Energy Awareness Quiz

Grades: 9-12

Topic: Energy Basics

Owner: National Energy Foundation

This educational material is brought to you by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

Objective
The student will be able to identify actions that contribute to the greenhouse effect.

Curriculum Focus
Science, Math, Social studies

Materials
Student Activity Sheet, *Energy Awareness Quiz*

Student Activity Sheet, *How Much CO_2 Do You Spew?*

Calculators

Key Terms
Carbon dioxide (CO_2)

Greenhouse gas (GHG)

Kyoto Protocol

Energy Awareness Quiz

Introduction

This is an activity to determine students' awareness of critical energy issues. The *Student Activity Sheets* can provide basic information about students' backgrounds in energy and can be used to highlight the severity of the greenhouse effect.

Procedure

1. Distribute the *Energy Awareness Quiz*.
2. Have students take the quiz and discuss the correct answers given below. Ask them what answers they disagree with and what answers surprise them.
3. Tell students that the environmental problem that gets the most attention these days is global warming and the greenhouse effect. Ask students to list ways that everyone contributes to the amount of carbon dioxide and other greenhouse gases entering the atmosphere.
4. Have students complete *How Much CO_2 Do You Spew?* Debrief with the following questions:
    a. What changes, if any, would students consider making in their consumption habits after doing this activity?
    b. What statements can students make about our consumption and GHG production as compared with other countries? (It is much higher than most countries'.)
    c. Which energy topics would students like to find out more about?

Answers to *Energy Awareness Quiz*

1. All answers are correct.
2. C
3. A
4. C for U.S.: B for Canada
5. C
6. All answers are correct.
7. All answers are correct.
8. C for U.S. (~ 94%): B for Canada (~ 76%)
9. A, B, D
10. All answers are correct.

STUDENT ACTIVITY SHEET

ENERGY AWARENESS QUIZ

For each question, choose all answers that apply.

1. The amount of energy each North American uses per year is equivalent to

   a. 13 one-kilowatt heaters operating continuously
   b. The amount of gasoline to drive a car 120,000 km
   c. 90,000 kg of coal

2. Compared to people in many developing countries, North Americans use about

   a. 5 times as much energy
   b. 15 times as much energy
   c. 50 times as much energy

3. In our country, the most widely used energy resource is

   a. Oil
   b. Natural gas
   c. Coal

4. In our country, the least abundant energy resource is

   a. Coal
   b. Natural gas
   c . Oil

5. How many years did it take nature to make oil?

   a. 2,000 years
   b. 2 million years
   c. 200 million years

6. Which of the following products are produced from oil?

   a. Gasoline
   b. Plastics
   c. Medicines
   d. Pesticides
   e. Cosmetics
   f. Paints
   g. Fabrics

7. Which of the following are nonrenewable forms of energy?

    a. Coal
    b. Kerosene
    c. Oil
    d. Uranium
    e. Natural gas

8. What percentage of our energy comes from nonrenewable fossil fuels?

    a. 50 to 60%
    b. 70 to 80%
    c. More than 90%

9. Which of the following environmental problems are related to the combustion of fossil fuels?

    a. Smog
    b. Acid rain
    c. Nuclear radiation
    d. The greenhouse effect (increase in carbon dioxide levels causing the warming of the Earth's surface)

10. Which of the following renewable sources of energy are currently being used in our country?

    a. Solar
    b. Biomass (energy from plants and animals)
    c. Wind energy
    d. Hydropower
    e. Geothermal energy

STUDENT ACTIVITY SHEET

HOW MUCH CO_2 DO YOU SPEW?

Do you ride in a car? Are you lucky enough to drive one? Do you travel by plane? Do you like watching television? Or movies? How about enjoying a hot meal?

If you're like the vast majority of people, you enjoy these things and life wouldn't be quite the same without all of these "necessities." Of course, you have to pay for all of this—cars aren't cheap, and airline tickets are only cheap if someone else pays for them, right?

But how much do we really pay? Are there "hidden costs" that we seem to (rightfully or wrongfully) forget? You bet! And, this is not just a case of dollars and cents (or is that "dollars and sense?").

You might remember that CO_2 is carbon dioxide, which puts the bubbles in your soft drink and is to plants and trees what protein is to you—a building block of food. It's the odorless gas that has evolved to tie us into a "circle of life" with plants and other photosynthetic organisms. We breathe out CO_2; plants take it in and give us oxygen, which we then inhale.

