STRATFORD PUBLIC SCHOOLS
Stratford, Connecticut

"Tantum eruditi sunt liberi"
Only The Educated Are Free

Physical Science
Grade 8 & Honors Curriculum

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PHYSICAL SCIENCE
GRADE 8 & Honors

Course Description:

Grade 8 Regular Physical Science: This course includes topics that focus on the Connecticut Science Standards for the middle school physical sciences, which can be found on the state education department website at: http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=320890 All grade eight students should gain an understanding of the major topics in physical sciences, such as matter, forces, motion, energy, simple machines and bridges. Throughout the course, students will practice using science inquiry skills in developing investigations to solve scientific questions, along with continued development of scientific literacy and numeracy skills. By participating in Common Formative Assessments, the skills and content found on the science CMT will be reinforced.

Grade 8 Honors Physical Science: The 8th grade honors science curriculum consists of the entire regular 8th grade science curriculum, including all assessments and CFA's. In addition, the honors science curriculum includes more advanced and in depth content on all topics, more rigorous performance assessments, inquiry lab experiences and projects. This curriculum will also include standards from the 9th grade Studies In Science curriculum. Such topics include chemical reactions, carbon compounds, polymers, energy and power technologies, magnetism, and electricity.

Stratford Public Schools Mission Statement:

To develop a community of learners in which ALL students acquire the knowledge, skills, and confidence to meet the challenges of a changing and increasingly diverse society.

Stratford Information Literacy and Technology Standards

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Safety In The Science Laboratory

Students and teachers must be aware of the potential for safety problems in the science classrooms and laboratories. Schools should review available safety resources and develop safety training for their teachers and students as well as safety rules for the classroom.

Teachers must choose safe labs that cover important concepts. Thought must be given to the chemicals purchased by schools. Which chemicals are the safest for the proposed labs, how much is needed, where will the chemicals be stored and in what arrangement? Are the storage areas locked and well ventilated?

General Lab Safety Recommendations

1. Always perform an experiment or demonstration prior to allowing students to replicate the activity. Look for possible hazards. Alert students to potential dangers.
2. Safety instructions should be given orally and be posted each time an experiment is begun.
3. Constant surveillance and supervision of student activities are essential.
4. Never eat or drink in the laboratory or from laboratory equipment. Keep personal items off the lab tables.
5. Never use mouth suction in filling pipettes with chemical reagents. Use a suction bulb.

General Science Safety Checklist

The following is a suggested checklist of safety concerns in K-12 science laboratories.

1. Appropriate protective equipment for the science laboratory
2. Enforcement of safety procedures
3. All students and teachers know the location of all protective equipment
4. All students read and sign a lab safety contract.
5. Sufficient, accessible lab stations per number of students in each laboratory
6. All students must wear proper safety goggles whenever chemicals, glassware, or heat are used

No food products should be consumed by staff or students as part of a lesson, unit or related course work.

Stratford Public Schools
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Grade 8

Unit 1 Name: Inquiry, Literacy, and Numeracy **Est. # of Days:** 9 days (with a Performance Task)

- **Synopsis:** This unit is to review the scientific method of experimentation through inquiry, literacy and numeracy. Skills such as measurements, research, calculations, observations and conclusions will be practiced throughout the year as well as in this unit.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **C INQ.1** Identify questions that can be answered through scientific investigation.
- **C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- **C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- **C INQ.4** Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- **C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- **C INQ.6** Use mathematical operations to analyze and interpret data.
- **C INQ.7** Identify and present relationships between variables in appropriate graphs.
- **C INQ.8** Draw conclusions and identify sources of error.
- **C INQ.9** Provide explanations to investigated problems or questions.
- **C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application
Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation
Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Inquiry, hypothesis, observations, conclusions, independent (manipulated) variables, dependent (responding) variables, constants, controls, validity, metric system

Enduring Understandings

- Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.
- Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.
- Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.
- Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science.
- Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

Essential Questions

- How is inquiry used to solve problems or gather data to better understand a situation?
- How do scientists gather observations to find answers to questions?
- How do scientists communicate their findings in science?
- What are the characteristics of a controlled experiment?

➢ Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.	

