

Science Curriculum Map: Lab Chem CP

2024

Updated 9/1/2024

<u>Unit</u>	<u>Topics</u>	<u>Time Frame</u>	<u>Standards</u>
Search for Life	• Are we alone? • Substances crucial to support life • Why water is so important • Explain charges and electricity • How electrolytes support life • Salts, what they are and how they are formed. • Dissolving salts in water • How the molecules of living things are formed • Substituting elements into molecules of life • Should scientists look for life on other planets	24-35 class periods	HS-PS1-1 HS-PS1-2 HS-PS1-3 HS-PS2-6 HS-ESS2-5 HS-ESS1-2
Fuels	• Why cars run on gasoline • Energy transfer from fuel to motion of a vehicle • Energy released from combustion reactions • Chemical reactions and rearrangement of atoms in molecules • Energy changes in chemical reactions. • Types of chemical bonds • Hydrogen as a fuel alternative to gasoline • Carbon emissions from vehicles, how to reduce or eliminate	21-25 class periods	HS-PS1-4 HS-PS3-5 HS-PS3-1 HS-PS1-7 HS-ESS3-2

Oysters	- What is happening to oysters on the West coast? - Acidification of the oceans and water sources - Properties of acids - How oysters make their shells - Impact of acid on oyster shell formation - Ocean buffer system - How can we fix the acidification of the oceans	27-31 class periods	HS-PS1-5 HS-PS1-6 HS-PS1-7 HS-ESS3-4  HS-ESS3-6 
Nuclear	- Nuclear reactions - Nuclear chain reaction - Isotopes - Fission vs Fusion energy output - Uses of nuclear reactions for energy generation - Nuclear radiation - Radioactive materials and waste	23-27 class periods	HS-PS1-8 HS-ESS3-2
Polar Ice	- Causes of rising sea levels - Melting of Antarctic ice - Glaciers, why are they important - Slowing down the melting of polar ice and glaciers - Social and justice considerations important for dealing with rising seas	26-31 class periods	HS-PS1-8 HS-ESS3-2

Unit 1 Summary: Name of Unit

This chemistry unit on the structure and properties of matter focuses on the substances scientists should look for when looking for life on other planets. Students explore the properties of substances necessary for life on Earth and how they interact with other substances, figuring out key ideas about charges on atoms and molecules, and patterns of bonding, focusing initially on the unique properties of water and then applying their knowledge to other elements. They learn to use the Periodic Table to predict what atoms will react with other atoms and identify substitutions for elements necessary for life on Earth that scientists could look for when searching for life on other planets. Students learn how scientists use probes to explore materials on planets in our solar system and information on light from other planets in far away solar systems to determine what elements are there.

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

Are we alone?

Why are certain substances such important supports for life?

Why is water so important?

How can we explain charges and electricity, and why might they be important to explaining why water is so important for life?

What is an electrolyte and how does it support life?

Why don't all salts make a one-to-one ratio?

Is water a salt?

Why is water so good at dissolving salts?

How do we search for life in outer space?

How are living things' molecules formed?

Can arsenic "switch" for phosphorus in DNA?

Can we substitute another compound for water?

How do scientists currently look for life and its substances?

Should scientists look for life on other planets, and if so, where should they look?

Vocabulary/Key Terms**Tier 2**

living, non-living, DNA, elements, photosynthesis, dissolving, conductivity, electrical charge, proton, neutron, electron, ion, electrolyte, valence electron,

Tier 3

biological molecules, phospholipid, membrane proteins, nucleic acids, carbohydrates, enzyme proteins, metal ions, static electricity, covalent bond, ionic bond, polarity,

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

Transfer Task 1, Transfer Task 2, SEET

Minor Assessments: Quizzes (20%)

Assessment Overview

Labs (30%)

Types of Liquids Investigation

Sticky Tape

PhET Static Electricity

Conductivity of Substances

Investigating Properties of Water

Practice (Homework/Classwork =10 %)

Various textbook problems and/or worksheets to polish necessary skills and reinforce objectives.

Formative Assessments: *Will use one of the techniques listed below as necessary to assess students*

Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

Inquiry Hub Chemistry Storylines Curriculum Unit 1 Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14

[General Education,](#)

[IEP,](#)

[504,](#)

[Multilingual Learners,](#)

[Students at-risk,](#)

[Gifted and Talented](#)

STANDARDS for Learning Targets		
NJSLS Science	Cross curricular	CTE(NJSLS 9) Technology(NJSLS)
HS-PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS1-3: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS1-2: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.	Math A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. S.ID.A Summarize, represent, and interpret data on a single count or measurement variable. S.IC.A Understand and evaluate random processes underlying statistical experiments. ELA RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem. W.AW.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.	CTE 9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. Technology 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society and environment and share this information with the appropriate audience.

