Course Title: Physical Science

Subject: Science

Grade Level: 9

Duration: 34 weeks

Prerequisite: Earth Science 8

Elective or Required: Required

Science Mission Statement:
The Glen Ridge Public School’s science curriculum seeks to develop scientifically literate life-long learners. Our program fosters a spirit of intellectual curiosity and collaborative problem solving that is authentic, hands-on, inquiry based and developmentally appropriate. This is done through the study of Life, Physical, Earth and Environmental Science. Our students will use the scientific method to understand and respond to questions about science, technology and global issues. Students will be challenged and encouraged to take risks and to develop critical thinking skills as they apply to real-world experiences.

Course Description:
Students will study the two disciplines of physical science. Chemistry will be explored during the 1st half of the year. Chemistry is the study of matter, its properties, composition, structure, and interactions. Physics will be explored during the 2nd half of the year. Physics is the study of energy and the natural laws as they apply to forces, motion and energy transformations. The course will include an examination of the major concepts of physical science and how these interacting components affect and shape our society. Students will develop problem solving and decision making skills utilizing the scientific method. The students will grow towards an understanding of the connections between physical science and the structure and dynamics of the world in which they reside.
**Author:** Kostas Barkouras

**Date Submitted:** Summer 2014

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Physical Science
Topic/Unit 1: Scientific Skills

Approximate # of Weeks: 4 weeks

Essential Questions:
1. What is science?
2. How do we use the scientific method to solve problems?
3. How is mathematics a tool for problem solving and as a means of expressing theories?
4. How do we describe the relationship between mass, volume and density

Upon completion of this unit, students will be able to
1. Define science and its various branches. (NJCCC: 5.1.A-D)
2. Explain the relationship between science and technology. (NJCCC: 5.1.A-D)
3. Use the steps of the scientific method to solve problems. (NJCCC: 5.1.A-D)
4. Explain how a scientific hypothesis, law and a theory differ. (NJCCC: 5.1.A-D)
5. Understand why scientific notation is useful for scientists. (NJCCC: 5.1.A-D)
6. Convert between standard notation and scientific notation. (NJCCC: 5.1.A-D)
7. Identify and compare units used for scientific measurement. (NJCCC: 5.1.A-D)
8. Use dimensional analysis to covert between metric units. (NJCCC: 5.1.A-D)
9. Use equations to relate mass, volume and density. (NJCCC: 5.2.6.A.2)

Common Core Standards
CCCS.ELA-Literacy.RST: 9-10.3, 9-10.4, 9-10.5, 9-10.6, 9-10.7, 9-10.8, 9-10.10
CCCS.ELA-Literacy.WHST: 9-10.1a, 9-10.2, 9-10.2a, 9-10.2b, 9-10.2c, 9-10.2d, 9-10.2e, 9-10.2f, 9-10.4, 9-10.9 9-10.10
CCCS.MATH: HSN.Q.A.1-3, HAS.SSE.A1a, HAS.CED.A1, HAS.CED.A4, HAS.REI.A1, HAS.REI.A2

Interdisciplinary Standards (njcccs.org)
Standard 6.3 Active Citizenship in the 21st Century
Standard 8.1 Computer and Information Literacy
Standard 8.2 Technology Education
Standard 9.1 Twenty First Century Life & Career Skills
Standard 9.3 Career Awareness, Exploration, and Preparation

Activities– include 21st Century Technologies
Lab Activity: Paper airplane and the scientific method
Scientific notation and the scale of matter
Measure length, volume and mass
Lab Activity: Measure the thickness of aluminum foil
Equal masses, equal volumes and different densities
**Enrichment Activities**
Find the surface area of a cube and compare it to its volume.
Set into a metric cube

**Methods of Assessments/Evaluation**
Calculators
Think/Pair/Share
Manipulatives
Whiteboards
Exit slips
Notebook Opened Ended Questions
Metric Units Pop Quizzes
Section Quizzes
Chapter Tests
Lab Reports
Classwork/Homework
Review Game
Rubrics

**Resources/Including Online Resources**
Teacher webpage
Physical Science- Concepts in Action Textbook
Physical Science- Concepts in Action Online Textbook
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PHSchool.com
Pkphysicalscience.com
Physicsclassroom.com
Middleschoolchemistry.com
Scaleofuniverse.com
Openculture.com
Physical Science

Topic/Unit 2: Chemical Foundations

Approximate # of Weeks: 4 weeks

Essential Questions
1. How is matter classified?
2. What are physical properties and why are they useful?
3. What are chemical properties and why are they useful?
4. What are the phases of matter?
5. How do substances change phase?
6. What is the structure of an atom?

