Name: _____

Date: _____

Class: _____

IB Environmental Systems and Societies

6.2 Stratospheric Ozone

Significant ideas:

Stratospheric ozone is a key component of the atmospheric system because it protects living systems from the negative effects of ultraviolet radiation from the Sun.

Human activities have disturbed the dynamic equilibrium of stratospheric ozone formation.

Pollution management strategies are being employed to conserve stratospheric ozone.

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Ultraviolet radiation and ozone

1. List the potential harmful effects of ultraviolet radiation on living tissue.

Effects include genetic mutation / damage to plant tissue & planktons.
Marine phytoplankton is the major biological producer of the biosphere.
Affects reproduction rates
In humans can cause cataract, skin cancer etc.

2. Explain how increased levels of UV radiation can influence biological productivity.

Damage to phytoplankton (imp. photosynthetic org) as destroys chlorophyll, resulting in reduced rate of photosynthesis. Also, in aquatic ecosystems, organisms that live in upper layers of H_2O are most affected.

3. With reference to the three types of UV radiation, outline how the frequency of the radiation affects its potential to cause harm to living tissues.

UV radiation 3 types: UVc, UVb, UVa

UVc → Highest Energy, Shortest wavelength → most potent

UVa → Low energy, Long Wavelength → Least harmful

Stratospheric O_3 absorbs 99% UVc

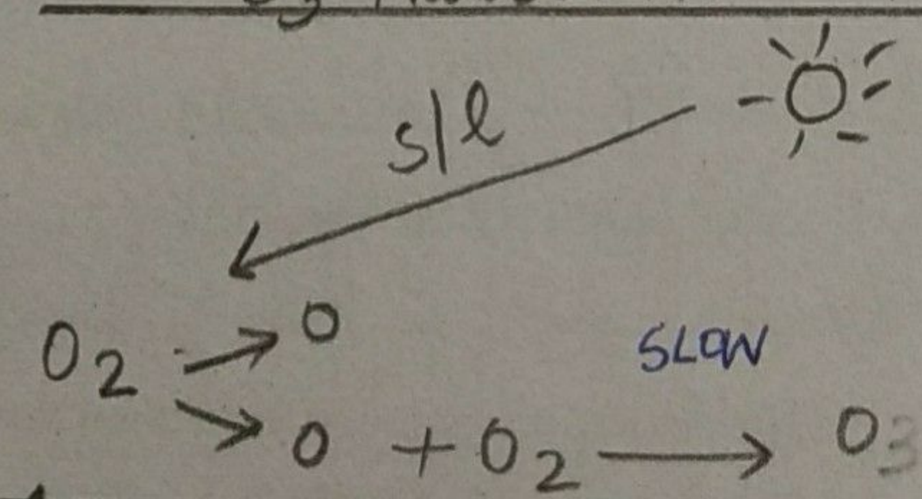
4. State why the stratospheric ozone is said to exist in a "dynamic equilibrium"

Ozone formation & breakdown is a natural process

5. Complete the diagram to summarise the natural formation and destruction of ozone in the presence of UV radiation in the stratosphere.

