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| **Lesson Title : Importance of water to life** | **Unit #:**  1 | **Lesson #:**  1 | **Activity #:**  1 |
| **Activity Title: Staying Alive…Life is Complicated!** |

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| **Estimated Lesson Duration:** | **9 days** |
| **Estimated Activity Duration:** | **4 days** |

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| **Setting:** | **Classroom, school grounds** |

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| **Activity Objectives:** |

The student will be able to:

* Identify the essential question as “How can we improve school attendance by preventing the spread of illness among students?”
* Identify the problem as how to reduce the spread of bacteria and viruses on school grounds.
* Compare the effectiveness of hand sanitizer with that of hand washing.
* Analyze survey data in regards to student population hygiene
* Create a graph to represent student population hygiene survey data

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| **Activity Guiding Questions:** |

* What are the common causes of illness?
* How does illness spread?
* What is the best way to prevent the spread of illness?
* Which school surfaces pose the greatest risk?
* Which is better for reducing the spread of illness, hand washing or hand sanitizer?
* How often do students wash their hands?
* Why is water essential to life?

| **Next Generation Science Standards (NGSS)** | |
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| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☒ Cause and effect |
| ☐ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☒ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function. |
| ☐ Engaging in argument from evidence | ☐ Stability and change. |
| ☒ Obtaining, evaluating, and communicating information |  |

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

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

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| **Unit Academic Standards (NGSS, ONLS and/or CCSS):** |

Cells:

• Eukaryotic cells and prokaryotic cells

• Characteristics of life regulated by cellular processes

• The essential functions of cells involve chemical reactions that involve water and carbohydrates, proteins, lipids and nucleic acids

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

* Big Idea Handout
* Essential Question Handout
* KWL Chart
* Pre-test
* Petri Dishes
* Sterile Swabs
* Hand Sanitizer
* Hand Soap
* Sharpies
* Directions for use of petri dishes Power Point
* Water Power Point and Guided Notes handout
* Article “Arizona Teen Dies After Drinking Red Bull” <http://www.nydailynews.com/news/national/dehydrated-arizona-teen-dies-mexico-vacation-article-1.1839141>
* New attendance requirements from the state of Ohio.
* Video Clips:

• News reel footage of norovirus outbreak on a Cruise Ship <http://www.today.com/video/today/46339604#46339604>

• News story of norovirus outbreak at a school, <http://krqe.com/2014/05/01/school-closes-due-to-suspected-norovirus-outbreak/>

• Nathan Wolfe Virus Hunter Video, <http://www.ted.com/talks/nathan_wolfe_hunts_for_the_next_aids>

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| **Teacher Advance Preparation:** |

* Create student teams of heterogeneous groups of 3.
* Pour agar into petri dishes
* Prep the incubator
* Download video clips
* Copy handouts (Big Idea, Essential Questions, KWL Chart)

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| **Activity Procedures:** |

Day 1 and 2 Presenting the Big Idea

* Students will take the Pre-Test
* The Hook will be presented using video clips and attendance requirements from the Ohio Department of Education.
* Present the Big Idea.
* Put students into teams of 3.
* Give each team 1 petri dish and 4 sterile swabs. Students are to draw a plus sign (+) on the bottom of the dish to create 4 quadrants. Teams are to write team name on the top of the dish.
* As a class brainstorm answers to the following questions: Where on school grounds do you think you can collect the most bacteria? And where on school grounds do you think has the least bacteria?
* Teams are to select 2 areas from each list (dirty/clean) then write the locations in the appropriate regions of the petri dish. Dismiss students to swab areas. Seal petri dishes and place in incubator.
* Think pair share: Why should we be concerned about finding bacteria on surfaces?
* Introduce students to the guidelines for strong Essential Questions.
* In teams students will use the 3 scenario hand out to come up with 3 Essential Questions.
* Group similar Essential Questions. Secret Ballot to vote for the Essential Question to investigate.
* Students are to view the Power Point on Water on Moodle and take notes for homework (any student without internet and pick up a copy of the Power Point) in preparation for day 4 activity.

Day3 Introduce the challenge

* Introduce Challenge Notebook and discuss importance of recording daily activities and progress on the project. Each team will be given a composition notebook in which to note observations and record daily activities. The team members will share responsibility as recorder (the notebook will be kept in the classroom and members will rotate the job of recorder daily).
* Guide students to the development of a Challenge. Brainstorm in teams: What can be done to reduce the spread of virus and bacteria school wide?
* Teams share out. Pull elements from suggestions to come up with the Challenge as a class: Design a method for reducing the spread of bacteria and viruses on school grounds.

Teams must design a comprehensive method that includes the following:

1. Personal hygiene

2. School facilities (physical environment and procedures)

3. Elicit participation by school community (campaign)

* Teams come up with guiding questions using handout (KWL)
* Provide each team with a petri dish and write team name on top of the dish.
* Students are to draw a “Y” to divide the plate into 3 regions. Students are to write the following words (1 per region): hand, sanitizer, washed.
* Teams are to select one member and swab the palm of both hands with one swab and place on the region labeled hand.
* Teams should then select one member to apply hand sanitizer to one of the hands and rub in thoroughly then swab and place on region labeled “sanitizer”.
* Teams should then have the last member wash the other hand using soap and warm water then swab and place on the region labeled “wash”.
* Place petri dishes in incubator.
* Record today’s activity in notebook. Each member of the team is to record the following in the notebook: predict which method they think with result in the least growth and explain why.

Day 4 Analyze Data

* Teams look at school attendance data. Analyze to find patterns and make inferences as to the reason behind days with high absences. Share out.
* Teams look at student hygiene survey data (survey was taken by the student body the first week of school on Survey Monkey) and identify patterns. Data is to be displayed as a bar graph and kept as baseline data.
* Teams are to make observations of petri dishes and record in notebook.
* Teams are to share findings.
* Reminder of note taking assignment due tomorrow.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

* Identifying Essential Questions.
* Survey analysis
* Composing Guiding Questions.
* Four Point Rubric warm up question at start of class day 4: Draw a molecule of water and label to illustrate polarity.

**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.

Challenge Notebook will be evaluated at the end of the unit.

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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. |

* Written directions provided along with illustrations to go along with verbal directions projected.
* Teams are grouped heterogeneously.
* Guided Notes available to students.
* Students who finish early can use the internet to research answers to the guiding questions for further clarification.

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| **Reflection:** This lesson went well although felt rushed at times. I added an additional day for the start of the unit to allow more time for brainstorming and swabbing. I was unable to get attendance data from the district due to changes in staffing and time. We improvised by taking an anonymous class survey regarding absences and found that many students will miss school due to reasons other than illness. Students missed most often for illness followed by lack of transportation, care for a sick younger sibling, and “mental health day” (staying home to avoid due dates, staying home to play video games, just don’t feel like going). The majority of students indicated that if school was “more fun” they would be less likely to take “mental health days”. We also had to skip the hand swabbing portion of the lesson due to a malfunction with the incubator which melted our first round of swabs. We used the time and materials to re-swab school grounds as that information is important in a later lesson. |