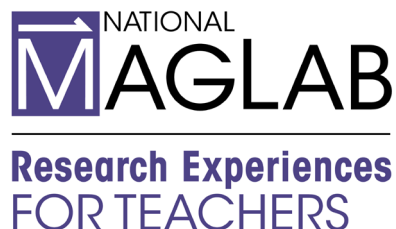


# Culturally Responsive STEM Lesson Plan:



## The Spoils of Oil

### Lesson Objectives:

- Students will be able to understand what oil is and how it is used in a wide variety of materials.
  - Students will be able to understand how physical properties can be used as a way to separate types of oil, reinforcing the importance of understanding physical properties.
  - Students will be able to create an oil spill simulation and explore ways to clean it up.
  - Students will be able to reflect on ways oil spills can impact communities and explore the potential of biofuels to provide renewable energy.
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### Next Generation Science Standards:

- MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
  - MS-ESS3-4. All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment.
  - MS-ESS3-2 , MS-ESS3-3.. The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.
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### STEM Rationale for Lesson:

This exploratory lesson helps students apply the physical properties of oil, such as density and solubility, to understand real life crises, like oil spills. To go further, students would investigate current research on alternatives to oil shipping and extraction such as biofuels and understand how the physical and chemical properties of biofuels allow them to potentially serve similar purposes as fossil fuels. Students, having already become familiar with alternative sources of energy, will be able to apply that knowledge to imagine alternatives to traditional oil use.

### Culturally responsive connection:

This lesson allows students to explore the multiple ways that oil production disproportionately affects low resourced communities, from those who directly experience the effects of oil spills on their shores. Students can reflect on ways communities are more vulnerable because of their proximity to oil reserves or ports of transport, as well as the innumerable ways oil products make their ways into their daily lives. In imagining a future without oil, students can talk about ways that some people are better resourced to be able to adapt to this new future, such as being able to charge electric cars and having the resources to front the upfront costs of solar panels.

# Culturally Responsive STEM Lesson Plan:

Because teamwork reflections and indicators are infused throughout the student worksheet, students are given the opportunity to discuss and examine how they participate in science. These indicators and reflections may help empower all students to play an active role, disrupting stereotypes of who gets to “do” science.

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## Materials Needed:

1. For density towers, per group:
    - Sink access (for washing)
    - 1 graduated cylinder 600 mL
    - 6 beakers
    - Styrofoam cup
    - 5 types of food coloring
    - Salt
    - Water
    - 6 beakers: 200 mL each
    - Beaker stirrers
    - Funnel
  2. For oil spills, per group:
    - Paper bowl
    - Tap water
    - 30 mL vegetable oil
    - Food coloring
    - Spoon
    - Paper towels
    - Cotton balls
    - 30 mL dish detergent
  3. Overall:
    - Access to computer & internet
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## Activate Prior Knowledge:

1. Students should have a general knowledge of density (students will draw a “high density” and “low density” model to review this key concept)
2. Students should be aware of what a molecule is and how they are composed of atoms with unique characteristics (to activate this knowledge, introducing 3D models of molecules and having students ask questions about them might be a way for them to visualize these differences).
3. Students should have a general sense of climate change and greenhouse gases (watching relevant videos on these topics might be a way to activate this knowledge).
4. Students should be reminded that a singular event can lead to diverse effects in multiple affected groups, and they should remember how to listen and engage with those with different perspectives.

## Lesson Introduction:

1. What \*isn't\* made from oil? After informing students about the basics of oil, students will try to find materials that \*aren't\* composed in part from oil products around the classroom. Students will check their findings against an [energy.gov](http://energy.gov) list with only a short list of oil products, they may also google to find whether or not their product comes from oil. (slides 3-6).
2. The students will then reflect on what surprised them about the activity, which could lead to a discussion about how intertwined our lives really are with oil and oil products.

# Culturally Responsive STEM Lesson Plan:

3. This introduction will be a good time to demonstrate to students the connections between oil, natural gas, petroleum, and plastic, all of which are derived from organic fossil fuels, and all of which are nonrenewable.

## Lesson Activity:

1. **Density towers:** In order to explain the connections between how oil is separated into the different products we use today, students will create density towers that separate different liquids and solids based on density. In groups, they will visualize density and then pour various liquids of varying densities (start with corn syrup) into the graduated cylinder and observe where they end up in the cylinder. They will then place (very carefully) different solid objects, from crayons to marbles, into the tower and see if they can separate them by density. In the video they'll watch after the activity, they will explore connections of density to boiling points, the basis of fractional distillation, the primary means of separating oil products.
2. **Oil Spill Cleanup:** Now, students will explore the effects, opportunities, and drawbacks of cleaning up a sample oil spill. First, students will draw on their previous knowledge of density to explore why oil and water don't mix (and introduce briefly the concept of immiscible liquids—like dissolves like). Then students will be equipped with materials to try to separate the oil and water mechanically and chemically. This hands-on investigation will lead to questions about how oil spills are cleaned up in real life and the challenges inherent in relying on oil transportation for energy.
3. **Impacts and Opportunities:** In the final section, students will read stories about the disparate impacts of oil spills on community stakeholders, from wildlife to community members near affected water. Students will then research one avenue of opportunities for replacing our reliance on oil, including types of renewable energy and biofuels. In doing so, they will ponder the question: Are all communities as prepared to adapt to using this technology?

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## Lesson Assessment

The primary goal of this activity is to help students explore oil's multitude of characteristics and its impacts from a diversity of perspectives. Successful comprehension of the lesson would look like students understanding why oil is important, how it creates so many diverse products, and some of the scientific and social challenges in cleaning it up and replacing it.

Assessment can include grading active participation and detailed scientific sketching for parts one and two, and thorough research and reflections for part three.

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