

Physical Science, Semester A

Course Overview

Science is the study of the natural world. It relies on experimentation and evidence to describe the natural events that occur around us. Physical science is the study of matter and energy. In Physical Science A, you'll describe the atomic and molecular structure of substances using models. You will investigate how chemical reactions involve energy and lead to changes in properties of substances. You'll also model different kinds of forces and the effect they have on the motion of objects. You'll solve problems involving work and power and apply these principles to simple machines. Finally, you will see how simple machines make up more complex machines that are important in our lives.

Course Goals

By the end of this course, you will be able to do the following:

- Apply the steps of the scientific method to explain phenomena involving matter and energy.
- Classify matter by its composition and properties.
- Model atomic and molecular structures of substances.
- Explain the relationship between thermal energy and states of matter.
- Describe the Bohr model of an atom.
- Research historical models of the atom developed by scientists.
- Compare properties of reactants and products to determine whether a chemical reaction has occurred.
- Develop a model to show that atoms are conserved in chemical reactions.
- Describe energy changes that occur during a chemical reaction.
- Design, build, test, and modify a device that relies on a transfer of thermal energy.
- Describe the properties and uses of synthetic materials and how they affect society.
- Identify and sketch forces that act on real-world objects.
- Analyze the motion of objects using words, equations, and graphs.
- Explain how the concepts of force and motion are related.
- Analyze input and output forces in simple machines.
- Solve problems involving work and power.
- Design, build, test, and modify a device that uses one or more simple machines.

General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word processing software, such as Microsoft Word or Google Docs.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Plato Student Orientation document, found at the beginning of this course.

Credit Value

Physical Science A is a 0.5-credit course.

Course Materials

- notebook
- computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- Microsoft Power Point or equivalent
- equipment listed in Appendix B

Course Pacing Guide

This course description and pacing guide is intended to help you keep on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

Unit 1: Structure and Properties of Matter

Summary

This unit begins with an introductory lesson where you'll learn about the scientific method and the kinds of phenomena studied in physical science. You will classify matter by its composition and properties, including matter that you find around your home. You'll develop models for the molecular structure of matter and explain how matter changes state with the addition or removal of thermal energy. Finally, you'll describe the model of the atom developed by Niels Bohr and explain how the model of the atom has changed over time based on the work of Bohr and other scientists.

| Day | Activity/Objective | Type |
|------------------|--|------------------------------|
| 1 day: 1 | Syllabus and Plato Student Orientation <i>Review the Plato Student Orientation and Course Syllabus at the beginning of this course.</i> | Course Orientation |
| 4 days: 2–5 | Introduction to Physical Science <i>Apply the steps of the scientific method, and identify the kinds of phenomena studied in physical science.</i> | Lesson |
| 3 days: 6–8 | Examining Matter <i>Carry out an investigation to compare properties of common household materials.</i> | Course Activity |
| 4 days 9–12 | Matter Around Us <i>Classify matter by its composition and properties.</i> | Lesson |
| 2 days: 13–14 | Building Models of Atomic Arrangements <i>Develop models of atomic arrangements of substances.</i> | Course Activity |
| 4 days: 15–18 | Energy and Changes in State <i>Explain how the motion of particles of matter changes when thermal energy is added or removed.</i> | Lesson |
| 2 days: 19–20 | Observing a Change in State <i>Carry out an investigation to predict changes in the state of water when thermal energy is added or removed.</i> | Course Activity |
| 4 days 21–24 | Atoms and Elements <i>Describe the Bohr model of the atom and explain how the model of the atom has changed over time.</i> | Lesson |
| 5 days: 25–29 | Unit Activity and Discussion—Unit 1 | Unit Activity/ Discussion |
| 1 day: 30 | Posttest—Unit 1 | Assessment |

Unit 2: Chemical Reactions

Summary

This unit focuses on chemical reactions between substances. You'll learn to determine whether a chemical reaction has occurred by comparing properties of reactants and products. You'll also develop a model to show that atoms are conserved in chemical reactions and describe the energy changes that have taken place. You'll apply ideas on chemical reactions to design, construct, test, and modify a device that releases or absorbs thermal energy. Finally, you'll see how inventors use chemical reactions to create synthetic materials and how the products affect society.

