# INTRODUCTION

The Hinsdale School District PreK-12 science curriculum is a coordinated program built around science education and the expectations of the New Hampshire Curriculum Frameworks. It proceeds sequentially; introducing, expanding, and further exploring content at appropriate grade levels with increasing degrees of depth and complexity. The Common Core State Standards for English Language Arts include standards pertaining to all content areas. **Teachers are responsible for incorporating the Common Core State Standards into their science instruction.**

# IMPORTANT NOTE TO ALL TEACHERS

It is important for teachers to follow the curriculum for each grade level or class as described in this guide; the integrity of the PreK-12 sequence has been carefully considered in its creation. Grade levels and individual classes have some degree of flexibility in designing the sequence of topics through the year, but *addressing the provided scope is required*. At the elementary level, the topics for each grade level have been carefully planned so as to address necessary content without redundancy or omission to meet the expectations of the NH frameworks and high stakes testing. At the middle school and high school levels the curricula are also constructed to fully meet the expectations of the NH frameworks and high stakes testing. The guiding questions in each section make clear the topics of inquiry (scope) for each grade. These topics change and build on each other through the grades (sequence), making it imperative that each teacher use the guiding questions to plan instruction.

# SCIENCE INQUIRY


## Capture student interest and motivate continued learning!

Inquiry involves QUESTIONING. Inquiry requires being able to identify assumptions, to use critical and logical thinking, and the ability to consider alternative explanations. Inquiry might be highly structured where known outcomes are clear, or students may be free to explore with unanticipated results!

Students engaged in Inquiry:

- make observations
- pose questions
- propose answers
- examine what they may already know
- review already researched information
- explain / communicate results
- use tools to
    - gather
    - analyze
    - interpret data

Students use journals to record observations, thoughts, ideas, and models, create diagrams, and represent data and observations with plots and tables. Students present their work to others with models, graphs, reports, posters, etc.
Asking students questions to guide continued exploration provides opportunities for discussion, further reflection, and student decision-making.
Appropriate activities are safe, developmentally appropriate, and directly related to the curriculum. Sufficient tools and materials must be available and science inquiry vocabulary (provided in guide) used.

# Essential Understandings

The Science Curriculum for Hinsdale Elementary, Middle and High School is built around the standards listed in the New Hampshire Curriculum Framework. Science is divided into three content domains (Earth Space Science, Life Science, and Physical Science) and one Science Process Skills domain. The three content domains should encompass the Scientific Process Skills of Inquiry and Critical Thinking Skills. The following list of Essential Understandings or Enduring Knowledge Statements are used across all grade levels.

## Essential Understandings
## Earth Space Science

| Strand (Enduring Knowledge Statements) | Stem (rows) in GSEs |
|---|---|
| **ESS1– The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.** | 1. Atmosphere, Climate, and Weather |
| | 2. Composition and Features |
| | 3. Fossils |
| | 4. Observation Of The Earth From Space |
| | 5. Processes and Rates Of Change |
| | 6. Rock Cycle |
| | 7. Water |
| **ESS2– The Earth is part of a solar system, made up of distinct parts, which have temporal and spatial interrelationships.** | 1. Earth, Sun And Moon |
| | 2. Energy |
| | 3. Solar System |
| | 4. View From Earth |
| **ESS3– The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.** | 1. Size And Scale |
| | 2. Stars And Galaxies |
| | 3. Universe |
| **ESS4– The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.** | 1. Design Technology |
| | 2. Tools |
| | 3. Local And Global Environmental Issues |
| | 4. Career and Technical Education |

(NH Department of Education- NH Curriculum Framework 2006)

**Essential Understandings**
**Life Science**

| Strand (Enduring Knowledge Statements) | Stem (rows) in GSEs |
|---|---|
| **LS1– All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species).** | 1. Classification |
| | 2. Living Things And Organization |
| | 3. Reproduction |
| **LS2– Energy flows and matter recycles through an ecosystem.** | 1. Environment |
| | 2. Flow Of Energy |
| | 3. Recycling Of Materials |
| **LS3– Groups of organisms show evidence of change over time (e.g. evolution, natural selection, structures, behaviors, and biochemistry).** | 1. Change |
| | 2. Evolution |
| | 3. Natural Selection |
| **LS4– Humans are similar to other species in many ways, and yet are unique among Earth's life forms.** | 1. Behavior |
| | 2. Disease |
| | 3. Human Identity |
| **LS5– The growth of scientific knowledge in Life Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.** | 1. Design Technology |
| | 2. Tools |
| | 3. Social Issues (Local And Global)<br>Medical Technology and Biotechnology |
| | 4. Career Technical Education Connections |

