

## ENVIROTHON 2006 GLOBAL CLIMATE CHANGE QUIZ

Instructions

You have 35 minutes to complete this test. You may want to divide up the questions among yourselves, and then confer on the difficult ones. If you cannot agree on an answer, go on to the next question, and come back later. The weighting is indicated for each question (total of 82 points). Final score will be adjusted to a 100% basis. If you need more room, write on the back of the page. Be sure to put your group number on every page. Be succinct!

1. A positive-feedback mechanism enhances a deviation in a system; a negative feedback mechanism dampens or reduces a deviation. Show these two kinds of feedback in simple sketches using boxes and arrows (4 pts).

2. For each of the following processes, indicate with a + or – whether it operates in a positive or negative feedback loop in global warming (6 pts.)
- a) Warming increases atmospheric water vapor, a greenhouse gas (GHG).
  - b) Increased water vapor may increase low clouds, which increase Albedo (reflectance)
  - c) Melting of polar ice decreases surface albedo
  - d) Thawing of permafrost and increased soil temperature release CO<sub>2</sub> and CH<sub>4</sub>
  - e) Increased CO<sub>2</sub> may increase plant growth
  - f) Politicians may finally take the warnings of scientists seriously, and implement programs that reduce GHG emissions.
3. Four of the following are anthropogenic greenhouse gases. For those, number them in descending order of their relative impact on the Earth's energy budget due to increases since 1750 ("radiative forcing") (1 for most important, 4 for least important). Cross out the four that are not greenhouse gases. (4 pts.)

Sulfur dioxide (SO<sub>2</sub>)  
Carbon dioxide (CO<sub>2</sub>)  
Nitrous Oxide (N<sub>2</sub>O)  
Hydrogen sulfide (H<sub>2</sub>S)  
Methane (CH<sub>4</sub>)  
Oxygen (O<sub>2</sub>)  
Halocarbons (CFCs, etc.)  
Nitrogen (N<sub>2</sub>)



8. For each effect, indicate one or more causes that are related to global warming. Some letters may be used more than once. (12 pts)

Effect	Cause
<p>_____Chaparral and grasslands may replace conifer forests in parts of the West</p>	<p>A. Summer sea ice in Arctic Ocean may be gone by the end of the century</p>
<p>_____Frogs in tropical forests are disappearing</p>	<p>B. Fire frequency and magnitude are increasing in the western US</p>
<p>_____Coastal wetlands are threatened</p>	<p>C. Maximum daily temperatures above timber line in mountains of the western US are increasing</p>
<p>_____Polar bears may become extinct</p>	<p>D. Warmer nights and cooler days favor growth of parasitic fungi</p>
<p>_____Salmonids in California rivers will be increasingly affected by warm water</p>	<p>E. Melting of the Greenland and Antarctic ice sheets is accelerating</p>
<p>_____Eskimos are seeing robins and yellow jackets for the first time</p>	<p>F. The intensity of tropical cyclones (hurricanes) is increasing</p>
<p>_____Oceanic food chains may be disrupted</p>	<p>G. Bark beetles can complete their life cycle in one season now instead of two</p>
<p>_____Distinct populations of pikas are disappearing</p>	<p>H. Timing of snowmelt and runoff in California is changing.</p>
<p>_____Millions of people in south Asia will have to find new homes</p>	<p>I. Warming of the oceans may increase their thermal stability</p>
	<p>J. The growing season in arctic tundra is getting longer</p>

