



Name: _____ Date: _____ Class: _____

Title: Heat Domes and Ozone Pollution
Student Sheets

Why study heat domes and their effects?

Heat and air pollution might be two of the biggest threats to our planet as the climate changes. The term “heat dome” is heard in the summer, when unusually high temperatures occur. A significant event can last a few days, or a few weeks. The biggest challenges come when a heat dome occurs in a location where exceptionally high temperatures is an unusual weather pattern. Temperature records may be broken. The effects on living things and infrastructure can be severe.

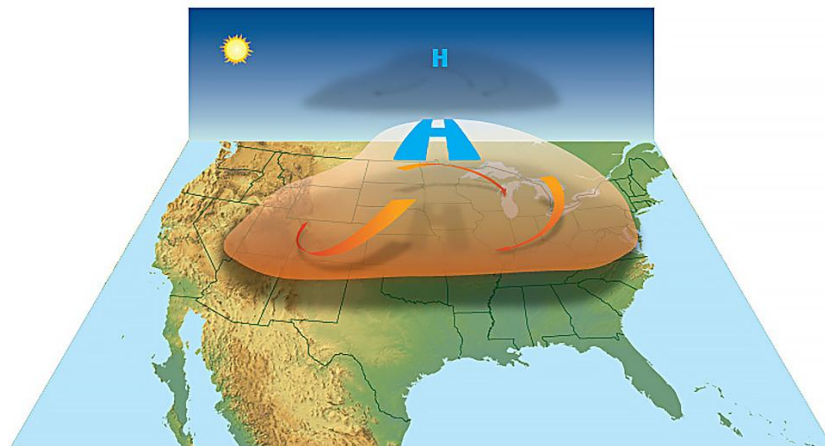
Heat Dome and Ozone Pollution

Heat and air pollution might be two of the biggest threats to our planet as the climate changes. The term “heat dome” is heard in the summer, when unusually high temperatures occur. The event can last a few days, or a few weeks. The biggest challenges come when a heat dome occurs in a location not used to this weather pattern. Temperature records may be broken. The effects on living things and infrastructure can be severe.

Warm, sunny skies increase the concentration of ozone over cities. Heat domes create especially hazardous conditions in harmful levels of pollution. A heat dome occurs when the atmosphere traps hot ocean air like a lid or cap.

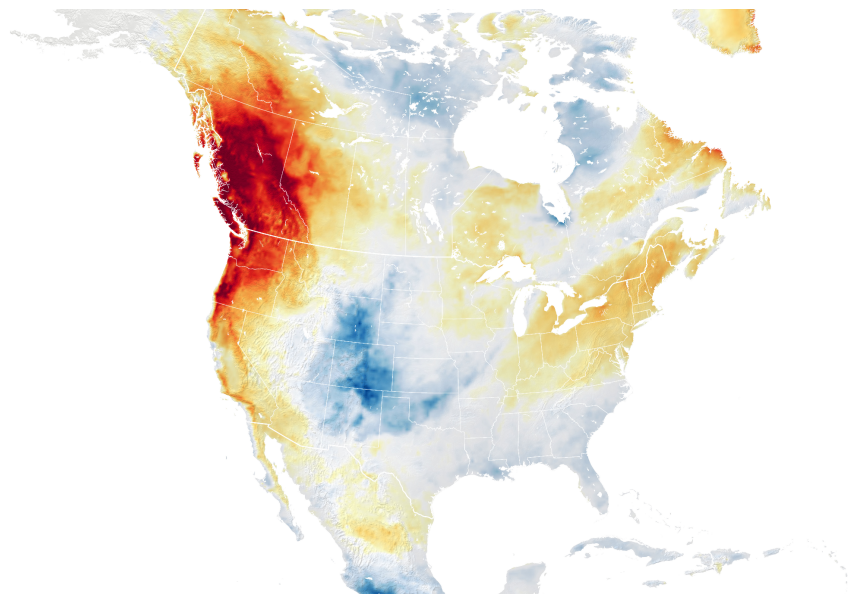


Name: _____ Date: _____ Class: _____



High-pressure circulation in the atmosphere acts like a dome or cap, trapping heat at the surface and favoring the formation of a heat wave. Source: NOAA | <https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/High%20Pressure%20circulation.jpg>

GOES satellite data and ground-level sensors were used to create models showing the extent of a June 2021 heat dome, with effects as far north as Alaska.

