CO2: HOW MUCH DO YOU SPEW?

Family:

1. Driving:

_____Miles driven per year by the vehicle

_____Miles per gallon (mpg) for the vehicle (average)

Divide: miles driven by miles per gallon = gallons used per year

Multiply: gallons used per year by 22 pounds of CO_2

Do the above calculations for each car or truck that the family drives.

Add the pounds of CO_2 for all cars and trucks ..... Pounds of CO_2 from driving

2. Flying: _____ total miles of air travel per year for all people

Multiply: total miles traveled by 0.9 pounds of CO_2 = ... Pounds of CO_2 from air travel

Note - Total the miles travelled by each family member. (For example, if four people take a 1000 mile flight, the total is 4000 miles.)

3. Mass Transit: _____ miles on mass transit per year by all people

Multiply: mass transit miles by 0.5 pounds CO_2 = ... Pounds of CO_2 from mass transit

4. Taxis and Limos: _____ miles by taxi/limo per year by all people

Multiply: taxi and limo miles by 1.5 pounds of CO_2 = ... Pounds of CO_2 from taxi/limo

5. Electricity: _____ Kilowatt hours (kWh) per year per household

Multiply: Kilowatt hours by 1.5 pounds of CO_2 per kWh = ... Pounds of CO_2 from electricity

6. Heating Oil: _____ gallons per year per household

Multiply: gallons of oil by 22 pounds of CO_2 per gallon = ... Pounds of CO_2 from heating oil

7. Natural Gas: _____ therms per year per household

Multiply therms of natural gas by 11 pounds of CO_2 = ... Pounds of CO_2 from natural gas

8. Bottled gas or Propane: _____ gallons per year per household

Multiply gallons per year by 13 pounds of CO_2 = ... Pounds of CO_2 from gas/propane

Adapted from measurements developed by the National Audubon Society

TOTAL pounds of CO_2 emitted by this family

What does this mean?

The total pounds of CO_2 you just calculated is only one third of the emissions for which this family is responsible. The other two thirds come from the businesses that provide the family with services such as stores and factories.

If you just calculated less than 11,000 pounds per person, then the family you are analyzing is to be congratulated. They are using less energy than 1990 levels, which is compliant with Kyoto Protocol recommendations (CO-OP America Quarterly).

Think about it! How could they reduce their emissions?

How could the family you analyzed reduce the amount of CO_2 they produce? What would you change about the way they live to decrease emissions?

HOW MUCH DO YOU SPEW?

Jason and Jane Jetsetter and Family

Who are they?
Jason and Jane are co-CEO's of Nirvana Airlines with corporate headquarters in Houston, TX, which is very hot in the summer months. They work very hard, make many important business trips, and earn high salaries. They enjoy free air travel on Nirvana Airlines for business and pleasure, enabling the whole family to spend their hard-earned vacation time visiting distant places such as Thailand, Costa Rica, and Botswana in the past year. They have two college age children, Jack and Jill, who are often homesick for Mom and Dad, requiring them to drive home every weekend (200 miles round trip from each college). Everyone in the family drives an SUV. "It is much safer to drive SUVs," says Jane confidently, "especially when we drive the treacherous snow-packed roads around our vacation house in Colorado where we ski during winter and spring breaks."

In one year...

Miles driven	15,000 miles per vehicle. Each of the four cars gets 15 mpg.
Miles flown	40,000 miles of business travel for each parent. 45,000 miles of vacation travel for each of the four people
Miles traveled by mass transit	0
Miles traveled by taxi or limo	500
Kilowatt hours of electricity (kWh)	40,000 kWh for the Houston home and 8000 kWh for the Vail home
Gallons of heating oil	0 (Both homes have electric furnaces.)
Therms of natural gas	0
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

Robert and Rachel Retireano

Who are they?
The Retireanos have been retired for 10 years. The live in a two bedroom apartment in a complex that has photovoltaic panels and solar hot water panels on its roof. They share a hybrid car that is used only when they drive on weekends from their home in Komfort, Kansas, to the prairie wetlands 20 miles away to watch birds, hike, and camp. Rachel enjoys visiting with neighbors on the bus when she shops for groceries at the shopping center, a convenient 5 miles away. Robert, a very fit 70 year-old, rides his bike all over town. He detests shopping, but when he must, he carries purchases home in his bike basket. The Retireanos enjoy the simple life close to home, but twice a year, they fly to San Francisco to see their daughter, her husband, and four grandchildren.

