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Reviewer Name__Maureen Bruins_ Grade:__7_ Lesson/Unit Title:__Hazardous Materials:The Barrel Mystery_____
I. Alignment to the NGSS

The lesson or unit aligns with the conceptual shifts of the NGSS:

Criteria	Specific evidence from materials and reviewers' reasoning	Suggestions for improvement
A. Grade-appropriate elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), work together to support students in three-dimensional learning to make sense of phenomena and/or to design solutions to problems. i. Provides opportunities to develop and use specific elements of the practice(s) to make sense of phenomena and/or to design solutions to problems. ii. Provides opportunities to develop and use specific elements of the disciplinary core idea(s) to make sense of phenomena and/or to design solutions to problems. iii. Provides opportunities to develop and use specific elements of the crosscutting concept(s) to make sense of phenomena and/or to design solutions to problems. iv.The three dimensions work together to support students to make sense of phenomena and/or to design solutions to problems.	The Barrel Mystery /Hazardous Materials Investigation is three-dimensional in nature, has coherence across the lesson and provides a number of important instructional supports. It provides methods to monitor student progress. What happens when unidentified, hazardous wastes are left abandoned? This module focuses on the physical and chemical properties of substances. Students explore the contents of a barrel of simulated hazardous waste as they learn to physically separate, test, and identify substances in a mixture. They investigate different types of chemical hazards and describe hazardous substances in the home. Students are assessed on their ability to analyze data. Evidence of opportunities for students to develop and use the DCI's include:	Introduce the lesson with the following:https://www.youtube.com/watch?v=NsNptnK-lA0 CK-12 Hazardous waste http://www.ck12.org/user%3Acndhz25lckbuzxzjlmsxmi5tby51cw../ book/NEVC-8th-Grade-Science-2014-2015-NGSS-Part-6/section/16.0/ Assessments Hazardous Waste http://www.learner.org/interactives/garbage/hazardous.html Reflective Informal Assessment: What is the most important idea you learned today? What idea was difficult to understand? Were there any other questions you had? Formal Assessment: Multiple choice quiz Sample questions: What is the best way to dispose of hazardous waste? A. Throw it in the garbage B. Dump it outside C. Bring it to a hazardous waste collection program D. Burn it Which of the following is not considered hazardous waste?

	Activity 1: Students are introduced to a scenario involving an abandoned barrel of hazardous waste. They watch a video segment that shows how a HAZMAT team responds to potentially hazardous waste . They then make observations of simulated h Examine various rooms in your home for common materials that you think may be hazardous. What are some of the common uses of hazardous materials found in homes? 2. How can you tell whether a material is hazardous? Individual 3. List at least three actions that you can take to reduce your exposure to hazardous materials in the home. On page 11 activity 1 students create a data table to record the following information for at least five different substances: • What is the name of the hazardous material? • Is the material a solid, liquid, or gas? • What are the hazardous (or "active") ingredients? • In what ways is this material hazardous? Activity 2 : Page 23 Students test three unidentified liquids to determine the type of hazard posed. Liquids will be tested for flammability, corrosiveness, reactivity, and toxicity. Based on testing students will determine what hazard each liquid poses. Page 27 ,complete a data table and analyze the results. If liquid A,B and C are mixed together, what categories of hazard would we apply? Students explain their reasoning.	A. Dead batteries B. Rotting meat C. Metals like mercury D. Both A and C Sources ● Ask the students to brainstorm physical properties of water when it is ice, liquid water, and water vapor. Record their responses in a table. ● Think – Pair – Share: Is ice the same molecule (substance) as water? Is liquid water the same molecule as water vapor? How do you know? ● Have students create a pictorial model of water molecules as a solid, liquid, and gas. Provide a simple template with three beakers for ice, water, and water vapor. ● When students finish their initial models, have a discussion about how the class should represent certain features of the model so that we understand each other's drawings. (i.e. how will we show one water molecule…) Then, post these commonalities in the classroom. ● Foldable ***** for interactive notebooking Non-Fiction Article: http://www.startribune.com/wayward-barrel-left-in-minneapolis-alley-remains-a-toxic-enigma/313974871/