So we need carbon dioxide to make the cycle go around—but too much and things get out of whack like a car running on three cylinders. For the last 150 years, the Industrial Revolution has been thumbing its nose at Mother Nature and now is literally choking on its own exhaust. The result is the infamous "Greenhouse Effect" and global warming.

Global warming has been a source of controversy within the scientific community for many years. After many investigations, it is now well-documented and accepted as fact. Some uncertainty remains about the role of natural variations such as cyclic changes in the sun's brightness and sun spot activity tha may cause climate change.

Sometimes things like the greenhouse effect seem far away—the same as troubles in the oil-rich countries of the Middle East (they presently, but not always, sell us all the oil we can pay for). Just like waste dumped at sea, these problems eventually come home—proving one of Murphy's laws, that "What goes around, comes around." Eventually we all must pay the costs.

So how much CO_2 do you contribute to the greenhouse effect? This is your "CO_2 Quotient." Here's how to figure it out.

Your answer may shock you, but it should help you to see that lowering your CO_2 quotient is necessary to your very survival. It seems with this problem, only two outcomes are possible: a big win or an even bigger loss.

For more information, visit http://solar-center.stanford.edu/sun-on-earth/glob-warm.html.

ADDING UP THE CO_2 YOU SPEW

1. Figure out your share of the number of liters of gasoline that you burn riding around in cars. To do this, figure the distance (miles or kilometers) you traveled and divide this by the fuel economy of the vehicle. For example, if you and one other person drive 60 kilometers to school each week in a car that gets 20 km/L, then the car consumed three liters of gasoline and your share would be half of that—because two were riding in the car—or about 1.5 liters. You also can simplify this by taking an average figure for your family car—most families average about 30,000 kilometers each year. Each liter contributes 2.5 kg of CO_2. You can convert gallons to liters by multiplying by 3.67, and miles to kilometers by multiplying by 1.61.

   Number of liters of gasoline _____ x 2.5 kg CO_2/liter = _____kg CO_2

2. Calculate the number of kilowatt-hours of electricity that you use in a year. Take the number of kilowatt-hours from an average monthly utility bill, multiply it by 12, and divide by the number of people in your family. Using one kilowatt-hour (kWh) of electricity generated in a coal-fired power plant produces 0.9 kg of CO_2. (Hydropower and nuclear generated electricity are CO_2-free; your local power company can tell you how your electricity is generated.)

   Avg. monthly kWh of electricity _____ x 12 / _____ people in household

   x 0.9 kg CO_2/kWh = _____ kg CO_2

3. Figure out how much natural gas you use (if any). One therm of natural gas produces about 15.5 kg of CO_2. (1 therm = 1 ccf, or 100,000 Btu or 105 MJ.) Check your gas bill and again divide by the number of people in your household.

   Number therms of gas_____ x 15.5 kg/therm = _____kg CO_2

4. Flying one kilometer on an airplane produces about 0.3 kg of CO_2

   Number of kilometers flown_____ x 0.3 kg/kilometer = _____ kg CO_2

5. Add up 1 through 4 for your direct CO_2 production. TOTAL _____kg CO_2

6. Double the answer from question 5 to account for the CO_2 produced indirectly through the things that you have bought and the services you have used (like going to the movies).

   Total from #5 _____ x 2 = _____ kg CO_2

   Congratulations! That's your CO_2 quotient. How do you compare to the "average" North American who contributes 16,500 kg of CO_2 to our atmosphere?

7. Now for the hard part—what to do about it. It's already been mentioned that trees love CO_2. So how many trees would you need to plant each year to soak up your CO_2 if you plant fast-growing trees that can use 22 kg of CO_2 each year?

   Would it help if you plant some of those trees so that they shade your house and reduce your electricity usage by 10%? Can you think of any other ways to minimize the greenhouse effect?

8. For a larger point-of-view, consider that the world is currently releasing 20 billion metric tons of CO_2 each year. Some experts believe that it will require slashing that figure in half to 10 billion tons to stabilize the climate. Because there are 6.5 billion people on Earth at present, each person's rightful share of CO_2 emissions is about 1.5 metric tons (1500 kg) annually. Do you think that some countries have the right to contribute more greenhouse gases than other countries?

   Why or why not?

   What do you think about the Kyoto Protocol?

9. It is now commonly accepted that global warming is occurring. Debate now centers around on how much humans are influencing global climatic cycles. What biases may cause scientists to interpret the same data in different ways? Consider whom scientists work for and where their funding comes from.