New Haven Public Schools

SCIENCE

CURRICULUM

OVERVIEW

NEW HAVEN SCHOOLS

SCIENCE STANDARDS

PACING GUIDE/ CURRENT USE/ EMBEDDED TASK (Oct 2015)

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SCIENCE in NEW HAVEN PUBLIC SCHOOLS OVERVIEW 

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See www.new havenscience.org for ALL materials: Grade resource pages have:
Goals/objectives/vision/mission/concept maps, **connections to Common Core**.
Science **grade level expectations**/standards www.newhavenscience.org/GLE.doc
Practice assessments/open ended rubrics, Embedded tasks

-**REQUIRED** CT standards, 4 units each year K-6, state standards in place till **2018**

CMT Test in Science! 5th grade covers K-5 curriculum, 8th grade 6-8: for ALL students (ELL & SpecEd) **in place to 2019. Counts as 25% of K-8 School Performance Index.**

CAPT Test in Science, end of 10th:. **Counts as 33% of School Perfomance Index.**

-New Haven Time Guidelines: For ALL students! (including intervention students)

K-4 hands on science at least twice a week**, 50 minX2 = 100 min/week** out of 1800 total
5-6 hands on science at least 2-4 times a week, 130 min/week
7-8 science every day with certified science teachers, curriculum, set pacing.

-NHPS Science Resource Center 946-2818, scienceresource@nhboe.net,
sends 3 kits a year K-5, 12-16 lessons per kit.
Some kits will need to be shared, and we rent/share with other towns. Rotation is different for each school**. Sep 13-Nov 29, Dec 20-Mar 18, Apr 17-June 15** and the schedule is firm!.

Kind: Weather, Wood/Properties, Trees
1st: Measurement, Sun/Shadows, Organisms
2nd: Solids/Liquids, Soil, Butterfly
3rd: Rocks, Chemical Tests, Plants ** Plus Soggy Paper embedded task
4th: Motion, Land/Water, Electric Circuits ** Plus Circuits embedded task
5th: Sound, Light/Color (dec), Senses, Sun/Earth/Moon (Jan/Feb) ** **Elem CMT Test**, Plus CatchIt embedded task
6th: Ecosystems, Watersheds, Weather, Machines ** Plus DigIn embedded task

All kits have: goals, objectives, inquiry, non fiction reading, writing, **measurement** practice that can tie into math/reading/writing. Bilingual vocab and resources available as well.

7-12, science every day... 7 units per year, with significant tasks. All students take PhyChem, Bio, Chem and most should do Physics.

-Inquiry skills! (50% of tests!)

Science Fair: each school decides, city wide fair is May 15-17, school fairs by April break.

-Key expectations.

Kids need experiences! Research shows long term learning takes place if experiences (labs) come BEFORE reading/vocab: (5 E learning cycle: Engage, Explore, Explain, Elaborate, Evaluate)

Elem science builds future success! Research shows the more engaging elementary science experiences, the more success in ALL subjects, and success in college and STEM careers.

Inquiry: 50% of CMT/CAPT! The CT model is for students to design and conduct experiments "fair tests" , and critique each other's work.

TALK: students learn science concepts and skills by discussing and talking!! THEN writing, and practice assessments.

Fidelity and integration: Stick to science concepts in the CT standards/expectations, and integrate important reading (literacy common core), writing (explanation from evidence), math (measurement and data analysis) skills.

Careers: speak positively about science. Use www.newhavenscience.org/STEM to investigate science careers.

NEW HAVEN PUBLIC SCHOOLS SCIENCE CONTENT OUTLINE MAP *www.newhavenscience.org October 2015*

Taught using learning cycle: Engage, Explore, Explain, Elaborate, Evaluate.

Key inquiry skills/practices with real-world experiences the majority of time:

Questioning, Modeling, Investigating, Analyzing/Math, Constructing Explanations, Argument from Evidence, Communicating/Discourse

(Note, K-5 content changes/ dependent on 3 kit/yr supply and school specific rotation, should be at least 100/min week hands-on science!)

	~Quarter One		~QuarterTwo	~Quarter	Three	~Quarter Four	
K	Weather		Object Properties		Seasons	Living Things: characteristics	
1	Measurement		Motion (nk)		Light Properties	Living Things: Structure	
2	Solids/Liquids		Soil		Nutrition (nk)	Animal Life Cycles	
3	Rocks		Material Properties *ET		Recycling/ Conservation	Plant Life Cycles	
4	Force and Motion		Ecosystems (nk)		Water	Electricity *ET	
5	Sound	Light and Color	Light and Uses (Lenses)	Senses (nk) *ET	Sun, Earth, Moon **(CMT TEST FOLLOWS)**	Health Topics/choice	
6	Ecosystem Populations		Weather Systems		Water Resources *ET	Simple Machines	
7	Properties of Matter	Chemical Properties	Cells	Genetics/ Reproduction	Life Systems Musculo-Skeletal	Life Systems Biochemical *ET	Microbes/ Food Safety
8	Forces/Bridges	Forces/ Motion *ET	Solar System Motion	Landforms/Earth Forces	Tectonic Plates **(CMT TEST FOLLOWS)**	Rock Cycle	Natural Disasters
9 PhyChem	Heat/Phase Changes	Atoms/ Bonding *ET	Polymers *ET	Earth chemical cycles *ET	Earth Materials/ Environment Impact *ET	Energy/ Electricity *ET	Energy Sources/ Impacts *ET
10 Bio	BioChemistry *ET	Cells/ Bacteria/ Viruses *ET	Heredity/ Genetics *ET	Evolution	Diseases/ Populations *ET **(CAPT TEST FOLLOWS)**	Organism Interdependence	Organism Behavior/ Structure
11 Chem	Chemical Properties	Atomic Structure	Nuclear	Compounds/ Bonding	Reactions/ Equations	Gas Behavior	Organic Chemistry
12 Physics	Motion	ACCEL	2 D Motion	Forces/Work	Energy/Electric	Wave/Sound/Light	Mod Physics

*ET = CT Embedded Task, NHPS District Unit Tasks and Quarterly Assessments Also Required Grades 7-12,

New Haven City Wide Science Fair May 16,17,18

New Haven Public Schools Science Curriculum Vision

SCIENCE IS FOR ALL STUDENTS

All students, regardless of age, sex, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science, should have the opportunity to attain high levels of scientific literacy. Excellence in science education embodies the ideal that all students can achieve understanding of science if they are given the opportunity. Our goal is to ensure that all students at all levels achieve science literacy, for science is the key to their future.

SCIENCE LITERACY

Science literacy is a combination of understanding major science concepts and theories, using scientific reasoning, and recognizing the complex interactions between science, technology and society. Scientific literacy requires the ability to apply critical thinking skills when dealing with science-related issues. A scientifically literate person is able to transfer knowledge of the academic theories and principles of science to practical applications in the real world. Scientific literacy also implies having the capacity to pose and evaluate arguments based on evidence and to apply logical conclusions from such arguments. Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena. Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed.

LEARNING SCIENCE IS AN ACTIVE PROCESS

Learning science is something students do, not something that is done to them. In learning science, students describe objects and events, ask questions, acquire knowledge, construct explanations of natural phenomena, test those explanations in many different ways, and communicate their ideas to others. This term "active process" implies physical and mental activity. Hands-on activities are not enough—students also must have "minds-on" experiences. Science teaching must involve students in inquiry-oriented investigations in which they interact with their teachers and peers. Students establish connections between their current knowledge of science and the scientific knowledge found in many sources; they apply science content to new questions; they engage in problem solving, planning, decision making, and group discussions; and they experience assessments that are consistent with an active approach to learning. Emphasizing active science learning means shifting emphasis away from teachers presenting information and "covering" science topics. The perceived need to include all the topics, vocabulary, and information in textbooks is in direct conflict with the central goal of having students learn scientific knowledge with understanding. Inquiry into authentic questions generated from student experiences is the central strategy for teaching science.

