

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

1) 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?

Environment:

- g) How much CO<sub>2</sub> 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<sub>2</sub>.

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.
- i) About what per cent of people in the following places could afford a Veyron?: USA, Guatemala, DR Congo. Assume that the person had to be an Ultra Millionaire (worth more than \$30 million). Site your sources.

2) Measure the power output of your body two different ways. Express it in watts, horsepower, and BTU/hr. Be creative. Estimate how long you could maintain this power output?

3) 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.

HW3, buildings, Ch. 11.

- 4) DH book problem, 11.8 House losses
- 5) DH book problem, 11.9 Multilayer wall
- 6) DH book problem, 11.11 Scaling Law
- 7) DH book problem, 11.12 degree days