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Why does Matter Matter?

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UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Why does Matter Matter?

Grade Level: High School

Subject/Topic Area(s): Chemistry

Designed By: Carrie Duesing and Carolyn Martin

Time Frame: 3 weeks (14 days)

School District: Northeast Independent School District

School: Lee High School

School Address and Phone: 1400 Jackson-Keller Rd, San Antonio, TX, 78213, 210-356-0800

Brief Summary of Unit (Including curricular context and unit goals):

In this unit, students will begin to explore matter. Students will learn about the states and properties of matter, along with classification of matter and an introduction to writing procedures for lab experiments. The overarching transfer goals include classifying substances based on their individual properties and developing procedures to solve problems. Our goal is to have students grapple with the essential questions: “How does classification help us understand the world around us?”, “How does a difference in chemical makeup change the properties of a substance?” and “Why are thorough procedures important in science and beyond?” Through numerous laboratory investigations, hands-on activities and cooperative learning, students will learn about matter and create a foundation for inquiry and investigation in the chemistry classroom.

Why does Matter Matter?

<table>
<tr><th colspan="3">Stage 1 – Desired Results</th></tr>
<tr><td rowspan="6">Established Goals

C. 4A differentiate between physical and chemical changes and properties Readiness Standard

C. 4C compare solids, liquids and gases in terms of compressibility, structure, shape and volume Supporting Standard

C. 4D classify matter as pure substances or mixtures through investigation of their properties Readiness Standard

C.1A demonstrate safe practices during laboratory and field investigations, including the appropriate use of safety showers, eyewash fountains, safety goggles, and fire extinguishers;

C.1E plan and implement investigative procedures, including asking</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will independently use their learning to…
- classify substances based on their individual properties.
- develop procedures to solve problems</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>Understandings
Students will understand that….
- Classification is a means of interpreting the world.
- Matters’ properties are determined by its identity and chemical makeup.
-A thorough scientific procedure is required to obtain valid results.</td><td>Essential Questions
- How does classification help us understand the world around us?
- How does a difference in chemical makeup change the properties of a substance?
-Why are thorough procedures important in science and beyond?</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Knowledge
Students will know…
- Matter is anything that has mass and takes up space
- the difference between solids, liquids and gases in terms of compressibility, structure, shape and volume
- Density is defined as mass divided by volume.</td><td>Skills
Students will be able to…
- differentiate between physical and chemical changes and properties
- classify matter as pure substances or mixtures through investigation of their properties
- demonstrate safe practices during laboratory and field investigations, including the appropriate use of safety showers, eyewash fountains, safety goggles, and fire extinguishers;
- plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology, including graphing calculators, computers and probes, sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, safety goggles, and burettes, electronic balances, and an</td></tr>
</table>

questions, formulating testable hypotheses, and selecting equipment and technology, including graphing calculators, computers and probes, sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, safety goggles, and burettes, electronic balances, and an adequate supply of consumable chemicals; C.1H organize, analyze, evaluate, make inferences, and predict trends from data C.3A in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;		adequate supply of consumable chemicals - organize, analyze, evaluate, make inferences, and predict trends from data - in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student
Stage 2 – Evidence		

CODE (M or T)	**Evaluative Criteria** (for rubric)	
		Performance Task(s) *Students will demonstrate meaning-making and transfer by…*
M, T		Develop and carry out a procedure for a separation lab based upon the physical and chemical properties of various substances in a
M, T		mixture. Justify and explain the process of separation in a written lab report.

M		--------
M, T		Other Evidence (e.g., formative)
M		States of Matter Writing Prompt
M		Exit ticket - Solids, Liquids, and Gases
M, T		Exit ticket - Why is classification important?
M, T		Classifying Matter Lab
M		Physical and Chemical Properties HW
M, T		Density Inquiry Mini Lab
M		Physical and Chemical Properties Lab
M		Properties of Matter Assessment
Stage 3 – Learning Plan		
CODE (A, M, T)	Pre-Assessment *How will you check students' prior knowledge, skill levels, and potential misconceptions?*	
A	The "Defining Matter Walk Around" will help to assess students' prior knowledge and misconceptions. This pre-assessment will enable the teacher to focus discussion and support student learning.	

