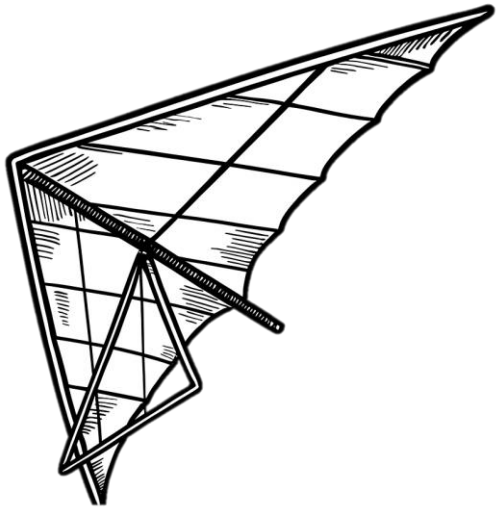
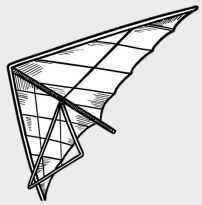
INTRODUCTION TO
PHYSICS & CHEMISTRY

Student Course Plan

HIGH SCHOOL
SCIENCE 9 (K)



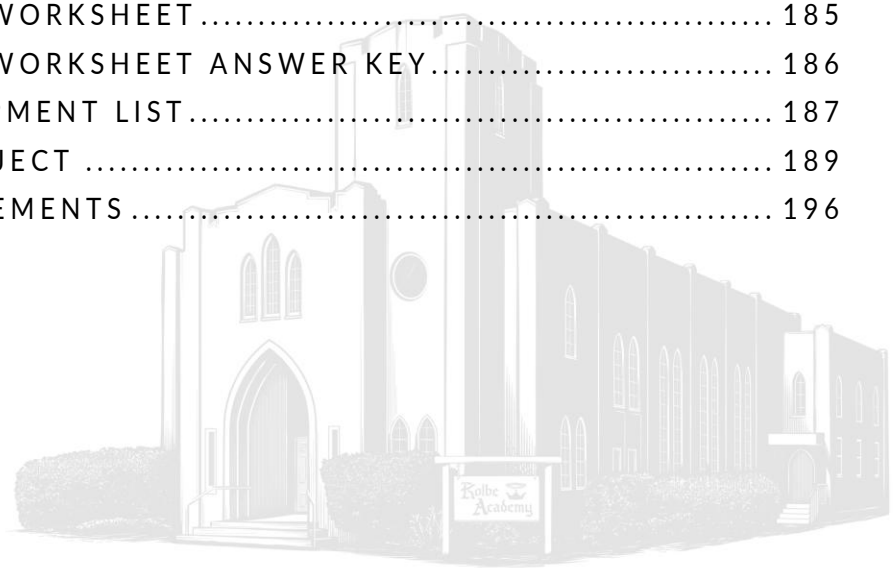
Kolbe Academy
A.M.D.G EST.1980



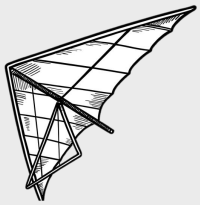
INTRODUCTION TO
PHYSICS & CHEMISTRY

TABLE OF CONTENTS

APPENDIX



Ad majorem Dei gloriam!



INTRODUCTION TO
PHYSICS & CHEMISTRY

COURSE TITLE: Intro to Physics and Chemistry

COURSE TEXTS:

- **TEXTBOOK** Wysession, Michael, et al. *Physical Science: Concepts in Action.* Pearson/Prentice Hall: Needham, 2006.
- **ANSWER KEY** *Physical Science Answer Key*. Kolbe Academy Press: Napa, 2024

OPTIONAL ADDITIONAL RESOURCES:

- *Lab Report Writing Guide.* Kolbe Academy Press: Napa, 2024. *(Strongly Recommended)*
- *Writing and Style Guide.* Kolbe Academy Press: Napa, 2023.

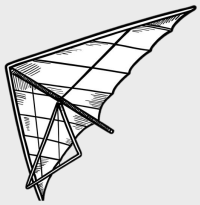
COURSE DESCRIPTION:

Intro to Physics and 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 an eighth grade student interested in beginning honors science coursework in high school and for typical ninth grade science coursework. For the student who does not have plans for honors science in high school, parents may wish to modify the course plan according to their child's abilities.

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

The coursework has been divided into two 16-week semesters with a four-day week, however, the student may use the fifth day of the week as needed. Coursework includes weekly reading and writing assignments, study guides, quizzes, and two exams per semester.