TEACHERS OF SCIENCE GUIDE AND FACILITATE LEARNING In doing this, teachers:

-Display and demand respect for the diverse ideas, skills, and experiences of all students.
-Focus and support inquiries while interacting with students.
-Encourage, model, and emphasize the skills, attitudes, and values of scientific inquiry, as well as the curiosity, openness to new ideas and data, and skepticism that characterize science.
-Orchestrate discourse and ongoing discussion among students about scientific ideas.
-Challenge students to accept and share responsibility for their own learning and the learning of all members of the community.
-Recognize and respond to student diversity and encourage all students to participate fully in science learning
-Enable students to have a significant voice in decisions about the content and context of their work.
-Nurture collaboration among students.

SCIENCE INSTRUCTION

Science uses instructional strategies and resources to promote thinking about the content, and students are encouraged to critically discuss ideas, seek information, and validate explanations.

Concepts: The overall instructional strategy for teaching science skills and concepts is that of learning by doing. Abstract concepts in science are explained in class using diagrams, models, simulations, and a variety of media. Students take notes in class, and participate in class discussions. There are questions asked of the students daily, both written and oral, that ask them to explain concepts and relate scientific behavior to real life phenomena. The teacher models the use of quantitative and qualitative analysis through some problem solving strategies in class, which the students then practice, both in groups and individually.

Labs/Activities: In each unit of study, students participate in laboratory investigations at least once a week. The lab investigations are sometimes set procedures in which the students practice the skills of observation, measurement, and data analysis. Many other lab experiences ask the students to design their own safe experiment: formulating hypothesis, controlling variables, and communicating and explaining their results and conclusions. The lab experiences directly relate to the concepts as well as show real life applications of science concepts. Students explore phenomena and collect empirical evidence to support their own explanations.

Real Life: Students apply the knowledge they have learned by using science concepts to make decisions about current issues in each unit. They write persuasive essays, conduct collaborative and independent research, and participate in forums and debates. The students are expected to synthesize information from various resources and construct carefully reasoned opinions about the issue. There are case studies and simulations that require students to learn and apply their science knowledge and make judgments.

The emphasis in all the instructional activities is to promote higher order thinking skills and making connections. Students learn how to use resources, rather than memorizing many facts, and apply their laboratory experiences to other situations.

A useful structure for inquiry-based learning units follows a **LEARNING CYCLE** model. One such model, the "5-E Model", engages students in experiences that allow them to observe, question and make tentative explanations before formal instruction and terminology is introduced. Generally, there are five stages in an inquiry-learning unit:

Engagement: stimulate students' interest, curiosity, and preconceptions.
Exploration: first-hand experiences with concepts without direct instruction;
Explanation: students' explanations followed by introduction of formal terms and clarifications;
Elaboration: applying knowledge to solve a problem. Students frequently develop and complete their own well-designed investigations.
Evaluation: students and teachers reflect on change in conceptual understanding and identify ideas still "under development".

KEY RESEARCH BASED SCIENCE INSTRUCTIONAL STRATEGIES
(Strategies adopted from Marzano, Journal of Research in Science Education, others)

-**Create a Climate for Learning**: well planned lessons, positive teacher attitude, safe, secure, enriching environment.

-**Follow a Guided Inquiry** Learning Cycle Model→ Open Ended Inquiry: Guided Inquiry into a teacher posed question by students leads to students investigating their own questions.

-**Generating and Testing Hypotheses**: students given the opportunity to investigate their ideas.

-**Setting Objectives/Providing Feedback**: Objectives are always clear for all class activities, students always know how they are meeting objectives.

-**Use Warm Up Activities, Questions, Cues, Advance Organizers**: Starter questions generate interest, cue students as to learning activities, and provide a reference throughout a lesson

-**Assess Prior Knowledge/Misconceptions**: Students have to construct their internal model of science concepts and reconcile it with previous experience, often leading to hard to overcome misconceptions.

-**Self-Explanation/Discussion**: Students given the opportunity to explain and discuss ideas are better able to connect prior and new knowledge and experiences.

-**Opportunities to Communicate/Cooperative Learning**: Science is a group endeavor, as is it's learning. Students learn best by communicating and learning from each other.

-**Vary the Way Students Work**: Lab groups, learning centers, projects, and other alternatives to traditional lecture allow for individualized instruction.

-**Practice Effective Questioning Techniques**: Questions are the tool to move towards a student-centered classroom, and different types of questions help guide instruction and learning.

-**Vary the Structure of Lessons**, Use Research Based Strategies: Lesson structure depends on the concepts and skills being learned and assessed. Brain based research in learning points to specific effective varying structures.

-**Identify Similarities and Differences/Graphic Organizers**: Science concepts are often organized into structures by humans attempting to understand nature. Help students understand the classification and organization of knowledge by continually comparing, classifying, as well as describing analogies and relationships.

-**Scaffolded Writing Practice**: Students can move from oral explanation to written explanation through careful guidance/practice, including both expository and persuasive writing in science.

-Strengthen Comprehension for Content Area Reading Text: provide guided focus question, organizers, response and discussion questions, summarize, evaluative prompts based on reading.

-**Non-Linguistic Representations**: Models, drawings, and pictures all can help understand science.

-**Allow Opportunities for Peer Review**: Students are frequently asked to evaluate others' work on standardized testing and must be given regular opportunities as part of their science experience.

-**Create and Embed Science, Technology and Society** (STS), issues, and other items relevant to students' lives. These interdisciplinary learning activities are designed to engage students in the applications of science using their critical thinking skills and content knowledge. They afford students the opportunity to examine ideas and data related to historical, technological, and/or social aspects of science concepts and content.

ASSESSMENT:

Assessment Strategies:

Students are assessed with a variety of methods on their knowledge of science concepts and skills and how they apply to the real world.

Diagnostic assessment can be used to determine the learning needs of students.

Formative assessment can be used during instruction in order to guide students and increase learning. Summative assessments are used to identify achievement of goals and objectives.

Daily classwork and homework is used to check for understanding of main ideas and application of the techniques and skills of science. These daily assessment tools include a mixture of written explanations, diagrams, model building, and problem solving. Students are assessed on their laboratory skills using rubrics and class monitoring. Students are assessed on their ability to explain unit-related concepts and their conclusions on experimentation results by written lab reports, written explanations on quizzes and tests, as well as occasional oral explanation of laboratory ideas and procedures.

There are periodic unit quizzes and tests, which assess students' skills and knowledge in a similar manner to their daily instructional activities. The written quizzes and tests include a mixture of knowledge and comprehension questions, as well as questions which require students to demonstrate knowledge of inquiry skills, explanation of concepts, as well as making connections to other concepts and everyday experiences. The assessment tools include questions about cause and effect, steps of scientific processes, and explanation of phenomena, and are not focused on just vocabulary and word problem solving. Tests and quizzes, as well as midterm and final exams, may include a lab performance component.

Students are assessed on their ability to explain science ideas, do research, and defend decisions about scientific issues by the use of projects and class simulations. Projects require some level of judgment and thinking by the students and extend beyond research into analysis and synthesis. Group and interpersonal skills are included. Rubrics detailing students' ability to present, discuss, and use scientific research, both lab results and issues, are used by students, peers, and the teacher.

SCIENCE CURRICULUM MODEL:

Each science grade K-6, and each science course 7-12, follows the essential same format, and is linked in content, skills, and format to the CT State Science Frameworks, standardized test guidelines, and Grade Level Expectations. ***Revised versions and update found at www.newhavenscience.org***

The state of Connecticut has published State Science Frameworks, which have specific content standards, in four units per grade level K-10, as well as 9-10 overall skill/inquiry standards. Further unwrapping has produced specific performance expectation standards (10-18) per grade level, and a further 10-20 list of specific grade level concept expectations per unit. There is one CT state required embedded performance task in grades 3-8, and 10 in grades 9-10. Currently, standardized testing is conducted in grades 5, 8, and 10, each testing students' knowledge and skills on science content in previous grades.