In one year...

Miles driven	2000 miles in a car that gets 60 mpg
Miles flown	Both of the Retireanos take two 4000 miles trips (round trip).
Miles traveled by mass transit	1500
Miles traveled by taxi or limo	100
Kilowatt hours of electricity (kWh)	They produce 100 kWh per month more than they use and get a credit from the power company.
Gallons of heating oil	0
Therms of natural gas	0
Gallons of bottled gas or propane	15 used for the BBQ on their apartment balcony and for the stove they take camping on the prairie

HOW MUCH DO YOU SPEW?

The Frank and Fannie Farmer Family

Who are they?
The Farmer family has lived on their 500-acre Illinois property for four generations. The whole family - two parents and ten children - work together to grow soybean and wheat, tend a herd of dairy cows, raise chickens for egg production, and maintain the farm machinery. Every penny seems to be stretched to the limit with so many children to feed and cloth. The long cold winter months demand costly heating oil for their drafty home, and the cost of fuel for the tractors is always going up. Vacations are unheard of. The parents expect the kids to come right from the bus to the barn to do the chores. In spite of the hardships, they all pride themselves in their self-sufficiency and they enjoy many good times with neighbors and local school sports events in the community.

In one year...

Miles driven	Frank drives his truck (which gets 12 mpg) 2000 miles and a tractor (which gets 5 mpg) 10,000 miles. Fannie drives her 1982 Chevrolet (10 mpg) 4000 miles and two of the teenage kids have cars that get 21 mpg. Each drives 8000 miles per year.
Miles flown	0
Miles traveled by mass transit	Are you kidding?
Miles traveled by taxi or limo	0
Kilowatt hours of electricity (kWh)	Each month, the house uses 900 kWh, the barn uses 600 kWh, and the chicken coop uses 400 kWh (chickens need light all night.) That's 22,800 kWh per year.
Gallons of heating oil	800
Therms of natural gas	0
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

The Sam and Sally Snow Family

Who are they?
Life in Snowdon, northern Saskatchewan, is lonely for some, but a joy for the Snows. They love living in their four-room log cabin, which is "off the grid," deep in the taiga forest not far from the arctic tundra. The long, dark, winter days are perfect for Sam and Sally, who work at home as writers of children's books. They home school their five-year-old twin sons, Saul and Sean. Thank goodness, the cabin's thick walls offer good insulation. The propane tank in the backyard is so large that when filled in the fall, it gets them through the winter with adequate fuel for the cook stove fuel, a small heater in the kids' bedroom, and the lanterns. They could never get by without the two snowmobiles which they use to drive 20 miles into Snowden once a week for supplies. Their gasoline storage tank is enough to last them a whole year.

In one year...

Miles driven	2100 miles traveled by each of the two snowmobiles. Each snowmobile gets 10 mpg
Miles flown	Sam and Sally fly to see their book publisher in Montreal twice per year for a total of 4000 miles
Miles traveled by mass transit	0
Miles traveled by taxi or limo	50 miles for each trip to Montreal, sharing the ride
Kilowatt hours of electricity (kWh)	0
Gallons of heating oil	0 (The Snows heat their home with a wood stove and propane.)
Therms of natural gas	0
Gallons of bottled gas or propane	2000 gallons

HOW MUCH DO YOU SPEW?

Connie and Conrad Conservatoria

Who are they?
The Conservatorias live in a suburb of Washington, DC, close to the office of the organization they co-direct which has a mission to save endangered sea mammals. Connie and Conrad are both scientists who are able to work from home three days a week. When they go to the office, 50 miles away in the city, they take the subway. Connie, as an expert on sea mammals, must fly internationally at least twice a month to give her expert advice. Conrad spends his recreational hours developing alternative fuels from cooking oils and composted vegetables he tests in their furnace, which is otherwise heated with oil during their short, mild winter. They both love to cook using their new gourmet stove with 10 burners heated by natural gas. The Conservatorias are so energy conscious, they invest in carbon offset credits equal to 2,000 pounds each year.

