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| **Lesson Title : Properties of Sand, Silt, Clay and Loam. Soil Triangles, and Water Infiltration/Absorption.** | **Unit #:****1** | **Lesson #:****2** | **Activity #:****5** |
| **Activity Title: Design and Test an Effective Water Filtration System**  |

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| **Estimated Lesson Duration:** | **8 days**  |
| **Estimated Activity Duration:** | **3 days**  |

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| **Setting:** | **Science Classroom**  |

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| **Activity Objectives:** * **Identify and describe contaminated water sources.**
* **Explain the importance/societal impact of clean drinking water.**
* **Create and test a water filtration system that effectively removes sediments and contaminants from the water.**
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| **Activity Guiding Questions:*** **Will sand, silt, or clay allow for the best water infiltration?**
* **What are ways that water can become contaminated?**
* **How are some ways to see if water is safe to drink?**
* **What are some things in nature that can be used to filter water?**
* **What are some natural filtration processes in nature?**
* **What are the benefits of using ground water as a drinking source?**
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| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| [x]  Asking questions (for science) and defining problems (for engineering) | [x]  Patterns |
| [x]  Developing and using models | [x]  Cause and effect |
| [x]  Planning and carrying out investigations | [x]  Scale, proportion, and quantity |
| [x]  Analyzing and interpreting data | [x]  Systems and system models |
| [x]  Using mathematics and computational thinking | [x]  Energy and matter: Flows, cycles, and conservation |
| [x]  Constructing explanations (for science) and designing solutions (for engineering) | [x]  Structure and function.  |
| [x]  Engaging in argument from evidence | [x]  Stability and change.  |
| [x]  Obtaining, evaluating, and communicating information  |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| [x]  Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| [x]  Demonstrating Science Knowledge **(D)** |
| [x]  Interpreting and Communicating Science Concepts **(C)** |
| [x]  Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or** **Common Core State Standards -- Mathematics (CCSS)** |
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| **Standards for Mathematical Practice (Check all that apply)** |
| [x]  Make sense of problems and persevere in solving them | [x]  Useappropriate tools strategically |
| [x]  Reason abstractly and quantitatively | [x]  Attendto precision |
| [x]  Construct viable arguments and critique the reasoning of others | [x]  Look for and make use of structure |
| [x]  Model with mathematics | [x]  Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):*** **Rocks, minerals, and soil have common and practical uses (SC.6.ESS.5)**
* **Minerals have specific quantifiable properties (SC.6.ESS.2)**
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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies)<https://www.jpl.nasa.gov/edu/teach/activity/water-filtration-challenge/>**FLINT** [**http://www.cnn.com/2016/01/11/health/toxic-tap-water-flint-michigan/index.html**](http://www.cnn.com/2016/01/11/health/toxic-tap-water-flint-michigan/index.html)**WATER QUALITY VIDEO** [**https://youtu.be/RMyCcWECbNE**](https://youtu.be/RMyCcWECbNE)**HATCHET** [**https://youtu.be/ZN70-C22ycc**](https://youtu.be/ZN70-C22ycc) |

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| **Teacher Advance Preparation:****Things to Collect** * **Water bottles**
* **Sand**
* **Gravel**
* **Square pieces of fabric**
* **Ashes from a fire**
* **Topsoil**
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| **Activity Procedures:****DAY 13*** **Warm up: “Why do Jack and Jill fetch a pail of water from the ground? Do you think this water will be safe to drink?”**
* **Review concepts students have learned from the unit.**
* **Have students share their answers small group and whole class.**
* **Ask students “What does it mean to say something is contaminated?”**
* **Have students discuss in small groups**
* **Have students share their answers whole class.**
* **Ask students “What if your water was contaminated? What do you think it would look like? What do you think would be inside of the water to make it contaminated?”**
* **Have students discuss their answers whole class.**
* **Ask the question “Do you think we have this problem here in the United States?”**
* **Have students discuss in small groups and whole class.**
* **Show students Flint video:** [**http://www.cnn.com/2016/01/11/health/toxic-tap-water-flint-michigan/index.html**](http://www.cnn.com/2016/01/11/health/toxic-tap-water-flint-michigan/index.html)
* **Discuss with the students the importance of clean drinking water.**

**DAY 14** * **Have students discuss the importance of water and notes from the previous video.**
* **Show students the water quality video** [**https://youtu.be/RMyCcWECbNE**](https://youtu.be/RMyCcWECbNE)
* **Have students list as many ways they think water can become contaminated.**
* **Have students share whole class as you make a list of possibilities on a piece of chart paper.**

**DAY 15-18** * **Introduce students to Hatchet video and scenario (lost in the wild)** [**https://youtu.be/ZN70-C22ycc**](https://youtu.be/ZN70-C22ycc)
* **Have students discuss what they would need to survive in the wild.**
* **Target water as a need**
* **Have students discuss if they think water in the wild would be safe to drink and what ways the water could be contaminated.**
* **Have students think about where they could collect the water and the problems they would face with some of these sources.**
* **Discuss how long a human being can go without water.**
* **Have students think about some things they could use in the wild to filter the water and remove some of the contaminants.**
* **Introduce students to the CBL challenge.**
* **Students will have 3 days to design a water filtration system that removes the most contaminants from the water as possible. Students are to use only the materials commonly found in the wild as well as two water bottles.**
* **Tell students they can test their water by examining before and after pictures of water clarity.**
* **Distribute sand, gravel, ashes (used), and water bottles to each team.**
* **Invite them to collect any other items for approval.**
* **Have students brainstorm ideas for approval.**
* **Distribute testing handouts that have spaces for sketches, brainstorming, and test results.**
* **Have students reflect on their designs and results. Prompt students to think about what changes they would make, or materials they would add if stranded in the wild.**
* **Have students think and discuss how this EDP challenge could connect to real world problems. What could students do to solve some of these global issues.**
* **Show students a video of Flint, Michigan and the water crisis.**
* **Discuss with students on steps that could be taken to solve problems like the Flint water crisis. Have students connect some of their own EDP challenge solutions to global problems.**
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**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

* CBL testing handout
* Contamination chart
* Video notes and discussion

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

* End of unit test

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.Refer to Activity Template for details. |

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson.* Be sure to burn some wood about 2 days prior to the EDP/challenge, and collect the black char. Grind this leftover carbon into gravel sized pieces for the students to use.
* Ashes will contaminate the water even further, this could be a good lesson but it does take more time and revisions if added as a material and is not necessary for 6th grade standards.
* No students collected items from home for approval, it would be good to have students go on a mini fieldtrip near the school to collect anything from their surroundings that might aid in the filtration process.
* Forcing the students to sketch and design before each iteration would have been better for the process.
* Be sure to thoroughly wash all gravel, pebbles, and sand before students use them for testing.
* Take pictures of all student designs that include labels of design and test #.
* Give students time to think through their revisions and designs after each test.

Overall the CBL activity went well, students were challenged and communicated throughout the entire process. Having students slow down and think about their designs and problems before continuing with iterations could have yielded better results.   |