Smog City Interactive

 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period:

***PART ONE: SAVE SMOG CITY FROM OZONE!***

1. Access the Smog City 2 website at [www.smogcity2.org](http://www.smogcity2.org).

2. Select “Save Smog City 2 from Ozone.”

3. Take note of the areas of Smog City 2, including **Weather Conditions**, **Emissions Levels** and **Population**. All areas have “clickable” choices. Mouse-over or click on the choices. *NOTE: in the information box at the bottom of the screen, there is information about each choice.*

4. Notice how each of the choices are pre-set to a certain level. These are called the **default settings**. You can use the reset button at any time to return to the default settings. In the chart below, **circle the default setting for each choice.**

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| **Weather Conditions** | **Choices Available** |
| Sunlight | Clear - Partly Cloudy - Cloudy |
| Inversion Layer | No inversion - Low inversion - High inversion |
| Wind Speed | Calm - Light Breeze - Breezy - Windy |
| Maximum Daily Temperature | 30ºF - 40 ºF - 50ºF - 80ºF - 90ºF - 100 ºF - 110 ºF |

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| **Emission** | **Choices Available** |
| Energy Sources | *Some energy sources produce more smog emissions than others. (Level 1 is cleaner sources like wind or solar technology, level 3 is dirtiest, like a coal-fired power plant)* **Levels: 1 2 3** |
| Cars and Trucks | *This includes Passenger vehicles (all sizes), large and medium trucks, motorcycles* **Levels: 1 2 3 4 5** |
| Off Road Vehicles | *This includes airplanes, trains, power boats, earth movers, tractors, harvesters, forklifts, bulldozers, backhoes* **Levels: 1 2 3 4 5** |
| Consumer Products | *This includes paint thinner, charcoal lighter fluid, glue or other adhesives, gasoline* **Levels: 1 2 3 4 5** |
| Industry | *This includes manufacturing facilities, power plants, oil refineries/storage/ distribution centers, food and agricultural processing* **Levels: 1 2 3 4 5** |

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| **Population***Changing population, as shown by the “total emissions” chart and the emission sources in the cityscape, affects VOCs, NOx and SO2. The compounds react to form ground-level ozone and particle pollution. When temperatures are cool, changing population also changes the usage of wood-burning stoves, which emit particle pollution.*  | *In Smog City 2, you can increase the population from near-zero to about two million people.* **Levels: 1 2 3 4 5** |

5. Observe the **AQI (Air Quality Index)** box in the lower right corner. The default settings, which are circled above, result in a “red”, or “Unhealthy” AQI for ground-level ozone. The health message is:

**“Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion.”**

**Scenario 1: Emission Sources**

1. Minimize the “Save Smog City 2 from Ozone!” instructions at the top of the screen.

2. Turn only Cars and Trucks control to 1. Leave all other choices at the default settings. **Record what happens on the in the table** below. Use the reset button to return the Cars and Trucks control to 4, so all controls are in default position again.

3. Turn only Off Road down to 1. Leave all other settings alone. **Record on data table.** Use the reset button to return the Off Road control to the middle setting, so all controls are in default position again.

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| **Energy Sources** | **Cars & Trucks** | **Off Road** | **Consumer Products** | **Industry** | **Air Quality Index (AQI)*****Color/message/value*** |
| *Default positions* | Red / Unhealthy / 175 |
| 2 | 1\* | 3 | 3 | 3 |  |
| 2 | 4 | 1\* | 3 | 3 |  |

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| *What do your results show about the effects of cars/trucks and off-road vehicles?* |

4. Using the data table below, adjust each of the starred controls noted and record the result.

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| --- | --- | --- | --- | --- | --- |
| **Energy Sources** | **Cars & Trucks** | **Off Road** | **Consumer Products** | **Industry** | **Air Quality Index (AQI)*****Color/message/value*** |
| 2 | 4 | 3 | **1\*** | 3 |  |
| 2 | 4 | 3 | 3 | **1\*** |  |
| **1\*** | 4 | 3 | 3 | 3 |  |

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| *What do your results show about the effects of your changes?* |

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| 5. Turn all Emission controls to level 1. What is the AQI? Why? |
| 6. Using the reset button, return all Emission controls to the middle setting. Turn the **Population control to level 1**. What is the AQI? Why? (*Hint: Click the Population icon and read the information under “What Is This?” in the “Information” box.)* |

Scenario 2: Weather

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| 1. Reset all Emission controls to the **middle setting**. What is the AQI level?
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| 1. Increase only the **temperature control to 110 ºF.** Check the black sign in the cityscape for the temperature. How does this affect the AQI? Why?
 |
| 1. Now move the cloud cover to **Cloudy (level 3).** How does sunlight affect ozone formation? Why?
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*Consider all of the data from both Scenarios*

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| 1. Was there any one variable that seemed to have a greater increase in **ozone** than others tested?
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| 1. What are solutions to control emissions levels on a *systemic* scale?
 |
| 1. What are solutions to control emissions levels on an *individual* scale?
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***PART TWO: EXPLORE OTHER FACTORS***

1. Go back to “Home”. Select “Create Your Own Smog City 2 Experience.”
2. Minimize the text box above the city.

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| 1. Move the emissions and population controls to the **maximum settings.** Change the wind speed to **calm** (far left).

What happens to ground-level ozone and particle levels? What time(s) of day would particle pollution levels be the highest? Without altering the weather conditions, how can you reduce particle pollution? |
| 1. Set **temperature to 110 °F** (far right).

What happens to the ground-level ozone and particle pollution? At what time of year would ground-level ozone levels be the highest? Without altering the weather conditions, how can you reduce ground-level ozone?  |
| 1. Check the **Random Events box** (lower left). As you use the weather, emissions, and population controls watch the cityscape and the news crawler for wildfires and dust storms.

How do wildfires and dust storms affect air quality? |
| 1. Compare two factors that have not been investigated yet.

Factors: Results: |