Exercise walk-through

6.4
Stratospheric ozone

International Baccalaureate · IB Diploma · Environmental Systems and Societies · SL

Composition and layers

Dry air

About 78% nitrogen, 21% oxygen and 0.9% argon.

NOAA global 2024 CO_2: about 422.8 ppm; water vapour excluded from dry air.

Temperature profile

Troposphere: most weather; temperature usually falls upwards.

Stratosphere: **ozone** absorbs UV; temperature rises upwards.

Radiation and ozone

Protective stratosphere

O_2/**ozone** absorb all UV-C and much UV-B; much UV-A reaches ground.

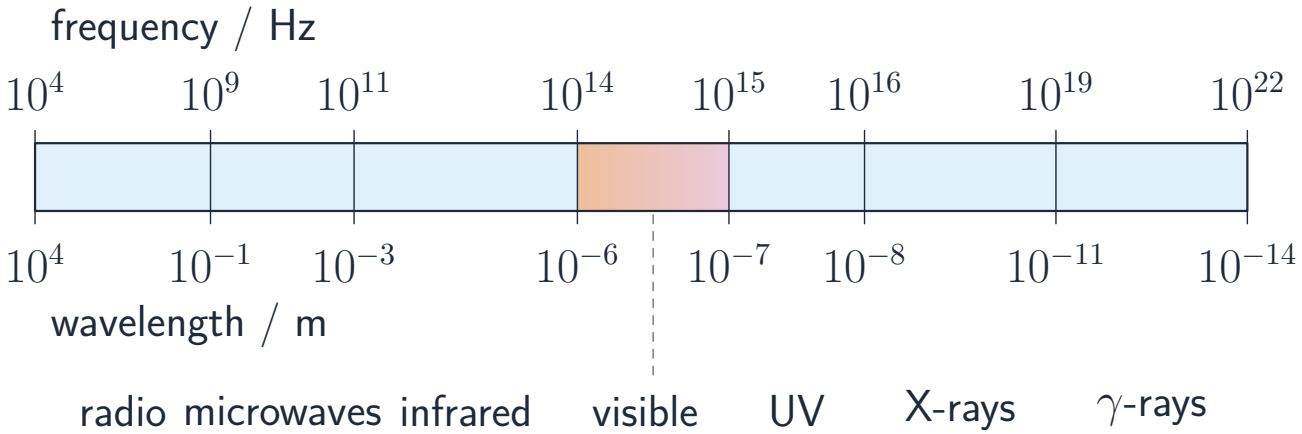
Shorter wavelength means higher photon energy.

Distinct problems

More UV-B damages DNA, eyes, crops and phytoplankton.

Ground-level ozone is the same molecule in a harmful secondary-pollutant context.

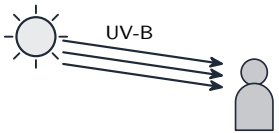
The electromagnetic spectrum



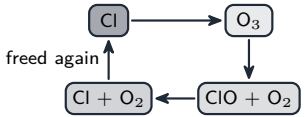
UV-B and UV-C damage living cells; **ozone** absorbs them

Exercises 2.1·2.2

2.1 State **two** effects on human health of more UV-B radiation reaching the ground. [2]

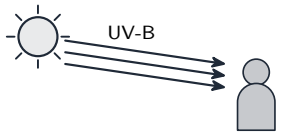


2.2 Explain how CFCs destroy ozone in the stratosphere. [3]



Exercises 2.1·2.2

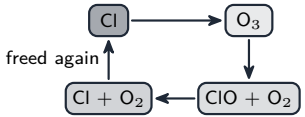
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2.1

any two: skin cancer; cataracts / eye damage; sunburn; weaker immune system

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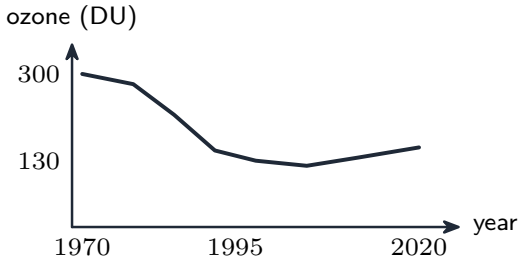
2.2

CFCs rise slowly into the stratosphere, where UV breaks them up and releases chlorine atoms; a chlorine atom reacts with ozone, forming oxygen; the chlorine is freed again, so one atom can destroy thousands of ozone molecules (catalyst)

Exercise 3.1 (a)

3.1 The graph shows the mean October ozone over Antarctica (approximate values).

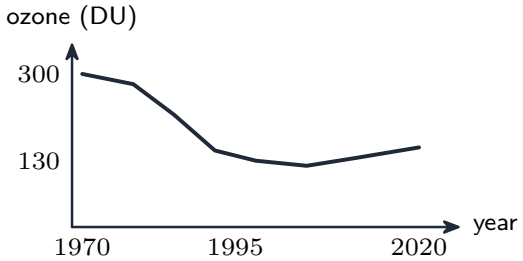
(a) Describe the trend shown. [2]



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(a) ozone fell sharply from about 300 DU in 1970 to about 130 DU in the 1990s; since about 2000 it has stopped falling and is rising slowly

Exercise 3.1 (b)

3.1 The graph shows the mean October ozone over Antarctica (approximate values).

(b) Explain why the ozone hole forms over Antarctica in spring. [2]

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(b) the very cold winter forms polar stratospheric clouds, where chlorine is changed into active forms; when sunlight returns in spring, it releases chlorine atoms that destroy ozone quickly

Exercise 3.2 (a)

3.2 The Montreal Protocol is often called the most successful environmental agreement.

(a) Outline **two** reasons why the Montreal Protocol worked. [2]

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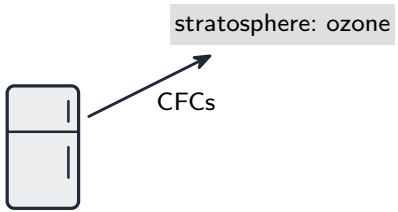
(a) Outline **two** reasons why the Montreal Protocol worked. [2]

(a) any two: replacement chemicals were available at low cost; only a few firms made CFCs; clear scientific evidence and visible ozone hole; a fund helped poorer countries switch; trade limits with non-members

Exercise 3.2 (b)

3.2 The Montreal Protocol is often called the most successful environmental agreement.

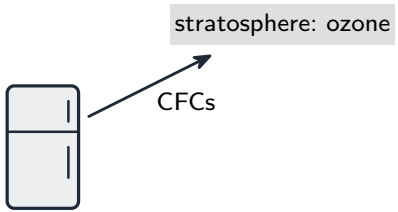
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(b) CFCs stay in the atmosphere for decades to a century; CFCs are still released from old fridges, foams and landfills; some illegal production continues, and chlorine keeps destroying ozone as a catalyst until it is removed