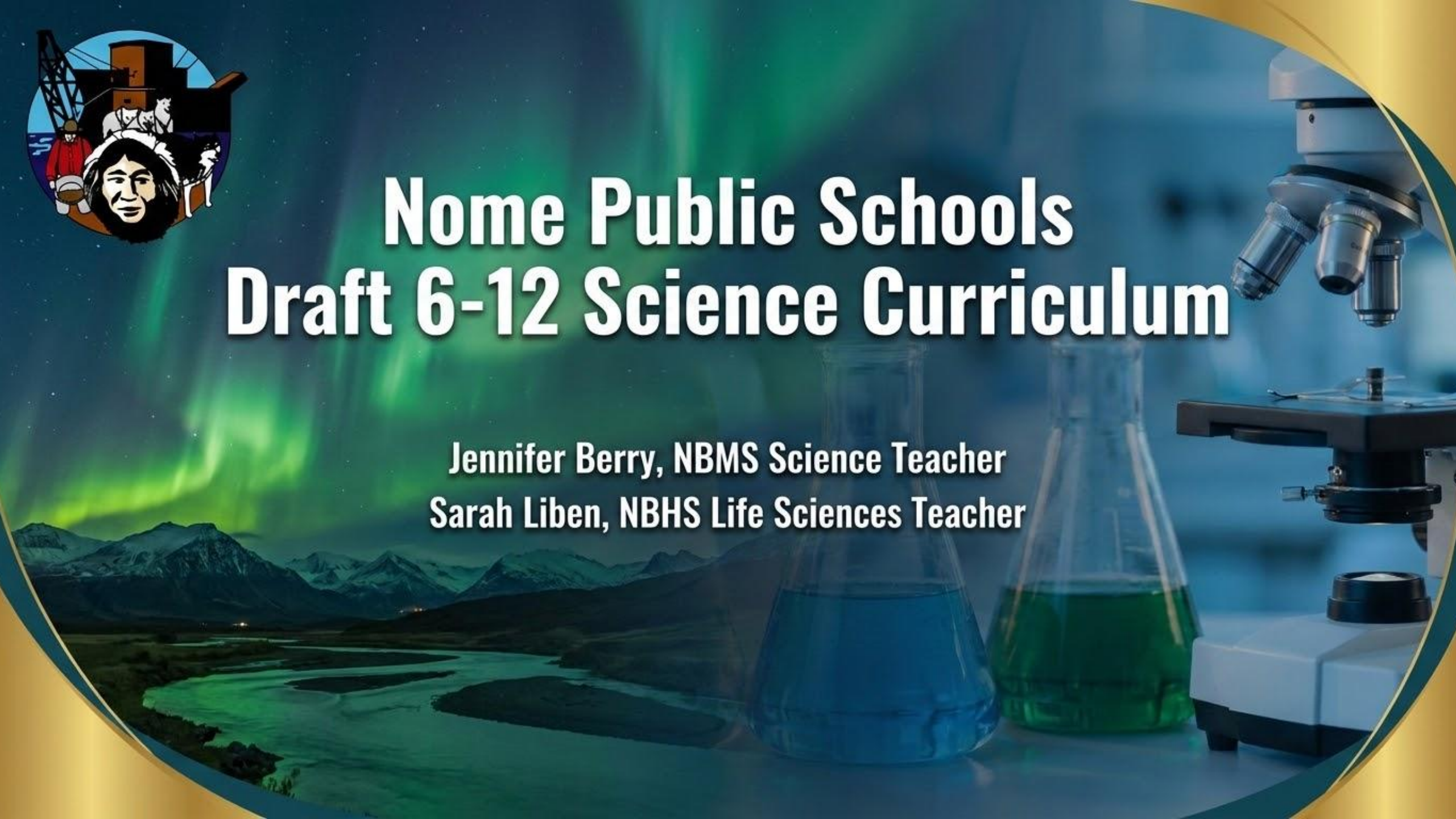


Nome Public Schools
Draft 6-12 Science Curriculum

Jennifer Berry, NBMS Science Teacher
Sarah Liben, NBHS Life Sciences Teacher

OUR GOAL AT NBMHS IS TO GRADUATE STUDENTS WHO ARE PREPARED TO BE SUCCESSFUL ADULTS.

ATTENDANCE/TEAMS

PRIORITIZE student attendance to improve academic readiness while maximizing their educational experience.

ACADEMICS/PLCS

IMPLEMENT an academic plan with fidelity to increase student achievement.

BEHAVIOR/TEAMS

ENSURE a school environment where staff and students can be successful.

ENGAGEMENT /TEAMS

SUPPORT student, family, and community engagement to grow a culture of belonging.

Science Department Smart Goal

"By the end of Semester 1, 2024-25, we will have a horizontal alignment for all core and related science elective courses with the intention of creating a vertical alignment from these resources. Each instructor will develop a horizontal alignment for every class they teach with feedback from the entire PLC group."

Horizontal vs. Vertical Curriculum Alignment

Ensures that students learn in a cohesive and organized manner

Horizontal (Same content)

- Same instruction from every teacher in that subject
- Teachers coordinate activities, note-taking methods, Learning Targets
- Science pathways to graduation (remedial, general, advanced)
- Science sequence (i.e. Earth Science 9th grade, Biology 10th grade, etc)

Vertical (K-12 Progression)

- What students learn in one grade level prepares them for the next
- Teachers who teach same content meet across grade level bands

