Preparing for the ABR Part 2 Exam in Diagnostic Medical Physics

Diana E. Carver, Ph.D., DABR
Diagnostic Medical Physicist
Department of Radiology and Radiological Sciences
Vanderbilt University Medical Center

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Disclaimers

- I am not affiliated with the American Board of Radiology (ABR).
- Opinions expressed during this presentation are my own.

ABR Initial Certification: Diagnostic Medical Physics

Part 2 Exam

Last verified on June 19, 2017

The second exam you will take is the Part 2 computer-based exam, which is specific to a particular specialty: diagnostic medical physics, therapeutic medical physics, or nuclear medical physics.

The Part 2 exam is based on material that would be learned during a CAMPEP-accredited medical physics residency. The material represents the broad subspecialty-specific knowledge across the discipline.

The Part 2 Exam is administered at Pearson VUE Testing Centers throughout the country.

https://www.theabr.org/medical-physics/initial-certification/part-2-exam

Eligibility to take Part 2: Candidates who applied for certification after July 1, 2013

- Must have passed the Part 1 exam (general and clinical).
- Must have completed a CAMPEP-accredited residency by August 31 of the year in which the Part 2 exam is to be taken.
    - If you completed a CAMPEP-accredited residency prior to the year that you are applying for the Part 2 exam, you must also provide documentation of current employment as a medical physicist.

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/requirements-application

Eligibility to take Part 2: Candidates who applied for certification prior to October 31, 2012

- You must have passed the Medical Physics Part 1 exam (general and clinical).
- AND you must satisfy one of these two requirements:

(1) If you submitted your initial application before June 30, 2011, you must hold a master's or doctoral degree from an approved institution (program accredited by one of the organizations recognized by the Council on Higher Education Accreditation or its successors), or an equivalent foreign degree in medical physics, physics, or another relevant physical science or engineering discipline. Foreign degrees must be substantiated by the National Association of Credential Evaluation Services (NACES).

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/requirements-application

Eligibility to take Part 2: Candidates who applied for certification prior to October 31, 2012

(2) If you submitted your initial application July 1, 2011, or later, and

(a) You used enrollment in a CAMPEP-accredited degree program as the basis for qualification to take Part 1, you must complete the CAMPEP-accredited degree. You may leave the CAMPEP-accredited degree program for a CAMPEP-accredited residency if you have at least an MS degree in medical physics or a related field, and you must complete the CAMPEP-accredited residency to advance to Part 2.

(b) If you used enrollment in a CAMPEP-accredited residency as the basis for qualification to take Part 1, you must complete the residency before advancing to Part 2.

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/requirements-application

Eligibility to take Part 2: Candidates who applied for certification prior to October 31, 2012

AND you must complete **one of the following**:

(1) You must complete a CAMPEP-accredited residency by August 31 of the year in which the Part 2 exam is to be taken.

- If you completed a CAMPEP-accredited residency prior to the year that you are applying for the Part 2 exam, you must also provide documentation of current employment as a medical physicist.

(2) You must have had at least three years (36 months) of full-time equivalent clinical experience under the supervision of a certified medical physicist in active association with an approved department, division, or practice in the specialty(ies) in which certification is sought.

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/requirements-application

Introduction to ABR Part 2 Diagnostic Physics Exam

- Computer-based exam at Pearson VUE Test Centers
- Exam Time: 4 hours with total of 80 questions
- Simple Questions (including new-item types) ~2/3:
  - Short and simple in nature
  - Includes New-item Types:
    - Multiple correct options
    - Fill-in-the-blank
    - Point-and-click
    - R-type
    - Case-based items
- Complex Questions ~1/3:
  - Longer and more involved calculations

Traditional Simple Question Examples

1. For a radiograph acquired with automatic exposure control, an increase in which of the following factors will increase patient skin dose?

   A. Tube current (mA)
   B. Tube voltage (kV)
   C. Patient thickness
   D. Focal spot size
   E. Source-to-image distance

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

Traditional Simple Question Examples

2. A region of interest (ROI) in a CT image has an intensity of -30 HU. What is the ratio of the linear attenuation coefficient for the ROI to that of water?

