High School Science Program Update

“Science” and therefore science education—is central to the lives of all Americans.

A high-quality science education means that students will develop an in-depth understanding of content and develop key skills—communication, collaboration, inquiry, problem solving, and flexibility—that will serve them throughout their educational and professional lives.”

https://www.nextgenscience.org/

Nashua School District Vision, Mission, & Values

Our Vision: *The Nashua School District will be the model for excellence in public education for our students, staff and community.*

Our Mission: *The Nashua School District will educate the whole child to empower student success.*

Our Values: *The Nashua School District values a passion for learning and the importance of integrity, trust, respect, empathy and tenacity.*

Portrait of a Learner

Vision of A Graduate: Competency based reimaging of mission statement

Student Learning practices maximize the impact of learning for each student.

The school has a vision of the graduate that includes the attainment of transferable skills, disciplinary/interdisciplinary knowledge, understandings, and dispositions necessary to prepare learners for their future. Students are assured consistent learning outcomes through a defined curricular experience and have the opportunity to demonstrate their skills and knowledge in a variety of creative ways. Students actively participate in authentic learning experiences while practicing the skills and habits of mind to regularly reflect upon, and take ownership of, their learning.

Action Steps to Improve Science Achievement with High-Quality Instruction for all Students

1. Align the Science Curriculum with the Next Generation Science Standards & update course sequence.

1. Increase required science credits for graduation from 2 to 3 to increase proficiency in Science & Engineering Practices.

Align the Science Curriculum with the Next Generation Science Standards and update course sequence.

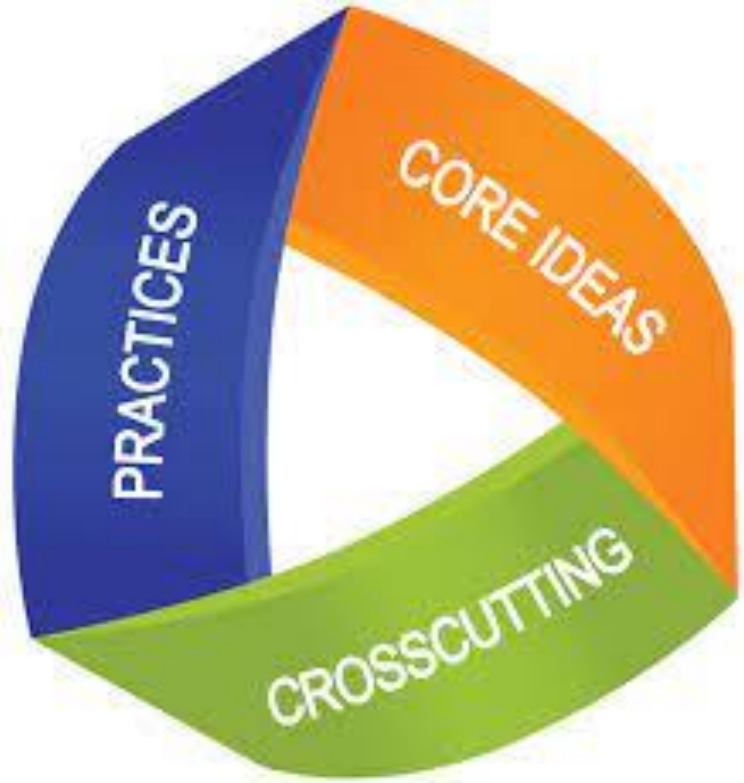
Next Generation Science Standards

Disciplinary Core Ideas: Life Science, Earth Science, Physical Science, and Engineering, Technology, and the Application of Science

Crosscutting Concepts: Patterns, Cause & Effect, Scale, proportion & quantity, Systems & system models, Energy & matter, Structure & function, Stability & change