Science Department Revised Smart Goal

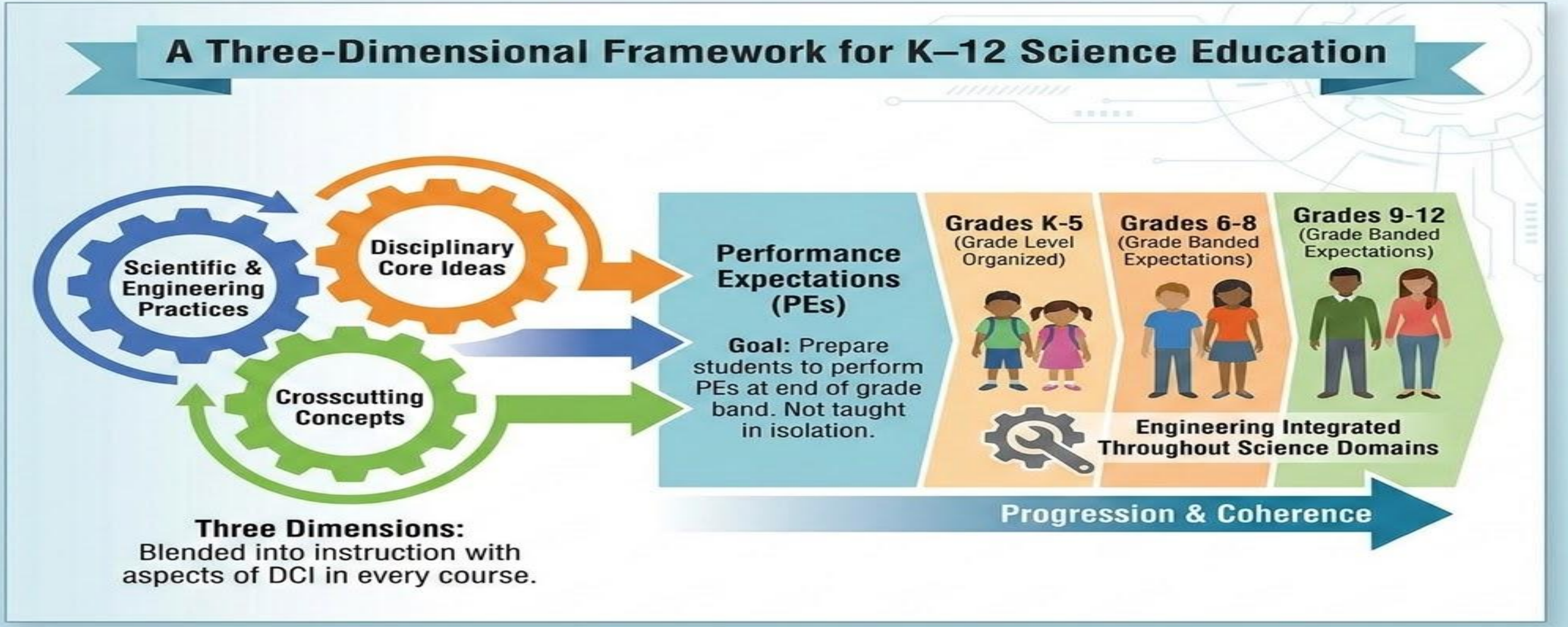
"By the end of Semester 2, 2025-26, we will have a vertical alignment for all core and related science elective courses."

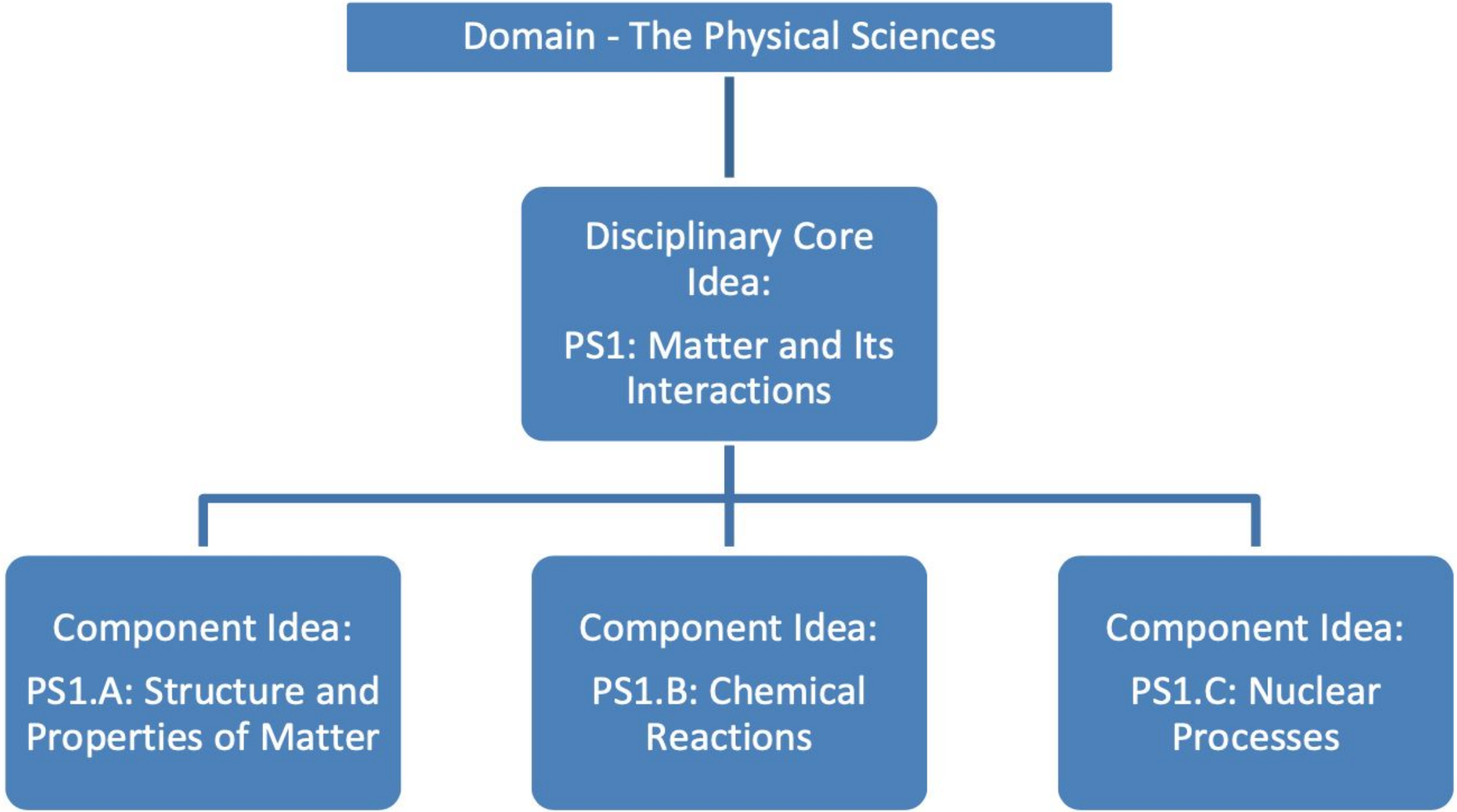
Please See Model Course Mapping in Middle and High School For Next Generation Science Standards

