# PHYSICAL SCIENCE EXPLORED

## GROUP FACILITATOR GUIDE

# Welcome to Physical Science Explored

Physical science is the study of physical reality at a fundamental level—a basic introduction to *chemistry* and *physics*. In this course, students will establish an understanding of the building blocks of matter and the most basic laws that govern the physical world. Students will learn about the God-created laws of motion that govern everything from falling skydivers to colliding cars to launching rockets.

As students embark on this introductory course in physical science, they will build a basic foundation of understanding of many important topics, equipping them to move on to more advanced courses like high school physics and chemistry.

Physical Science Explored is a full school-year lab science course. We have both a middle and high school track. If your students are in the Level B (middle school) track, you can expect them to spend about 2-3 hours per week on the course. If your students are in the Level C (high school track), you can expect them to spend about 4-5 hours per week on the course. We recommend dividing up the assignments and study periods over 4-5 days per week to help with the retention of the material.

This short guide will give you all the information you need to run each class smoothly and successfully. I believe you'll find it both easy to implement and a rich educational experience for your students.

Every part of this course is designed to help your student master an introduction to this fascinating science.

See you in the course!
Luke & Trisha Gilkerson

## Before the school year begins…

There are several things we recommend doing before your school year begins to ensure your co-op class runs smoothly.

1. Determine what weeks you'll be meeting throughout the year and how you'll handle absences (Physical Science Explored gives each student their own login, so if they are absent, they can still follow along with the lectures and won't fall too far behind).
2. Add your students to the course before you're ready to begin (see page 3).
3. Prepare student notebooks ahead of time. If you'll be printing out the student guidebooks and lab guides, complete this ahead of time. If you'll be requesting parents to print or purchase physical copies, be sure to do that. Order student books together to save on shipping (see page 6)!
4. Choose which labs you'll be completing in class and order lab supplies (see pages 10-11).
5. Familiarize yourself with the different parts of the program and determine the best way to run your class (see pages 7-10).

## Where to begin: add your students to the course

Log in to JourneyHomeschoolAcademy.com. From the dashboard...

1. Click on "Student Management."
2. You will see how many licenses (students) you have available. For each student, enter their first name, last name, and email address, then click the "Add" button.
3. A temporary password will be sent to the email address you assign to each student. Using their email and password, each student will be able to log into their *own* course dashboard.
4. If you have more students join your class, simply contact us via email at info@journeyhomeschoolacademy.com, and we can invoice you for additional students.

FAQ: Do my students need their own email address?

The student login must use a unique email address. However, if you have parents who prefer their student not to have an email address, here are a few alternatives.

1) You may use a parent email address.

2) If parents use a gmail address, you can add a qualifier to your email address. For instance, if the email address is parent@gmail.com you can place a plus sign (+) after the first part of your email address like this: parent+PhysicsStudent@gmail.com (you can use whatever you'd like after the +). Our system will view this as a *unique* email address, however all emails will still go to *your* inbox. It's a pretty handy feature gmail has.

3) Parents may open a new, free email account and have emails forwarded to their main account if they prefer.

## How To Begin Your Course Access

You have the flexibility to begin this course whenever you're ready. Once your co-op account is set up, facilitators can access the resources section to begin planning their year and exploring the resources available at any time.

When you're ready to begin your 1-year access to the course, simply email us at info@journeyhomeschoolacademy.com, and we will start your course access.

## Course Schedule

There are 35 lessons. You should plan to complete one per week. You will have access to the course for a full calendar year, so you should be able to easily complete the course during the school year with your co-op.

## Study Skills Training

One of the deficiencies we've seen in students is truly understanding how to study. We don't want to see students continue to make the same study mistakes over and over, but we want them to learn strong study habits. We developed a training available to all of our Level B and C students. They will learn to apply the research-backed, time-tested study and note-taking techniques that will guide them toward becoming lifelong learners.

Students can access *Lesson 0: The Secrets to Student Success* anytime before or after they begin the course by logging into their student account now. They'll have access to two videos along with accompanying note-taking pages:

- **Study Smarter, Not Harder!**
- **Notetaking Crash Course**

## The Student Guidebook & Lab Guide

From your dashboard, under "Resources," you can **download the Student Guidebook and Lab Guide or purchase full-color copies here**. This is their guide for all their activities and lab assignments, along with note-taking pages for each of the lectures. The note-taking pages include fill-in-the-blank outlines so the student can follow along with the lecture, along with spaces to take extra notes. Note-taking is a skill that will help your students remember what they're listening to. If it's not a skill they have yet learned, be sure to take some time before class begins to talk with them about the importance and find some practice opportunities.

We've worked hard to help even the newest note-takers be successful.

- These outlines can be used to follow along with the lectures, fill in the blanks, and label appropriate diagrams.
- Use the extra space on the pages so they can take more notes, too.
- Your students will also find new words they should familiarize themselves with because they may encounter a number of unfamiliar words throughout this course.

If these note-taking pages don't work for your students, it's completely alright to skip them. While they are helpful to the majority of our students, each student is different, and your student may have a note-taking strategy that works better for them.

## Physical Science PLUS Assignment Guide

For co-ops using the PLUS (Level C) version of the course, the assignment guide is available under the resources section. You can also download individual assignments from the corresponding Level C assignment pages.

The PLUS version includes an additional assignment for each weekly lesson. These extra assignments vary from week to week but may include:

- Lectures with lecture outlines in the assignment guide.
- Additional labs, hands-on activities, or extensions to the main lesson's lab with detailed lab and activity instructions are included in the guide.

