## **Stage 2 Chemistry**

## **Birdwood**

HIGH SCHOOL **Topic 1: Monitoring the Environment**

**Review of electronic Configuration, molecular shape,**

**Review Paper 3 acid rain, photochemical smog, water treatment, greenhouse effect**

**DUE DATE:**

**Question 1**

Photochemical smog is a significant problem associated with the use of motor vehicles in urban areas.

1. Ozone is one of the major components of photochemical smog. The *partially written* equations below show how it can be formed:

NO2 NO + \_\_\_ *Reaction* A

followed by:

O2 + O \_\_\_ *Reaction* B

Complete each equation by writing in the missing *products*. (2 marks)

1. The nitrogen dioxide in *Reaction* A is also a major component of photochemical smog.

Explain, with the aid of equations, how nitrogen dioxide forms in the troposphere. (4 marks)

1. State *one* undesirable effect of ozone in photochemical smog. (1 mark)
2. Catalytic converters are devices that reduce the amount of pollutants in motor vehicles’ exhaust gases. The catalyst in the converters increases the rate of conversion of nitric oxide (NO) and carbon monoxide into nitrogen and carbon dioxide. Write a balanced equation for this conversion reaction.

(2 marks)

**Question 2**

Rainwater polluted with sulfurous, sulfuric, nitrous and nitric acids can be termed acid rain if its pH falls below 5.6.

1. Calculate the hydrogen ion concentration in rainwater with a pH of 5.6. (2 marks)
2. Water in a mountain stream is known to have a [OH-] = 4.5 x 10-6 mol L-1.

Calculate the pH of the water. (2 marks)

1. One effect of acid rain is that it corrodes metal structures, particularly those made of iron.

Write an ionic equation for the reaction between iron and acid rain. (2 marks)

1. State the likely source of the nitrogen oxides responsible for the formation of acid rain. (1 mark)
2. Sulfur dioxide is commonly associated with acid rain.

i Write an equation for the reaction between water and sulfur dioxide.

ii State what this equation suggests about the nature of this oxide of sulfur.

iii State the shape of the sulfur dioxide molecule and explain why it has this shape.

iv In what state would sulfur dioxide be found at room temperature? (5 marks)

**Question 3**

Nitrogen, phosphorus and potassium are the three key elements required by plants for healthy growth. When a soil becomes deficient in these elements, it is common to use inorganic fertilizers to improve the soil. One such fertilizer is ammonium phosphate, (NH4)3PO4.

1. Write the equation showing how ammonium phosphate dissociates in water. (2 marks)
2. The phosphate ion has the formula PO43-.

Draw and name the shape of the phosphate ion. (2 marks)

1. Describe what property of these ions make them more accessible for plants to use when compared to the pure elements. (2 marks)



**Question 4**

1. Describe how carbon dioxide helps maintain a

steady temperature in the Earth’s atmosphere.

1. State the effect of an increased concentration of

carbon dioxide on the temperature of the

Earth’s atmosphere.

1. Describe one human activity this century that has

led to an increase of carbon dioxide in the

Earth’s atmosphere.

(6 marks)

**TOTAL MARK = 42**