What is Our Objective?

- Mapping out What to Teach (and) When
- Background: Next Generation Science Standards (NGSS) organized by grade level from K-5 but as grade banded expectations at middle school (6-8) and high school (9-12)

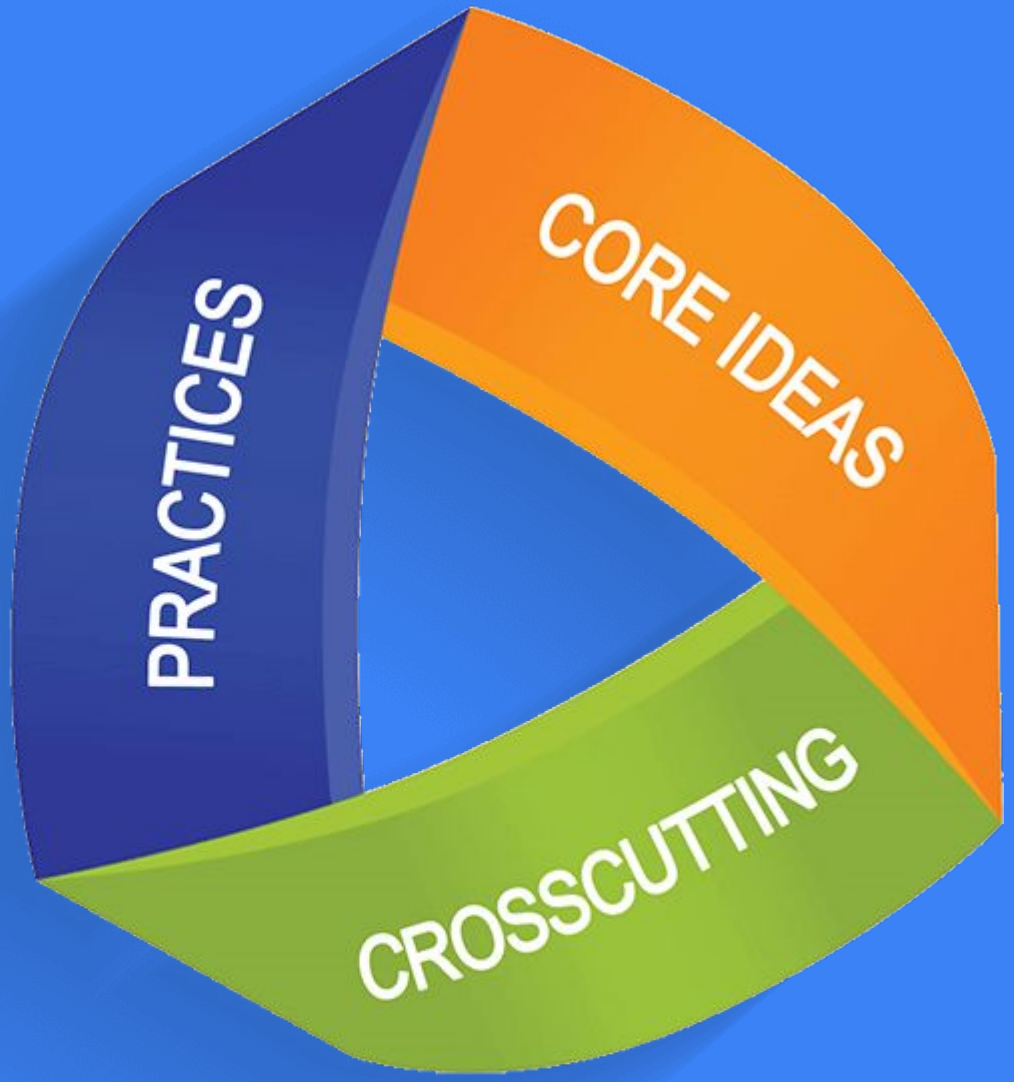
Structure of the Next Generation Science Standards (NGSS)



