Spring 2020

CHEMISTRY IN THE THROPOSPHERE

1. AIR POLLUTION

There large differences in air quality depending on geographic location.

A. What are some of the primary anthropogenic sources of air pollutants?

B. One of the most important features of Earth's atmosphere is that it is an oxidizing environment.

   i. What does this mean?

2. CONCENTRATON UNITS FOR ATMOSPHERIC POLLUTANTS

A. Write the units for:

i. Molecules per cubic centimeter

ii. Micrograms per cubic meter

iii. Moles per liter

iv. Mole ratio's

3. CHEMICAL FATE OF TRACE GASES IN AIR

A. List some of the trace gases found in the atmosphere from natural sources.

i. What are the primary sources of these gases.

ii. What is the primary fate (sink).

B. Discuss the importance of hydroxyl radical.

i. What are the mechanisms (reactions) associated with hydroxyl radical reaction in the troposphere?

C. Similarly discuss the importance of nitrogen oxides in the troposphere.

4. THE ORIGIN AND OCCURRENCE OF SMOG

A. What are the primary reactants in an episode of smog (precursors)?

i. What are their sources?

B. Why is sunshine a vital ingredient in a smog event?

C. What is the primary source of atomic oxygen in the troposphere?

D. Describe the timeline associated with a smog event.

i. Why does geography often play a crucial role in areas prone to smog?

E. What are the end products of a smog event?

F. Diagram the important reactions for the conversion of reactant molecules to product molecules in a smog event. (Write out the series of reactions)

G. What is typically the source of increased concentrations of VOC's and NO_x's in urban smog production?

H. Catalytic converters for gasoline engines

i. What is the purpose?

ii. How do they work?

5. ACID PRICIPITATION

A. Natural Sources

i. Carbon dioxide to carbonic acid

1. *Show reactions and calculate pH of rain for an atmospheric concentration of 450m ppm CO_2.*

B. Anthropogenic Sources – Show the reaction sequence that causes acid precipitation for:

i. Sulfur dioxide

ii. Nitrogen oxides

iii. What are the sources of these compounds?

iv. Ammonium Ion from farm fertilizer applications.

1. *Ammonium is oxidized to nitrate.*
    a. *Set up and balance this conversion by the half reaction technique to show how acidity is increased in the environment.*

C. What are some of the effects of acid precipitation on the environment?

i. Vegetation

ii. Building materials

iii. Humans

D. Where are the effects of acid precipitation most prominent? (geographic locations)

E. What types of water bodies are especially susceptible to acidification?

6. PARTICULATES

A. Why are particulates considered air pollutants?

B. How does the size of the particulate relate to the health hazard it imposes?

C. What are some of the sources and composition of atmospheric particles of concern?