In one year…

Miles driven	5000 miles in their compact car that gets 30 mpg
Miles flown	Connie makes 26 trips per year. Each is about 6000 miles round trip.
Miles traveled by mass transit	10,400 mile for each of them per year
Miles traveled by taxi or limo	Connie travels 100 miles by taxi to get to and from the airport for each of her 26 trips.
Kilowatt hours of electricity (kWh)	800 kWh/month or 9600 kWh in a year
Gallons of heating oil	200 gallons plus another 200 gallons from Conrad's experimental fuels
Therms of natural gas	1000 therms
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

Ursula Urbanite

Who is she?
Ursula lives in the Big Apple, not an actual apple but New York City! She is so happy to be finally living on her own in a 200 square foot studio apartment in Manhattan. Ursula was an art history major in college and now works at a gallery in the City that specializes in ceramic sculptures shaped like enormous amoebas. She walks to work when the weather is nice and takes the subway if it is not, or if she is running late. (If she opens the gallery late, the City's ceramic amoeba aficionados would be outraged.) Twice last year Ursula rented a car with three friends and they drove to Maine to get away from the city hubbub for a few days. Once last year she flew to visit her grandmother in Florida. Otherwise, Ursula enjoys the Big Apple, the ceramic amoebas, and her little apartment in the middle of all of it.

In one year…

Miles driven	1000 miles for the two road trips to Maine in a compact rental car that got 30 mpg.
Miles flown	2000 miles for the round trip flight to Florida
Miles traveled by mass transit	1000 miles on the subway
Miles traveled by taxi or limo	500 miles
Kilowatt hours of electricity (kWh)	3500 kWh in a year to power the tiny apartment
Gallons of heating oil	0 (Ursula's apartment is heated by electricity.)
Therms of natural gas	0
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

Harriet Homeless

Who is she?
Harriet has spent the last three years living over a subway vent on Market Street in San Francisco. Fortunately, the temperature there is seldom near freezing, though she must sleep in doorways and cardboard boxes some nights during the rainy season. By crocheting brightly colored hats and selling them to tourists on street corners, she makes just enough money to buy two meals a day and more hat-making supplies. Harriet was once married, worked as a nurse, and enjoyed painting and music. But her mental illness grew worse, and she eventually found herself on the street. About once a month, when her medications run out, she winds up in the hospital emergency room, where she has many tests and often spends the night before she is issued new pills and is sent "home." On the bright side, just think of all the people who wear Harriet's colorful hats wherever they live, all over the world!

In one year...

Miles driven	0
Miles flown	0
Miles traveled by mass transit	500
Miles traveled by taxi or limo	0
Kilowatt hours of electricity (kWh)	2400 per year in the emergency room
Gallons of heating oil	0
Therms of natural gas	0
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

Dudley and Dahlia Demo

Who are they?
The Demo's Sante Fe, New Mexico home is constructed of hay and pink adobe. It has very large, south-facing windows to let in sunshine during winter. A shade prevents too much sun from getting in on hot summer days. Vegetarians, the Demo's eat vegetables grown in their greenhouse. Their lights, the computer, and a few, small household appliances are powered by a wind generator and photovoltaic cells, which are installed on the roof next to their solar hot water panels. The Demos own no car. They bicycle into town for dinner and a movie once a month, making the most of the $40 check they receive from the energy company. They decided not to have children due to the global population problem. Dahlia does not work. She inherited just enough from her father, a California brussel sprouts grower, to build the house and maintain her happy, simple, lifestyle with Dudley, who hand crafts mandolins for students in the Sante Fe Music Academy.

In one year...

