# 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 / 12

# Physics

| | Standards | Guiding Questions |
|---|---|---|
| **PS1** | Covered in Chemistry | |
| **PS2** | **S:PS2:11:1.5** Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.<br><br>**S:PS2:11:2.5** Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and physical systems)<br><br>**S:PS2:11:3.1** Explain that all energy can be considered to be either kinetic energy, potential energy, or energy contained by a field.<br><br>**S:PS2:11:3.2** Provide examples of how kinetic and potential energy can be transformed from one to the other.<br><br>**S:PS2:11:3.4** Explain the range of the electromagnetic spectrum as it relates to both wavelength and energy, and provide examples of practical applications of the different wavelengths in the spectrum.<br><br>**S:PS2:11:3.6** Describe the relationship between heat and temperature, explaining that heat energy consists of the random motion and vibrations of atoms, molecules, and ions and that the higher the temperature, the greater the atomic or molecular motion. | How is energy transformed?<br><br>What is the relationship between kinetic and potential energy?<br><br>Is there more to the electromagnetic spectrum than we can see?<br><br>What is the difference between Heat and Temperature?<br><br>Why don't all materials conduct electricity? |

GRADE: 11 / 12

# Physics

| | | |
|---|---|---|
| **PS2** | **S:PS2:11:3.9** Describe how electrons flow easily in some materials, such as metals, whereas in insulating materials, such as glass, they can hardly flow at all. | |
| **PS3** | **S:PS3:11:1.1** Explain that magnetic forces are related to the action of electrons and can be thought of as different aspects of a single electromagnetic force; and describe how the interplay of these forces is the basis for electric motors, generators, radio, television, and many other modern technologies.<br><br>**S:PS3:11:1.4** Compare the strength of nuclear, electromagnetic and gravitational forces; and explain that the strength of nuclear forces account for the great amounts of energy released from the nuclear reactions in atomic or hydrogen bombs, and in the Sun and other stars.<br><br>**S:PS3:11:1.8** Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, acceleration to predict and explain the motion of objects.<br><br>**S:PS3:11:2.3** Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.<br><br>**S:PS3:11:2.4** Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky). | How are magnets and electricity related?<br><br>Why are nuclear reactions so strong?<br><br>What makes objects move?<br><br>How does light interact with matter? |

GRADE: 11 / 12

# Physics

| | | |
|---|---|---|
| **PS4** | **S:PS4:11:1.1** Recognize that the basic principles of energy, work and power are related to design technology.<br><br>**S:PS4:11:3.2** Demonstrate and explain how an engine converts chemical energy in the form of fuel, into mechanical energy in the form of motion.<br><br>**S:PS4:11:3.4** Explain the relationship between energy and power.<br><br>**S:PS4:11:4.1** Explain the kinds of applications of knowledge and skills necessary for jobs/careers specific to the physical sciences. | How can the energy principles we learned about be applied for the development and improvement of technology ?<br><br>What are some of the careers in the field of physical science? |

GRADE: 11 / 12

# Physics

| Essential Vocabulary | |
|---|---|
| **CONTENT** | **INQUIRY** |
| Electric charges | Explain |
| Magnetic fields | Demonstrate |
| Electromagnetic forces | Provide examples |
| Atomic particles | Describe |
| Efficiency | Compare |
| Kinetic energy | Predict |
| Potential energy | Apply concepts |
| Electromagnetic spectrum | Identify |
| Heat | Differentiate |
| Temperature | Recognize |
| Nuclear reaction | Explain |
| Force | Justify |
| Mass | Compare/contrast |
| Momentum | Evidence |
| Acceleration | Inquiry |
| Velocity | Scientific method |
| Inertia | Observation |
| Motion | Hypothesis |
| Wavelength | Prediction |
| Frequency | Variable |
| | Experiment |
| | Data |
| | Measurement |
| | Analyze |
| | Infer |
| | Conclude |
| | Graph |

GRADE: 11 / 12

# Physics

| Suggested Resources/ Activities |
| --- |
| Labs on graphical analysis of motion using recording timers. Labs on Newton's second law, varying force and mass and measuring acceleration changes.<br><br>Force Table labs, Parallel force labs (build mobiles) and<br><br>Friction labs (coefficient of friction)<br><br>Labs with collision cars and linear air track.<br><br>Labs on horizontal projectiles, centripetal acceleration.<br><br>Pendulum lab, inclined plane and pulley systems lab, three simple machines challenge.<br><br>Method of Mixtures lab, Calorimetric method of heat capacity determination for aluminum and copper, latent heats determination for water.<br><br>Flotation Lab<br><br>Pascal's vases<br><br>Home projects in text on fluid pressure<br><br>Materials to generate static charges,<br><br>Lab on circuit using DC ammeter and voltmeters and labeled resistors.<br><br>Ripple tank for wave property lab, |

GRADE: 11 / 12

# Physics

Open and closed tubes with tuning forks for resonance lab, mirrors, water tubs, plate glass and lenses for light labs.

Computer and internet access for research and PowerPoint preparation.

Decay series patterns from text.

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

http://www.education.nh.gov/instruction/assessment/necap/released/index.htm
(Science NECAP- Released items)