

Midterm

I. False statements (10 points). Correct the following incorrect statements by changing the underlined words.

1. The region of the atmosphere closest to Earth is called the exosphere.
2. Prior to 1996, liquid nitrogen was the primary refrigerant used in industrialized countries.
3. Carbon dioxide is a leading cause of air pollution.
4. An all white ice-covered planet would have high absorption.
5. Seasons occur, because the distance from the Earth to the Sun is different in winter than in summer.

II. Short answer (20 points each). Answer these questions with a brief and carefully constructed paragraph. You may find it helpful to draw a diagram.

1. What is the difference between global warming and the greenhouse effect?

2. You will recall that Daisyworld is the hypothetical planet with brown soil and white daisies. How are the daisies able to regulate the planet's temperature? What would happen on a planet with white soil and black daisies?

3. Why does the amount of incoming solar radiation (per unit area) vary with latitude on Earth? How does the amount of outgoing radiation (from Earth) compare with the incoming radiation? What is the geographic distribution of the outgoing radiation?

III. Essay (30 points).

We've spent some time discussing ozone depletion. Here's a clip from a press release describing recent research investigating the influence of rice farming on the ozone layer.

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Irvine, Calif., Nov. 2, 2000 - A UC Irvine study has determined that the world's rice paddies emit a small but significant amount of methyl halide gases that contribute to stratospheric ozone depletion, suggesting that agricultural sources also play a role in this atmospheric phenomena.

In the first field study to measure methyl halide gas emissions from agricultural crops during an entire season, a team led by UCI Professor and Chancellor Ralph J. Cicerone, an internationally recognized researcher on stratospheric ozone depletion, and graduate student researcher Kelly R. Redeker has estimated the amounts of these gases contributed by rice farming. These findings will be published in the Nov. 3 issue of Science.

Methyl halide compounds include methyl chloride, methyl bromine and methyl iodide, which become reactive agents when released into the atmosphere. ... Iodine is believed to affect tropospheric ozone, a common air pollutant. ...

"As the major industrial sources of these halides increasingly are being regulated, it's now even more important to uncover their natural sources," Cicerone said. "We only know where half of the methyl chloride and two-thirds of the methyl bromide are coming from. This study is significant because it gives direct evidence that some of the unknown sources of these halides could very well be plant sources. ...

"Most people think methyl bromide is only an industrial gas, yet agricultural plants also release it into the air. So to understand the potential benefits of a ban on methyl bromide, we must learn about the sizes of natural sources."

After monitoring the methyl halide gases emitted from a rice paddy in Maxwell, Calif., over two planting seasons in 1998 and 1999, the UCI team calculated that worldwide rice farming contributes 1 percent of the methyl bromide and 5 percent of the methyl iodide to atmospheric totals.

They also noted that unplanted flood fields emit as much methyl chloride as planted flooded fields, suggesting that global wetlands may be a notable natural source and worth further study.

The UCI team also found that the rate of methyl halide emissions is not constant, varying with stage of plant development in the growing season, soil halide amount and soil organic content. Emissions of methyl bromide, for instance, increased during tillering and appeared to peak during the reproductive stage of rice growth. Methyl iodide appears to have maximum emissions during the vegetative phase. However, methyl chloride counts were unaffected by stages of rice growth. ...

Studying rice farming is important in understanding the natural sources of ozone-depleting gases. Rice is the world's largest crop and is the primary source of food for billions. As the human population grows, so will the need for increased rice cultivation. Currently, it is estimated that rice paddies cover 1 percent of the Earth's landmass. Rice paddies also are a significant contributor of methane, a greenhouse gas, which forms in soil pores and is passed into the air through the rice plant.

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Based on the above article and your knowledge of the topic, write an essay addressing the following questions:

Why is the release of methyl bromide a cause for concern? How might the negotiators

for the Montreal Protocol respond to these findings? How are developing countries likely to respond to the research reported in this article?