For New Haven Public Schools:

Each science course/grade has:

-Overview and Pacing Guide

-Course Goals/ Objectives

UNIT:
Each unit, 4 units in grades K-6, and 7 units each year in grades 7-12 have the format:

-Unit Goal/Introduction Description/Essential Question

-Power Standards, link to applicable CT State Performance Expectations.

-Essential Concepts/ Essential Skills: The essential content and concepts for each unit, leading to the unit standards. Linked to CT State Grade Level Expectations where available.

-Science Misconceptions: linked to essential concepts, based on research

-Essential Vocabulary: To be used as a guide for teachers.

-Outline of Suggested Sequence of Instructional Activities: In each unit, some activities are references, and some are required. Links to some teacher and student templates are provided.

-Reading for Information Piece In some 7-12 units, a suggested reading for information piece is provided.

-Significant Task: A learning activity that addresses the essential power standard and concepts of the units. Student and teacher materials are provided, along with assessment tools.

-Suggested Assessments: Other suggested assessment tools

-Resources: A list of unit related resources, websites, and activities. This will be constantly edited and revised as feedback is given.

-Quarterly Assessments: In grades 7-12, district wide quarterly assessments are given in science courses, focusing on skills and concepts to be found on CT standardized tests and are required.

K-12

THE STANDARDS FOR SCIENTIFIC INQUIRY, LITERACY AND NUMERACY ARE INTEGRAL PARTS OF THE CONTENT STANDARDS FOR EACH GRADE LEVEL IN THIS CLUSTER.

Grades PreK-2 Core Scientific Inquiry, Literacy and Numeracy *How is scientific knowledge created and communicated?*	
Content Standards	**Expected Performances**
SCIENTIFIC INQUIRY • Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. **SCIENTIFIC LITERACY** • Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science. **SCIENTIFIC NUMERACY** • Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**A INQ.1** Make observations and ask questions about objects, organisms and the environment. **A INQ.2** Use senses and simple measuring tools to collect data. **A INQ.3** Make predictions based on observed patterns. **A INQ.4** Read, write, listen and speak about observations of the natural world. **A INQ.5** Seek information in books, magazines and pictures. **A INQ.6** Present information in words and drawings. **A INQ.7** Use standard tools to measure and describe physical properties such as weight, length and temperature. **A INQ.8** Use nonstandard measures to estimate and compare the sizes of objects. **A INQ.9** Count, order and sort objects by their properties. **A INQ.10** Represent information in bar graphs.

Kindergarten (as well as inquiry standards)

Core Themes, Content Standards and Expected Performances (subject to rotation order)

Content Standards	Expected Performances
• *Energy in the Earth's Systems – How do external and internal sources of energy affect the Earth's systems? (EARTH)* • **K.3 - Weather conditions vary daily and seasonally.** • Daily and seasonal weather conditions affect what we do, what we wear and how we feel.	**A7** Describe and record daily weather conditions. **A8** Relate seasonal weather patterns to appropriate choices of clothing and activities. **STC KIT Weather**
• *Properties of Matter – How does the structure of matter affect the properties and uses of materials? (PHYSICAL)* • **K.1 - Objects have properties that can be observed and used to describe similarities and differences.** • Some properties can be observed with the senses, and others can be discovered by using simple tools or tests.	**A1** Use the senses and simple measuring tools, such as rulers and equal-arm balances, to observe common objects and sort them into groups based on size, weight, shape or color. **A2** Sort objects made of materials such as wood, paper and metal into groups based on properties such as flexibility, attraction to magnets, and whether they float or sink in water. **A3** Count objects in a group and use mathematical terms to describe quantitative relationships such as: same as, more than, less than, equal, etc.
• *Science and Technology in Society – How do science and technology affect the quality of our lives? (PHYSICAL)* • **K.4 - Some objects are natural, while others have been designed and made by people to improve the quality of life.** • Humans select both natural and man-made materials to build shelters based on local climate conditions, properties of the materials and their availability in the environment.	**A9** Describe the types of materials used by people to build houses, and the properties that make the materials useful. **Current FOSS Kit: Wood or DSM Kit:Properties**
• *Heredity and Evolution – What processes are responsible for life's unity and diversity?(BIO)* • **K.2 - Many different kinds of living things inhabit the Earth.** • Living things have certain characteristics that distinguish them from nonliving things, including growth, movement, reproduction and response to stimuli.	**A4** Describe the similarities and differences in the appearance and behaviors of plants, birds, fish, insects and mammals (including humans). **A5** Describe the similarities and differences in the appearance and behaviors of adults and their offspring. **A6** Describe characteristics that distinguish living from nonliving things. **Current FOSS Kit: Tree**

Grade 1 (as well as inquiry standards)

Core Themes, Content Standards and Expected Performances (subject to rotation order)

Content Standards	Expected Performances
• *Science and Technology in Society – How do science and technology affect the quality of our lives? (PHYSICAL)* • **1.4 - The properties of materials and organisms can be described more accurately through the use of standard measuring units.** • Various tools can be used to measure, describe and compare different objects and organisms.	**A17** Estimate, measure and compare the sizes and weights of different objects and organisms using standard and nonstandard measuring tools. **STC Kit: Comparing/Measuring**
• *Forces and Motion – What makes objects move the way they do? (PHYSICAL)* **1.1 -The sun appears to move across the sky in the same way every day, but its path changes gradually over the seasons.** • An object's position can be described by locating it relative to another object or the background. • An object's motion can be described by tracing and measuring its position over time.	**A10** Describe how the motion of objects can be changed by pushing and pulling. **A11** Describe the apparent movement of the sun across the sky and the changes in the length and direction of shadows during the day. **(optional DSM Force Motion)** **DSM Sun Shadow**
• *Structure and Function – How are organisms structured to ensure efficiency and survival?(BIO)* • **1.2 - Living things have different structures and behaviors that allow them to meet their basic needs.** • Animals need air, water and food to survive. • Plants need air, water and sunlight to survive.	**A12** Describe the different ways that animals, including humans, obtain water and food. **A13** Describe the different structures plants have for obtaining water and sunlight. **A14** Describe the structures that animals, including humans, use to move around. **STC Organism**

Grade 2 (as well as inquiry standards)

Core Themes, Content Standards and Expected Performances (subject to rotation order)

Content Standards	Expected Performances
Properties of Matter – How does the structure of matter affect the properties and uses of materials? (PHY) **2.1 - Materials can be classified as solid, liquid or gas based on their observable properties.** Solids tend to maintain their own shapes, while liquids tend to assume the shapes of their containers, and gases fill their containers fully.	**A18** Describe differences in the physical properties of solids and liquids. **STC KIT: Solid/Liquid**
The Changing Earth – How do materials cycle through the Earth's systems? (EARTH) **2.3 - Earth materials have varied physical properties which make them useful in different ways.** Soils can be described by their color, texture and capacity to retain water. Soils support the growth of many kinds of plants, including those in our food supply.	**A21** Sort different soils by properties, such as particle size, color and composition. **A22** Relate the properties of different soils to their capacity to retain water and support the growth of certain plants. **STC/DSM KIT: Soil**
Science and Technology in Society – How do science and technology affect the quality of our lives? (BIO) **2.4 - Human beings, like all other living things, have special nutritional needs for survival.** The essential components of balanced nutrition can be obtained from plant and animal sources. People eat different foods in order to satisfy nutritional needs for carbohydrates, proteins and fats.	**A23** Identify the sources of common foods and classify them by their basic food groups. **A24** Describe how people in different cultures use different food sources to meet their nutritional needs. **optional UNH Unit Nutrition/Nutrition Detectives**
Structure and Function – How are organisms structured to ensure efficiency and survival? (BIO **1.3 - Organisms change in form and behavior as part of their life cycles.** Some organisms undergo metamorphosis during their life cycles; other organisms grow and change, but their basic form stays essentially the same.	**A15** Describe the changes in organisms, such as frogs and butterflies, as they undergo metamorphosis. **A16** Describe the life cycles of organisms that grow but do not metamorphose. **STC KIT Butterflies**

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Grades 3-5 Core Scientific Inquiry, Literacy and Numeracy

How is scientific knowledge created and communicated?