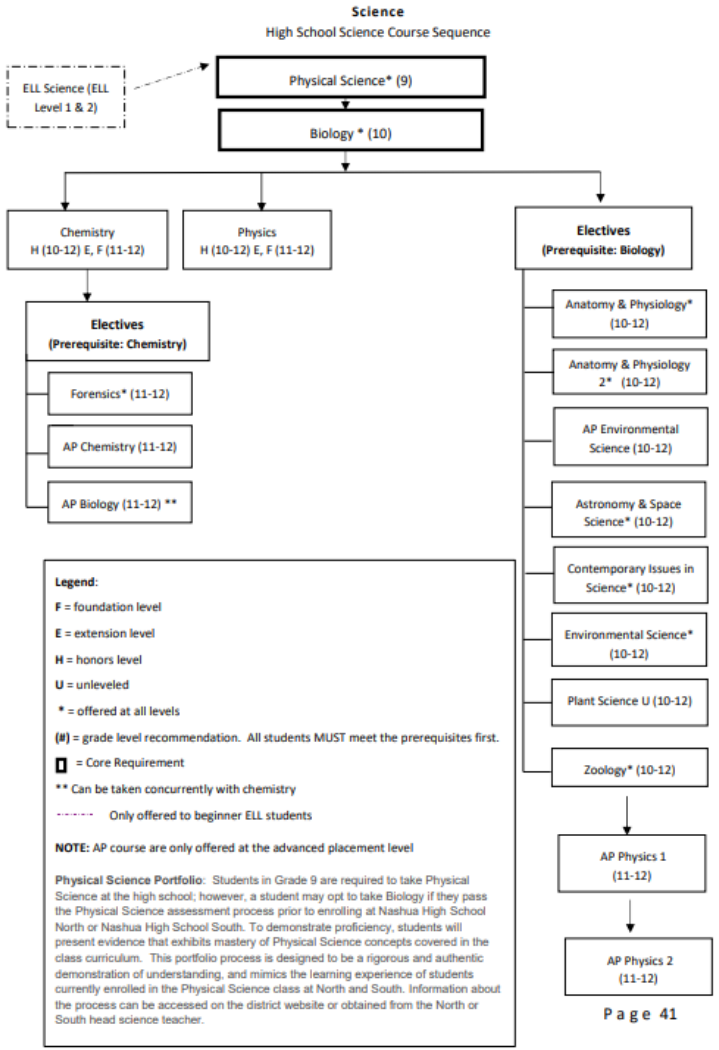
Science & Engineering Practices: Asking questions, Developing & using models, Planning & carrying out investigations, Analyzing & interpreting data, Using mathematics & computational thinking, Constructing explanations and designing solutions, Engaging in argument from evidence, Obtaining, evaluating, & communicating information

https://www.nextgenscience.org/



Current Requirements & Sequence

- Physical Science & Biology are graduation requirements & prerequisites for all other science courses
- Students may double up sciences to take more electives/AP Courses. Some students would prefer to skip Physical Science in order to take additional higher level courses.
- 8th grade will have a greater emphasis on Physical Science standards moving forward. https://docs.google.com/document/d/1hWSCJTAIrQKFPWoI9CyIji9xRBrSWB2o4oQlIf3_ehQ/edit (8th grade was previously Earth Science)
- ELL Science is offered for level 1 & 2 ELL students prior to Physical Science (Does not currently meet graduation requirements).



NGSS Model Course Maps

"States and districts/local education agencies are not expected to adopt these models; rather, they are encouraged to use them as a starting point for developing their own course descriptions and sequences."

