Kolbe Academy
Home School

HIGH SCHOOL
CHEMISTRY WITH LAB
(Kolbe Core)

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Kolbe Academy
Home School

♦ SYLLABUS ♦

Chemistry (K)
High School

COURSE TITLE: Chemistry

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 with eText and Online Student Access. Napa, CA: Kolbe Academy Press, 2016. (optional)

Lab Report Writing Guide. Napa, CA: Kolbe Academy Press, 2008. (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* helpful; students with weaker math skills may wish to use *Pearson Chemistry Skills and Math Workbook.*

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.

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. The course plans outline a track for a Kolbe Academy Core course (K). The "Core Chemistry" track will emphasize the basic chemical interactions between atoms, compounds, and

molecules. This course provides an introduction to chemistry suitable for students in a college preparatory program.

SCOPE AND SEQUENCE:

1. Introduction to Chemistry
2. Electrons and the Structure of Atoms
3. Bonding and Interactions
4. Reactions
5. Kinetic Theory
6. Moles and Quantification
7. Matter, Energy, and Change
8. Nuclear Chemistry (optional)

DIPLOMA REQUIREMENTS:

Summa Cum Laude diploma candidates are required to follow either the Kolbe Core course (K) or Kolbe Honors course (H) track outlined in the course plan, and are required to fulfill the laboratory component with this chemistry course (see page 5). ***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 Chemistry 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 Chemistry, 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 two of the following three courses: Chemistry, Chemistry or Physics. There is no lab requirement for the ***Standard*** diploma. Please see below 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. Kolbe Core students need to complete at least 2 of the 14 weekly papers each semester. Further, they should have discussions or write informal essays in response to the rest of the weekly paper topics as these are major themes and will appear in some way on the exams.

- Students pursuing the Kolbe Core (K) designation should be sure to complete the additional Kolbe Core sections included in the exams.

- To receive the Kolbe Core (K) designation on the high school transcript, be sure to turn in the appropriate sample work, as outlined below.

KOLBE CORE (K) HIGH SCHOOL COURSES:

- Students pursuing the Kolbe Core (K) designation should do the readings and problems indicated and use the weekly tests and quarterly 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:

Course Title	Chemistry	Chemistry w/ Lab	(K) Chemistry	(K) Chemistry w/ Lab
Semester 1	1. Any two written samples of work.	1. Any two written samples of work. 2. Any two samples of lab work	1. Exam I 2. Exam II 3. Exam III Each with "Core" sections answered fully	1. Exam I (Core) answered fully 2. 1 lab report 3. Exam II (Core) answered fully 4. 1 lab report 5. Exam III (Core) answered fully
Semester 2	1. Any two written samples of work.	1. Any two written samples of work. 2. Any two samples of lab work	1. Exam IV with "Core" sections fully answered 2. Exam V 3. Exam VI Each with "Core" sections fully answered	1. Exam IV (Core) answered fully 2. 1 lab report 3. Exam V (Core) answered fully 4. Exam VI (Core) answered fully 5. 1 lab report

***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.

COURSE PLAN METHODOLOGY:

There are 30 chapter quizzes. 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. 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 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 CD 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 the virtual laboratory CD. 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 Prentice Hall *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 Prentice Hall 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 Prentice Hall Chemistry text. Review questions for previous sections are also included

Go Online: The text has a supplemental website provided by Prentice Hall at www.successnetplus.com. 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 either the Virtual Chemistry Labs or from the *Chemistry* text itself. 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 Virtual Chemistry 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 Virtual 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 quiz on the current chapter.

Optional: Suggestions for additional reading or research

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

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♦♦♦ 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	Kinetic Art: Molecular Models Chem Tutor: Estimated Walking Time Math Tutor: Equations States of Matter
Lab Work	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*. There is no formal lab assignment this week. **Optional:** Quick Labs, page 17	
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 volume extensive property intensive property physical chemistry substance physical property
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.
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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	Significant figures, Precision in Measurement SI Units Exactly, Converting between Temperature Scales, Density of Solids and Liquids
Lab Work	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)	
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: $cm^3 \leftrightarrow$ mL ($1\ cm^3 = 1$ mL).	

Notes

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	Conversion Factors, Using Dimensional Analysis Using Density as Conversion Factor, Converting Rations of Units
Lab Work	Online textbook The Density of Solids and Liquids	
Quiz	Weekly Quiz # 3	
Optional	Periodic videos (see week **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
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♦ COURSE PLAN ♦

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WEEK 4		
Reading	Chapter 4	4.2-4.3
Section Assessment	4.2 4.3	9-14 18-21, 26-28, 32-34
Chapter Assessment	Chapter 4	39, 44-45, 47, 50, 52,53, 64
Go Online	Kinetic Art: Cathode Ray Kinetic Art: Rutherford's Experiment If Atoms were Pennies, Banks Would Be Huge ChemTutor, Math Tutor (optional)	
Lab Work	Virtual Lab: Rutherford's Experiment	
Quiz	Weekly Quiz # 4	
Optional	Periodic videos (see week **Optional** week 1), Fluorine, Neon	
Key Terms	electron cathode ray neutron nucleus atomic number	
Important Concepts	The inner structure of the atom is not visible even with any equipment but is known through experiments. The number of protons defines elements; the number of neutrons (and electrons as students will see in later chapters) is not fixed. To calculate the atomic mass of an element, multiply the mass of each isotope by its natural abundance expressed as a decimal then add the products. The atomic mass on the periodic table is an average. Students should memorize the symbols for the first 10 elements of the periodic table found on page 112.	
Notes		