Problem Set #1: PHYS-310 The World: Energy Units & Conversions, Global Energy Use
Due Monday, April 6 in class.

Please do your work without a calculator, and estimate your answers best you can. Usually if you are within 20%, that is fine. We recommend you start a list of constants and equations – possibly keep them on a dedicated Excel Spreadsheet. Some of your assignments will involve simple computer models that Excel is nice for. Because you will need to look up values on the web and make some assumptions and estimates, your answers may vary considerably.

Proper canceling of units. Everyone in this class has some technical background. Thus, we presume that you're good with cancelling units. You are responsible for working problems out with a pencil to make sure that units work… this is VERY important because the world conspires to make life difficult with units that vary from Watts, to Tons (if ice per day). So, for full credit, please show all units all the way through a problem with proper canceling

1) Spend 10 – 15 minutes on the EIA website. Printout or write down your favorite:
   a) graph
   b) statistic
   c) fun fact
2) In the global stocks and flow energy diagram (this is provided for April 1 class on the class website), please estimate how many years our oil will last if we continue using it at the present rate. Assume that we can use every last drop (impossible – most of it is not accessible).
3) Look up the rate of petroleum use and verify that global petroleum use is about 5 TW.
4) Let's say we did the equitable thing and split up the earth's surface area equally among all people. Start with the earth's radius (which you remember because of how the meter is defined) and calculate how much surface area each of us gets!
5) Let's say you covered your portion of the earth with a solar heat absorber. Remember the earth is round and turns.
   a) At noon on a sunny day, how much power would you absorb? Please put this in terms of Watts and tons (of ice per day).
   b) In a year, how much energy would you absorb? Please put your answer in Joules and Barrels of Oil Equivalent. What is the financial value of this oil?
   c) If instead of a thermal solar panel, I put a PV panel on my surface area with a conversion efficiency of 15%. What is the financial value of the electricity I would generate in a year?
6) DH said that the average North American's (because Guatemalan's also consider themselves Americans and their energy use is way different) daily energy consumption is about ¼ of their body weight in oil equivalent. Is this true?
7) Calculate your own horsepower over a short period of time or a long period of time
8) Show that e^{it} is a solution to dQ/dt = iQ, or for population = P, dP/dt = iP, or d$/dt = i$, where i is NOT square root of -1, but is a constant with units of $(\text{time})^{-1}$.
9) What is the tripling time for exponential growth?