

GUJARAT TECHNOLOGICAL UNIVERSITY

6 SEMESTER – OLD PAPER – SUMMER 2022 TO SUMMER 2026 – QUESTION BANK

Subject Name & Code: Global Warming and Climate Change - 3161312

Chapter 1: Basics of Climate Change

Repeated Questions:

1. Weather and Climate:

- **Q.** Differentiate between Weather and Climate / Justify whether they can be used interchangeably. (SUMMER 2022, 3 Marks; WINTER 2022; SUMMER 2023, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2025; WINTER 2025, 7 Marks)

2. Climate Variability, Climate Change and Global Warming:

- **Q.** What is meant by climate variability and climate change? / Explain Climate Change and Climate Variability with examples. (WINTER 2022; SUMMER 2023, 7 Marks; WINTER 2024, 3 Marks)
- **Q.** Differentiate between Global Warming and Climate Change. (SUMMER 2024, 4 Marks; SUMMER 2026, 4 Marks OR)

3. Greenhouse Effect:

- **Q.** Explain / Differentiate Natural and Enhanced Green House Effect. (SUMMER 2023, 3 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 7 Marks; SUMMER 2025; WINTER 2025, 4 Marks; SUMMER 2026, 4 Marks)
- **Q.** Explain Greenhouse effect / Discuss Green House effect in detail / Discuss effect of Green House Effect. (WINTER 2022, 3 Marks; WINTER 2023, 4 Marks; WINTER 2025, 7 Marks)

4. Earth's Energy Balance and Radiation Laws:

- **Q.** How does energy get balanced on the Earth? / Explain earth's energy budget in detail. (SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks)
- **Q.** State and derive / State the Stefan-Boltzmann law / principle. (WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks)

Other Important Questions:

1. Definitions and Terminology:

- **Q.** Define the following terms: Climate Change, Climate Adaptation and Climate Resilience. (SUMMER 2024, 3 Marks)
- **Q.** Define the term Climate Resilience. (WINTER 2025, 3 Marks OR)
- **Q.** Define the term Weather and Climate. (SUMMER 2026, 3 Marks)

2. Causes of Climate Change and Human Influence:

- **Q.** Compare and contrast the natural and anthropogenic causes of climate change. (WINTER 2022, 7 Marks OR)
- **Q.** Explain the role of humans in Climate Change. (WINTER 2025, 3 Marks)
- **Q.** Discuss the indicators of human fingerprint on climate change. (WINTER 2025, 7 Marks OR)
- **Q.** How anthropogenic activities exert cooling influence on earth's climate? (SUMMER 2022, 3 Marks)

3. Evidence and Case Studies:

- **Q.** Elaborate any one case study as an evidence of Climate change. (WINTER 2022, 7 Marks)
- **Q.** Justify the statement: "The Sun: A Weather Engine". (SUMMER 2026, 7 Marks)

Chapter 2: Green House Gases

Repeated Questions:

1. Contribution and Significance of Greenhouse Gases:

- **Q.** Give the statistical contribution of greenhouse gases in the atmosphere. (**WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks; WINTER 2024, 3 Marks**)
- **Q.** Water vapor and Carbon dioxide will act as significant Greenhouse Gases — Justify / Carbon Dioxide and Water Vapor are the most significant GHGs — Justify. (**WINTER 2023, 7 Marks; SUMMER 2025**)

2. Sources of Greenhouse Gases:

- **Q.** Explain / Describe the sources of Methane emission / Discuss sources of methane and its climatic effects. (**SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks OR; SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks; SUMMER 2026, 4 Marks**)
- **Q.** Discuss anthropogenic sources of Greenhouse Gases / Explain the sources of GHGs. (**WINTER 2023, 7 Marks; WINTER 2025, 4 Marks**)

3. Global Warming Potential:

- **Q.** Define Global Warming Potential / Enlist GHG and mention respective Global Warming Potential (GWP). (**WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks OR**)

Other Important Questions:

1. Definitions and Terminology:

- **Q.** Explain the term Carbon Dioxide Equivalent Emission with example. (**SUMMER 2024, 3 Marks**)
- **Q.** Define the following terms: Global Warming Potential, Carbon Flux, Residence Time. (**WINTER 2023, 3 Marks**)
- **Q.** Define the following terms: Short-lived climate forcers (SLCF), Emission trading, Climate Projection. (**SUMMER 2022, 3 Marks - cross-chapter: includes Emission trading (Ch. 5) and Climate Projection (Ch. 6)**)
- **Q.** Define the following terms: Global Warming Potential, Jet Stream, Gulf Stream. (**SUMMER 2025 - cross-chapter: Jet Stream and Gulf Stream also relate to Ch. 3**)

