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APES- Ozone (Good and Bad)
DO NOT WRITE ON THIS SHEET- ***Use a separate piece of paper- write out questions/headings for reference***

Go to: http://www.epa.gov/oar/oaqps/gooduphigh/

Click on: Good Up High
Answer the following questions in your own words: (On separate piece of paper)
1: How can ozone be both good and bad?
-Ozone in the troposphere is harmful to breathe and damages crops and vegetation, but stratospheric ozone blocks harmful UV rays
2: What is happening to the "good" ozone layer?
-Man-made chemicals are destroying the ozone layer; degrade slowly and broken down by UV rays, releases bromine and chlorine that destroys ozone
3: How much damage can 1 Chlorine atom do? Explain.
-1 chlorine atom can destroy 100,000 ozone molecules
4: How does the "good" ozone protect the Earth?
-By blocking the sun's harmful UV rays
5: What is being done about ozone depletion?
-EPA established regulations on phasing out ozone depleting chemicals, warning labels made, prohibition of non-essential ozone depleting chemicals

Click on: Bad Nearby
1: What causes "bad" ozone?
-By chemical reactions between nitrogen oxide and VOCs under sunlight
2: What are some sources of bad ozone?
-Industry, electric utilities, car exhaust, gasoline vapor, chemical solvents
3: How does "bad" ozone affect human health and environment?
-Can cause chest pain, coughing, throat irritation, congestion; can worsen bronchitis, emphysema and asthma. Damages vegetation and decreases growth and survivability of seedlings, also increases susceptibility to pests and harsh weather
4: What is being done about "bad" ozone?
-Health standards set by EPA has limited emissions and reformulation of products that contain VOCs, encouragement of less motor vehicle activity
5: What can we do/actions can we take to reduce our risks?
-Carpool, use VOC-free products, use alternative fuel

Ozone- Air Now
Go to: www.epa.gov/airnow/
In the far right corner- choose "Ozone"- found under Air Quality Basics. Read about good and bad ozone and answer the following questions.
1: Where is the good ozone located and what is its function?
-Earth's upper atmosphere – 6-10 miles above surface; shields us from UV rays

2: What depletes good ozone?
-Manmade chemicals
3: Where is the bad ozone located and what creates it? What does NOX and VOC stand for?
-Located in lower atmosphere, created by pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and sources that react chemically in presence of sunlight.
NOx=Nitrogen Oxide, VOC=Volatile Organic Compound
4: List three health problems associated with bad ozone. *(Hint: You may need to go to Ozone and your Health- How can ground-level ozone affect your health?)*
-Respiratory irritation, permanent lung damage, and lung infection
5: *Scroll down to the Air Quality Index Color Chart- Write down a one-word descriptor of each color code.*
Green- Good
Yellow- Moderate
Orange- Unhealthy for Sensitive Groups
Red- Unhealthy
Purple- Very Unhealthy
6: After answering this question, go back to **Air Now at: www.epa.gov/airnow/** In the far left corner, choose **National Overview** and then choose **Ozone Now.**
What is the current ozone reading for our area? Moderate (use color code)

The AQI for Students
Go to: How Ozone is Formed- *Watch the video and take notes.*
-Ozone is created from Nitrogen Oxides and Volatile Organic Compounds.
-NOX and VOC is released by factories and automobiles
-When NOX and VOC mix with sunlight, ozone is formed
Go to: O_3- Good Up High, Bad Nearby- *Watch the video and take notes.*
-Ozone – gas occurs o nEarth
-Upper atmosphere protects Earth
-Ozone bad for health and environment at lower atmosphere
-Layer closest to Earth's surface is the trophosphere, extending to a level about 6 miles up, under the stratosphere
-Ozone is harmful for humans to breathe and can cause chest pain, coughing, throat irritation and congestion
-Can worsen asthma, bronchitis, and emphysema
-Ground level ozone damages crops, trees and other vegetation
-Stratosphere extends 6-30 miles
-The ozone layer at the stratosphere blocks harmful UV rays
-Ozone produced naturally in atmosphere, but is being destroyed by human-made chemicals
-Some chemicals like CFCs are no longer used in the US but stay in the stratosphere
-Ozone depletion can increase amounts of UV radiation to reach Earth
-Increased UV can lead to skin cancer, cataracts, reduce crop yields and damage sensitive crops

Smog City 2- Save the Smog City from Ozone
Go to: www.smogcity2.org
Instructions: *Change the settings in "Smog City" and notice the effects that those changes have on the amount of "smog" the city produces and the air quality.*

On your paper, **take notes about what the various condition changes do to the AQI**.
-Small population: Good
-More clouds: Unhealthy > Unhealthy for sensitive groups
-More inversion: Good > Moderate
-Temperature cooler: Unhealthy
-High Temperature: Good
-Energy source non-renewable: Moderate
-Renewable: Good - No inversion: Unhealthy > Unhealthy for sensitive groups
-Less cars: unhealthy > Moderate
-Off road: Unhealthy
-Consumer products: Unhealthy
-Less industry: Unhealthy for sensitive groups
-Large population: Unhealthy > Very unhealthy
-Lots of wind: Unhealthy > Moderate, Unhealthy for sensitive groups >good

Which set of conditions produce the best possible scenario for the city?

-A full cloud cover, no inversion, high wind, hot temperature, renewable energy, very little cars and trucks, moderate off road, low consumer products for low emissions, small pop.

Which set of conditions produce the worst scenario for the people, animals and plants of Smog City?

-No clouds, high inversion, no wind, hot temperature, non-renewable energy, plenty of cars and trucks, moderate off road, consumer products and industry for emissions, and high pop.

Summary: On your paper, write a ***2-3 paragraph summary*** about what you have learned about ***ozone, ozone depletion, ozone destruction and air quality*** by completing this assignment. **Make sure to use the new vocabulary that you have learned.**

-Ozone, AKA O_3, is a triatomic oxygen molecule that naturally occurs in the stratosphere, the outermost layer of the atmosphere on Earth. Ozone plays an important role by blocking out the Sun's UVC and UVB rays, which could heat up the environment and affect health and vegetation on the planet if they were to penetrate through the Ozone Layer.

Ozone also plays a negative role in our environment. "Bad" ozone is created in the lower atmosphere when VOCs (Volatile Organic Compounds) and NOx (Nitrogen Oxides) react under sunlight. These two products are produced by emissions from industries, chemicals, and automobiles. Ozone can cause various side effects to both human health and vegetation, including lung inflammation and reduced growth and pest resistance in crops.

To measure air quality and to ensure safety, the AQI measure gives us a good idea of how polluted our air is, and how the ozone would be affected. A clear sky, cool temperatures, no inversion, high winds, low population, low automobile count, low industry, renewable energy-using area would have a very "green" AQI, while the opposite will yield a purple AQI, the worst.