Sample Measurable Objectives for Lesson Planning
• The charged substructure of atoms helps explain the formation of bonds. • Properties of water such as its cohesion, power to dissolve things, ability to absorb, transmit, and make water a valuable substance for supporting life processes. • The properties of water are linked to the structure and charges on a water molecule and to the properties of the elements that make it up. • The organization of the Periodic Table allows us to infer properties of elements and make predictions about what elements will bond with other elements to form compounds. • How attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter. • Scientists looking for life on other planets search mainly for substances that can be found on Earth and support life on Earth, but are also investigating elements that could substitute for other elements and play similar roles when combined with other elements. • Elements on other planets can be identified by the unique electromagnetic spectrum each element produces.

Unit 2 Summary: Fuels

This high school chemistry unit starts with our recognition of an urgent problem -- the need to change how we get energy for transportation to limit carbon emissions and curb global climate change. This leads us to a noticing -- there's an alternate fuel called hydrogen (used in rockets), that has a much higher energy output per gram than gasoline, and produces no CO₂ through burning. We end up asking the question, so why don't we just use rocket fuel in our cars and not gasoline?

Through investigating the answer to this question, students first look to chemical reactions and energy to really figure out *why* rearranging matter sometimes seems to result in a net increase or decrease in energy of the surroundings. They then zoom in to the atomic scale to build and refine models of bonding that help explain these changes in energy at the bulk scale.

After linking atomic structure, attractive and repulsive forces, and bonding to endothermic and exothermic processes, students still wonder why hydrogen has such a high energy output per gram, and turn to questions of measurement. How are we talking about how much fuel is in a fuel tank? And what is this thing called a mole? After building our final model to explain hydrogen combustion's unique appeal, we return back to the big picture. What would it take to use this fuel in our vehicles and in so doing combat climate change? What all must be weighed and considered in this decision that has profound implications for human and more than human life on the planet?

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

Why do cars run on gasoline and not rocket fuel?

What's the connection between the energy you get from burning fuel and moving a vehicle like a car or a rocket?

What is burning and how does it give us energy?

Could any chemical reaction be used to fuel a car? Do all chemical reactions "release" energy?

Can we model what is happening when particles are rearranging to help us explain changes we are seeing in energy?

Why might the breaking and making of bonds lead to temperature changes?

Why doesn't the energy that goes IN to break bonds and that comes OUT when bonds are made just "balance out"?

What makes some bonds stronger and other bonds weaker? Why do atoms form bonds anyway and what's 'stability'?

Can we explain now why hydrogen has such a high energy output per gram compared to other fuels?

What are the similarities and differences between one mole and one gram of hydrogen and gasoline?

Why does burning one mole of gasoline result in more energy than burning one mole of hydrogen?

What technology exists now to allow us to use a form of rocket fuel in a car?

How could we change transportation systems that would reduce or eliminate carbon emissions?

What should we do to decarbonize transportation and how can it be done? What part, if any, does hydrogen fuel play moving forward?

Vocabulary/Key Terms

Tier 2

fuel, gasoline, natural gas, octane, chemical reaction, endothermic, exothermic, attract, repel, carbon footprint,

Tier 3

mole, energy, kinetic energy, potential energy, fuel energy, fuel cell,

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

Transfer Task 1, Transfer Task 2, SEET

Minor Assessments: Quizzes (20%)

Assessment Overview

Labs (30%)

Burning Ethanol & BTB Test

Chemical Reactions

Netlogo Simulation: Bonds & Chemical Energy

Building Molecular Models

Electrolysis of Water

Practice (Homework/Classwork =10 %)

Various textbook problems and/or worksheets to polish necessary skills and reinforce objectives.

Formative Assessments: Will use one of the techniques listed below as necessary to assess students

Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

Inquiry Hub Chemistry Storylines Curriculum Unit 2 Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12, Lesson 13, Lesson 14, Lesson 15

[General Education,](#)

[IEP,](#)

[504,](#)

[Multilingual Learners,](#)

[Students at-risk,](#)

[Gifted and Talented](#)

STANDARDS for Learning Targets		
NJSLS Science	Cross curricular	CTE(NJSLS 9) Technology(NJSLS)
HS-PS1-4: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. HS-PS3-5: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. HS-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	Math A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. S.ID.A Summarize, represent, and interpret data on a single count or measurement variable. S.IC.A Understand and evaluate random processes underlying statistical experiments. ELA RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem. W.AW.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.	CTE 9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. Technology 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society and environment and share this information with the appropriate audience.

Sample Measurable Objectives for Lesson Planning
- Identify net energy changes in chemical reactions - Determine if reaction is endothermic or exothermic by looking at energy diagrams - Amount of particles is different from mass at the macro scale (measurements in grams). We need a way to keep track of both the mass of materials which we can measure on the macroscale and the amount of molecules we have because it is the amount of molecules that determines how much energy we can get from a specific mass. We can use the construct of a "mole" to talk about large amounts of atoms or molecules. - When doing a cost benefit analysis on different fuels we have to pay attention to more than just scientific or technological considerations, including socio-political considerations.

