

國立清華大學 101 學年度碩士班考試入學試題

系所班組別: 生醫工程與環境科學系 丙組 (醫學物理與工程組)

考試科目(代碼): 放射物理學 (2401)

1. (10%) Describe the mass attenuation coefficient, mass energy transfer coefficient, and mass energy absorption coefficient.
2. (10%) (1) Derive the quantity of half-value layer (HVL) with usage of the attenuation coefficient (μ). (2) Given the mass attenuation coefficient (μ/ρ) = 0.455 cm²/g at 100 keV. Please estimate the HVL of Cu. Note: the density of Cu = 8.96 g/cm³.
3. (10%) (1) Describe the quantities of kerma and absorbed dose. (2) Assume that a beam of 10.0 MeV photons with fluence of 10¹⁴/m² is incident on a small block of carbon. Calculate the kerma. Note: the mass attenuation coefficient (μ/ρ) = 0.00196 m²/kg; the average energy transferred (E_{tr}) = 7.30 MeV.
4. (10%) Describe the characteristics of (1) ionization collisions, (2) K characteristic radiation, and (3) Bremsstrahlung radiation.
5. (10%) (1) Define the unit of Bq. (2) You have a source with activity of 1 G Bq. You are told its activity was 4 G Bq twenty years ago. Calculate the activity five years later.
6. (10%) Compare the stochastic effect and the deterministic effect caused by radiation.
7. (10%) Plot and explain the graph showing the relationship between the current or pulse from the ion chamber as the voltage applied is increased.
8. (10%) What is ring artifact in Computed Tomography image? Why this artifact is not seen in fourth generation CT?
9. (10%) Define the percentage depth dose. Describe how the depth, the width of the beam, the distance from the source to the surface, and the energy of the beam affect the percentage depth dose.
10. (10%) Compare the PET (positron emission tomography) and SPECT (single photon emission computed tomography)?