Unit 1: Think Like a Scientist

Key Concept: Systems
Related Concept: Form, Function
Global Context: Scientific and Technical Innovation

NGSS:

- Crosscutting Concept: Patterns
- MS-ETS1: Engineering and Design

Statement of Inquiry: The Scientific Method allows us to investigate the form and function of patterns observed in natural systems.

Inquiry questions:
Factual: What are the steps of the Scientific Method?
Conceptual: How can we use the Scientific Methods to design experiments?
Debatable: Can the Scientific Method of inquiry be used to solve any problem?

Main Content:

- The scientific method
- Write a testable question and hypothesis
- Manipulated, responding, and controlled variables
- Observation vs Inference
- Writing Conclusions
- Lab Safety

Resources: Youtube, It's Okay to Be Smart, Teachers Pay Teachers

Summative Assessment:
Criteria A (knowing and understanding)

i. Outline scientific knowledge

ii. Apply scientific knowledge and understanding to solve problems set in familiar situations and suggest solutions to problems set in unfamiliar situations

iii. Interpret information to make scientifically supported judgements

Criteria B (inquiring and designing)

i. Outline an appropriate problem or research question to be tested by a scientific investigation.

ii. Outline a testable prediction using scientific reasoning

iii. Outline how to manipulate the variables, and outline how data will be collected

iv. Design scientific investigations

Criteria C (processing and evaluating)

i. present collected and transformed data

ii. interpret data and outline results using scientific reasoning

iii. discuss the validity of a prediction based on the outcome of the scientific investigation

iv. discuss the validity of the method

v. describe improvements or extensions to the method.

ATLs *(goal is how to be a successful student in science class)*

Category: Communication **Cluster:** Communication **Skill Indicator:** structure information in summaries, essays, and reports

Category: Self-management **Cluster:** Reflection **Skill Indicator:** Develop new skills, techniques, and strategies for effective learning

Category: Self-management **Cluster:** Organization **Skill Indicator:** bring necessary equipment and supplies to class, keep an organized and logical system of information files/notebooks

Unit 2: Writing Gets Electrified!

Key Concept: Form
Related Concept: Energy, Systems
Global Context: Globalization and Sustainability explored through communication

NGSS:

- Crosscutting Concepts: Systems and System models; Energy and Matter: Flows, Cycles, and Conservation
- MS-PS3.A. Definitions of Energy
    - MS-PS3-2 A systems of objects may also contain stored (potential) energy, depending on their relative positions
- MS-PS3.B Conservation of Energy and Energy Transfer
- MS-ETS1 Engineering Design

Statement of Inquiry: We use writing structures to synthesize and share information.

Inquiry questions:

Factual: What are the necessary components for different types of writing?
Conceptual: How can we organize our thoughts to communicate information?
Debatable: Are there better ways to share information?

Main Content:

- Magnetism
- Electric circuits and components
- Electromagnetism
- Insulators, conductors, and resistance
- Scientific Writing

Resources: Discovering Electricity STC kit, Prentice Hall Science Explorer: Electricity and Magnetism, PHET simulation, YouTube

ATLs *(apply scientific knowledge to understand global issue)*
Category: Communication **Cluster:** Communication **Skill Indicator:** Structure information in summaries, essays, and reports
Category: Research **Cluster:** Media Literacy **Skill Indicator:** locate, organize, analyze, evaluate, synthesize, and ethically use information

Category: Thinking **Cluster:** Critical Thinking **Skill Indicator:** Recognize unstated assumptions and bias
Category: Thinking **Cluster:** Creative Thinking **Skill Indicator:** ask “what if” questions and generate testable hypotheses

Summative Assessment:
Criteria A (knowing and understanding)

i. Outline scientific knowledge

ii. Apply scientific knowledge and understanding to solve problems set in familiar situations and suggest solutions to problems set in unfamiliar situations

iii. Interpret information to make scientifically supported judgements

Criteria B (inquiring and designing)

i. Outline an appropriate problem or research question to be tested by a scientific investigation.

ii. Outline a testable prediction using scientific reasoning

iii. Outline how to manipulate the variables, and outline how data will be collected

iv. Design scientific investigations

Criteria C (processing and evaluating)

i. present collected and transformed data

ii. interpret data and outline results using scientific reasoning

iii. discuss the validity of a prediction based on the outcome of the scientific investigation

iv. discuss the validity of the method

v. describe improvements or extensions to the method.