Learning Objectives / Grade Level Expectations
Students will:

- Identify questions that can be answered through scientific investigation.
- Read, interpret and examine the credibility of scientific claims in different sources of information.
- Design and conduct appropriate types of scientific investigations to answer different questions.
- Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- Use appropriate tools and techniques to make observations and gather data.
- Use mathematical operations to analyze and interpret the data.
- Identify and present relationships between variables in appropriate graphs.
- Draw conclusions and identify sources of error.
- Provide explanations to investigated problems or questions.
- Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.
- Identify and implement the safety measures to be taken in laboratory and field investigations.
- Collect and record data, using a variety of metric measures.
- Analyze direct and indirect evidence in order to propose reasonable explanations.
- Write lab reports about his or her laboratory and field investigations, using a standard format: Problem, Hypothesis, Materials, Procedure, Results, Conclusion, and Validity.

ASSESSMENT PLAN

Suggested Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
➢ Balloon Graph ➢ Inquiry Activity: Film Canister Rockets ➢ Inquiry Activity: The Great Tomato Race ➢ Inquiry Activity: Glowstick Lab ➢ Inquiry Activity: Mole Dollars	➢ The Incredible, Edible Candle (suggested) ➢ Sewer Lice (suggested)

LEARNING PLAN COMPONENTS

- These skills will be reviewed in the beginning of the year and will continue to be implemented within all units throughout the year.

HONORS PROGRAM

Content-Specific Powered Standards:

- **D INQ.3** *Formulate* a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- **D INQ.7** *Assess* the reliability of the data that was generated in the investigation.
- **D INQ.8** Use mathematical operations to *analyze* and *interpret* data, and present relationships between variables in appropriate forms.
- **D INQ.9** *Articulate* conclusions and explanations based on research data, and *assess* results based on the design of the investigation.

Enhanced Program:

- Students will design their labs throughout curriculum and carry out their procedures. They will be required to write up formal lab reports with detailed rationales and conclusions. Students will also compose a formal science literature review by the end of the academic year.

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Grade 8

Unit 2 Name: Matter (Measuring Matter and properties of Matter, Classification and Structure of Matter)

Est. # of Days: 46 days (23 days for each subtopic) (With "Separation of Mixtures" Performance Task)

- **Synopsis:** This unit focuses on classification of materials as pure substances or mixtures depending on their chemical and physical properties.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **(C.1):** Describe the properties of common elements, such as oxygen, hydrogen, carbon, iron and aluminum.
- **(C.2):** Describe how the properties of simple compounds, such as water and table salt, are different from the properties of the elements of which they are made.
- **(C.3):** Explain how mixtures can be separated by using the properties of the substances from which they are made, such as particle size, density, solubility and boiling point.
- **C INQ.1** Identify questions that can be answered through scientific investigation.
- **C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- **C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- **C INQ.4** Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- **C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- **C INQ.6** Use mathematical operations to analyze and interpret data.
- **C INQ.7** Identify and present relationships between variables in appropriate graphs.
- **C INQ.8** Draw conclusions and identify sources of error.
- **C INQ.9** Provide explanations to investigated problems or questions.
- **C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use
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Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- matter, atom, mixtures, pure substances, atoms, elements, molecules, compounds, Periodic Table of Elements, chemical properties, physical properties, physical change, chemical change, density, solutions, solubility, boiling point, melting point, mass, volume, density, chromatography, distillation, surface tension, viscosity

Enduring Understandings

- Mixtures are made of combinations of elements and/or compounds, and they can be separated using a variety of physical means.
- Pure substances can be either elements or compounds, and they cannot be broken down by physical means.

Essential Questions

- How can we describe the differences among materials?
- How can the periodic table be used to identify elements?
- When two materials combine chemically to form a new material, how does it compare to the materials from which

	it was made? ➢ How can properties of matter be used to separate mixtures?

Learning Objectives / Grade Level Expectations
Students will:

- Compare and contrast mass and weight.
- Compare and contrast the molecular arrangement and movement of particles in solids, liquids, and gases.
- Describe the structure of the atom, and its component parts.
- Explain that density (mass/volume) is a characteristic property that can be used to identify an element or substance.
- Compare and contrast the properties of a metal (aluminum, iron, etc.) with a nonmetal (oxygen, carbon, etc.)
- Illustrate the differences in the physical and chemical properties of a molecule and the individual atoms that bond to form that molecule.
- Differentiate between a mixture and an element or compound and identify examples.
- Conduct and report on an investigation that uses physical means such as particle size, density, solubility and magnetism to separate substances in a mixture.
- Use the patterns in a Periodic Table to locate metals, semimetals and nonmetals and predict the general characteristics of an element.
- Use appropriate tools and metric units to measure and/or calculate various physical properties including mass, volume, density, temperature, length, boiling point, melting point, surface tension, viscosity, and solubility.
- Integrate C INQs 1-10 while exploring the scientific concepts of matter.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
➢ Separating a Mixture Inquiry (required) ➢ A Matter of Fact (suggested) ➢ Project: Marvel Comics, Eat Your Heart Out! (suggested) ➢ Project: Sell An Element (suggested) ➢ Periodic Table Letter (suggested)	➢ Inquiry Activity: Cartesian Diver (suggested) ➢ Inquiry Activity: Gobstoppers (suggested) ➢ Element/Compound Chart Research Project (suggested)