# How the Course Works

## What Each Lesson Involves

It's recommended that co-ops in the Level B section of the course meet for one hour each week and co-ops in the Level C section of the course meet for one and a half to two hours each week.

Most weeks you meet for class, you should complete the following…

1. Have student lesson outlines and lab assignments on hand.
2. Watch the lesson video (average 20 minutes).
3. Assign reading from their textbook, *Novare Physical Science*.
4. Hand out any homework questions to be completed.
5. Laboratory assignment (on weeks where you are doing the labs)
    a. Watch the lab video together.
    b. Complete the lab as a class.
6. Level C only: Watch the level C lesson video (when available) or review the assignment together. Begin working on assignments in class, as time permits.

FAQ: Is *Novare Physical Science* required?

We highly recommend the textbook *Novare Physical Science*. It is an excellent textbook that will reinforce what students are learning in the lecture material. Any time a student can use multiple modes of learning, it helps them retain the information better. However, as a homeschool class you're free to omit the textbook reading altogether or assign reading from a different book as you see fit.

## Homework Questions & Practice Equations

Students will typically be assigned homework questions to answer each week. These questions are designed to reinforce the lecture material and help students practice the equations introduced in the lesson.

Each week, you'll collect your students' homework questions and use the grading key provided to grade your students' work.

Students have access to an equation guide in their resources with the important equations they learn in the course. They may use this to help answer homework and quiz questions.

## Homework Help Videos

In your resources, you'll also find homework help videos. You may share these videos with your students if they are having a hard time figuring out how to answer any of the homework questions involving math equations or chemical formulas. These videos walk students through how to answer the problems step by step.

## Quizzes

The quizzes are designed to help the student test their own knowledge of the material. There are three options you have for administering the quiz depending on what you believe works best for your students and class situation.

**Option 1:** At the beginning of each class, give students the quiz that corresponds to the previous week's lesson. You may even allow students to use their notes during the quiz if you choose. Have students grade the quizzes in class. You can have students trade papers and grade one another or have students grade their own. Once a grade is written on the top of each quiz, collect the quizzes and record the grades for your own records later.

**Option 2:** Give students their quizzes at the end of each class to take home or send parents the quizzes electronically. Parents can then proctor the quizzes. If your time is limited, this option will allow you a few extra minutes in class for discussion.

**Option 3:** Have the students complete and correct the quizzes right after watching the video lesson each week (this is our least preferred option as students tend to do better after having time to complete their homework and reading that corresponds with the lesson).

Quizzes can be used in class to help review. For questions students found to be particularly tricky, we recommend going over these together as a class as an extra learning opportunity.

## Exams

There are four quarterly exams. These weeks, students will be provided with a study guide which includes mixed practice to help prepare for the exam and review concepts learned that quarter. There will not be lab assignments,

homework questions, or lectures to watch these weeks.

During exam weeks, it's a good idea to spend time going through the study guide together in class. You can even make a game of it. Try out one of these ideas!

- Try dividing your class into two groups and quizzing students. Go over any questions students aren't able to answer on their own.
- Have students take turns teaching various concepts to one another.

## Laboratory Assignments

Each weekly lesson has a corresponding lab or activity. Many of the labs also have videos that provide instruction, give demonstrations on how to complete labs, and give your students ongoing learning opportunities in the field of physical science.

Please be aware that some labs take longer to complete than others. Be sure to look ahead each week to plan your time accordingly.

Labs are some of the most fun and interesting parts of science for most students, so we recommend doing as many labs as are feasible! While we encourage you to watch all lab videos with your students, you do *not* need to complete every lab assignment.

Depending on time constraints, you may choose to assign students to complete some labs at home, or you may start a lab in class and have students finish it at home. Many labs have follow-up questions that can be completed at home by students.

The majority of the needed supplies are household items that can easily be found around your house or at a local store. However, the rock and mineral kit you'll need to order from a lab supply company. You can see **instructions for ordering supplies and a complete list of supplies** at the

link below:

**Supplies Listed by Lesson**

**Students in the PLUS (Level C) version of the course** will be asked to write lab reports to accompany six labs in the first half of the course and six labs in the second half of the course.

For many students taking Physical Science Explored, this will be their first experience writing lab reports. It's important to give your students feedback on each lab report. The first lab reports may not be perfect, but that's okay. Just work with your students towards improving them throughout the school year.

Some of your students may have the skill to write much more advanced lab reports, or maybe it will be a challenge for your students to write any kind of lab report! We realize this is a brand-new skill for most students. Take the time to sit down and give plenty of feedback on individual lab reports or spend some time giving the class some extra tips if they're really struggling.

## Overview of Assignments

The textbook we recommend for the course is *Novare Physical Science*. While none of the quizzes or exams will be based on material exclusively in the textbook, the book will help reinforce what is learned in the lectures.

