

BioE 1330 - HW 4 Questions

1. What two physical characteristics cause an atom (nucleus really) to be unstable? How does each type of instability become stable, i.e. what changes, what is emitted?
2. What are gamma rays? X-rays? What's the difference between them?
3. High speed electrons interacting with a target material can result in three types of radiation. Briefly describe them.
4. High energy photons interacting with a target material can result in three types of interactions. Describe each briefly:
5. Why do X-ray images made with higher energy tend to be more blurry.
6. Why are x-rays filtered before exposing the patient?
7. What is a "K-edge" as applied to a contrast agent? How is it used to increase contrast?
8. Describe the roll of a grid-screen assembly in an x-ray system.
9. How many light photons are typically created by the phosphor screen for each x-ray photon, and what accounts for the increase in number? What is this phenomenon called?
10. How many light photons are created by a fluoroscopy tube for each x-ray photon, and where does the energy come from for this increase over the number from the phosphor screen?
11. What two factors increase geometric blurring of an image?

12. Infrared light is defined as having wavelengths in the range of $1\ \mu\text{m} - 100\ \mu\text{m}$
- Determine the frequency range of IR light
 - Determine the photon energy range of IR light
 - Is IR light ionizing or not?
13. Calculate the thickness of shielding material needed to block out 95.0 % of the incident radiation for a material with linear attenuation coefficient μ .
14. An x-ray tube fires on average, 10000 photons per seconds at an x-ray image intensifier. If the detector provides an average count of 10000 photons per second, calculate and plot the variance of the detector's output as a function of DQE. What DQE value is required for an output variance of 2000?