| Day | Activity/Objective | Type |
|------------------|---|------------------------------|
| 2 days: 31–32 | Observing a Chemical Reaction <i>Plan and carry out an investigation to compare properties of reactants and products in a chemical reaction.</i> | Course Activity |
| 4 days: 33–36 | Properties and Chemical Reactions <i>Determine whether a chemical reaction has occurred by comparing properties of reactants and products.</i> | Lesson |
| 4 days: 37–40 | Atoms in Chemical Reactions <i>Develop a model that shows that atoms are conserved in chemical reactions.</i> | Lesson |
| 4 days: 41–44 | Energy Changes in Chemical Reactions <i>Describe energy changes that occur during a chemical reaction.</i> | Lesson |
| 4 days: 45–48 | Building a Device That Uses Energy from Chemical Reactions <i>Design, construct, test, and modify a device that uses a chemical reaction to release or absorb thermal energy.</i> | Course Activity |
| 3 days: 49–51 | Synthetic Materials <i>Describe the properties and uses of synthetic materials and how they affect society.</i> | Lesson |
| 5 days: 52–56 | Unit Activity and Discussion—Unit 2 | Unit Activity/ Discussion |
| 1 day: 57 | Posttest—Unit 2 | Assessment |

Unit 3: Forces and Motion

Summary

This unit focuses on the relationship between force and motion. You'll identify and sketch forces that act on objects and predict how the objects will move. You'll analyze the motion of objects using words, equations, and graphs. You will apply the concepts of force and motion to design a car bumper that will reduce the force on riders during a collision. Finally, you will analyze the forces involved in simple machines that make our lives easier, and you'll solve problems involving work and power.

| Day | Activity/Objective | Type |
|------------------|---|------------------------------|
| 2 days: 58–59 | Exploring Forces <i>Identify and sketch forces that act on real-world objects.</i> | Course Activity |
| 4 days: 60–63 | Motion and Motion Graphs <i>Analyze the motion of objects using words, equations, and graphs.</i> | Lesson |
| 4 days: 64–67 | Using Forces to Predict Motion <i>Identify forces exerted on an object and predict the object's motion.</i> | Lesson |
| 4 days: 68–71 | Investigating Forces and Motion <i>Plan and carry out an investigation to determine how force and motion are related to each other.</i> | Course Activity |
| 4 days: 72–75 | Collisions <i>Identify force interactions between two objects and predict the motion of the objects.</i> | Lesson |
| 3 days: 76–78 | Designing a Car Bumper <i>Design a car bumper that will reduce the force on riders during a collision.</i> | Course Activity |
| 4 days: 79–82 | Simple Machines <i>Analyze input and output forces in simple machines, and solve problems involving work and power.</i> | Lesson |
| 5 days: 83–87 | Unit Activity and Discussion—Unit 3 | Unit Activity/ Discussion |
| 1 day: 88 | Posttest—Unit 3 | Assessment |

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|--------------|-----------------------------|------------|
| 1 day: 89 | Semester Review | |
| 1 day: 90 | End-of-Semester Test | Assessment |

Course Map

You will achieve course level objectives by completing each lesson's instruction, assignments, and assessments. For a detailed look at how the materials meet these objectives, review the [course map for Semester A](#).

Appendix A: Safety Notes and Disclaimer

Each Course Activity and Unit Activity that includes a lab/experiment component will highlight key safety guidelines using the safety icon (⚠️), which appears directly in the activity. In addition to adhering to those guidelines, you must ensure that you follow these general safety practices:

- Work slowly and safely at all times, and abide by the safety notes and icons.
- Pay attention and be alert at all times. Limit any distractions.
- Keep your hands away from your nose, eyes, mouth, and skin. Wash your hands before and after experiments.
- If you don't understand something, ask a teacher or an adult before proceeding.
- Wear the required protective gear.
- Adult supervision is required for all activities involving an experiment/lab component.
- Do not perform experiments that have not been approved. Follow the procedure.
- Follow good housekeeping practices. Keep your work area clean.
- Abide by all disposal instructions and icons to protect yourself and our planet.
- Report any problems or complications to an adult.

Note: *Edmentum assumes no liability for personal injury, death, property damage, equipment damage, or financial loss resulting from the instruction included in this course.*

Appendix B: Equipment List for Course Activities and Unit Activities

| Unit | Activity Name | Task | Equipment List |
|------|---|--|--|
| 1 | Course Activity: Examining Matter* *Task 4 of this activity may need to be carried out in a school lab. | Task 1: Mixing Substances | <ul style="list-style-type: none"> • liquid measuring cup • 2 small clear containers (glasses or plastic cups) • 2 drops of food coloring • 1 piece of plain white paper • apron (optional) |
| | | Task 2: Comparing Appearance, Relative Density, and Solubility | <ul style="list-style-type: none"> • safety goggles • small, clear container (glass or plastic cup) • liquid measuring cup • ¼-teaspoon measuring spoon • ¼ teaspoon each of these materials: <ul style="list-style-type: none"> ○ baking soda ○ baking powder ○ salt ○ sugar ○ white flour ○ white vinegar ○ cooking oil (any kind) • paper towels or napkins |