Below are the assigned readings and labs listed in order of lesson, along with the Level C assignments (not applicable to students completing the level B version of the course). The online classroom also informs students about each of these assignments each week, but the assignments are listed for you as a handy reference.

| Lesson | Textbook | Lab & Activities | Level C Assignments |
|---|---|---|---|
| Lesson 1: Introduction to Physical Science & The Scientific Method | Sections 7.1 & 7.4-7.6 | Freezing Liquids & Exploring the Scientific Method | Introduction to Lab Reports<br>**1.** Watch the level C assignment video.<br>**2.** Download and read the physical science lab report guide.<br>**3.** Write a lab report for "Freezing Liquids & Exploring the Scientific Method." |
| Lesson 2: Investigating Measurements & Unit Conversions | Sections 8.1 - 8.4 | Scientific Measurements | Understanding the Metric System<br>**1.** Memorize the units for measurement along with their symbols.<br>**2.** Memorize the metric system prefix meanings.<br>**3.** Use the worksheet to quiz yourself. |

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| Lesson 3: Tools for Scientific Study | Section 1.1 | Bullseye! Activities to Explore Accuracy & Precision | Accuracy & Precision in Science<br>**1.** Write a "Mars Climate Orbiter" summary paragraph.<br>**2.** Write a "Chernobyl Accident" summary paragraph.<br>**3.** Write a "Consequence of Errors: Memory Molecules" summary paragraph.<br>**4.** Write a "Consequence of Errors: Chromosome Abnormalities" summary paragraph. |
| Lesson 4: Classification & Properties of Matter | Sections 6.2-6.5 9.1, & 9.5 | Physical vs. Chemical Changes | Memorizing Common Elements<br>**1.** Watch the level C assignment video.<br>**2.** Download the element fact file and use the periodic table to write the element symbol on the worksheets.<br>**3.** Use the quizlet cards or create your own flashcards to quiz yourself on element names and symbols.<br>**4.** Use the missing elements worksheet to help you practice element symbols. |
| Lesson 5: Density & States of Matter | Sections 9.3 - 9.4 | Calculating & Comparing Density | Exploring Gas Laws<br>**1.** Download the level C outline and take notes as you watch the assignment video.<br>**2.** Complete the lab: "Exploring Gas Laws."<br>**3.** Write a lab report for “Exploring Gas Laws.” |
| Lesson 6: Structure of the Atom | Chapter 1 | Building Bohr Models | Atomic Theory Research Project - Part I<br>**1.** Begin research for your atomic theory project and consider how best to present the information.<br>**2.** On each of your element fact files, fill in the following information: atomic number, average atomic mass, mass number, protons, neutrons, electrons, and Bohr Model (where indicated). |

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| Lesson 7: Introducing the Periodic Table | Section 6.3 | Research Your Favorite Element | Atomic Theory Research Project - Part II<br>**1.** Finish your atomic theory project research being sure you included the scientists and information outlined in the lesson.<br>**2.** Present your atomic theory project to your family.<br>**3.** On each of your element fact files, fill in the following information: period number, group number, valence electrons, ion charge, hyphen notation, nuclear notation, type of element. |
| Lesson 8: Stability & Types of Bonding | Sections 6.1 & 11.2 | Exploring Properties of Ionic & Molecular Compounds | Excited Electrons Flame Test<br>**1.** Add electron dot diagrams to each element fact files where indicated.<br>**2.** Watch the level C assignment video.<br>**3.** Complete the lab: "Excited Electrons Flame Test."<br>**4.** Write a lab report for "Excited Electrons Flame Test." |
| Lesson 9: Exam 1 | | | |
| Lesson 10: Reading & Writing Chemical Formulas | Sections 6.4 | Growing Ionic Crystals | Calculating Percent Composition<br>**1.** Download the Level C outline and take notes as you watch the assignment video.<br>**2.** Continue memorizing the names and symbols for the 35 elements in your element fact files.<br>**3.** Complete the percent composition homework questions. |
| Lesson 11: Naming Ionic Compounds | Section 11.1 (stop at *Acids & Bases*) | Ionic Compounds Dice Lab | Ionic Compound Scavenger Hunt<br>**1.** Download directions for the ionic compound scavenger hunt and fill in the chart.<br>**2.** Continue memorizing the elements and symbols in your element fact files. |

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| Lesson 12: Naming & Writing Formulas for Molecular Compounds | | Exploring Covalent Compounds | Organic Compounds & Properties of Polymers<br>**1.** Download the level C outline and take notes as you watch the assignment video.<br>**2.** Continue memorizing the names and symbols for the 35 elements in your element fact files.<br>**3.** Complete the lab: "Properties of Polymers." |
| Lesson 13: Balancing Chemical Equations | | Balancing Chemical Equations & Exploring Conservation of Mass | Conservation of Mass<br>1. Continue memorizing the 35 elements and their symbols in your element fact files. Next week you will be quizzed on these.<br>2. Write a lab report for "Conservation of Mass with Alka-Seltzer."<br>3. Write a 1-paragraph summary of the linked article on the conservation of mass. |
| Lesson 14: Types of Chemical Reactions | Section 11.3 | Types of Reactions Lab | Element Quiz<br>1. On each of your element fact files, fill in: element at room temperature, year of discovery, who discovered the element, and interesting fact.<br>2. Take the first element quiz.<br>3. On another day, take the second element quiz. |
| Lesson 15: Solutions | Section 6.5 | Solubility of Epsom Salts & Sodium Carbonate | Creating Precipitates<br>1. Watch the level C assignment video.<br>2. Complete the lab: "Creating Precipitates."<br>3. Write a lab report for "Creating Precipitates." |

