

Nuclear Energy and Human Physiology

Nuclear Energy · Answer Key · 8 Questions

1. Which specific radioisotope is primarily responsible for the thyroid gland's susceptibility to radiation-induced carcinogenesis following nuclear fallout?

- A) Cesium-137
- B) Iodine-131**
- C) Strontium-90
- D) Plutonium-239

2. What is the primary biological mechanism by which ionizing radiation from nuclear decay induces cellular DNA damage?

- A) Direct ionization of DNA molecules
- B) Thermal denaturation of nuclear proteins
- C) Oxidative stress via radiolysis of intracellular water**
- D) Inhibition of ATP synthesis in mitochondria

3. In the context of internal radiation exposure, which radionuclide is chemically treated as a calcium analog, leading to its accumulation in the bone matrix and bone marrow?

- A) Strontium-90**
- B) Americium-241
- C) Cobalt-60
- D) Tritium

4. Which phase of the human cell cycle is characterized by the highest sensitivity to ionizing radiation, contributing to the effectiveness of radiotherapy?

- A) G1 phase
- B) S phase
- C) G2 phase
- D) M phase**

5. What is the deterministic effect of high-dose radiation on the hematopoietic system typically observed first after acute whole-body exposure?

- A) Permanent alopecia
- B) Depletion of circulating lymphocytes**
- C) Cataract formation
- D) Erythema of the dermis

6. Why is Alpha radiation considered significantly more hazardous when deposited internally than when encountered as an external source?

- A) It has a higher wavelength than gamma radiation
- B) It possesses a high Linear Energy Transfer (LET) causing dense ionization in localized tissue**
- C) It is easily absorbed by the epidermal layer of the skin
- D) It induces systemic allergic reactions in the blood stream

7. Which specific DNA repair pathway is most crucial for cell survival following exposure to double-strand breaks induced by ionizing radiation?

- A) Base Excision Repair (BER)
- B) Nucleotide Excision Repair (NER)
- C) Non-Homologous End Joining (NHEJ)**
- D) Mismatch Repair (MMR)

8. The 'LD50/60' metric in radiation biology refers to which specific health outcome?

- A) The dose resulting in 50% risk of lung cancer within 60 years
- B) The dose causing death in 50% of an exposed population within 60 days**
- C) The threshold for 50% skin necrosis over 60 square centimeters
- D) The amount of isotope required to reduce bone density by 50% in 60 days