2019 H CHEM Unit 2: Abiotic Chemistry

Content Area: **Science**
Course(s): **Chemistry**
Time Period: **November**
Length: **20 days**
Status: **Published**

Unit Overview:

In this unit of study, students develop and use models, plan and carry out investigations, analyze and interpret data, and engage in argument from evidence to make sense of energy as a quantitative property of a system—a property that depends on the motion and interactions of matter and radiation within that system. They will also use the findings of investigations to provide a mechanistic explanation for the core idea that total change of energy in any system is always equal to the total energy transferred into or out of the system. Additionally, students develop an understanding that energy, at both the macroscopic and the atomic scales, can be accounted for as motions of particles or as energy associated with the configurations (relative positions) of particles. Students apply their understanding of energy to explain the role that water plays in affecting weather. Students examine the ways that human activities cause feedback that create changes to other systems. Students are expected to demonstrate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, engaging in argument from evidence, and using these practices to demonstrate understanding of core ideas. Students also develop possible solutions for major global problems. They begin by breaking these problems into smaller problems that can be tackled with engineering methods. To evaluate potential solutions, students are expected not only to consider a wide range of criteria, but also to recognize that criteria need to be prioritized.

Enduring Understandings:

- Energy and matter move within abiotic systems via physical, chemical, and biological processes.
- Energy is neither created nor destroyed, it only changes form.
- Water has a unique role in chemical systems due to its polarity.

Essential Questions:

- Does thermal energy always transfer or transform in predictable ways?
- How would I meet the energy needs of the house of the future?
- What is the best energy source for a home?
- What makes water so special?
- What makes water's properties essential to life on our planet? or Why do we look for water on other planets?

Standards/Indicators/Student Learning Objectives (SLOs):

- Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that

account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. [Clarification Statement: See Three-Dimensional Teaching and Learning Section for examples].

- Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

- Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: 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).]

- Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). [Clarification Statement: 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 Boundary: Assessment is limited to investigations based on materials and tools provided to students.]

9-12.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
9-12.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
9-12.HS-LS1-4.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales.
9-12.HS-LS1-5.5.1	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.
9-12.HS-LS1-1.6.1	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
9-12.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.
9-12.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.
9-12.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
9-12.HS-PS1-8.2.1	Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
9-12.HS-PS1-4.2.1	Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
9-12.HS-PS1-4.5.1	Changes of energy and matter in a system can be described in terms of energy and matter

	flows into, out of, and within that system.
9-12.HS-PS1-7.5.1	students learn that the total amount of energy and matter in closed systems is conserved. They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. Energy drives the cycling of matter within and between systems. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
9-12.HS-PS1-5.6.1	Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
9-12.HS-PS1-6.7.1	students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability.
9-12.HS-PS1-6.PS1.A.1	The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.

Lesson Titles:

- Energy Transfer
- Heat Calculations
- Solubility
- Water

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections:

LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and

	phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
LA.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
LA.RST.11-12.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.WHST.11-12.1.A	Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
LA.WHST.11-12.1.B	Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
LA.WHST.11-12.1.C	Use transitions (e.g., words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
LA.WHST.11-12.1.D	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.11-12.1.E	Provide a concluding paragraph or section that supports the argument presented.
MA.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MA.A-REI.D	Represent and solve equations and inequalities graphically
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.

TECH.8.2.12.E	Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Distribution of Water Activity
- Erosion Activity
- Fracking Project
- Heat Calculations Notes
- Heat Lab
- Polarity Activity
- Solubiity Lab

Modifications

ELL Modifications:

- 1:1 testing
- Be flexible with time frames and deadlines
- Digital translators
- Group students
- Offer alternate/modify assessments
- Offer resources for specific topics in primary language
- Provide formal and informal verbal interaction to provide practice
- Provide multiple literacy strategies
- Repeat, reword, clarify
- Tap prior knowledge
- Use real objects when possible

IEP & 504 Modifications:

- Allowing student to edit with teacher comments the first attempt at a graded assignment
- Breaking up larger assignments into shorter tasks with clear deadlines for each section
- Less problems/questions per page or assignment
- Modeling and showing lots of examples
- Non-verbal redirection of behaviors

- Provide a copy of the notes from class
- Provide paraphrased or modified reading materials at the student's reading level
- Provide student with content vocab prior to lesson that includes that vocab
- Provide study guides that pare down the material to study
- Pull student(s) aside for individualized teaching by the special ed teacher
- Rewording questions
- Teach main concept multiple ways over multiple days or interactions

G&T Modifications:

- Allow generation and testing of hypotheses
- Ask students higher level questions to make conclusions and connections
- Employ differentiated curriculum to keep interest high
- Encourage further exploration of topics through reading or investigations
- Offer additional activities that solicit a deeper understanding of the material
- Offer opportunities for peer leadership or mentoring
- Provide additional challenging problems
- Provide different test items
- Provide opportunities for inquiry based learning
- Refrain from having them complete more work in the same manner
- Require graphical analysis and interpretation

At Risk Modifications

- Assign a peer to help keep the student on task
- Break tests down into smaller increments
- Check in with student often to keep on task
- If possible, one on one testing or oral exams
- Increase interaction time between you and the student
- Make directions and instruction short and simple
- Modify or reduce assignments
- Preferential seating
- Provide hands on tasks when applicable
- Regular communication with parents and guardians

Formative Assessment:

- Demonstration
- Exit ticket

- Google survey
- Image/Video clip
- Kahoot
- KWL form
- Lesson summary
- Object
- Previous class review
- Question of the day
- Think-pair-share

Summative Assessment:

- Fracking Project
- Heat Lab Report
- Marking Period Exam
- Quiz (Heat)
- Quiz (Polarity)
- Solubility Lab Report
- Unit Test (Abiotic Chemistry)

Benchmark Assessments

Skills-based assessment
Reading response
Writing prompt
Lab practical

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations
Reflective pieces
Concept maps
Case-based scenarios
Portfolios

Resources & Materials:

- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Association of Physics Teachers: http://www.aapt.org/resources/
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- North American Association for Environmental Education: http://www.naaee.net/