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| Lesson 16: Acids & Bases | Section 11.1 | Acids & Bases in Your Home | Acids & Bases Lab Report<br>1. Write a lab report for: "Acids and Bases in Your Home." |
| Lesson 17: Nuclear Changes | Section 5.1 | The Half-life of Radioactive Pennies | Nuclear Decay Reactions<br>1. Download the level C outline and take notes as you watch the assignment video.<br>2. Complete the nuclear decay homework questions. |
| Lesson 18: Exam 2 | | | |
| Lesson 19: Describing Motion | Sections 10.1-10.2 | Calculating Velocity | Creating & Interpreting Graphs in Physical Science<br>1. Watch the level C assignment video.<br>2. Download "Graphing Guidelines" to use as a reference throughout the remainder of this course.<br>3. Complete the velocity & graphing homework questions. |
| Lesson 20: Acceleration | Section 10.3 | Exploring Acceleration | Continued Exploration of Velocity & Acceleration<br>1. After completing the main lab for the lesson, complete “Exploring Acceleration Lab Extension.”<br>2. Complete the velocity and acceleration graphs as indicated in the lab instructions.<br>3. Write a combined lab report for the labs: “Exploring Acceleration” and “Exploring Acceleration Lab Extension.” |

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| Lesson 21: Newton's 1st & 2nd Laws | Section 10.4 through Newton's Second Law of Motion | Exploring Inertia | Bridge Project: Research Phase<br>1. Watch the level C assignment video.<br>2. Research different types of bridge designs and the types of loads bridges must withstand.<br>3. Write a 1-2 page summary of your findings.<br>4. Sketch design ideas for your bridge. |
| Lesson 22: Gravity & Projectile Motion | Section 5.1 *The Gravitational Force section* & 5.2 *The Gravitational Field section* | Explorations in Gravity & Air Resistance | Bridge Project: Building Phase<br>1. Finalize your bridge project plan and design your bridge.<br>2. Build your bridge using wooden craft sticks and glue.<br>3. Write a lab report for "The Dynamics of Falling Objects: Understanding Gravity & Air Resistance." |
| Lesson 23: Newton's 3rd Law | Section 10.4 *Newton's Third Law of Motion section* | Building a Slingshot | Bridge Project: Testing Phase<br>1. Download the "Bridge Project Test Instructions."<br>2. Test your bridge design and answer the questions found in the instructions. |
| Lesson 24: Work & Power | Section 3.4 | Investigating Human Work & Power | Mousetrap Car: Research Phase<br>1. Watch the level C assignment video.<br>2. Write a lab report for "Investigating Human Work & Power."<br>3. Begin research on how mousetrap cars work and how to build one.<br>4. Consider factors that will impact how far your mousetrap car can travel and start designing your mousetrap car. Consider what materials you'd like to use to build your mousetrap car and begin gathering them. |

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| Lesson 25: Exploring Energy, Heat, & Temperature | Sections 2.3 (*starting at Kinetic Energy*), 3.1, 3.3, & 3.5 | Exploring Conduction | Mousetrap Car: Building Phase<br>1. Build your mousetrap car.<br>2. Complete pre-tests on your car and make modifications to your design as necessary.<br>3. Write a lab report for "Conduction Contest- Comparing Wire Conductivity." |
| Lesson 26: Simple Machines | | Simple Machines Challenge: Rescuing the Circus Elephant | Mousetrap Car: Testing Phase<br>1. Follow the instructions in the download for testing your mousetrap car.<br>2. Answer the question demonstrating your understanding of how this project connects to physics concepts. |
| Lesson 27: Exam 3 | | | |
| Lesson 28: Introduction to Waves | Sections 12.1-12.2 | Hands-On Wave Dynamics with a Slinky | Mapping Wave Motion with a Simple Pendulum<br>1. Watch the level C assignment video.<br>2. Complete the lab: "Mapping Wave Motion with a Simple Pendulum." |
| Lesson 29: Properties of Sound Waves | Section 12.4 | Frequency of sounds | Wave Math<br>1. Watch the level C assignment video.<br>2. Complete the wave math homework questions. |
| Lesson 30: Light & Color | Section 2.3 (*stop at kinetic energy*) | Light & Color Dynamics | Light & Color Dynamics Extension<br>1. Complete the lab: "Light & Color Dynamics extension".<br>2. Write a combined lab report for the labs "Light & Color Dynamics" and "Light & Color Dynamics extension." |

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| Lesson 31: Behaviors of Light | Section 12.3 | Bending Light: Reflection & Refraction Diagrams | Concave & Convex Mirrors and Lenses<br>1. Download the level C outline and take notes as you watch the assignment video.<br>2. Write a 2-paragraph paper on Galilean vs. Keplearian telescopes. |
| Lesson 32: Exploring Electrical Charge | Sections 13.1-13.2 | Conductivity in Action | Energy Origins & Applications<br>1. Research one energy source of your choice.<br>2. Create a 3-5 minute presentation including the information outlined below. |
| Lesson 33: Electric Circuits | Sections 13.3-13.5 | Circuit Discovery: Building and Understanding Connections | Math of Power & Consumption<br>1. Present your research from last week on your chosen energy source to your family.<br>2. Download the level C outline and take notes as you watch the assignment video.<br>3. Complete the homework questions. |
| Lesson 34: Magnetism | Section 14.1 | The Science of Compass-Making | Electromagnet Exploration: Coils & Cores<br>1. Watch the level C assignment video.<br>2. Read Novare Sections 14.2 and 14.3 (optional).<br>3. Complete the lab: “Electromagnet Exploration: Coils & Cores.”<br>4. Write a lab report for “Electromagnet Exploration: Coils & Cores.” |
| Lesson 35: Exam 4 | | | |

# Scope & Sequence

*This Physical Science course introduces students to the fundamentals of chemistry and physics through engaging lessons and hands-on activities. Students will explore the structure of matter, chemical reactions, solutions, and nuclear changes before diving into motion, forces, energy, waves, electricity, and magnetism. They will develop problem-solving skills while learning how scientific principles apply to the world around them. By the end of the course, students will have a strong foundation in physical science, preparing them for further studies in chemistry and physics.*

