Q17

Discuss global warming and mention its effects on the global climate. Explain the control measures to bring down the level of greenhouse gases which cause global warming, in the light of the Kyoto Protocol, 1997.

UPSC Civil Services Mains 2022 · GS III · 15 marks · Environment and Conservation

Conservation, environmental pollution and degradation, environmental impact assessment.

Core demand of the question

- Explain global warming and its effects
- State control measures in the light of the Kyoto Protocol, 1997

Revision summary

Global warming is the rise in surface temperature from extra greenhouse gases trapping infrared.

Effects include glacier and ice loss, sea-level rise, coral bleaching, harsher extremes, and crop and coastal stress.

The Kyoto Protocol 1997 set quantified limits for Annex I countries and created emissions trading, Joint Implementation and the CDM.

India was not under a Kyoto cap but hosted CDM projects.

Paris 2015 extended pledges to all parties; the control toolkit remains mitigation, markets, efficiency and sinks.

Introduction

Global warming is the long-term rise in Earth's average surface temperature from **enhanced greenhouse gases**-chiefly carbon dioxide, methane and nitrous oxide-trapping outgoing infrared. The **Kyoto Protocol (1997)** was the first binding attempt to put **quantified emission limits** on industrial countries. Control today still uses Kyoto's logic (count, cap, trade) even after **Paris 2015** shifted to universal pledges.

Body

Global warming

- Solar short-wave energy reaches the surface; Earth emits **long-wave infrared**. Greenhouse gases absorb some of that infrared and re-radiate it, warming the lower atmosphere.
- **Anthropogenic** extra CO2 from fossil fuels and land-use change, **CH4** from livestock, waste and leaks, and **N2O** from fertiliser thicken that blanket.
- **IPCC-assessed** warming relative to pre-industrial times is already more than a degree Celsius; the exact tenth is a moving measured quantity-do not invent a false precision here.
- **Warming is** uneven**:** land faster than ocean, Arctic faster than tropics.

Effects

• **Cryosphere:** glacier retreat (Himalayan water towers), ice-sheet loss, permafrost thaw that can release more methane.

• **Oceans:** thermal expansion and ice melt raise **sea level**; warmer water **bleaches coral** and lowers oxygen; CO2 itself causes **acidification** (a cousin problem).

• **Weather:** more intense heatwaves, shifting monsoon risk, heavier extreme rain, and compound drought-fire in some regions.

• **Biosphere and food:** crop heat stress, pest range shifts, fisheries moving poleward.

• **People:** coastal flooding, heat mortality, climate-related displacement, and security stress over water.

• **Tipping elements** (AMOC, rainforest dieback, ice sheets) are risks, not a calendar prediction.

Control measures in light of Kyoto 1997

• Kyoto (adopted **1997**, entered into force **2005**) bound **Annex I** parties to **emission limitation or reduction** over a first commitment period, with **common but differentiated responsibilities** relative to the 1992 UNFCCC.

• **Flexible mechanisms: Emissions Trading**, **Joint Implementation**, and the **Clean Development Mechanism (CDM)** so cuts could occur where cheaper, including projects in developing countries (India hosted many CDM projects: renewables, industrial gases).

• **Domestic control toolkit consistent with that architecture:** carbon price or trading, renewable standards, energy efficiency, forest sinks (Kyoto allowed land-use accounting with rules), and methane capture.

• **Limits of Kyoto:** the United States did not ratify; some targets were missed; aviation and much of shipping sat awkwardly; developing-country **growth emissions** were outside binding Annex I caps-hence **Paris** nationally determined contributions for all.

• **India's control path in that light:** not an Annex I Kyoto cap, but CDM experience, later **Panchamrit** and non-fossil capacity, energy-efficiency missions, and a possible carbon market-**Kyoto's MRV and market tools without pretending India had a 1997 QELRC**.

Continuity

• Measure, report, verify; put a cost on carbon; protect sinks. That is Kyoto's lasting method. Paris changed **who pledges**, not the physics.

Flow diagram

GHG CO2 CH4 N2O -> Global warming

Global warming -> Ice seas extremes food

Kyoto 1997 -> Annex I quantified limits

Kyoto 1997 -> ET JI CDM

ET JI CDM -> Price technology sinks

Price technology sinks -> Global warming

Conclusion

Global warming is greenhouse trapping of infrared, with effects on ice, seas, extremes and food. Kyoto 1997 first capped Annex I emissions and invented trading, JI and CDM. Control still means price, technology, sinks and honesty about who was bound. Paris universalised pledges; it did not repeal the need to cut gases.

Facts & figures

Kyoto Protocol 1997

UNFCCC protocol adopted in Kyoto in 1997; entered into force in 2005; binding targets for Annex I parties.

CDM

Clean Development Mechanism: Annex I parties fund emission-reduction projects in non-Annex I countries for credits.

UNFCCC 1992

Parent climate convention; Kyoto operationalised differentiated binding targets for industrial countries.

Paris Agreement 2015

Successor architecture of nationally determined contributions for all parties, after Kyoto's limited membership.

Annex I

Industrialised parties listed in the UNFCCC who took quantified Kyoto commitments.