

**GEO 302c Climate: Past, Present and Future
Review Questions for Exam 3**

Note that Exam 3 will have 50 multi-choice questions. The contents to be tested are mainly from the book (see below for specific chapters) plus some additional materials that have been emphasized in class.

Chapter 10

Key terms: Carbon isotope, carbon response to earth's orbital change

1. Why are air bubbles in ice cores younger than the ice in which they are sealed?
2. What features of the ice core CH₄ signal suggest a link to tropical monsoons?
3. To what extent does a cooler glacial ocean surface explain lower CO₂ in the glacial atmosphere?
4. Where did the carbon (CO₂) removed from the atmosphere go during glaciations?
5. What process controls the fractionation of the carbon-isotope?
6. How does carbon isotope ($\delta^{13}\text{C}$) trace the transfer of carbon between land and ocean during the glacial and inter-glacial cycle?
7. What were the ranges of the atmospheric CO₂ and CH₄ (methane) concentrations during the glacier and inter-glacier period (exclude the last 100 years)? How do they compare to the concentrations of CO₂ and CH₄ in current climate?

Chapter 11

Key term: ice-driven responses

8. In what sense are ice sheets both a climatic response and a source of climatic forcing?
9. Name an ice-driven response and cite evidence that it originates from changes in ice sheet size.
10. How could responses driven by northern hemisphere ice sheets to the Earth's orbital change influence climate in the southern hemisphere?
11. Cite two kinds of evidences indicating that changes in northern hemisphere rather than Antarctic ice sheets are a major player in orbital-scale climate changes.
12. What evidence suggests that orbital-scale changes in the northern hemisphere ice volume drive changes in atmospheric CO₂, rather than vice versa?
13. What mechanisms are suggested to cause the 100KY glacial-interglacial cycle during the past 1 MY?

Chapter 12

Key terms: Laurentide ice sheet, Cordilleran ice sheet, Scandinavian ice sheet, permafrost

14. How did Earth's surface at the last glacial maximum differ from its surface today?
15. How much colder was the global mean surface temperature during the last glacial maximum period compared to that of today?
16. What is the major uncertainty about the size of ice sheets at the glacial maximum?
17. In what ways did ice sheets make the glacial world a "dirty" place?
18. How does the composition of pollen in lake sediments tell us about climate?
19. How did the glacial climate of the southwestern United States differ from the climate there today? Why?
20. How did the glacial climate of Europe differ from the climate there today? Why?
21. How did the glacial climate of northern Asia differ from the climate there today? Why?

Chapter 13

Key terms: deglacial two-step, Younger Dryas, proglacial lakes

22. What is the best method of measuring the melting of ice sheets over the last 17,000 years?
Does the timing of ice sheet melting support the Milankovitch theory that orbital insolation controls the sizes of ice sheets?
23. Were changes in the intensity of summer monsoons in the last 17,000 years controlled by orbital insolation?
24. What evidence suggests that variations in orbital insolation were not the only cause of climate changes during the last 17,000 years?
25. Why were summer temperatures at high northern latitudes warmer 6000 years ago than they are today?
26. List evidences from ice, land, and water for a cooling in north polar regions since 6000 years ago.

Chapter 14

Key terms: millennial oscillations, Dansgaard-Oeschger cycles, Heinrich events

27. What evidence of millennial oscillations do we find in Greenland ice cores?
28. How do the processes that control $\delta^{18}\text{O}$ changes measured in ice sheets differ from those measured in ocean cores?
29. Why is it difficult to correlate millennial oscillations in records from different regions?
30. Describe two kinds of evidence of millennial oscillations from North Atlantic sediments.
31. What other regions show millennial oscillations like those in the North Atlantic and Greenland?
32. What could explain the small size of millennial oscillations during the last 8000 years?
33. What is the evidence for and against millennial oscillations originating from processes internal to ice sheets?
34. What is the evidence that millennial oscillations originate from interactions between deep water and ice sheets?
35. How could ocean flow cause millennial oscillations to have opposite timing north and south of the equator?
36. Could changes in the Sun account for millennial oscillations

Chapter 16

Key terms: Medieval Climatic Optimum, Little Ice Age, sunspot cycle, Maunder sunspot minimum

37. What evidence indicates a cooler climate in Europe and nearby regions during the Little Ice Age?
38. Why are climate changes during the last millennium difficult to detect?
39. What evidence from ice cores suggests that the warming during the 20th century reached levels unprecedented over the last 1000 years?
40. What are the ideal proxy data for millennial oscillations?
41. What climate events were the Heinrich events referred tot?
42. What might cause the little ice age?
43. What factors determine the climate impact of volcanoes? Why some volcanoes have greater impact on climate than others? What are the two most important volcano eruptions occurred during the past 200 years?

Chapter 17

Key terms: warming trend, sea-level rises, ecosystem response,

44. What evidences support the warming shown by surface-station measurements in the 20th century?
Can you find evidences that do not support the warming of global climate during the last century?
Explain why?
45. Name four kinds of evidence that support a gradual warming of high northern latitudes in the last two decades.
46. How would the increase of global surface temperature influence Texas?
47. Why does sea-level rise vary with locations?
48. What do observations tell us about the strength of the Sun in the late 20th century?
49. Describe major characteristics related to global climate change in the past century.
50. Name the warmest year in terms of global mean surface temperature during the past fifty years?
Among the top ten warmest years during the last fifty years, how many of them occurred since 2000? Name the warmest decade during the past 100 years?