Unit 02: Atomic Structure and Nuclear Chemistry

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **2-3 Weeks**
Status: **Published**

Brief Summary of Unit

This unit introduces the concepts of atomic structure, isotopes, and the Periodic Table. Isotopes will be related to half-lives and radioactivity and the conservation of matter will be applied in nuclear equations. How nuclear energy affects climate change will also be addressed. Writing formulas and naming ionic compounds, molecules, and acids will be emphasized.

Revised June 2022

Standards

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.
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
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.K-12.NJSLSA.R8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
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.
PS1.A	Structure and Properties of Matter
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
PS1.B	Chemical Reactions
LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
LA.K-12.NJSLSA.W8	Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).

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.
PS1.C	Nuclear Processes

Essential Questions

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How does the structure of the atom affect its properties?

How do nuclear reactions produce energy and how can that energy be used?

How are formulas written and compounds named?

Enduring Understandings

Relate the role of nuclear fusion in producing essentially all elements heavier than helium.

Use IUPAC nomenclature for both chemical names and formulas for ionic, covalent, and acidic compounds.

Students Will Know/Students Will be Skilled At

Students will know the sequence of experiments that lead to the discovery of the subatomic particles.

Students will know how to explain the arrangement and behavior of subatomic particles according to modern atomic theory.

Students will be skilled at determining the number of protons, neutrons, and electrons in a given isotope or ion.

Students will be skilled at solving half life problems and writing nuclear equations.

Students will know the difference between fusion and fission.

Students will know how nuclear energy affects the planet/climate change.

Students will know how the Periodic Table was developed and organized.

Students will know the subcategories of the Periodic Table and distinctive properties of each.

Students will be skilled in writing formulas and naming binary molecular compounds, ionic compounds, and acids.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Introduce the history of the atomic theory and discuss the structure of the atom and the experiments in which they were discovered.

Present the Law of Conservation of Mass, Law of Definite Proportions, and Law of Multiple Proportions.

Model how to determine the number of protons, neutrons, and electrons in an isotope and ions.

Assign the Chem Matters article, "Chernobyl's Legacy," and assign the anticipation guide and/or comprehension questions.

Introduce radioactivity and differentiate between fusion and fission.

Model how to solve half life problems and how to write a balanced, nuclear equation.

Introduce how the periodic table is organized.

Identify the subgroups of the Periodic Table and distinct characteristics of each.

Model how to write formulas and name binary molecules.

Model how to write formulas and name ionic compounds.

Quiz on molecules and ionic compounds.

Model how to write formulas and name acids.

Review how to differentiate between molecules, ionic compounds, and acids.

Complete in class and suggested practice.

Unit Test

Labs:
Law of Conservation of Mass Inquiry Lab

Evidence of a Chemical Change

Nuclear Fission PhET simulation

Half life and Carbon Dating PhET simulation

Evidence/Performance Tasks

Formative

Completed worksheets on determining number of protons, neutrons, electrons, half life, and nuclear equations

Completed worksheet packet on writing formulas and naming molecules, ionic compounds, and acids

Self Assessments provided for writing formulas and naming

Assigned homework problems in CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

Summative

Unit Quizzes and Tests

Lab Analysis for Law of Conservation of Mass and for Evidence of a Chemical Change

Nuclear Fission PhET simulation

Benchmark

Midterm Exams

Alternative

Lab Report for Law of Conservation of Mass Lab

Persuasive Essay based on the Chem Matters article, Open for Discussion: Can Nuclear Power Save the Planet?" (Feb 2020).

Materials

CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Approved Textbook Link

In addition to general lab and safety equipment as noted in lab handouts:

hot plate

copper (II) nitrate

sodium hydroxide

hydrochloric acid

laptop

Suggestions for Modifications

FOR SPECIAL EDUCATION STUDENTS , ELL, AT RISK AND STUDENTS GIFTED STUDENTS

https://docs.google.com/spreadsheets/d/1pQwsQoD_QLot65BTdHFEHN5dXIiqS54iQ5iDL8C4q6o/edit?usp=sharing