Content Standards	Expected Performances	
SCIENTIFIC INQUIRY 1. Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena. **SCIENTIFIC LITERACY** 2. Scientific literacy includes speaking, listening, presenting, interpreting, reading and writing about science. **SCIENTIFIC NUMERACY** 3. Mathematics provides useful tools for the description, analysis and presentation of scientific data and ideas.	**B INQ.1**	Make observations and ask questions about objects, organisms and the environment.
	B INQ.2	Seek relevant information in books, magazines and electronic media.
	B INQ.3	Design and conduct simple investigations.
	B INQ.4	Employ simple equipment and measuring tools to gather data and extend the senses.
	B INQ.5	Use data to construct reasonable explanations.
	B INQ.6	Analyze, critique and communicate investigations using words, graphs and drawings.
	B INQ.7	Read and write a variety of science-related fiction and nonfiction texts.
	B INQ.8	Search the Web and locate relevant science information.
	B INQ.9	Use measurement tools and standard units (e.g., centimeters, meters, grams, kilograms) to describe objects and materials.
	B INQ.10	Use mathematics to analyze, interpret and present data.

Grade 3 (as well as inquiry standards)

Core Themes, Content Standards and Expected Performances (subject to rotation order)

Content Standards	Expected Performances
The Changing Earth – How do materials cycle through the Earth's systems?(EARTH) **3.3 - Earth materials have different physical and chemical properties.** Rocks and minerals have properties that may be identified through observation and testing; these properties determine how earth materials are used.	**B5 -**Describe the physical properties of rocks and relate them to their potential uses. **B6 -**Relate the properties of rocks to the possible environmental conditions during their formation. **STC or SCHOOL KIT : ROCKS/MINERALS**
Properties of Matter – How does the structure of matter affect the properties and uses of materials? (PHYS) **3.1 - Materials have properties that can be identified and described through the use of simple tests.** ♦ Heating and cooling cause changes in some of the properties of materials.	**B1 -**Sort and classify materials based on properties such as dissolving in water, sinking and floating, conducting heat, and attracting to magnets. **B2 -**Describe the effect of heating on the melting, evaporation, condensation and freezing of water. **STC KIT: CHEMICAL TESTS**
Science and Technology in Society – How do science and technology affect the quality of our lives? (EARTH) **3.4 - Earth materials provide resources for all living things, but these resources are limited and should be conserved.** Decisions made by individuals can impact the global supply of many resources.	**B7** Describe how earth materials can be conserved by reducing the quantities used, and by reusing and recycling materials rather than discarding them. **optional UNH/QU Recycling KIT** **REQUIRED CMT EMBEDDED TASK: SOGGY PAPER**
Heredity and Evolution – What processes are responsible for life's unity and diversity? (BIO) **3.2 - Organisms can survive and reproduce only in environments that meet their basic needs.** ♦ Plants and animals have structures and behaviors that help them survive in different environments.	**B3 -**Describe how different plants and animals are adapted to obtain air, water, food and protection in specific land habitats. **B4 -**Describe how different plants and animals are adapted to obtain air, water, food and protection in water habitats.
Structure and Function – How are organisms structured to ensure efficiency and survival? (BIO) **2.2 - Plants change their form as part of their life cycles.** The life cycles of flowering plants include seed germination, growth, flowering, pollination and seed dispersal.	**A 19 -**Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds. **A20 -** Explore and describe the effects of light and water on seed germination and plant growth. **STC KIT: PLANT GROWTH**

Grade 4 (as well as inquiry standards)

Core Themes, Content Standards and Expected Performances (subject to rotation order)

Content Standards	Expected Performances
Forces and Motion – What makes objects move the way they do? (PHYS) **4.1 - The position and motion of objects can be changed by pushing or pulling**. ♦ The size of the change in an object's motion is related to the strength of the push or pull. ♦ The more massive an object is, the less effect a given force will have on its motion.	**B8 -** Describe the effects of the strengths of pushes and pulls on the motion of objects. **B9 -**Describe the effect of the mass of an object on its motion. **STC KIT: Motion And Design**
Matter and Energy in Ecosystems – How do matter and energy flow through ecosystems? (BIO) **4.2 - All organisms depend on the living and non-living features of the environment for survival.** ♦ When the environment changes, some organisms survive and reproduce, and others die or move to new locations.	**B10** Describe how animals, directly or indirectly, depend on plants to provide the food and energy they need in order to grow and survive. **B11** Describe how natural phenomena and some human activities may cause changes to habitats and their inhabitants. **optional UNH/QU Ecosystems Units/KIT LITERACY**
Energy in the Earth's Systems – How do external and internal sources of energy affect the Earth's systems? (EARTH) **4.3 - Water has a major role in shaping the Earth's surface.** ♦ Water circulates through the Earth's crust, oceans and atmosphere.	**B12** Describe how the sun's energy impacts the water cycle. **B13** Describe the role of water in erosion and river formation. **STC Kit: Land/Water**
Energy Transfer and Transformations – What is the role of energy in our world? (PHYS) **4.4 - Electrical and magnetic energy can be transferred and transformed.** ♦ Electricity in circuits can be transformed into light, heat, sound and magnetic effects. ♦ Magnets can make objects move without direct contact between the object and the magnet.	**B14** Describe how batteries and wires can transfer energy to light a light bulb. **B15** Explain how simple electrical circuits can be used to determine which materials conduct electricity. **B16** Describe the properties of magnets, and how they can be used to identify and separate mixtures of solid materials. **STC KIT: Electric Circuits** **REQUIRED CMT EMBEDDED TASK: GO WITH THE FLOW (Light Bulb)**

Grade 5 (as well as inquiry standards) **Core Themes, Content Standards and Expected Performances (subject to rotation order)**	
Content Standards	**Expected Performances**
Energy Transfer and Transformations – What is the role of energy in our world? (PHYS) **5.1 - Sound and light are forms of energy.** ♦ Sound is a form of energy that is produced by the vibration of objects and is transmitted by the vibration of air and objects. ♦ Light is a form of energy that travels in a straight line and can be reflected by a mirror, refracted by a lens, or absorbed by objects.	**B17** Describe the factors that affect the pitch and loudness of sound produced by vibrating objects. **B18** Describe how sound is transmitted, reflected and/or absorbed by different materials. **UNH SOUND KIT** --- **B19** Describe how light is absorbed and/or reflected by different surfaces. **B20** Describe how light absorption and reflection allow one to see the shapes and colors of objects.
Science and Technology in Society – How do science and technology affect the quality of our lives? (PHY) **5.4 - Humans have the capacity to build and use tools to advance the quality of their lives.** ♦ Advances in technology allow individuals to acquire new information about the world.	**B24** Compare and contrast the structures of the human eye with those of the camera. **B25** Describe the uses of different instruments, such as eye glasses, magnifiers, periscopes and telescopes, to enhance our vision. **GEMS KIT COLOR ANALYZERS,** **GEMS KIT MORE THAN MAGNIFIERS**
Structure and Function – How are organisms structured to ensure efficiency and survival? (BIO) **5.2 - Perceiving and responding to information about the environment is critical to the survival of organisms.** ♦ The sense organs perceive stimuli from the environment and send signals to the brain through the nervous system.	**B21** Describe the structure and function of the human senses and the signals they perceive. **SCHOOL: SENSES** **REQUIRED CMT EMBEDDED TASK: CATCH IT**
Earth in the Solar System – How does the position of Earth in the solar system affect conditions on our planet? (EARTH) **5.3 - Most objects in the solar system are in a regular and predictable motion.** ♦ The positions of the Earth and moon relative to the sun explain the cycles of day and night, and the monthly moon phases.	**B22** Explain the cause of day and night based on the rotation of Earth on its axis. **B23** Describe the monthly changes in the appearance of the moon, based on the moon's orbit around the Earth. **GEMS KIT: EARTH, MOON, STARS** **CMT TEST IN MARCH**
HEALTH TOPICS/Astronomy Units	**HEALTH TOPICS and/or Astronomy Units (GEMS: EARTH MOON STARS)** **(CT STATE HEALTH)**

THE STANDARDS FOR SCIENTIFIC INQUIRY, LITERACY AND NUMERACY ARE INTEGRAL PARTS OF THE CONTENT STANDARDS FOR EACH GRADE LEVEL IN THIS CLUSTER.