LEARNING PLAN COMPONENTS

➢ **Textbook:** ***Chemical Building Blocks*** (Prentice Hall, 2007)

HONORS PROGRAM

CHEMICAL REACTIONS (20 days)

Content Specific Powered Standards with Performance Standards:

➢ **(9.4)** Atoms react with one another to form new molecules.

- **(D.10):** Describe the general structure of the atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structure.
- **(D.11):** Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).
- **(D.12):** Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions.

Enduring Understandings:

- Atoms have a positively charged nucleus surrounded by negatively charged electrons.
- The configuration of atoms and molecules determines the properties of the materials.

Essential Question:

- How does the structure of matter affect the properties and uses of materials?

Learning Objectives/Grade Level Expectations:

- *Describe* the general structure of the atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structures.
- *Compare and Contrast* how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).
- *Differentiate* the chemical composition of acids and bases, and *explain* the change of pH in neutralization reactions

Honors Key Vocabulary:

Ion, isotope, ionic bond, covalent bond, reactant, product, synthesis, decomposition, acid, base, neutralization, pH scale

➢ Required Textbook: ***Holt Science Spectrum – Physical Science*** **(2006)**

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Unit 3 Name: Motion and Forces **Est. # of Days:** Motion: 19 days / Forces: 14 days (with Embedded Task)

Synopsis: This unit focuses on motion, which includes speed, velocity and acceleration. Newton's Laws of Motion affect everyday events of our lives. An object's inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion, such as friction.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **(C.22)** Calculate the average speed of a moving object and illustrate the motion of objects in graphs of distance over time.
- **(C.23)** Describe the qualitative relationships among force, mass and changes in motion.
- **(C.24)** Describe the forces acting on an object moving in a circular path.
- **C INQ.1** Identify questions that can be answered through scientific investigation.
- **C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- **C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- **C INQ.4** Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- **C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- **C INQ.6** Use mathematical operations to analyze and interpret data.
- **C INQ.7** Identify and present relationships between variables in appropriate graphs.
- **C INQ.8** Draw conclusions and identify sources of error.
- **C INQ.9** Provide explanations to investigated problems or questions.
- **C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

21st Century Skills

1) "Fun"derstanding Coasters – February/March
   (Critical Skills: 1, 2, 4, 5)
2) Vehicle Safety Research – April/May
   (Critical Skills: 1, 2, 3, 4, 5)
3) Shipping and Sliding – January/February
   (Critical Skills: 1, 2, 3, 4, 5)

Critical Skills:

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application
Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation
Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Motion, point of reference, speed, constant speed, average speed, position-time graph, slope, force, friction, gravity, inertia, mass, weight, Newton, acceleration, balanced/unbalanced forces, net force, momentum, air resistance, terminal velocity, centripetal force, projectile, satellite, freefall, circular motion

Enduring Understandings	Essential Questions
➢ The motion of an object can be described by its position, direction of motion and speed. ➢ An unbalanced force acting on an object changes its speed and/or direction of motion. ➢ Objects moving in circles must experience force acting toward the center.	➢ How can the motion of an object be specifically described? ➢ How are balanced and unbalanced forces related to an object's motion? ➢ What are examples of Newton's three Laws of Motion in everyday life? ➢ How are force, mass and the movement of an object related to each other? ➢ What forces act on an object moving in a circular path?

