

ABR Part 2 Therapy Board Exam Preparation

Surendra Prajapati, PhD, DABR
July 15th, 2019

 **Wake Forest***
Baptist Medical Center
Winston Salem, North Carolina

Disclosure

- None ☺
- Most information / facts directly from ABR website
<https://www.theabr.org/>
- Tips / suggestions are personal opinions and based on personal experience

 **Wake Forest***
Baptist Medical Center

My Path to ABR Certification

- PhD from University of Wisconsin-Madison (Part 1 in 2013)
- Residency at the UT MD Anderson Cancer Center (Part 2 in 2017)
- Currently Faculty at Wake Forest University School of Medicine (Part 3 in 2018)
- Other resources in AAPM Virtual Library:
 - Ryan Flynn, 2011:
<https://www.aapm.org/education/VL/vl.asp?id=1835>
 - Bonnie Chinsky, 2014 :
<https://www.aapm.org/education/VL/vl.asp?id=3653>
 - Susu Yan, 2018:
<https://www.aapm.org/education/VL/vl.asp?id=13171>

 **Wake Forest***
Baptist Medical Center

Basic Information

- ABR website: <https://www.theabr.org>
 - Username and password (**do you remember?**)
 - **Update email address** and other information
- Initial Certification: <https://www.theabr.org/medical-physics/initial-certification>
 - Part 1 → Part 2 → Part 3
- Part 2: Computer-based exam administered at Pearson Vue Testing Centers
- Requirements (For applications after July 1, 2013):
 - Passed Part 1
 - Completed **CAMPEP-accredited residency** by Aug 31st of the year of taking the Part 2 exam
 - If taking a year later, must provide documentation of current employment as medical physicist

Wake Forest
Baptist Medical Center

Part 2 Application Process

- Application: Usually accepted between Dec 1 - Jan 31
- Exam is specific: diagnostic, **therapeutic**, or nuclear medical physics
- You may get audited by ABR after application:
- https://www.theabr.org/wp-content/uploads/2017/06/CSD_IC_MP_2017_RandomAudit_Policy.pdf



Note: Invitation informs when registration at Pearson Vue will open and associated fees
Don't wait to register for desired location! Don't forget to pay fee at the ABR website!

Wake Forest
Baptist Medical Center

Know Your Dates and Plan Wisely

Initial Certification Exams

2019

Description	Date	Location
Medical Physics Part 1 Exam	August 5, 2019	Pearson VUE® Test Centers
Medical Physics Diagnostic, Nuclear, and Therapeutic Part 2 Exams	August 7, 2019	Pearson VUE® Test Centers

2020

Description	Date	Location
Medical Physics Part 1 Oral Exam	April 26-29, 2020	ABR Exam Center, Tucson only
Medical Physics Part 1 Exam	August 5, 2020	Pearson VUE® Test Centers
Medical Physics Diagnostic, Nuclear, and Therapeutic Part 2 Exams	August 6, 2020	Pearson VUE® Test Centers

- Part 2 is (most likely) after your residency – you may be moving!
- Plan where you want to take the exam
- Plan if you want to take a break after residency until exam time

Wake Forest
Baptist Medical Center

Part 2 Content Guide

- **Know/review** what ABR provides in exam
 - Some values may be different than what you normally remember
 - May be presented in different units than you normally see

<https://www.theabr.org/medical-physics/initial-certification/constants-physical-values>

Initial Certification for Medical Physics	
Overview	Constants and Physical Values <small>Last verified on March 26, 2019</small> <small>The ABR provides candidates with a list of constants, physical values, and related on this page. While the list includes many constants and physical values, the ABR's compilation of all constants and physical values needed on the exams. The absent</small>
Certification Requirements	
Part 1 Exam	
Part 2 Exam	

Wake Forest
Baptist Medical Center

Part 2 Content Guide (5 Main Topics)

- Reference and Relative Dosimetry
- Treatment Machines
- Therapy imaging and room design, patient safety, data transfer and integrity, [professionalism and ethics](#)
- Treatment planning for photons, electrons, SRS, SBRT, inter- and intra-fraction variations, planning system safety
- Brachytherapy, radiation protection, radiation biology
- Details at ABR website:
<https://www.theabr.org/medical-physics/initial-certification/part-2-exam/part-2-therapeutic-content-guide>