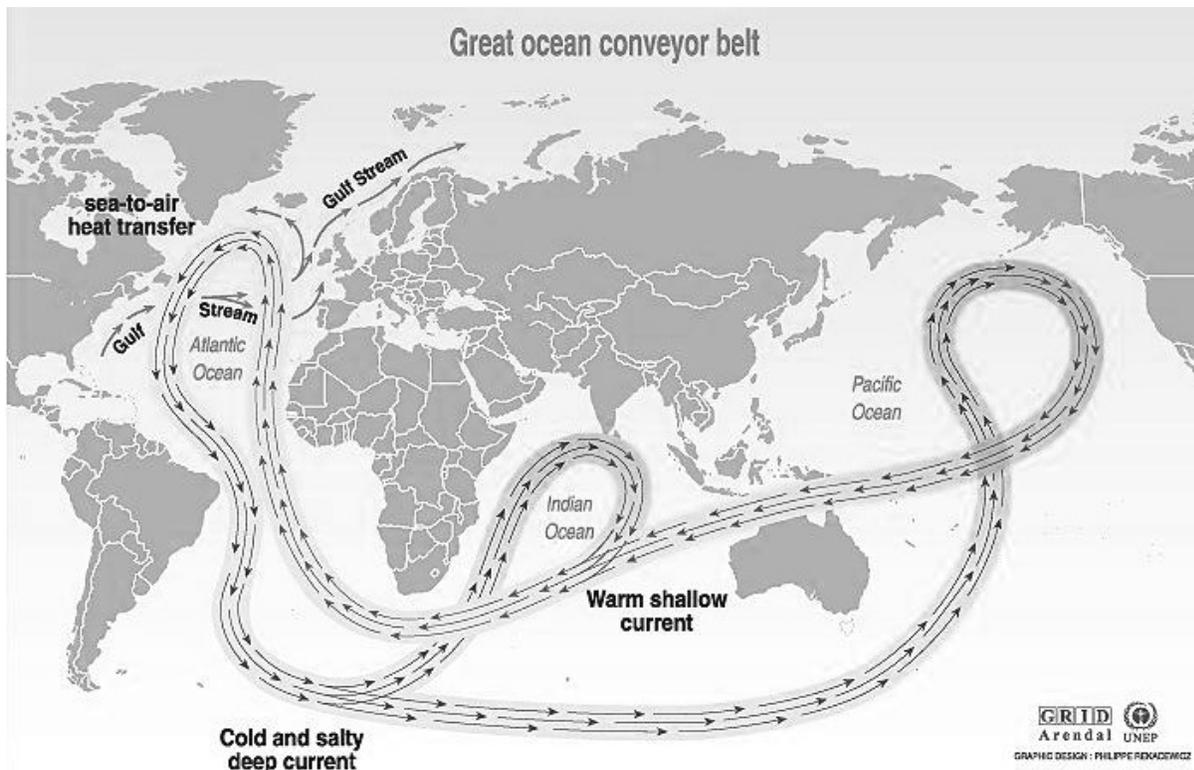


11. The attached picture represents the “Great Ocean Conveyor Belt”. How does the Conveyor Belt work? (4 pts.)

12. How might the heat conveyor belt be affected by global warming? (4 pts)

13. Which 2 of the following could be a consequence of this change? (4 pts)

- N. Europe would become hotter in the summer
- N. Europe would become colder in the winter
- Precipitation over N. America would decrease
- Precipitation over N. America would increase
- The circulation of nutrients in the oceans would decrease



14. How (by what mechanisms) will climate warming affect the availability of, and demand for, water in California? (4 pts)
15. What steps could water resource managers take to address California's coming water crisis? (4 pts)
16. Warming trends have been observed in large lakes around the world. How does a warming trend in a lake affect its thermal stability during periods of stratification? (4 pts)
17. Of the following, circle the two mechanisms that explain your answer to the last question. (4 pts)
- a) The warming rate is greatest at the lake surface.
  - b) Increasing primary productivity increases thermal stability
  - c) Increasing primary productivity decreases thermal stability
  - d) The decrease in water density with temperature is non-linear. There is a greater difference in density between 20 and 25 degrees C than between 5 and 10 degrees.
  - e) The increase in water density with temperature is non-linear. There is a less difference in density between 20 and 25 degrees C than between 5 and 10 degrees.

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