2. Role and Mechanism of Greenhouse Gases:

- **Q.** What are the 5 greenhouse gases that contribute to climate change? How do greenhouse gases affect the climate? (**SUMMER 2023, 4 Marks**)
- **Q.** Define the term Green House Gas (GHG). Discuss the role of GHGs in Global warming and Climate change. (**SUMMER 2025**)
- **Q.** Explain the mechanisms of sunlight interacts with GHGs. (**SUMMER 2026, 7 Marks**)
- **Q.** How do greenhouse gases such as carbon dioxide cause global warming? (**SUMMER 2022, 3 Marks**)

3. Individual Greenhouse Gases: Sources and Impacts:

- **Q.** How does CFCs contribute in climate change? What are the sources and impacts? (**SUMMER 2023, 4 Marks**)
- **Q.** Enlist and explain sources and impacts of any THREE Green House Gases. (**SUMMER 2024, 7 Marks**)
- **Q.** Compare CO₂ and CH₄ as Green House Gases. (**SUMMER 2026, 7 Marks OR**)

4. Carbon Fluxes:

- **Q.** Enlist and explain any TWO Carbon Fluxes in detail. (**SUMMER 2025, 4 Marks**)

Chapter 3: Basics of Global Warming

Repeated Questions:

1. Global Warming: Concept and Significance:

- Q. Explain global warming in brief / Explain the concept of Global Warming. (**WINTER 2022, 3 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 3 Marks**)
- Q. Explain the significance of Global warming and Climate change in Environmental Engineering field. (**WINTER 2022; SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks**)

2. Global Carbon Cycle:

- Q. Explain / Describe the Global Carbon Cycle in detail. (**SUMMER 2022, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks OR; WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR**)

3. Stabilization and Mitigation of Climate Change:

- Q. Enlist ways / Explain pathways to stabilize Atmospheric Carbon Dioxide Concentration. (**SUMMER 2024, 3 Marks; WINTER 2025, 4 Marks**)
- Q. Enlist and explain options to mitigate Climate Change in detail / Discuss GHG emission mitigation action. (**SUMMER 2022, 7 Marks OR; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks**)

4. Global Wind Circulation and ITCZ:

- Q. Discuss Global Latitudinal / Longitudinal Wind Pattern / Global Wind Circulation. [Diagram required – refer to the original question paper] (**SUMMER 2022, 7 Marks; SUMMER 2022, 7 Marks OR; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025; SUMMER 2026, 7 Marks**)
- Q. Explain Global Wind Circulation for Hadley Cell / Polar Cell. (**WINTER 2023, 3 Marks; WINTER 2023, 3 Marks OR**)
- Q. Define ITCZ / Discuss significance of ITCZ in atmospheric circulation / Define ITCS. (**SUMMER 2022, 3 Marks OR; SUMMER 2025, 4 Marks OR; WINTER 2025, 3 Marks OR; SUMMER 2026, 3 Marks**)
- Q. Explain Easterlies and Westerlies Wind / Define Trade winds, Westerlies, ITCS. (**WINTER 2025, 4 Marks OR; SUMMER 2026, 3 Marks**)

5. Role of Oceans and Ocean Circulation:

- Q. Discuss the role of Oceans with respect to Global Warming / role of Oceans in Climate Change / role of Oceans in climate. (**WINTER 2023, 7 Marks OR; SUMMER 2024, 7 Marks; WINTER 2024, 4 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks**)
- Q. Describe Thermohaline Circulation / Discuss global ocean conveyor belt. (**SUMMER 2022, 4 Marks; SUMMER 2022, 3 Marks; SUMMER 2025, 7 Marks**)
- Q. Describe Temperature and Salinity Variability of the Ocean / Discuss significance of Salinity in Ocean for Climate Change. (**WINTER 2025, 4 Marks OR; SUMMER 2026, 3 Marks**)

Other Important Questions:

1. Definitions and Terminology:

- Q. Define the following terms: Thermohaline circulation, Gulf stream, Ocean current. (**SUMMER 2022, 3 Marks OR**)
- Q. Define the following terms: Radiative Forcing, ITCZ, Carbon Capture and Sequestration (CCS). (**SUMMER 2022, 3 Marks OR - cross-chapter: Radiative Forcing → Ch. 2; ITCZ → Ch. 3; CCS → Ch. 4**)

2. Role of Oceans and Ocean Circulation:

- Q. Discuss the factors affecting ocean current in detail. (**WINTER 2023, 4 Marks OR**)

- **Q.** Explain the El-Nino Southern Oscillation (ENSO) in detail. **(SUMMER 2026, 4 Marks)**

Chapter 4: Carbon Capture and Sequestration (CCS)

Repeated Questions:

