Kolbe Academy
Home School

GRADE EIGHT OR NINE
INTRODUCTION TO PHYSICS & CHEMISTRY
Prentice Hall Physical Science: Concepts in Action

TABLE OF CONTENTS

COURSE TITLE: Introduction to Physics & Chemistry (IPC)

COURSE TEXTS:

- *Physical Science: Concepts in Action* by Wysession, Frank, and Yancopoulos; © 2006 (T4828)
- *Kolbe Academy Physical Science Answer Key* and Online Access, (T4828A), Optional

COURSE DESCRIPTION:

Introduction to Physics & Chemistry (IPC) is a course that studies the fundamental principles of physical science which are so important for the in depth approach to the high school sciences of Biology, Chemistry, and Physics. Although the main emphasis in this course is on Chemistry and Physics, the same scientific thought processes and especially many of the Chemistry concepts, are applied and used fully in the high school Biology course as well. Any student wishing to pursue the Kolbe Academy Core or Honors high school science courses is encouraged to complete this course in order to put in place the math, analysis, and process skills necessary for success in those courses.

This course plan covers a breadth of material recommended both for eighth grade students interested in beginning honors science coursework in high school and for typical ninth grade science coursework. For students who do not have plans for honors science in high school, parents may wish to modify the course plan according to their child's abilities.

Ideally, IPC should be taken concurrently with Algebra I. However, strong math students will find that a pre-Algebra course provides most of the necessary math skills needed to complete this course successfully.

SCOPE AND SEQUENCE:

Introduction to Chemistry

1. Properties of Matter
2. States of Matter
3. Atomic structure
4. The Periodic Table
5. Chemical Bonds
6. Chemical Reactions
7. Solutions, Acids, and Bases

Introduction to Physics

1. Forces and Motion
2. Forces in a Fluid
3. Work, Power, and Machines
4. Energy
5. Thermal Energy and Heat
6. Mechanical Waves and Sound
7. The Electromagnetic Spectrum and Light
8. Optics
9. Electricity
10. Magnetism

HIGH SCHOOL* DIPLOMA REQUIREMENTS:

Summa Cum Laude diploma candidates are required to follow this course plan as laid out if they wish to receive science credit for this course. Summa students should be sure to turn in the appropriate sample work to receive the (K) designation on their transcript as a Kolbe Academy Core high school course (see below). Summa students using this course in 9th grade will be required to complete Biology with Lab, Chemistry with Lab, and Physics with Lab in subsequent years. ***Magna Cum Laude*** and ***Standard*** diploma candidates may choose to pursue the (K) designation by following the course plan, but are not required to do so, and instead have the option of altering the course plan as they choose. Although a student may pursue lab credit with this course, for a student pursuing the ***Magna Cum Laude*** diploma, the science requirement dictates that lab work is incorporated into at least two of the following three courses: Biology, Chemistry or Physics. There are no lab requirements for the ***Standard*** diploma. Please see next page for specific course titles, semester reporting requirements and transcript designations for Introduction to Physics and Chemistry.

**There are no diploma requirements for 8th grade students.*

REQUIRED SAMPLE WORK FOR HIGH SCHOOL CREDIT:

Designation*			**K**	**K**
Course Title	**IPC**	**IPC w/ Lab**	**IPC**	**IPC w/ Lab**
Semester 1	1. Any two written samples	1. Any two written samples. 2. Any two samples of lab work	1. Exam I 2. Exam II 3. Exam III	1. Exam I 2. Exam II 3. Exam III
Semester 2	1. Any two written samples	1. Any two written samples. 2. Any two samples of lab work	1. Exam IV 2. Exam V 3. Exam VI	1. Exam IV 2. Exam V 3. Exam VI

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

If a student wishes to have the course distinguished on the transcript with a (K) as a Kolbe Academy Core high school course, please be sure to send the correct exams 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.** If you have any questions regarding what is required for the (K) designation or high school diploma type status, please contact the academic advisor department.