Learning Objectives / Grade Level Expectations
Students will:

- Use appropriate tools and techniques to make observations and gather data to determine how forces, including friction, act on an object to change its position over time in relation to a fixed point of reference.
- Calculate the average speed of a moving object, and distinguish between instantaneous speed and average speed of an object.
- Create and interpret distance-time graphs for objects moving at constant and nonconstant speeds.
- Predict the motion of an object given the magnitude and direction of forces acting on it (net force).
- Investigate and demonstrate how unbalanced forces cause acceleration (change in speed and/or direction of an object's motion).
- Describe friction and identify factors that determine the friction force between two objects.
- Assess in writing the relationship between an object's mass and its inertia when at rest and in motion.
- Express mathematically how the mass of an object and the force acting on it affects its acceleration.
- Design and conduct an experiment to determine how gravity and friction (air resistance) affect a falling object.
- Illustrate how the circular motion of an object is caused by a center-seeking force (centripetal force) resulting in the object's constant acceleration.
- Integrate C INQs 1-10 while exploring the scientific concepts of forces and motion.

ASSESSMENT PLAN

Summative Assessment(s)	Formative and Diagnostic Assessment(s): NA
➢ State Embedded Task – Shipping and Sliding (Required) ➢ Sticky Sneakers (suggested) ➢ Tracking a Toy (suggested) ➢ Newton's Banana (suggested) ➢ Seatbelt Performance Task (suggested) ➢ Design and Build a Water Rocket (suggested)	For copies of the student/teacher guide and scoring rubric for the State Embedded Task, "Shipping and Sliding", go to: http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=320890

LEARNING PLAN COMPONENTS

- **Textbook:** ***Motion, Forces, and Energy*** (Prentice Hall, 2005)
- Materials used to perform the State Embedded Task, "Shipping and Sliding"

HONORS PROGRAM

This unit will be taught with more complicated formulas and problem solving with speed, velocity and acceleration. More critical application skills will be required for concepts such as friction and Newton's Laws of Motion and gravity.

Est. # of Days: 19 days

- Required Textbook: ***Holt Science Spectrum – Physical Science*** **(2006)**

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Unit Name: Gravity and the Solar System **Est. # of Days:** 5 days (Without Performance Task)

- **Synopsis:** This unit focuses on the forces that keep the planets and other objects in orbit.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **(C.28):** Explain the effect of gravity on the orbital movement of planets in the solar system.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
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Standard 4: Literacy and Literary Appreciation
Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- satellites, gravity, Law of Universal Gravitation, mass, distance, orbit, forces, inertia

Enduring Understandings

- Gravity is the force that governs the motions of objects in the solar system.

Essential Questions

- What bodies are in the solar system, and why do they move as they do?

Learning Objectives / Grade Level Expectations
Students will:

- Relate the strength of gravitational force between two objects to their mass and the distance between the centers of the two objects and provide examples.
- Describe in writing how gravitational attraction and the inertia of objects in the solar system keep them on a predictable elliptical pathway.

ASSESSMENT PLAN

Summative Assessment(s)

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Formative and Diagnostic Assessment(s): NA

LEARNING PLAN COMPONENTS

- **Textbook:** ***Earth Science*** (Prentice Hall, 2007)

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Unit 4 Name: Energy, Work and Machines **Est. # of Days:** 20 days (Without Performance Task)

- **Synopsis:** This unit focuses on energy and work. Different types of simple and compound machines will be explored as well as mechanical advantage of each one and mechanical efficiency. Different forms of energy, and their transformations will be explored as well.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **(C.12):** Explain the relationship among force, distance and work, and use the relationship (W=FxD) to calculate work done in lifting heavy objects.
- **(C.13):** Explain how simple machines, such as inclined planes, pulleys and levers, are used to create mechanical advantage.
- **(C.14):** Describe how different types of stored (potential) energy can be used to make objects move**.**
- **C INQ.1** Identify questions that can be answered through scientific investigation.
- **C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- **C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- **C INQ.4** Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- **C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- **C INQ.6** Use mathematical operations to analyze and interpret data.
- **C INQ.7** Identify and present relationships between variables in appropriate graphs.
- **C INQ.8** Draw conclusions and identify sources of error.
- **C INQ.9** Provide explanations to investigated problems or questions.
- **C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
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Standard 2: Information Use
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Standard 3: Information and Technology Application
Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation
Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- energy, work, power, simple machines, compound machines, potential energy, kinetic energy, gravitational potential energy, elastic potential energy, force, input force, output force, Joules, lever, fulcrum, load, resistance, pulley, inclined plane, wheel and axle, screw, wedge, gears, mechanical advantage, mechanical efficiency

Enduring Understandings

- Work is the process of making objects move through the application of force.
- Energy can be stored in many forms, and can be transformed into the energy of motion.