INTRODUCTION TO
PHYSICS & CHEMISTRY

LEARNING OUTCOMES:

This course will enable the student to:

- Observe the order, predictability, and beauty of the natural world through the lens of physical science
- Develop an understanding of the fundamental laws and concepts of physics and chemistry, and their roles in explaining everyday phenomena
- Analyze the relationship between forces, motion, and energy through hands-on lab work and problem-solving
- Apply scientific thought processes, mathematical skills from Algebra 1, and analytical skills to solve physics and chemistry problems
- Formulate and communicate clear, logical arguments and conclusions for physical and chemical processes using appropriate scientific vocabulary and models
- Understand the connections between the scientific method, experimentation, and the development of reliable knowledge in the physical sciences
- Develop critical thinking, problem-solving, and quantitative reasoning skills necessary for higher-level science courses.

COURSE PLAN COMPONENTS:

Readings | Assigned readings from the course text, which have been broken down under the Course Plan weekly assignments.

Key Points | Each week of the Course Plan Weekly Plans includes up to three sections: Lesson Key Concepts, Math Skills Key Concepts, and Key Vocabulary Terms. These resources introduce important weekly topics and serve as an overview to help review for quizzes and exams.

Section and Chapter Assessments | The textbook includes Section Assessments, questions end of each section, as well as Chapter Assessments, which help the student review important concepts from each lesson and chapter. They are assigned within the Course Plan weekly assignments in order to aid understanding of the material and help the student prepare for Chapter Quizzes and Exams. 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*.

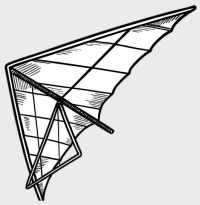
Math Practice | These questions are embedded within the section itself and will help the student practice problem-solving from the section.

Lab Activity | These are laboratory experiments laid out in the textbook 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 Appendix located at the end of the course plan.**

Chapter Quizzes | There are quizzes for each chapter throughout the course. These quizzes generally concentrate on a certain math, analytical, or scientific process skill that will become extremely important in high school. These quizzes should be utilized to help the student prepare for exams and develop the important skills necessary for future high school science courses. The Chapter Quizzes and Answer Keys are located in the Course Plan after the Weekly Plans.

Exams | There are three exams per semester, given in order to assess the student's understanding and retention of materials and concepts. Exams are composed of up to three parts: Short Answers, Short Essays, and/or Essays. The Exams and Exam Answer Keys are provided in the Course Plan.

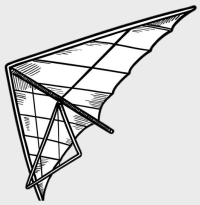
Appendix | The Course Plan appendix includes grading guidance, the Significant Figures Worksheet and key, Lab schedule and equipment list, Simple Machines Project information and rubric, as well as the Periodic Table of Elements that is to be used on several quizzes and exams. It is recommended that this table be removed and laminated for use throughout the course. See the portal for additional materials.



INTRODUCTION TO PHYSICS & CHEMISTRY

SCOPE AND SEQUENCE | Semester 1

Week:	Lesson / *Topic*:	Major Assignments:
1	Science and Measurement Lessons 1.1-1.3; Chapter 1 Quiz	
2	Significant Figures and Matter Lesson 2.1	
3	Chemical and Physical Properties Lessons 2.2-2.3; Chapter 2 Quiz	
4	States of Matter Lessons 3.1	**Exam I** *Chapters 1-2*
5	Gas Laws Lessons 3.2-3.3	
6	Phase Changes and Studying Atoms Chapter 3 Quiz; Lesson 4.1	**Exam II** *Chapters 3-4*
7	Structure of an Atom and Organizing Elements Lessons 4.2-5.1; Chapter 4 Quiz	
8	Modern Periodic Table and Representative Groups Lessons 5.2-5.3	
9	Chapters 4-5 Review Chapter 5 Quiz	**Exam III** *Chapters 4-5*
10	Ionic and Covalent Bonding Lessons 6.1-6.2	
11	Formulas Lesson 6.3; Chapter 6 Quiz	
12	Balancing Equations and Chemical Calculations Lesson 7.1	**Exam IV** *Chapter 6*
13	Classifying Reactions and Energy Changes Lessons 7.2-7.3	
14	Formation of Solutions Chapter 7 Quiz; Lessons 8.1-8.2	
15	Intro Acids and Bases Lesson 8.3-8.4; Chapter 8 Quiz	
16	Semester 1 Review and Exam	**Semester 1 Final Exam** *Chapters 1-8*