	Learning Activities Lesson 1: Defining Matter and States of Matter	Progress Monitoring (e.g., formative data)
A	Defining Matter Walk-Around -Adapted from Dustin Demoin, "What's the Matter… Do Things Keep Changing?" (10 minutes) -Three prompts on the walls with "Matter," "Not Matter," "Unsure" - As an example, the teacher will place 2 - 3 words in the appropriate categories. - Students will each get one word to categorize on the board. (The words will be on cardstock, laminated, and magnets glued to the reverse.) - Any leftover words will be decided by the class. - The class will go through each word to determine whether it is correctly categorized. - Have students determine the commonalities of the words in each category and write a definition for "matter"	Lesson 1: States of Matter Writing Prompt Lesson 1: Exit ticket - Why are you able walk freely in air, with some difficulty in liquids, and not all through solids? Lesson 2: Exit ticket - Why is classification important? Lesson 2: Card Sort - Elements, Compounds and Mixtures
A, M	Discovery task On the SMART board is a PhET simulation about phase changes/states of matter. Students should try adjusting the settings and make observations about what happens when different variables are changed. "Today I'm going to show you a representation of the 3 states of matter. For each state of matter, you will need to write at least 3 chemistry-related observations." Teacher shows each of the 3 states of matter and gives students 1 minute to write observations for each. Class discussion about what is happening in each state of matter - movement of molecules, structure, shape, volume, spacing/compressibility.	Lesson 2: Classifying Matter Rotation Lab Lesson 3: Homework: Physical or Chemical Changes? Lesson 3: Density inquiry mini lab Lesson 3: Density Problems (2-1-0)
A M A	Segue into notes in the form of States of Matter Foldable with Notes - solids liquids and gases as an overview Exit ticket (Students can add to their observation paper): Why are you able walk freely in air, with some difficulty in liquids, and not all through solids? Review States of Matter with this video, or States of Matter song in this video	Lesson 3: Physical and Chemical Properties Lab (station cards) and Student Document Lesson 4: Round Robin Post it Review Game- Matter

<table>
<tr>
<td>A, M, T

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A

A, M

A</td>
<td>Lesson 2: Classifying Matter
As an introduction to the concept of categorization, students will perform a card sort, in pairs, of particle diagrams.
Card Sort - Elements, Compounds and Mixtures (print a set of cards on cardstock and laminate) - Students must work together and sort their cards into groups. They will justify their groupings and contribute to class discussion on classification.

- Exit ticket/formative assessment about “why is classification important”?

Fill in Graphic Organizer on Classifying Matter. Students will use the graphic organizer to understand the differences between pure substances and mixtures. Students will also add boxes with particle diagrams to represent each classification (element, compound, homogeneous mixture and heterogeneous mixture).

Classifying Matter Rotation Lab - Students will use their knowledge about classifying matter to apply the graphic organizer to tangible objects and classify items as elements, compounds, heterogeneous, or homogeneous.

Lesson 3: Physical and Chemical Properties

Intro/Notes: Physical and Chemical properties - describe me… all of these are physical properties, what are chemical properties?

<table><tr><td>Physical properties:</td><td>Properties that do not change the chemical nature of matter</td></tr><tr><td>Chemical properties:</td><td>Properties that do change the chemical nature of matter</td></tr></table>Chem props: toxicity, flammability, reactivity, chemical stability

3. Keep those definitions in mind as we play a game: Physical and chemical changes:
Concept Attainment Model (Examples and non-examples). On the board, make a T chart labeled “example” and “non-example” Students must help the teacher to place cards with chemical and physical changes into the example or non-example columns. When all the cards are placed,</td>
<td>Lesson 4: Assessment A and Assessment B

Lesson 5: Matter Separation Challenge!</td>
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	students may offer additional examples or non-examples, until the teacher asks for someone to explain the “rule” for something to be designated as an “example”(10 minutes) After the concept attainment model, explain physical changes: In a physical change there is only a change of state. The new substance has the same chemical properties as the old one. No new substance(s) are produced. ice – water – steam (They are all still water!) For example: ice melting to water or water boiling. **In all of these changes, you can get the original materials back!** A physical change may also involve changing the shape of the substance. Paper cut into pieces is still paper, sloughing a field but the field still remains as soil, cutting wood into pieces is still wood, and molding a sculpture is still cement or marble! 4. Describe chemical changes (**5 mins)** In a chemical change one or more NEW substances are created. The new substance is different from the original. It has properties that are different than those of the starting materials. Plus, **you cannot get the original materials back easily.** (Show class an example of this by lighting a match. Explain that the match has undergone a chemical change and that the resulting product is something that cannot be changed back to its original form) A A <u>Notes</u>: Physical and Chemical Changes 5. Give them their homework: <u>Physical or Chemical Changes?</u> Introduction to density Demo: Ice cube in alcohol and ice cube in H_2O. How would the world as we know it change if ice didn’t float?	

