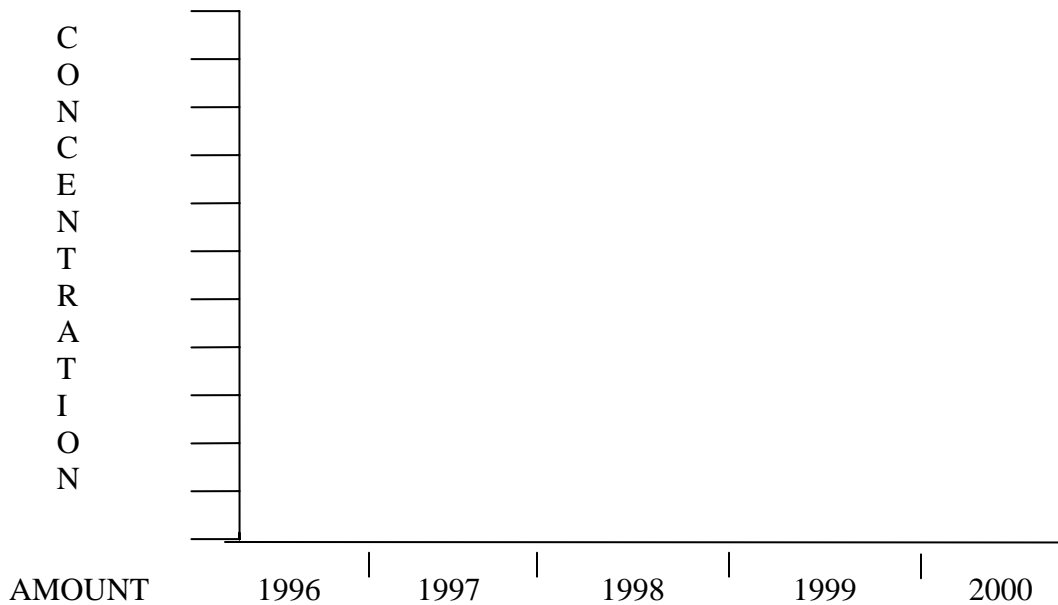


ISOPLETH EMISSION CONCENTRATION DATA TABLE – (1) copy per student

<b>ACID RAIN FACTOR BEING STUDIED _____</b>					
<b>State / Year</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>
California					
Florida					
Kansas					
Massachusetts					
Michigan					
New York					
Ohio					
Oregon					
Texas					
Virginia					

LINE GRAPH TEMPLATE FOR EMISSION FACTORS – (10) copies per student



## INDIVIDUAL RESEARCH ASSIGNMENTS FOR ACID RAIN PROJECT

**Researcher #1:** Responsible for explaining wet deposition and the various forms it can take; explaining how dry deposition can affect the acidity levels of wet deposition results; explaining why normal precipitation is slightly acidic in nature; explaining the predominant movement of weather fronts across the United States and factors that influence amounts of rainfall in a particular region of the country.

**Researcher #2:** Responsible for explaining the chemical nature of SO<sub>2</sub>, illustrating how it forms Sulfurous and Sulfuric Acids in the atmosphere; giving the primary sources of SO<sub>2</sub> emissions and amounts; determining the means of reducing the SO<sub>2</sub> emissions and their effectiveness; determining which region(s) of the United States has the highest SO<sub>2</sub> emissions.

**Researcher #3:** Responsible for explaining the chemical nature of NO<sub>x</sub>; illustrating how it forms nitrous and nitric acids in the atmosphere; giving the primary sources of NO<sub>x</sub> emissions and amounts; determining the means of reducing the NO<sub>x</sub> emissions and their effectiveness; determining which region(s) of the United States has the highest NO<sub>x</sub> emissions.

**Researcher #4:** Responsible for defining H<sup>+</sup> ion concentration and its relationship to pH; explaining the pH scale and how it is used to measure the severity of the acid rain effects; converting all H<sup>+</sup> ion concentrations to pH values by utilizing the formula:  $\text{pH} = -\log [\text{H}^+ \text{ ion conc}]$ ; determining which region(s) of the United States has the highest H<sup>+</sup> ion concentration and lowest pH levels.

## ASSESSMENT/GRADE DETERMINATION BY PERCENTAGE

1. By accomplishing procedure 7: 20% of the project score will be assigned according to the amount of detail the student gives in his/her answers to the questions posed to them as individual researcher in their group.
2. By accomplishing procedures 8 – 11: 40% of the project score will be assigned according to the accuracy of the computations and precision of their graphs. The student will mathematically compute the mean concentrations of the H<sup>+</sup> ion, SO<sub>2</sub>, and NO<sub>x</sub> gases and precipitation amounts over a five-year period; along with the mean percentage of reduction of these factors during the same time period. They will illustrate these results in the form of line graphs and lists of the factors for the ten key states under study.
3. By accomplishing procedures 12 – 15: 30% of the project score will be assigned according to the amount of detail the student gives in his/her answers to the questions posed to the group of researchers as a whole. Their answers must relate the physical factors causing acid rain and the lowering of pH to each other by comparing sources of emissions, rainfall, amounts and locations across the United States.

4. By accomplishing procedures 16 – 17: 10% of the project score will be assigned according to the amount of participation seen during the discussion period. The students will compare the results they obtained with researchers from all other groups studying the same factor. They will reach a consensus as to their final results and report their findings to the class as a whole.

#### BACKUP WEBSITE LISTINGS TO BE UTILIZED DURING RESEARCH

**<http://nadp.sws.uiuc.edu/isopleths/>**

<http://www.doc.mmu.ac.uk/aric/eae/index.html>

[http://www.ns.ec.gc.ca/msc/as/as\\_acid.html](http://www.ns.ec.gc.ca/msc/as/as_acid.html)

<http://www.eagle.ca/~matink/themes/Environ/acidrain.html>

<http://www.ec.gc.ca/acidrain>

<http://www.soton.ac.uk/~engenvir/environment/air/acid.home.html>

<http://www2.nature.nps.gov/ard/lessons.html>

<http://www.epa.gov/airmarkets/acidrain>