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# LAB 40

## Humans and Global Climate Change

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### Purpose

In the following lab, you will explore the influences that human beings and our technology have on global climate. Topics such as acid precipitation, photochemical smog, and global warming are all examples of how humans have the ability to affect the environment in such a way as to alter local, regional, and global climate. The results of these actions are unprecedented changes occurring in the Earth's climate in a relatively short period of time.

### Materials

sample of coal

balance or scale

### Procedure A—Sulfur Dioxide Emissions

In this activity, you will predict the amount of sulfur dioxide ( $\text{SO}_2$ ) produced as a result of burning coal. Use the following information to help you with your calculations: coal contains approximately 1.1 percent sulfur.

1. Using the piece of coal provided, determine its mass to the nearest tenth of a gram, then calculate the amount of sulfur dioxide emitted into the atmosphere by completely burning your sample. Assume that all of the sulfur contained within the coal (1.1 percent) is converted into sulfur dioxide. This is calculated by multiplying the mass of your coal sample by .011. Record your answer below. Show your work.
2. Coal consumption in the United States during 1995 amounted to 864 million tons. Using this data, determine the amount of sulfur dioxide put into the atmosphere by burning coal during 1995. This can be determined by multiplying the U.S. annual coal consumption by 0.011. Record your answer below. Show your work.
3. The U.S. Environmental Protection Agency (EPA) is attempting to lower the amount of acid-forming compounds put into the atmosphere by controlling fossil fuel emissions. Their proposed target emissions for sulfur dioxide in 1995 was seven million tons. According to your sulfur dioxide emission calculations from the previous question, did the EPA meet its goals?

## Procedure B—Carbon Dioxide and Global Warming

In this activity, you will determine the effects of automobile emissions on the amount of carbon dioxide in the atmosphere.

1. Determine, to the best of your ability, how many gallons of gasoline are used by you or your family's motor vehicles each week. Assume that the average car uses approximately 15 gallons per week. Record your answer below. Show your work.
2. Next, determine the amount of gasoline used by your motor vehicle annually. This can be determined by multiplying your weekly gasoline use from the previous question by 52 weeks per year. Record your answer below. Show your work.
3. Use the following information to determine the amount of carbon dioxide (CO<sub>2</sub>) generated by your family's vehicles and emitted into the atmosphere annually: one gallon of gasoline when burned emits 21.7 pounds of carbon dioxide into the atmosphere. Multiply your annual use of gasoline by 21.7, and record your answer below. Show your work.
4. Scientists have determined that on average, a young growing tree removes 25 pounds of carbon dioxide from the atmosphere each year. Use your annual carbon dioxide emissions from Question 3 to determine how many trees you or your family needs to remove all of the carbon dioxide they produce. This is calculated by dividing your total annual carbon dioxide production by 25. Record your answer below. Show your work.
5. An average healthy forest contains approximately 400 trees per acre. Knowing this, how many acres of forest would you or your family require to remove all of the carbon dioxide generated by your family's motor vehicles? To calculate this, you must divide the number of trees required to remove the carbon dioxide you determined in Question 4 by 400. Record your answer below. Show your work.

## Conclusions

1. Based on your calculations from Procedure A, do you think it is possible that the burning of coal has led to an increase in the amount of sulfur dioxide in the atmosphere?
2. Explain the negative effects of having increased amounts of sulfur dioxide in the atmosphere.
3. Based on your calculations from Procedure B, do you think it is possible that humans have increased the amount of carbon dioxide in the atmosphere?
4. Do you and your family have enough trees on your property to remove all of the carbon dioxide you produce?
5. If half of all Americans (approximately 160 million people) produce the same amount of carbon dioxide as your family, are there enough forests in the country to remove it all? Assume that the entire forest land of the United States is 736,681,000 acres. Show your work.
6. Now take your answer from Question 5 and double it to account for all of the commercial vehicles that produce carbon dioxide such as trucks, buses, and planes. Is there enough forest land in the U.S. to remove it all?