Unit 3 Summary: Oysters

In this unit on ocean acidification, students investigate what is happening to oysters along the West coast of the United States. They develop models of the changing dynamic equilibrium between the atmospheric carbon dioxide (CO₂) concentrations and the carbonic acid concentrations within the ocean, resulting from increased anthropogenic CO₂ emissions. Students ultimately explain how this changing equilibrium is affecting shellfish in the world's oceans and design a solution to preclude any further push toward lower ocean pH levels.

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

What is happening to oysters on the West coast?

Can we use carbon dioxide to make water more acidic?

What is an acid?

How does carbon dioxide interact with water to make it more acidic?

How do oysters make their shells?

How does increased acidity impact oyster shell formation?

Does acid destroy oyster shells?

Why isn't the ocean super acidic?

Why are shellfish dying?

Is it worse in some places than others?

How can we fix this problem?

Vocabulary/Key Terms

Tier 2

bivalve, acidity, pH, upwelling, renewable resources,

Tier 3

indicators, litmus paper, hydronium ion, equilibrium,

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

Transfer Task 1, Transfer Task 2, SEET

Minor Assessments: Quizzes (20%)

Assessment Overview

Labs (30%)

Measuring CO₂ in water

Acid-Base Lab

Acids dissolving Oyster Shells

Practice (Homework/Classwork =10 %)

Various textbook problems and/or worksheets to polish necessary skills and reinforce objectives.

Formative Assessments: Will use one of the techniques listed below as necessary to assess students

Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

Inquiry Hub Chemistry Storylines Curriculum Unit 3 Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11

[General Education,](#)
[IEP,](#)
[504,](#)
[Multilingual Learners,](#)
[Students at-risk,](#)
[Gifted and Talented](#)

STANDARDS for Learning Targets

NJSLS Science	Cross curricular	CTE(NJSLS 9) Technology(NJSLS)
HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.  HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. 	Math A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. S.ID.A Summarize, represent, and interpret data on a single count or measurement variable. S.IC.A Understand and evaluate random processes underlying statistical experiments. ELA RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem. W.AW.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.	CTE 9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. Technology 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society and environment and share this information with the appropriate audience.

Sample Measurable Objectives for Lesson Planning

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
- Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise.
- The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.

Unit 4 Summary: Nuclear

In this unit, students investigate how a milk-gallon-sized amount of uranium could destroy a city, and we ask ourselves whether and how this energy might be used for good and whether it should be used at all. The unit begins with investigations of fission within a nuclear chain reaction, stable and unstable isotopes, and the role of the strong force within the nucleus in binding protons and neutrons together. The unit turns to how nuclear chain reactions are controlled in nuclear power plants and explores radiation associated with both enrichment of uranium and waste from nuclear reactors. Students explore how people could communicate across hundreds of thousands of years the dangers associated with stored waste, and whether there are alternative ways to use nuclear energy that involve fusion. The unit ends with an engineering challenge that asks them to take up the ethical challenge: Should humans use nuclear energy?

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

What can a nuclear reaction do?

What is going on in a nuclear chain reaction?

What's the difference between different types of uranium?

Why does adding neutrons make uranium so unstable that it splits?

What is happening in the nuclear chain reaction in an atomic bomb?

Why does "splitting" in fission produce so much more energy than typical fuel sources?

How can we capture and use this energy for something other than for a bomb?

Why aren't all of our power plants nuclear?

Can radiation happen outside of the power plant and for how long?

How can we keep ourselves and future generations safe from radioactive materials?

Is there another option for nuclear power plants?

Should we ever use radioactive material?

Vocabulary/Key Terms

Tier 2	Tier 3
chain reaction, neutron, isotope,	fission, fusion, radioactive decay, half-life

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

Transfer Task 1, Transfer Task 2, & SEET

Minor Assessments: Quizzes (20%)

Assessment Overview

Labs (30%)

PhET Atom Builder

PhET Isotopes & Atomic Mass

PhET Nuclear Fission

PhET Half-Life

Practice (Homework/Classwork =10 %)

Various textbook problems and/or worksheets to polish necessary skills and reinforce objectives.

Formative Assessments: Will use one of the techniques listed below as necessary to assess students

Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

Inquiry Hub Chemistry Storylines Curriculum Unit 4, Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11, Lesson 12

[General Education,](#)

[IEP,](#)

[504,](#)

[Multilingual Learners,](#)

[Students at-risk,](#)

[Gifted and Talented](#)

STANDARDS for Learning Targets**NJSLS Science****Cross curricular****CTE(NJSLS 9) Technology(NJSLS)**

HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Math

A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

S.ID.A Summarize, represent, and interpret data on a single count or measurement variable.

