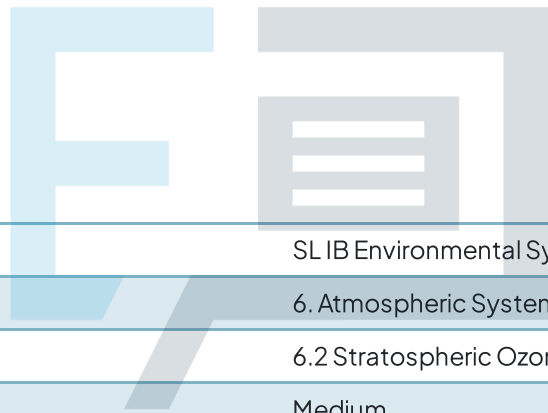




# 6.2 Stratospheric Ozone

## Mark Schemes



Course	SL IB Environmental Systems & Societies (ESS)
Section	6. Atmospheric Systems & Societies
Topic	6.2 Stratospheric Ozone
Difficulty	Medium

# Exam Papers Practice

To be used by all students preparing for  
SL IB Environmental Systems & Societies (ESS)  
Students of other boards may also find this useful

1

### Indicative Content

The trend in ozone levels shown in the graph above can be described as follows:

Any **four** from the following:

- Ozone levels are approximately constant / have a small/slight overall decline between 1955 and 1970(s); [1 mark]
- (This is followed by a) steep decline / sharp decrease in ozone levels between 1970s and 1990s; [1 mark]
- There is some evidence of recent recovery in ozone levels between 1990s and 2010s/2020; [1 mark]
- Although ozone levels remain approximately constant between 2010 and 2020; [1 mark]
- There is an isolated peak / brief spike / outlier in 2002 that might be anomalous / an anomaly / due to a random event; [1 mark]

2

### Indicative Content

Potential effects of ozone depletion on living systems include:

Any **four** from the following:

- Upper atmosphere / stratospheric ozone plays a crucial role in limiting the penetration of solar ultraviolet radiation to the Earth's surface; [1 mark]
- So depletion of ozone results in increased UV radiation reaching Earth's surface; [1 mark]
- With potentially harmful impacts on living organisms; [1 mark]
- (UV radiation) can cause an increased rate of mutations; [1 mark]
- Plant tissues are susceptible to damage from UV radiation; [1 mark]
- Especially when combined with other stressors e.g. higher temperatures; [1 mark]



- This could adversely affect crops and natural plant communities; [1 mark]
- Phytoplankton (key to marine food webs) might be particularly at risk; [1 mark]
- A decrease in plankton populations could disrupt marine food chains / disturbance of entire (globally significant) ecological food chains, impacting commercial fish stocks / higher trophic levels; [1 mark]
- Impacts on human health from (excess) exposure to UV radiation include weakening of the immune system / increase in skin cancer / cataracts / eye cancer; [1 mark]

3

### Indicative Content

Depletion of the ozone layer is an example of positive feedback because:

Any **five** from the following:

- Positive feedback is defined as / involves a process that increases/amplifies/magnifies changes, leading to a departure from equilibrium **OR** causes a system to move away / deviate (exponentially) from an equilibrium state; [1 mark]
- Ozone layer depletion is an positive feedback through interactions involving ozone-depleting substances e.g. CFCs, which release chlorine/bromine/halogen atoms when they are exposed to UV radiation; [1 mark]
- These released (chlorine/bromine/halogen) atoms then catalyse the breakdown of ozone molecules in the upper atmosphere / stratosphere; [1 mark]
- As ozone molecules break down, they release oxygen atoms, which can further combine with the released chlorine/bromine/halogen atoms **OR** the breakdown of ozone molecules provides more oxygen atoms for chlorine bonding; [1 mark]
- This depletes the available oxygen atoms for  $O_2$  to bond with, to form new ozone; [1 mark]
- The combined effect of released atoms / the catalytic action of chlorine/bromine accelerates ozone depletion; [1 mark]

- This reduction in ozone concentration allows more harmful UV radiation to reach the Earth's surface; [1 mark]
- Increased UV radiation leads to higher rates of ozone depletion as more chlorine/bromine becomes available, creating a self-amplifying cycle / positive feedback loop; [1 mark]

4

### Indicative Content

Methods for reducing the manufacture and release of ozone-depleting substances include:

Any **two** from the following sets of answers:

- Recycling refrigerants; [1 mark]
- This involves reclaiming/reprocessing used refrigerants from appliances / the collection/purification/reuse of refrigerants from old/discarded refrigeration / air conditioning systems; [1 mark]
- This prevents the release of ozone-depleting substances during disposal; [1 mark]
- This minimises the need for new production (of refrigerants); [1 mark]

OR

- Developing alternatives to gas-blown plastics / halogenated pesticides / propellants / aerosols; [1 mark]
- Researching/using non-ozone-depleting substances in manufacturing; [1 mark]
- Developing new formulations without harmful halogenated compounds; [1 mark]
- This results in the creation of products with minimal/no impact on ozone depletion; [1 mark]

OR

- Developing non-propellant alternatives; [1 mark]
- This involves creating aerosol products that do not require ozone-depleting propellants; [1 mark]



- E.g. utilising pump sprays / compressed air / mechanical pressurisation/dispersion methods; [1 mark]
- This will help to transition to environmentally friendly / propellant-free delivery systems; [1 mark]

OR

- International agreements/regulations; [1 mark]
- This involves countries/industries/companies participating in international protocols e.g. the Montreal Protocol; [1 mark]
- This requires collaboration with other nations to phase out ozone-depleting substances; [1 mark]
- And enforcing bans on the production/use of certain harmful chemicals; [1 mark]

OR

- Consumer education/awareness; [1 mark]
- This involves educating consumers about ozone depletion and its consequences; [1 mark]
- And encouraging informed choices through labelling / information campaigns; [1 mark]
- And promoting the purchase of products using ozone-friendly technologies; [1 mark]

Exam Papers Practice