INTRODUCTION TO PHYSICS & CHEMISTRY

SCOPE AND SEQUENCE | Semester 2

Week:	Lesson / *Topic*:	Major Assignments:
1	Motion and Vectors Lessons 11.1-11.2	
2	Acceleration and Forces Lessons 11.3; Chapter 11 Quiz	
3	Newton's Laws and Momentum Lessons 12.1-12.3	
4	Fluid Pressure Chapter 12 Quiz; Lesson 13.1	**Exam V** *Chapters 11-12*
5	Fluids: Pressure and Buoyancy Lessons 13.2-13.3; Chapter 13 Quiz	
6	Work, Power, and Machines Lesson 14.1-14.4	
7	Simple Machines Chapter 14 Quiz; Lesson 15.1	
8	Energy: Forms, Conversion, and Conservation Lessons 15.2; Chapter 15 Quiz	**Exam VI** *Chapters 13-15*
9	Mechanical Waves and Properties Lessons 17.1-17.3	
10	Behavior of Waves and Sound Lessons 17.4-18.1; Chapter 17 Quiz	
11	Electromagnetic Spectrum and Waves Lessons 18.2-18.4; Chapter 18 Quiz	
12	Behavior of Light and Color Lessons 19.1-19.2	**Exam VII** *Chapters 17-18*
13	Mirrors and Lenses Lessons 19.3; Chapter 19 Quiz	
14	Electric Charges and Magnetic Fields Lessons 20.1-21.1	
15	Chapters 19-21 Review Simple Machines Project Due	
16	Semester 2 Review and Exam	**Semester 2 Final Exam** *Chapters 11-21*

REQUIRED SAMPLE WORK:

	No Designation	*No Designation*	Kolbe Core (K) Designation
Course Title	**Intro to Physics and Chemistry**	**Intro to Physics and Chemistry with Lab**	**Intro to Physics and Chemistry**
Semester 1	• Any two (2) samples of written and graded work from Semester 1.	*Complete and graded:* • Any two (2) written work samples from Semester 1. • Any two (2) samples of lab work from Semester 1.	*Complete:* • Exam I • Exam II • Exam III • Exam IV • Semester 1 Final Exam
Semester 2	• Any two (2) samples of written and graded work from Semester 2.	*Complete and graded:* • Any two (2) written work samples from Semester 1. • Any two (2) samples of lab work from Semester 1.	*Complete:* • Exam V • Exam VI • Exam VII • Semester 2 Final Exam

* ***Designation*** *refers to designation type on transcript. K designates a Kolbe Academy Core course. For additional information, see Grading Guidance notes in the appendix.*

- **No Designation:** If no designation on the transcript is desired, parents may alter the lesson plan. Any two graded, written samples are acceptable to receive credit for the course each semester.
- **Kolbe Core (K) Designation**: Students pursuing the Kolbe Core (K) designation must follow the course plan and submit the samples in the chart.

MODIFICATIONS

For students entering Kolbe Academy who struggle with reading or have not read, it can be helpful to cut the course down a bit. This page provides guidance on cutting content from the course. The cut content is divided between semesters in this course, making it easier to manage.

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 Physical Science. The list below

includes a section and optional activities that may be omitted. These may be adjusted as needed for the student.

First Semester:

- Lesson 8.2
- Optional Labs

Second Semester:

- Simple Machines Project
- Optional Labs

NOTE: A student wishing to receive the (K) designation for a Kolbe Academy Core high school course *may not* alter the course plan.

SEMESTER 1: WEEK 1

TEXTS AND MATERIALS:

- *Physical Science: Concepts in Action*
- *Physical Science Answer Key*
- *Optional Lab Activity Materials:*
  - (p. 24) Paper, Pencil
  - (p. 26) Metric ruler, aluminum foil, scissors, balance, graph paper

KEY POINTS:

Begin by familiarizing yourself with the course components, texts, and Course Plan with a careful review of each. Several times in the course, a periodic table is 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 the student take this periodic table out of the course plan NOW and laminate it for use throughout the course.

Each week, this section will include up to three sections: Lesson Key Concepts, Math Skills Key Concepts, and Key Vocabulary Terms. These resources introduce important weekly topics and serve as an overview to help review for quizzes and exams.

LESSON KEY CONCEPTS:

- **Section 1.1 –** The student should understand the basic division of natural science into life, earth/space, and physical science. The student will be concentrating mainly on physical science in this course, but he should not forget that many of the natural science branches overlap.
- **Section 1.2 –** The student 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 are 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. The student 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. The student should understand how derived units of measurement are obtained (for example, how the unit for density, kg/m3¬, is derived from the ratio of mass to volume). The student needs 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. The 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). The student should understand the general rules for adding, subtracting, multiplying, and dividing using the appropriate number of significant figures. Finally, the student should know how to convert between the three units of temperature.

