共十題 每題 10 分

1. The mean life can be considered as the average length of time an atom lives. Prove that the mean life of an atom is $1/\lambda$, where λ is the decay constant.

2. In an x ray machine, what properties make tungsten a good candidate to be used as the target?

3. Using the principle of conservation of energy and momentum, show that a photoelectric process can't take place with a free electron.

4. Explain why electronic equilibrium can never be achieved by very high energy radiation.

5. Explain why electron density distribution of patient is used for dose calculation in high energy **gamma** radiation therapy? How to obtain an electron density distribution of a patient? What will be used for dose calculation in **proton** therapy?

6. Describe the dependence of radiation damage (of a cell) on LET.

7. Let N_s be the sample counts measured in time t_s and N_b the background counts in time t_b. A_s and A_b are the sample and background count rate, respectively. What is the standard deviation in A_s and A_b? What is the true count rate A? What is the standard deviation in A? Prove that the portion of time should be spent between sample and background for a given total count time (i.e. $t_s + t_b$ = constant) to minimize the standard deviation in A is

$$\frac{t_s}{t_b} = \sqrt{\frac{A_s}{A_b}}.$$

8. What is the oxygen effect in radiation therapy? How the fractionated radiation treatments reduce this potential problem?

9. What factor needs to be considered to select a radioisotope for nuclear medicine (said PET or SPECT) study?

10. Draw a diagram to compare the isodose curves of Co-60 and x ray with half value layer (HVL) equal to 1.0mm Cu. Also indicate the effect of source to skin distance (SSD).