# Western Engineering Outreach

## Breath of Fresh Air

## Grade 3-5

## Meet Today's ENG HERO!

**Mita Ray** - Professor with Western Engineering

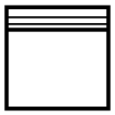
*Mita Ray is a professor with the Chemical Engineering Department at Western University. She does work in two main categories with advanced water treatment technologies and environmental modelling. All of her work has direct bearing on reducing pollution in the environment. To learn more about Dr. Ray visit: https://www.eng.uwo.ca/chemical/faculty/ray_m/index.html*

## Learning Goal:

- Students will learn of the implications of air pollution
- Curriculum connections: Grade 4 - Habitats and Communities, Grade 5 - Properties of and Changes in Matter

## Materials Needed:

- 2-3 index cards / construction paper
- tape
- scissors
- pipe cleaners
- cotton balls
- cloth / fabrics / cheesecloth / aluminum foil
- tissues / napkins
- Shoebox
- string
- black pepper, sand, or similar small particles
- large container (trash can / cardboard box)
- hair dryer



## Engineering and Science Connections:

What is are particulates?

Particulates, or particulate matter, are a complex mix of all the extremely small particles that can be either liquids or solids which are stuck in the air. It can be made of many things → dust, pollen, soot, ash, fumes, smoke, liquid droplets. Once inhaled it can cause some serious health effects for people, plants, and animals.

Even though our technology has allowed us to do many amazingly good things, it has also come at the cost of causing a few amazingly bad things.

Technology has allowed us to create things that we could have never dreamed of in the past. But with these new creations come potentially harmful pollution. Without further advancements, factories and vehicles that create these products can release harmful gases and particulate matter in the air, which can have serious implications for the livelihood of countless organisms we share the planet with… including ourselves.

Environmental pollution (pollution of air, water, ground) like dust, soot, asbestos, freon, various dangerous / toxic chemicals are mostly invisible to the eye, and can be trapped in the environments we live in. They can enter the body through breathing in, drinking the water, and even eating organisms that have been exposed to the pollution.

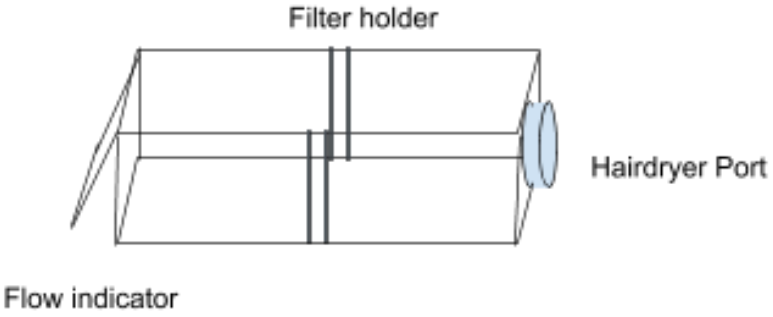
Many different kinds of engineers develop new technologies to control the problems that old tech has created. They have worked on creating filtration systems, which can be placed in factories and on vehicles to help reduce the amount of pollution we put in the environment.

## Activity:

### Set Up

- Before the activity, make the testing apparatus:
  - cut a hole on one end of the shoe box, wide enough for the hairdryer to fit into it
  - cut out the entire panel of the other side of the shoebox
  - Fold foil in half and hang it over a string, then attach string to the open end (this will act as an indicator of air flow and deflection of particles that go through the filter)
  - fold the index cards into 4 L shapes, then tape them in pairs (facing each other to look like a T with a space between them) halfway down the path of the shoebox: this will be our filter holder that will be where we place the home made filters.

- Diagram of testing apparatus:




- put your large container over the open end with the flow indicator to catch escaping particles
- position apparatus such that the blow dryer is blowing air into the bin

## Discussion

- what is particulate matter?
- what is air pollution?
- what are some solutions that you think engineers have come up with to clean the air?
- What is an ammeter? It is a device used to measure air flow. This is what the foil is (the foil flap will be pushed up a certain distance when the flow rate is high, and will be pushed up less)
- can demonstrate this by turning the hairdryer to the max and seeing how high the foil goes, then turning the hairdryer down to medium and seeing that the foil doesn't go up as high.

## Design Challenge

- We need to design an air filter that can filter out particulate matter from the air without blocking the air flow too much.
- Our air filter cannot block more than 50% (1/2) of the air flow (the foil will come up to half its angle when nothing was blocking the flow)
- filter must fit in the testing apparatus (the shoebox) while the apparatus is closed

## Make It

- Give student a walk-through of the materials available for use
- have your student discuss the materials they will use and the design that they think will most effectively filter out the particles

- After approval they can build their filter, revising design as needed
- They can make up to 4 filters and see which one is best

### Test It

- Place a filter into the filter slot of the apparatus, close the apparatus lid
- Test the air flow, how much does the filter reduce air flow?
- Hold a piece of paper with the "particulate matter" on it directly in front of the blow dryer, then turn on the blow dryer to disperse the particulate matter onto the filter
- About a small palmful of whatever particulate matter you chose should work depending on how big the apparatus and the filters are
- You can tell how much matter gets past the filter either by looking at how many of the particles are blown into the large container or by looking at the amount of particles that are trapped on the filter after the test.

## What Did You Learn?

- What is particulate matter?
- Why might we want to filter it out?
- If your design wasn't very successful, why do you think your filter didn't work so well? Why do you think the air flow was blocked?

## Future Learning

- Turn this activity into an experiment! In order to do this, try four different filter designs. Use different materials for each filter design. Make a prediction: what will happen to the airflow with each filter design? What happens to the amount of particles that get past the filter when the filter blocks more of the airflow? Does it go up, down, or stay the same? Which filter did you find works best, why do you think it works so well?

## Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

Instagram: @westernueng
Twitter: @westernueng
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*Thanks for discovering with us!*