Grades 6-8 Core Scientific Inquiry, Literacy and Numeracy

How is scientific knowledge created and communicated?

Content Standards	Expected Performances
SCIENTIFIC INQUIRY ♦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** ♦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** ♦Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.	**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.

Grade 6 (as well as inquiry standards)

Core Themes, Content Standards and Expected Performances (subject to rotation order)

Content Standards	Expected Performances
Matter and Energy in Ecosystems – How do matter and energy flow through ecosystems? (BIO) **6.2 - An ecosystem is composed of all the populations that are living in a certain space and the physical factors with which they interact.** Populations in ecosystems are affected by biotic factors, such as other populations, and abiotic factors, such as soil and water supply. Populations in ecosystems can be categorized as producers, consumers and decomposers of organic matter.	**C 4.** Describe how abiotic factors, such as temperature, water and sunlight, affect the ability of plants to create their own food through photosynthesis. **C 5.** Explain how populations are affected by predator-prey relationships. **C 6.** Describe common food webs in different Connecticut ecosystems. **STC KIT: ECOYSTEMS**
Energy in the Earth's Systems – How do external and internal sources of energy affect the Earth's systems? (EARTH) **6.3 - Variations in the amount of the sun's energy hitting the Earth's surface affect daily and seasonal weather patterns.** Local and regional weather are affected by the amount of solar energy these areas receive and by their proximity to a large body of water.	**C 7.** Describe the effect of heating on the movement of molecules in solids, liquids and gases. **C 8.** Explain how local weather conditions are related to the temperature, pressure and water content of the atmosphere and the proximity to a large body of water. **C 9.** Explain how the uneven heating of the Earth's surface causes winds. **PH/NEOSCI or FOSS KIT: WEATHER (all yr)**
Science and Technology in Society – How do science and technology affect the quality of our lives? (EARTH) **6.4 - Water moving across and through earth materials carries with it the products of human activities.** Most precipitation that falls on Connecticut eventually reaches Long Island Sound.	**C 10.** Explain the role of septic and sewage systems on the quality of surface and ground water. **C 11.** Explain how human activity may impact water resources in Connecticut, such as ponds, rivers and the Long Island Sound ecosystem. **REQUIRED CMT EMBEDDED TASK: DIG IN** **URI KIT (OPEN SPACES): WATERSHEDS**
Energy Transfer and Transformations – What is the role of energy in our world? (PHYS) **7.1 - Energy provides the ability to do work and can exist in many forms.** 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.	**C 12.** Explain the relationship among force, distance and work, and use the relationship (W=F x D) 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. **DMS KIT: SIMPLE MACHINES/ FOSS LEVERS**

Grade 7 Core Themes, Content Standards and Expected Performances (as well as inquiry standards)	
Content Standards	**Expected Performances**
Properties of Matter – How does the structure of matter affect the properties and uses of materials?(PHYS) **6.1 - Materials can be classified as pure substances or mixtures, depending on their chemical and physical properties.** Mixtures are made of combinations of elements and/or compounds, and they can be separated by using a variety of physical means. Pure substances can be either elements or compounds, and they cannot be broken down by physical means.	**C0.** Describe matter and its properties. **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. *END QUARTER ONE: Q1 ASSESSMENT*
Structure and Function – How are organisms structured to ensure efficiency and survival? (BIO) **7.2 - Many organisms, including humans, have specialized organ systems that interact with each other to maintain dynamic internal balance.** All organisms are composed of one or more cells; each cell carries on life-sustaining functions.	**C 15.** Describe the basic structures of an animal cell, including nucleus, cytoplasm, mitochondria and cell membrane, and how they function to support life. **C 25.** Explain the similarities and differences in cell division in somatic and germ cells.
Heredity and Evolution – What processes are responsible for life's unity and diversity? (BIO) **8.2 - Reproduction is a characteristic of living systems and it is essential for the continuation of every species**. Heredity is the passage of genetic information from one generation to another. Some of the characteristics of an organism are inherited and some result from interactions with the environment.	**C 26.** Describe the structure and function of the male and female human reproductive systems, including the process of egg and sperm production. **C 27.** Describe how genetic information is organized in genes on chromosomes, and explain sex determination in humans. *END QUARTER TWO: Q2 ASSESSMENT* ***DSM Human Body Systems Kit Available***
Structure and Function – How are organisms structured to ensure efficiency and survival?(BIO) **7.2 - Many organisms, including humans, have specialized organ systems that interact with each other to maintain dynamic internal balance.** Multicellular organisms need specialized structures and systems to perform basic life functions.	**C 17.** Explain how the human musculo-skeletal system supports the body and allows movement. **C 16.** Describe the structures of the human digestive, respiratory and circulatory systems, and explain how they function to bring oxygen and nutrients to the cells and expel waste materials. **REQUIRED CMT EMBEDDED TASK: FEEL THE BEAT** *END QUARTER THREE: Q3 ASSESSMENT*
Science and Technology in Society – How do science and technology affect the quality of our lives?(BIO) **7.4 - Technology allows us to improve food production and preservation, thus improving our ability to meet the nutritional needs of growing populations.** Various microbes compete with humans for the same sources of food.	**C 21.** Describe how freezing, dehydration, pickling and irradiation prevent food spoilage caused by microbes. **(STC FOOD Chemistry Kit Available)** **DISTRICT EMBEDDED TASK: FOOD** *END QUARTER FOUR: Q4 ASSESSMENT*

Grade 8 Core Themes, Content Standards and Expected Performances (as well as inquiry standards)	
Content Standards	**Expected Performances**
Science and Technology in Society – How do science and technology affect the quality of our lives? (PHYS) **8.4 - In the design of structures there is a need to consider factors such as function, materials, safety, cost and appearance.** Bridges can be designed in different ways to withstand certain loads and potentially destructive forces.	**C. 30** Explain how beam, truss and suspension bridges are designed to withstand the forces that act on them. **DISTRICT EMBEDDED TASK: STRONG BRIDGES** *END QUARTER ONE Q1 ASSESSMENT*
Forces and Motion – What makes objects move the way they do? (PHYS) **8.1 - 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.** 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.	**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. **STC Force/Motion Kit Available** **REQUIRED EMBEDDED CMT TASK: SHIPPING/SLIDING**
Earth in the Solar System – How does the position of Earth in the solar system affect conditions on our planet? (PHYS) **8.3 - The solar system is composed of planets and other objects that orbit the sun.** Gravity is the force that governs the motions of objects in the solar system. The motion of the Earth and moon relative to the sun causes daily, monthly and yearly cycles on Earth.	**C 28.** Explain the effect of gravity on the orbital movement of planets in the solar system. **C 29.** Explain how the regular motion and relative position of the sun, Earth and moon affect the seasons, phases of the moon and eclipses. *END QUARTER TWO: Q2 ASSESSMENT* **GEMS Reason for Seasons Kit Available**
Energy in the Earth's Systems – How do external and internal sources of energy affect the Earth's systems? (EARTH) **7.3 - Landforms are the result of the interaction of constructive and destructive forces over time.** Volcanic activity and the folding and faulting of rock layers during the shifting of the Earth's crust affect the formation of mountains, ridges and valleys. Glaciation, weathering and erosion change the Earth's surface by moving earth materials from place to place.	**C 18.** Describe how folded and faulted rock layers provide evidence of the gradual up and down motion of the Earth's crust. **C 19.** Explain how glaciation, weathering and erosion create and shape valleys and floodplains. **C 20.** Explain how the boundaries of tectonic plates can be inferred from the location of earthquakes and volcanoes. **DSM Landforms/Plate Tectonics Kit** **DISTRICT EMBEDDED TASK: EROSION (MIDDLE SCHOOL SCIENCE CMT IN MARCH)** *END QUARTER THREE Q3 ASSESSMENT*
The Changing Earth – How do materials cycle through the Earth's systems? (STRAND III) **9.7 - Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere, organisms as part of biogeochemical cycles.** Elements on Earth exist in essentially fixed amounts and are located in various chemical reservoirs. The cyclical movement of matter between reservoirs is driven by the Earth's internal and external sources of energy.	**D 21.** Explain how internal energy of the Earth causes matter to cycle through the magma and the solid earth. **(POSSIBLE 4th Quarter TOPIC)** *END QUARTER FOUR Q4* **DISTRICT EMBEDDED TASK: CYCLES** **NATURAL DISASTERS (NAEP standard)**

THE STANDARDS FOR SCIENTIFIC INQUIRY, LITERACY AND NUMERACY ARE INTEGRAL PARTS OF THE CONTENT STANDARDS FOR EACH GRADE LEVEL IN THIS CLUSTER.

