Unit 7: Water, A Fragile Resource

Content Area: **Science**
Course(s):
Time Period: **Marking Period 3**
Length: **3 weeks**
Status: **Published**

Summary

In this unit students will explore water as a resource and the major types of water pollution. This unit will also address what the sources of the pollutants are and how these pollutants affect the environment and affect climate change. Major topics include the categories of water pollutants, sewage treatment, eutrophication and chemical pollutants. Students will distinguish between point and non point sources of pollution and how we as individuals can help to reduce these sources. Students will also learn to measure water quality using various tools such as water testing kits.

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CS.9-12.8.2.12.EC.1	Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
CS.9-12.8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.
CS.9-12.8.2.12.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.
CS.9-12.8.2.12.ETW.4	Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.
LA.SL.11-12.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.
LA.SL.11-12.1.B	Collaborate with peers to promote civil, democratic discussions and decision-making, set clear goals and assessments (e.g., student developed rubrics), and establish individual roles as needed.
LA.SL.11-12.1.C	Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
LA.SL.11-12.3	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.S-IC.B.6	Evaluate reports based on data.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
SCI.HS.PS3.B	Conservation of Energy and Energy Transfer

SCI.HS.ESS2.C	The Roles of Water in Earth's Surface Processes
SCI.HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
SCI.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change have influenced human activity.
SCI.HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
SCI.HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
TECH.9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
TECH.9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).

Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down).

Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).

Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).

Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.

Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.

Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.

Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.

Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.

Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.

Examples of the causes of climate change differ by timescale, over 1–10 years: large volcanic eruption, ocean circulation; 10–100s of years: changes in human activity, ocean circulation, solar output; 10–100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10–100s of millions of years: long-term changes in atmospheric composition.

The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.

Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.

Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.

The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.

Essential Questions and Enduring Understandings

Essential Questions:

How has water as a resource impacted the development of human civilization?

What human activities use and impact water to the greatest degree?

What is the relationship between human use of freshwater and our ability to grow food?

How has global climate change influenced human access to water and its quality/quantity in different parts of the world?

Enduring Understandings:

Water is the most vital resource to human life and is needed by every person, every day not only for direct consumption but also to produce the things we eat and consume.

Human population growth and climate change have redistributed water and impacted the hydrologic cycle in ways that will create major challenges for food production and clean water access for millions of people around the world.

Objectives

Students will know key terms: point and non point pollution, Biochemical Oxygen Demand, Fecal coliform, sediment pollution, algal bloom, eutrophication, Dissolved Oxygen, thermal pollution, sludge, septic system, salinization, chlorinization, indicator species, water diversion.

Students will know the materials and equipment used by environmental scientists to analyze water quality.

Students will know the major categories of water pollution and their sources

Students will know the mechanisms of a wastewater treatment plant.

Students will know how measuring water quality in local areas can reflect the overall health of the ecosystem.

Students will know why monitoring water quality periodically is vital in determining trends in land use.

Students will know how sewage discharge is related to eutrophication, Biochemical Oxygen Demand and Dissolved Oxygen.

Students will know why treating wastewater is extremely important in maintaining human health and the health of ecosystems.

Students will be skilled at analyzing examples of diversion and the impacts it may have on local aquatic ecosystems.

Students will be skilled at using a water quality test kit to analyze water samples and the potential sources of their pollution.

Students will be skilled at identifying watersheds on a map

Learning Plan

Complete homework assignments consisting of 3-5 textbook questions, web based assignments or using

outside resources.

Properties of water Power Point Presentation

Water Diversion: Case Studies, Mono Lake, Aral Sea and the Three Gorges Dam

Enviroscape: Point vs. non point water pollution

Watersheds PPT and NJ Water Management Areas independent research assignment

Video: Assignment Discovery: Water to the Last Drop

Assess water quality of Nomahegan pond through macro invertebrate and micro invertebrate surveys.

Assess and identify three to five unknown water samples using LaMotte Water Quality testing kits for chemical and physical characteristics.

PPT and Class discussion: Eutrophication in Nomahegan Pond

Lab: Macro invertebrate Indicator Species

Case Study: Boston Harbor

Video and PPT: Wastewater Treatment and Septic Systems

Wastewater Treatment Packet

Assessment

Formative Assessments:

- Worksheets
- Do Nows
- Exit Tickets
- Class Discussions

Quizzes:

- Water as a resource: Earth's Water Budget, Diversion examples and case studies
- Water Quality and Pollution: major categories of pollutants and their impact

Bench Marks:

Midterm and Final Exam

Alternative:

- Case Study Worksheet: Mono lake and the Aral Sea
- Independent reading and notes: impact of dams
- Watershed analysis worksheet and research assignment
- Hands on lab: measuring water quality factors for differrent samples from around Cranford
- Wastewater Treatment PPT and worksheet

Summative:

Unit Tests:

- Water: A Fragile Resource

Materials

Raven & Berg Evnironment Textbooks (ISBN: 978-1-119-39341-2)

Guided note packets (teacher developed)

Technology (student & teacher laptops, SmartBoard)

PowerPoints

Workshets/notes

Youtube/Netflix

Boston Harbor Case Study

La Motte Water Quality Test kits

Water Samples

Wastewater Treatment Notes Packet

Suggested Strategies for Modification

https://docs.google.com/spreadsheets/d/1P8BzKodtBsbWi4rQ0tunGWhZkCOg52IvbNO7yy-TFJI/edit?usp=sharing