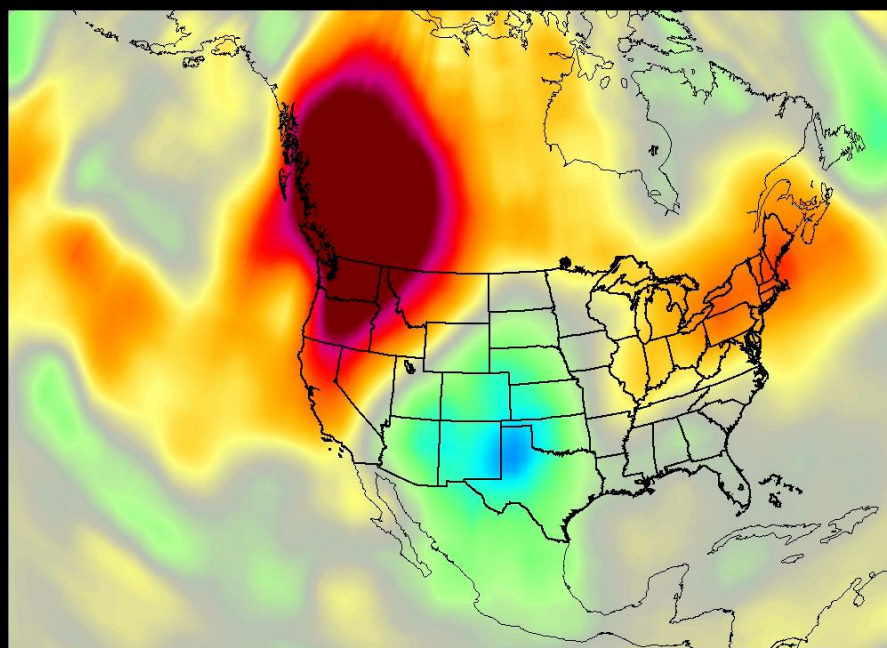


GOES satellite data and ground-level sensors showing the extent of a June 2021 heat dome. Source: NASA Earth Observatory | <https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/Pacific%20Northwest.png>

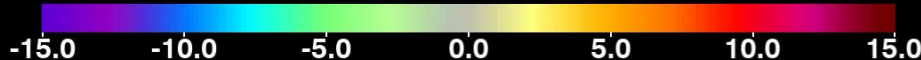


Name: _____ Date: _____ Class: _____

Daytime Surface Air Temperature Anomaly June 30, 2021



degrees F from average



Surface Air Temperature Anomalies of the Pacific Northwest, June 2021. Source: AQUA (AIRS)
| <https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/Heat%20Dome.png>

The heat dome occurred over the Pacific Northwest and British Columbia in June 2021. Temperatures in some locations were more than 15 degrees Fahrenheit above normal, for nine days. While the heat was intense in one location, below-normal temperatures occurred elsewhere, like Texas. To see how the heat dome progressed, visit [Heat Wave Surface Temperature \(nasa.gov\)](https://www.jpl.nasa.gov/images/pia24537-heat-wave-surface-temperature) for the visualization. (Link: <https://www.jpl.nasa.gov/images/pia24537-heat-wave-surface-temperature>)



Name: _____ Date: _____ Class: _____

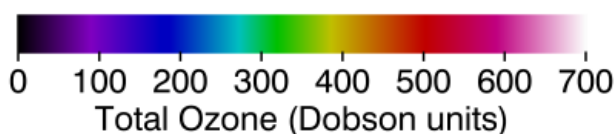
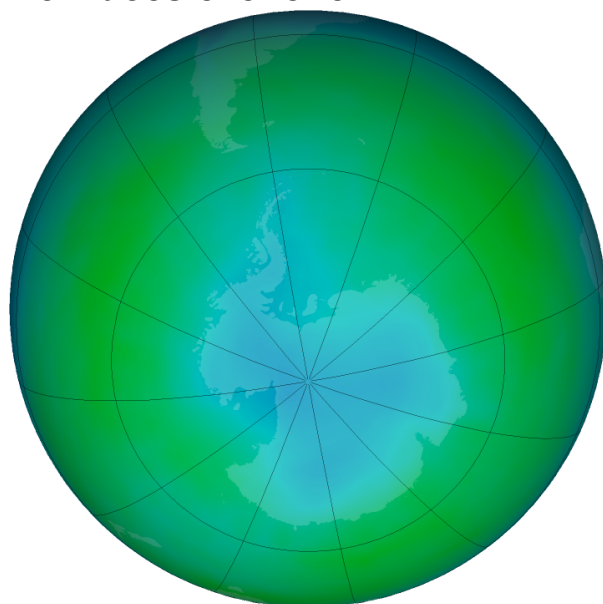
Question Set 1