   A. 0.70
   B. 0.97
   C. 1.00
   D. 1.03
   E. 1.30

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Traditional Simple Question Examples

3. As a potential contrast agent for ultrasound, which of the following materials is expected to be the strongest scatterer for a fixed concentration of small (< 5 μm) particles?

   A. Encapsulated polymer
   B. Encapsulated lipid
   C. Encapsulated gas
   D. Encapsulated iodine

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

Traditional Simple Question Examples

4. Which one of the following objects will have the highest MR signal in a brain image acquired with a spin echo pulse sequence of TR=2500 ms and TE=100 ms?

   A. Gray matter
   B. White matter
   C. Lens of the eye
   D. Cerebrospinal fluid

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

Traditional Simple Question Examples

5. According to NCRP Report No. 116, what is the annual occupational equivalent dose limit for an extremity?

A. 0.5 Sv
B. 1.5 Sv
C. 5 Sv
D. 15 Sv
E. 50 Sv

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New-type Simple Questions: Multiple Correct

Multiple Correct Options

The candidate must select all of the correct options for each item:

1. An electrophysiology procedure is being performed on an interventional fluoroscopy system with a digital receptor and automatic exposure rate control. Which two steps can be used to reduce the probability of a radiation-induced skin burn? (Please select two options.)

A. Positioning the patient close to the digital detector
B. Using a higher magnification mode
C. Increasing the amount of added filtration
D. Using a lateral projection versus an anteroposterior projection

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

New-type Simple Questions: Fill-in-the-blank

Fill-in-the-blank

The candidate must type in the correct response:

1. According to MQSA regulations, the calculated average glandular dose to the ACR phantom for a single craniocaudal view must be less than _____3_____ mGy.

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

New-type Simple Questions: Point-and-click

Point-and-click

1. Point and click on the x-ray tube.

Answer: Clicking any place inside the yellow box is correct.

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New-type Simple Questions: R-type

Lead-in:

The following is a list of components of an image intensifier fluoroscopy system. The system has three magnification modes: 23 cm, 15 cm, and 12 cm. Identify the component that is the best answer for each question. Each option may be used once, more than once, or not at all.

1. Which major component of an image intensifier system has the smallest physical size?

   A. Input phosphor
   B. Photo cathode
   C. Focusing electrodes
   D. Magnetic shielding
   E. Output phosphor
   F. Charge-coupled device array (2k × 2k)
   G. Flat panel monitor (1k × 1k)

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

New-type Simple Questions: R-type

1. Which component is held at the most negative electric potential?

   A. Input phosphor
   B. Photo cathode
   C. Focusing electrodes
   D. Magnetic shielding
   E. Output phosphor
   F. Charge-coupled device array (2k × 2k)
   G. Flat panel monitor (1k × 1k)

1. Which component is used to minimize S-distortion?

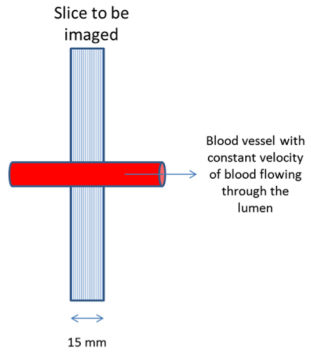
   A. Input phosphor
   B. Photo cathode
   C. Focusing electrodes
   D. Magnetic shielding
   E. Output phosphor
   F. Charge-coupled device array (2k x 2k)
   G. Flat-panel monitor (1k x 1k)

1. Which component determines the limiting spatial resolution in normal (23 cm) mode?

   A. Input phosphor
   B. Photo cathode
   C. Focusing electrodes
   D. Magnetic shielding
   E. Output phosphor
   F. Charge-coupled device array (2k × 2k)
   G. Flat panel monitor (1k × 1k)

New-type Simple Questions: Case-based Items

1. A 15-mm-thick slice is imaged using a conventional spin-echo pulse sequence with a TE of 100 ms and a TR of 2500 ms. How long after the excitation pulse is the 180 degree refocusing pulse applied?