1. **Conceptual Progressions Model:** The grade-banded PEs are organized so that student understanding of concepts is built progressively throughout the course sequence. This model maps PEs into courses based on what ***concepts are needed for support without focusing on keeping disciplines separate.***
   (3 integrated science courses)

1. **Science Domains Model:** The grade-banded PEs are organized into content-specific courses that match the three science domains of the Framework: ***physical sciences, life sciences, and earth and space sciences.***
   (Earth, Life, & Physical Science)

1. **Modified Science Domains Model:** The grade-banded PEs are organized into content-specific courses that match a common high school course sequence of ***biology, chemistry, and physics***. To ensure that all students have access to all standards, the PEs connected to the earth and space sciences domain of the Framework are divided among these courses. This model was included as a model for comparison because it is currently a common sequence in high schools across the United States.
   (Biology, Chemistry, & Physics *with Earth Science divided among courses****)***

https://nap.nationalacademies.org/

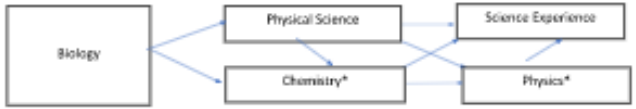
NSD NGSS Proposed Course Sequence

9th Grade	10th & 11th Grades	12th Grades
Biology	Physical Science → Elective Chemistry→ Physics	Electives & AP Courses

- Biology, Chemistry, and Physics are based on the NGSS Modified Domain model.
- Physical Science will include standards in physics, chemistry, and earth science.
- Curriculum is being developed for Biology, Physical Science, Chemistry & Physics first, then elective course curriculum will be rewritten to meet NGSS.
- NGSS Curriculum can be developed within the current framework/courses that already exist.

Science

High School Science Course Sequence



Science Elective Prerequisites

Biology and a Physical Science Course (Physical Science, Chemistry*, Physics*, or AP Physics 1*)	Biology and Physical Science or Chemistry*	Biology and Chemistry*
Astronomy & Space Science Contemporary Issues in Science Environmental Science AP Environmental Science Plant Science Zoology AP Physics 2**	Anatomy & Physiology 1 Anatomy & Physiology 2**	Forensic Science AP Biology AP Chemistry

*Math Prerequisite **Part 1 is a prerequisite for Part 2

Science Experience Credit Options

Science Department Courses	CTE Courses
Anatomy & Physiology Astronomy Chemistry Contemporary Issues in Science ELL Science Environmental Science Forensic Science Plant Science Physical Science Physics Zoology AP Biology AP Chemistry AP Environmental Science AP Physics 1 and 2	Intro to Engineering Principles of Engineering Manufacturing, Eng., Design & Development Health Sciences Biotechnology & Biomedical Sciences Marine Robotics VEX Robotics CADD

Rationale for Course Sequence Changes

- The proposed high school course sequence aligns with the new middle school progression.
- Biology is a common experience for all students and meets the NH state requirement, while incorporating Earth Science standards.
- Students have choice while meeting the NH state physical science requirement. This sequence allows students to choose physical science courses based on their interests.
- All students will have access to all NGSS Performance Expectations. This is a pathway to implement the NGSS Modified Domain model, while giving student choice.
- There will be more opportunities for students to take engaging and impactful science electives and increase Science and Engineering Practice proficiency.

Increase required science credits for graduation from 2 to 3 to increase proficiency in Science & Engineering Practices.

Rationale for Additional Science Requirement

Improving Science Proficiency:

North SAS Testing Using TIDE

2017-2018 – 225 tested 43% proficient (NH 41% proficient)

2018-19 – 164 tested 41% proficient (NH 41% proficient)

2019-2020 – No testing COVID-19

Note: approximately 400 students should take the test each year, many have opted out

Next Generation Science Standards

Disciplinary Core Ideas

Crosscutting Concepts

Science & Engineering Practices: Asking questions, Developing & using models, Planning & carrying out investigations, Analyzing & interpreting data, Using mathematics & computational thinking, Constructing explanations and designing solutions, Engaging in argument from evidence, Obtaining, evaluating, & communicating information

Rationale continued

STEM Employment Projections

Employment in STEM occupations : US Bureau of Labor Statistics

Table 1.11 Employment in STEM occupations, 2020 and projected 2030
(Numbers in thousands)

Occupation category	Employment, 2020	Employment, 2030	Employment change, 2020–30	Percent employment change, 2020–30	Median annual wage, 2020(1)
Total, all occupations	153,533.8	165,413.7	11,879.9	7.7	$41,950
STEM occupations(2)	10,204.2	11,278.7	1,074.5	10.5	$89,780
Non-STEM occupations	143,329.5	154,135.0	10,805.5	7.5	$40,020