Essential Questions

- What is the difference between work and energy?
- What are "simple machines" and how can they be used to make it easier for us to complete some tasks?
- How can we measure how useful a

	simple machine is? ➢ What are some different situations in which there is potential energy?

Learning Objectives / Grade Level Expectations
Students will:

- Conduct simple experiments that show and explain how forces work to change the motion of an object.
- Calculate work done on an object as a force or distance varies.
- Explain in writing how the six simple machines make work easier but do not alter the amount of work done on an object, and demonstrate how everyday objects function as simple machines.
- Determine ways to modify a simple machine (inclined plane, pulley and lever) to improve its mechanical advantage.
- Define the statement, "Work output of a machine is always less than work input because of energy lost due to friction."
- Design and create a working compound machine from simple machines.
- Use a diagram or model of a moving object (roller coaster, pendulum, etc.) to describe the conversion of potential energy into kinetic energy and vice versa.
- Discuss different forms of energy and describe how they can be converted from one form to another for use by humans (e.g., thermal, electrical, light, chemical, mechanical).
- Trace energy conversions that occur in the human body once food enters and explain the conversions in writing.
- Calculate potential and kinetic energy and relate those quantities to total energy in a system.
- Apply appropriate tools and metric units to measure, calculate, and manipulate distance, force, work and power.
- Integrate C INQs 1-10 while exploring the scientific concepts of energy, work and simple machines.

ASSESSMENT PLAN

Suggested Summative Assessment(s)	**Formative and Diagnostic Assessment(s): NA**
➢ Marshmallow Catapults ➢ Machine Mania ➢ Water Wheel ➢ Pendulum Inquiry	

LEARNING PLAN COMPONENTS

- **Textbook:** ***Forces. Motion and Energy,*** (Prentice Hall, 2005)

HONORS PROGRAM

Content Specific Powered Standards with Performance Standards:

ENERGY CONSERVATION AND TRANSFORMATION (15 days)

- **(9.1)** Energy cannot be created or destroyed; however, energy can be converted from one form to another.
  - **(D.1):** Describe the effects of adding energy to matter in terms of motion of atoms and molecules, and the resulting phase changes.
  - **(D.2):** Explain how energy is transferred by conduction, convection and radiation.
  - **(D.3):** Describe energy transformations among sound, light, electricity, and motion.

Enduring Understandings:

- Energy enters the Earth's system primarily as solar radiation. It is captured by materials through the photosynthetic process, and eventually is transformed into heat.
- Energy cannot be created nor destroyed; however, energy can be converted from one form to another.

Essential Question:

- What is the role of energy in our world?

Learning Objectives/Grade Level Expectations:

- *Describe* the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes.
- *Interpret* phase change graphic data with respect to temperature change and heat changes.
- *Assess* how energy is transferred by conduction, convection and radiation.
- *Compare and contrast* energy transformation among heat, light, electricity and motion.

Honors Key Vocabulary:

Radiation, convection, conduction, absolute zero, heat, specific heat

- **CAPT Embedded Performance Tasks: (Do after CMTs)**
  - Solar Cookers

- Additional Textbook: ***Holt Science Spectrum – Physical Science***

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Unit 5 Name: Bridges **Est. # of Days:** 9 days (without performance task)

- **Synopsis:** This unit focuses on the designs and structures of yesterday's and today's bridges with the consideration of factors such as function, stress, materials, safety, cost and appearance.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **(C.30):** Explain how beam, truss and suspension bridges are designed to withstand the forces that act on them.
- **C INQ.1** Identify questions that can be answered through scientific investigation.
- **C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- **C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- **C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- **C INQ.6** Use mathematical operations to analyze and interpret data.
- **C INQ.8** Draw conclusions and identify sources of error.
- **C INQ.9** Provide explanations to investigated problems or questions.
- **C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

21st Century Skills

Bridges Web Quest – May/June
(Critical Skills: 1, 2, 3, 5)

Critical Skills:

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application
Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation
Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Force, mass, weight, unbalanced/balanced forces, net force, load, tension, compression, beam, arch, truss, suspension, cable-stay bridges

Enduring Understandings

- Bridges can be designed in different ways to withstand certain loads and potentially destructive forces.

Essential Questions

- Why are bridges built in so many different ways?
- What kinds of materials can be used to build bridges?
- What determines how a certain bridge will be built?
- How did people learn how to build better bridges?

