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1. Describe how the high speed stream of electrons which have been generated in the wave guide of a linear accelerator may then be used, manipulated and controlled in order to produce beams of:
   (a) photons and
   (b) electrons for clinical use.

2. Discuss the physical principles of the use of unsealed radionuclides in radiation oncology. Describe the concepts of uptake, distribution and elimination. Indicate the activities used in clinical practice and how the dose to target tissues and to critical organs is estimated.

3.
   (a) Define percentage depth dose, tissue-air ratio, scatter-air ratio, tissue- phantom ratio and off-axis ratio.
   (b) For the first four of these parameters, indicate a situation in which its use is particularly appropriate, and explain why.
   (c) How and why does the off-axis ratio vary with depth?
   (d) Describe and briefly explain the way in which percentage depth dose varies with beam energy, field size and SSD, for photon beams.
   (e) Approximately what percentage depth dose would occur in water at 10 cm depth, 100 cm SSD, for a 10 cm x 10 cm 6 MV x-ray beam?

4. Discuss:
   (a) Phantoms and their use and limitations in radiotherapy.
   (b) Half value layer and its measurement.
   (c) The dose distribution which results from a central spinal cord shielding block in a 6 MV beam

5.
   (a) Write short notes on the physical principles and clinical uses (including advantages and disadvantages) of in-vivo patient dosimetry.
   (b) Compare the use of multileaf collimators to fixed shielding blocks for shielding critical normal tissues.

6. Define the following ICRU terms and explain the relationship between them:
   (a) Gross Tumour Volume
   (b) Clinical Target Volume
   (c) Planning Target Volume
   (d) Internal Margin
   (e) Internal Target Volume
   (f) Set-up Margin
   (g) Conformity Index
   (h) Planning Organ at Risk Volume
   (i) Reference point

   Give an example illustrated with diagrams.