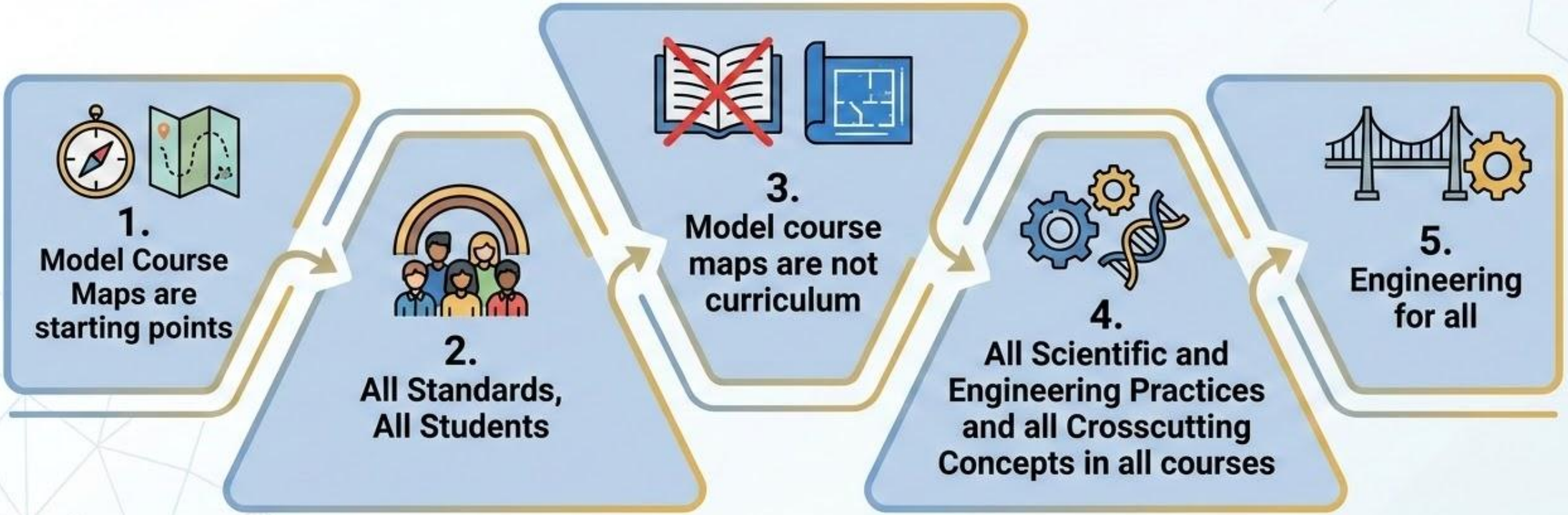

Domain - The Physical Sciences
Disciplinary Core Idea:
PS1: Matter and Its Interactions
Component Idea:
PS1.A: Structure and Properties of Matter
Component Idea:
PS1.B: Chemical Reactions
Component Idea:
PS1.C: Nuclear Processes

What is NGSS?

NGSS



Foundations for Understanding NGSS Model Course Maps



6-8 MIDDLE SCHOOL CURRICULUM

6

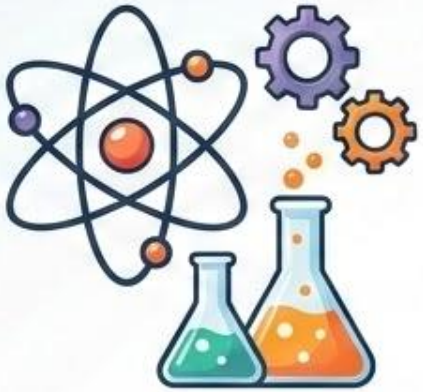
6th Grade: Earth Sciences

7

7th Grade: Life Sciences

8

8th Grade: Physical Sciences



PROCESS

1) NBMHS Team established objectives of vertical alignment, using NGSS as baseline
2) Used FBNS curriculum as a template
3) Rearranged Earth Science (History of Universe/Space first)
4) Updated textbook and chapters
5) Added column for Place-Based/Cultural Activities

6th Grade Earth Science

Semester 1:

Intro to NBMHS/Nature of Science

Formation of the Universe and Space Exploration

The Solar System

The Dynamic Earth

Semester 2:

Rocks, Minerals, Natural Resources, Geologic Change

Circulation of Earth's Air and Water

Weather and Climate/Natural Hazards

Performance Expectations*

Science Competencies

Foundational Skills

- Scientific Method
- Variables
- Claim, Evidence, Reasoning

Measurement & Data

- Measurement
- Decimals, Exponents
- Scientific Notation
- Significant Digits
- Analog Time
- Converting temperature, length

Lab & Communication

- Lab Equipment
- Lab Safety
- Graphing
- Writing Lab Reports

UNIT 2: THE SOLAR SYSTEM						
Timing: Semester 1, Quarter 1 **Teaching Time Required:** All estimated teaching times are based on a 50 minute period. **Textbook: *iScience* Unit 5: *Exploring the Universe: Ch. 20: The Sun-Earth-Moon System***						
Topic	**Days**	**Objectives**	**Key Vocabulary**	**Activity**	**Cultural Standards/ Activities**	**Resources & Materials**
Ch. 2: How did the Solar System and Earth form?	2	–Explain formation of solar system and Earth	–gravity –density –bya	–Scale of Solar System Project –Textbook reading, questions	Native American/ Alaska Native stories	–11x17 paper
Ch. 20: Earth – Sun – Moon System: –lunar phases, eclipses, tides	3	–Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of the sun and moon.	–Orbit –Phase –Eclipse –Umbra –Penumbra	–Eclipse nay nay video –Eclipse lab with flashlights –Monthly moon chart –Phases of the Moon foldable –Textbook reading, questions	Native American/ Alaska Native stories	–lab:flashlights,sun, earth, moon balls –coloring pages of planets –Brain Pop
Seasons	3	–Develop and use a model of the Earth-Sun-Moon system to describe the seasons.	–Season –Tilt –Solstice –Equinox	–Seasons Brain Pop –Solstice foldable –Textbook reading, questions	–Inupiaq/Yup'ik Seasons of Subsistence	–Brain Pop
Tides	3	Develop and use a model of the Earth-Sun-Moon system to describe tides.	–Tide –Spring tide –Neap tide –Bore tide	–Notes –Tides video –Turnagain Arm Bay of Fundy bore tide videos –Textbook reading, questions	–Turnagain Arm bore tide	–Notes –videos
Aurora	2	–Explain how the Aurora works and the height of the colors	–Aurora borealis/australis	–Aurora notes –Art project	–Inuipiaq stories	
Unit Project	2	–Aurora art project				
Standards:	**MS-ESS1-1:** Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.					