Stratosphere

O_3 PRODUCTION



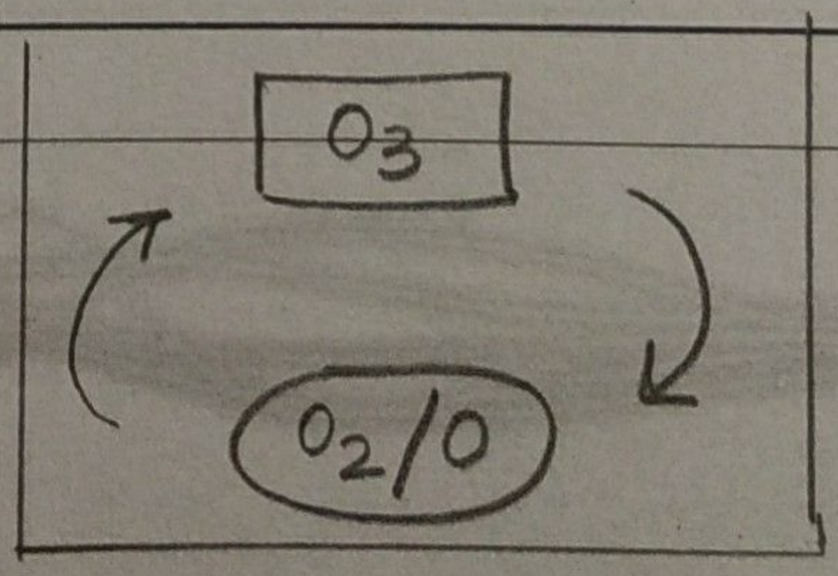
O_3 DESTRUCTION

$O_3 + UV \longrightarrow O + O_2$

$O_3 + O \rightarrow 2O_2$

Troposphere

O_2 produced



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Ozone depletion

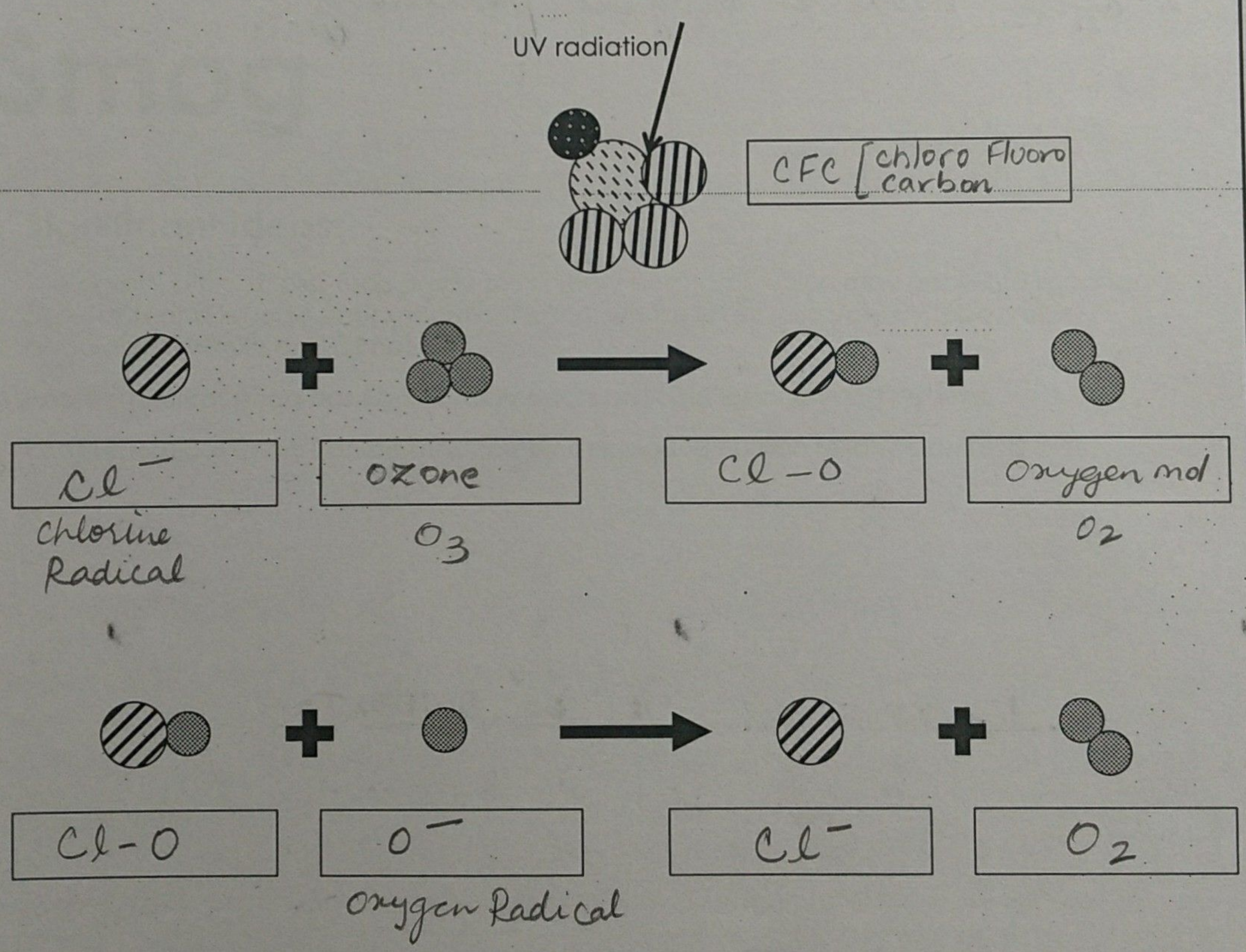
1. Chloroflourocarbons (CFCs) can deplete ozone levels. List the uses of CFCs:

Manufacture of Aerosol sprays, foams, packing material, refrigerants, pesticides, flame retardants

Non toxic / Non-flammable

2. The diagram below represents the depletion of ozone as a consequence of CFC emission. Label each molecule below. Use the following words:

Chlorine radical, ClO, CFC, Oxygen molecule, Ozone molecule, Oxygen radical



Note: You don't need to know words like "radical", and you don't need to memorise any equations. The diagram above is to help with your understanding, but you aren't expected to learn it by heart.

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3. From the diagram above, you should be understand the following points:

- Chloroflourocarbons release Cl atoms ~~with~~ when exposed to UV radiation in the atmosphere
  Chlorine
- The chlorine atom reacts to O_3 and breaks it down to molecular oxygen (and produces ClO).
- ClO can then be split up to regenerate a chlorine atom. This can continue to deplete levels of strat ospheric O_3.

4. State the effect of CFC release on the amount of UV radiation reaching living things:

Since CFC depletes O_3 layer, more UV reaches earth & affects tissue & biological productivity.

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