

PHYS-320 Energy: Demographics and Heat Engines
Schwartz Problem Set #2

- 1) Imagine you drive *your* car to San Francisco (if you actually drive an electric car, then imagine you drive someone else's gasoline car) – you may need to look up some information:
 - a) How many gallons of gasoline would you use? About how many kg of gasoline is this? About how much energy is this? Put answer in Joules and kWhr.
 - b) About how much CO₂ is emitted from your trip?

For Activity Section

- 2) Measure the power output of your body two different ways. Express it in Watts, horsepower, and BTU/hr:
 - a) Calculate the total energy you produced and time the process.
 - b) Calculate the power you put out in Watts, horsepower, and BTU/hr.
 - c) Calculate how long it would take you to charge a 1 kWh battery (like a car battery) if you could keep up this activity.
- 3) What do you think has more energy: you riding fast on your bicycle, or a hot cup of coffee? Please do the calculations.
- 4) What takes more energy: Running up the flight of stairs in Baker or heating your tea (half a liter of water) 10 °C. Please explain your experience and please show a calculation.

****more questions****

- 5) 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.
- 6) Check out the : [Animated Engines \(http://www.animatedengines.com/\)](http://www.animatedengines.com/) website and write down an explanation of how the following engines work, which will be testable, so this is just practice for the exams:
 - a) Reciprocating Engines: What's the difference between a four-stroke engine and a two-stroke engine? When would you use one rather than the other?
 - b) What's the difference between a diesel and a gasoline engine?
 - c) How does a Brayton Cycle (gas turbine) work?
 - d) How does a Rankine Cycle (steam turbine) work? How is it different from a Brayton (gas turbine)?
 - e) Pick one other kind of heat engine and explain how it works. – You could even look up the new Free Piston Linear Engine and see how it works – do you think this kind of engine will take on? Up to you.