Content Guide (Question Type)

- **Simple questions:** may require a quick one-step math or just choose qualitative/concept-based answers without any calculations
- **Complex questions:** requires calculations
- **Case-based questions** → replaces few complex questions (since 2017)
 - Consist of two or more (typically three) sequentially related questions on a single topic
 - Each sub-question is a single-answer, multiple-choice question, independently scored
 - Questions linked in a one-way direction (can not go back and change answers)
- All questions are multiple-choice type questions with few exceptions
 - **Fill in the blank**
 - If answer is a number, a range of numbers may be accepted
 - **Point and Click:** A red box will appear in the image at different areas where one of them is a correct answer
 - Click within the area marked in **red**

Example: Simple Question

- In using kV cone-beam CT for image-guided radiation therapy of head and neck cancer, which of the following structures receives the largest imaging dose?

- A. Brain stem
- B. Mandible**
- C. Parotid
- D. Lens

Wake Forest
Baptist Medical Center

Example: New Question Types (Simple)

Fill-in-the-Blank

- A PMMA phantom, 20 cm thick, is exposed to an x-ray beam with an effective linear attenuation coefficient of 0.19 cm⁻¹. The fraction of the beam attenuated is _____.

(Enter a fractional number between 0 and 1, with three significant digits.)

- Answer:** $1 - e^{-(20 \times 0.19)} = 0.978$. Accepted values are 0.975 to 0.981.

Point-and-Click

The candidate must identify a region on an image:

- Which part of the internal shielding device shown in the picture below is designed to prevent backscatter?



Answer: The candidate must put the marker somewhere within area marked in red.



Wake Forest
Baptist Medical Center

Example: Complex Question

- At 1 cm distance in tissue from a 0.46-mCi permanently implanted I-125 seed, what is the total dose?

- A. 5.5 Gy
- B. 10.5 Gy
- C. 13.2 Gy**
- D. 30.5 Gy
- E. 50.0 Gy

Solution: Given Dose Rate Constant for I-125:

$0.034 \mu\text{Sv/h MBq at 1 m}$

So, $\Gamma = 0.034 \mu\text{Sv m}^2/\text{h MBq}$

Initial dose rate: $\dot{D} = \frac{\Gamma A}{d^2}$

Cumulative Dose: $D_{\text{tot}} = 1.44 \times \dot{D} \times t_{1/2}$

- An MR image is acquired with a gradient strength of 2.5 mT/m over a field of view of 25 cm and 128 frequency-encoding samples. If fat and water are shifted in an MR image by exactly 1 pixel, what is the main magnetic field strength? (Assume that the chemical shift of fat to water is 3 ppm.)

- A. 0.8 T
- B. 1.0 T
- C. 1.3 T
- D. 1.6 T**
- E. 3.0 T

Wake Forest
Baptist Medical Center

Example: Case-Based Complex Questions

- <https://www.theabr.org/medical-physics/initial-certification/new-questions-parts1-2>
- MRI resonance frequency and chemical shift concepts (3 parts, single scorable unit per question):
 - **Part 1.** An MR image is acquired with a gradient strength of 2.5 mT/m over a field of view of 25 cm during the Frequency Encode Gradient readout. What is the bandwidth of the echo?
 - **Part 2.** If the 26.6 kHz bandwidth echo is acquired with 128 samples in the frequency-encoding direction of the k-space matrix, what is the bandwidth across each pixel?
 - **Part 3.** If fat and water are shifted in the MR image by exactly 1 pixel, what is the main magnetic field strength? (Assume the chemical shift of fat to water is 3 ppm.)
- Final Answer: 1.6 T (as in last complex question)