7th Grade Life Sciences

Semester 1:

- Introduction to NBMHS, Nature of Science
- Cells and Organization in Organisms
- Reproduction, Heredity, and Growth
- Evolution

Semester 2:

- Classification of Organisms
- The History of Life on Earth
- Matter and Energy in Living Systems
- Ecosystem Dynamics
- **Performance Expectations***

*Refer to curriculum document for details.

UNIT 6: ECOSYSTEMS

Timing: Semester 1, Quarter 2
Teaching Time Required: 28 days
Textbook: *iScience Life Science, Ch. 20*

Topic	Days	Objectives	Key Vocabulary	Activity	Cultural Standards/ Activities	Resources & Materials
Resource Availability Affects Organisms	5	–Interpret data to predict the effects of resource availability on the growth of organisms and populations in an ecosystem.	–Ecosystem –Biomes –Biotic Factor –Abiotic Factor –Species –Population –Community	–BrainPop –Moby Max –Textbook reading, questions	–Nome area ecosystems (tundra)	
Interactions in Ecosystems	5	–Analyze patterns of interaction between organisms.	–Predator –Prey –Herbivore –Symbiosis –Competition	–BrainPop –Moby Max –Textbook reading, questions		
Matter & Energy in Ecosystems	5	–Develop a model to explain how matter and energy flow through ecosystems.	–Producer –Consumer –Decomposer –Food Web –Energy Pyramid	–BrainPop –Moby Max –Textbook reading, questions	–Nome area food webs	
Changes in Ecosystems	5	–Use evidence to support an explanation of how changes in ecosystems cause changes in populations.	–Disturbance –Succession –Gradual Change –Interconnected –Pioneer Species –Recovery	–BrainPop –Moby Max –Textbook reading, questions		
Unit Test	3			Western Alaska Food Web Poster		

Standards:

- **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- **MS-LS2-1** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

8th Grade Physical Sciences

Semester 1:

- Introduction to NBMHS, Nature of Science
- Structure of Matter
- Atomic Theory
- Forces and Motion

Semester 2:

- Energy Transfer/Transformation
- Electric and Magnetic Forces
- Waves and Information Transfer
- Ongoing, yearlong learning objects: Scientific Process Skills and Engineering Design Concepts

UNIT 4: ENERGY TRANSFER AND TRANSFORMATION

Timing: Semester 2, Quarter 3
Teaching Time Required: 18 days
Textbook: *iScience* Physical Science, Ch. 5

Topic	Days	Objectives	Key Vocabulary	Activity	Cultural Standards/ Activities	Resources & Materials
Introduction to Energy	5	–Identify various sources and forms of energy, and classify them as potential or kinetic.	–Energy –Potential Energy –Kinetic Energy	–Eureka video BrainPop –Moby Max –Textbook reading, questions		
Changes in Energy	5	–Investigate relationships among the amount of energy transferred, the type of matter, the mass, and the change in temperature of a sample.	–Energy Transfer –System	–BrainPop –Moby Max –Textbook reading, questions		
Temperature and Heat	5	–Examine energy transfers, conservation of energy, and identify energy that is useful vs. energy that is unavailable	–Temperature –Thermal Energy –Heat	–BrainPop –Moby Max –Textbook reading, questions		
Thermal Energy Transfer in Systems	6	Differentiate between renewable and non- renewable energy resources. Investigate how energy is produced and used, including alternative energy sources in Alaska. Evaluate the impact of energy production methods on the environment.	–Renewable resource –Non-renewable resource	–Textbook reading, questions	–Energy in Alaska, alternative energy options in Western Alaska	Alaska Resource Education
Unit Test/Project	3			Design an insulator		
Standards:	**MS-PS3-1:** **MS-PS3-2:** **MS-PS3-5:** **MS-PS3-3:** **MS-PS3-4:**					

Concepts Not Covered in Middle School

LS: Life Science

- Hardy Weinberg
- Human Body Systems

ES: Earth Science

Herzburg-Russell Diagram of stars

PS: Physical Science

- Buoyancy
- Fluid Dynamics

These were included in textbook and Nitty Gritty curriculum, and some in NGSS standards.

Housekeeping Edits to Complete

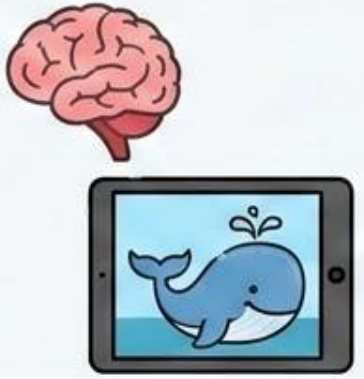
1) Add text to standards for ES, PS
2) Chapters for LS, PS
3) Write pacing guides, organize handouts, files

Questions to Answer

1) Where to teach Dinosaurs? NGSS says Life Science, but I feel it belongs in Earth Science

2) Where to teach Natural Resources? ES with mining in Alaska or PS with Energy?

3) Make a block in each course for Nature of Science, *Welcome to* NBMHS?



4) Will we have BrainPop and Moby Max next year?

Grades 9-12 Science Course Tracks

Need 2 Credits to Graduate

Remedial Track

9th Grade
Foundations of Life Science
(year-long course- 1 HS credit)

10th Grade
Foundations of Physical/Earth Science*
(year-long course: 1 HS credit)

General Track

9th Grade
Earth Science**
(year long course- 1 HS Credit)

10th Grade
Biology
(year long course: 1 HS credit)

Students may take Upper level Science Courses from 11th-12th Grade (see Advanced Track)

Advanced Track

9th Grade
Biology
(year long course: 1 HS credit)

10th - 12th Grade Options:

- **Chemistry***: 1 HS Credit
- **Physics***: 1 HS Credit
- **Intro to Env. Science**: 1 HS / 4 College Credits
- **Human Anatomy & Physiology*****

* Needs to be developed
** Not developed but curriculum resources will be available
*** A&P Curriculum purchased by Liben; District investment encouraged

What is Curriculum?