**Lesson 1: Introduction to Physical Science**

What Is Physical Science?
Scientific Method

**Lesson 2: Measurements & Unit Conversions**

SI vs. English Unit Systems
Unit Conversions Using the Factor-Label Method

**Lesson 3: Tools for Scientific Study**

Accuracy and Precision
Scientific Notation

**Lesson 4: Classification & Properties of Matter**

Matter, Mass, and Weight
Pure Substances and Mixtures
Physical and Chemical Properties and Changes

**Lesson 5: Density & States of Matter**

Calculating Density
States of Matter and Their Properties
Phase Changes

**Lesson 6: Structure of the Atom**

Subatomic Particles
Bohr Models

**Lesson 7: Introducing the Periodic Table**

Reading the Periodic Table
Identifying Periods, Groups, and Types of Elements

**Lesson 8: Stability & Types of Bonding**

Valence Electrons and Dot Diagrams
Ionic, Covalent, and Metallic Bonding

**Lesson 9: Exam 1**

**Lesson 10: Reading & Writing Chemical Formulas**

Understanding Chemical Formulas
Writing Chemical Formulas From Names

**Lesson 11: Naming Ionic Compounds**

Fixed and Variable Charged Ions
Naming Ionic Compounds

**Lesson 12: Names & Formulas for Molecular Compounds**

Why Do Nonmetals Have Different Charges?
Naming and Writing Formulas for Molecular Compounds

**Lesson 13: Balancing Chemical Equations**

Law of Conservation of Mass
Reading and Balancing Chemical Equations

**Lesson 14: Types of Chemical Reactions**

Identifying Types of Reactions: Synthesis, Decomposition, Single Replacement, Double Replacement, and Combustion

**Lesson 15: Solutions**

Categories of Matter
Solubility and Types of Solutions
Calculating Molarity

**Lesson 16: Acids & Bases**

Properties of acids and bases
Strength of acids and bases
Neutralization reactions

**Lesson 17: Nuclear Changes**

Radioactivity
Types of nuclear decay
Introduction to half-L\ife

**Lesson 18: Exam 2**

**Lesson 19: Describing Motion**

Velocity and Motion
Speed Calculations
Velocity Graphs

**Lesson 20: Acceleration**

What is Acceleration?
Acceleration Calculations
Acceleration Graphs

**Lesson 21: Newton's 1st & 2nd Laws**

Inertia (Newton's 1st Law)
Net Force (Newton's 2nd Law)
Force Diagrams

**Lesson 22: Gravity & Projectile Motion**

Calculating Force of Gravity
Force Diagrams
Projectile Motion

**Lesson 23: Newton's 3rd Law**

Action and Reaction Forces
Momentum and Change in Momentum
Momentum Calculations

**Lesson 24: Work & Power**

Mechanical Work
Calculating Power

**Lesson 25: Exploring Energy, Heat, & Temperature**

Introduction to Mechanical Energy
Potential and Kinetic Energy
Heat and Temperature

**Lesson 26: Simple Machines**

What is a Simple Machine?
Types of Simple Machines

**Lesson 27: Exam 3**

**Lesson 28: Introduction to Waves**

Transverse vs. Longitudinal Waves
Parts of a Wave
Graphing Waves

**Lesson 29: Properties of Sound Wave**

Speed of Sound
Loudness and Intensity
Frequency and Pitch
Human Hearing

**Lesson 30: Light and Color**

Properties of Light Waves
The Electromagnetic Spectrum
How We See Color

**Lesson 31: Wave Behaviors**

Reflection, Refraction, and Diffraction
Reflection & Refraction Diagrams

**Lesson 32: Exploring Electrical Charge**

Electrical Charge
Movement of Electrons: friction, conduction, & induction
Electric Force
Electric Field Line

**Lesson 33: Electric Circuits**

How do Circuits Work?
Circuit Diagrams
Series vs Parallel Circuits

**Lesson 34: Magnetism**

Properties of Magnets
Permanent vs Temporary Magnets
Magnetic Field Diagrams
Earth's Magnetic Field

**Lesson 35: Exam 4**

# Grading

## Homework Question Recordkeeping

Physical Science Explored requires students to answer homework questions throughout the school year. Each question is worth up to 3 points. Below are suggested point values.

- 3 points: Answers that are accurate and thorough.
- 2 points: Answers that may be missing important details, but effort was made to find the correct answer.
- 1 point: Answers that look largely inaccurate or incomplete.
- 0 points: Answers that are hastily completed and incorrect.

*Copy the pages below to keep a record of homework grades for each of your students.*

