

## ***ENVIR 202: AIR ESSAY ASSIGNMENT 2003***

Length: about 5 pages plus figures (at 1 ½ line spacing, font-size 12).

Assigned: Thurs. 6 Feb

Drafts due: Thurs 13 Feb

Final due: Tues. 25 Feb

*Note: if you really are not pleased by the essay assignment for your experiment you may choose another, but try to make use of the lab experiments in some way as you construct it.*

### **A1. A miniature planet: weather, heat transport, climate on a rotating planet.**

One of the consequences of global warming is a rising sea level. Warming makes the water expand, and also ice lying on lands in Antarctica and Greenland may melt. You have been appointed Commissioner of Sea-level for the Island Republic of Seychelles, in the Indian Ocean. Look at maps of these, and write a report on their vulnerability to rising sea level. Describe the physical factors that would make a higher sea level more dangerous to people and ecosystems on these islands, and try to use library or Web resources on global warming to evaluate the danger. If you discover other dangers to the islands relating to global warming, report them. The 'IPCC' report is an international study of global warming that is useful <http://www.ipcc.ch>

### **A2. Violent Storms: hurricanes and tornadoes.**

Bangladesh lies on the Indian Ocean. The country has suffered enormous loss of life from hurricanes (called tropical cyclones there). You are in charge of the nation's Budget Office, and have to develop measures to defend against this hazard. However, your opposition leader claims that flooding from strong monsoons \_\_seasonal rainy periods \_\_ is far more destructive. Using Web resources write an introduction about the history of these storms, and the reasons for their severe nature. You will see the movement of these 'cyclones' for example at <http://dmsp.ngdc.noaa.gov/html/hurricanes/indian98.html>

Compare the flooding that occurs due to cyclones and that due to monsoons, and the impacts of both on people living there. In a country with very limited resources, what protective measures are most important?

### **A3 'Bad air': particles in the atmosphere and the lungs: dust, smoke, raindrops**

Write an essay comparing the small particles in the air in eastern and western Washington state, their historic trends and possible future changes. The goal is to assess health hazards. Using the Web, research some or all of the following: source of particles (smoke, car or diesel exhaust, blowing soils); composition (mineral, soot-like hydrocarbons, organic material....), geography of their distribution, effects of mountains (<http://www.ngdc.noaa.gov/seg/topo/img/wa.jpg>), weather and seasonal changes.

We want to know whether particulate air pollution is more severe in Seattle or in farming communities over the mountains to the east. Washington State Dept. of Ecology has a useful site, [http://airr.ecy.wa.gov/Public/faqs\\_pm25.shtml](http://airr.ecy.wa.gov/Public/faqs_pm25.shtml)

### **A4 . Atmospheric inversions over a city**

A railroad tank-car filled with chlorine has overturned 3 miles from the town of Ultra, which lies on a lake at the bottom of a small valley, in the foothills of the Cascade mountains. It is August, late at night and the mountain slopes have cooled following a very hot, sunny day. Using library and Web resources, and what you have seen in this experiment, decide whether the town should be

evacuated immediately, and describe what you expect the chlorine gas to do, and how dangerous it is to humans. Write on the physical, geographical and health-related issues in a coherent essay. While Ultra does not really exist, make up a map of the region and its topography. One of many sources on the Web is

<http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/mah.htm>

#### **A5. Rain ,clouds and snow: Ice crystal growth, freezing of water, cloud chamber**

Using Web or library resources, find out the distribution of ice crystals in the atmosphere: both their occurrence at different altitudes and something about their geographical distribution. Freezing depends on having some kind of nucleus, unless it gets colder than about  $-40^{\circ}\text{C}$ . Does the distribution of ice crystals relate to sources of dust or industrial air pollution in the atmosphere? Describe something about the sizes of the crystals, and hence whether they will fall out rapidly as snow.

#### **A6 A biological microcosm: Oxygen production uptake by aquatic plants and animals, and exchange from air to water.**

Biosphere II is the name of an experiment in Arizona, an attempt at building a totally isolated 'microcosm' in which a few human beings were to live for some years. It failed. Using the Web, find out something about the design of the experiment and why it failed. In particular, make estimates of the amount of plant material needed to support the oxygen needs of 6 people.

#### **A7. Winds in the lower atmosphere.**

The lowest few hundred meters of the atmosphere are known as the 'atmospheric boundary layer'. Here the winds change from their high speed (farther up) to nearly zero at the ground. In doing so they become turbulent...unsteady, full of whirling eddies. Both the variation of wind-speed as you go up or down, and the turbulence have strong effect on the movement and dilution of atmospheric pollutants. Describe the distribution of turbulent motion in observations of the atmospheric boundary layer, and their effect on pollutant distributions.

#### **A8. Evaporation, water vapor**

The central question is to research the recent pattern of drought in Washington State, and the northwest. Most atmospheric moisture comes from the oceans, and that is why coastal regions downwind of the oceans can be very wet, whereas a coastal region like Peru which has off-shore (easterly, that is, westward) winds is desert-like. Rising air cools due as it expands due to decreasing pressure around it: water condenses eventually. Sinking air compresses due to the increasing pressure, and any cloud droplets evaporate. This is describes desert regions like the Sahara (air sinking) and rainy regions like western Scotland.

Using Web and library resources, describe the precipitation patterns and historical trends in this region. Is there evidence for effects of global warming or other global weather phenomena? What are the most severe impacts of drought currently, and in the future? One State reference is the Dept. of Natural Resources,

<http://www.wa.gov/dnr/htdocs/adm/comm/DNRNews/summer01/fire.html>