Outcomes

Upon completion of this unit, students will be able to
1. Classify matter as a pure substance or mixture. (NJCCC:5.2.8.A.1, NGSS:PS1.A)
2. Differentiate between an element and a compound. (NJCCC:5.2.8.A.2, NGSS:PS1.A)
3. Differentiate between homogeneous and heterogeneous mixtures. (NJCCC: 5.2.8.A.2, NGSS: PS1.A)
4. Identify physical properties and common physical changes. (NJCCC: 5.2.12.A.3, NGSS:PS1.A)
5. Identify chemical properties and common chemical changes. (NJCCC: 5.2.12.A.3, NGSS:PS1.A)
6. Distinguish between a physical change and a chemical change. (NJCCC: 5.12.8.A.3, NGSS:PS1.A)
7. Describe the phases of matter. (NJCCC: 5.2.8.A.3, NGSS:PS1.A)
8. Use the kinetic theory and forces of attraction be used to explain the behavior of matter. (NJCCC: 5.2.8.A.3, NGSS:PS1.A)
9. Identify six common phase changes. (NJCCC:5.2.8.A.3, NGSS:PS1.A)
10. Explain the change in energy that occurs during a phase change. (NJCCC: 5.2.8.A.3, NGSS:PS1.A)
11. Identify major contributions to atomic theory. (NJCCC:5.2.12A.1, NGSS:PS1.A)
12. Identify and compare the properties of the three main subatomic particles. (NJCCC: 5.2.12.A.1, NGSS:PS1.A)
13. Determine the number of shells and the number of valence electrons of an element using the periodic table. (NJCCC: 5.2.12.A.1, NGSS:PS1.A)
14. Draw a Bohr model of the atom for the first 20 elements. (NJCCC: 5.2.12.B.1, NGSS:PS1.A)

Common Core Standards
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CCCS.ELA-Literacy.WHST: 9-10.1, 9-10.1a, 9-10.1b, 9-10.1c, 9-10.1d, 9-10.1e, 9-10.2, 9-10.2a, 9-10.2b, 9-10.2c, 9-10.2d, 9-10.2e, 9-10.2f, 9-10.4, 9-10.9
CCCS.MATH: HSN.Q.A.1-3

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Standard 9.1  Twenty First Century Life & Career Skills
Standard 9.3  Career Awareness, Exploration, and Preparation

Activities– include 21st Century Technologies
Scale of the atom
Classify common substances based on phase and purity
Identify physical and chemical properties and changes
States of matter student activity
Phase changes and dry ice
Use the heating curve for water to explain energy changes
Use a timeline to explain the development of atomic theory
Periodic table and the Bohr Model
Bohr Model playing cards

Enrichment Activities
 Carry out the flame test and use it to identify an unknown.
 Relative weight of an element using pennies minted before and after 1982

Methods of Assessments/Evaluation
Think/Pair/Share
Manipulatives
Whiteboards
Exit slips
Notebook Opened Ended Questions
Section Quizzes
Chapter Tests
Lab Reports
Classwork/Homework
Review Game
Rubrics

Resources/Including Online Resources
Teacher webpage
Physical Science- Concepts in Action Textbook
Physical Science- Concepts in Action Online Textbook
Scilinks.org
PHSchool.com
Pkphysicalscience.com
Physicsclassroom.com
Middleschoolchemistry.com
Openculture.com
Physical Science
Topic/Unit 3: The Periodic Table & Chemical Bonding

Approximate # of Weeks: 5 weeks

Essential Questions
1. How is the modern periodic table organized?
2. What is metallic bonding?
3. How does ionic bonding occur?
4. How does covalent bonding occur?
5. How does one write chemical formulas for compounds?