Learning Objectives / Grade Level Expectations
Students will:

- Identify the forces acting on a truss, beam and suspension bridge, including compression, tension and gravity using models, pictures, or diagrams.

- Explain in writing the advantages and disadvantages of truss, beam and suspension bridge design and visually identify each bridge.
- Conduct an experiment to discover and report on a bridge's ability to support a load based on the interplay of tension and compression forces that result in a net force of zero.
- Use technology to simulate how engineers plan, test and revise bridge designs given parameters, including cost, time, safety and aesthetics.
- Integrate C INQs 1-3, 5-6, 8-10 while exploring the scientific concepts of bridges.

ASSESSMENT PLAN

Summative Assessment(s) (suggested)	**Formative and Diagnostic Assessment(s): NA**
➢ Toothpick Bridges ➢ Popsicle Sticks Bridges	

LEARNING PLAN COMPONENTS

- ***Forces, Motion and Energy,*** (Prentice Hall, 2005) (pages 204-211)
- **Other Resources:**
  - How Bridges Work: http://science.howstuffworks.com/bridge.htm
  - United Streaming Video: Understanding: Bridges
  - Bridges: http://school.discovery.com/lessonplans/programs/bridges/
  - The Physics of Bridges: http://www.yale.edu/ynhti/curriculum/units/2001/5/01.05.08.x.html
  - Bridges: http://www.brantacan.co.uk/artofbridges.htm
  - National Building Museum: http://www.nbm.org/Education/Educator/Bridges_ERPacket.pdf.
  - The US Military Academy: http://bridgecontest.usma.edu/purpose.htm
  - PBS/Nova has a great episode called "Super Bridge" available for viewing, along with this companion website with teacher's guide, bridge information, on-line simulation game, etc.: http://www.pbs.org/wgbh/nova/bridge/ and http://www.pbs.org/wgbh/buildingbig/bridge/

HONORS PROGRAM

Before doing the Practical Application of Physical Science Concepts, the Honors must complete:

CARBON COMPOUNDS and POLYMERS (20 days)

Content Specific Powered Standards with Performance Standards:

- **(9.5)** Due to its unique chemical structure, carbon forms many organic and inorganic compounds.
  - **(D.13):** Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.
  - **(D.14):** Describe combustion reactions of hydrocarbons and their resulting by-products.
  - **(D.15):** Explain the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.

Enduring Understanding:

- Carbon atoms can bond to one another in chains, rings, and branching networks to form a variety of structures, including fossil fuels, synthetic polymers, and large molecules of life.

Essential Questions:

- How does the structure of matter affect the properties and uses of materials?

Learning Objectives/Grade Level Expectations:

- *Explain* how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.
- *Characterize* combustion reactions of hydrocarbons and their resulting by-products.
- *Evaluate* the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.

➢ **(9.6)** Chemical technologies present both risks and benefits to the health and well-being of humans, plants, and animals.

- **(D.16):** Explain how simple chemical monomers can be combined to create linear, branched, and/or cross-linked polymers.
- **(D.17):** Explain how the chemical structure of polymers affects their physical properties.

Enduring Understanding:

- Materials produced from the distillation (cracking) of petroleum are the starting points for the production of many synthetic compounds.
- The products of chemical technologies include synthetic fibers, pharmaceuticals, plastics and fuels.

Essential Questions:

- How do science and technology affect the quality of our lives?

Learning Objectives/Grade Level Expectations:

- *Explain* how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers.
- *Assess* how the chemical structure of polymers affects their physical properties.

Honors Key Vocabulary (9.5 and 9.6):

Polymer, organic compounds, hydrocarbon, alkane, alkene, combustion, petroleum

CAPT State Embedded Tasks (9.6):

Strand II: C Synthetic Polymers

Strand II: D Synthetic Polymers Internet Research

<u>ENERGY AND POWER TECHNOLOGIES (15 days)</u>

➢ **(9.3)** Various sources of energy are used by humans, and all have advantages and disadvantages.

- **(D.7):** Explain how heat is used to generate electricity.

- **(D.8):** Describe the availability, current uses, and environmental issues related to the use of fossil and nuclear fuels to produce electricity.
- **(D.9):** Describe the availability, current uses, and environmental issues related to the use of hydrogen fuel cells, wind, and solar energy to produce electricity.

