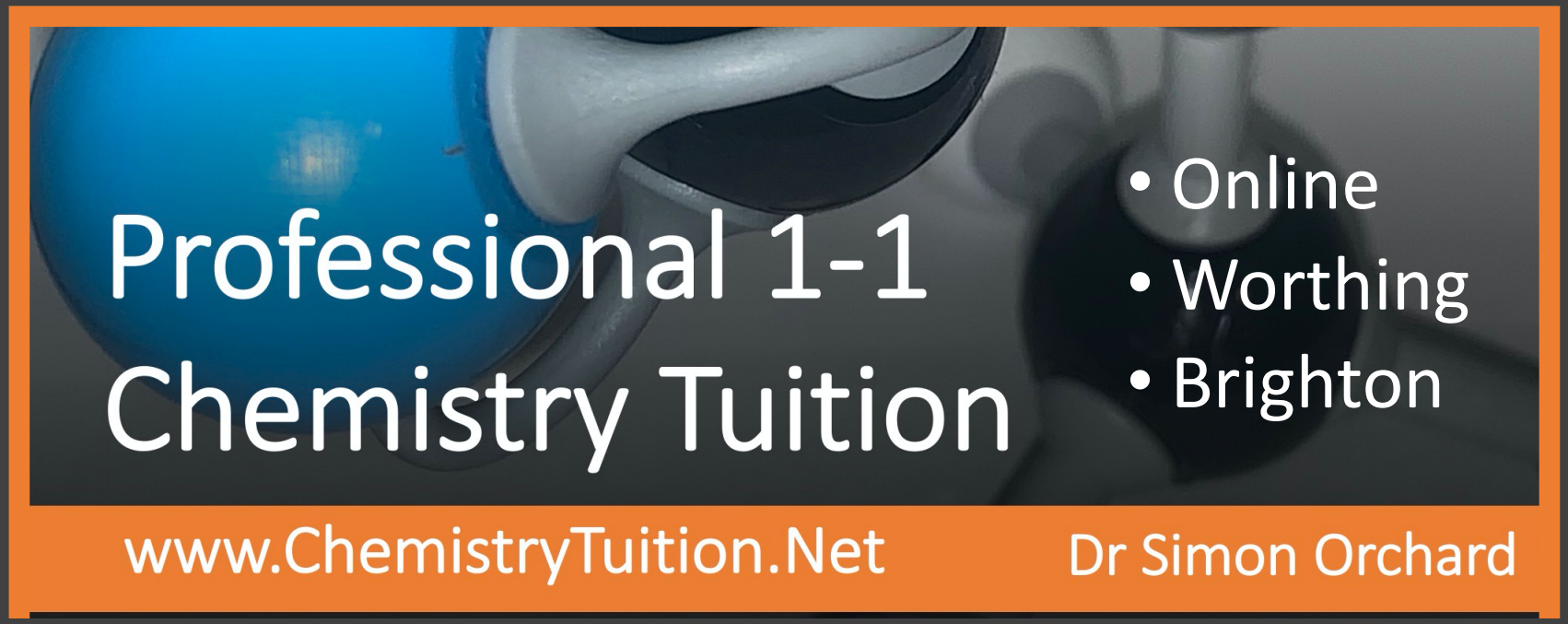
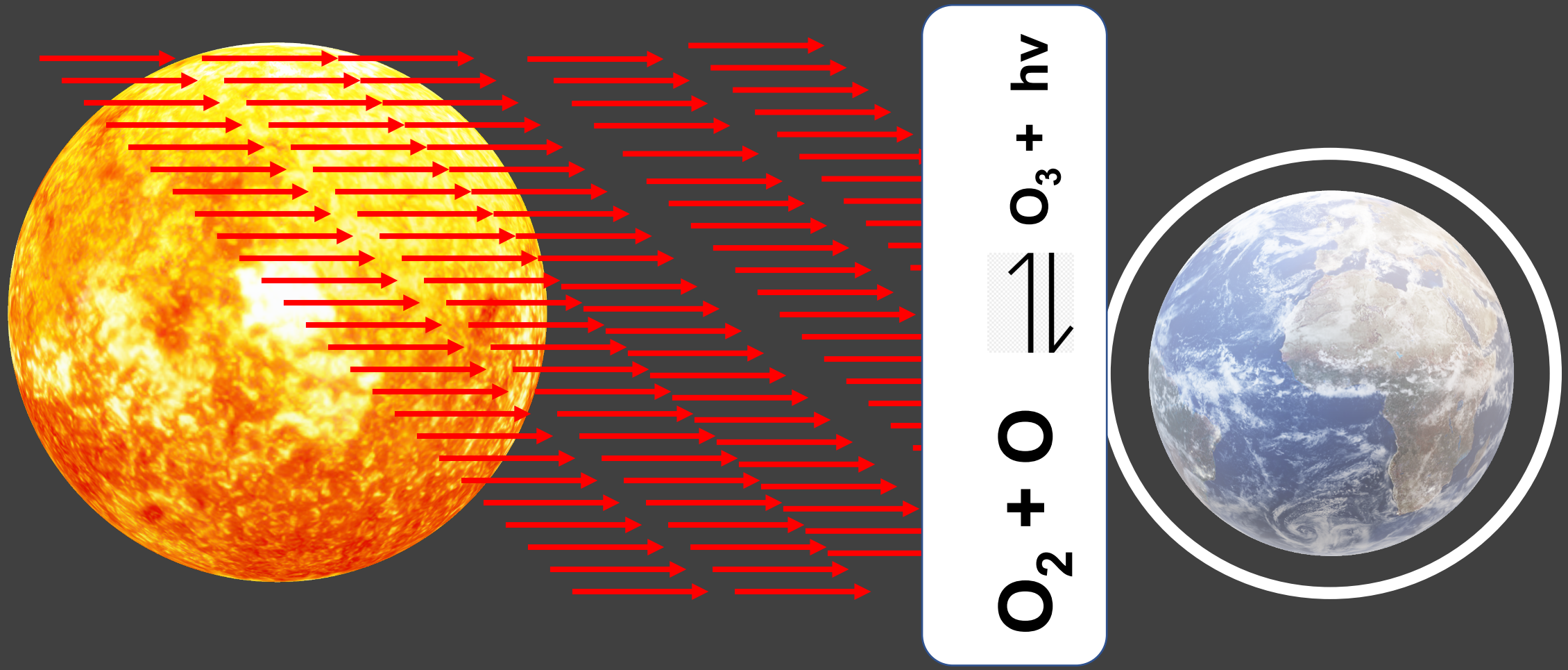
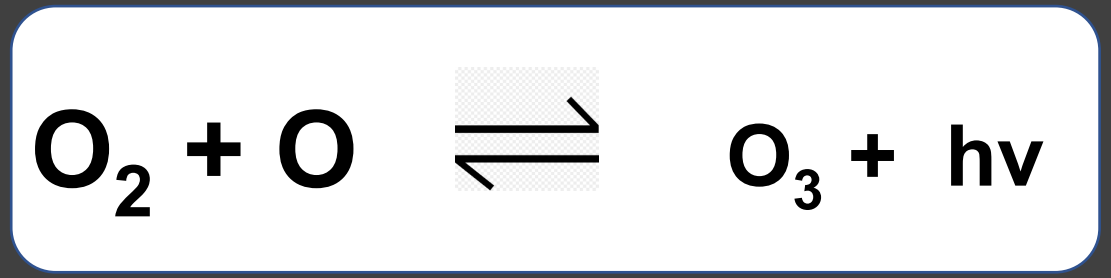