Subject Area	Grad Requirement *(Credits)*	Courses and notes to fulfill requirement
Art Education	0.5	Graphics Design 1 or 2 may meet the Art or ICT requirement. All Art, Drama, and Music courses meet the Art Education requirement.
Information and Computer Technology	0.5	See List of Advanced Computer Courses
English	4	English 1, 2, 3, and either English 4 or an elective. At least one course must be taken every year.
Mathematics	3 (*Algebra 1, Part 1 and 2 or Algebra 1(H) is required.)*	Students must have a math experience every year of high school.
Physical Science	1	Physical Science is a prerequisite for all science courses and is taken freshman year. *Students may submit a Physical Science Portfolio for approval to determine advanced standing and course credit in lieu of taking Physical Science.*
Biological Science	1	Biology is required for graduation.
Social Studies	3	World Studies, Civics, Economics, and US History are required. AP World History meets World Studies requirements. AP US Government meets Civics requirements. AP Microeconomics or AP Macroeconomics meet Economics requirements. AP US History meets US History requirements.
Physical Education	1	Sports Education is required. Fit for Life or Personal Fitness are also required.
Health	0.5	Health 1
Electives	12.5 or 5.5	12.5: Standard Diploma 5.5: Core Diploma

2021 Graduates with 2 or 3+ Science Department Classes

Graduating Students in 2021 at Nashua High School South

3+ Science Classes: 289 **289/363= 79.6%**
2 Science Classes: 74

Graduating Students in 2021 at Nashua High School North

3+ Science Classes: 242 **242/310= 78.1%**
2 Science Classes: 68

(This list excludes students who have not taken at least 2 science classes, excludes transferred classes in the count, and excludes classes

The majority of High Schools in the Greater Nashua area and the State already require 3 + Science Credits to graduate

Greater Nashua Area (North, South, Merrimack, Alvirne, BG, H-B, Milford, Pelham, Wilton, Campbell, Mascenic, Souhegan)

9 of 12 Area high schools require 3+ science credits to graduate. Only North, South and Merrimack do not.

In NH (Sample was 80 schools who participate in NHIAA Basketball) There are 111 Public High schools in NH. Three private, catholic schools are included in the sample (BG, Bishop Brady, St. Thomas) and 2 Public/Private Academies (Pinkerton, Pembroke)

73% of schools in sample require 3+ science credits to graduate

58 out of 80 require 3+

1 requires 2.5 (John Stark)

Proposed Science Graduation Requirements

1. Biological Science: Biology is required for graduation.
2. Physical Science: Physical Science, Chemistry, Physics or AP Physics meet the physical science requirement.
3. Science Experience: Students must have an additional science experience credit for graduation.

Proposed Science Experience Courses

Science Department Courses

Anatomy & Physiology
Astronomy
Chemistry
Contemporary Issues in Science
ELL Science
Environmental Science
Forensic Science
Physical Science
Physics
Plant Science
Zoology
AP Biology
AP Chemistry
AP Environmental Science
AP Physics 1 & 2

CTE Courses

Intro to Engineering
Principles of Engineering
Manufacturing, Eng., Design & Development
Health Sciences
Biotechnology & Biomedical Sciences
Marine Robotics
VEX Robotics
CADD

Next Steps

1. Change graduation requirements for the Class of 2027.

1. Update course sequence and appropriate course prerequisites to align with the new course progression for the 2023-24 Program of Studies.

1. Continue NGSS curriculum work and updating curriculum documents for Biology, Physical Science, Chemistry, and Physics. Update course descriptions to reflect curriculum changes..

1. Modify curriculum for elective science department courses to align with NGSS.

1. Create new science electives based on student interest, including broadening earth science opportunities.

Course Sequence Draft 2023

Program of Studies Science Changes for 2023-24