

Phys 24

Potential questions for second midterm exam

Below are some potential exam questions submitted by you and your fellow classmates. In some cases I have modified them slightly to make them more like a question I might ask on the exam, or combined multiple similar questions on the same topic into one. While these cover a fair amount of the material, please keep in mind that these do not cover all possible topics that might be on the midterm.

1. Consider the equation $I = PAT$.
 - a. Explain what each letter represents and give its units. One of the letters is the product of two other quantities, so be sure to explain each of those as well (both definition and units).
 - b. Mathematically, reducing any of the terms on the right will reduce the overall product. But some of them are more feasible than others to reduce. Pick one term that is unlikely to lead to significant reductions in the near future, and one term where we have a better chance of achieving significant reductions. For each, explain why you reach that conclusion.
2. Choose one likely impact of climate change, and describe both adaptive and mitigation responses to it. For both types of responses, list the pros and cons of that response.
3. Feedbacks:
 - a. Explain in general terms what feedback means in the context of climate change, and how positive feedbacks differ from negative feedbacks.
 - b. Choose one specific feedback and explain how it works.
4. Why do we believe that the El Niño / Southern Oscillation (ENSO) is not responsible for the climate change in the past 50 years?
5. In a conversation you witness between two scientists, one argues that we are overly concerned with greenhouse gas emissions, since it's just as likely that climate change is caused by the changing output of the Sun. The second scientist berates the first one, arguing that the Sun's output is unchanging: "It's the solar constant, after all!" They turn to you to settle the dispute. How do you respond?
6. There are many human-caused changes of the Earth's albedo. Do these contribute positive or negative radiative forcing? Explain.

7. After checking the weather forecast, Aelin put on her rain jacket and took her umbrella as she set out for the day. To her dismay, it turned out to be a beautiful sunny day. She took this as evidence that weather forecasts can't be trusted, and if we can't predict something one day ahead, then we surely can't predict the climate years ahead. Is Aelin right in thinking so? Explain your answer.
8. Explain the pros and cons of two carbon-free energy sources.
9. A rogue group of biologists, desperate to alleviate the current climate conditions, genetically engineer a white alba-moss that is extremely well-adapted to the current climate conditions. They unleash this moss on the planet, and it begins to grow over the Earth's surface. This moss increases the planet's albedo from 0.3 to 0.33.
 - a. Calculate the radiative forcing caused by the alba-moss.
 - b. Dessler tells us that the current balance of E_{in} and E_{out} is $+0.9 \text{ W/m}^2$. When we add this new forcing, what is the new balance of E_{in} and E_{out} ? Using climate sensitivity, calculate the change in temperature based on this new balance.
 - c. Give at least one reason (other than morality) why this solar radiation management solution is problematic.
10. The shape of Earth's orbit, the orbit's orientation around the Sun, and the tilt of Earth's axis all change over time.
 - a. Explain how a combination of these effects *does* influence Earth's climate (i.e. what is it about those changes that changes the climate?).
 - b. Explain why we are confident that those changes are *not* the cause of the climate change in the past 100 years.