8.4.3 - Slick Solutions: Designing Solutions for Oil Spills

Unit: Natural Resources	**Utah SEEd Standard / NGSS Performance Expectation:** **Standard 8.4.3** **Design a solution** to monitor or mitigate the potential effects of the use of natural resources. **Evaluate** competing design solutions *using a systematic process to determine how well each solution meets the criteria and constraints of the problem.* Examples of uses of the natural environment could include agriculture, conservation efforts, recreation, solar energy, and water management. (ESS3.A, ESS3.C, ETS1.A, ETS1.B, ETS1.C)	**Time:** 70-minute class period

Access to all material for this lesson: Link to lesson folder

Anchor Phenomenon	Tell students there has been an oil spill, and they need to clean it up. (Lab activity)
Driving Question(s)	- What is an oil spill, and how do we mitigate its environmental effects? - How do oil spills hurt Earth's systems? - What is the best way to clean up oil? (leading towards how we can clean up oil on a large scale)
Performance Task	Students will design and explain a solution to help mitigate the spread of spilled oil that would affect the use of our natural resources and destroy our ecosystems.

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Lesson Summary:			
	Time	**Guiding Question / Learning Objective**	**How are students answering the guiding question or meeting the learning objective?**
 **Engage**	7-10 min	How do you clean up an oil spill?	Students will experiment to discover how to clean oil off of different materials.
 **Explore**	15 min	What is an oil spill, and how do we mitigate its effects on the environment?	Students will read over suggested websites to determine how people can mitigate effects of an oil spill on the environment
 **Explain**		Design a solution to mitigate the damage of a potential oil spill. solution to mitigate the damage of a potential oil spill.	Student's will design a solution to mitigate the damage of a potential oil spill.
 **Evaluate**		What method works best for removing oil from your	Communicate (SEP) the best method for oil clean-up and how it benefits the environment and that natural resource.

Three Dimensions Focused on in This Lesson		
Disciplinary Core Idea: NGSS Appendix E **ESS3.C Human Impacts on Earth Systems** Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.	**Science and Engineering Practices:** NGSS Appendix F **Constructing explanations and designing solutions.**	**Crosscutting Concept:** NGSS Appendix G **Scale, Proportion, and Quantity**
Connections to Mathematics and ELA/Literacy Standards		

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ELA/Literacy Standards:	Mathematics Standards:
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. **RST.6-8.7** 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). **WHST.6-8.1** Write arguments focused on discipline content. **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.	**MP.2** Reason abstractly and quantitatively.

Materials

Handouts	Lab Supplies (some optional)	Other Resources
Paper for foldable poster (11x17 or similar size, thickness is not really important Slick Solutions Lesson Vertical Slick Solutions student worksheet	- Safety Wear (apron, gloves, eyewear) - Oil (vegetable oil, used motor oil, dark olive oil, etc.) - Water - Food coloring (to dye water if using light-colored oil) - Rocks - Feathers - Plant pieces (or 100% cotton fabric) - Sponges (small cubes) - Cotton balls (2 per lab) - Plastic Spoons - Dish soap - String - Rags - Pipette/eyedropper - Vinegar - Rubbing alcohol	Links to research articles: Cleaning oil from animals Oil Spill Prevention and Response Oil Spills Oil Tanker Spill Statistics 2022 Grand Staircase-Escalante National Monument Poster rubric

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ENGAGE

What is an oil spill, and how do we mitigate(lessen) its effects on the environment?

PHENOMENON:

Micro-spill Oil Clean-up:

- Students will try to clean oil from several objects.
  - The goal is to learn how difficult it is to clean oil when spilled, all while keeping the integrity of the object the oil is on/in as much as possible.
  - Remind students to use safety precautions while in the lab and wear appropriate safety equipment.
  - Use a table similar to the one below to record the data:
  - Time limit on spill clean-up (7-10 minutes)

