**Elemental and Environmental Chemistry Practice Test**

**1.**  **Aluminium is a relatively active metal that is found as alumina (Al2O3), which is quite abundant in the earth's crust**

**a)** State the group and period of Aluminium

**b)** What is the charge of the aluminium ion found in alumina?

**c)** Write the electronic configuration of the aluminium ion found in alumina

**d)** Acid rain can leach aluminium ions out of the soil. Why would these ions be more harmful to plants than solid aluminium metal?

**2.** **Sulfur can exist in numerous oxidation states**

**a)** State the oxidation number of sulfur in hydrogen sulfide, sulfur dioxide, sulfate and sulfur trioxide

**b)** Draw and name the structure of these four oxides of sulfur, indicating any bonding and non- bonding pairs of electrons

**c)** Explain what causes the hydrogen-sulfur bond to be polar

**d)** Explain wether the hydrogen sulfide molecule is polar or non-polar

**e)** Name one environmental concern that may be associated with the release of sulfur oxides

**f)** Hydrogen sulfide has a boiling point of -60oC, while water with a similar structure has a boiling point of 100oC, explain this difference of boiling points

**3.** **Nitrogen oxides are formed in high heat situations such as combustion engines and furnaces**

**a)** Why is atmospheric nitrogen only reactive at these high temperatures

**b)** Write equations for the formation of nitrogen dioxide from atmospheric nitrogen and oxygen

**c)** Write an equations for the formation of ozone from nitrogen dioxide

**d)** Account for the time differences for peak concentrations of nitrogen oxide, nitrogen dioxide and ozone

**e)** Label these three compounds as primary or secondary pollutants

**4.** **Sodium hypochlorite can be added to pools to purify the water**

**a)** Write an equation to show the formation of hypochlorous acid from hypochlorite ions

**b)** Label the conjugate acid and base pairs from the previous equation

**c)** How could the equilibrium be manipulated to produce more hypochlorous acid

**5. Nitrogen is an important element in the growth of plants**

**a)** Explain, using equations, how atmospheric nitrogen can be made available for plants to use

**b)** Write the equation for respiration

**6. Acid rain can be formed from sulfur and nitrogen oxides**

**a)** Calculate the minimum molar concentration of hydronium ions in acid rain

**b)** What are some problems caused by acid rain

**7.** **Describe, using equations the difference between the reactions of metal and non-metal oxides with water, acids and bases**

**8.** **Many common compounds are molecular**

**a)** Describe the characteristics of a molecular compound

**b)** What are the aerobic and anaerobic breakdown products of phosphorus

**c)** What is the oxidation number of phosphorus in these two compounds

**d)** Describe why phosphorus is able to have these two oxidation numbers (number and sign)