

AHL Worksheet – Option E

- 1**
- a** Draw the Lewis structures of ozone and dioxygen. [2]
- b** Use the diagrams you have drawn in part **a** to explain why the wavelength of UV light required to dissociate O_2 is shorter than that to dissociate O_3 . [3]
- c** Explain, with the aid of equations, how a chlorine free radical acts as a catalyst in the destruction of ozone. [3]
- 2**
- a** State two types of primary pollutant that are involved in the formation of photochemical smog. [2]
- b** Hydroxyl radicals are important intermediates in the formation of some of the secondary pollutants in photochemical smog. Draw a Lewis structure for a hydroxyl radical. [1]
- c** Methanal is a secondary pollutant in photochemical smog. Write a series of equations to show how methanal can be formed from methane in the atmosphere. [4]
- d** In further reactions, peroxyacylnitrates (PANs) can be formed from aldehydes in photochemical fog. Give the structural formula of the PAN formed from methanal. [1]
- 3** Sulfuric(VI) acid is one of the components of acid rain. Hydroxyl radicals in the atmosphere are involved in the formation of sulfuric(VI) acid.
- a** Explain, with the aid of equations, how hydroxyl radicals are formed in the atmosphere. [2]
- b** Write equations to show the series of reactions by which sulfuric(VI) acid is formed from sulfur(IV) oxide in the atmosphere. [3]
- 4**
- a** Write expressions for the solubility products of the following sparingly soluble salts: [3]
- i** nickel sulfide
- ii** silver sulfate
- iii** iron(III) hydroxide.
- b** The solubility product of barium sulfate is $1.3 \times 10^{-10} \text{ mol}^2 \text{ dm}^{-6}$ at 25°C . Calculate the following:
- i** the solubility of barium sulfate in water at 25°C [2]
- ii** the solubility of barium sulfate in $0.100 \text{ mol dm}^{-3}$ sulfuric acid at 25°C . [3]
- c** The solubility of chromium(III) hydroxide in water at 25°C is $2.54 \times 10^{-7} \text{ g dm}^{-3}$. Calculate the amount of chromium(III) hydroxide that will precipitate from 100.0 cm^3 of a saturated solution when sufficient sodium hydroxide is added to raise the pH to 12. [9]
- 5**
- a** Explain what is meant by cation exchange capacity of soil. [1]
- b** Explain how the cation exchange capacity changes as the pH of a soil sample is lowered. [2]