Upon completion of this unit, students will be able to
1. Explain the organization of the modern periodic table. (NJCCC:5.2.8.A.4, NGSS:PS1.B)
2. Explain the reactivity of elements based on the periodic table. (NJCCC:5.2.12.A.3, NGSS:PS1.B)
3. Explain how the transfer of electrons allows elements to achieve stable electron configurations. (NJCCC: 5.2.8.B.1, NGSS: PS1.B)
4. Explain how the sharing of electron(s) allows elements to achieve stable electron configurations. (NJCCC: 5.2.8.B.1, NGSS: PS1.B)
5. Write formulas for ionic compounds. (NJCCC: 5.2.12.B.2, NGSS: PS1.B)
6. Write formulas for covalent compounds. (NJCCC: 5.2.12.B.2, NGSS: PS1.B)

Common Core Standards
CCCS.ELA-Literacy.RST: 9-10.1, 9-10.3, 9-10.4, 9-10.6, 9-10.8, 9-10.9, 9-10.10
CCCS.ELA-Literacy.WHST: 9-10.1a, 9-10.1b, 9-10.2, 9-10.5, 9-10.6, 9-10.9
CCCS.MATH: HSN.Q.A.1-3, HSG.MG.A2

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Standard 8.2 Technology Education
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Standard 9.3 Career Awareness, Exploration, and Preparation

Activities– include 21st Century Technologies
Lab Activity: Favorite foods periodic table
Lab Activity: Color the periodic table
Name that periodic table family game
Compare the properties of ionic compounds and covalent compounds.
Lab Activity: Model covalent compounds
Draw Lewis Dot Structures and construct simple models.
Project: Compound Element Poster

**Enrichment Activities**
Cookie manipulative to create a periodic table
Period Trends: size, electronegativity, electron affinity

**Methods of Assessments/Evaluation**
Think/Pair/Share
Manipulatives
Whiteboards
Exit slips
Notebook Opened Ended Questions
Metric Units Pop Quizzes
Section Quizzes
Chapter Tests
Lab Reports
Classwork/Homework
Review Game
Rubrics
Projects

**Resources/Including Online Resources**
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Physical Science- Concepts in Action Online Textbook
Scilinks.org
PHSchool.com
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Physicsclassroom.com
Middleschoolchemistry.com/
Cellsalive.com
Scaleofuniverse.com
Openculture.com
Physical Science

Topic/Unit 4: Chemical Reactions and Quantities

Approximate # of Weeks: 4 weeks

Essential Questions
1. What is a chemical equation and what law must be obeyed?
2. What are the main types of chemical reactions?
3. What energy changes occur during a chemical reaction?
4. What is a mole?
5. What are the characteristic properties of acids and bases?
6. How can one determine the strength of an acid or base?

Upon completion of this unit, students will be able to
1. State the law of conservation of mass and how it explains why all chemical equations must be balanced. (NJCCC:5.2.12.B.3, NGSS: PS1.B)
2. Identify and balance the general types of chemical reactions. (NJCCC:5.2.8.B.1, NGSS: PS1.B)
3. Explain what happens to energy during chemical reactions. (NJCCC:5.1.A.1, NGSS: PS1.B)
4. Explain the concept of the mole. (NJCCC:5.2.12.B.3, NGSS: PS1.B)
5. Convert between moles and mass. (NJCCC:5.2.12.B.3, NGSS: PS1.B)
8. Define the pH scale and use it to determine the strength of acids and bases. (NJCCC: 5.2.12.A.5)

Common Core Standards:
CCCS.ELA-Literacy.RST: 9-10.2, 9-10.3, 9-10.4, 9-10.6, 9-10.8, 9-10.9, 9-10.10
CCCS.ELA-Literacy.WHST: 9-10.1c, 9-10.1d, 9-10.1e, 9-10.2e, 9-10.2f, 9-10.6, 9-10.7, 9-10.9
CCCS.MATH: HSN.Q.A.1-3, HAS.SSE.A1a, HAS.CED.A4, HAS.REI.A1

Interdisciplinary Standards (njcccs.org)
Standard 6.3  Active Citizenship in the 21st Century
Standard 8.1  Computer and Information Literacy
Standard 8.2  Technology Education
Standard 9.1  Twenty First Century Life & Career Skills
Standard 9.3  Career Awareness, Exploration, and Preparation