Curriculum is….

- a standards -based sequence of planned experiences where students practice and achieve proficiency in content and applied learning skills.
- the central guide for all educators as to what is essential for teaching and learning, so that every student has access to rigorous academic experiences.
- the structure, organization, and considerations in a curriculum are created in order to enhance student learning and facilitate instruction.
- Curriculum must include the necessary goals, methods, materials and assessments to effectively support instruction and learning.

INTRODUCTION TO ANATOMY UNIT

Review of biology, homeostasis and regulation, and anatomy basics, such as anatomical terminology and histology

SUPPORT AND MOTION UNIT

Skeletal system, movement and joints, and the muscular system

CONTROL AND COORDINATION UNIT

Nervous system, senses, and endocrine system

TRANSPORT UNIT

Blood, the cardiovascular system, and respiratory system

ABSORPTION AND EXCRETION UNIT

Digestive system, nutrition and metabolism, and the urinary system

PROTECTION UNIT

Integumentary system, lymphatic system, and immune system

REPRODUCTION UNIT

Male and female reproductive systems, fertilization, and pregnancy

ANATOMY INDEPENDENT RESEARCH PROJECTS

Adopted Textbooks

Introduction to Environmental Science

Grade(s): 11-12
Length: two semesters
Credit: 1.0 (4.0 college credits)*
Prerequisites: Teacher recommendation or *Biology*, and *Chemistry*
Textbook: Pearson *Environmental Science*

This course can be taught as a high school science course or for college credit. College credit is incumbent on the incorporation of a lab section that requires students to complete 10 lab-based activities over the course of the school year. In the past, this course has used online-lab resources purchased though ScienceInteractive:

https://https://www.scienceinteractive.com/www.scienceinteractive.com/

Course Overview:
Introduction to Environmental Studies is designed to be equivalent to a one-semester, introductory college course, through which students engage with the scientific principles, concepts and methodologies required to understand the interrelationships of the natural world. Environmental science is an interdisciplinary subject that embraces various topics including geology, biology, ecology, hydrogeology as well as earth and atmospheric science. The course requires that students identify and analyze natural and human made environmental problems at the local level, evaluate the relative risks associated with these problems and examine alternative solutions for resolving or preventing these issues.

This can be taught as a lab based course where each lab is designed to help reinforce concepts and skills that are addressed in class. Students will complete up to 10 labs throughout the school year and will be asked to work independently as well as collaboratively in groups.

This course integrates two significant activities each semester. The Strait Science Lecture Review will engage students in primary resources as they analyze and discuss Strait Science lectures on a variety of environmental topics. Strait Science is a local lecture series organized by Northwest Campus that invites researchers to discuss local projects ongoing in the region with community members. Strait Science lectures viewed in class will be relevant to course content and encourage students to reflect on the scientific process as they identify the research objective and hypotheses, discuss project methods as well as analyze the significance of the results presented in the lecture. Students will discuss the significance of the research to their community and region, delineate questions that they would like answered on the topic and note any biases that may be present in the research. In addition, students will work collaboratively with classmates to research local environmental issues for the Stewards of Our Land project. The objective of this project is to familiarize students with local issues related to renewable energy sources and mining operations so that students may brainstorm ways to inform the community on complex issues as well as provide strategies to ameliorate negative impacts on the environment. Projects may include discussions of environmental topics through the local radio station, publish articles in the school and local newspaper, and/or construct project proposals that may be discussed with local leaders in order to discuss possible solutions that may resolve issues we currently face in Nome.
.

Units(Recommended Order)	
Semester 1	**Semester 2**
Traditional Teaching Method: • Introduction to Environmental Science • Biosphere • Atmosphere	Traditional Teaching Method: • Atmosphere (continued) • Geosphere • Hydrosphere

Housekeeping Edits to complete

Add text to standards for all Unit

Write Pacing Guide for Curriculum Map

Curriculum Map: Revise and edit Atmosphere and Geosphere units

Organize handouts and files

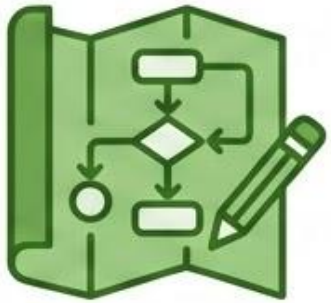
Implementation Guide: Overview of interactive notebooks, place-based projects, list of community contacts

Biology

Grade(s): 9-12 **Length**: two semesters **Credit**: 1 **Prerequisites**: Teacher recommendation, Freshman entry- level class	**Course Overview**: *Biology* is a one-year course (1 credit) designed to meet the Biological Science Requirements for graduation. Students will engage in the practices of science to help them understand how scientific knowledge develops as well as gain an appreciation for the wide range of approaches used to investigate, model and explain the world. Such practices will include learning how to develop and use models, planning and carrying out investigations, analyzing and interpreting data as well as engaging in argument from evidence. Academic content will focus on core ideas that will help students develop a broader and deeper understanding of content so that it can be used to make sense of new information and resolve authentic problems. First semester will begin with the Nature of Science, transition into the Cells: Structure and Function concluding with Ecosystem Dynamics. Second semester will focus on Chemistry of Life, Genetics: Inheritance and Variation of traits and will conclude with Evolution and Natural Selection. **Adopted Textbook**: *Biology*, Miller and Levine

Units (Recommended Order)	
Semester 1	**Semester 2**
Traditional Teaching Method: • The Nature of Science • Strutcure of Life: From Cells to Organisms • Ecosystem Dynamics* *This unit can be taught in the fall or spring to allow for place-based lessons.	Traditional Teaching Method: • Chemistry of Life • Genetics: Inheritance and Variation • Evolution and Natural Selection *This unit can be taught in the fall or spring to allow for place-based lessons.

