

February 2004

1. Discuss the specific physical features of a radionuclide which would make it suitable for use in patient treatment. Discuss separately the principles and requirements for using:
 - (a) Sealed and
 - (b) Unsealed radioactive substances.
2. A number of separate physical concepts and associated physical quantities are used in radiotherapy. Give at least ten examples of such concepts and their measures. Why are all of these necessary in day to day clinical practice?
3.
 - (a) Sketch central axis depth dose (in water) curves for:
 - i. a 6 MV and an 18 MV photon beam, both 10 cm x 10 cm at 100 cm SSD, on the one graph
 - ii. a 5 cm x 5 cm and a 10 cm x 10 cm orthovoltage beam, both of 3 mm Cu HVL, 50 cm SSD, on the one graph
 - iii. a 6 MeV and an 18 MeV electron beam, both 10 cm x 10 cm at 100 cm SSD, on the one graph.Show percentage and depth scales with numerical values on each of the three graphs.
 - (b) Explain the important features of the curves drawn, and comment on the clinical significance of these features.
4.
 - (a) Discuss the use of wedge filters and compensating filters in megavoltage photon beam radiotherapy, indicating the physical principles involved in their design and application.
 - (b) How can independent jaws and multileaf collimators be used to produce wedging and compensation? What are the advantages and disadvantages of using these instead of physical wedges and compensators?
5. Irregularly shaped X-ray treatment fields can be achieved using either multileaf collimators or customised shielding blocks. Comment on the advantages and disadvantages of each technique for:
 - (a) achieving the required field shape
 - (b) penumbra
 - (c) dose to tissues under the shielding
 - (d) treatment planning
 - (e) treatment delivery.
6. Write short notes on
 - (a) the physical aspects of prostatic implants using radioactive seeds
 - (b) the radiation protection requirements relating to the discharge of patients undergoing treatment with radioactive substances including iodine-131, samarium-153 and strontium-90.
[Note: For Australian candidates attempting Q 6(b), either the old or the new (Sept 2002) recommendations will be acceptable.]