Enduring Understanding:

- During the burning of fossil fuels, stored chemical energy is converted to electrical energy through heat transfer processes.
- In nuclear fission, matter is transformed directly into energy in a process that is several million times as energetic as chemical burning.
- Alternative energy sources are being explored and used to address the disadvantages of using fossil and nuclear fuels.

Essential Questions:

- Why must we find alternatives to fossil fuels?
- How is electricity produced?

Learning Objectives/Grade Level Expectations:

- *Explain* how heat is used to generate electricity.
- *Compare and contrast* the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity.
- *Research* the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind, and solar energy to produce electricity.

Honors Key Vocabulary:

Fossil fuels, nonrenewable resources, renewable resources, global warming, recycling, water cycle, carbon cycle, generator, hydropower

- **CAPT Embedded Performance Tasks:**
  - Energy Uses in CT

ELECTRICAL FORCES (10 days)

- **(9.2)** The electrical force is a universal force that exists between any two charged objects.
  - **(D.4):** Explain the relationship among voltage, current and resistance in a simple series circuit.
  - **(D.5):** Explain how electricity is used to produce heat and light in incandescent bulbs and heating elements.
  - **(D.6):** Describe the relationship between current and magnetism.

Enduring Understandings:

- Moving electrical charges produce magnetic forces, and moving magnets can produce electrical force.
- Electrical current can be transformed into light through the excitation of electrons.

Essential Question:

- How is the concept of electromagnet induction essential to our everyday lives?

Learning Objectives/Grade Level Expectations:

- *Characterize* the relationship among voltage, current, and resistance in a simple series circuit.
- *Evaluate* how electricity is used to produce heat and light in incandescent bulbs and heating elements.
- *Research* the relationship between current and magnetism.

Honors Key Vocabulary:

electric charge, electric force, conductor, insulator, electric field, electric potential, voltage, current, resistance, series circuit, parallel circuit, electromagnetic induction, electromagnet

➢ Additional Textbook: ***Holt Science Spectrum – Physical Science***

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Unit 6 Name: Practical Application of Physical Science Concepts **Est. # of Days:** 59 days (After CMTs)
Honors: 10 days (After completion of previous units)

- **Synopsis:** This unit is to review all skills and concepts taught during the school year. Many performance tasks and projects cannot be done within the units due to CMT time frame, so the last 10 weeks is for these tasks or other major projects that combine various physical science concepts taught during the school year.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- **C INQ.1** Identify questions that can be answered through scientific investigation.
- **C INQ.2** Read, interpret and examine the credibility of scientific claims in different sources of information.
- **C INQ.3** Design and conduct appropriate types of scientific investigations to answer different questions.
- **C INQ.4** Identify independent and dependent variables, and those variables that are kept constant, when designing an experiment.
- **C INQ.5** Use appropriate tools and techniques to make observations and gather data.
- **C INQ.6** Use mathematical operations to analyze and interpret data.
- **C INQ.7** Identify and present relationships between variables in appropriate graphs.
- **C INQ.8** Draw conclusions and identify sources of error.
- **C INQ.9** Provide explanations to investigated problems or questions.
- **C INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (Technology Integration)

Standard 1: Information Strategies
Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application
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Standard 4: Literacy and Literary Appreciation
Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management
Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Key Vocabulary

- Refer to all vocabulary in the previous units.

Enduring Understandings

- Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.
- Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.
- Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.
- Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science.
- Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.
- Scientific numeracy includes the ability to use mathematical operations and procedures to calculate,

Essential Questions

- What are some practical applications of physical science concepts, such as forces, motion, simple machines, elements, compounds, and mixtures?

analyze and present scientific data and ideas.

Learning Objectives / Grade Level Expectations
Students will:

- Explore physical science concepts through design and/or construction of structures such as catapults, launcher, egg drop, bridge, racer, flyer, Rube Goldberg Devices, etc

ASSESSMENT PLAN

Suggested Summative Assessment(s)	Formative and Diagnostic Assessment(s)
➢ Any task not completed yet from the previous units. ➢ Egg Drop ➢ Marshmallow Catapults (Projectile Motion) ➢ Rube Goldberg Devices ➢ Robotics ➢ Helicopter Design ➢ Forensic Science ➢ Science of Sports ➢ Amusement Park Physics ➢ Junkbox Wars ➢ Any others that correlate with the standards	➢ None.

LEARNING PLAN COMPONENTS

- Refer to unit that the Performance Task is located within the curriculum.