1. Which states were most affected by the heat dome?
2. What other area, even larger, was most affected by the heat dome?
3. Describe something you know about these areas that made this heat dome particularly devastating.



Name: _____ Date: _____ Class: _____

How does ozone form?



False-color view of total ozone over the Antarctic pole. The purple and blue colors are where there is the least ozone, and the yellows and reds are where there is more ozone.
<https://ozonewatch.gsfc.nasa.gov/>

Ground-level 'bad' ozone forms when nitrogen oxide gases from vehicle and industrial emissions react with volatile organic compounds -- carbon-containing chemicals that evaporate easily into the air, such as gasoline and paint thinners. Ozone data have been collected from space by NASA's Total Ozone Mapping Spectrometer (TOMS) aboard several satellites that flew between 1978 and 2005 and now from the Ozone Monitoring Instrument (OMI) on the Aura satellite, launched in 2004. ([NASA - Increasing 'Bad' Ozone Threatens Human and Plant Health](#)) (Link: https://www.nasa.gov/topics/earth/features/bad_ozone.html)

Question Set 2

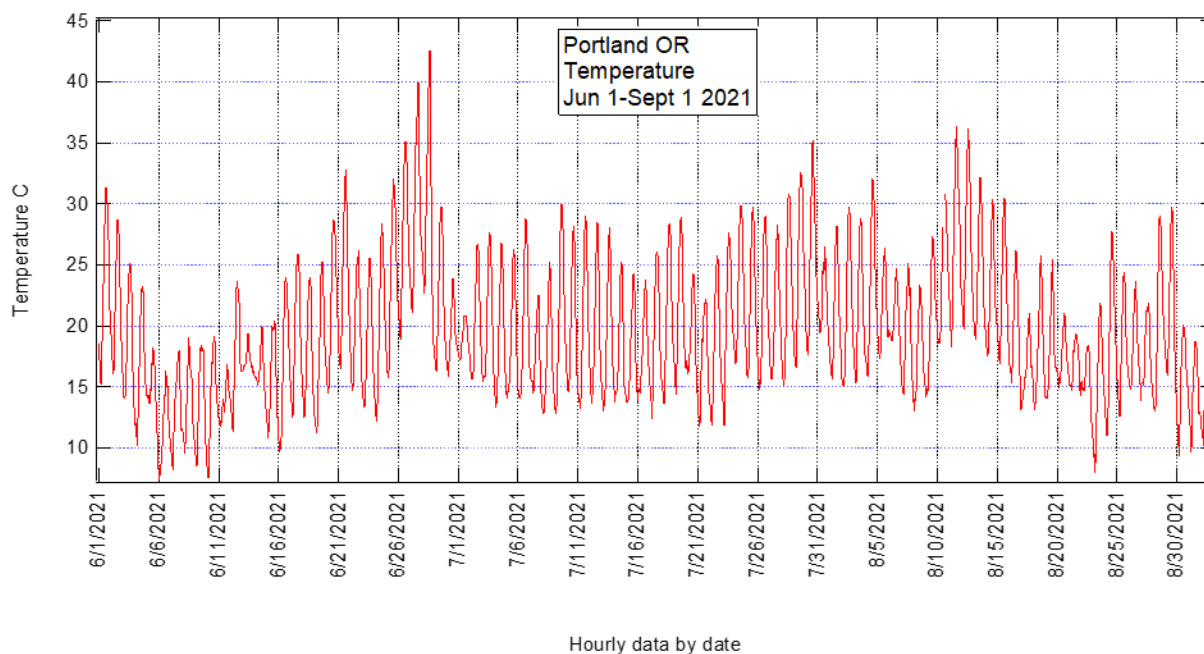
1. What is the difference between stratospheric and surface ozone?



