
Fracking the Case

A collaboration with
CASE

NSTA Nashville 2016



Ward's Kits



- Easy to use resources are being linked to the product pages
- Quality materials you can trust
- Kits are ready to use straight from the box!
- Contact: michelle.pagani@vwr.com
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CASE

Curriculum for Agricultural Science Education



What is CASE?

CASE

Curriculum for Agricultural Science Education

- An instructional **system**
- **Standards-based** curriculum
- **Intense** teacher professional development
- **Student-directed, inquiry-based, hands-on** instruction

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*Curriculum for Agricultural
Science Education*

Enhancement of Math and Science

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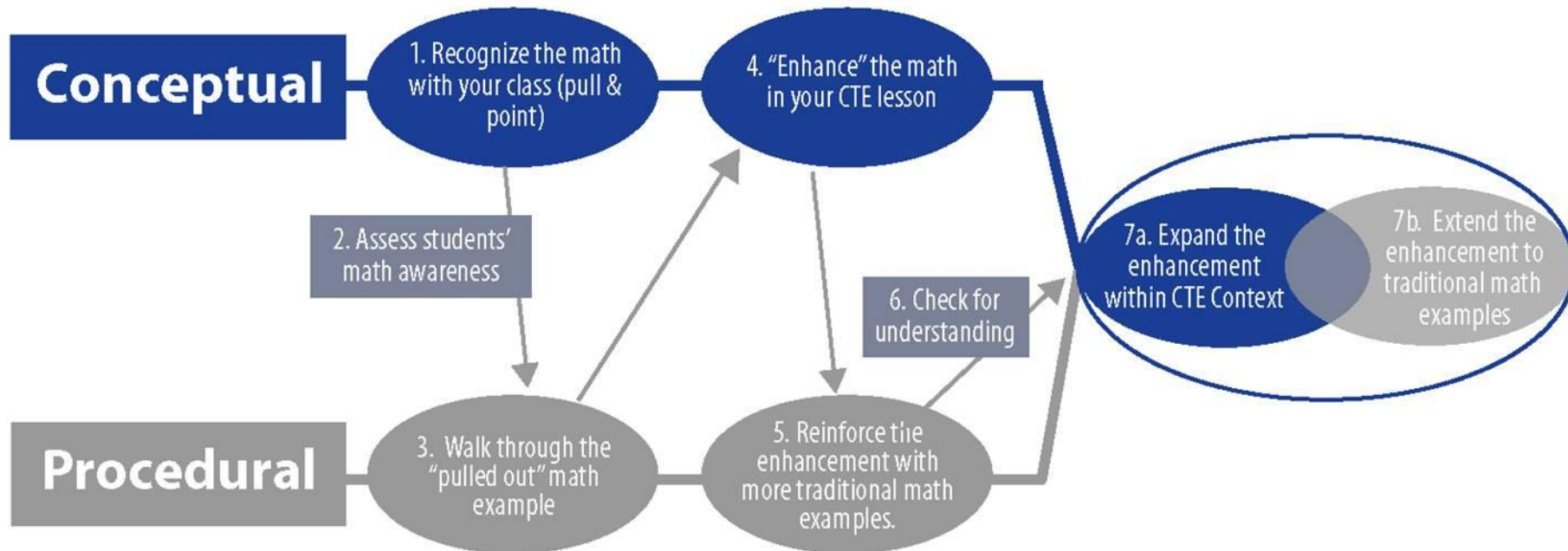
- **CASE** utilizes best instructional design strategies for enhancing math and science within agriculture subject matter:
 - Mathematics – NRCCTE Seven Elements of Mathematics Lesson Enhancement
 - » *Stone, et.al, 2006*
 - Science – Inquiry based approaches as defined by Colburn (2004)

Purposeful Teaching of Math

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Bring the math out and purposely teach it in a generic way so students understand the math



The Seven Elements of a Mathematics Enhanced Lesson (Stone, 2006)

