AOS/IES 171 Name _____

Quantitative Assignment #1 10 points

Due Tuesday, February 8, 2005

1. Energy and Carbon Dioxide (6 points) This explores your personal energy usage and CO_2 emission from transportation. Start by writing down a rough estimate of how many miles that you travel in one year in gasoline-driven vehicles:

a) Using this number and your gas mileage, estimate your rate of fuel consumption in kg/yr. (1 gallon $\approx$ 4 liters, 1 liter $\approx$ 1 kg of fuel.)

b) Using your answer from part a, estimate your rate of emission of CO_2 in kg/yr. (About 80% of the mass of gasoline is carbon. The atomic weight of C is 12; O is 16.)

c) Your answer for b) should be larger than for a). Explain where the extra mass comes from.

d) A typical car has a mass of about 1000 kg. What is the ratio of the mass of CO_2 emitted in one year of driving to the mass of your car?

e) Starting from your answer to a), estimate your rate of energy consumption in Joules per second (Watts). (The energy content of gasoline is 50 x 10^6 J/kg. 1 year $\approx$ 3 x 10^7 s. 1 W = 1 J/s.)

f) Using your answer from e), estimate how many 100 W light bulbs you could keep illuminated with the energy you used for driving in one year. (Recall that the power you get from food is equal to about one 100 W light bulb.)

2. Global population and fossil fuel consumption (4 points) Let's make a forecast into the next century.

a) Estimate the doubling time for the global population from Table A.

b) If the doubling time remained the same as in a), estimate the global population in the year 2100.

c) Using the data in Table A and Table B (where 1,715 means 1.715 x 10^{12} kg of equivalent oil used for all human purposes), calculate the average energy usage (in kg per person per year) in 1950 and in 1996. Compare your answer for 1996 to your answer from question 1a.

d) If the rate of global equivalent oil usage increases linearly, estimate the energy usage in kg per person per year in 2100. (Use the point-slope form for a line and two of the data points in Table B, or sketch a graph to estimate global fuel usage in 2100.)