| Unit | Activity Name | Task | Equipment List |
|------|---|--|--|
| | | Task 3: Comparing pH | <ul style="list-style-type: none"> • 2 tablespoons chopped or shredded red cabbage • 2 small glass or stainless steel bowls • heat source (stove or hot plate) • small pan • oven mitt or hot pad • strainer (if not available, just carefully pour off the red cabbage juice) • apron • white ice cube tray (or a small, clear container that you reuse) • 8.5 × 11-inch piece of paper (for labeling) • rubber gloves • ½-teaspoon measuring spoon • 1-teaspoon measuring spoon (or a regular-size spoon) • ½ teaspoon of each of these materials: white vinegar, water, ammonia (if not available, use ¼ teaspoon of baking soda) • four or more additional household materials for pH testing, such as lemon juice, apple juice, hand soap, citrus cleaner, milk, or dishwasher soap |
| | | Task 4: Measuring Density | <ul style="list-style-type: none"> • 10 mL graduated cylinder (mL stands for milliliter) • gram scale • water • 6 metal paper clips of the same size and material |
| 1 | Course Activity: Building Models of Atomic Arrangements | Task 1: Building an Atomic Model of Salt | <ul style="list-style-type: none"> • 4 regular-size marshmallows • 4 mini marshmallows (if not available, tear 2 regular-size marshmallows in half) • 12 toothpicks • 1 sheet of 8½-inch × 11-inch paper to build the model on |

| Unit | Activity Name | Task | Equipment List |
|------|---|--|---|
| | | Task 2: Building an Atomic Model of Water | <ul style="list-style-type: none"> • 4 regular-size marshmallows • 8 mini marshmallows (if not available, tear 4 regular-size marshmallows in half) • 8 toothpicks • 2 sheets of 8½-inch × 11-inch paper to build the model on |
| | | Task 3: Building an Atomic Model of Copper | <ul style="list-style-type: none"> • 9 regular-size marshmallows • 8 straws, cut in half (small-diameter coffee or hot chocolate straws are best; if using larger straws, flatten both ends when connecting them to the marshmallows) • scissors • 1 sheet of 8½-inch × 11-inch paper to build the model on |
| 1 | Course Activity: Observing a Change in State | Task 1: Prepare and Predict | <ul style="list-style-type: none"> • 1 small sealable plastic bag, approximately 3 in. × 6 in. • 1 teaspoon • 1 empty ice cube tray • tap water |
| | | Task 2: Observe and Explain | <ul style="list-style-type: none"> • ice made in task 1 • 2 pieces of foil, each 12 inches square |
| 1 | Unit Activity: Structure and Properties of Matter | Task 1: Writing a Research Paper | None |

| Unit | Activity Name | Task | Equipment List |
|------|---|--|--|
| 2 | Course Activity: Observing a Chemical Reaction | Task 1: Deciding Whether a Reaction Occurs | <ul style="list-style-type: none"> • safety goggles • ½ teaspoon measuring spoon • 1 teaspoon baking soda • 2 large containers of similar size and shape; must hold at least 2 cups (suggestion: tall glasses, large mugs, or bowls) • pen • sticky notes for labeling • 2 small containers (suggestion: small cups or snack bowls) • ¼ cup measuring cup (equal to 4 tablespoons) • ¼ cup water at room temperature (set out water 1 hour before the activity so it reaches room temperature) • ¼ cup white vinegar at room temperature |
| | | Task 2: Changing Ratios of Reactants | <ul style="list-style-type: none"> • safety goggles • baking soda • white vinegar at room temperature • set of measuring spoons • 1 cup graduated measuring cup • 3 or more large containers of similar size and shape; must hold at least 2 cups (suggestion: tall glasses, large mugs, or bowls) • tray, rimmed cookie sheet, or large sink to hold containers and contain overflow • paper towels |

| Unit | Activity Name | Task | Equipment List |
|------|--|--|--|
| 2 | Course Activity: Building a Device That Uses Energy from Chemical Reactions | Task 1: Carry Out an Endothermic Reaction | <ul style="list-style-type: none"> • safety goggles • measuring cup for liquids • water • small container (about 1 cup) • thermometer that measures between 0°C and 30°C (32°F and 86°F) • 1-teaspoon measuring spoon (or a regular-size spoon) • 2 teaspoons baking soda • 2 teaspoons citric acid (also called sour salt, available at grocery, health food, or hardware stores) • foam cup • spoon or stirrer |
| | | Task 2: Design, Build, and Test a Prototype of the Cup | <ul style="list-style-type: none"> • safety goggles • scrap cardboard of different thicknesses, such as cereal boxes, tag board, and shipping boxes • 2 paper towel tubes • 2 toilet paper tubes • scissors • tape • ½-cup and 1-cup measuring cups • 2½ cups shredded paper |