(NH Department of Education- NH Curriculum Framework 2006)

## Essential Understandings
## Physical Science

| Strand (Enduring Knowledge Statements) | Stem (rows) in GSEs |
|---|---|
| **PS1– All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).** | 1. Composition |
| | 2. Properties |
| **PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.** | 1. Change |
| | 2. Conservation |
| | 3. Energy |
| **PS3– The motion of an object is affected by force.** | 1. Forces |
| | 2. Motion |
| **PS4– The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.** | 1. Design Technology |
| | 2. Tools |
| | 3. Social Issues (Local and Global)<br>Energy, Power, and Transportation<br>Manufacturing |
| | 4. Career Technical Education Connections |

(NH Department of Education- NH Curriculum Framework 2006)

## Essential Understandings
## Science Process Skills

| Strand (Enduring Knowledge Statements) | Stem (rows) in GSEs |
|---|---|
| **SPS1– Scientific Inquiry and Critical Thinking Skills** | 1. Making observations and asking questions |
| | 2. Designing scientific investigations |
| | 3. Conducting scientific investigations |
| | 4. Representing and Understanding results of Investigations |
| | 5. Evaluating Scientific Investigations |
| | NECAP Science Assessment Targets for Inquiry (INQ)<br>*May subject of performance component* |
| **SPS2– Unifying Concepts of Science (including NECAP Science Assessment Targets by Big Idea)** | 1. Nature of Science (NOS) |
| | 2. Systems and Energy (SAE) |
| | 3. Models and Scale (MAS) |
| | 4. Patterns of Change (POC) |
| | 5. Form and Function (FAF) |
| **SPS3– Personal, Social, and Technological Perspectives** | 1. Collaboration in Scientific Endeavors |
| | 2. Environment, Natural Resources, and Conservation |
| | 3. Science, Technology, and Design |
| **SPS4– Science Skills for Information, Communication and Media Literacy** | 1. Information and Media Literacy |
| | 2. Communication Skills |
| | 3. Critical Thinking and Systems Thinking |
| | 4. Problem Identification, Formulation, and Solution |
| | 5. Creativity and Intellectual Curiosity |
| | 6. Interpersonal and Collaborative Skills |
| | 7. Self Direction |
| | 8. Accountability and Adaptability |
| | 9. Social Responsibility |

(NH Department of Education- NH Curriculum Framework 2006)

GRADE:11- Chemistry

# Physical Science

| | Standards | Guiding Questions |
|---|---|---|
| **PS1** | **S:PS1:11:1.1** Recognize and describe the structure of an atom and explain how the components interact with each other. (include quarks and leptons)<br><br>**S:PS1:11:1.2** The periodic table. Relationship between atomic number and atomic mass. (2.7: Explain how the properties of elements and their location in the periodic table are related)<br><br>**S:PS1:11:1.4** Isotopes. Explain how neutrons affect the mass and stability of the nucleus. (Radioactivity)<br><br>**S:PS1:11:1.5** Development of the Atomic Theory.<br><br>**S:PS1:11:1.6** Electron configuration and chemical reactivity.<br><br>**S:PS1:11:2.1** Explain that the physical properties of a compound are determined by their molecular structure and the interactions among the molecules.<br><br>**S:PS1:11:2.2** Formation of positive and negative ions.<br><br>**S:PS1:11:2.3** Describe how atoms interact with one another by transferring or sharing their outermost electrons. (Covalent and Ionic bonding)<br><br>**S:PS1:11:2.5** Arrangement of matter in solids, liquids and gasses. Water and hydrogen bonds. | What is matter?<br><br>How were atoms discovered?<br><br>What determines the position of an element within the periodic table?<br><br>How are the electrons distributed within the electron cloud?<br><br>How do atoms make molecules?<br><br>How do the properties of an element change when it combines to form a compound?<br><br>How do ions form?<br><br>How do molecules interact with one another?<br><br>What are the molecular differences between a solid a liquid and a gas?<br><br>How can an unknown substance be identified experimentally? |

