

**Greenhouse gases**

1. For each of the following greenhouse gases, give 1) the major sources (natural or anthropogenic), 2) its average atmospheric concentration, 3) its contribution to the natural greenhouse effect, and 4) its contribution to the anthropogenic greenhouse effect. Be as quantitative as you can. If any of these is not applicable to a given greenhouse gas, explain why.

A. Carbon Dioxide ( $\text{CO}_2$ ) (2)

B. Water Vapor ( $\text{H}_2\text{O}$ ) (2)

C. Methane ( $\text{CH}_4$ ) (2)

D. CFCs and HFCs (2)

## Forcings and Feedbacks

2. What is the difference between a climate forcing and a climate feedback? Give an example of each to illustrate your explanation. (3)
  
  
  
  
  
  
  
  
  
  
3. Give two examples each of *anthropogenic* climate forcings. Explain what impact each forcing has on climate. What is the estimated radiative forcing of these, expressed in Watts per square meter ( $\text{W/m}^2$ )? (3)
  
  
  
  
  
  
  
  
  
  
4. If solar intensity decreased and caused Earth to cool, what impact would the snow/ice albedo feedback have on that cooling? Explain your reasoning. (4)
  
  
  
  
  
  
  
  
  
  
5. The climate system includes some positive and some negative feedbacks. When all of these feedbacks are combined, do they appear to be positive, negative, or close to zero, i.e., what is the overall impact of feedbacks on how strongly temperature is responding to climate forcings? How confident do you think climate scientists are about this? (There is room for you to make your own argument here!) (3)

6. True or False: If there are enough strong negative feedbacks in the climate system, the global mean temperature could actually decrease due to CO<sub>2</sub> emissions. Explain.  
(2)

### **Discussion Question**

7. Please write down at least one question from this week's material that you would like to discuss on Friday. This may be on a topic you don't feel you understand well enough, or it may be a topic you found interesting and would like to discuss more.  
(2)