

# EXPERIMENTS

## Car Exhaust Experiment

(Adapted from "What's Making it Brown Outside? Collecting and Measuring Particulate Matter" [www.airinfonow.org/pdf/CurriculaBrownWithGraphic.PDF](http://www.airinfonow.org/pdf/CurriculaBrownWithGraphic.PDF) PDF no longer available).

Possible BC Curriculum Linkages:

### **Science 7**

*Processes of Science*

- Hypothesizing
- Modeling

*Life Science*

- Assess the requirements for sustaining healthy ecosystems
- Evaluate human impacts on local ecosystems

*Physical Science*

- Conduct investigations into properties of matter
- Classify substances as elements, compounds, and mixtures
- Measure substances and solutions according to pH, solubility, and concentration

**NOTE: Rainy weather will interfere with the results of this experiment.**

### **Students will:**

1. Identify gaseous and solid pollutants in the atmosphere.
2. Observe an experiment that illustrates how to capture particulate pollutants and identify which vehicle gives off more particulates.
3. Conduct an experiment capturing particulate pollutants and determine which sources emit high amounts of particulate.

### **Materials Needed:**

- Scissors
- Six coffee filters
- Six 3" x 5" index cards
- Microscope or magnifying glass
- Access to six motor vehicles
- Particulate Scale (provided)

### **Hypothesis:**

Older vehicles, and those using diesel fuel, will produce more particulate matter emissions.

**Procedure:**

1. *Prior to performing this experiment*, find six people who are willing to be interviewed by students and have their automobiles tested (if possible, include a diesel school bus and an older leaded gas vehicle).
2. Divide the class into six groups. Cut the coffee filter into 2"x4" rectangular pieces. Have each group glue one piece of coffee filter to their index card.
3. Allow your students to see the six vehicles you are going to test. Ask them to guess which vehicles will produce the most and least particulate pollution and have them write down why they chose as they did.
4. Assign one vehicle to each student group.
5. Assign one student from each group to interview the vehicle's owner to determine how old the vehicle is, when it was last tuned, what type of fuel it uses, etc. Have another student write the car owner's name, vehicle year and make on the back of the card. When the interviews are complete, have owners start their cars. Have another student from each group hold the index card approximately 6 inches from the automobile exhaust pipe for one minute.

**CAUTION: Do not allow the students to touch the tailpipe and have everyone avoid breathing the fumes. Do this experiment in a well-ventilated area.**

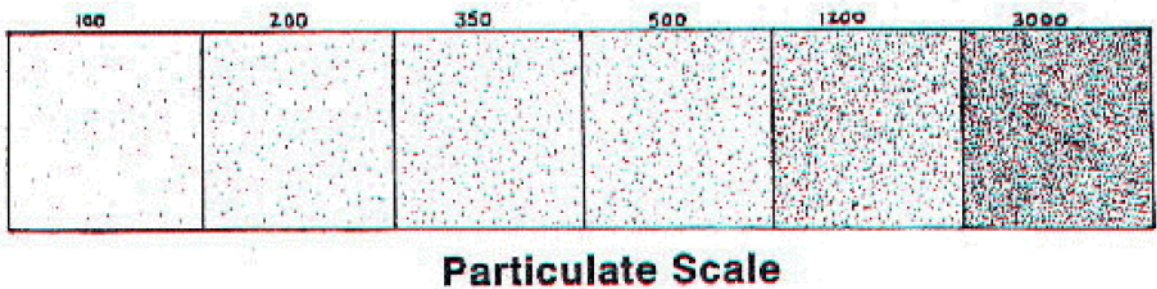
6. After each group has tested their vehicle, bring the index cards back to the classroom and look at the cards under a microscope, or with a magnifying glass. Using the particulate scale (see below), have the students estimate the number of particulates per square inch on their card. Have the students write the approximate number of particles per square inch on their card.
7. Have one student from each group bring their card to the board and relay their findings to the class. As a class, display the cards from least amount to greatest amount of particulates.

**Conclusion:**

Based on your observations, do the results of the experiment support or reject your hypothesis? Why or why not?

1. Have the students discuss which cars gave off more particulate pollution; was it older cars, larger cars, diesel-fueled cars, cars that hadn't been tuned in a long time?
2. What conclusion do the students draw from this investigation?
3. Would it matter if the car is regularly tuned up?

4. What other car maintenance factors could influence its emissions?
5. Have the students describe any relationship they see between the answers to the interview questions and the level of particulates on the scale.
6. Have the students graph the age of the automobile versus the number of particulates per square inch.
7. What other ways do vehicles contribute to particulate pollution?
8. Do you think the type of fuel used is also responsible for the amount of particulate emissions?
9. Would you expect solar-, electric-, or compressed natural gas-powered vehicles to have more or less emissions?



## Solar Oven Experiment

From GreenLearning Canada invite students to participate in the Annual Solar Oven Challenge. Details found at [re-energy.ca](http://re-energy.ca)

Possible BC Curriculum Linkages:

**Science 5**

*Earth and Space Science*

**Science 6**

*Physical Science*

**Science 20**

*Earth and Space Science*

“The sun is the ultimate renewable energy source. Every day for about ten billion years, the sun has poured out unimaginable amounts of energy. The Earth, orbiting at a distance of 150 million kilometres from the sun, intercepts a tiny fraction of this solar output. At the Earth's surface, incoming energy from the sun is absorbed by the land, water and atmosphere, and converted into measureable heat. This heat acts like a giant engine, creating winds and currents in our atmosphere, oceans, and rivers.

Most of the sun's energy is emitted as visible light. To harness the sun as a source of energy, we need to convert it from visible light into heat or electricity. Use the [re-energy.ca](http://re-energy.ca) construction plan to build your own solar oven that really cooks! You can also use our plan to design your own and consult the many other models provided in the Links. Canadian classes can enter our Annual Solar Oven Challenge.”