S.IC.A Understand and evaluate random processes underlying statistical experiments.

ELA

RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.

W.AW.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.

CTE

9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Technology

8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.

8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution.

8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society and environment and share this information with the appropriate

Sample Measurable Objectives for Lesson Planning

- Nuclear processes are unique because they help explain how an atom can change from being one element to another.
- Nuclear processes are unique in the amount of energy produced compared to chemical processes.
- Fission, fusion, and radioactive decay are all processes where nuclei of atoms break apart or come together to form new ones that involve the strong and weak forces.
- Fission involves breaking apart the nucleus of an atom.
- Fusion reactions generally take place at really high temperatures and pressures, where the nuclei have lots of kinetic energy, energy that can overcome repulsion between two positively charged nuclei.
- Radioactive decay occurs when the relationship of protons and neutrons deviates from one where the nucleus is stable.
- Radioactive decay can take different forms (alpha, beta, gamma radiation).
- Radioactive decay occurs when an unstable isotope emits subatomic particles and energy to become more stable.
- The total number of neutrons plus protons does not change in any nuclear process.
- Nuclear processes do result in a small decrease in mass, which releases large amounts of energy.
- Energy cannot be produced for human consumption without costs of varying kinds, which are interrelated.
- The costs and benefits of energy production and other resource extraction vary in amount, salience of what kind to different stakeholders, and also in terms of who benefits and who suffers for decisions made by others.
- Ethical values (e.g., considerations of justice) should inform the evaluation of technological solutions to societal and environmental problems; science cannot resolve ethical dilemmas.
- The sources and means of energy production in a given location and time reflects policies and political processes, available technologies, and social and economic factors.
- Policies and innovations in technology influence the choice to rely on particular forms of energy.

Unit 5 Summary: Polar Ice

In this unit, students investigate the phenomenon of rising sea levels and warming oceans to figure out that thermodynamic energy in a system disperses. In the case of the melting Antarctic glaciers, we figure out that the temperatures of water and its behavior with more and less energy can help us predict changes in the Earth's ocean systems. The unit concludes by investigating the most important mitigation strategies for polar ice melt and students must engage with the constraints of modern life as they argue for a plan that will best fit the scientific evidence of sea level rise.

Essential Questions:

These questions establish inquiry to unify the unit's assignments and assessments.

Why are some people who live on coasts facing trouble?

How could ice melting so far away affect people in these different places?

How is Antarctic ice getting in the ocean?

Where are the glaciers?

What makes the most difference in ice melting?

Why does water melt ice faster than land and air?

How is polar ice melting creating global climate refugees?

Can we do anything to slow how fast Thwaites glacier is melting?

How can we be confident we are making the best decision about which design solution to implement?

What are communities doing now to deal with rising sea levels?

What scientific, social, and justice considerations are important to keep in mind as we design solutions to deal with rising seas?

Vocabulary/Key Terms

Tier 2

climate change, glacier,

Tier 3

glacier interfaces, climate refugee

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

Transfer Task 1, Transfer Task 2, SEET

Minor Assessments: Quizzes (20%)

Assessment Overview

Labs (30%)

Ice Melt Lab

PhET Diffusion Rates

Practice (Homework/Classwork =10 %)

Various textbook problems and/or worksheets to polish necessary skills and reinforce objectives.

Formative Assessments: Will use one of the techniques listed below as necessary to assess students
Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

Inquiry Hub Chemistry Storylines Curriculum Unit 5 Lesson 1, Lesson 2, Lesson 3, Lesson 4, Lesson 5, Lesson 6, Lesson 7, Lesson 8, Lesson 9, Lesson 10, Lesson 11

[General Education](#),
[IEP](#),
[504](#),
[Multilingual Learners](#),
[Students at-risk](#),
[Gifted and Talented](#)

STANDARDS for Learning Targets

NJSLS Science	Cross curricular	CTE(NJSLS 9) Technology(NJSLS)
HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	<u>Math</u> A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. S.ID.A Summarize, represent, and interpret data on a single count or measurement variable. S.IC.A Understand and evaluate random processes underlying statistical experiments. <u>ELA</u> RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem. W.AW.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence.	<u>CTE</u> 9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities. 9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data. <u>Technology</u> 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systematic plan of investigation, and propose an innovative sustainable solution. 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society and environment and share this information with the appropriate audience.

Sample Measurable Objectives for Lesson Planning

- Identify areas of climate refugees
- Identify the differences in land ice vs. sea ice
- Describe changes in glaciers as climate and weather change
- Analyze the differing rates of ice melt on the Antarctic coasts
- Investigate the rates of ice melt at land-ice, ice-ice, and water-ice interfaces
- Design ways to help reduce glacier melt