MATH SKILLS KEY CONCEPTS:

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 0.000099 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, so they 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 ones 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 x 83 x 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.

KEY VOCABULARY TERMS:

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

Weekly Plan

DAY ONE	☐ **Read** Sections 1.1 – 1.2. ☐ Do **Section Assessment** for lesson 1.1, number 4, and lesson 1.2, numbers 2 and 6. Refer to notes on Sections 1.1 and 1.2.
DAY TWO	☐ **Read** Section 1.3. ☐ Do **Section Assessment** 1.3, numbers 1-2. Refer to notes on Section 1.3. ☐ Do **Math Practice** on page 15 for Section 1.3, numbers 1 and 2. Read the Skills Manual: Math Skills on page 668. Refer to math notes.
DAY THREE	☐ Do **Chapter Assessment**, numbers 9, 12, 14, 17, 18, 19, 24, 28, and 30. ☐ *Optional:* Do **Data Analysis Lab Activity** on page 24.
DAY FOUR	☐ Take **Chapter 1 Quiz.** ☐ *Optional:* Do **Consumer Lab Activity** on page 26.
DAY FIVE	☐ Optional day for catch-up, studying, bigger assignments (projects/paper composition), appointments, field trips, etc.

Weekly **NOTES:**

SEMESTER 1: WEEK 2

TEXTS AND MATERIALS:

- *Physical Science: Concepts in Action*
- *Physical Science Answer Key*
- *Optional Lab Activity Materials:*
  - (p. 42) Paper, pencil

KEY POINTS

LESSON KEY CONCEPTS:

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

KEY VOCABULARY TERMS:

pure substance
element atom
compound
heterogeneous mixture
homogeneous mixture
solution
suspension
colloid

DAY ONE	☐	**Read** Section 2.1.
DAY TWO	☐	Do **Section Assessment** 2.1, numbers 2-5 and 8.
DAY THREE	☐	Complete the **Significant Figures Worksheet**, found in the Course Plan Appendix.
DAY FOUR	☐ ☐	Review completed lessons and vocabulary from Chapters 1 and 2 so far. Exam I will be in two weeks. *Optional:* Do **Data Analysis Lab Activity** on page 42.

DAY FIVE	☐ Optional day for catch-up, studying, bigger assignments (projects/paper composition), appointments, field trips, etc.

***Weekly* NOTES:**

SEMESTER 1: WEEK 3

TEXTS AND MATERIALS:

- *Physical Science: Concepts in Action*
- *Physical Science Answer Key*

KEY POINTS

LESSON KEY CONCEPTS:

- **Section 2.2** – The student should be able to describe the physical properties of matter and identify a substance based on its physical properties. The student should also know how to describe the methods used to separate mixtures (distillation and filtration). Finally, the student should be able to identify evidence that indicates a physical change in a substance is taking place.
- **Section 2.3** – The student should be able to describe the chemical properties of a substance. The student should be able to identify clues that indicate that a chemical change is taking place. The student should also be able to distinguish between chemical and physical changes.

KEY VOCABULARY TERMS:

physical property
chemical property
viscosity
conductivity
malleability
melting point
boiling point
filtration
distillation
physical change
chemical change
flammability
reactivity
precipitate

DAY ONE

- ☐ **Read** Section 2.2.
- ☐ Do **Section Assessment** 2.2, problems 1, 5, 6, and 9.
- ☐ **Review** your assignments in Chapters 1 and 2 in preparation for Exam I next week.

DAY TWO

- ☐ **Read** Section 2.3.
- ☐ Do **Section Assessment** 2.3, problems 2, 3, 5, and 7.
- ☐ **Study** Chapters 1 and 2 for the exam next week.

Weekly Plan

DAY THREE	☐ Do **Chapter Assessment** Ch. 2, numbers 1- 12, 18-21, 26-27, and 30. ☐ **Study** Chapters 1 and 2 for the exam next week.
DAY FOUR	☐ Take **Chapter 2 Quiz.** ☐ **Study** Chapters 1 and 2 for the exam next week.
DAY FIVE	☐ **Study** Chapters 1 and 2 for the exam next week. ☐ Optional day for catch-up, studying, bigger assignments (projects/paper composition), appointments, field trips, etc.

Weekly **NOTES:**