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| **Lesson Title :** The causes of air pollutants and methods used to control air pollutants | **Unit #:** 1 | **Lesson #:** 1 | **Activity #:** 1 |
| **Activity Title:** Introduction to big idea, hook, essential questions; introduction to major air pollutants, causes and health effects chart/notes; air quality survey lab |

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| **Estimated Lesson Duration:** | 5 days |
| **Estimated Activity Duration:** | 2 days |

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| **Setting:** | Classroom |

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| **Activity Objectives:** |

(Given the topic – Air Pollution/Air Quality) will generate an Essential Question.

(Chart/Notes)

Identify and describe the major air pollutants.

Describe the sources of air pollution.

(Air Quality Survey Lab)

Observe the effects of various air pollutants on a number of different materials.

Test ways to reduce light pollution.

Gather and inspect particulate matter.

Study the effects of acid rain after simulating acid rain formation.

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| **Activity Guiding Questions:** |

Given a topic and big idea, what are some good essential questions?

What causes major air pollution?

What effects are there of air pollution? Environmental/human health?

What are the major air pollutants?

| **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 Learning Standards for Science (OLS)** |
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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)** |

| **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)** | |
| ☐ 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, OLS and/or CCSS):** |

College Board for Advanced Placement Environmental Science themes covered: 1. Science is a process, 4. Humans alter natural systems, 5. Environmental problems have a cultural and social context, 6. Human survival depends on developing practices that will achieve sustainable systems. College Board for Advanced Placement Environmental Science topics covered: VI. Pollution: A. Pollution types, 1. Air pollution; B. Impacts on the environment and human health, 1. Hazards to human health.

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

‘Hook’ video: <http://www.cnn.com/videos/health/2016/09/27/air-pollution-deadly-orig.cnn> , pre-assessment, ‘big idea’ worksheet, ‘air pollutants chart/notes’ worksheet, see ‘Carolina EcoKits: Air Quality Survey’ lab teacher’s manual pages 5-6. See the following link for details on the ‘Carolina EcoKits: Air Quality Survey’ lab: <http://www.carolina.com/carolina-ecokits/carolina-eco-kit-air-quality-survey/187218.pr> . ‘Air Pollution Control Methods Notes’, ‘EDP: Building an Air Filtration Device’ worksheet, ‘Wet Scrubbers’ lab (background and pre-lab questions).

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| **Teacher Advance Preparation:** |

Give pre-assessment before this day or at the beginning of this class before the video.

Have ‘hook’ video uploaded and ready to show first thing during class.

Fill out the ‘big idea/essential questions’ worksheet to help guide students during the activity.

Fill out ‘air pollutants chart/notes’ beforehand so you know what exactly you want your students to know about each air pollutant.

‘Carolina EcoKits: Air Quality Survey’ lab needs advanced teacher preparation (see teacher’s manual pages 7-10). This lab has students test local air quality by rotating through various stations: examining effects of air pollutants on fabrics, investigating light pollution, collecting and examining particulate matter, simulating acid rain and its effects, and demonstrating the acidity of smoke.

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| **Activity Procedures:** |

Day 1

Administered pre-assessment.

Showed students the ‘hook’ video:

Gave students the ‘Big Idea’ worksheet and guided them through that in order to have them come up with the essential questions.

Completed ‘Air Pollutants Chart/Notes’ with students.

Gave ‘Carolina Ecokits: Air Quality Survey’ lab (background and pre-lab questions) and had the end of class to start working pre-lab questions.

Day 2 (Start some of Lesson 1 Activity 2)

Gave pre-lab quiz to make sure students read through the lab and answered the pre-lab questions.

Started all activities in the ‘Carolina Ecokits: Air Quality Survey’ lab.

Completed ‘Air Pollution Control Methods Notes’ with students (Lesson 1 Activity 2).

Introduced the challenge🡪 KWL Section of ‘Big Idea’ worksheet.

Completed sections of the ‘EDP: Building an Air Filtration Device’ worksheet (Identify and Define; Gathering Information sections).

Gave students ‘Wet Scrubbers’ background information and pre-lab questions.

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

Air quality survey data sheets with activity questions.

**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

Air quality survey end-of-lab questions.

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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. |

I grouped students with varied learning abilities to help with differentiation. In addition, animations and graphics were used on Power Point presentations to give students’ notes. Instead of giving them the ‘Big Idea/Essential Questions’ worksheet I gave them neon Expo markers so they could write their ideas and questions directly on the lab tables.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson.  For the ‘Air Quality Survey’ lab I should have set-up one of the activities ahead of time so they could have completed all of the lab activities in one class period. In addition, students stated on their surveys that they wish they would have had more information about air filters and I could have used some of this time to discuss with them different materials used for filters. I chose not to do this because I wanted them to research it themselves and do their own work versus having it given to them. Some successes were using neon Expo markers on the desk because this really gets students involved in the process and using hands-on labs like the ‘Air Quality Survey’ lab helped them learn more about air quality within our school community. |