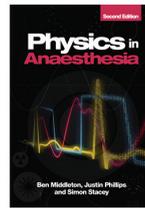


Chapter 26

Nuclear physics and radiation



Self-assessment questions

These questions and answers, in both MTF and SBA formats, accompany *Physics in Anaesthesia 2e* and link back to the book for guidance.

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Multiple true / false questions

For each of the following questions, mark all answers as either true or false

1. Regarding radioactive decay:

- Isotopes of an element vary in the number of neutrons they possess
- Radioisotopes are isotopes liable to undergoing decay and emit radiation
- The greater the half-life of decay, the more radiation emitted in a given time
- Positrons are high speed alpha particles
- Beta particles are essentially high speed electrons

Reminder

- Alpha particles are identical to a helium nucleus (two protons and two neutrons).
- Beta particles can be negative (high speed electrons) or positive (high speed positrons – the anti-matter to electrons).
- Gamma rays are electromagnetic waves (or photons).

2. X-rays used in medical imaging are:

- Emitted from an X-ray tube that has both an anode and cathode
- High-energy electromagnetic waves capable of producing radiation
- Generated in a vacuum
- Generated by accelerating electrons against a target metal
- The least attenuated when they pass through high-density materials

Pointer

- See *Figure 26.5* for the components in an X-ray tube.

3. Which of the following scans involve the injection of radionuclide and measurement of the result of its nuclear decay:

- MRI
- Ultrasound
- X-rays
- SPECT
- PET

Reminder

- SPECT uses gamma-emitting radioisotopes.
- PET uses positron-emitting radioisotopes. The positrons emitted collide with electrons in tissue to produce a detectable pair of electromagnetic gamma rays travelling in opposite directions (annihilation).

Single best answer questions

For each of the following questions, select the single best answer – note that more than one answer may be true but only one option represents the best answer

1. What is true concerning the penetration of radiation?

- a. Gamma radiation with a low energy is less penetrating than high energy beta particles
- b. Positrons are the most highly penetrating form of radiation
- c. Gamma waves are blocked by low density media
- d. Alpha waves generally have poor penetration of the skin
- e. Thyroid shields are necessary for MRI radiographers

Did you know?

- Specialities such as interventional radiology and interventional cardiology have potentially high levels of radiation exposure.
- The greater the length of exposure the greater the protective shielding required.
- Protection tools include lead aprons, thyroid shields, leaded glasses, leaded surgical gloves, protective patient drapes, radiation protection cabins and floor- and table-mounted shields.

2. What is not involved in the process of PET imaging?

- a. Gamma camera
- b. Coincidence circuit
- c. Thermionic emission
- d. Radionuclide decay
- e. Annihilation

Reminder

- PET imaging enables assessment of the metabolic activity of body tissues.

3. Tomography is best described as the process of:

- a. Producing X-ray films
- b. Eradicating motion artefact
- c. Generating a detailed three-dimensional image from cross-sectional images or slices
- d. Generating a cross-sectional image of tissue from X-ray images taken at multiple angles
- e. The complex computer processing of images from an ultrasound scanner

Did you know?

- Ultrasonic computerized tomography (USCT) is a growing field of imaging.

Answers to questions for Chapter 26 – Nuclear physics and radiation

Multiple true / false questions

The following answers are true:

1. a, b and e
2. a, b, c and d
3. d and e

Single best answer questions

The options below represent the single best answer, although other options may also be true:

1. d
2. c
3. d