



Radiation Oncology
Initial Certification Qualifying (Computer-Based) Examination:
Study Guide for Medical Physics for Radiation Oncology

This exam tests your knowledge of the principles of medical physics underlying the practice of radiation oncology. Included are questions on the general domains listed below. Exam performance will be reported to you based on an overall pass: fail grade, with specific information provided regarding quintile performance in the five individual domains. Because the nature of scientific knowledge and subcategories are such, there may be some overlap of items across domains. Each exam will include items from every domain, but individual subtopics may not be included in every exam.

Primary Domains:

- I. Basic physics**
- II. Radiation measurements and basic treatment planning**
- III. Imaging, simulation, and treatment plan evaluation & verification**
- IV. Safety, QA, and radiation protection**
- V. Advanced treatment planning & special procedures**

-
- I. Basic physics**
 - A. Fundamental Physics
 - B. Atomic and Nuclear Structure
 - C. Production of Kilovoltage X-ray beams
 - D. Production of Megavoltage X-ray beams
 - E. Radiation Interactions
 - II. Radiation measurements and basic treatment planning**
 - A. Radiation Quantities and Units
 - B. Radiation Measurement and Calibration
 - C. Photon Beam Characteristics and Dosimetry
 - D. Electron Beam Characteristics and Dosimetry
 - III. Imaging, simulation, and treatment plan evaluation & verification**
 - A. Imaging Fundamentals
 - B. Simulation and Treatment Verification
 - C. Informatics
 - D. Prescribing, Reporting, and Evaluating Radiotherapy Treatment Plans

IV. Safety, QA, and radiation protection

- A. Quality Assurance
- B. Radiation Protection and Shielding
- C. Safety and Incidents

V. Advanced treatment planning & special procedures

- A. Intensity Modulated Radiation Therapy (IMRT)
- B. Special Procedures
- C. Brachytherapy
- D. Particle Therapy
- E. Stereotactic Radiosurgery/Stereotactic Body Radiation Therapy

References: References are intended as resource for exam takers and will form the sources for the majority of individual items in the exam. Individual items may be sourced from references not cited in this study guide. Primary references are intended to be the source of the majority of exam items. Secondary references are individual smaller categories of items. Additional references may be the source of individual, selected items.

Primary References:

Podgorsak EB. Radiation Oncology Physics: A Handbook for Teachers and Students. Vienna, Austria: International Atomic Energy Agency; 2005

Hendee WR, Ibbott GS, and Hendee EG. Radiation Therapy Physics. Hoboken, NJ: Wiley-Liss; 2005

Khan FM and Gibbons JP. The Physics of Radiation Therapy. Philadelphia, Pa: Lippincott Williams & Wilkins; 2014

McDermott, P and Orton, C. The Physics and Technology of Radiation Therapy. Madison, WI: Medical Physics Publishing; 2010

Secondary References:

Dieterich S, Ford E, Pavord D, and Zeng J. Practical Radiation Oncology Physics Philadelphia, PA: Elsevier; 2015

Metcalfe P, Kron T, and Hoban P. Physics of Radiotherapy X-Rays and Electrons. 2nd edition. WI: Medical Physics Publishing; 2007

Van Dyk J. The Modern Technology of Radiation Oncology. Volume 1. Medical Physics Publishing; 1999

Van Dyk J. The Modern Technology of Radiation Oncology. Volume 2. Medical Physics Publishing; 2005

Van Dyk J. The Modern Technology of Radiation Oncology. Volume 3. Medical Physics Publishing; 2013

Additional References:

Nath, R. , Anderson, L. L., Luxton, G. , Weaver, K. A., Williamson, J. F. and Meigooni, A. S. (1995), Dosimetry of interstitial brachytherapy sources: Recommendations of the AAPM Radiation Therapy Committee Task Group No. 43. Med. Phys., 22: 209-234. doi:10.1118/1.597458

Almond, P. R., Biggs, P. J., Coursey, B. M., Hanson, W. F., Huq, M. S., Nath, R. and Rogers, D. W. (1999), AAPM's TG-51 protocol for clinical reference dosimetry of high-energy photon and electron beams. Med. Phys., 26: 1847-1870. doi:10.1118/1.598691

Huq, M. S., Fraass, B. A., Dunscombe, P. B., Gibbons, J. P., Ibbott, G. S., Mundt, A. J., Mutic, S. , Palta, J. R., Rath, F. , Thomadsen, B. R., Williamson, J. F. and Yorke, E. D. (2016), The report of Task Group 100 of the AAPM: Application of risk analysis methods to radiation therapy quality management. Med. Phys., 43: 4209-4262. doi:10.1118/1.4947547

Benedict, S. H., Yenice, K. M., Followill, D. , Galvin, J. M., Hinson, W. , Kavanagh, B. , Keall, P. , Lovelock, M. , Meeks, S. , Papiez, L. , Purdie, T. , Sadagopan, R. , Schell, M. C., Salter, B. , Schlesinger, D. J., Shiu, A. S., Solberg, T. , Song, D. Y., Stieber, V. , Timmerman, R. , Tomé, W. A., Verellen, D. , Wang, L. and Yin, F. (2010), Stereotactic body radiation therapy: The report of AAPM Task Group 101. Med. Phys., 37: 4078-4101. doi:10.1118/1.3438081

Klein, E. E., Hanley, J. , Bayouth, J. , Yin, F. , Simon, W. , Dresser, S. , Serago, C. , Aguirre, F. , Ma, L. , Arjomandy, B. , Liu, C. , Sandin, C. and Holmes, T. (2009), Task Group 142 report: Quality assurance of medical accelerators. Med. Phys., 36: 4197-4212. doi:10.1118/1.3190392

United States Code of Federal Regulations, Title 10, Chapter 1 – Nuclear Regulatory Commission, Part 20 – Standards for Protection Against Radiation. <https://www.nrc.gov/reading-rm/doc-collections/cfr/part020/>

United States Code of Federal Regulations, Title 10, Chapter 1 – Nuclear Regulatory Commission, Part 35 – Medical Use of Byproduct Material. <https://www.nrc.gov/reading-rm/doc-collections/cfr/part035/>