Housekeeping Edits to complete



1. Revise & Edit Curriculum Map

Using the FNSD template.

2. Write Pacing Guide

For Curriculum Map.

3. Organize Handouts & Files

Prepare materials for distribution.

4. Implementation Guide

Overview of interactive notebooks, place-based projects, list of community contacts.

Foundations of Life Science

Grade(s): 9-11 **Length**: two semesters **Credit**: 1 **Prerequisites**: Teacher recommendation	**Course Overview**: *Foundations of Life Science* is a one-year course (1-credit) that meets a core-science requirement for graduation. This class is designed with interactive investigations that dive into the topics related to fisheries and arctic gardening practices. During the first semester, students will learn how to raise pacific salmon (Coho) in a classroom incubator from the egg to fry stage under the supervision of the Norton Sound Economic Development Corporation (NSEDC) fisheries biologists and technicians. Through hands-ons projects and activities, students will study topics about the life cycle, habitat requirements, and behavior/ physical adaptations of salmon before releasing their fry in Moonlight Springs at the end of the school year. Second semester, the class will switch gears and focus on plants and arctic gardening through the development of an indoor vegetable garden. Cheryl Thompson will help supervise indoor garden activities and assist students as they transfer their knowledge through activities at the Community Garden. Throughout Semester 2, students will learn about the diversity, reproductive strategies and physiology of plants. Over the course of the year, students will also discuss local employment opportunities in fisheries available to them after high school as well as discuss and implement a business plan that utilizes the resources from their school vegetable garden. . **Adopted Textbook** To be Determined. (Used to develop this curriculum: *Environmental Science*. National Geographic, 2022)

Units (Recommended Order)	
Semester 1	**Semester 2**
• Introduction: Nature of Science • Fisheries Management • Classroom Gardening	• Classroom Gardening/Fisheries Management (ongoing)* • Wildlife Management *Place-based Projects: Raising Salmon in the Classroom and Gardening will continue until the end of S2

Housekeeping Edits to Complete

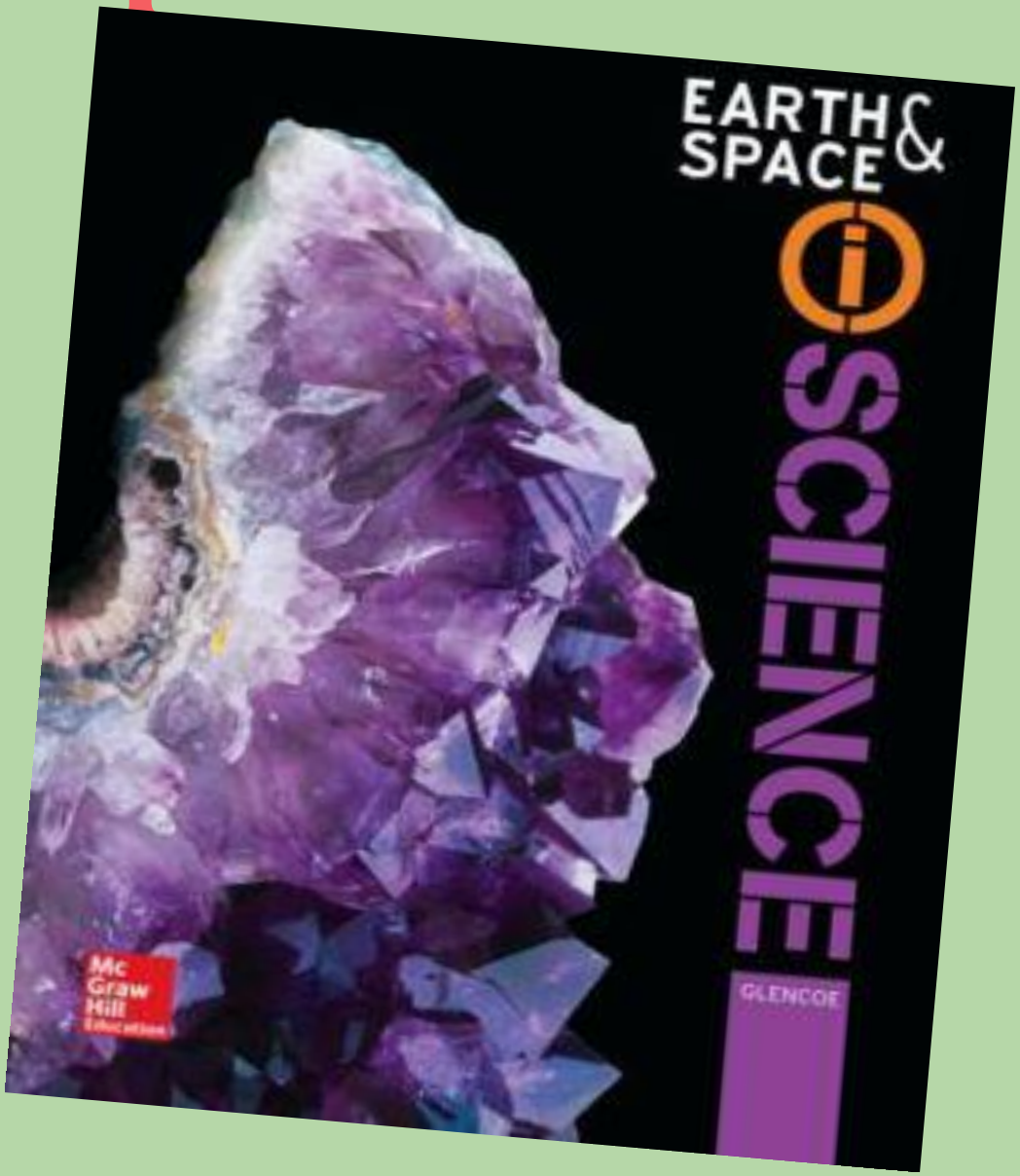
Revise and Edit Curriculum Map using the FNSD template

