab worksheet for this simulation.
	Optional	Quick Lab p. 39 (a white coffee filter can be cut to make the filter strip)
Quiz	Weekly Quiz #2	
Optional	Periodic videos (see week **Optional** week 1) Beryllium, Boron, Carbon	
Key Terms	scientific notation accuracy precision accepted value experimental value error percent error significant figures International System of Units meter (m) liter (L)	kilogram (kg) gram (g) weight temperature energy joule (J) calorie (cal) Celsius scale Kelvin scale absolute zero density
Important Concepts	If necessary, students should practice scientific notation. All students will be expected to present their answers with the correct number of significant figures from this point forward. **Answers should not be considered entirely correct unless they are reported using the correct number of significant figures** Students should know the equation for density by memory (density = mass/volume) and understand how to manipulate this equation. The most common unit used for density is g/cm^3, but g/mL is another unit used especially for the density of liquids. Conversions to note: cm^3 ←→ mL (1 cm^3 = 1 mL).	

WEEK 3		
Reading	Chapter 3 Chapter 4	3.3, 4.1
Section Assessment	3.3, 4.1	36,38,40, 53-54 1-7
Chapter Assessment	Chapter 3 Chapter 4	74-75, 86, 87, 89, 91 35-37
Go Online	3.3	3.3 Kinetic Art: Conversion Factors 3.3 Chemistry Tutorial: Using Dimensional Analysis 3.3 Chemistry Tutorial: Using Density as Conversion Factor 3.3 Chemistry Tutorial: Converting Ratios of Units
Lab Work	None this week.	
Quiz	Weekly Quiz # 3	
Optional	Periodic videos (see **Optional** week 1) Nitrogen, Oxygen <u>Atoms and the Classical Curriculum</u> While most chemistry belongs to the modern era, its roots stretch back to thinkers that students may be familiar with from the classical curriculum. The following points may be integrated with the student's current historical and literary studies, now or later in the course, and can be researched in greater detail by the student if the parent wishes: **Ancient Greece:** Democritus is generally considered to be the founder of atomism. Most works do not survive but his ideas come to us through the much later historian Diogenes Laërtius. Aristotle disagreed and thought matter was composed of four elements: earth, water, fire, and air. This is outlined in Aristotle's *On Generation and Corruption* and *Meteorology*. Aristotle's view prevailed for over a thousand years. **Ancient Rome:** Lucretius was a poet and philosopher whose *De Rerum Natura* (On the Nature of Things) imagines a permanent universe made up of perpetually moving particles that come together to make matter, a relationship between atoms and void. **Middle Ages:** St. Albert Magnus is a Doctor of the Church, the patron saint of scientists, and the teacher of St. Thomas Aquinas. His studies were devoted to unifying the Greek thought of Aristotle with Christianity. He traveled a great deal while researching ancient texts, and during his travel made numerous observations about minerals, collected in his work *De Mineralibus*. He took the Aristotelian (not atomic) view of matter, and even though his work was later superseded, he was a key figure in the development of chemistry. He is often thought of as the archetypical alchemist, and many folk tales were written about him. Roger Bacon, a Franciscan friar, seems to have done early work with gunpowder and is credited with moving science ("natural philosophy") closer to the scientific method in *De Scientia Experimentali* (On Experimental Knowledge). Like Albertus Magnus, he too was the subject of many folk tales and legends about alchemy.	

Key Terms	3.3 4.1	conversion factor dimensional analysis atom Dalton's Atomic theory scanning tunneling microscope size range of atomic radii
Important Concepts		The section on conversions may have been covered in a previous physical science course. It is absolutely essential that students understand the process of converting from one unit to another and how to represent figures in scientific notation. These skills will be used over and over again in this course