

Teacher Survey

Instructions: Please complete the following evaluation.

1. Did you make any adjustments to the learning module? If so, what did you change or omit?

2. From your observations, are the students more interested in atmospheric science?

3. What part of the lesson was most effective or interesting to them?

4. What concept did the students have most trouble understanding or applying?

Student Survey

Please distribute this survey to the students before and after completing the module.

Instructions: Circle the answer that best describes your feelings about science.

1. I like science.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

2. How often do you talk to your *family* about what you do in science class?
 - a. Never
 - b. Rarely (less than once a week)
 - c. Once a week
 - d. A few times a week
 - e. Every day

3. How often do you talk to your *friends* about what you do in science class?
 - a. Never
 - b. Rarely (less than once a week)
 - c. Once a week
 - d. A few times a week
 - e. Every day

4. I think science will be useful when I am older.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

5. I would like to be a scientist when I am older.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

Effectiveness Assessment

Part 1: Pre- and Post-Assessment (Student Evaluation)

Instructions: Please distribute and score the **Student Evaluation** for each student before and after completing the module. Each question is worth 1 point.

Student Evaluation

Instructions: After completing the lesson on air pollution, please have the students answer the following questions.

1. What is the major difference between primary and secondary pollutants?
 - a. Primary pollutants are harmful to the environment, while secondary pollutants are only harmful to human health.
 - b. Primary pollutants are emitted directly from a source, while secondary pollutants are those that are formed through chemical reactions with primary pollutants in the atmosphere.
 - c. Primary pollutants are emitted from cars and trucks, while secondary pollutants are emitted from natural sources such as forest fires and dust storms.
 - d. There are no differences between primary and secondary pollutants.

2. In which layer of the atmosphere is ozone harmful to human health?
 - a. Troposphere
 - b. Stratosphere
 - c. Mesosphere
 - d. Thermosphere
 - e. None of the above

3. Which of the following is not a source of aerosol pollution?
 - a. Forest fires
 - b. Dust storms
 - c. Volcanic eruptions
 - d. Motor vehicles

4. What is the name of the agency that sets air quality standards?
 - a. Clean Air Agency
 - b. Environmental Protection Agency
 - c. National Weather Service
 - d. International Panel on Climate Change

5. Which scale is used to determine how clean or polluted the air is?
 - a. Air Quality Index
 - b. Smog Index
 - c. Saffir-Simpson Scale
 - d. Enhanced Fujita Scale

6. Which of the following is not a health effect associated with breathing in polluted air?
 - a. Asthma
 - b. Respiratory infections
 - c. Difficulty breathing
 - d. Hearing loss
 - e. Irritation to heart conditions
 - f. Increased risk of cancer

7. Who is at risk of negative health effects from air pollution?
 - a. Children
 - b. Elderly persons
 - c. People with asthma
 - d. People with heart conditions
 - e. Everyone

8. What can you do to reduce your contribution to air pollution?
 - a. Carpool to school/work
 - b. Walk or ride your bike
 - c. Plant a tree/garden
 - d. All of the above

9. Air quality is greatly affected by the concentration of air pollutants and the weather. Assume that you experienced an unhealthy air quality day yesterday (Day 1) and the air quality greatly improved today (Day 2). Write a short weather discussion describing how you think the weather changed between yesterday and today to improve the air quality.

Day 1 Weather (Unhealthy AQI):

Day 2 Weather (Good AQI):

10. The EPA measured 0.05 parts per million (ppm) of ozone in Los Angeles, CA. What is the concentration of ozone in Los Angeles written in scientific notation?
 - a. 5×10^2 ppm
 - b. 5×10^{-5} ppm
 - c. 5×10^{-2} ppm
 - d. 50×10^{-2} ppm

Part 2: Math & Science Proficiency (In-Class Activity: Part 1)

Please score **In-Class Activity: Part 1** for each student using the rubric below. This problem is aligned with the following academic standards:

NGSS.MS-ESS3-2

MS-ESS3-2. Human Impacts: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

NGSS.MS-ESS3-3

MS-ESS3-3. Human Impacts: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

NGSS.MS-ESS3-4

MS-ESS3-4. Human Impacts: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Scoring Rubric

Questions	Score (0 – 3)
Did the student correctly identify the ten controls of air quality (Step 2)?	
Did the student demonstrate the ability to correctly read ozone and particle levels from a graph (Questions)?	
Did the student clearly identify sources of air pollution (Steps 3 & 5)?	
Did the student demonstrate understanding of how weather affects air pollution (Steps 3 & 4)?	
Did the student demonstrate understanding how the human population affects air quality (Step 4)?	
Did the student follow all instructions to accurately analyze the Smog City 2 program?	

0 – Incomplete

1 – Completed with incorrect answer

2 – Complete with small errors

3 – Complete with correct answer

In-Class Activity

Part 1. Smog City Activity 2, 3, 4

Instructions: [Click here](#) to learn what controls pollution emissions and our air quality. Follow each step and answer the questions below.

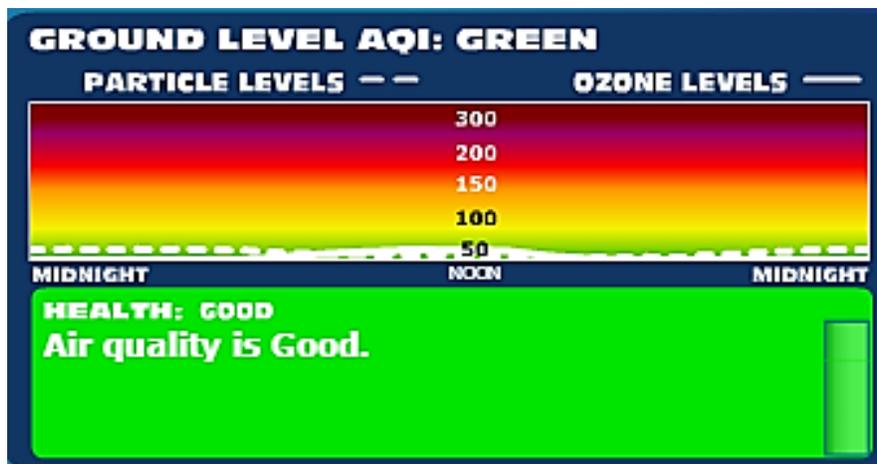
Step 1: Before moving the controls, record the current temperature and air quality index below.

Temp =
AQI =

Step 2: List the 10 controls that affect air quality on the left side of the page.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

At the bottom right of the Smog City 2 Experience, you will see an Air Quality Index (AQI) chart like the one below. The top panel shows the AQI by color and number. The dashed line represents the particle levels by the time of day, and the solid line represents ozone by the time of day.



Step 3: Move the emissions and population controls to the maximum settings. Change the wind speed to calm (far left).

Questions

1. What happens to ground-level ozone and particle levels?
2. What time(s) of day would particle pollution levels be the highest?
3. Without altering the weather conditions, how can you reduce particle pollution?

Step 4: Set the temperature to 110°F (far right).

Questions

1. What happens to the ground-level ozone and particle pollution?

2. At what time of day would ground-level ozone levels be the highest?
3. Move the population slide. What effect does the population control have on air pollution?

Step 5: Check the Random Events box (lower left). As you use the weather, emissions, and population controls, watch the cityscape for wildfires and dust storms.

Questions

1. How do wildfires and dust storms affect air quality?