Purposeful Teaching of Science

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- Inquiry-based methodology
- Proper use of science equipment as professionals in agricultural research use
- Reinforcement of scientific method and appropriate communication of data



APP Modalities

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- Activities
 - Structured inquiry



- Projects
 - Guided inquiry



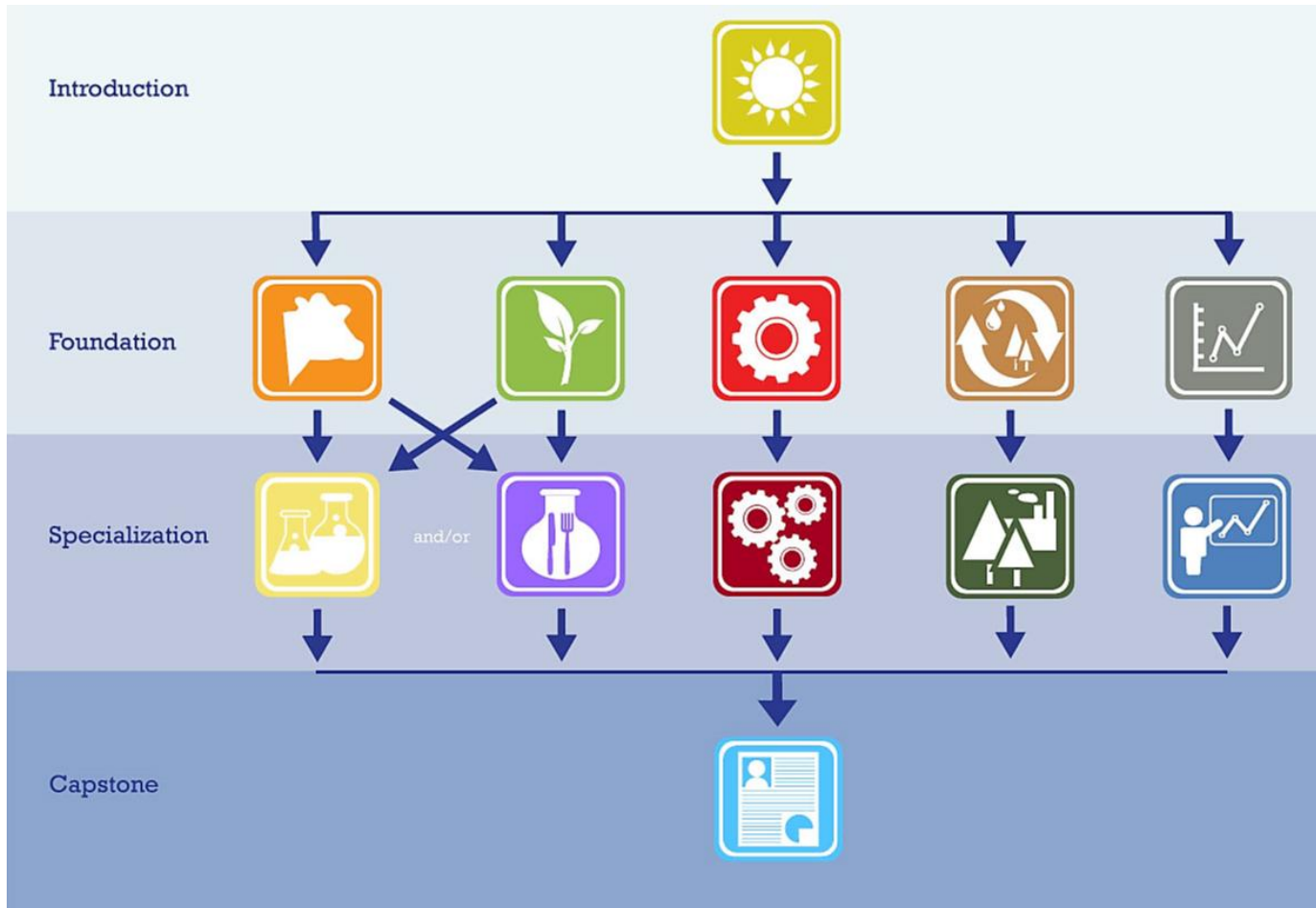
- Problems
 - Open inquiry



CASE Programs of Study

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CASE Training and Support

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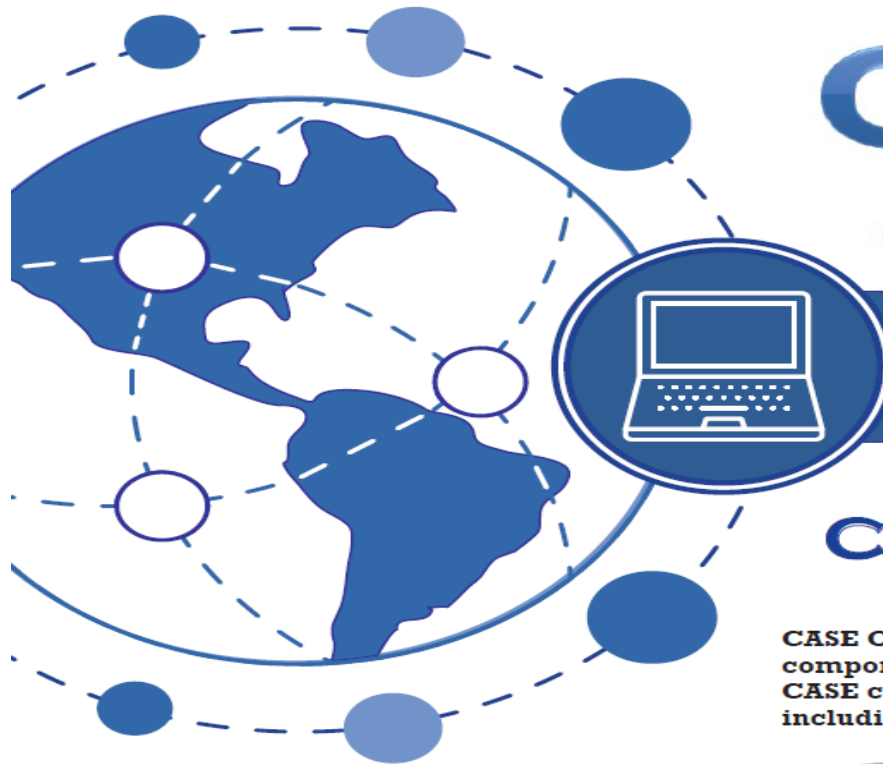
- CASE provides the curriculum, resources and teacher support services to promote effective teaching practices.



CASE Online

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CASE *ONLINE™*

An assessment and web based delivery system for CASE curricula

WHAT DOES CASE ONLINE™ OFFER?

CASE Online™ features four major components to maximize implementing the CASE curriculum in your classroom including:

Online student version of the curriculum

Student assignment submission portal

End-of-Course (EoC) national assessments

Test question database for the teacher to create quizzes & exams

Natural Resources and Ecology

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The lessons in *Natural Resources and Ecology* include the following.

- Conservation, Preservation, Exploitation
- Mother Earth
- Water Works
- Lighter than Air
- Earth's Energy
- Flora and Fauna
- Farming, Forestry, and Ferrous
- We the People
- Past, Present, Future

Activity 7.3.3 Enhanced Oil Recovery

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Lesson 7.3 and Activity 7.3.3 illustrate the features of the CASE curriculum.

