

This homework covers materials presented in lectures 17, 18, and 19 as well as the accompanying reading assignments for those lectures (see syllabus). These are primarily short answer questions. In most cases, a few sentences should suffice. Please try to answer all questions in the space provided, use the back of the page if you have to. Be careful to answer each part of multi-part questions. **Note:** Homeworks will be graded on the basis of a *random subset* of these questions – so your best strategy will be to answer all the questions to the best of your ability.

1) Suppose you have a record of oxygen isotope variations in foram shells in a marine sediment core. During one point in your record (say about 20 thousand years ago), you see that the foram shells have a significantly higher $\delta^{18}\text{O}$ than, say, 2 thousand years ago. What does that tell you about a) the relative size of the glacial ice sheets 20,000 vs 2,000 years ago; and b) the relative sea level 20,000 vs 2,000 years ago? (Explain the reasoning behind your answers).

2) What do foram oxygen isotope records as discussed in question #1 show about the number and timescale of glacial-interglacial cycles over the past 700,000 years of Earth history?

3) Which of the three major Milankovitch orbital parameters shows the closest match to the major periodic component of the marine oxygen isotope record, and why does this suggest the involvement of positive climate feedback loops in the Pleistocene glaciation cycles?

4) Explain why iron fertilization of the oceans could represent one positive feedback loop operative during Pleistocene glacial times. How would this feedback loop work, and what evidence is there to support this scenario?

5) What types of proxy data are used to reconstruct northern hemisphere climate and temperature variations over the Holocene period?

6) Describe the Younger Dryas event in terms of when it occurred and its effects on climate. Were the effects global or regional?

7) Explain why the formation of North Atlantic deep water might have played a role in causing the Younger Dryas event.

8) Give an example of how historical records have provided information about past climate.

9) How do volcanic eruptions affect climate?

10) What are sunspots and why are they thought to have a possible effect on climate?

11) Explain what happens to atmospheric and ocean circulation in the tropical Pacific during an El Niño-Southern Oscillation event.

12) Identify and briefly describe three major interactions and/or feedback processes between sea ice and climate.