Assignment-1

1. How may neutrons and protons are there in the nuclei of the following atoms.
   (a) Li^{7}, (b) Mg^{24}, (c) Xe^{135}, (d) Rn^{222}.
2. The fission of the nucleus of U^{235} releases approximately 200 MeV. How much energy (in kilowatt-hours and megawatt-days) is released when 1 g of U^{235} undergoes fission?
3. Compute the neutron-proton mass difference in MeV.
4. Tritium (H^{3}) decays by negative beta decay with a half-life of 12.26 years. The atomic weight of H^{3} is 3.016. (a) To what nucleus does H^{3} decay? (b) What is the mass in grams of 1 mCi of tritium?
5. The radioisotope generator SNAP-9 was fueled with 475g of $Pu^{238}C$ (Plutonium-238 carbide), which has a density of 12.5 g/cm^{3} . The Pu^{238} has a half life of 89 years, and emits 5.6 MeV per disintegration, all of which may be assumed to be absorbed in the generator. The thermal to electrical efficiency of the system is 5.4 percent. Calculate (a) the fuel efficiency in curies per watt (thermal); (b) the specific power in watts (thermal) per gram of fuel; (c) the power density in watts (thermal) per cm^{3}; (d) the total electrical power of the generator.
6. Tata Memorial Hospital has been procuring a short-lived radio-isotope for medical applications. The doctors, of late, had been complaining that the supplied isotope did not have the necessary strength for which the order was placed.. In order to verify this, the inspection department carried out the following test. The sample was counted for 1 minute for the number of disintegration, immediately on its arrival. In the first one minute 1791 disintegrations were counted. After 10 minutes from the arrival time, the sample was again counted for 1 minute. This time the number of counts were 1620. Based on the above facts, compute the strength of the source in Bequerrels (dps), when supplied
7. Three elements A,B and C, not connected by a chain, decay individually. At t=10s, the ratio of their activities are 1:0.5:0.25, and at t=15s, their activities are in the ratio 1:0.25:0.0625. What would be the ratio of their activities at t=0s.
8. Rutherford had postulated that at the time of earth's birth, U^{235} and U^{238} had equal concentration. Assuming that their ratio today 0.007 to 0.993, compute the Rutherford's estimate for the age of earth. The respective half lives of U^{235} and U^{238} are, 0.709 X 10^{9} and 4.47 X 10^{9} years.