COURSE PLAN "AT A GLANCE" OUTLINE:

Semester 1

Weeks 1-7: Chapters 1-5
Week 8: Exam I, begin Chapter 6
Week 9: Chapter 6
Week 10 - 14: Chapter 6 (cont), 7-8
Week 15: Exam II, begin Ch 11
Week 16-17: Chapters 11-12
Week 18: finish Chapter 12, Exam III

Semester 2

Week 1-5: Chapters 13-15
Week 6: Exam IV, begin Chapter 16
Week 7-9: Chapters 16-17
Week 10-11: Chapter 18
Week 12: Exam V, begin Chapter 19
Week 13-17: Chapters 19-21
Week 18: Exam VI

Be sure to refer to the course plan that follows for specific guidance on assignments, quizzes, and exams.

Semester 1 Quiz Schedule

Week 1: Quiz 1
Week 4: Quiz 2
Week 7: Quiz 3
Week 10: Quiz 4
Week 17: Quiz 5

Semester 2 Quiz Schedule

Week 4: Quiz 6
Week 10: Quiz 7
Week 14: Quiz 8

COURSE PLAN METHODOLOGY:

Many times a periodic table should be used for test taking. It will be indicated on the quiz or test when this is permitted. **Only the periodic table located at the end of this course plan should be used on tests and quizzes when indicated.** It is advisable that students take this periodic table out of the course plan NOW and laminate it for use throughout the course.

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

Reading: Includes sections of the chapter for students to read in the Prentice Hall *Physical Science* textbook.

Section Assessment: These are questions located at the end of each section. These questions will help the student prepare for the Exams.

Math Practice: These are questions imbedded within the section itself which will help the student practice problem solving from the section.

Chapter Assessment: These are questions located at the end of the chapter. These questions, along with the section assessment questions, will help the student prepare for the Exams.

Online Assessment: This prompts the student to go to a self-grading assessment provided by Prentice Hall which is located on the web at www.phschool.com. Enter the Web Code provided in the course plan into the box on the left side of the page. This web code also appears at the end of every Chapter Assessment in a box that says "Go Online." Students can use this resource to further prepare themselves for taking the Exams. Consult the User's Manual for specific guidance.

Lab Activity: These are laboratory experiments laid out in the text book that generally use materials easily found within the home or nearby grocery store. Since lab work is not required for this course, all Lab Activities are optional, but add a great component to the course to see the science "in action." **For a list of lab materials, please see the end of the course plan (after the exams).**

Quiz: Quizzes are located after the course plan and their answer keys are located in the Answer Key section after the Exams. There are 8 quizzes interspersed throughout the course as well. These quizzes generally concentrate on a certain math, analysis, or scientific process skill that will become extremely important in high school. These quizzes should be utilized to help the student develop the important skills necessary for future high school science courses.

Exam: There are 6 tests incorporated into this course (3 per semester). These tests reflect the content of what was assigned in the weekly course plans. If a student does the work assigned during the week, he should be adequately prepared for any question that arrives on the tests. The tests consist of several types of questions including True/False, Fill in the Blank, Short Answer, and Problem Working.

Modifications for struggling students:

The online access offers several features for presenting the physical science material in alternate ways for different learning styles. For students that may need guidance in taking notes as they read the chapters, there

are **guided reading** and **study worksheets** to help concentrate the student's thoughts on the most important concepts of the chapter. Students should go to the corresponding chapter section in the interactive textbook. The worksheets are located as links toward the top of the page. These worksheets can be downloaded and printed at home for the student's use as he reads along in the textbook. Please consult the User's Manual for additional information on features available in the interactive textbook.

Parents may wish to omit a few sections if their student is struggling with the course in order to concentrate on the most important concepts presented in IPC. The following are suggestions for section omissions: 7.4, 7.5, 8.4, 12.4, Chapter 13, Chapter 19 (especially 19.4), 20.3, 20.4, and 21.3. Note, students wishing to receive the (K) designation for a Kolbe Academy Core high school course *may not* alter the course plan.

