
HL Paper 3

Explain, in terms of their bonding, how the presence of oxygen and ozone in the ozone layer helps to prevent both higher and lower energy UV light from reaching the surface of the Earth.

Ozone is a gas present in both the stratosphere and the troposphere.

Oxygen absorbs much of the ultraviolet (UV) radiation from the sun, but ozone is important because it absorbs UV radiation not absorbed by oxygen.

Explain, referring to the bonding in the two molecules, why this is the case.

(a) (i) Explain the dependence of the dissociation of diatomic oxygen, O_2 , and ozone, O_3 , on the wavelength of light.

(ii) State the equations for the formation and depletion of ozone in the stratosphere by natural processes.

Formation of ozone:

Depletion of ozone:

(b) (i) State the equations for the depletion of ozone by the CFC, dichlorodifluoromethane, CCl_2F_2 .

(ii) Use your answer to part (b) (i) to explain why CFCs are so effective at ozone depletion.

Ozone prevents UV radiation emitted from the Sun reaching the surface of the Earth.

d. Explain, with the aid of Lewis (electron-dot) structures, the difference between oxygen and ozone in terms of the energy required to dissociate both molecules. [2]

Oxygen: Ozone:

e. One CFC, Freon-13 (chlorotrifluoromethane), which can be used as a refrigerant, has been phased out by the Montreal Protocol. Describe, using equations, the mechanism of the catalysis of ozone depletion by this particular CFC. [2]
