

Exercise walk-through

9.1

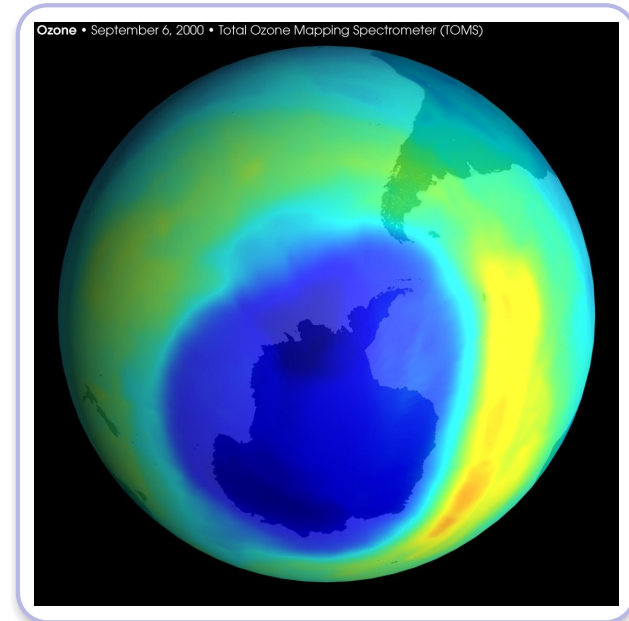
Stratospheric Ozone Depletion

AP Environmental Science

Ozone depletion and the Montreal Protocol

The **ozone layer** blocks UV.
CFCs release chlorine that destroys it (catalyst).

The 1987 **Montreal Protocol** phased out CFCs worldwide and is a rare environmental success – the layer is slowly recovering. The substitutes still carry a climate cost, which is the follow-up the question asks for.



Ozone hole: CFC chlorine catalysis

The ozone layer, and what took it apart

ozone layer

high in the stratosphere; absorbs harmful **ultraviolet** radiation before it reaches the ground

CFCs

chlorofluorocarbons – once used in coolants and sprays; stable enough to drift up intact

the mechanism

UV splits off a chlorine atom, which destroys ozone **catalytically** – one atom, thousands of molecules

the consequence

more UV at the surface: skin cancer, cataracts, damage to crops and plankton

The **Montreal Protocol** phased CFCs out and the layer is recovering – the one clear success story in the whole course.

Exercises 2.1-2.3

2.1 Which chemicals are the main cause of ozone depletion?

[1]

2.2 What atom released from CFCs destroys ozone?

[1]

2.3 State one effect of increased UV from ozone loss.

[1]

Exercises 2.1-2.3

2.1 Which chemicals are the main cause of ozone depletion? [1]

2.1

- CFCs (chlorofluorocarbons)
-

2.2 What atom released from CFCs destroys ozone? [1]

2.2

- Chlorine
-

2.3 State one effect of increased UV from ozone loss. [1]

2.3

- Any one: skin cancer, cataracts, crop/plankton damage

Exercise 3.1

3.1 Stratospheric ozone is important because it

[1]

☐

A causes smog

B absorbs harmful UV radiation

C warms the ground

D is a greenhouse gas only

Exercise 3.1

3.1 Stratospheric ozone is important because it

[1]

☐

A causes smog

B absorbs harmful UV radiation

C warms the ground

D is a greenhouse gas only

3.1 B

- absorbs harmful UV radiation

Exercise 3.2 (a)

3.2 CFCs from old refrigerators reach the stratosphere.

(a) Explain how they destroy ozone.

[3]

Exercise 3.2 (a)

3.2 CFCs from old refrigerators reach the stratosphere.

(a) Explain how they destroy ozone.

[3]

(a)

- CFCs rise to the stratosphere; UV breaks them, releasing chlorine; each chlorine atom destroys many ozone molecules in a chain reaction

Exercise 3.2 (b)

3.2 CFCs from old refrigerators reach the stratosphere.

(b) State one health effect of the resulting UV increase.

[1]

Exercise 3.2 (b)

3.2 CFCs from old refrigerators reach the stratosphere.

(b) State one health effect of the resulting UV increase.

[1]

(b)

- Skin cancer (or cataracts)

Exercise 3.3

3.3 Distinguish “good” stratospheric ozone from “bad” ground-level ozone.

[2]

Exercise 3.3

3.3 Distinguish “good” stratospheric ozone from “bad” ground-level ozone. [2]

3.3

- Good ozone is in the stratosphere and shields Earth from UV; bad ozone is at ground level, a smog pollutant that harms lungs