	Activity 3: page 31 Students are introduced to simulated hazardous material that is a mixture. Students develop a three part plan to (1) separate the liquid and solid substances, (2) separate the different solids, and (3) separate the different liquids. Introduce separation by physical means . How can we separate saltwater? The simulated hazardous material is a mixture of 5 substances:nitrate solution,mineral oil,aluminum washers,iron washers,and high density polyethylene squares. Activity 4: page 39 Students separate solids from liquids. Four tests are used to identify solids. Students collect data as they test for density,magnetism, and reactivity with copper chloride and use a key to identify solids. Students then separate the different liquids from the simulated hazardous waste. They test each liquid for corrosiveness,reactivity, and toxicity,and observe flammability tests.Pure substances are identified by performing qualitative tests to determine their physical and chemical properties. Students identify each liquid and discuss whether the mixture is hazardous. Data is collected and analyzed as to odor ,miscibility in water,miscibility in methanol,and the presence of water.	

	Students make a claim as to the identification of an unknown liquid based on the evidence of eight tests. Evidence of opportunities for students to develop and use the practices include:**Activity 2- Make observation of simulated hazardous waste barrel. Students get an opportunity to investigate the contents of the barrel in plastic cups and record their observations in their interactive science notebooks.** **Activity 2- Students examine the simulated contents of the mystery barrel and perform a series of tests to determine the identify of the substances.** **Activity 2-Data is collected in a "Testing for Hazards" chart. Students can then discuss how testing can be used to evaluate hazards substances.** **Activity 4 & 5- Data is collected in tables and students use that data to determine if they have enough evidence to identify each chemical with confidence.** **Activity 1- Students are given a scenario and are asked to answer the question, "What is the hazardous material in the barrel?" This question drives the overall investigation.**	

	Activity 1- Students are asked *How did the HAZMAT team approach the waste in the barrel different from the way in which your class approached the waste?* **Activity 2 What hazards do the unidentified samples pose?** **Activity 4 & 5 What changes did you have to make during your planned procedure and during your investigation?** Evidence of opportunities for students to develop and use the CCCs include:Students investigate three unidentified liquids to determine the type(s) of hazard posed by each. Students discuss how testing can be used to evaluate hazardous substances and the precautions that should be taken to prevent accidents when using or storing liquids.(*Activity 2)* Students will be introduced to the ideas that different substances can pose different types of hazards.During an investigation, students will test three unidentified liquids to determine the types of hazards posed by each. The activity concludes with discussion questions. Students explore how testing can be used to evaluate hazardous substances.	

A unit or longer lesson will also:

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B. Lessons fit together coherently targeting a set of performance expectations. i. Each lesson links to previous lessons and provides a need to engage in the current lesson. ii. The lessons help students develop proficiency on a targeted set of performance expectations. C. Where appropriate, disciplinary core ideas from different disciplines are used together to explain phenomena. D.Where appropriate, crosscutting concepts are used in the explanation of phenomena from a variety of disciplines. E. Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.	B. **MS-ESS3 Earth and Human Activity** **Performance Expectation MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-PS1 Matter and its Interactions** **Performance Expectations:MS-PS1-2.Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.** C.Physical Science and Earth Science D.A**ctivity** 2 Cause and Effect Students will be introduced to the ideas that different substances can pose different types of hazards.During an investigation, students will test three unidentified liquids to determine the types of hazards posed by each. The activity concludes with discussion questions. Students explore how testing can be used to evaluate hazardous substances. E. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS3-2) CCSS.ELA-LITERACY.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. Math:Reason abstractly and quantitatively. (MS-ESS3-2),*(MS-ESS3-5)*	This lesson could also be used as an introduction for physical and chemical properties of matter.

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Disciplinary Core Ideas (DCIs)	Element	Evidence

ESS3.C: Human Impacts on Earth Systems **MS-PS-1 Structure and Properties of Matter**	ESS3.C - Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on the Earth. Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)	**Activity 1:** Students are introduced to a scenario involving an abandoned barrel of hazardous waste. They watch a video segment that shows how a HAZMAT team responds to potentially hazardous waste . They then make observations of simulated h Examine various rooms in your home for common materials that you think may be hazardous. What are some of the common uses of hazardous materials found in homes? 2. How can you tell whether a material is hazardous? Individual 3. List at least three actions that you can take to reduce your exposure to hazardous materials in the home. On page 11 activity 1 students create a data table to record the following information for at least five different substances: • What is the name of the hazardous material? • Is the material a solid, liquid, or gas? • What are the hazardous (or "active") ingredients? • In what ways is this material hazardous? Activity 2 : Page 23 Students test three unidentified liquids to determine the type of hazard posed. Liquids will be tested for flammability, corrosiveness, reactivity, and toxicity. Based on testing students will determine what hazard each liquid poses. Page 27 ,complete a data table and analyze the results.