Name: _____ Date: _____ Class: _____

Temperature and Ozone Data

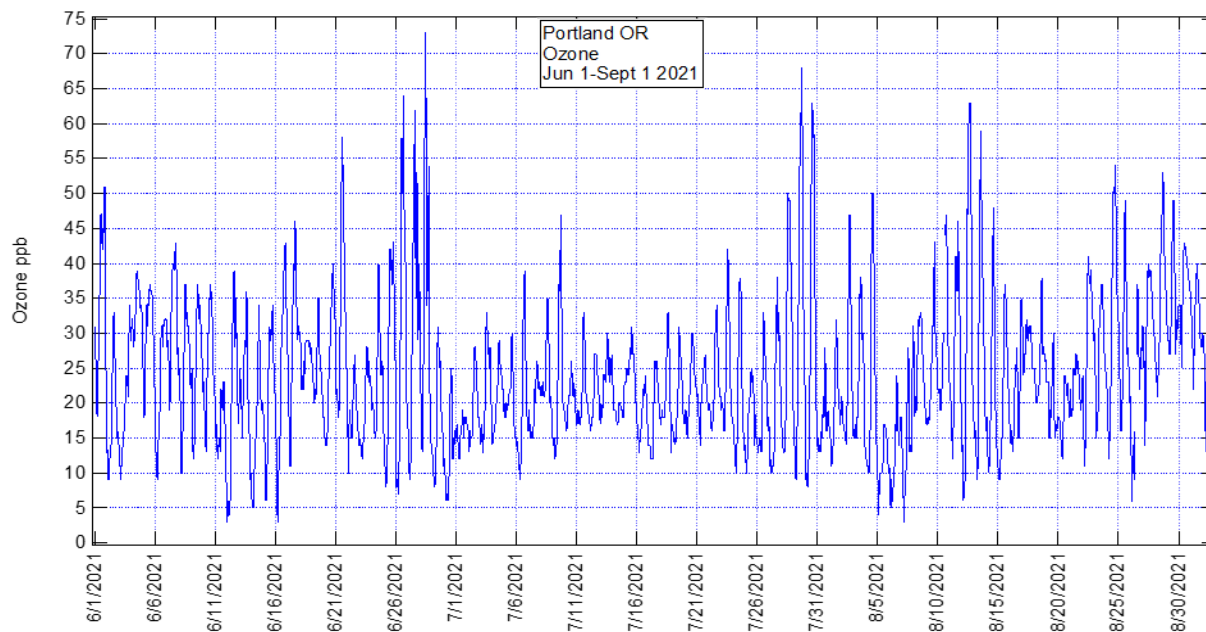
Surface ozone forms when the necessary ingredient pollutants are present, often from sources such as vehicles. With more vehicles in a large city, there is more potential for ozone to form during warm, sunny days. Is there evidence for an increase in ozone during the heat dome in the Pacific Northwest in 2021? Compare the data from Portland, Oregon.



Temperature (degrees Celsius) of Portland, Oregon June 1 - September 1 2021. | Source:
www.airnow.gov |
https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/Temp%20Data_1.png



Name: _____ Date: _____ Class: _____



Hourly data by date

Ozone (ppb) of Portland, Oregon June 1 - September 1 2021. | Source: www.airnow.gov | https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/Temp%20Data_1.png



Name: _____ Date: _____ Class: _____

Question Set 3

1. What, if any, similarities in the data do you see between the two graphs?
2. Identify the highest values on both graphs. Are these data points on the same date?
3. Are the dates during the Pacific Northwest heat dome?
4. Is this enough data to prove that the high ozone readings were caused by the excessively high temperatures? Why or why not?
5. While this may or may not be enough evidence to conclusively know if there is a connection between temperature and ozone, what would make this evidence stronger?
6. Look at the data for July 28-29. The ozone readings are high, but the temperatures are not as high as in June. Propose an explanation for why the ozone readings could still be high even when the temperatures aren't.
7. What evidence would you need to prove your explanation?