PHYS-310 Demographics, Heat Transfer, Heat Engines, Problem Set #2:

1) Please go to: http://www.animatedengines.com/ and pick out at least 4 engines that interest you and watch the apps for each. Please identify how and where WE put work into the gas, and then add heat and then the gas does work FOR us that we get out. Also be aware of why the work we get out is more than the work we put in.

2) Go to Gapminder.org, and click on "Gapminder world" at the top of the webpage. Explore demographics of the world's people. Pay particular attention to the country of your community of interest. How did the things you're looking at develop over time? Take at least two screen shots to discuss with your colleagues.

3) Coal Power Production

Coal and natural gas are the two predominant forms of fossil fuels used for generating electricity in the world. Compared to the NGCC, coal is a worse polluter on two levels – criteria pollutants (like toxins), and in terms of CO_2 production.

a) What does NGCC stand for?
b) Why does burning coal emit more toxins into the atmosphere and what are some of these toxins?
c) For the same amount of electricity, coal emits more CO_2 than the most efficient Natural Gas electricity generation by what factor?
d) Why is it that Coal Electricity emits more CO_2 than natural gas electricity generation? Please give two reasons.
e) What portion of the world's coal does the US consume? China? What portion of the world's NG does the US consume? China?

4) Your friend who left his 100 W incandescent light on for a year. This choice resulted in:

a) How much money did this choice cost him?
b) How much CO_2 was emitted if the electricity was generated with a new NGCC power plant?
c) How much CO_2 was emitted if the electricity was generated with an old coal-fired Rankin Cycle facility?

This choice required the combustion of what mass of fuel if:

d) if the electricity was generated with a new NGCC power plant.
e) the electricity was generated with an old coal-fired Rankin Cycle facility.

buildings, Ch. 11.

5) DH book problem, 11.8 House losses
6) DH book problem, 11.9 Multilayer wall

7) Folks in the physics department are making a fuss about the fastest, most expensive production car in the world, Bugatti Veyron. Here's the video: http://www.youtube.com/watch?v=LO0PgyPWE3o Then you can read about it in Wikipedia, or any place else you can find that interests you. You can skip down to the statistics if you like. At its maximum speed we can presume that it puts out its maximum power, find the efficiency:

a) Look up the maximum power that the engine puts out (please give answer in HP and Watts). What form of energy is this?
b) How does this power compare to a regular car? What is the max power (in HP and Watts) of your car?
c) What is the rate of consumption of petroleum at maximum power output?
d) What is the (chemical potential) energy consumption rate? Please put answer in Watts.
e) What is the efficiency of the gasoline engine at maximum power?
f) What rate (in Watts) does the engine dissipate heat? How many 100W light bulbs would this be? Why would this car need 10 radiators?
g) How much CO_2 does the car put into the atmosphere in one second? And how much does it put into the atmosphere in the 12 minutes it can drive at top speed before running out of gas? Please put answers in kg of Carbon, AND kg of CO_2.

Demographics: You may not be able to find the exact information you are looking for below. Don't sweat it… Please innovate an answer that makes sense to you.

h) If a group of people in the following countries wanted to buy a Veyron, and saved half of their salary for a year, how many people would they have to get together?: USA, Guatemala, DR Congo.