- Review features of Lesson 7.3
 - Distribute copies of activity
- Review features of Activity 7.3.3.
- Complete data collection and analysis.
 - Questions and comments

NRE Lesson 7.3 Concepts

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| Concepts | Performance Objectives |
|---|--|
| <p><i>Students will know and understand</i></p> <p>1. Many practices and methods are used to mine important mineral resources</p> | <p><i>Students will learn concepts by doing</i></p> <ul style="list-style-type: none"> • Synthesize and make connections to the different practices and methods that are used to mine important mineral resources through a mining simulation. • Investigate the process of enhanced oil recovery while considering the resources used to recover the oil. • Investigate methods for cleaning up oil spills. • Design and test an oil-water separator. |
| <p>2. Mining natural resources has positive and negative impacts on the environment and human populations.</p> | <ul style="list-style-type: none"> • Consider the impact mining has on the environment and natural resources and determine mining practices that are utilized to protect the environment. • Characterize the effects of oil spills on ecosystems and humans. |

NRE Lesson 7.3 Essential Questions and Key Terms

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Essential Questions

1. → Why is mining for minerals or other natural resources important?
2. → What are the many methods used to mine for natural resources?
3. → What are the positive and negative impacts on the environment and human populations when mining for natural resources?
4. → What are the practices and methods used to extract petroleum resources?
5. → How does an oil spill affect an ecosystem?
6. → How does an oil spill affect a human community?
7. → How is oil separated from water in an oil separator?

Key Terms

| | | |
|-------------------|------------------------|----------------------|
| Fracking | Geologic sequestration | Hydraulic fracturing |
| Mineral resources | Mining | Oil-Water Separator |
| Ore | Skimmer | |

NRE Lesson 7.3 Materials

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Unit 7 – Lesson 7.3 Digging and Drilling

| APP | Qty/ 20 | Qty/ 30 | Unit | Item Specifications | Vendor |
|---------------------------------|------------|------------|--------|---------------------------------------|--------|
| Activity 7.3.1 | 1 | 2 | Pkg | Small gold beads | Local |
| Activity 7.3.1 | 1 | 2 | Pkg | Small silver beads | Local |
| Activity 7.3.1 | 1 | 2 | Pkg | Small blue beads | Local |
| Activity 7.3.1 | 1 | 2 | Pkg | Medium white beads | Local |
| Activity 7.3.1 | 10 | 15 | Lbs | Wild birdseed | Local |
| Activity 7.3.1 | 10 | 15 | Each | Shallow pans | Local |
| Activity 7.3.1 | 20 | 30 | Pairs | Tweezers | Local |
| Activity 7.3.1 | 1 | 2 | Roll | Paper towels | Local |
| Activity 7.3.3 Problem 7.3.5 | 10 | 16 | Each | 250ml Erlenmeyer flasks | Wards |
| Activity 7.3.3 | 5 | 8 | Each | 250ml beaker | Wards |
| Activity 7.3.3 | 5 | 8 | Each | 100ml beaker | Wards |
| Activity 7.3.3 | 1 | 1 | Each | 500ml 25% soap solution | Local |
| Activity 7.3.3 Problem 7.3.5 | 10 | 16 | Each | Double hole stoppers | Wards |
| Activity 7.3.3 Problem 7.3.5 | 15 | 24 | Each | 3" pieces of rigid plastic tubing | Wards |
| Activity 7.3.3 Problem 7.3.5 | 5 | 8 | Each | 6" piece of rigid plastic tubing | Wards |
| Activity 7.3.3 Problem 7.3.5 | 10 | 16 | Each | 15" pieces of flexible plastic tubing | Wards |
| Activity 7.3.3 | 5 | 8 | Each | 30ml syringe | Wards |
| Activity 7.3.3 | 1 | 2 | Each | Yellow food coloring dye | Local |
| Activity 7.3.3 | 1 | 2 | Each | 2000 ml of water | Local |
| Activity 7.3.3 | 5 | 8 | Each | Weigh boat | Wards |
| Activity 7.3.3 | 1 | 1 | Box | Baking soda | Local |
| Activity 7.3.3 | 1 | 1 | Bottle | Vinegar | Local |
| Activity 7.3.3 | 20 | 30 | Each | Safety glasses | Wards |
| Problem 7.3.5 | 7 | 10 | Each | Ring Stand, iron ring, clamp | Wards |
| Problem 7.3.5 | 56 | 80 | Each | Foam cups or plastic cups | Local |