A A, M, T A A A A, M A	What would happen to rivers and lakes (and fish) in cooler climates? Discuss units - mass/volume Density inquiry mini lab - each group gets a different object, access to lab equipment and is tasked with determining the density of the object (mass/volume). In order to introduce procedure writing skills, the class will write the procedure for finding mass together, then individual groups will write the procedure for finding the volume of their object. Once each group has collected data on mass and volume for their object, they will rotate one group (leaving their procedure behind, but taking their data/calculations page with them). Students will then follow the procedure at their new table to determine the density of a second object. This exercise should provide opportunities for discussion on procedure writing and what makes a good procedure. After the lab is performed, teacher will lead a discussion of units and conversions (some student may use inches to find volume/measure or ounces to measure mass) Also use this opportunity to discuss significant figures - how accurate are your measurements and how many decimals places should you record. Density and Conversions practice: 2-1-0 Cooperative learning strategy, Density Problems (2-1-0), Answer KEY Introduction to lab safety Students will watch the Lab Safety Video, then the teacher will perform the flaming hands/methane mamba demo. Following the demo, the teacher will lead a discussion on the location of various safety gear and safety procedures. Physical and Chemical Properties Lab (Station Cards) Physical and Chemical Properties Student Document Lesson 4 Students will be given a review paper earlier in the week and will participate in the "Round Robin Post it Review Game- Matter." The students are divided into groups of 3	

A A A M, T	-4. Each team is given 5 questions on slips of paper. Each member of the team starts by answering one of the questions using a dry erase marker on their desk. After 1.5 minutes, the students pass their question to the person on their left and begin to work that question for 1.5 minutes. When each student has answered all 5 questions at the table, the team must come to a consensus on the correct answer for each question. When the team has agreed upon an answer, the answer is written on a "post-it" note (along with team number and placed on the board. The teacher will check each teams answers and give points accordingly. This method allows the teacher to spend time reviewing topics missed by the groups and allows them to bypass topics that are commonly understood. "Round Robin Post it Review" Review: Matter Assessment A Assessment B Lesson 5 Matter Separation Challenge! Students must first individually investigate properties of sand, salt, iron filings, poppy seeds, etc. Based on these properties, they will develop a well written procedure to separate these. They will give evidence to support their procedure by explaining which property justifies each step (include what type of change, if any, is occurring at each step) Mini lesson on procedure - how to make a PB&J, example and non example. - Discussion of chemical and physical properties (how to test for them) - Each group will receive one of the component to test and record the properties for a class set of data - Based on the class data, each group will develop a written procedure (with justification for each step,	

	including whether things are chemical or physical properties/changes) - After a procedure is approved, students will test their procedure on a mixture. - Students will write a conclusion addressing the success or shortcomings of their procedure and detail how to adjust their procedure for a more successful separation. - Class discussion/share out - Find someone not in your group and discuss what worked, and what didn't - come together and discuss overall procedure - Final lab report will be assessed using the Separating Matter Challenge Rubric.	

Calendar

Day 1: **Lesson 1**: Defining Matter and States of Matter - Defining Matter Walk Around	Day 2: **Lesson 1**: Defining Matter and States of Matter - PhET simulation and States of Matter notes	Day 3: **Lesson 2**: Classifying Matter - Card Sort and Graphic Organizer	Day 4: **Lesson 2**: Classifying Matter - Classifying Matter Rotation Lab	Day 5: **Lesson 2**: Classifying Matter
Day 6: **Lesson 3:** Physical and Chemical Properties - Intro/Notes and "Examples vs. Nonexamples" Game	Day 7: **Lesson 3:** Physical and Chemical Properties- Density Demo and Mini Lab	Day 8: **Lesson 3:** Physical and Chemical Properties - Density/Conversion 2-1-0 practice	Day 9: **Lesson 3:** Physical and Chemical Properties - Intro to Lab Safety and Physical Chemical Changes Lab	Day 10: **Lesson 4 (Review)**

Day 11: **Lesson 4 (Assessment)**	Day 12: **Lesson 5:** Performance Assessment - Matter Separation Challenge!	Day 13: **Lesson 5:** Performance Assessment - Matter Separation Challenge!	Day 14: **Lesson 5:** Performance Assessment - Classifying and Separating Matter Lab	