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Freons

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The Chemistry, Applications, and

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Environmental Paradox of CFCs

Essential Vocabulary

Chlorofluorocarbons

Methane and ethane derivatives heavily substituted with Cl and F atoms.

Freon 12

CCl2F2 — The most common industrial variant used in refrigeration and aerosols.

Radical Chain Reactions

The high-energy chemical mechanism initiated by UV light that destroys atmospheric ozone.

Industrial Synthesis of Freon 12



By 1974, total global production of Freons reached **~2 billion pounds annually**, primarily driven by demand for aerosol propellants and air conditioning.



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The Properties of Freons

Extremely Stable

Unreactive

Easily Liquefiable

Non-toxic

Non-corrosive

The Atmospheric Lifecycle

Stratosphere (High Altitude)



Exposure to intense UV radiation ignites **radical chain reactions**, upsetting the natural ozone balance.

Troposphere (Ground Level)



Freon gases diffuse upward, remaining completely unchanged and unreactive in the lower atmosphere.

Watch for this Mechanism

The 'Stability' Trap

In MCQs, you might assume that a “highly stable” compound is environmentally safe. **Do not fall for this.** Ground-level stability is the exact mechanism that allows Freon to survive long enough to reach the stratosphere intact. Its unreactive nature below is what makes it so dangerous above.

Concept Summary

- Freon 12 (CCl_2F_2) is synthesized from CCl_4 via the **Swarts reaction** and is defined by its extreme ground-level stability and non-toxicity.
- This high stability allows it to diffuse into the stratosphere unchanged, where UV light triggers **radical chain reactions** that actively deplete the ozone layer.



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