Criteria D (Reflecting on the Impacts of Science)

i. Summarize the ways in which science is applied and used to address and specific problem or issue

ii. Describe and summarize the various implications of using science and its application in solving a specific problem or issue

iii. Apply scientific language effectively

iv. Document the work of others and sources of information used

Unit 3: Ride the Behavior of Waves

Key Concept: Relationships

Related Concepts: Energy, Movement and Interaction

Global Context: Scientific and Technological Innovation (explored through communication)

NGSS:

- **Crosscutting Concepts:** Systems and System Models; Energy and Matter: Flows, Cycles, and Conservation
- **MS-PS4-1** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- **MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- **MS-PS4-3** Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Statement of Inquiry: Engineers use properties of waves to design everyday tools.

Inquiry Questions:

Factual: What are the properties of waves?
Conceptual: What is the relationship between the behaviour of energy and how we transform it into different uses?
Debatable: Has our use of wave energy transformed the world for the better?

Resources: A Better Lesson, STC Carolina Kit, Sound and Light: Prentice Hall Science Explorer, IET Faraday (Institute of Engineering and Technology) Faraday, It's Okay to be Smart, The Oatmeal

Main Content:

- Wave Behavior
- Properties of Waves
- Properties of Sound
- Electromagnetic Spectrum and Communication
- Properties of Light
- Color

Summative Assessment:

Criteria A (knowing and understanding)

i. Outline scientific knowledge

ii. Apply scientific knowledge and understanding to solve problems set in familiar situations and suggest solutions to problems set in unfamiliar situations

iii. Interpret information to make scientifically supported judgements

Criteria B (inquiring and designing)

i. Outline an appropriate problem or research question to be tested by a scientific investigation.

ii. Outline a testable prediction using scientific reasoning

iii. Outline how to manipulate the variables, and outline how data will be collected

iv. Design scientific investigations

Criteria C (processing and evaluating)

i. present collected and transformed data

ii. interpret data and outline results using scientific reasoning

iii. discuss the validity of a prediction based on the outcome of the scientific investigation

iv. discuss the validity of the method

v. describe improvements or extensions to the method.

ATLs *(conduct investigations and participate in activities with less teacher direction)*

Category: Self-Management **Cluster:** Organization **Skill Indicator:** use appropriate strategies for organizing complex information
Category: Self-Management **Cluster:** Affective Skills **Skill Indicator:** self-motivation and resilience
Category: Thinking **Cluster:** Critical Thinking **Skill Indicator:** use models and simulations to explore complex systems and issues

Unit 4: What's the MATTER with Chemistry?

Key Concept: Change

Related Concepts: Form, Interaction

Global Context: Identities and Relationships (explored through properties of matter)

NGSS:

- **Crosscutting Concepts:** structure and function, cause and effect
- **MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

Statement of Inquiry: We use the relationship between matter and energy to identify a substance based on change.

Inquiry Questions:

Factual: What are the physical and chemical properties of matter?
Conceptual: What is the relationship between changes in matter and changes in energy?
Debatable: How can we use the properties of matter to innovate?

Resources: Prentice-Hall Science Explorer: Chemical Building Blocks (Ch. 1 and 2)
Teachengineering.org, Kristin Lee/Teacherspayteachers,
MisterScience/Teacherspayteachers
https://www.theverge.com/2013/2/18/4002550/scientists-find-weird-new-property-of-matter-that-breaks-all-the-rules

Main Content:

- Properties of matter
- Elements and compounds.
- Mixtures and solutions.
- Density
- Physical and chemical changes.
- Relationship between forms of energy and changes in matter.
- States of matter.
- Relationship between volume, temperature, and pressure of a gas

Summative Assessment:

Criteria A (knowing and understanding)

i. Outline scientific knowledge

ii. Apply scientific knowledge and understanding to solve problems set in familiar situations and suggest solutions to problems set in unfamiliar situations

iii. Interpret information to make scientifically supported judgements

Criteria C (processing and evaluating)

i. present collected and transformed data

ii. interpret data and outline results using scientific reasoning

iii. discuss the validity of a prediction based on the outcome of the scientific investigation

iv. discuss the validity of the method

v. describe improvements or extensions to the method.

ATLs *(Demonstrate understanding of material in a creative way)*

Category: Thinking **Cluster:** Creative-Thinking **Skill Indicator:** generate metaphors and analogies

Category: Communication **Cluster:** Communication **Skill Indicator:** use a variety of media to communicate with a range of audiences

Category: Self-management **Cluster:** Organization **Skill Indicator:** plan short and long-term assignments, meet deadlines

We can make it better! Ice Cream Design Challenge

Key Concept: Development

Related Concepts: Form, Function

Global Context: Scientific and Technological Innovation (explored through product creation)

NGSS:

- **Crosscutting Concepts:** Energy and Matter: Flows, Cycles, and Conservation; Structure and Function
- **MS-PS1-4** Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- **MS-PS1-6** Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
- **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **MS-PS3-4** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- **MS-PS3-5** Construct, use, and present arguments to support the claim that when the motion of energy of an object changes, energy is transferred to or from the object.