Student Name:_____

| **Question Number** | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 3.1 | 3.2 | 3.3 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 4.1a | 4.1b | 4.1c | 4.1d | 4.1e | 4.1f | 4.1g | 4.2a |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 4.2b | 4.2c | 4.2d | 4.2e | 4.2f | 5.1 | 5.2 | 5.3 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 5.4 | 5.5 | 5.6 | 6.1.1 | 6.1.2 | 6.1.3 | 6.2a | 6.2b |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 6.2c | 7.1 | 7.2 | 7.3 | 8.1 | 8.2 | 8.3 | 8.4 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 10.1a | 10.1b | 10.1c | 10.2a | 10.2b | 10.2c | 10.3a | 10.3b |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 10.3c | 10.3d | 10.3e | 10.3f | 10.3g | 10.3h | 11.1 | 11.2 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 11.3 | 11.4 | 11.5 | 11.6 | 11.7 | 11.8 | 12.1 | 12.2 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 12.3 | 12.4 | 12.5 | 12.6 | 12.7 | 12.8 | 13.1 | 13.2 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 13.3 | 13.4 | 13.5 | 14.1 | 14.2 | 14.3 | 14.4 | 14.5 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 15.1 | 15.2 | 15.3 | 16.1 | 16.2 | 16.3 | 16.4 | 16.5 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 16.6 | 19.1 | 19.2 | 19.3 | 19.4 | 19.5 | 20.1 | 20.2 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 20.3 | 20.4 | 21.1a | 21.1b | 21.2a | 21.2b | 21.3 | 21.4 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 22.1a | 22.1b | 22.1c | 22.1d | 22.1e | 22.1f | 23.1 | 23.2 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 23.3 | 23.4 | 24.1 | 24.2 | 24.3 | 24.4 | 25.1 | 25.2 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 25.3a | 25.3b | 25.3c | 25.3d | 26.1a | 26.1b | 26.1c | 26.1d |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 26.1e | 26.1f | 26.2 | 26.3 | 28.1 | 28.2 | 28.3 | 33.1 |
|---|---|---|---|---|---|---|---|---|
| *Total Score* | | | | | | | | |

| **Question Number** | 33.2 | 33.3 | 33.4 | 33.5 |
|---|---|---|---|---|
| *Total Score* | | | | |

# Quiz & Exam Grading

*Copy this page to maintain a record of student quiz and exam scores.*

Student Name:_____

| **Quiz** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | End Q1 |
|---|---|---|---|---|---|---|---|---|---|
| *Score* | | | | | | | | | |

| **Quiz** | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | End Q2 |
|---|---|---|---|---|---|---|---|---|---|
| *Score* | | | | | | | | | |

| **Quiz** | 19 | 20 | 21 | 22 | 23 | 24 | 25 | End Q3 |
|---|---|---|---|---|---|---|---|---|
| *Score* | | | | | | | | |

| **Quiz** | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | End Q4 |
|---|---|---|---|---|---|---|---|---|---|
| *Score* | | | | | | | | | |

| **Exam** | Q1 Exam | Q2 Exam | Q3 Exam | Q4 Exam |
|---|---|---|---|---|
| *Score* | | | | |

# Lab Assignments

*Record your student's primary lab scores in the table below (this does not include Level C lab reports). Assign your student 1-10 points for each lab completed. A student should receive a 10 for exceptional work that shows mastery of the concepts.*

*Copy this page to keep a record of homework grades for each of your students.*

Student Name:_____

| **Lab Number** | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Score | | | | | | |

| **Lab Number** | 7 | 8 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|
| Score | | | | | | |

| **Lab Number** | 14 | 15 | 16 | 17 | 19 | 20 |
|---|---|---|---|---|---|---|
| Score | | | | | | |

| **Lab Number** | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|
| Score | | | | | | |

| **Lab Number** | 28 | 29 | 30 | 31 | 22 | 33 | 34 |
|---|---|---|---|---|---|---|---|
| Score | | | | | | | |

# Level C: PLUS Grading Rubric

*Below is a detailed grading rubric for the Level C assignments in Physical Science. In addition, you'll find the lab report grading rubric and the accompanying tables below to help with grading each of these assignments. Copy these pages to keep a record of homework grades for each of your students.*

Student Name:_____

| Lesson | Graded assignments | Grading Rubric | Points Possible | Student Grade |
|---|---|---|---|---|
| 1: Introduction to Lab Reports | Write a lab report for *Freezing Liquids & Exploring the Scientific Method*. | Use lab report grading rubric. | 100 | |
| 2: Understanding the Metric System | Measurements & Unit Conversion Worksheet | Give students 1 point for each blank answered correctly. | 36 | |
| 3: Accuracy & Precision in Science | **1.** Write a *Mars Climate Orbiter* summary paragraph.<br>**2.** Write a *Chernobyl Accident* summary paragraph.<br>**3.** Write a *Consequence of Errors: Memory Molecules* summary paragraph.<br>**4.** Write a *Consequence of Errors: Chromosome Abnormalities* summary paragraph. | Assign 25 points for each paragraph that's thoughtfully written and includes the information outlined in the answer key. Deduct points for key ideas that are missed. | 100 | |

| | | | | |
|---|---|---|---|---|
| 4: Memorizing Common Elements | Element Fact Files: Use the periodic table to write the element symbol on the element fact files. | Assign ¼ point for each element symbol correctly written on the element fact files. | 8.75 | |
| 5: Exploring Gas Laws | Write a lab report for *Exploring Gas Laws*. | Use lab report grading rubric. | 100 | |
| 6: Atomic Theory Research Project - Part I | Element Fact Files: fill in the following information: atomic number, average atomic mass, mass number, protons, neutrons, electrons, Bohr Model (where indicated). | Assign ¼ point for each item correctly written on the element fact file. | 57.5 | |
| 7: Atomic Theory Research Project | 1. Atomic Theory Research Project Presentation<br><br>2. Element Fact Files: fill in the following information: period number, group number, valence electrons, ion charge, hyphen notation, nuclear notation, type of element. | **1.** Students should, at minimum, include the 12 scientists and the contributions outlined in the answer key. For each of the scientists they correctly identify key ideas found in the answer key, assign 7 points. Deduct points when ideas are left out. Assign up to 16 points for creativity and presentation style.<br><br>2. Element Fact File: assign ¼ point for each item correctly written on the element fact file. | Atomic Theory Project 100<br><br>Element Fact File 61.25 | |

