Unit 6: Nuclear Chemistry

Content Area: **Science**
Course(s): **Chemistry/Lab Honors**
Time Period: **4th Marking Period**
Length: **3.5 Weeks**
Status: **Published**

Unit Overview

Changes occurring in the nucleus of an atom may alter the identity of an atom often resulting in large changes in energy.

Transfer

Students will be able to independently use their learning to understand the social and environmental impact of changes in the nuclear makeup of atoms.

Meaning

Understandings

1) Atoms can be unstable and emit radiation.

2) Fission and Fusion Processes can cause produce energy.

3) Earth's composition was shaped by impactors from elsewhere in the solar system.

4) There are advantages and disadvantages to alternative energy sources.

Essential Questions

1) What causes instability in the nucleus of atoms?

2) How can a nuclear process emit energy and how can humans harness this energy?

3) How can we prove that impacting of the Earth early in its history lead to the current makeup of the planet?

4) How can we use the Earth and its processes to produce energy for human use?

Application of Knowledge and Skill

Students will know...

1) How predict the outcome and rate nuclear decays and fission/fusion reactions.

2) How Earth recieves its energy from the Sun.

3) How we can use radioisotopes for dating purposes and their other potential uses.

4) How all forms of energy sources can be used and harnessed.

Students will be skilled at...

1) Relating the different radioactive expressions.

2) Drawing a diagram comparing and contrasting fission and fusions.

3) Arguing the uses of various forms of energy.

4) Timelining the Earth's History.

5) Modeling the Sun and its Energy Output.

Academic Vocabulary

Academic Vocabulary	Application Vocabulary

nuclear	transformation
fission	solar energy
fusion	fossil fuel
alpha decay	emission
beta decay	unstable
gamma decay	stable
electron capture	renewable
positron decay	non-renewable
radioactive decay	core
half life	meteorite
nuclear force	minerals
radioisotope	composition
radiometric dating	

Learning Goal 1

Students will demonstrate knowledge of radiation and different types of nuclear reactions

Proficiency Scale

- Students will demonstrate knowledge of radiation and different types of nuclear reactions

SCI.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.

Target 1

SWBAT use concepts to write nuclear reactions for an alpha, beta, gamma, positron emission, electron capture.

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Target 2

SWBAT formulate calculations involving half-life.

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Learning Goal 2

Compare and Contrast Fission and Fusion Reactions, giving examples of each, with respect to reactants, products and energy.

Proficiency Scale

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SCI.HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
SCI.HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
SCI.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.

Target 1

SWBAT differentiate between fission and fusion reactions.

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Target 2

SWBAT explain phenonmena in terms of the energy transformations and transfers that occur in a nuclear power plant.

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Target 3

SWBAT explain phenomena in terms of the role of nuclear fusion in the Sun's core is to release energy in the form of radiation.

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Learning Goal 3

To determine the applications of radioisotopes impact on the discovery of Earth's history and societal uses today.

Proficiency Scale

- To determine the applications of radioisotopes impact on the discovery of Earth's history and societal uses today.

SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.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.

Target 1

SWBAT investigate radioisotopes that are commonly used for medical and commercial purposes. Compare, based on the half-life of each radioisotope, the advantages and disadvantages of why certain radioisotopes are used for different purposes.

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Target 2

Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

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Learning Goal 4

Students will investigate sources of energy on Earth that can be used for human consumption.

Proficiency Scale

- Students will investigate sources of energy on Earth that can be used for human consumption.

SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ESS3-3	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
SCI.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.

Target 1

SWBAT connect the challenges of using both renewable and non-renewable sources of energy.

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Target 2

SWBAT investigate alternate sources of energy including advantages and disadvantages such as needs, benefits, distribution, pollution, and cost associated with society's needs

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Formative Assessment and Performance Opportunities

Lab Reports

Worksheets

PowerPoints with Notes

Homework and Classwork Activities

Group Activites

In Class Discussion

- Lab Reports, Worksheets, PowerPoints with Notes, Homework and Classwork Activities, Group Activites, In Class Discussion

Summative Assessment

Unit Assessment will be created collaboratively and used for every student in the course. In addition, there will be other assessments in the form of lab reports, pen and paper tests, and quizzes. Common Assessment is administered through LinkIt.

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Accommodations/Modifications

All instruction, labs, activities, and assessments will be modified and enhanced to adhere to individual student's IEPs and 504s. As well differentiated classroom management strategies will be utilized as to adhere to these students individual plans as well. These strategies can be but are not limited to the following: Graphic Organizers and Flow Charts to help visulaization of content, Using acronyms and pneumonic devices to assist memorization, Academic Games to practice skills and deepen understanding of topics, Stations and Learning Centers to influence peer tutoring, Utilizing Reviews and Study Guides to reteach complex content before summative and formative assessment, Providing additional resources to students during and outside of school

(videos, study guides, teacher notes, web-based resources).

On Assessments, College Prep Chemistry Students will have access to the following resources: Formula for Half Life.

On Assessments, Honors AND College Prep Chemistry Students will have access to the following resources: Periodic Table.

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Unit Resources

Teacher generated PowerPoints, Notes, Labs and Worksheets

Textbooks

Resource Books

Internet Resources

Computer Based Activities

Labs in this unit: Licorice Half Life Lab, Radioisotope Article Lab, Energy Web Quest Lab

- Teacher generated PowerPoints, Notes, Labs and Worksheets, Textbooks, Resource Books, Internet Resources, Computer Based Activities

21st Century Life and Careers

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through

	their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP11.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to

	pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Interdisciplinary Connections

MA.K-12.2	Reason abstractly and quantitatively. Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.
MA.K-12.4	Model with mathematics. Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
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.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
LA.WHST.11-12.7	Conduct short as well as more sustained research projects to answer a question (including

	a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.