

Big Exam #1: PHYS 320

In Midterms, you are allowed a calculator and notes with 50 bits of information. However, in this big exam, please work out your answers without a calculator. I will be looking for proper canceling of units. Precision is not important.

- 1) What is the rate of energy consumption of your car?:
  - a) How long does it take you to burn a gallon of gas while driving?
  - b) How many joules of energy are in a gallon of gas?
  - c) What rate of energy consumption does this correspond to?

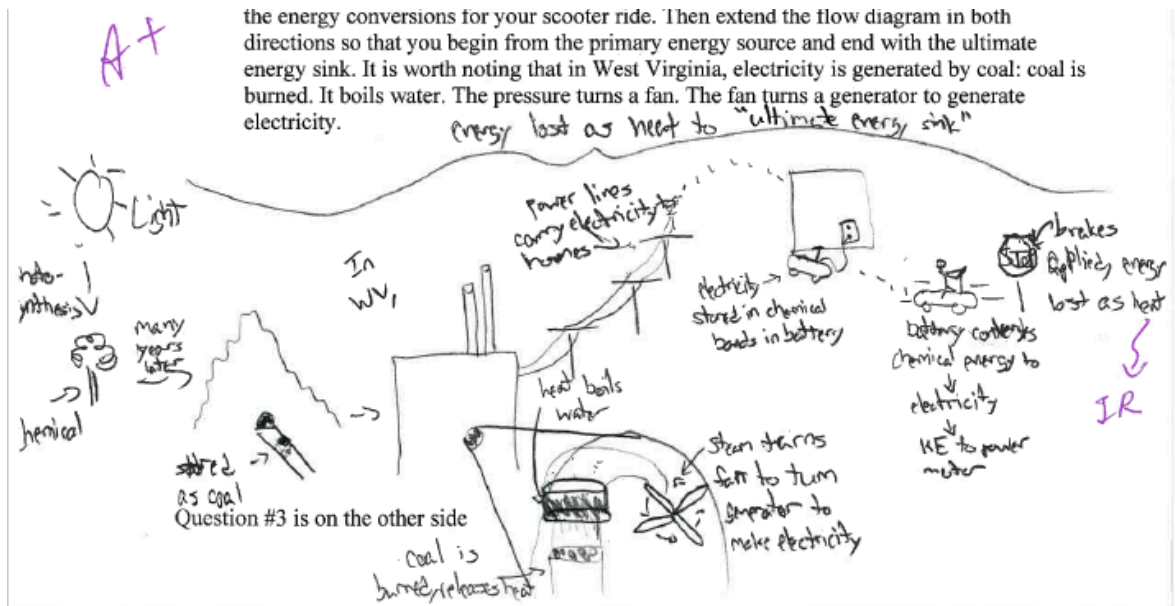
a)  $\frac{60 \text{ miles/hr}}{30 \text{ miles/gal}} = 2 \text{ gal/hr} = \boxed{\frac{1}{2} \text{ hr}}$

b)  $(1 \text{ gal gas}) \left( \frac{42 \text{ MJ}}{\text{kg}} \right)$   
 $= (16000 \text{ g gas}) \left( \frac{42000000 \text{ J}}{1000 \text{ g}} \right)$   
 $= \boxed{672 \times 10^6 \text{ J}}$

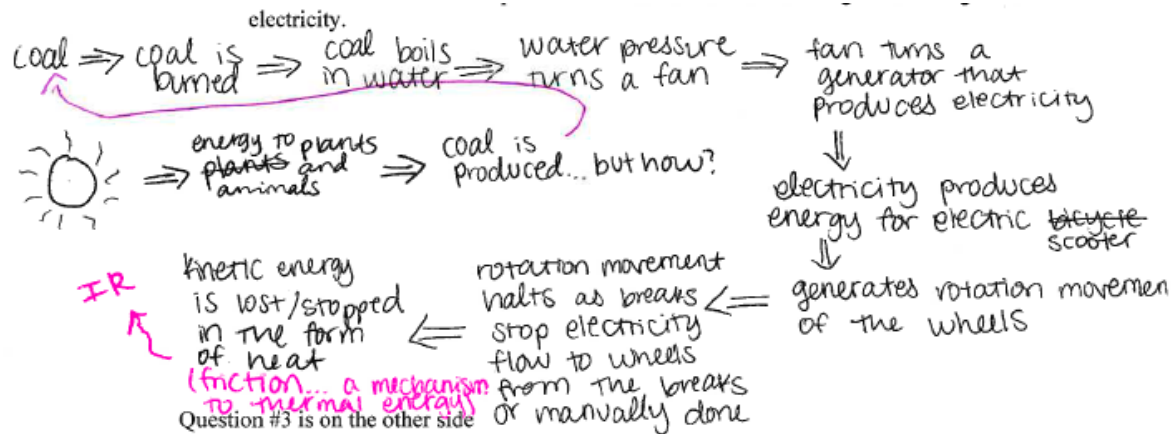
c)  $\boxed{1344 \times 10^6 \text{ J/hr}} = \boxed{80 \text{ kW}}$

$P = \frac{\Delta E}{\Delta t}$

- 2) You visit a friend in West Virginia and ride her electric scooter. You accelerate her scooter and then come to a stop by applying the breaks. Please make an energy diagram showing the energy conversions for your scooter ride. Then extend the flow diagram in both directions so that you begin from the primary energy source and end with the ultimate energy sink. It is worth noting that in West Virginia, electricity is generated by coal: coal is burned. It boils water. The pressure turns a fan. The fan turns a generator to generate electricity.



OR...



- 3) This class is about *ENERGY*, so why are we talking about *POVERTY* and all the related concepts such as life expectancy, per capita GDP, and fecundity (number of babies per woman)? In short, what does the study of energy have to do with the societal concerns of poverty?

A +

As poor countries become wealthier, they will need more energy demands. That is why we have seen greenhouse gas emissions much higher because countries like India and China became wealthier, thus using more energy. Although we have the needs to meet energy demands as countries get wealthier, the USA and Europe use a lot of the energy and may not want to cut back. So, as we see poor countries utilizing more energy, we may also see an increase in greenhouse gas emissions from countries that did not previously emit. Also, the more people there are and the higher life expectancy will also produce more greenhouse gases b/c people will live longer and there will be more people.

OR...

Up to a point Energy consumption per capita is related to how poor a country is.

We want to explore how we can decrease poverty while keeping energy use to a minimum.

We also want to lower our energy use per capita while not becoming poor. (Very doable),