Write Pacing Guide for Curriculum Map

Organize handouts and files

Implementation Guide: Overview of interactive notebooks, place-based projects, list of community contacts

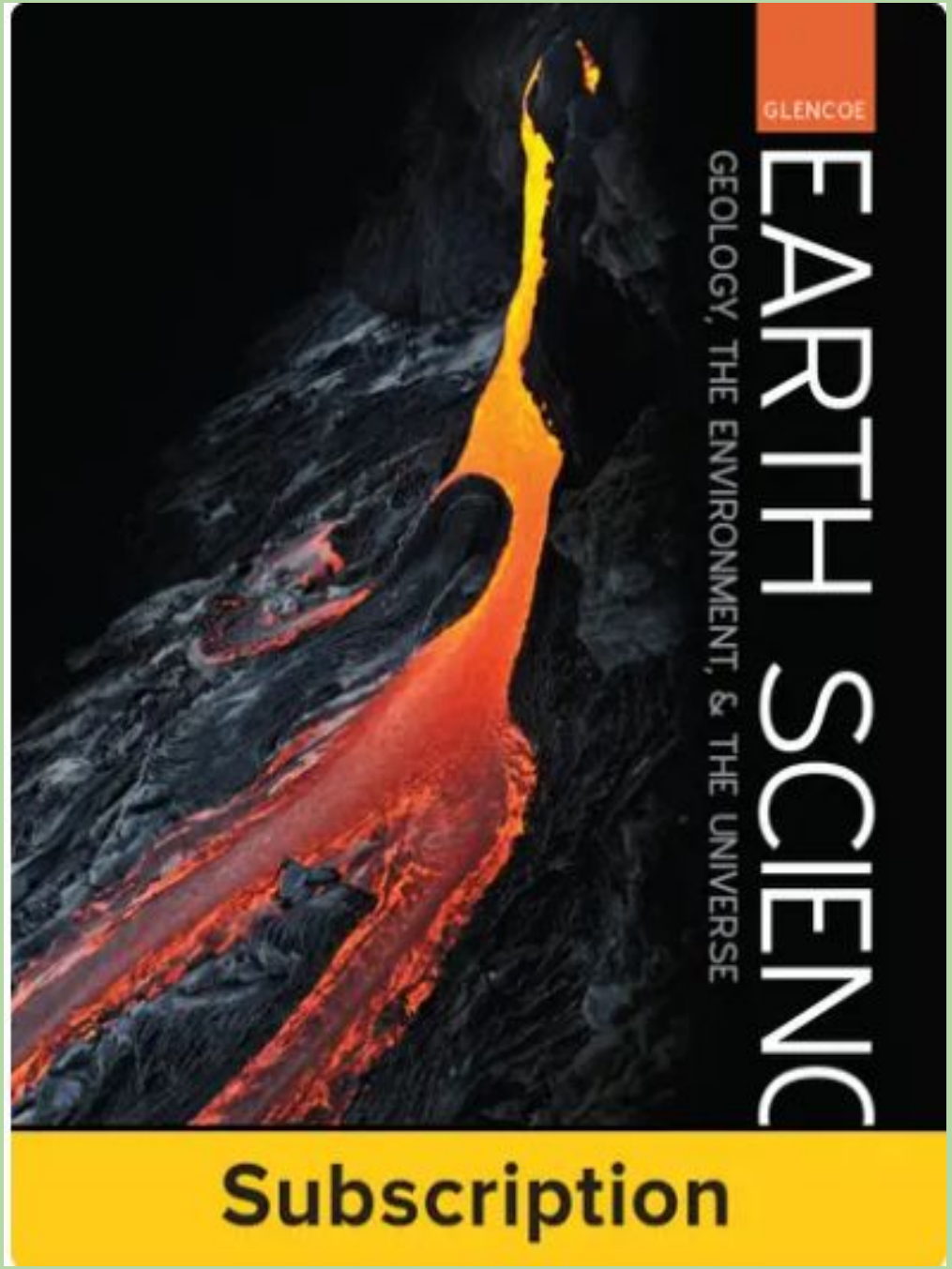
Adopted Textbooks



Coming soon...

Glencoe Earth Science: GEU, Complete Teacher Bundle, 1-year Subscription

Glencoe Earth Science: GEU, Complete Student Bundle, 1-year Subscription



Future Work

Incorporate more **place-based/culturally-relevant lessons** from ADFG, Village Science, UAF Math in Cultural Context

Align with **K-5**

Align with **Portrait of a Graduate**

Holiday Plans (Orange Shirt Day, Indigenous People's Day, Pi Day, Earth Day, etc)

Comments for the Board

1. What are we hoping to accomplish with our work?
    a. An adoption that allows incoming middle/high school science teachers the freedom and flexibility to choose materials from our work to implment in their own classrooms (i.e. not required; some teachers may be coming into the District with their own materials).
    b. We are hoping to help reduce work load, especially for teachers that are new to the profession and/or area, from developing courses from the foundation up. We offe place-based and culturally relevant curriculum that addresses the strands that construct the Next Generation Science Standards and is vertically aligned with the Life Science Standards.
2. Working model? i.e. teachers that want to continue working on this can work with the district to add and revise material?