Grades 9-10 Core Scientific Inquiry, Literacy and Numeracy

How is scientific knowledge created and communicated?

Content Standards	Expected Performances
SCIENTIFIC INQUIRY ♦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** ♦Scientific literacy includes the ability to read, write, discuss and present coherent ideas 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** ♦Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.	**D INQ.1** Identify questions that can be answered through scientific investigation. **D INQ.2** Read, interpret and examine the credibility and validity of scientific claims in different sources of information. **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.4** Design and conduct appropriate types of scientific investigations to answer different questions. **D INQ.5** Identify independent and dependent variables, including those that are kept constant and those used as controls. **D INQ.6** Use appropriate tools and techniques to make observations and gather data. **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. **D INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

Grade 9 Core Themes, Content Standards and Expected Performances pg 1 of 3 **Strand II: Chemical Structures and Properties (as well as inquiry standards)**	
Content Standards	**Expected Performances**
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **9.4 - Atoms react with one another to form new molecules.** ♦ Atoms have a positively charged nucleus surrounded by negatively charged electrons. ♦ The configuration of atoms and molecules determines the properties of the materials.	**D 1.** Describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes. (I) **D 2.** Explain how energy is transferred by conduction, convection and radiation. (I) **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 structures. **D 11.** Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).
	END QUARTER ONE: Q1 ASSESSMENT
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **9.5 – Due to its unique chemical structure, carbon forms many organic and inorganic compounds.** ♦ 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 the large molecules of life. *Science and Technology in Society – How do science and technology affect the quality of our lives?* **9.6 - Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.** ♦ Materials produced from the 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.	**D 17.** Explain how the chemical structure of polymers affects their physical properties. **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. **REQUIRED CAPT EMBEDDED TASK: LAB ACTIVITY PLASTICS** **D 16.** Explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers. **REQUIRED CAPT EMBEDDED TASK: STS ACTIVITY PLASTICS WEBSITES**

Grade 9 Core Themes, Content Standards and Expected Performances pg 2 of 3 **Strand III: Global Interdependence (as well as inquiry standards)**	
Content Standards	**Expected Performances**
The Changing Earth – How do materials cycle through the Earth's systems? **9.7 - Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.** ♦ Elements on Earth exist in essentially fixed amounts and are located in various chemical reservoirs. ♦ The cyclical movement of matter between reservoirs is driven by the Earth's internal and external sources of energy.	**D 19.** Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs. **D 20.** Explain how solar energy causes water to cycle through the major earth reservoirs. **D 24.** Explain how the accumulation of mercury, phosphates and nitrates affects the quality of water and the organisms that live in rivers, lakes and oceans.
	END QUARTER TWO: Q2 ASSESSMENT
Science and Technology in Society – How do science and technology affect the quality of our lives? **9.9 - Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.** ♦ New technologies and changes in lifestyle can have positive and/or negative effects on the environment. **9.8 - The use of resources by human populations may affect the quality of the environment.** ♦ Accumulation of metal and non-metal ions used to increase agricultural productivity is a major source of water pollution.	**D 12.** Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions. (I) **REQUIRED CAPT EMBEDDED TASK: LAB ACTIVITY ACID RAIN** **D 18.** Explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment. **D 25.** Explain how land development, transportation options and consumption of resources may affect the environment. **D 26.** Describe human efforts to reduce the consumption of raw materials and improve air and water quality. **REQUIRED CAPT EMBEDDED TASK: STS ACTIVITY BROWNFIELD SITES**
	END QUARTER THREE: Q3 ASSESSMENT

Grade 9 Core Themes, Content Standards and Expected Performances pg 3 of 3 **Strand I: Energy Transformations (as well as inquiry standards)**	
Content Standards	**Expected Performances**
Energy Transfer and Transformations – What is the role of energy in our world? **9.1 - Energy cannot be created or destroyed; however, energy can be converted from one form to another.** ♦ Energy enters the Earth system primarily as solar radiation, is captured by materials and photosynthetic processes, and eventually is transformed into heat.	**D 7.** Explain how heat is used to generate electricity **D 3.** Describe energy transformations among heat, light, electricity and motion. **REQUIRED CAPT EMBEDDED TASK: LAB ACTIVITY SOLAR COOKER**
Energy Transfer and Transformations – What is the role of energy in our world? **9.2 - The electrical force is a universal force that exists between any two charged objects.** ♦ 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.	**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.
Science and Technology in Society – How do science and technology affect the quality of our lives? **9.3 - Various sources of energy are used by humans and all have advantages and disadvantages.** ♦ 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. **9.8 - The use of resources by human populations may affect the quality of the environment.** Emission of combustion by-products, such as SO_2, CO_2 and NOx by industries and vehicles is a major source of air pollution.	**D 8.** Describe the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity. **REQUIRED CAPT EMBEDDED TASK: STS ACTIVITY ENERGY USE GRAPHS** **D 22.** Explain how the release of sulfur dioxide (SO_2) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures. (III) **D 23.** Explain how the accumulation of carbon dioxide (CO_2) in the atmosphere increases Earth's "greenhouse" effect and may cause climate changes. (III) **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. *END QUARTER FOUR: Q4 ASSESSMENT*

Grade 10 Core Themes, Content Standards and Expected Performances pg 1 of 2 **Strand IV: Cell Chemistry and Biotechnology (as well as inquiry standards)**	
Content Standards	**Expected Performances**
Structure and Function – How are organisms structured to ensure efficiency and survival? **10.1 - Fundamental life processes depend on the physical structure and the chemical activities of the cell.** ♦ Most of the chemical activities of the cell are catalyzed by enzymes that function only in a narrow range of temperature and acidity conditions. ♦ The cellular processes of photosynthesis and respiration involve transformation of matter and energy.	10.c.5 (National Standard) Life Science: matter, energy, and organization in living systems. **D 29.** Describe the general role of enzymes in metabolic cell processes **D 31.** Describe the similarities and differences between bacteria and viruses. **D 30.** Explain the role of the cell membrane in supporting cell functions. **D 27.** Describe significant similarities and differences in the basic structure of plant and animal cells. **REQUIRED CAPT EMBEDDED TASK: LAB ACTIVITY APPLE JUICE ENZYMES**
	END QUARTER ONE: Q1 ASSESSMENT
Structure and Function-How are organisms structured to ensure efficiency and survival ? *Science and Technology in Society – How do science and technology affect the quality of our lives?* **10.3 - Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.** ♦ The principles of genetics and cellular chemistry can be used to produce new foods and medicines in biotechnological processes. *Heredity and Evolution – What processes are responsible for life's unity and diversity?* **10.4. - In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.** ♦ Genetic information is stored in genes that are located on chromosomes inside the cell nucleus. ♦ Most organisms have two genes for each trait, one on each of the homologous chromosomes in the cell nucleus.	**D 36.** Explain how meiosis contributes to the genetic variability of organisms. **D 34.** Describe, in general terms, how the genetic information of organisms can be altered to make them produce new materials. **D 35.** Explain the risks and benefits of altering the genetic composition and cell products of existing organisms. **D 37.** Use the Punnet Square technique to predict the distribution of traits in mono- and di-hybrid crossings. **D 28.** Describe the general role of DNA and RNA in protein synthesis. **D 38.** Deduce the probable mode of inheritance of traits (e.g., recessive/dominant, sex-linked) from pedigree diagrams showing phenotypes. **D 33.** Explain how bacteria and yeasts are used to produce foods for human consumption. **REQUIRED CAPT EMBEDDED TASK: STS ACTIVITY BIOENGINEERED FOODS PAMPHLET**