“Before Exam” Tips: Calculator and Writing Board

- Calculators: (Now) two options
 - Texas Instruments TI-30XS calculator
 - An emulated version of the TI-30XS calculator will be available in the Pearson VUE® exam interface
- Either choose one and practice with it; or try to practice both
- Practice questions that uses calculator:
<https://www.theabr.org/medical-physics/initial-certification/calculators>
- Very easy to make mistakes when using a calculator!
- Practice with a small white board with sharpie for practicing problems
 - Ink can temporarily dry if sharpie left open; and it may take extra effort to actually start writing
 - Get used to the sharpie ink smell ☹

“Before Exam” Tips: Study Materials

- Reports, free for AAPM members via AAPM website
 - AAPM TG Reports (**TG 51, 43, 40, 142**, etc)
 - NCRP Reports # 116, 147, **151**
 - Code of Federal Regulations: 10 CFR 35, 10 CFR 20, Report: NUREG1556 Vol. 9, Rev 2
- Summary Textbooks
 - Khan's Lectures, Handbook of the Physics of Radiotherapy
 - Dieterich, Ford, Pavord and Zeng's Practical Radiation Oncology Physics: A Companion to Gunderson & Tepper's Clinical Radiation Oncology
 - Karzmark: A Primer on Theory and Operation of Linear Accelerators in Radiation Therapy
 - Huda's Review of Radiologic Physics
 - McGinley's Shielding Techniques for Radiation Oncology Facilities

“Before Exam” Tips: Study Materials

- The “heavyweight” textbooks
 - Khan's The Physics of Radiation Therapy
 - Khan's Treatment Planning in Radiation Oncology
 - Attix's Introduction to Radiological Physics and Radiation Dosimetry
 - Bushberg's The Essential Physics of Medical Imaging
 - Johns/Cunninghams' The Physics of Radiology
 - Karzmark's Medical Electron Accelerators
 - Hall's Radiobiology for the Radiologists
- Others
 - Graduate School notes, problem sets, shielding projects, Qualifying exams, etc
 - MU calculations in various books and also from dosimetry colleagues

“Before Exam” Tips: Other Resources

- That costs money ...
 - Raphex Therapy Collection Booklets from Medical Physics Publishing
<https://medicalphysics.org/SimpleCMS.php?content=booklist.php&category=raphex>
 - WePassed! : <https://wepassed.com/>
 - ABR Physics Help : <https://www.abrphysicshelp.com/>
 - ARC: Advanced Radiotherapy Consulting: <http://www.arcphysics.net/>
- Potentially free ... (requires search and collaboration)
 - Quizlet (has a repository of knowledge built by others) or can start your own or collaborate with others
 - Flash Cards / Summary notes from others who also prepared for the exam

“Before Exam” Tips: Practice, Practice and Practice

- What works best for you to study? Alone? In group? A mixture of both?
- Practice problems, writing by hand and using approved calculator
 - For each potential topic listed in ABR Content Guide
 - Start with ones you have answers for (Example from book or Raphex)
- My experience:
 - Limited and organized group study helps
 - Having 'Study Buddy' (buddies) helps
 - Also need time to study/prepare alone
 - Written 'flash cards' for "Rule of Thumb" type info and some equations
 - Example: Shielding equations
 - Review this in the last couple days before exam
- Asking each other questions (weekly sessions)

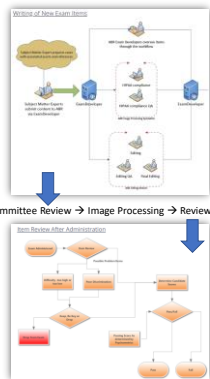
“Before Exam” Tips: Continued ...

- Start early
- **Be active in clinic:** you learn a lot from actually doing things, having discussion with experienced physicists and also being in clinical situations
- Try to **understand concepts** than just memorize certain things
 - Part 2 is not the end
 - Preparing part 2 well helps for Part 3 and your clinical career as well
- Radiation protection related values: Remember in one unit
Example: **rad vs. Gy (Sv)**
- After registration, take a sample computer-based exam in Pearson Vue website for practice

