The following questions are made by F. Wu, spell checked by F.H. Garcia.

Name:_____

1. Solar Energy Generating Systems (SEGS) in California, USA is one of the world's largest solar farms. It is located in the Mojave Desert, and has a combined field area of 2314978 m^2 (roughly the area of 435 football fields). Its average annual production of electricity is about 655000MWh. In the year 2017, solar energy supplies around 16% of the total energy consumption in California.

   (a) Assume the decay of 1 ^{235}U nucleus releases 200MeV energy, and the efficiency of the reactor is 35%. Calculate the mass of ^{235}U needed to generate the same amount of electricity as SEGS for a year. Here are some unit conversions you might need: 1MWh = 2.25×10^{22}MeV, the mass of 10^{24} ^{235}U nuclei is about 390g.

   Answer:_____

   (b) What is the combined power (in MW) which the nuclear power plants need to have in order to meet this annual production goal? Assume the capacity of one reactor is 500MW, how many reactors do you need to meet the production goal? Hint: power is work (energy produced) divided by time.

   Answer:_____

2. Calculate the total mass of reactants needed to generate the same amout of electricity in question 1 (655000MWh), if the reactor runs on d + t$\rightarrow \alpha$ + n. For simplicity, assume the reactor has a 100% efficiency. The mass excesses are: Δ(d) = 13.1357 [MeV], Δ(t) = 14.9498 [Mev], $\Delta(\alpha)$ = 2.4249 [MeV], and Δ(n) = 8.0713 [MeV]. 10^{24} ^{2}H (d) is about 3.3g and 10^{24} ^{3}H (t) is about 5g. The energy released per reaction is given by: $Q = \Delta$(reactants) $- \Delta$(products).

Answer:_____

Bonus : Disscuss the advantages and disadvantages of the 3 ways of power production mentioned in questions 1 and 2.

Answer:_____

The End.