Halogenoalkanes – Effect on the Ozone Layer

The ozone layer

Ozone is continuously being formed and broken down in the stratosphere by the action of ultraviolet radiation.





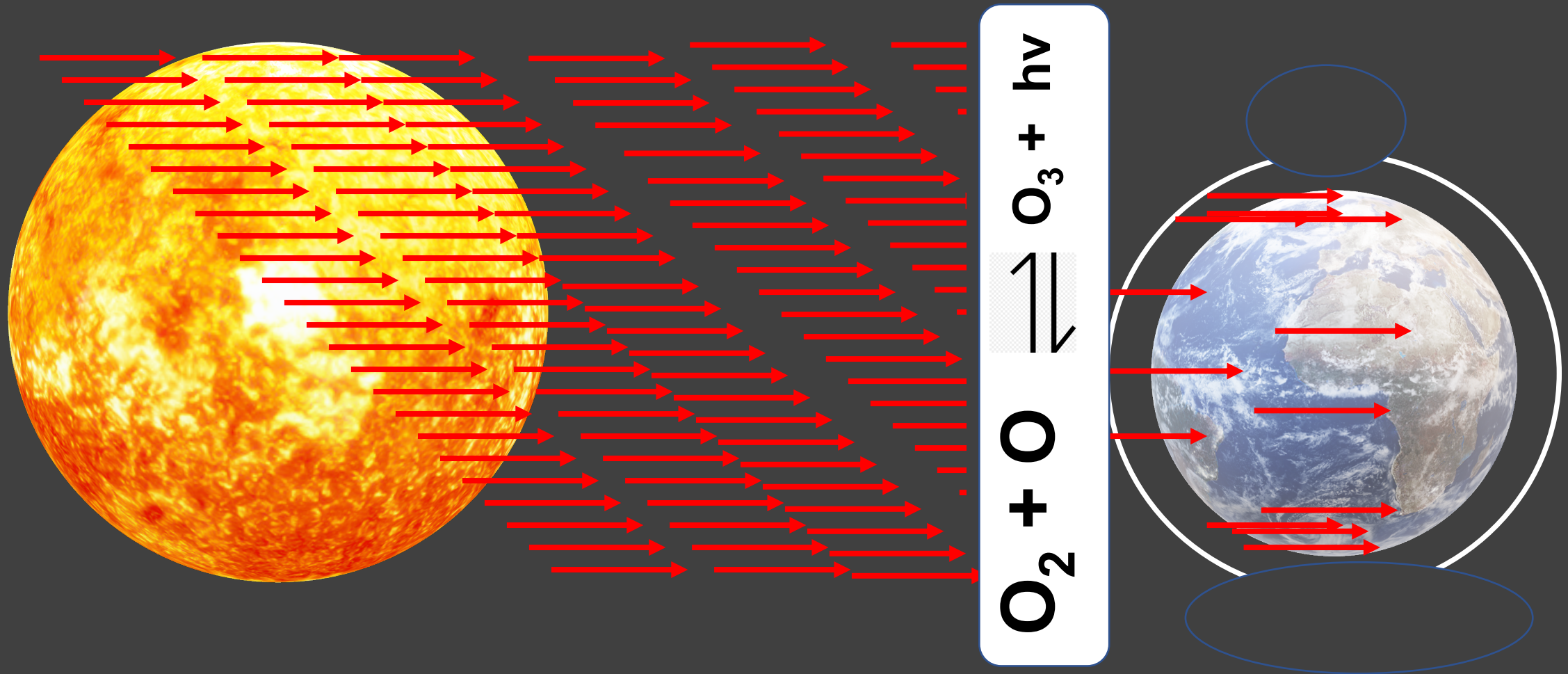
Ozone absorbs ultraviolet radiation and undergoes photodissociation. In doing so, it shields the earth from the sun's UV radiation. Since this reaction is reversible, O_2 and O can recombine to form ozone.

The ozone layer prevents:

- skin cancers in animals and humans
- a suppression of the human immune systems
- some inhibition to plant life, and an increased susceptibility to pests
- reduction in growth of phytoplankton, endangering the food chain
- a decrease in aquatic life

The ozone layer

In the 1980s scientists discovered the ozone layer was thinning, especially in the polar regions. This led to an increase in skin cancers.



Radicals from carbon containing halogens (chlorofluorocarbons) and nitrogen oxides (NO) from thunderstorms or aircraft may catalyse the breakdown of ozone by the following equations:

Initiation: $CF_2Cl_2 \rightarrow \bullet CF_2Cl + Cl\bullet$

Propagation:

$$Cl\bullet + O_3 \rightarrow \bullet ClO + O_2$$

$$\bullet ClO + O \rightarrow \bullet Cl + O_2$$

Overall: $O_3 + O \rightarrow 2O_2$

Ozone depletion due to $^{\bullet}NO$

Propagation:

$$^{\bullet}NO + O_3 \rightarrow {}^{\bullet}NO_2 + O_2$$

$$^{\bullet}NO_2 + O \rightarrow {}^{\bullet}NO + O_2$$

Overall:

$$O_3 + O \rightarrow 2O_2$$

Summary Reaction where R = $Cl^{\bullet}$ or $^{\bullet}NO$

Propagation:

$$R + O_3 \rightarrow RO + O_2$$

$$RO + O \rightarrow R + O_2$$

Overall:

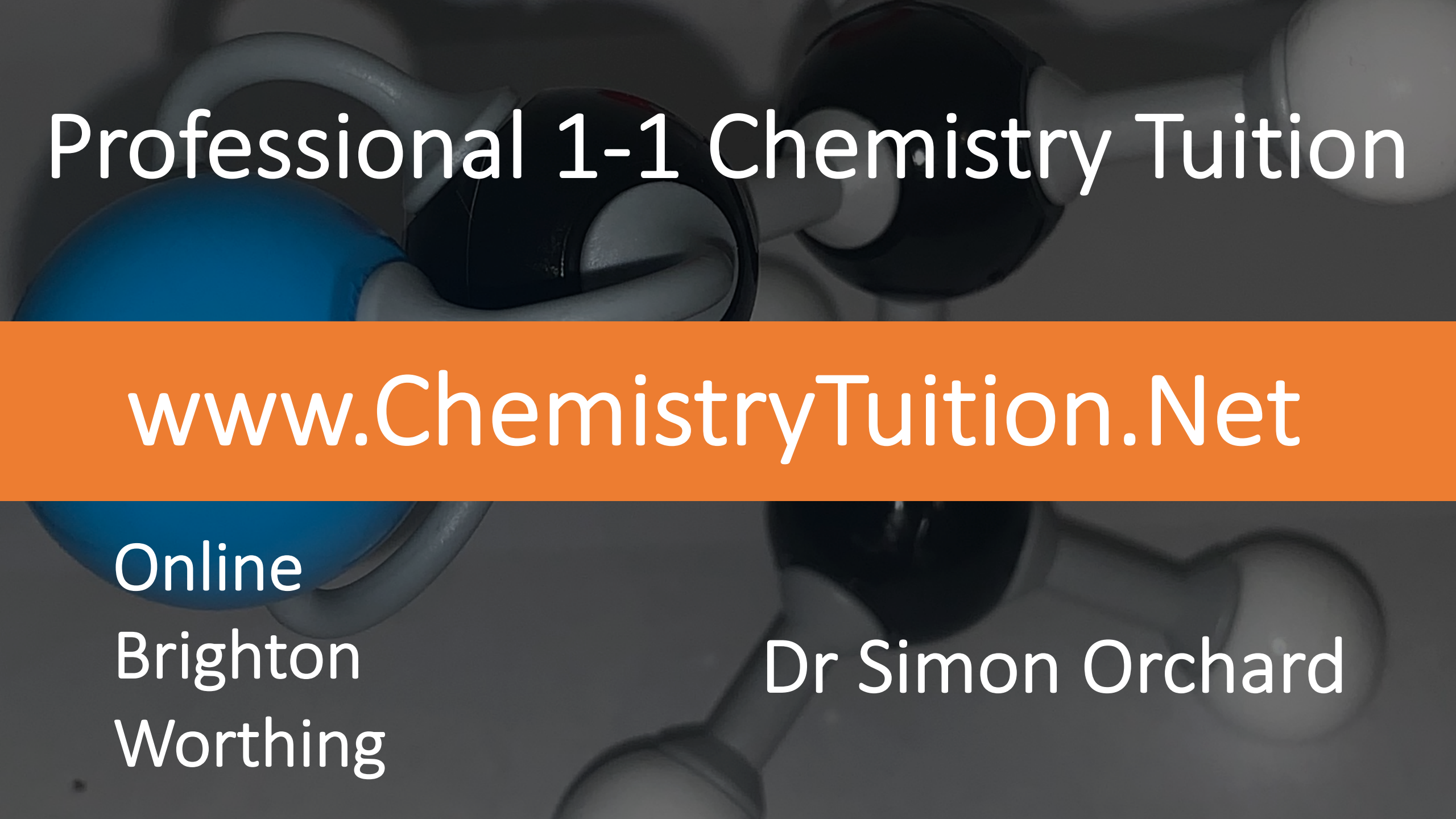
$$O_3 + O \rightarrow 2O_2$$

Recovery of the ozone layer

CFCs are no longer used in aerosols and refrigerators

The ozone layer is recovering

But CFCs are still leaking from old fridges and CFCs take many years to reach the upper atmosphere.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