Miles driven	0
Miles flown	0
Miles traveled by mass transit	0
Miles traveled by taxi or limo	0
Kilowatt hours of electricity (kWh)	They make 2400 kWh more than they use each year.
Gallons of heating oil	0
Therms of natural gas	0
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

Laurence and Peoria Des Moines

Who are they?
Laurence (who goes by Larry) and Peoria and their children Lansing (age 6) and Toledo (age 4) live in a suburb of Chicago, IL. Larry drives a minivan and Peoria drives an SUV to get to work and to bring Lansing and Toledo to daycare and school. They don't take buses or the subway because they don't think these modes of transportation are fast enough. The whole family recently flew to Florida to visit Disneyworld, which Lansing really liked. Toledo was scared by the giant mice that followed him around. Their home is the same size as most homes in their town, about 2400 square feet, and their home energy use is about the same as everyone else in town too, in fact, it is the American average. Like most homes in the Midwest US, a chilly place in the winter, their home is heated with natural gas. Their area also gets hot in the summer and a string of recent heat waves inspired them to install a central air conditioner.

In one year…

Miles driven	15,000 miles driven in a minivan and 15,000 driven in an SUV Both vehicles get 15 mpg
Miles flown	The four Des Moines fly 2000 miles round trip to Florida
Miles traveled by mass transit	0
Miles traveled by taxi or limo	100 miles to and from the airports in Chicago and Florida
Kilowatt hours of electricity (kWh)	14,000 kWh per year
Gallons of heating oil	0
Therms of natural gas	1182 therms to heat the home in the chilly Midwest winters
Gallons of bottled gas or propane	0

HOW MUCH DO YOU SPEW?

Martha, Molly and Margie Median

Who are they?
Martha and her daughters Molly and Margie live in a ranch house in Orange County near Los Angeles, CA. They use an average amount of electricity in their home. Even in Southern California's mild climate they need to heat their home in the winter. They use natural gas for that. The family drove into the nearby mountains for several camping trips during the year. Martha works in downtown Los Angeles and commutes each weekday in her station wagon. She drops Molly at elementary school and Margie at the middle school on her way to work. The traffic getting to and from work means that Martha spends lots of time in her car not moving. This uses much more gasoline than driving at highway speeds.

In one year…

Miles driven	Matha's wagon gets 21 mpg During the year she drove 23,400 miles Add 53 gallons of gasoline for what was wasted sitting in traffic.
Miles flown	0
Miles traveled by mass transit	0
Miles traveled by taxi or limo	0
Kilowatt hours of electricity (kWh)	12,000 kWh per year
Gallons of heating oil	0
Therms of natural gas	400 therms to heat their home in the mild California winter
Gallons of bottled gas or propane	0

CO2: HOW MUCH DO YOU SPEW?

Answers:
The table below gives the pounds of CO_2 per year for each category in the worksheet calculation for each scenario. Negative numbers are given in situations where the household is producing more energy from photovoltaic panels than they use.

	Jetsetter Family	**The Retireanos**	**Farmer Family**	**Snow Family**	**Conservatorias**	**Ursula Urbanite**	**Harriett Homeless**	**The Demos**	**Des Moines Family**	**Median Family**
Driving	88,000	733	73,229	4,620	3,667	733	0	0	44,000	25,680
Flying	234,000	14,400	0	3,600	140,400	1,800	0	0	7,200	0
Mass Transit	0	750	0	0	10,400	500	250	0	0	0
Taxi/Limo	750	150	0	150	3,900	750	0	0	150	0
Electricity	72,000	-1800	34,200	0	14,400	5250	3,600	-3,600	21,000	18,000
Heating Oil	0	0	17,600	0	8,800	0	0	0	0	0
Natural Gas	0	0	0	0	11,000	0	0	0	13,002	4,400
Propane	0	195	0	26,000	0	0	0	0	0	0
TOTAL	**394,750**	**14,428**	**125,029**	**34370**	**192,567**	**9,033**	**3,850**	**-3,600**	**85,352**	**48,080**
Per person	**98,687.5**	**7214**	**10,419**	**8,592.5**	**96,283.5**	**9,033**	**3,850**	**-1800**	**21,338**	**16,027**

Questions to discuss:
Talk about the following questions in groups or as a class.

The Kyoto Protocol recommended that emissions be reduced to at or below 1990 levels. That means less than 11,000 pounds of CO_2 per person per year. Is the family you analyzed meeting that goal?

What activities emitted the most CO_2 for the family you examined?

Could those activities be changed to emit less CO_2? How?

How would you change your scenario to reduce CO_2?

For more information about this activity, including a teacher's guide, visit:
https://scied.ucar.edu/activity/co2-how-much-do-you-spew
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