♦♦♦ FIRST SEMESTER ♦♦♦

WEEK 1				
Reading	Chapter 1	Sections 1.1 – 1.4		
	Skills Handbook	Math Skills page 668		
Section Assessment	**Section 1.1:** 4	**Section 1.2**: 2, 6	**Section 1.3:** 3, 5 – 8	**Section 1.4:** 3, 4, 5
Be sure to take note of the question numbers assigned in the Section Assessment. For example, in Section 1.2, only questions 2 and 6 are assigned. Questions assigned within the scope of Kolbe Academy's course plan are the only questions that are answered in the *Kolbe Academy Physical Science Answer Key*.				
Math Practice	**Section 1.3**: 1, 2 (page 15)			
Chapter Assessment	1 – 10, 12, 14, 17, 18, 19, 21, 24, 28, 30			
Online Assessment	Chapter 1 - Self assessment. Web Code: cca-0015 (Go to www.phschool.com)			
Lab Activity	Data Analysis - Page 24		Consumer Lab - Page 26 (Data share!)	
Quiz	Quiz 1 (quizzes provided at end of the course plan)			
Important Concepts and Chapter Notes				
Section 1.1 – Students should understand the basic division of natural science into life, earth/space, and physical science. Students will be concentrating mainly on physical science in this course, but they should not forget that many of the natural science branches overlap.				
Section 1.2 – Students should understand the scientific method, the difference between a scientific law and theory, and the idea of a scientific model. The scientific method can begin with an observation that leads to hypothesis about the observations. In the scientific method, the hypothesis must be tested by making further observation or by performing an experiment. The results of the experiment are analyzed, and conclusions drawn about the original observation in the conclusion of a scientific method. Scientific laws should not be affected by new theories that come about because theories are new explanations of observation made in nature. A scientific law describes the pattern of nature. Every hypothesis that a scientist proposes does not automatically become a theory, and then a scientific law. The hypothesis is the reasonable guess as to why something is occurring in nature. The theory may help to explain why certain parts of the hypothesis is correct, incorrect, or incomplete, but not all theories are correct and will be under constant scientific scrutiny. Even theories that have not been proven incorrect for years and years do not necessarily become scientific law (i.e. theory of evolution).				
Section 1.3 – Additional help on scientific notation can be found in the Math Skills section of the Skills and Reference Handbook on page 667, as well as in the notes below. Remind the student that exponents should				

be added when numbers in scientific notation are being multiplied and subtracted when being divided. Students should look carefully over the math skills example on page 15. The metric system is used by scientists for its ease of converting from one unit to another (everything gets multiplied by factors of 10!). If scientists use the same system of measurement, it also helps them to interpret each other's results more easily. Students should understand how derived units of measurement are obtained (for example how the unit for density, kg/m^3 is derived from the ratio of mass to volume). Students need to memorize the different SI units for the quantities listed in Figure 13 and should either know by memory the derived units in Figure 14 or know how to derive them. Thee metric prefixes in Figure 15 should also be committed to memory. When scientists take measurements, there can be uncertainty in the measurements. To account for this uncertainty, the number of figures used in the final result is very important. The number of digits used in the final result are called significant figures (or significant digits). Students should understand the general rules for adding, subtracting, multiplying and dividing using the appropriate number of significant figures. Finally, students should know how to convert between the three units of temperature.

Section 1.4 – Students should understand the different ways in which scientific data can be presented. As students go further into Algebra, the idea of slope will be presented and students should understand how that can be applied to scientific data. Students can refer to the math handbook for more information on constructing line graphs (page 671).

Significant Figure Rules

6 rules for determining whether a number is significant or not

(Taken from Prentice Hall *Chemistry)*

1. Every nonzero digit in a reported measurement is assumed to be significant. The measurements 24.7 meters, 0.743 meter, and 714 meters each express a measure of length to three significant figures.

2. Zeros appearing between nonzero digits are significant. The measurements 7003 meters, 40.79 meters, and 1.503 meters each have four significant figures.

3. Leftmost zeros appearing in front of nonzero digits are not significant. They act as placeholders. The measurements 0.0071 meter, 0.42 meter, and 0.000 099 meter each have only two significant figures. The zeros to the left are not significant. By writing the measurements in scientific notation, you can eliminate such placeholding zeros: in this case,
7.1 x 10^-3 meter, 4.2 x 10^1 meter, and 9.9 x 10^5 meter.

4. Zeros at the end of a number and to the right of a decimal point are always significant. The measurements 43.00 meters, 1.010 meters, and 9.000 meters each have four significant figures.

