Unit 1 - Introduction to Chemistry: Matter & Measurement

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **15 days**
Status: **Published**

Summary

Chemistry is the study of matter and its properties. This opening unit introduces students to foundational concepts crucial to success in chemistry. Part of the foundation includes problem solving techniques and mathematical skills related to the use and manipulation of the SI system, which is relevant to both general and chemistry-specific applications. The rest of the foundation is building on the various ways of classifying matter and analyzing data. The differences and similarities between homogeneous and heterogenous matter and ways they can be separated will be considered. The classification of matter as an element, mixture, or compound will be examined in detail. The densities of various substances will be calculated and compared. Data will be collected and analyzed based on percent error, precision, accuracy, and other relevant factors. In addition, the behavior of a substance changing from one state of matter to another will be investigated.

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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.
P.3	Consider the environmental, social and economic impacts of decisions.
P.4	Demonstrate creativity and innovation.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
9.4.12.CT	Critical Thinking and Problem-solving
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
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P.9	Work productively in teams while using cultural/global competence.
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.
LA.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
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.
9.4.12.GCA	Global and Cultural Awareness
9.4.12.IML	Information and Media Literacy
MA.A-CED.A	Create equations that describe numbers or relationships
LA.WHST.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

2.C.6	Use effective collaboration and cooperation skills
LA.WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
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.
2.C.7	Use leadership and teamwork skills to work effectively in diverse teams
9.4.12.TL	Technology Literacy
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.
LA.WHST.9-10.7	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.WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
LA.WHST.9-10.9	Draw evidence from informational texts to support analysis, reflection, and research.
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.

Essential Questions/Enduring Understandings

Essential Questions

- Why do scientists obtain, record, and publish/present consistent data?
- What are the distinctions between matter and energy?
- How to the types of substances-- elements and compounds-- and mixtures differ?

Enduring Understandings

- The SI system is preferred due to its simple method of unit conversion and because each unit is defined by a universal constant.
- Matter, and all the ways it can be categorized, is defined by the behavior of the particles (atoms or molecules) that it is composed of.
- Data can be collected and analyzed through various modes, such as precision, accuracy, and percent error.

Objectives

Students Will Know

- Students will know how to obtain measurements and perform calculations using the SI system.
- Students will know how to connect the properties of a substance with the behavior of the particles (atoms of molecules) that make up the substance.
- Students will know general laboratory procedures as well as safety precautions and location of specific safety equipment.
- Students will know the difference between precision and accuracy and be skilled at describing data (obtained or provided) as such.
- Students will know how to calculate density and percent error.
- Students will know when to use, and how to write, values in scientific notation and be skilled at converting to and from the decimal form.
- Students will know the difference between elements, compounds, and mixtures.
- Students will know the states of matter are defined by the behavior of the particles (atoms/molecules) they are composed of.
- Students will know how matter can change from one state to another.
- Students will know how to describe physical and chemical properties of substances and that physical changes and chemical changes have different effects on the substance's identity.

Students Will Be Skilled At

- Students will be skilled at identifying similarities and differences between elements and compounds beyond a simple visual observation.
- Students will be skilled at utilizing the SI system for conversion, measurement, and analysis including the appropriate use of significant figures.
- Students will be skilled at identifying materials as elements, compounds, and mixtures.
- Students will be skilled at differentiating pure substances vs. mixtures, elements vs. compounds, and heterogeneous vs. homogeneous mixtures.
- Students will be skilled at calculating percent error and determining precision vs. accuracy.
- Students will be skilled at analyzing phase diagrams to identify states of matter, changes of state, and rate of change.
- Students will be skilled at recognizing processes-- chemical reactions or phase changes-- as exothermic or endothermic.

Learning Plan

- Preview essential questions and connect them to the concepts we will cover in the unit.

- Compare the accuracy and precision of measurements as well as the best methods (and units) when recording data.
- Calculate density and percent error.
- Utilize scientific notation when most appropriate and convert to and from decimal notation.
- Use the properties of substances as a means of identifying them in the Density of Unknown Substances Lab.
- Accurately obtain and record data to determine the year when the composition of the penny changed.
- Identify mixtures based solely on the states of matter of the substances within.
- Differentiate between physical and chemical properties and changes via Observation of a Candle Lab.
- Develop a model for the behavior of particles to best describe the properties of the states of matter (solid, liquid, gas, plasma).
- Predict a "phase diagram" and then perform the Phase Diagram Lab to compare and contrast the prediction to reality.

Assessment

Formative Assessment

- Do Now Questions
- Exit Ticket Questions
- Whole Class Discussion Participation
- Small Group Discussion Participation
- Individual Student Questions/Responses
- Independent Tasks
    - Utilize the SI system when obtaining data and performing calculations.
    - Identifying the data as precise and accurate as well as recording it in the most appropriate manner (i.e. scientific notation vs. decimal).
    - Communicate and identify the differences between all classifications of matter.
    - Define the states of matter by the behavior of the particles they are composed of.
- Lab Experiments

Summative Assessment

- Unit Quizzes
- Unit Tests
- Lab Reports

Benchmark Assessment

- CP Chemistry Midterm Exam

Alternative Assessment

- Organize the classifications of matter according to a scheme of broadest to most specific term.
- Analyze phase diagrams as well as construct one from data obtained in an experiment.
- Organize substances based on physical properties such as density.
- Obtaining data from experimentation and presenting findings in the most appropriate matter.

Materials

- SAVVAS Experience Chemistry 2021 Textbook Volumes 1 & 2
- Guided notes
- Teacher handouts
- Supplementary worksheets
- Lab Handouts (see learning plan) (NOTE: supplies for each lab included on handout.)
    - Observation of a Candle Lab
    - Density of Unknown Substances Lab
    - Composition of Pennies Lab
    - Phase Diagram Lab
- Density Identification Set (Cubes or Cylinders)
- Phase diagram samples
- Simulations:
    - “States of Matter: Basics” [https://phet.colorado.edu/en/simulation/states-of-matter-basics]
    - “States of Matter” [https://phet.colorado.edu/en/simulation/states-of-matter]
    - "Density" [https://phet.colorado.edu/en/simulations/density]
- Safety supplies (specifics to when they are required included in lab handouts)
- Classification of Matter card sorting activity

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education, and those with 504s

https://docs.google.com/spreadsheets/d/1mfe42JCam4Rlgd626vidMg54nDZ1ic055qKKGLvhcPg/edit?usp=sharing