Activities—include 21st Century Technologies
Lab Activity: Create balanced equation using molecular models
Student Led Activity: Match the elements to create a compound
Carry out several chemical reactions and write balanced equations.
Determine exothermic and endothermic reactions by measuring temperature changes.
Change the reaction rate by adjusting various factors individually.
Classify common substances as acids, bases or neutral based on the pH.
Determine the mass of a pure substance and calculate the moles.
Lab Activity: Determine the unknown substance based mass and by observation

**Enrichment Activities**
Lab Activity: Moles and Molarity
Lab Activity: pH and indicators

**Methods of Assessments/Evaluation**
Think/Pair/Share
Manipulatives
Whiteboards
Exit slips
Notebook Opened Ended Questions
Section Quizzes
Chapter Tests
Lab Reports
Classwork/Homework
Review Game
Rubrics
Projects

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Middleschoolchemistry.com/
Cellsalive.com
Scaleofuniverse.com
Openculture.com
Physical Science
Topic/Unit 5: Newtonian Mechanics & Fluid Mechanics

Approximate # of Weeks: 10 weeks

Essential Questions
1. What is the relationship between distance and displacement?
2. What is the relationship between speed and velocity?
3. How are force and acceleration related?
4. What is a force?
5. What are Newton’s Laws three laws of Motion?
6. What are the universal forces?
7. What is the relationship between force and pressure?
8. What is the relationship between density and buoyancy?

Upon completion of this unit, students will be able to
1. Define and calculate displacement. (NJCCC:5.2.8.E.1, NGSS: PS2.A)
2. Calculate velocity. (NJCCC: 5.2.8.E.1, NGSS: PS2.A)
3. Define and calculate acceleration. (NJCCC: 5.2.12.E.1, NGSS: PS2.A)
4. Define force and differentiate between balanced and unbalanced forces. (NJCCC: 5.2.8.E.2, NGSS: PS2.A)
11. Define the four universal forces. (NJCCC: 5.2.E, NGSS: PS2.A)
12. Define and calculate pressure. (NJCCC: 5.2.E, NGSS: PS2.A)
13. Explain how Pascal’s Principle describes the transmission of pressure through a fluid. (NJCCC: 5.2.E, NGSS: PS2.A)
14. Explain how a fluid’s speed is related to the pressure it exerts. (NJCCC: 5.2.E, NGSS: PS2.A)
15. Define and calculate buoyancy force. (NJCCC: 5.2.E, NGSS: PS2.A)

Common Core Standards:
CCCS.ELA-Literacy.RST: 9-10.2, 9-10.3, 9-10.4, 9-10.5, 9-10.6, 9-10.7, 9-10.8, 9-10.9, 9-10.10
CCCS.ELA-Literacy.WHST: 9-10.1c, 9-10.1d, 9-10.1e, 9-10.2e, 9-10.2f, 9-10.4, 9-10.5, 9-10.6, 9-10.8, 9-10.9
CCCS.MATH: HSN.Q.A.1-3, HSN.VM.A1, HAS.SSE.A1a, HAS.CED.A1, HAS.CED.A4, HSG.SRT.C8

Interdisciplinary Standards (njcccs.org):
Standard 6.3  Active Citizenship in the 21st Century  
Standard 8.1  Computer and Information Literacy  
Standard 8.2  Technology Education  
Standard 9.1  Twenty First Century Life & Career Skills  
Standard 9.3  Career Awareness, Exploration, and Preparation  

Activities—include 21st Century Technologies  
Lab Activity: Calculate velocity  
Lab Activity: Calculate acceleration  
Lab Activity: Friction boards  
Lab Activity: Collision Balls & Momentum  
Weight on other planets  
Lab Activity: Gravity  
Pressure in a vacuum  
Air Pressure  
Use the buoyant force to determine if an object sinks or floats. 
Lab Activity: Buoyancy  

Enrichment Activities  
Use Newton’s 1st and 2nd laws to keep a penny in orbit.  
Create a Tornado  
Build a Cartesian diver to explain Pascal’s law.  

Methods of Assessments/Evaluation  
Calculators  
Think/Pair/Share  
Manipulatives  
Whiteboards  
Exit slips  
Notebook Opened Ended Questions  
Metric Units Pop Quizzes  
Section Quizzes  
Chapter Tests  
Lab Reports  
Classwork/Homework  
Review Game  
Rubrics  
Projects  

Resources/Including Online Resources  
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Physical Science- Concepts in Action Online Textbook  
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PHSchool.com  
Pkphysicalscience.com  
Physicsclassroom.com  
Middleschoolchemistry.com/  
Cellsalive.com
Physical Science
Topic/Unit 6: Work & Energy

Approximate # of Weeks: 5 weeks

Essential Questions
1. How are work, power and energy related?
2. What are the major forms of energy?
3. What is the law of conservation of energy?
4. How are energy and mass related?