5. Zeros at the rightmost end of a measurement that lie to the left of an understood decimal point are not significant if they serve as placeholders to show the magnitude of the number. The zeros in the measurements 300 meters, 7000 meters, and 27,210 meters are not significant. The numbers of significant figures in these values are one, one, and four, respectively. If such zeros were known measured values, however, then they would be significant. For example, if all of the zeros in the measurement 300 meters were significant, writing the value in scientific notation as 3.00 x 10^2 meters makes it clear that these zeros are significant.

6. There are two situations in which numbers have an unlimited number of significant figures. The first involves counting. If you count 23 people in your classroom, then there are exactly 23 people, and this value

has an unlimited number of significant figures. The second situation involves exactly defined quantities such as those found within a system of measurement. When, for example, you write 60 min = 1 hr, or 100 cm = 1 m, each of these numbers has an unlimited number of significant figures. As you shall soon see, exact quantities do not affect the process of rounding an answer to the correct number of significant figures.

An expansion on these rules…

Zeros only count as significant figures if they are *preceded* by another significant number. For example:

0.1234 : the zero is not significant (4 sig figs)
0.12340 : the zero is significant (5 sig figs)
10.1234 : the zero is significant (6 sig figs)
0.0002345 : zeros are only place holders in this case. (4 sig figs)
10.00002345 : zeros are *not* just place holders in this case (10 sig figs)
10.0 : zeros are not just place holders in this case (3 sig figs)
0.000023450 : first five zeros are just place holders, but final 0 is not a place holder (5 sig figs)

The rule of ***exact numbers***. Exact numbers include things like the number of people in a room, unit multipliers (1 km = 1000 m), number of atoms in a molecule, temperature conversions between Celsius and Kelvin, etc. All exact numbers have an infinite number of significant figures and so are not used to limit the final reporting of significant figures. Exact numbers "count up" how many of something are present, and are not actual measurements made with instruments. If a number is exact, it does not affect the accuracy of a calculation nor the precision of the expression.

For ***addition* or *subtraction***, the rule is that the answer can have no more significant figures than the least number of significant figures in any measurement in the problem. To determine the number of significant figures, first, look at all the numbers you are adding. Your answer should have the least number of decimal places of all the numbers in the problem. Let's look at the following example:

$$11.2 + 83 + 16.894 = 111$$

In this problem, we add a number with the tenths place (11.2), one with the one's place (83) and one with the thousandths place (16.894). The greatest of these places is the ones place in 83, so our answer should reflect a digit in the ones place and no more.

So, the answer of "111" reflects the least number of decimal places in all of the figures we were adding. It doesn't matter that when we add them, we end up with a number that has more significant figures than the original addends, as long as the decimal places are adjusted correctly by rounding.

For ***multiplication* and *division***, the rule is that you look at the *total number* of significant figures in all your measurements and reflect the resulting answer with the least number of significant figures. In other words, the answer can have no more significant figures than the least number of significant figures in any measurement in the problem. Let's look at the following example:

$$11.2 \times 83 \times 16.894 = 16{,}000$$

Our answer, 16,000, should have only two significant figures since (83) has only two significant figures. And for clarity, in another example, let's assume you get an answer of 1000 for a certain multiplication or division problem that requires you to include two significant figures. This can pose a problem since 1000 has only 1 significant figure. To remedy, we express the answer in scientific notation: 1.0 x 10^3, being sure to reflect the 1.0 with the appropriate number of significant figures.

Vocabulary

science	observation	scientific notation	accuracy
technology	hypothesis	length	significant figures
chemistry	manipulated variable	mass	accuracy
physics	responding variable	volume	thermometer
geology	controlled experiment	density	slope
astronomy	scientific theory	conversion factor	direct proportion
biology	scientific law	precision	indirect proportion
scientific method	model		

MON	**Read** Section 1.1 – 1.2 and do **Section Assessment** 1.1 and 1.2. Refer to notes on Section 1.1 and 1.2.
TUES	**Read** Section 1.3, do **Section Assessment** 1.3 and **Math Practice** for Section 1.3. Read page 668. Refer to notes on Section 1.3.
WED	**Read** Section 1.4. Do "Data Analysis" **Lab Activity**. Refer to notes on Section 1.4. Do **Section Assessment** 1.4
THUR	Do "Consumer Lab" **Lab Activity**. Do **Chapter Assessment**. Do **Online Assessment**.
FRI	Take **Quiz**.