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|---|---|---|---|---|
| 8: Excited Electrons Flame Test | **1.** Write a lab report for *Excited Electrons Flame Test*.<br><br>2. Element Fact Files: add electron dot diagrams where indicated | **1.** Use lab report grading rubric.<br><br>2. Element Fact File: assign ¼ point for each item correctly written on the element fact file. | Lab Report 100<br><br>Element Fact File 6.25 | |
| 10: Calculating Percent Composition | Complete the percent composition homework questions. | Assign 15 points for each homework question correctly completed. Deduct points for incorrect calculations and/or not showing work. | 60 | |
| 11: Ionic Compound Scavenger Hunt | Ionic Compound Scavenger Hunt | Assign 2 points for each box correctly filled out. | 40 | |
| 12: Organic Compounds & Properties of Polymers | Complete the lab: *Properties of Polymers" and answer the discussion questions*. | For each discussion question correctly and thoughtfully answered, assign up to 5 points. | 20 | |

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|---|---|---|---|---|
| 13: Conservation of Mass | 1. Write a lab report for *Conservation of Mass with Alka-Seltzer*.<br><br>2. Write a 1-paragraph summary of the linked article on the conservation of mass. | **1.** Use lab report grading rubric.<br><br>**2.** Assign 25 points for a paragraph that's thoughtfully written and includes the information outlined in the answer key. Deduct points for key ideas that are missed. | Lab Report 100<br><br>Paragraph 25 | |
| 14: Element Quiz | 1. Element Quiz (2 parts)<br><br>2. Element Fact File: fill in the following information: element at room temperature, year of discovery, who discovered the element, interesting fact | 1. Assign 1 point for each element and element abbreviations correctly identified.<br><br>2. Element Fact File: assign ¼ point for each item correctly written on the element fact file. | Quiz 70<br><br>Element Fact File 35 | |
| 15: Creating Precipitates | Write a lab report for *Creating Precipitates*. | Use lab report grading rubric. | 100 | |
| 16: Acids & Bases Lab Report | Write a lab report for *Acids and Bases in Your Home*. | Use lab report grading rubric. | 100 | |

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|---|---|---|---|---|
| 17: Nuclear Decay Reactions | Nuclear decay homework questions | Assign 5 points for each homework question correctly completed. Deduct points for incorrectly completed questions. | 35 | |
| 19: Creating & Interpreting Graphs in Physical Science | Complete the velocity & graphing homework questions. | Assign 5 points for each homework question correctly completed. Deduct points for incorrectly completed questions. | 25 | |
| 20: Continued Exploration of Velocity & Acceleration | Write one combined lab report for the labs: *Exploring Acceleration* and *Exploring Acceleration Lab Extension*. | Use lab report grading rubric. | 100 | |
| 21: Bridge Project: Research Phase | Write a 1-2 page summary of your findings on types of bridge designs and loads a bridge must withstand. | Assign up to 100 points for a paper that is thoughtfully written and includes all the key ideas as indicated in the answer key. Deduct points for missing or sloppy work. | 100 | |
| 22: Bridge Project: Building Phase | Write a lab report for *The Dynamics of Falling Objects: Understanding Gravity & Air Resistance*. | Use lab report grading rubric. | 100 | |

| | | | | |
|---|---|---|---|---|
| 23: Bridge Project: Testing Phase | 1. Completed bridge design.<br><br>2. Test your bridge design and answer the questions found in the instructions. | 1. Assign up to 75 points for a thoughtfully and carefully designed bridge.<br><br>2. Assign 5 points for each question that's correctly completed. | Bridge Design 75<br><br>Questions 25 | |
| 24: Mousetrap Car: Research Phase | Write a lab report for *Investigating Human Work & Power*. | Use lab report grading rubric. | 100 | |
| 25: Mousetrap Car: Building Phase | Write a lab report for *Conduction Contest- Comparing Wire Conductivity*. | Use lab report grading rubric. | 100 | |
| 26: Mousetrap Car: Testing Phase | 1. Completed Mousetrap Car<br><br>2. Answer questions demonstrating your understanding of how this project connects to physics concepts. | **1.** Assign up to 70 points for a thoughtfully and carefully designed mousetrap car.<br><br>2. Assign 5 points for each question that's correctly completed. | Mousetrap Car Design 70<br><br>Questions 30 | |

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|---|---|---|---|---|
| 28: Mapping Wave Motion with a Simple Pendulum | 1. Complete the lab: *Mapping Wave Motion with a Simple Pendulum* and collect data.<br><br>2. Answer questions and complete calculations from the lab. | 1. Assign up to 50 points for correctly completing the lab and collecting data.<br><br>2. Assign 5 points for the questions and calculations that are correctly completed. | Lab<br>50<br><br>Questions<br>15 | |
| 29: Wave Math | Complete the wave math homework questions. | Assign 5 points for each question that's correctly completed (count 6a as one question and 6b as another question). | 35 | |
| 30: Light & Color Dynamics Extension | Write one combined lab report for the labs *Light & Color Dynamic*s and *Light & Color Dynamics extension*. | Use lab report grading rubric. | 100 | |
| 31: Concave & Convex Mirrors and Lenses | Write a 2-paragraph paper on Galilean vs. Keplearian telescopes. | Assign up to 50 points for paragraphs that are thoughtfully written and include all the key ideas indicated in the answer key. Deduct points for missing or sloppy work. | 50 | |
| 32: Energy Origins & Applications | Create a 3-5 minute presentation including the information outlined below. | The assignment will be presented and graded next week. | | |