Upon completion of this unit, students will be able to
1. Explain the relationship between force and work. (NJCCC:5.2.8.D.1, NGSS: PS3.C)
2. Calculate work. (NJCCC:5.2.8.D.1, NGSS: PS3.C)
3. Define and calculate power. (NJCCC:5.2.8.D.1, NGSS: PS3.C)
4. Define the different forms of energy. (NJCCC:5.2.8.D.1, NGSS: PS3.A)
5. Calculate potential energy. (NJCCC:5.2.12.D.1, NGSS: PS3.A)
6. Calculate kinetic energy. (NJCCC:5.2.8.D.1, NGSS: PS3.A)

Common Core Standards:
CCCS.ELA-Literacy.RST: 9-10.2, 9-10.3, 9-10.4, 9-10.5, 9-10.6, 9-10.7, 9-10.8, 9-10.9, 9-10.10
CCCS.ELA-Literacy.WHST: 9-10.1, 9-10.1c, 9-10.1d, 9-10.2a, 9-10.2b, 9-10.2d, 9-10.2e, 9-10.2f, 9-10.4, 9-10.5, 9-10.6, 9-10.8, 9-10.9
CCCS.MATH: HSN.Q.A.1-3, HAS.SSE.A1a, HAS.CED.A1, HAS.CED.A4

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Activities—include 21st Century Technologies
Lab Activity: Halls Car
Student Demos Work vs. no Work
Lab Activity: Work & Power up the stairs
High Low Track Potential Energy
Demo: Roller Coaster Loop Kinetic Energy
Diving Board Energy Conversion
Lab Activity: Conservation of Energy

**Enrichment Activities**
Student Project: Demonstration of Conservation of Energy

**Methods of Assessments/Evaluation**
- Calculators
- Think/Pair/Share
- Manipulatives
- Whiteboards
- Exit slips
- Notebook Opened Ended Questions
- Metric Units Pop Quizzes
- Section Quizzes
- Chapter Tests
- Lab Reports
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- Middleschoolchemistry.com/
- Cellsalive.com
- Scaleofuniverse.com
- Openculture.com
Physical Science
Topic/Unit 7: Waves

Approximate # of Weeks: 2 weeks

Essential Questions
1. How are waves and energy related?
2. How are wavelength, frequency and energy related?
3. What is electromagnetic spectrum?

Student Learning Outcomes
Upon completion of this unit, students will be able to:
1. Describe what a wave is. (NGSS:PS4.A)
2. Distinguish between the two types of waves. (NGSS:PS4.A)
3. Describe the different parts of a wave. (NGSS:PS4.A)
5. Differentiate between different types of electromagnetic radiation. (NGSS:PS4.A-B)

Common Core Standards:
CCCS.ELA-Literacy.RST: 9-10.1, 9-10.2, 9-10.3, 9-10.4, 9-10.5, 9-10.6, 9-10.7, 9-10.9, 9-10.10
CCCS.ELA-Literacy.WHST: 9-10.1b, 9-10.1e, 9-10.2a, 9-10.2b, 9-10.2c, 9-10.2d, 9-10.2e, 9-10.2f, 9-10.7, 9-10.10
CCCS.MATH: HSN.Q.A.1-3, HAS.SSE.A1a, HAS.CED.A1, HAS.CED.A4

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Standard 8.2 Technology Education
Standard 9.1 Twenty First Century Life & Career Skills
Standard 9.3 Career Awareness, Exploration, and Preparation

Activities—include 21st Century Technologies
Diagram the components of a wave
Slinky and longitudinal waves
Transverse wave activity
Additive color and led lights
Absorption and reflection with LED Lights

Enrichment Activities
Why the sky is blue
Why the sun is yellow
Lab Activity: True color of a paper
Methods of Assessments/Evaluation
Think/Pair/Share
Exit slips
Notebook Opened Ended Questions
Section Quizzes
Lab Reports
Classwork/Homework

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