NRE Lesson 7.3 Teacher Notes

(Excerpt)

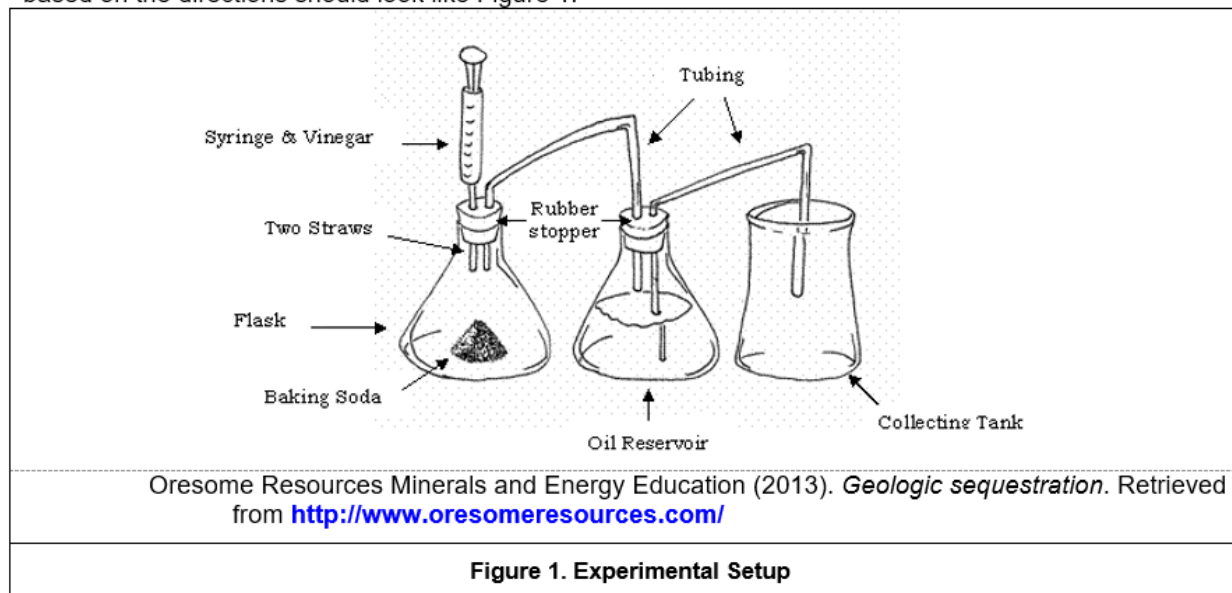
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I Activity 7.3.3 Enhanced Oil Recovery

Students will simulate the process of enhanced oil recovery in this experiment. The activity is written for students to insert the rigid tubing in the rubber stoppers, but you may choose to do this ahead of class. To prepare the simulated oil, use yellow food coloring to dye approximately 2000 ml of water. Do not use oil as the viscosity will skew results in this activity.

It is recommended that you demonstrate the proper setup of the laboratory equipment. The final assembly based on the directions should look like Figure 1.



Remind the students to make sure the tubing is not kinked, and to hold the stoppers on the flasks so they do not pop off. Do not run the reaction without safety glasses.

NRE Lesson 7.3 Check for Understanding

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Lesson 7.3 Check for Understanding

1. What are two examples of methods used to mine important mineral resources?
2. Explain the purpose and techniques used in geological sequestration.
3. List two positive and two negative impacts of mining and using natural resources that have occurred in your region.