| | | | | |
|---|---|---|---|---|
| 33: Math of Power & Consumption | 1. Present your research from last week on your chosen energy source to your family.<br><br>2. Complete the homework questions. | **1.** Students should, at minimum, include the information outlined in the answer key for the energy source they have chosen. Assign 12 points each for defining their energy source, explaining its origin, and describing its conversion. Deduct points when key ideas or points are left out of their presentation. Assign up to 14 points for creativity and presentation style.<br><br>2. Assign 5 points for the questions and calculations that are correctly completed. | Energy Project 50<br><br>Homework 20 | |
| 34: Electromagnet Exploration: Coils & Cores | Write a lab report for *Electromagnet Exploration: Coils & Cores*. | Use lab report grading rubric. | 100 | |
| **Total Points Possible** | | | **2491.75** | |

# Level C: PLUS Lab Report Grading Rubric

*Below are the sections that should be included in your student's lab reports. Each lab report is worth up to 100 points with each section being worth the assigned number of points. Read the descriptions of what is expected to be included in each section and determine how many points your student will receive for that section.*

**Title** (5 points)
Each lab report should have a descriptive title. The title should clearly explain what you're studying. Also, include your name and the date of the laboratory experiment or observation.

A poor title choice might be "Pool Water." A much better title choice would be "Comparing the number of bacteria found in chlorinated and salt-treated pool water."

**Introduction** (15 points)
The introduction should describe the problem. This is also where you explain what the investigation is about—why you are doing the lab. You should give some background information, explaining what is already known about this problem.

If your lab is to simply complete observations, which is often the case in science, it's okay to write a problem statement like this, "I intend to make observations about chemicals commonly found around the home and how they interact with each other." It is not acceptable to write, "I'm doing lab #1."

Don't forget to do some reading in your textbook or other resources. The research step is very important. Consult some resources to help you explain some of what is already known about the problem. What have you learned in your lectures or textbook reading? For instance, if you're doing a lab observing plant cells, you could discuss specific structures found in plant cells, noting unique plant cell structures as part of your background information.

**Hypothesis** (10 points)
Your hypothesis is a statement that tells what you expect to happen *and* why. It's important to explain your reasoning; otherwise, your hypothesis is just a random guess. Scientific

hypotheses are based on the knowledge you have. Your hypothesis should be written as a statement.

If your lab assignment is just observation, you do not need to make an educated guess about what will happen—no hypothesis is needed.

**Materials** (5 points)
In a neat column, list *all* the materials that are necessary to carry out the investigation. In the labs for this course, this should be easy because the materials list will be given in your directions. However, if you vary the materials used from the instructions, be sure to change that in your lab report.

**Procedure** (10 points)
In the procedure section, you'll discuss what you did and how you did it. Using a numbering system, give all the steps in the procedure you used. This should be so complete that someone else could follow your instructions to do the same lab. If needed, you can also draw pictures to help with this step. For instance, if you have an elaborate equipment set-up, a picture may be helpful to someone trying to recreate your experiment.

This part should be fairly easy since you'll have procedures listed in your instructions for completing each lab report. You may use the instructions as a guide; however, an important part of this process is putting into your own words what you did. If you varied the procedures in any way, be sure to indicate this in your lab report. Accuracy is extremely important!

**Results** (30 points)
Your results should include information in any and all formats you've collected. Be sure to include a written description of your results. In addition, if you collected any numerical data, present this in a neat, easy-to-read data chart or graph. Observations, in the form of drawings, should also be recorded in this section. You're not interpreting your data in this section, just recording what you observed and the data you collected.

**Conclusion & Discussion** (25 points)
The conclusion is a very important step and should not be skipped. This is the step where you're interpreting the data you collected. In your analysis, you should state whether your hypothesis was supported by the data or not and explain the evidence for your conclusion.

Explain why you think it happened, trying to evaluate the data from an unbiased point of view. Give reasons for why you believe the outcome is or is not consistent with your hypothesis. Were there errors or potential errors that impacted your results? Be sure to discuss those.

This is also where you answer any questions that have been presented in the discussion section of your lab instructions. In your conclusion, you should also record what you learned and any questions this research brought up for you. Give suggestions for more investigation on this topic.

# Level C: PLUS Lab Report Grading

*Copy this page and record your students' lab scores in the table below. Assign your students points for each section out of the given number possible next to the name of the section.*

Student Name:_____

| **Lab Number** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Title (5) | | | | | | | |
| Introduction (15) | | | | | | | |
| Hypothesis (10) | | | | | | | |
| Materials (5) | | | | | | | |
| Procedure (10) | | | | | | | |
| Results (30) | | | | | | | |
| Conclusion (25) | | | | | | | |
| *Total Score* | | | | | | | |

# Final Grade

Below is a suggested way to compute your student's final grade at the end of the school year.

For Level B students, take the average of the first four values (homework, quiz, exam, and lab grades).

For Level C students, take the average of all five values (homework, quiz, exam, lab grades, PLUS assignment grades).

| | |
|---|---|
| **Average homework question grade** | |
| **Average quiz grade** | |
| **Average exam grade** | |
| **Average lab grade** | |
| **Average level C assignment grade x 2** (Level C only)<br>Give these assignments twice the weight of the above assignments | |
| **Add scores together** | |
| **Final grade**<br>Level B: divide by 4 for final grade<br>Level C: divide by 6 for final grade | |