Observe each object's interaction with oil and write down your observations:				
	Water - 200mL (25-50mL oil)	**Rock (5-10 drops oil)**	**Feather (5-10 drops oil)**	**Plant (5-10 drops oil)**
Reaction to Oil:				
Evaluate each cleaning tool and determine if it effectively cleans up the oil. Give it a score of 1= Not Successful—5=Removes it completely.				
	Water - 200mL (25-50mL oil)	**Rock (5-10 drops oil)**	**Feather (5-10 drops oil)**	**Plant (5-10 drops oil)**
Spoon				
Cotton Ball				
Sponge				
Dawn Dish Soap				

Teacher:

- **PREP BEFORE STUDENTS COME TO CLASS:**
  - The lab is set up with all contents in a spill-safe tray.
  - Contents include:
    - Oil (Food coloring may need to be used in the water to define differences between light oil and water)
    - Items to cover in oil (this lesson will use water, rock, feathers, and plants.)
    - Tools for helping students explore the best clean-up method (this lesson will use a plastic spoon, sponge, cotton ball, and Dawn dish soap)

Teacher Tips:

Previous student knowledge should include the definition of natural resources and how their use can negatively or positively affect the environment.

The teacher decides what objects students use to clean the oil spill.

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Students explore their stations with the oil. Students record results and observations of their findings.	

EXPLORE	
What is an oil spill, and how do we mitigate its effects on the environment?	

Students: Explore different oil spill information to understand better what they are, how they have impacted the Earth's ecosystems, and how they can be mitigated.
▪ Students gain information on what an oil spill is by going to these links:
  ▪ NOAA.Gov Oil Spill
 	
▪ More information on oil spills
  ▪ Deepwater Horizon: 10 Years Later
  ▪ Links to research articles:
  ▪ Cleaning oil from animals
  ▪ Oil Spill Prevention and Response
  ▪ Poster rubric
  ▪ Grand Staircase-Escalante National Monument
	Teacher Tips
	▪ To save time in class, teachers may want to Jigsaw the reading of the articles.
	▪ The teacher will need to time the process of obtaining information from the articles so that all students may be ready to start the Hands-On lab together.

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EXPLAIN

What is an oil spill, and how do we mitigate its effects on the environment?

Students: Design a solution for how your material could be cleaned up on a large scale. Your design needs to be:

- Mostly automated (does it work on its own)
- Works on a large scale(macro-scale) or higher quantity of oil

Constraints and Criteria:

- The solution cannot be more expensive than the problem
- The solution cannot ruin the environment more than the problem
- Unlimited funds are not available, so design wisely

Students: Using the information from the following websites (plus other online research if needed), create a foldable poster representing their design.

For Plant, Rock, and Water Clean-up

For Animal/Feather/Fur Clean-up

Example poster:

(On Front) (Creative name for design)	Draw your Design	Describe your design
Materials Needed		Name:

Teachers: Allow students to think of a macro-solution by tinkering around with their oil lab and supplies. If they come up with a solution they believe will work—and the classroom has the supplies to test it in a micro-lab environment—let them test it hands-on to see if that could work.

- See the rubric for guidance on everything that should be included in the final submission.

Students: Record all observations and include the positive results in your final poster design

Teacher Notes:

Teacher: Design and lab work is more efficient and straightforward if students are given a specific assignment on what they are designing their solution for. Example: Team 1 will design a solution and explanation for oil on roads/dirt/rocks. Team 2 will design a solution and explanation for oil on animals.

Learning time in this lab setting could get messy. Remind students to keep tests of oil clean-up within the tray provided and to reiterate safety and respect.

Learning here could take longer than the allotted time, so the teacher needs to determine what and when the students should clean up and move forward with their poster submission.

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EVALUATE

What is an oil spill, and how do we mitigate its effects on the environment?

Students: Communicate (SEP) the best method for oil clean-up and how it benefits the environment and that natural resource.

- Does it mitigate or monitor the effects on the environment?

Teacher: Give feedback on the poster blueprint and provide a rubric to help them be successful.

- Poster Rubric

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS

If resources for oil and lab supplies are unavailable, use the links provided to just research and infer the best practices for understanding what an oil spill is and how to best monitor and/or mitigate its effects on specific environments.

This lesson was created by Karen Pineda, Tyrel Hanson, Luis Hernandez, and Valorie Draper.

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