

PHYS-320 Energy: Demographics and Heat Engines
Schwartz 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. We will look at the mechanics of the power in the next problem set. For now, let's address the demographics.

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.

- a) If a group of (average income) 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, China, Guatemala, DR Congo.
- b) About what number of people in the following places could afford a Veyron?: USA, China, Guatemala, DR Congo. Assume that the person had to be an Ultra Millionaire (worth more than \$30 million). Also state what % of the population of these countries these numbers represent. 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 machine, and then add heat and then the machine 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 and where that extra energy comes from.

4) I want to make a house out of adobe, (mud, cob, earth whatever you like to call it). If the wall is 10' x 20' and is 3' thick, when it is 70 °F inside and 30 °F outside,

- a) Please calculate the temperature gradient
- b) please calculate the rate of heat loss in Watts and BTU/hr through the wall.