USPAS 2019 Name:
The Effect of Radiation on Electronics and Materials
Homework 2
June 25, 2019
Due June 26, 2019 at 9am

1. Match the name of each region to the appropriate numeral labeled on the diagram.

____ Limited Proportionality

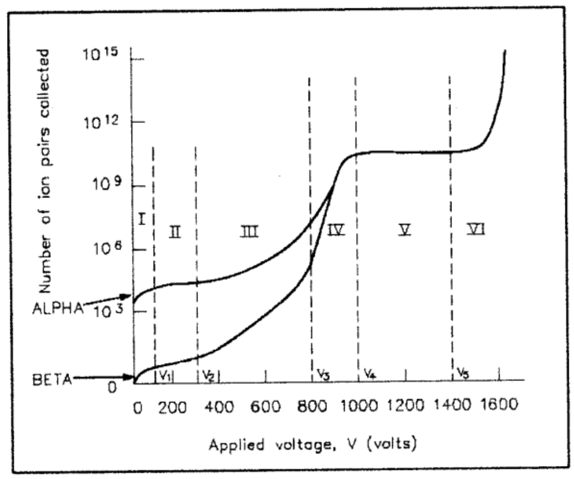
____ Ionization Region

____ Geiger-Muller Region

____ Recombination Region

____ Continuous Discharge Region

____ Proportional Region



2. True / False

   Lead (Pb) is a good shield for
   Neutrons (T / F)

   Radiation induced cancer is a somatic effect (T / F)

   The unit of a Becquerel describes 3.7×10^{10} disintegrations per second (T / F)

   A Geiger Tube will output a large pulse for a 2 MeV β when compared to a 1 MeV β (T / F)

   A 511 keV photon can initiate pair production (T / F)

   A 662 keV photon can Compton scatter to 331 keV (T / F)

   Implanted alpha particles can lead to helium bubbles that may embrittle metal (T / F)

   Any element greater than Z = 82 is radioactive (T / F)

   Microwave ovens emit ionizing radiation (T / F)

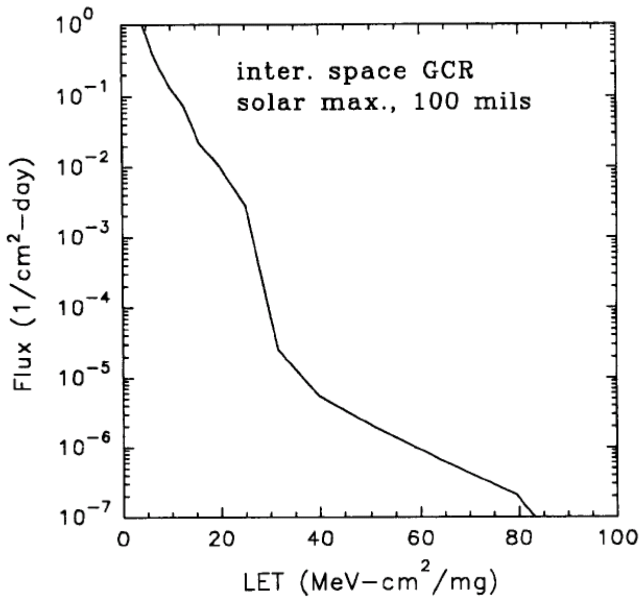
   Food, commercially irradiated becomes slightly more radioactive (T / F)

3. What is the resolution of your NaI detector given an incoming energy of 650 keV? (Assume a Scint efficiency of 13.4%, loss at the interface of 19%, PMT QE of 20%)

4. Why is reverse, rather than forward bias used for semiconductor junctions in radiation measurements?

USPAS 2019 Name:
The Effect of Radiation on Electronics and Materials
Homework 2
June 25, 2019
Due June 26, 2019 at 9am

5. Figure our how you are going to convolve the Weibull Curves for SEE events with a radiation environment?
   Reminder: the SEE curves are fit to this Weibull equation F(L) = 1-exp{-[(L-L0)/W]^s}, if L > L0, F(L) = 0, if L < L0
   Reminder: make certain your units match
   What is the effect of onset, width and saturation on the error rate?



6. Figure out how you are going to calculate probability of failure given mean-time-to-event, the amount of time, and the number of events?

Terrestrial neutron environment, which has analytical fit

$$\frac{d\dot{\Phi}_0(E)}{dE} = 1.006\times10^{-6}\exp\left[-0.35(\ln(E))^2+2.1451\ln(E)\right] + 1.011\times10^{-3}\exp\left[-0.4106(\ln(E))^2-0.667\ln(E)\right]. \quad \text{(A.1)}$$

where E is neutron energy and $d\dot{\Phi}_0(E)/dE$ is the reference neutron differential flux.

If interested in the JESD89A, find it at https://www.jedec.org/sites/default/files/docs/jesd89a.pdf