PS1.B: Chemical Reactions	Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2),(MS-PS1-3) Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3),(MS-PS1-5)	If liquid A,B and C are mixed together, what categories of hazard would we apply? Students explain their reasoning. Activity 3: page 31 Students are introduced to simulated hazardous material that is a mixture. Students develop a three part plan to (1) separate the liquid and solid substances, (2) separate the different solids, and (3) separate the different liquids. Introduce separation by physical means . How can we separate saltwater? The simulated hazardous material is a mixture of 5 substances:nitrate solution,mineral oil,aluminum washers,iron washers,and high density polyethylene squares. Activity 4: page 39 Students separate solids from liquids. Four tests are used to identify solids. Students collect data as they test for density,magnetism, and reactivity with copper chloride and use a key to identify solids. Students then separate the different liquids from the simulated hazardous waste. They test each liquid for corrosiveness,reactivity, and toxicity,and observe flammability tests.Pure substances are identified by performing qualitative tests to determine

		their physical and chemical properties. Students identify each liquid and discuss whether the mixture is hazardous. Data is collected and analyzed as to odor ,miscibility in water,miscibility in methanol,and the presence of water. Students make a claim as to the identification of an unknown liquid based on the evidence of eight tests.

Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson

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Science and Engineering Practice (SEP)	Element	Evidence
Developing and Using Models **Planning and Carrying Out Investigations**	Develop a model to predict and/or describe phenomena. (MS-PS1-1),(MS-PS1-4) Develop a model to describe unobservable mechanisms. (MS-PS1-5)	**Activity 2- Make observation of simulated hazardous waste barrel. Students get an opportunity to investigate the contents of the barrel in plastic cups and record their observations in their interactive science notebooks.**

	Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.	**Activity 2- Students examine the simulated contents of the mystery barrel and perform a series of tests to determine the identify of the substances.**
Analyzing and Interpreting Data	Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) Analyze and interpret data to provide evidence for phenomena.	**Activity 2-Data is collected in a "Testing for Hazards" chart. Students can then discuss how testing can be used to evaluate hazards substances.** **Activity 4 & 5- Data is collected in tables and students use that data to determine if they have enough evidence to identify each chemical with confidence.**
Ask Questions and Define Problems	Ask questions that can be investigated within the scope of the classroom. Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. o to identify	**Activity 1- Students are given a scenario and are asked to answer the question, "What is the hazardous material in the barrel?" This question drives the overall investigation.** **Activity 1- Students are asked *How did the HAZMAT team approach the waste in the***

	and/or clarify evidence and/or the premise(s) of an argument. Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	***barrel different from the way in which your class approached the waste?*** **Activity 2 What hazards do the unidentified samples pose?** **Activity 4 & 5 What changes did you have to make during your planned procedure and during your investigation?**

Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson

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Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson

Crosscutting Concepts (CCCs)	Element	Evidence
Cause and Effect	**Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)**	**Activity** 2 Students will be introduced to the ideas that different substances can pose different types of hazards.During an investigation, students will test

	Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)	three unidentified liquids to determine the types of hazards posed by each. The activity concludes with discussion questions. Students explore how testing can be used to evaluate hazardous substances.
Patterns	Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)	Activity 3 Students investigate methods for the separation of hazardous mixtures. Students will create a step- by-step procedure for separating the liquids and solids.
Structure and Function	Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)	Activity 4 Students will perform their procedures to separate the solid and liquid parts of a mixture. After separating the solids students will conduct tests to identify the solid.
Energy and Matter	Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)	Activity 5 Students will perform their procedures again to separate the different liquids from the simulated hazardous waste. They will test each liquid for corrosiveness, reactivity and toxicity, and observe flammability tests.Finally students will conduct four additional tests on properties of the liquids to help identify them.