GRADE:11- Chemistry

# Physical Science

| | | |
|---|---|---|
| **PS1** | **S:PS1:11:2.6** Use physical and chemical properties to identify a substance | |
| **PS2** | **S:PS2:11:1.1** Crystalline solids. Recognize and explain that atoms bond together to form molecules or formula units. Explain the Mole concept.<br><br>**S:PS2:11:1.4** Recognize that the rate of chemical reactions can vary greatly.<br><br>**S:PS2:11:1.5** Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.<br><br>**S:PS2:11:2.1** Explain that chemical reactions either release or consume energy.<br><br>**S:PS2:11:2.2** Explain that chemical reactions can be accelerated by catalysts such as enzymes.<br><br>**S:PS2:11:2.3** Recognize that a large number of important reactions involve the transfer of either electrons, or hydrogen ions between reacting ions, molecules, or atoms.<br><br>**S:PS2:11:2.4** Identify the variety of structures that may be formed from the bonding of Carbon atoms.<br><br>**S:PS2:11:2.5** Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (laws of Thermodynamics)<br><br>**S:PS2:11:3.1 and 3.2** Different types of energy and energy conversions. | What are the properties of a crystalline solid?<br><br>What affects the rates of chemical reactions?<br><br>What is a chemical reaction?<br><br>How is energy related to chemical reactions?<br><br>Why is life on this planet Carbon based?<br><br>Why can Carbon form so many different molecules?<br><br>How does energy change form? |

GRADE:11- Chemistry

# Physical Science

| | | |
|---|---|---|
| | **S:PS2:11:3.3** Describe how the energy associated with individual atoms and molecules can be used to identify the substances they comprise; and explain that each kind of atom or molecule can gain or lose energy in particular discrete amounts, absorbing and emitting light only at wavelengths corresponding to these amounts.<br><br>**S:PS2:11:3.4** The Electromagnetic Spectrum<br><br>**S:PS2:11:3.5** Heat, temperature and molecular motion. | Why do we see colors?<br><br>What is heat and how does it get transferred? |
| **PS3** | Covered in Physics | |
| **PS4** | Covered in Physics | |

GRADE:11- Chemistry

# Physical Science

## Essential Vocabulary

| CONTENT | INQUIRY |
|---|---|
| Atoms | Scientific Method |
| Matter | Hypothesis |
| Elements | Variable |
| Compounds | Independent and dependent variables |
| Periodic table | Data |
| Atomic number | Statistical analysis |
| Atomic mass | Model |
| Protons, neutrons, electrons | Inference |
| Molecule | Evidence |
| Ion | Understanding |
| Isotope | Recognizing |
| Quarks | Identifying |
| Leptons | Explain |
| String Theory | Differentiate |
| Orbital and suborbital | Predict |
| Electron configuration | Demonstrate |
| Physical and chemical properties | Compare |
| Reactants | |
| Products | |
| Covalent bond | |
| Ionic bond | |
| Energy | |
| Exothermic | |
| Endothermic | |
| Entropy | |

GRADE:11- Chemistry

# Physical Science

## Suggested Resources/ Activities

Training on safety features and hazards in the lab, use of equipment, MSDS, Safety Color Code, 10 steps in using Bunsen burner, and handling/disposal of chemicals.

**Laboratory activities:**

"Accuracy and Precision in Measurement"
"Relative Solubility of Alkaline Earth Metals".
"Halides and Their Identification"
Molecular Geometry using molecular model kits.
Classifying Bonds in Compounds based on properties.
" Percent Oxygen in Potassium Chlorate"
"Solubility Rules" for solutions, including roles of heat of solution, similarity in bonding, surface area of solute, and agitation on the rate of solution.
"Catalysis and Rate of Hydrogen Peroxide Decomposition"
" Types of Chemical Reactions"

**Lab investigations from Holt Modern Chemistry:**

Conservation of Mass,
Boyle's Law,
Stoichiometry and Gravimetric Analysis,
Molar Volume of Hydrogen

**Labs:**

Preparation and Properties of Hydrogen,
Chemical properties of water,
Crysallization
Labs using spectroscopy (Beer's Law), freezing point determination, and acid-base properties.
Lab on pH, and on acid-base titration
Atomic Model Kits, Lab on Carbon and its properties, Lab on Casein Glue.

http://www.education.nh.gov/instruction/curriculum/science/index.htm
(Science Curriculum Website)

GRADE:11- Chemistry

# Physical Science