Notes

WEEK 2

♦♦♦ Introduction to Chemistry ♦♦♦

Reading	Chapter 2	Sections 2.1 – 2.3	
Section Assessment	**Section 2.1**: 2 – 5, 8	**Section 2.2**: 1, 5, 6, 9	**Section 2.3**: 2, 3, 5, 7
Chapter Assessment	1 – 10, 11, 12, 18, 19, 20, 21, 26, 27, 30		
Online Assessment	Chapter 2 – Self assessment. Web Code: cca-1020		
Lab Activity	Data Analysis – Page 42		

Important Concepts and Chapter Notes

Section 2.1 – Students should understand how to classify pure substances as elements or compounds. Students should be able to describe the characteristics of elements and compounds. They should be able to distinguish between pure substances and mixtures, and know how to classify a mixture as homogenous or heterogeneous. Further, students should be able to classify homogeneous mixtures as solutions, suspensions or colloids.

Section 2.2 – Students should be able to describe the physical properties of matter and identify a substance based on its physical property. Students should also know how to describe the methods used to separate mixtures (distillation and filtration). Finally, students should be able to identify evidence that indicates a physical change in a substance is taking place.

Section 2.3 – Students should be able to describe the chemical properties of a substance. Students should be

able to identify clues that indicate that a chemical change is taking place. Students should also be able to distinguish between chemical and physical changes.

Vocabulary

pure substance	suspension	malleability	physical change
element atom	colloid	melting point	chemical change
compound	physical property	boiling point	flammability
heterogeneous mixture	chemical property	filtration	reactivity
homogeneous mixture	viscosity	distillation	precipitate
solution	conductivity		

MON	**Read** Section 2.1 and do **Section Assessment** 2.1. Do "Data Analysis" **Lab Activity.** Refer to notes on Section 2.1.
TUES	**Read** Section 2.2, do **Section Assessment** 2.2. Refer to notes on Section 2.2.
WED	**Read** Section 2.3, do **Section Assessment** 2.3. Refer to notes on Section 2.3.
THUR	Do **Chapter Assessmen**t. Do optional **Online Assessment**.

Notes

WEEK 3

Reading	Chapter 3	Sections 3.1 & 3.2
Section Assessment	**Section 3.1:** 3 – 6, 8	**Section 3.2:** 2 – 5, 8, 9, 10
Math Practice	**Section 3.2:** 1 – 3 (page 80)	
Chapter Assessment	Chapter 3: 1 – 7, 12 – 14, 18, 19, 20, 21, 27, 28, 31, 32	
Lab Activity	Data Analysis – page 71.	Quick Lab – page 79

Important Concepts and Chapter Notes

Section 3.1 – Students should be able to describe the three main states of matter and classify substances as a solid, liquid, or gas. Students should be aware of the state of matter called plasma and the Bose-Einstein condensate. Using kinetic theory, students should be able to describe the behavior of liquids, solids, and gases. In general, solids have a definite volume and definite shape. Liquids have a definite volume but indefinite shape. Gases have an indefinite volume and shape. Students should realize that even solid particles have kinetic energy due to the vibrating motion of the particles that make them up.

Section 3.2 – Students should be able to define pressure and gas pressure and be able to identify the factors that can affect gas pressure. Students should be able to predict changes in gas pressure due to a change in temperature, volume, and the number of particles present. Students should be able to explain and apply the various gas laws discussed in this chapter (Charles's law, Boyle's law, and combined gas law).

Vocabulary

solid	kinetic energy	pressure	Charles's Law
liquid	kinetic theory	absolute zero	Boyle's Law
gas			

MON	**Read** Section 3.1. Do **Section Assessment** 3.1. Refer to notes on Section 3.1.
TUES	Do **Lab Activity** "Data Analysis."
WED	**Read** Section 3.2. Do **Math Practice** Section 3.2. Do **Section Assessment** 3.2. Refer to notes on Section 3.2.
THUR	Do **Lab Activity** "Quick Lab." Do **Chapter Assessment**.