Statement of Inquiry: Human ingenuity drives the development of innovative products.

Inquiry Questions:

Factual: How does knowledge of thermal energy apply to designing a better ice cream maker?

Conceptual: How does the design cycle help people create products or design solutions?

Debatable: Is following the design cycle an important part of creating a product?

Resources: SchoolHouse Rock “Mother Necessity”; Review Skeptic;Thermal Energy: Transfer and Phase Change: Making Ice Cream;
websites: https://www.weareteachers.com/recognize-bias/
https://www.cnet.com/how-to/spot-fake-amazon-reviews-with-fakespot/
https://www.techlicious.com/tip/how-to-tell-if-a-review-is-fake/
https://www.allaboutexplorers.com/explorers/columbus/

Main Content:

- Relationship between temperature of a substance and the average kinetic energy of the particles that make up a substance
- States of matter and thermal energy
- The design cycle

**need to understand the process of how to make ice cream in order to design the best possible ice cream maker. Need to know why salt-ice gets cold, that the heat from the cream mixture needs to move into the ice salt mixture, and that insulating the heat from the air or your hands will make this work better.

Summative Assessment:

Criteria C (Creating the Solution)

i. Outline a plan, which considers the use of resources and time, sufficient, for peers to be able to follow to create the solution.

ii. Demonstrate excellent technical skills when making the solution

iii. Follow the plan to create the solution, which functions as intended

iv. List the changes made to the chosen design and plan when making the solution

v. present the solution as a whole.

Criteria D (Evaluating)

i. Outline simple, relevant testing methods, which generate data, to measure the success of the solution

ii. Outline the success of the solution against the design specification

iii. Outline how the solution could be improved

iv. Outline the impact of the solution on the client/target audience

ATLs *(work collaboratively in groups and communicate positively)*

Category: Communication **Cluster:** Communication **Skill Indicator:** negotiate ideas and knowledge with peers and teacher.

Category: Social **Cluster:** Collaboration Skills **Skill Indictator:** manage and resolve conflict, work collaboratively in teams; listen actively to other perspectives and ideas; exercise leadership and take on a variety of roles within groups

Category: Thinking **Cluster:** Creative Thinking **Skill Indictator:** design improvements to existing machines, media, and technologies

Category: Thinking **Cluster:** Transfer **Skill Indicator:** combine knowledge, understanding, and skills to create products or solutions

Unit 5: Ecosystems and Interdependence

Key Concept: Relationships

Related Concepts: Energy, Interaction

Global Context: Globalization and Sustainability

NGSS:

- **Crosscutting Concepts:**
- **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.
- **MS-LS2-4** Construct an argument supported by empirical evidence that changes to the physical or biological components of an ecosystem affect populations.
- **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Statement of Inquiry: Understanding relationships in an ecosystem impacts the decisions we make globally.

Inquiry Questions:

Factual: What is an ecosystem?
Conceptual: How does energy flow through an ecosystem?
Debatable: What responsibility do we have to practice sustainability?

Resources: A Better Lesson Mariana Serrano, Environmental Science: Prentice Hall Science Explorer, BiologyGuy “Ecosystems: Interactions, Energy, and Dynamics”, It’s Okay to be Smart, Lynda R. Williams “Ecological Problem Research Project, Youtube.

Main Content:

- What are ecosystems, abiotic and biotic factors
- Effect on populations of organisms that live in an ecosystem
- Limiting Factors
- Interactions between living things (symbiotic/commensalism, parasitic, mutualism, predator-prey, competition)
- Energy Flow in ecosystems
- Food Chains and Food Webs

- Carbon and Nitrogen Cycles
- Biodiversity

Summative Assessment:

Criteria A (knowing and understanding)

i. Outline scientific knowledge

ii. Apply scientific knowledge and understanding to solve problems set in familiar situations and suggest solutions to problems set in unfamiliar situations

iii. Interpret information to make scientifically supported judgements

Criteria D (Reflecting on the Impacts of Science)

i. Summarize the ways in which science is applied and used to address and specific problem or issue

ii. Describe and summarize the various implications of using science and its application in solving a specific problem or issue

iii. Apply scientific language effectively

iv. Document the work of others and sources of information used

ATLs *(goal: write for a variety of purposes, show more effort in the writing)*

Category: Communication **Cluster:** Communication **Skill Indicator:** use a variety of organizers for academic writing tasks.

Category: Communication **Cluster:** Communication **Skill Indicator:** structure information in summaries, essays, and reports

Category: Self-management **Cluster:** Organization **Skill Indicator:** plan short and long term assignments; meet deadlines