1. Concept of CCS:

- **Q.** Explain the concept / Define Carbon Capture and Sequestration (CCS). (WINTER 2022, 4 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 7 Marks)

2. CO₂ Capture Technologies:

- **Q.** Explain the types of CO₂ Capture technologies in detail with schematic block diagram / Enlist and explain any ONE CO₂ capture technology with schematic block diagram. [Diagram required – refer to the original question paper] (SUMMER 2024, 7 Marks; WINTER 2024; SUMMER 2025, 4 Marks; SUMMER 2026, 7 Marks OR)
- **Q.** Discuss Oxy-fuel combustion capture systems in detail. (WINTER 2024, 3 Marks OR; SUMMER 2025, 4 Marks OR)
- **Q.** Enlist and explain configuration of CO₂ Capture and Storage for use in electricity generation with schematic block diagram. [Diagram required – refer to the original question paper] (WINTER 2023, 7 Marks OR; WINTER 2024, 7 Marks OR)

3. Enhanced Oil Recovery (EOR):

- **Q.** Explain the concept / Define Enhanced Oil Recovery (EOR) / Discuss Enhanced Oil Recovery system. (WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks OR; SUMMER 2026, 4 Marks OR)

4. Carbon Capture and Utilization (CCU):

- **Q.** Explain the concept of Carbon Capture and Utilization (CCU) / Define CCU / Discuss advantage of CCU / Differentiate CCS and CCU. (WINTER 2023, 4 Marks OR; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks OR; SUMMER 2025, 3 Marks; SUMMER 2025, 7 Marks OR)

5. Carbon Dioxide Removal (CDR) and Negative Emissions:

- **Q.** Define and discuss the pathways for Carbon Dioxide Removal (CDR) and Negative Emissions. (SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks)

6. Applications of CCS:

- **Q.** Discuss applications of Carbon Capture and Sequestration (CCS). (WINTER 2025, 7 Marks; SUMMER 2026, 3 Marks OR)

Other Important Questions:

1. CO₂ Capture Technologies:

- **Q.** Discuss Post-combustion capture systems in detail. (WINTER 2024, 3 Marks OR)
- **Q.** Discuss the Industrial Process Capture System for: (a) Natural gas sweetening, (b) Steel production, (c) Cement production. (WINTER 2024, 7 Marks OR)
- **Q.** Explain one process of Carbon Capture adopted by Cement manufacture. (SUMMER 2023, 7 Marks - part of CCS question)

2. CO₂ Storage:

- **Q.** What are the geological storage options for CO₂? (SUMMER 2023, 3 Marks)
- **Q.** What are the advantages of storing carbon dioxide in geological reservoirs? (SUMMER 2023, 4 Marks)

3. Enhanced Oil Recovery (EOR):

- **Q.** List the models used for CO₂ storage through EOR. Explain any one. (WINTER 2022, 4 Marks)

Chapter 5: Policies and Legislation

Repeated Questions:

1. IPCC:

- **Q.** State the objectives of IPCC / Discuss the role of IPCC / Define IPCC / Explain role of IPCC. (SUMMER 2022, 4 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; WINTER 2023, 3 Marks OR; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks)

2. UNFCCC:

- **Q.** Discuss the role of UNFCCC. (SUMMER 2022, 4 Marks; SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks)

3. Kyoto Protocol:

- **Q.** What is the Kyoto Protocol? On which mechanism it works? / Write a detailed note / Discuss significance / Describe Kyoto Protocol. (SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks; WINTER 2024, 3 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 4 Marks)

4. Kyoto Mechanisms: CDM and JI:

- **Q.** What is CDM of Kyoto Protocol? How does CDM work? / Explain the Concept of Clean Development Mechanism / Define CDM. (SUMMER 2023, 3 Marks; WINTER 2023, 4 Marks OR; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks)
- **Q.** Describe Joint Implementation (JI) mechanism / Difference between Joint Implementation and Clean Development Mechanism. (SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks OR; SUMMER 2025, 4 Marks)

5. COP and MOP:

- **Q.** What is COP and MOP? What is the purpose of the COP Conference? / What is the COP? (WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks)

6. National Climate Action Plan and Legislation:

- **Q.** Discuss National Climate Action Plan / National Action Plan for Climate Change in detail. (WINTER 2023, 7 Marks OR; WINTER 2025, 7 Marks OR)

7. Environmental Economics and Policy:

- **Q.** Explain in detail how does economic system help to solve economic issues and problems in an economy? (SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks)
- **Q.** Define Environmental Economics / What is environmental economics and how is it beneficial in environmental management? (SUMMER 2023, 4 Marks; SUMMER 2024, 3 Marks)

Other Important Questions:

1. Definitions and Terminology:

- **Q.** Define the following terms: Short-lived climate forcers (SLCF), Emission trading, Climate Projection. (SUMMER 2022, 3 Marks)

2. IPCC:

- **Q.** Enlist the important findings of IPCC AR5. (WINTER 2024, 3 Marks OR)

3. UNFCCC:

- **Q.** Discuss the role of UNFCCC and WMO. (WINTER 2023, 4 Marks)

4. National Climate Action Plan and Legislation:

- **Q.** Discuss National legislative frameworks for Climate Change in detail. (SUMMER 2025, 7 Marks)

5. Environmental Economics and Policy:

- **Q.** How is economics related to environmental policy? **(SUMMER 2023, 3 Marks)**
- **Q.** Explain how environmental policies to deal with air and water pollution. **(SUMMER 2023, 7 Marks)**
- **Q.** Explain the consequences on economy of a country in times of extreme weather events. **(WINTER 2022, 7 Marks)**

6. Sustainable Development and Circular Economy:

- **Q.** Explain the term Sustainable Development. **(WINTER 2023, 3 Marks)**
- **Q.** Explain the concept of Circular Economy. **(SUMMER 2025, 4 Marks OR)**

Chapter 6: Climate Change Modeling

Repeated Questions:

1. Climate Models and Climate Modelling:

- Q. Explain Global Circulation Model (GCM). (WINTER 2023, 3 Marks OR; SUMMER 2024, 3 Marks; WINTER 2025, 7 Marks OR; SUMMER 2026, 3 Marks OR)
- Q. Differentiate between weather model and climate model. (SUMMER 2022, 4 Marks OR; WINTER 2024, 4 Marks OR; SUMMER 2026, 4 Marks OR)
- Q. Describe / Enlist and explain elements of Weather and Climate Modelling / components of a climate model. (SUMMER 2022, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2025, 4 Marks OR)
- Q. Enlist and explain the various types of models used for modeling the climate / Classify the climate models. (SUMMER 2022, 4 Marks; WINTER 2022, 7 Marks)

2. Applications and Benefits of Climate Modelling:

- Q. Discuss / Explain applications of Climate Modelling. (WINTER 2023, 3 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 3 Marks; SUMMER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR)

3. Scenarios, Sensitivity and Feedback:

- Q. Explain the term Representative Concentration Pathway (RCP) Scenario / Define Climate Sensitivity, Climate feedback, RCP Scenario. (SUMMER 2022, 3 Marks; SUMMER 2024, 3 Marks)

4. Elements of Climate:

- Q. State elements of Climate. Explain any two in detail / Enlist and describe any TWO climate elements. (SUMMER 2022, 4 Marks; WINTER 2022, 7 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)

5. Climate Change Impacts: General and Warming Thresholds:

- Q. Discuss the Impacts of 1.5°C and 2°C of Warming. (SUMMER 2022, 7 Marks; WINTER 2024, 7 Marks OR)
- Q. "An estimate of the average rise in sea level is a useful measure of the future impact of global warming..." — Justify. [Data truncated in source – refer to the original question paper] (WINTER 2022, 7 Marks; WINTER 2024, 7 Marks OR)
- Q. Discuss Climate Change Impacts in detail / Explain Climate Impacts with example. (WINTER 2023, 7 Marks OR; SUMMER 2026, 3 Marks OR)

6. Climate Impacts on India, Agriculture, Precipitation and Ecosystems:

- Q. How has climate change created an impact on India? (WINTER 2022, 3 Marks; WINTER 2024, 3 Marks)
- Q. Discuss effect of climate change on agriculture and food production / Discuss Climate Impacts on Agriculture in detail. (SUMMER 2022, 4 Marks; WINTER 2025, 7 Marks)

Other Important Questions:

1. Climate Models and Climate Modelling:

- Q. What is meant by a climate model? (WINTER 2022, 3 Marks)
- Q. Explain testing the validity of models. (WINTER 2022, 4 Marks)

2. Applications and Benefits of Climate Modelling:

- Q. What are the benefits of climate change models? (SUMMER 2023, 3 Marks)

3. Climate Change Impacts: General and Warming Thresholds:

- Q. Define the term Climate Impact. (WINTER 2025, 3 Marks)

- **Q.** Discuss the indications of global warming. **(SUMMER 2022, 4 Marks OR - cross-chapter: also relevant to Ch. 3)**

4. Climate Impacts on India, Agriculture, Precipitation and Ecosystems:

- **Q.** During past changes in climate, many forms of flora and fauna were able to migrate... Why could this option not be available to many species as the climate changes in the future? [Data truncated in source – refer to the original question paper] **(WINTER 2022)**
- **Q.** Discuss effect of climate change on Precipitation. **(SUMMER 2022, 3 Marks OR)**