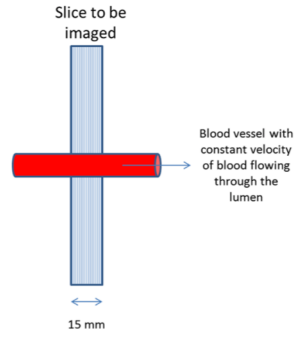
A. 50 ms
B. 100 ms
C. 500 ms
D. 1000 ms
E. 1250 ms

BLOCK: After you move to the next question, you will be unable to go back to change your answer!!

https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-diagnostic-content-guide#samples

New-type Simple Questions: Case-based Items

1. A 15-mm-thick slice is imaged using a conventional spin-echo pulse sequence. The refocusing pulse is applied at 50 ms after the excitation pulse. What is the minimum velocity of the blood in the lumen of the vessel so that a flow void is observed on the corresponding image?



A. 100 mm/s
B. 300 mm/s
C. 500 mm/s
D. 700 mm/s

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Complex Question Examples

1. For the series of repeat measurements of the output of an x-ray tube and generator for an 80-kV beam, 10 mAs at 1 m, what is the coefficient of variation?

Measurement#	Output (mR)
1	71.3
2	70.9
3	72.2
4	71.8
5	71.5

A. 70
B. 7.0
C. 0.7
D. 0.07
E. 0.007

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Complex Question Examples

1. A 5-MHz ultrasound beam is incident on a blood vessel at an angle of 45 degrees. If the blood is moving toward the transducer, and the mean velocity is 30 cm/s, what is the mean frequency shift of the reflected beam?

A. 0.7 kHz
B. 1.4 kHz
C. 2.8 kHz
D. 5.6 kHz
E. 11.2 kHz

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Complex Question Examples

1. A pencil ionization chamber has an active length of 10 cm. A CT dose measurement is made with the body CTDI phantom and the chamber is positioned appropriately. A single axial CT scan is performed at 130 kV, 120 mAs, and 5-mm slice thickness. The chamber reading is 110 mR. (Assume an f-factor of 0.9 cGy/R.) What is the CTDI for this measurement?

   A. 12 mGy
   B. 20 mGy
   C. 32 mGy
   D. 40 mGy
   E. 44 mGy

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Complex Question Examples

1. For a 1.5 T MRI system using a phase encode gradient of 2.1 mT/m, at a distance of 10 cm from the null of the phase encode gradient, what is the change in frequency of protons?

   A. 40.6 kHz
   B. 26.8 kHz
   C. 21.3 kHz
   D. 8.9 kHz
   E. 2.1 kHz

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Exam Content Guide and Scope

1) Radiography, Mammography, Fluoroscopy, and Interventional Imaging
2) Computed Tomography
3) MRI and Ultrasound
4) Informatics, image display, and image fundamentals
5) Radiation Biology, Dosimetry, Protection, and Safety

Radiography, Mammography, Fluoroscopy, and Interventional Imaging

- X-ray imaging physics
- Radiography
- Mammography
- Fluoroscopy and Interventional Radiology
- Clinical Medical Physics Practice (radiography, mammography, fluoroscopy)

Computed Tomography

- Design and Fundamentals of Operation
- Clinical protocols and procedures
- Image Quality
- Radiation Dose and Patient Safety
- Clinical Medical Physics Practice

MRI and Ultrasound

- Magnetic Resonance Imaging and Spectroscopy Basic Physics
- MR Imaging procedures and Safety considerations
- Ultrasound basic physics, interactions, production and beam properties
- Ultrasound data acquisition, image characteristics and safety
- MRI and US Clinical Medical Physics Practice

Informatics, image display, and image fundamentals

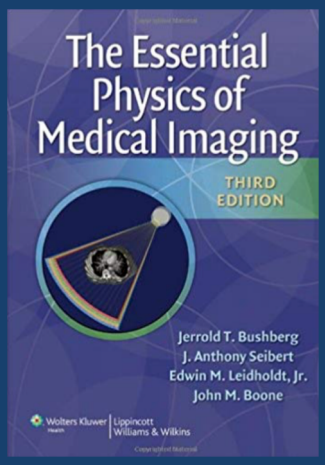
- Information Systems Design and Fundamentals of Operation
- Image Display and Workstation
- Modality Image Characteristics
- Imaging Fundamentals
- Professionalism and Ethics – Clinical Medical Physics Practice