Lesson 7.3 Check for Understanding Answer Key

1. What are two examples of methods used to mine important mineral resources?
Answers will vary but should include responses such as the following.
Surface and underground mining or digging for coal to be used for electricity
Surface and underground mining or digging for sand and gravel for roads and other construction projects
Use of gases to inject into the subsurface of the earth to remove minerals
Hydraulic fracturing to extract oil or gas
2. Explain the purpose and techniques used in geological sequestration.
Geologic sequestration is used to force oil out of oil formations underground, increasing productivity
Geologic sequestration is the process of injecting carbon dioxide into the deep subsurface of the earth.
3. List two positive and two negative impacts of mining and using natural resources that have occurred in your region.
Answers will vary, but should be similar to the following.
Positive: Mining for coal provides a means to produce electricity.
Mining for gas provides a means to power vehicles, heat homes and building, and other related uses.
Mining for metals supports electronic devices.
Answer will vary depending on region.
All areas benefit from petroleum products for fuel food and fiber. Some area will have had oil spills.
All areas have experienced leaking fuel storage tanks, spills of tanker trucks, and varying degrees of air pollution. Many areas have damaged ecosystems from mining operations and mine waste.

Activity 7.3.3 - Purpose

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Purpose

You may have seen images of oil spurting from the ground or being pumped from wells. Together, these methods extract only about 15% of the oil in the ground. Enhanced oil recovery (EOR) methods can be employed to remove approximately 40% of the oil in the ground.

One method of EOR is geologic sequestration, which sequesters or traps unwanted products while extracting desirable products. One example is carbon dioxide sequestration. Carbon dioxide is pumped into the oil reservoir increasing the pressure making it easier to extract the oil. The carbon dioxide, often considered an unwanted greenhouse gas, is then trapped and stored in the reservoir.

Hydraulic fracturing, or fracking, is another method for increasing oil and natural gas production. Hydraulic fracturing injects water and gas under high pressure, opening channels in deep shale formations to release natural gas deposits. Sand, walnut shells, ceramic particles, or other agents are pumped into the channels and used to facilitate the extraction of gas. Fracking is controversial due to the large volumes of water required, waste water produced, and the potential for groundwater contamination.

In this activity, you will use a working model to simulate the process of enhanced oil recovery. Does the model demonstrate the risk and benefits of the EOR process? Does the EOR process raise concerns about environmental impacts as you consider the chemicals used?

Introductory paragraph grabs the student's attention.

Body provides background and content necessary to complete the activity.

Posed questions structure and lead into inquiry.

Activity 7.3.3 – Materials and Procedure

Materials

Per group of four students:

- 2 250ml Erlenmeyer flasks
- 250ml beaker
- 100ml beaker
- 2 double hole stoppers
- 3 3" pieces of rigid plastic tubing
- 6" piece of rigid plastic tubing
- 2 15" pieces of flexible plastic tubing
- Soap solution
- 30ml syringe
- 200ml simulated oil
- Weigh boat
- Baking soda
- Vinegar

Per student:

- Safety glasses
- Pencil
- *NRE Notebook*

Materials are organized by group and student.

Activity 7.3.3 Student Worksheet and Conclusion questions

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The Student Worksheet organizes predictions, observations, data and results of the inquiry.

Conclusion questions target concept understandings.

Activity 7.3.3 Student Worksheet

Table 1. Predictions

| | |
|---|--|
| Reaction caused by baking soda and vinegar | |
| Effects in oil reservoir. | |
| Changes in collecting tank | |

Supplementary materials



Describe each of the rocks that are in front of you.

Based on just these 2 rocks, what characteristics might be found in an area that fracking occurs?

NRE Summer Institutes

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University of Nebraska – Lincoln hosted at
Waverly High School – June 19-28, 2016

Oakland Schools Technical Campus NW
(Michigan) – July 18-28, 2016

Registration information:

case4learning.org

Conclusion

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- Questions
- Final
Comments
- Contact
Information

Next Steps



- Find the products used in this workshop at wardsci.com
- Pick up **helpful literature** on your way out
- Any questions? Email our Plus Us team at: sciencehelp@vwr.com
- Stop by **Ward's Science booth 142** for a chance to win one of two \$500 science shopping sprees!