Grade 10 Core Themes, Content Standards and Expected Performances pg 2 of 2 **Strand V: Genetics, Evolution and Biodiversity (as well as inquiry standards)**	
Content Standards	**Expected Performances**
Heredity and Evolution – What processes are responsible for life's unity and diversity? **10.5 - Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.** ♦ Mutations and recombination of genes create genetic variability in populations. ♦ Changes in the environment may result in the selection of organisms that are better able to survive and reproduce.	**D 40.** Explain how the processes of genetic mutation and natural selection are related to the evolution of species. **D 41.** Explain how the current theory of evolution provides a scientific explanation for fossil records of ancient life forms. **D 42.** Describe how structural and behavioral adaptations increase the chances for organisms to survive in their environments. **REQUIRED CAPT EMBEDDED TASK: LAB ACTIVITY YEAST GROWTH**
	END QUARTER TWO: Q2 ASSESSMENT
Science and Technology in Society – How do science and technology affect the quality of our lives? **10.2 - Microorganisms have an essential role in life processes and cycles on Earth.** ♦ Understanding the growth and spread patterns of viruses and bacteria enables the development of methods to prevent and treat infectious diseases.	**D 32.** Describe how bacterial and viral infectious diseases are transmitted, and explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases. (IV)
Science and Technology in Society – How do science and technology affect the quality of our lives? **10.6 - Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.** ♦ Human populations grow due to advances in agriculture, medicine, construction and the use of energy. ♦ Humans modify ecosystems as a result of rapid population growth, use of technology and consumption of resources.	**D 39.** Describe the difference between genetic disorders and infectious diseases. **D 43.** Describe the factors that affect the carrying capacity of the environment. **D 44.** Explain how change in population density is affected by emigration, immigration, birth rate and death rate, and relate these factors to the exponential growth of human populations. **D 45.** Explain how technological advances have affected the size and growth rate of human populations throughout history. **REQUIRED CAPT EMBEDDED TASK: STS ACTIVITY HUMAN POPULATION GRAPH**
	(CAPT TEST IN MARCH) *END QUARTER THREE: Q3 ASSESSMENT*
ORGANISMS STRUCTURE AND FUNCTION	**10.c.4, 6 (National Standard)ORGANISM INTERDEPENDENCE ORGANISM STRUCTURE AND FUNCTION** *END QUARTER FOUR: Q4 ASSESSMENT*

HIGH SCHOOL SCIENCE COURSES continued

Scope and Sequence: SCIENCE Chemistry (Grade 11) (CHEMISTRY AND PHYSICS ALSO INCLUDE QUARTERLY ASSESSMENTS)

	QuarterOne		QuarterTwo		Quarter Three	Quarter Four	
Unit Titles Learning Outcomes	**Chemical Properties**	**Atomic Structure**	**Nuclear**	**Compounds / Bonding**	**Reactions/ Equations**	**Gases and Heat**	**Organic Chemistr**
INQUIRY STANDARDS ACROSS ALL UNITS	-Use properties to distinguish types of matter. -Determine the density of objects from measurements and grap -Know that matter is composed of particles and how these particles are held together. -Describe the three phases of matter. -Know the properties of metals and non-metals. -Define and contrast physical, chemical, and nuclear changes. -Determine whether a substance is a mixture, element, or compound. -Use properties of matter to separate mixtures.	Develop atomic theory in an historical perspective comparing and contrasting different models. Describe the discovery of the parts of the atom. Know atomic structure in terms of protons, neutrons, and elections. Define and use concepts of atomic number, mass number, and isotopes. - Develop the concept of atomic weight. Describe the general structure of the	Describe the nuclear changes that release energy. Use the concepts of half life to predict the results of nuclear decay. Know natural and man-made occurrences of fission and fusion, including medical, industrial and military applications. Use the scientific concepts involved in nuclear power generation to make decisions about current societal issues.	Describe the historical development of the organization of the Periodic Table and the modern periodic law. Describe atomic properties such as atomic radius, ionization energy, oxidation number, and electron affinity using the periodic table and charts. Develop the concept of chemical activity as it relates to atomic structure. Know the trends in properties of the families and series on the Periodic Table. Describe the uses of some common elements. Write correct	Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions. Develop the concept of conservation of mass. Be able to write and balance common equations. Identify the different types of chemical reactions. Develop the concept of mass relationships in a chemical reaction. Identify endothermic and exothermic reactions. Determine the molecular mass of a compound. Determine empirical and molecular	Identify endothermic and exothermic reactions. Identify the three basic assumptions of the kinetic molecular theory. Describe the basic differences between solids, liquids, and gases in terms of the kinetic theory. Be able to apply the concepts of phase change to explain everyday phenomena. Describe energy changes accompanying a change of state. Describe how the intermolecular forces affect the properties of condensed states of matter. Read and interpret phase change	Explain how the chemical structure of polymers affects their physical properties. Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules. Describe combustion reactions of hydrocarbons and their resulting by-products. Explain the general formation and structure of carbon-based polymers, including synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate. Explain how simple chemical monomers

		atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structures.		formulas for compounds using ratios and ion charts. Identify names and formulas and uses for common compounds and elements. Determine whether a chemical bond between any two elements is ionic or covalent. Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding)	formulas for compounds. Calculate masses and yields of reactants and products in a reaction. Understand the concepts behind limiting reactions	graphs. Describe the factors that effect phase changes. Describe the physical properties of gases. Describe volume, temperature, and pressure of a gas and their units of measurement. Apply the relationships between pressure, temperature, concentration and volume to gas behavior (i.e. Boyle's Law, Charles' Law).	can be combined to create linear, branched and/or cross-linked polymers. Be able to draw structural formulas and name organic compounds. Describe the existence and uses of some organic compounds.
Significant Task	Phase Change Lab, Density Lab	Element Project	Nuclear Energy Debate	Supermarket Chemistry	Chemistry of A Car	Coffe Cup Project Gas Laws and Hot Air Balloons	Making Plastic Lab
Content Supporting Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials, Teaching Plastics, CRISPY Programs	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials

HIGH SCHOOL SCIENCE COURSES continued

PHYSICS (as well as inquiry standards) Scope and Sequence: SCIENCE PHYSICS (Grade 10-12) (see also www.newhavenscience.org/physics)

	QuarterOne		QuarterTwo		Quarter Three		Quarter Four
Unit Titles Learning Outcomes	**MOTION ANALYSIS**	**DIMENSIONAL MOTION**	**FORCES**	**MOMENTUM AND ENERGY**	**FLUID AND HEAT**	**ENERGY AND ELECTRICITY**	**WAVES, SOUND, AND LIGHT**
INQUIRY STANDARDS ACROSS ALL UNITS	Use measuring devices and senses to observe and record physical properties of matter Develop an understanding of the measurements and units used in physics Design and conduct a good physics experiment. Use distance time and velocity time graphs to analyze moving objects Be able to explain speed (velocity), time, and acceleration. Analyze moving objects. -develop the relationships between the variables involved in moving objects. Solve simple one dimensional motion word problems. Use physics to make predictions about accelerated objects.	Use the concepts of relative motion. Explain the consequences of special relativity for moving objects. Use vectors to analyze 2 dimensional motion. Determine the results of projectile motion using x and y sets of kinematic equations	Continue using math, measurement, observation and experimentation skills to analyze moving objects. Explain the fundamental forces in the universe. Use Newton's Laws to explain the relationship between force, mass and acceleration. Be able to predict the results of air resistance (terminal	Determine all the forces and properties, including momentum, on a moving object. Use the principle of conservation of momentum in elastic and inelastic collisions. analyze the transformations of mechanical energy (kinetic, gravitational and elastic) in moving objects. Determine all the factors involved in common collisions, and use physics to evaluate. Analyze circular motion	Explain the concepts of heat transfer Relate the laws of thermodynamics and work Explain the units and measurements of pressure and density. Describe how Bernouilli's Principle is a restatement of the conservation of energy. Use fluid pressure principles to analyze flight	Describe energy transformations among heat, light, electricity and motion. Explain the relationship among voltage, current and resistance in a simple series circuit. Explain how electricity is used to produce heat and light in incandescent bulbs and heating elements. Describe the relationship between current and magnetism.	Describe and analyze the behavior of simple harmonic oscillator systems, such as pendulums and springs. Describe the property of waves. Explain the cause of different sounds. Describe and predict the physics of music Explain how light is produced and perceived Describe applications of color addition and subtraction Use the principles

