PHY140Y

Spring Term – Tutorial 24 Discussion

3 April, 2000

1. (a) Assuming that each fission event releases 200 MeV of energy, how many such fissions per second will occur if a reactor is to have a thermal output of 3200 MW?

   (b) If this is CANDU reactor system, how much natural uranium fuel would be "consumed" in a given year?

   (c) Suppose that we control the nuclear reaction by inserting neutron absorbing material into the reactor core, so that 95% of all of the neutrons are absorbed. Does the rate of fuel consumption change? Estimate the rate of fuel consumption with the control rods in place.

   (d) General Electric makes a light water thermal reactor using enriched uranium fuel (contains 3% ^{235}U). Does its rate of ^{239}Pu production differ from the CANDU system (assuming the same power rating)? Of so, how large is the difference?

2. The 1974 Threshold Test Ban Treaty limited underground nuclear tests to a maximum yield of 150 kT.

   (a) What amount of ^{235}U would be required if the device had an efficiency of 30%?

   (b) Such devices have "pits" that are spherical in size. What would be the diameter of the pit in such a device (the density of U is 18.7 g/cm^3)?

3. Given that 0.72% of uranium is in the form of ^{235}U, what was the original percentage of this isotope when the Earth formed 4.5 billion years ago?