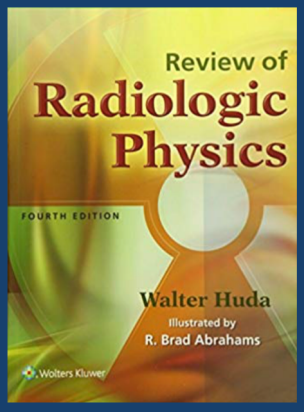
Radiation Biology, Dosimetry, Protection, and Safety

- Radiation Biology
- Dosimetry Fundamentals
- Radiation Protection
- Radiation Safety
- Room Shielding Design

Study Resources

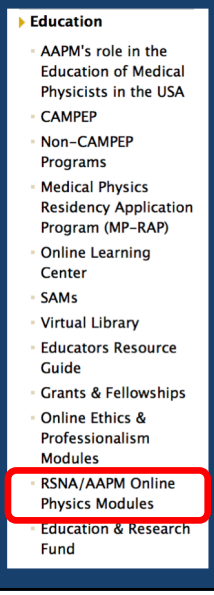
- The Essential Physics of Medical Imaging, Bushberg et al

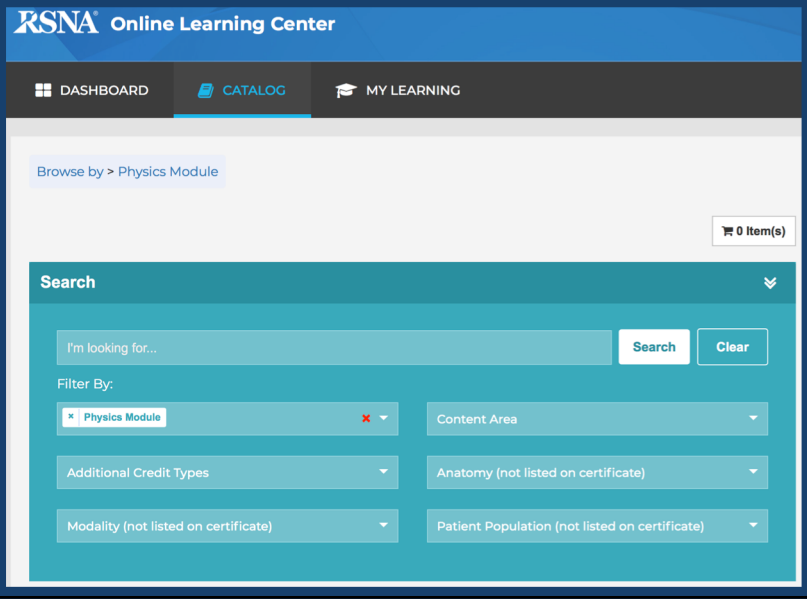




- Review of Radiologic Physics, Huda and Sloane

Study Resources: AAPM/RSNA Physics Modules





Study Resources

- ACR QC Manuals for all Modalities (Mammo, CT, MRI, Ultrasound…)
- AAPM Reports
- RAPHEX exams
- ABR sample questions
- NCRP Reports (147, …)
- BEIR IV Report
- AAPM-ACR-SIIM Technical Standards

Final Summary and Tips

- Start early! And stay calm and keep on studying.
- Hands-on experience proves the most worthwhile in retaining knowledge.
- If possible, take the AAPM diagnostic review course in advance to help identify weak areas.
- Don’t get stuck on one question for too long. Mark it for later and move on.
- Give yourself more time on longer, complex questions.
- Go through the questions at least once, even if you have to mark them and come back to them.

Thank you for your attention

and

Good Luck!!!

VANDERBILT UNIVERSITY MEDICAL CENTER

Monroe Carell Jr. Children's Hospital at Vanderbilt