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| **Lesson Title :** Pollution types and designing and testing their device | **Unit #:** 1 | **Lesson #:** 2 | **Activity #:** 4 |
| **Activity Title:** Introduce the challenge and design and test their device; create and present presentations |

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| **Estimated Lesson Duration:** | 5 days |
| **Estimated Activity Duration:** | 4 days |

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| **Setting:** | Classroom |

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| **Activity Objectives:** |

(Challenge)

Design an air filtration device that could filter indoor air pollutants (specifically particulate matter).

Parameters of challenge: Box—size; dust matter introduced; time air filtration device is in box filtering air; creating own filter—not given one; finite supply of materials (given a budget); solar fan used to pull air through device for 5 minutes and air quality is measured; reduce by a certain percentage; filter size must meet certain dimensions or thickness.

Testing devices: make a box that the device will go in/on—poke holes in the top to put hose through for monitoring PM—put filter in box and then light incense and turn on device after the incense is completely burned out and test for a certain amount of time (5 minutes) to see how much it filters/reduces the amount of PM in the box over time. Use a DustTrak monitor from our RET program to test the amount of PM.

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| **Activity Guiding Questions:** |

How is indoor air pollution different in developing and developed countries?

What are major indoor air pollutants? What are the risks associated with these indoor air pollutants?

How could someone create an air filtration device that would be cheap and easily accessible for those in developing countries that are effected the most by indoor air pollution?

| **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) |

‘EDP: Building an Air Filtration Device’ worksheet, solar powered car cooler fan (or solar panels and computer fan), cardboard, paper, rolls of tape, Styrofoam, hot glue, DustTrak monitor.

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| **Teacher Advance Preparation:**  |

Gather all the materials needed to complete the EDP activity.

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| **Activity Procedures:**  |

Day 1

Completed sections of the ‘EDP: Building an Air Filtration Device’ worksheet as classwork (Identify alternatives, select solution, implement solution).

Day 2

Completed sections of the ‘EDP: Building an Air Filtration Device’ worksheet as classwork (Implement solution, evaluate solution, refine)

Students built and tested their devices.

Day 3

After finished testing their devices, students created a convincing presentation of why someone in the developing world might want to purchase their device to filter indoor air pollutants.

Day 4

Students communicated their solutions by presenting their presentations.

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

Checking the EDP worksheet throughout the design process.

**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.

Presenting their air filtration device as something someone in a developing country might want to buy to make sure their air is clean.

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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. Students could build devices almost however they wanted as long as they adhered to the constraints. In addition, students could present their devices with a poster or Power Point.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson.This lesson was very fun to watch the students interact with each other and build their devices. I was slightly disappointed in a few presentations that were lacking what was spelled out in the rubrics I gave to them ahead of time, but overall most of the presentations were what I was looking for.  |