Oxford Cambridge and RSA

A Level Chemistry B (Salters)

H433/01 Fundamentals of chemistry

Question Set 13

1 (a) Ozone in the stratosphere causes the absorption of UV radiation.

When ozone absorbs UV radiation the following reaction occurs:

$O_3 \xrightarrow{hv} O_2 + O$

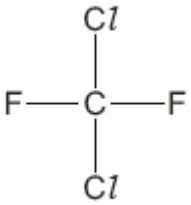
This reaction is one that absorbs the harmful UV radiation that causes sunburn.One wavelength in this radiation is 330 nm.

Calculate the bond enthalpy of the bond broken in ozone by this wavelength.(1 nm = 1×10^{-9} m)

bond enthalpy = ……..kJ mol^{-1} **[3]**

1 (b) The natural reactions involving ozone in the atmosphere are disrupted by the presence of chlorine radicals from CFCs, for example CCl_2F_2.

Show, by means of curly arrows, the formation of a chlorine radical from the molecule below.



Name the type of bond breaking. **[1]**

1 (c) Some reactions involved in the depletion of ozone by CFCs are shown in the table below.

Classify each of these reactions as initiation, propagation or termination, by ticking the appropriate columns in the table.

Reaction	Initiation	Propagation	Termination
$CCl_2 \rightarrow CClF_2 + Cl$			
$Cl + O_3 \rightarrow ClO + O_2$			
$ClO + O \rightarrow Cl + O_2$			
$Cl + Cl \rightarrow Cl_2$			

[2]

1 (d) (i) Ozone in the stratosphere is at a pressure of 1100 Pa and a temperature of –20 °C.

Calculate the amount in moles of ozone in 1.5 dm^3 of ozone from the stratosphere.

amount of ozone = …….mol **[2]**

1 (d) (ii) Calculate the volume (in cm^3) that this number of moles would occupy on the surface of the Earth where the pressure is 97 kPa and the temperature is 298 K.

Give your answer to an **appropriate** number of significant figures.

volume of ozone = ……cm^3 **[2]**

1 (e) (i) Nitrogen monoxide, NO, is formed in a car engine and it is converted to nitrogen dioxide.

Ozone is formed by the action of sunlight on nitrogen dioxide.

Ozone in the troposphere is a pollutant and can cause photochemical smog.

Explain how nitrogen monoxide forms in a car engine. **[2]**

1 (e) (ii) Describe the appearance of the atmosphere as nitrogen monoxide is converted to nitrogen dioxide. **[1]**

1 (f) (i) One of the products of the reaction of ozone with unburned fuel from car exhausts is $(CH_3)_3CCH_2CH(CH_3)CHO$.

Name the functional group in $(CH_3)_3CCH_2CH(CH_3)CHO$. **[1]**

1 (f) (ii) Give the equation for the reaction of HCN with the functional group identified in **(f)(i)**. **[1]**

Total Marks for Question Set 13: 15

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