“Before Exam” Final Tips

- Old questions ? First, its **unethical / illegal** as per ABR
 - You don't really know if they are old questions (for sure)
 - You do not want to limit your studies to just “the old question collections”
 - You may waste time looking / asking for them
 - Best to **study thoroughly** than taking chance with so called “old/recall questions”
- Life cycle of ABR medical physics exam items (AAPM Newsletter Vol 45, No. 5 2018)
 - ~1179 questions at a given time to choose from
 - 60% of each exam composed of new questions
 - ~ 142 medical physicists contributing to ABR exam processes

https://w3.aapm.org/newsletter/posts/2018/sep-t-oct/4305_5.php



Tips for Exam Day and Day Before

- Eat your normal food in a normal routine!
- Get a good night sleep a day before
- Arrive early;
 - If you need to drive few hours to a different city, it may help to arrive a day before
- Remember your ID and “approved” calculator
- Leave your phone in car
 - They also have lockers at Pearson Vue Centers
- Follow instructions ... pretty easy!



Tips for Exam Time

- Don't panic if you don't know the answer. Most questions you can flag and come back to it.
 - You can not come back after you start the Case-based questions
- Time management
 - Do not spend too much time on a single question
 - Figure out how much time you have (in average) for each simple and complex questions
- Your (calculation) answer is not one of the options
 - Can the question be wrong? **Probably but unlikely**
 - Are any answers very close to the answer you got?
 - How many significant numbers did you carry on each step of the calculations?
 - Pay attention to the **UNITS and Conversions**
 - Some questions are long; don't forget to scroll to see if any tables provided
- Answer all questions but flag them if any doubt. Revisit them at the end if time permits.
 - No penalty for guessing answers



Wake Forest
Baptist Medical Center

After Exam

- Celebrate months/years of hardwork ... Chillax!
- Grab a drink (or two)
- Give your brain some rest
- Stressing now about the exam does not help
- Get another good night sleep
- Wait for the results. You will be emailed!
 - Hope you get to celebrate again!



Wake Forest
Baptist Medical Center

Part 2 Results Statistics

- Results are posted 4 - 6 weeks after the exam (contact ABR if not notified of results after 6 weeks of taking the exam)
- It is a **pass or fail** exam – no conditional pass
- Score (percentage) required to pass is not reported. This depends upon how the each questions are rated, and the review goes through a psychometric analysis

Part 2: Three-year Average Results

First-Time Takers Enrolled in a CMPPF Program			
Exam Dates	Average Percentage Failing	Average Percentage Passing	Average Total Examinees
2014 - 2015	21%	79%	140
Average pass rates for residents taking the exam for the first time: 2014-2015			
	Average Count	Average Pass Rate	
Diagnostic Radiology Core Exam	1,171	90%	
Medical Physics Part 1 Clinical Exam	444	68%	
Medical Physics Part 1 General Exam	391	62%	
Medical Physics Part 2 Exam	112	80%	
Medical Physics Part 3 (Oral) Exam	227	74%	

<https://www.abr.org/medical-physics/certification/part-2-exam/part-2-exam-results>

Wake Forest
Baptist Medical Center

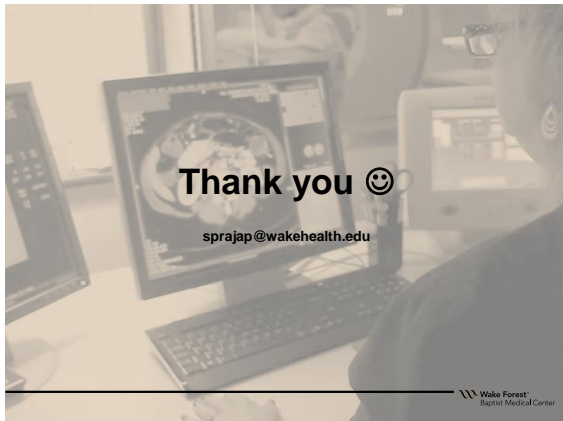
Summary

- Get updated information from the ABR website and look out for emails from the ABR
- Know your dates and plan accordingly
- Start early, and review thoroughly, and discuss periodically with others
- Learn from the clinic
- Practice!, practice!., practice!!!
- Do not panic, manage time, and ace the exam



Wake Forest
Baptist Medical Center

25



Wake Forest
Baptist Medical Center