	Apply knowledge of accelerated motion to a real life situation. Determine what factors affect the acceleration due to gravity.		velocity) Find out what factors affect friction				of reflection and refraction to analyze light.
Significant Task	Traffic Light: Speed Up or Slow Down?	Dart Gun Lab	Terminal Velocity or Friction Lab	Traffic Accident	Coffe Cup Cooling, Flight Project	Circuit Challenge	Amusement Park Physics, Physics of the Musical
Content Supporting Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials,	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials	Textbooks, Labs, NHPS Web Materials

Scope and Sequence: SCIENCE Physics ^

ELECTIVES:

Forensics,

Weather,

Astronomy,

Science Issues,

Environmental Science,

Health,

Anatomy/Physiology (district curriculum guide at www.newhavenscience.org)

AP Chemistry,

AP Physics,

AP Biology,

AP Environmental Science,

Advanced Physics

Refer to NAEP STANDARDS P.12.1 – P.12.23, E.12.1-E.12.13, L.12.1-L.12.13

NAEP PHYSICAL SCIENCE STANDARDS ADDRESSED IN CHEMISTRY AND PHYSICS

P12.1: Differences in the physical properties of solids, liquids, and gases are explained by the ways in which the atoms, ions, or molecules of the substances are arranged and the strength of the forces of attraction between the atoms, ions, or molecules.
P12.2: Electrons, protons, and neutrons are parts of the atom and have measurable properties including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.
P12.3: In the Periodic Table, elements are arranged according to the number of protons (called the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.
P12.4: In a neutral atom, the positively charged nucleus is surrounded by the same number of negatively charged electrons. Atoms of an element whose nuclei have different numbers of neutrons are called isotopes.
P12.5: Changes of state require a transfer of energy. Water has a very high specific heat, meaning it can absorb a large amount of energy while producing only small changes in temperature.
P12.6: An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds.
P12.7: A large number of important reactions involve the transfer of either electrons (oxidation/reduction reactions) or hydrogen ions (acid/base reactions) between reacting ions, molecules, or atoms. In other chemical reactions, atoms interact with one another by sharing electrons to create a bond. An important example is carbon atoms, which can bond to one another in chains, rings, and branching networks to form, along with other kinds of atoms—hydrogen, oxygen, nitrogen, and sulfur—a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.
P12.8: Atoms and molecules that compose matter are in constant motion (translational, rotational, or vibrational).
P12.9: Energy may be transferred from one object to another during collisions.
P12.10: Electromagnetic waves are produced by changing the motion of charges or by changing magnetic fields. The energy of electromagnetic waves is transferred to matter in packets. The energy content of the packets is directly proportional to the frequency of the electromagnetic waves.
P12.11: Fission and fusion are reactions involving changes in the nuclei of atoms. Fission is the splitting of a large nucleus into smaller nuclei and particles. Fusion involves joining of two relatively light nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the sun and other stars.
P12.12: Heating increases the translational, rotational, and vibrational energy of the atoms composing elements and the molecules or ions composing compounds. As the translational energy of the atoms, molecules, or ions increases, the temperature of the matter increases. Heating a sample of a crystalline solid increases the vibrational energy of the atoms, molecules, or ions. When the vibrational energy becomes great enough, the crystalline structure breaks down and the solid melts.
P12.13: The potential energy of an object on Earth's surface is increased when the object's position is changed from one closer to Earth's surface to one farther from Earth's surface.
P12.14: Chemical reactions either release energy to the environment (exothermic) or absorb energy from the environment (endothermic).
P12.15: Nuclear reactions—fission and fusion—convert very small amounts of matter into appreciable amounts of energy.
P12.16: Total energy is conserved in a closed system.
P12.17: The motion of an object can be described by its position and velocity as functions of time and by its average speed and average acceleration during intervals of time.
P12.18: Objects undergo different kinds of motion—translational, rotational, and vibrational.
P12.19: The motion of an object changes only when a net force is applied.
P12.20: The magnitude of acceleration of an object depends directly on the strength of the net force and inversely on the mass of the object. This relationship ($a=F_{net}/m$) is independent of the nature of the force.
P12.21: Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted by the second object back on the first object. In closed systems, momentum is the quantity of motion that is conserved. Conservation of momentum can be used to help validate the relationship $a=F_{net}/m$.
P12.22: Gravitation is a universal attractive force that each mass exerts on any other mass. The strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.
P12.23: Electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel. The strength of the electric force is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them. Between any two charged particles, the electric force is vastly greater than the gravitational force.

NEW HAVEN PUBLIC SCHOOLS SCIENCE CONTENT OUTLINE MAP *www.newhavenscience.org* ***October 2015***

Taught using learning cycle: Engage, Explore, Explain, Elaborate, Evaluate.

Key inquiry skills/practices with real-world experiences the majority of time:

Questioning, Modeling, Investigating, Analyzing/Math, Constructing Explanations, Argument from Evidence, Communicating/Discourse

(Note, K-5 content changes/ dependent on 3 kit/yr supply and school specific rotation, should be at least 100/min week hands-on science!)

	~Quarter One		~QuarterTwo	~Quarter	Three	~Quarter Four	
K	Weather		Object Properties		Seasons	Living Things: characteristics	
1	Measurement		Motion (nk)		Light Properties	Living Things: Structure	
2	Solids/Liquids		Soil		Nutrition (nk)	Animal Life Cycles	
3	Rocks		Material Properties *ET		Recycling/ Conservation	Plant Life Cycles	
4	Force and Motion		Ecosystems (nk)		Water	Electricity *ET	
5	Sound	Light and Color	Light and Uses (Lenses)	Senses (nk) *ET	Sun, Earth, Moon **(CMT TEST FOLLOWS)**	Health Topics/choice	
6	Ecosystem Populations		Weather Systems		Water Resources *ET	Simple Machines	
7	Properties of Matter	Chemical Properties	Cells	Genetics/ Reproduction	Life Systems Musculo-Skeletal	Life Systems Biochemical *ET	Microbes/ Food Safety
8	Forces/Bridges	Forces/ Motion *ET	Solar System Motion	Landforms/Earth Forces	Tectonic Plates **(CMT TEST FOLLOWS)**	Rock Cycle	Natural Disasters
9 PhyChem	Heat/Phase Changes	Atoms/ Bonding *ET	Polymers *ET	Earth chemical cycles *ET	Earth Materials/ Environment Impact *ET	Energy/ Electricity *ET	Energy Sources/ Impacts *ET
10 Bio	BioChemistry *ET	Cells/ Bacteria/ Viruses *ET	Heredity/ Genetics *ET	Evolution	Diseases/ Populations *ET **(CAPT TEST FOLLOWS)**	Organism Interdependence	Organism Behavior/ Structure
11 Chem	Chemical Properties	Atomic Structure	Nuclear	Compounds/ Bonding	Reactions/ Equations	Gas Behavior	Organic Chemistry
12 Physics	Motion	ACCEL	2 D Motion	Forces/Work	Energy/Electric	Wave/Sound/Light	Mod Physics

*ET = CT Embedded Task, NHPS District Unit Tasks and Quarterly Assessments Also Required Grades 7-12

New Haven City Wide Science Fair May 16,17,18