| Unit | Activity Name | Task | Equipment List |
|------|-----------------------------------|--|---|
| | | Task 3: Design, Build, and Test a Prototype of the Cold Pack | <ul style="list-style-type: none"> • safety goggles • 1 toilet paper tube or a small rectangular box (depends on cold pack compartment shape from Task 2) • scrap cardboard of different thicknesses, such as cereal boxes, tag board, and shipping boxes • scrap paper • scissors • glue • tape • thread or string • paper clips • plastic produce bag or similar • ½-cup measuring cup • 1-teaspoon measuring spoon • 4 teaspoons baking soda • water |
| 2 | Unit Activity: Chemical Reactions | Task 1: Planning and Creating a Presentation | None |
| 3 | Course Activity: Exploring Forces | Task 1: Contact Forces | <ul style="list-style-type: none"> • safety goggles • cleared space on a smooth, durable table that is at least 3 feet in length • 12-inch ruler • ball made of a hard material, such as a baseball, tennis ball, pool ball, lacrosse ball, whiffle ball, or ping-pong ball • large, heavy book or box to use as a barrier • piece of plastic or wood with a broad flat surface, such as a three-ring binder or a cutting board • area rug, carpet, or piece of fabric with nap |

| Unit | Activity Name | Task | Equipment List |
|------|--|--|--|
| | | Task 2: More Contact Forces | <ul style="list-style-type: none"> • safety goggles • 2 sheets of paper that are the same size • small rubber band • 1-foot piece of string or rope |
| | | Task 3: Forces Exerted Over a Distance | <ul style="list-style-type: none"> • safety goggles • 4 or more identical clothes hangers • any kind of tape • 2 bar magnets with labeled or colored ends • 2 balloons • 2 (2-foot) pieces of thread or string • wool or fur to charge balloon (can use wool yarn, a sweater, or even your hair to create the charge) • 2-foot piece of plastic wrap |
| 3 | Course Activity: Investigating Forces and Motion | Task 1: Set Up the Experiment | <ul style="list-style-type: none"> • goggles • square piece of cardboard, about 8 inches per side • ruler • hole punch or scissors • 36 inches of string or strong thread • large paperclip to use as a hook • 1 nonbreakable object to be placed on top of the cardboard (e.g., plastic or metal kitchen utensils such as spatulas and large spoons) • 2 nonbreakable objects to hang on the paperclip hook (e.g., small or large kitchen utensils with holes in the handles such as ½- and 1-cup measuring cups) • a table at least 24 inches wide • 1 square meter of floor space next to the table, covered with a rug, mat, or carpet |

| Unit | Activity Name | Task | Equipment List |
|------|--|---|---|
| | | Task 2: Plan and Observe | <ul style="list-style-type: none"> • goggles • the experimental setup from Task 1 • one more nonbreakable object to place on top of the cardboard (e.g., another kitchen utensil) • table at least 24 inches wide • 1 square meter of floor space next to the table, covered with a rug, mat, or carpet |
| | | Task 3: Analyze and Extend | None |
| | | Task 4: Calculate Velocity and Acceleration | None |
| 3 | Course Activity: Designing a Car Bumper | Task 1: Set It Up | <ul style="list-style-type: none"> • goggles • a ruler at least 12 inches long • scissors • tape • glue • a 6-inch × 7-inch piece of heavy cardboard • a small box, about 5 inches × 7 inches on one side and 2.5 inches deep (e.g., 1-pound pasta box or similar) • a board or a piece of stiff cardboard, at least 30 inches long, for the ramp • 6 8-inch disposable straws • a ball (golf, tennis, lacrosse, or similar) • uncarpeted floor space, about 2 feet × 6 feet • an 8- to 12-inch high support for the ramp (e.g., a heavy box, a stool, or a stack of books) |

| Unit | Activity Name | Task | Equipment List |
|------|----------------------------------|---|---|
| | | Task 2: Design, Build, and Test Bumper Prototypes | <ul style="list-style-type: none"> • goggles • a ruler at least 12 inches long • scissors • tape • glue • balloons • thick and thin pieces of scrap cardboard • setup from task 1 |
| 3 | Unit Activity: Forces and Motion | Task 1: Analyze a Tool | <ul style="list-style-type: none"> • goggles • any tool that uses one or more simple machines |
| | | Task 2: Design, Build, and Test a Prototype of a Tool | <ul style="list-style-type: none"> • materials you find around the house • repurposed toys and other objects |