Preparing for ABR Medical Nuclear Physics and ABSNM Exams

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Disclosures

Recently completed ABSNM - Physics and Instrumentation (2016) and ABR Medical Nuclear Physics (MNP) (2017)

Item-writer for ABR OLA MOC Diagnostic committee

No specific knowledge of test items

ABR - Obtaining a Second Certificate

For a first certificate in MNP, process is similar to Diagnostic, but requires MNP residency.

For those with an existing certificate, Part 2 requires equivalent of at least **one year of clinical experience in MNP** obtained AFTER diplomate is fully certified in previous discipline.

Experience must be attested to by someone with ABR, ABMP, ABSNM Nuclear Medicine certification.

Once approved, candidate has six years to complete process, Part 2 must be taken within four years of approval. If either of the preceding requirements aren't met, candidate must complete a year of clinical experience at an institution that has a CAMPEP-accredited residency.

Beginning in 2019, the clinical experience must be PROSPECTIVE. Diplomate and supervisor must submit plan prior to initiation of clinical experience. More details to be published in 2017.

Applications accepted between Dec 1 and Jan 31.

ABR Part 2 Content Guide

CONTENT GUIDE

1. **Radiation Protection, Safety, Professionalism, and Ethics**
   - Internal dosimetry
   - Dose terminology and Definitions
   - Dose Regulations
   - Expected doses
   - Fetal Dosimetry
   - CT dosimetry
   - Occupational safety
   - Safety for the patient, family and public
   - Time, distance shielding
   - Shielding calculations
   - Professionalism and Ethics

2. **PET & Hybrid**
   - Basic PET scanner Instrumentation
   - Radionuclide production and characteristics
   - PET Detectors
   - Acquisition
   - Reconstruction
   - Corrections (Attenuation, random, scatter)
   - Quantitative PET
   - PET/CT
   - QC procedures
   - Acceptance/Annual testing

3. **Single photon imaging systems including scintillation cameras, solid state cameras and hybrids**
   - Basic system instrumentation
   - Radionuclide production and characteristics
   - Intrinsic Specifications
   - Extrinsic Specifications
   - Collimation
   - Digital Systems
   - Dynamic imaging
   - SPECT
   - SPECT/CT
   - QC procedures
   - Acceptance/Annual testing

4. **Radiation measurements including dose calibrators, well counters, survey meters, thyroid probes**
   - Scintillation detector system
   - Solid State Detectors
   - Well Counters and Probes
   - Survey Meters
   - Dose Calibrator
   - Dead-time
   - Efficiency
   - Operation of SCA, MCA
   - Statistical distributions
   - Statistical Tests
   - Propagation of Errors
   - Digital Image Statistics
   - Chi-Square Tests
   - Minimum detectable activity
   - Quantitative measurements including calibration
   - Quality Control

5. **Clinical Procedures**
   - Cardiac
   - Pulmonary
   - Tumor Imaging
   - Bone Imaging
   - Brain
   - Endocrine (Thyroid)
   - Lymphatic
   - Radionuclide therapy
   - Brachytherapy
   - Other

ABR Part 3 Content Guide

NMP	Category Description
Radiation protection	• Internal dosimetry, including MIRD (formalism), fetal dose, units; • Personnel safety, including facility surveys and occupational dose limites, radiation protection principals, personnel dosimetry; • Safety for the patient, family and public (including exposure pathways, breastfeeding, and pregnancy); • Shielding including facility design and personnel protection; • Regulations and regulatory bodies including medical event assessment, shipping and waste disposal, ALARA, time, distance and shielding, radiation surveys
PET and hybrids	• Radionuclide production and characteristics; • QC procedures including ACR/TJC/NEMA and acceptance testing, artifacts; • System principles, image fusion, random coincidences, scattered radiation, dead-time; • Quantitative PET including SUV; • Image reconstruction including attenuation correction, iterative reconstruction, filtered back projection
Single photon imaging systems including scintillation cameras, solid state cameras, and hybrids	• Radionuclide production and characteristics for SPECT and planar imaging; • QC procedures including ACR/TJC/NEMA and acceptance testing, artifacts; • System principles including scintillation cameras, solid state cameras, collimators, image fusion, system characteristics; • Dynamic imaging, renograms, cardiac function, ejection fraction, tracer kinetics, lung shunt fraction; • Image reconstruction including scanograms, attenuation correction, filters, edge enhancement, smoothing, unsharp masking, segmentation
Radiation measurements including dose calibrators, well counters, survey meters, thyroid probes	• Radioactivity measurement including dose calibrators, well counters, thyroid uptake probe, survey meters; • Statistics, minimum detectable activity; • Radiation detectors including survey meters, dead-time, personnel monitoring; • Quantitative measurements including calibration; • QC procedures including use of chi square, energy resolution, counting efficiency, geometry, linearity accuracy
Clinical procedures	• Radionuclide therapy including facilities, release criteria, radionuclide production; • PET & hybrids; • SPECT & hybrids including gamma cameras; • Radiation dosimetry including risk, radiation protection, and CT dose; • Radiopharmaceutical usage, thyroid imaging/uptake, informatics, display performance; misc.

ABSNM Overview

Offered annually on the Saturday before the start of the SNMMI annual meeting

Four different subspecialty exams:

-**Nuclear Medicine Physics and Instrumentation**

-Radiopharmaceutical Science

-Radiation Protection

-Molecular Imaging

1. *Nuclear Medicine Physics and Instrumentation*. This examination includes in-depth materials on atomic and nuclear physics, radioactivity measurement, imaging, basic image data processing, statistical analysis, quality control, radiation dose estimation, mathematical modeling, principles of imaging and radioactivity detection and instrumentation, instrument design, health physics and radiation protection and clinical diagnostic nuclear medicine physics.

ABSNM - Required Credentials

Requirements for Physics and Instrumentation:

-MS or PhD in physics, medical physics, engineering, applied math, or other physical sciences

-Two or three years experience (PhD / MS) of full-time practical training and/or supervised experience in medical physics either by medical physicist certified by an NRC recognized specialty board or a physician AU meeting requirements for imaging and localization studies and unsealed byproduct material requiring a written directive (10 CFR 35.290 and 390)

-Letter documenting the experience

-Does not require letter from someone who has taken ABSNM

ABR - Exam Format and Day of

Same as ABR Diagnostic Parts 2 and 3

ABSNM - Exam Day Of

Administered in hotel conference room.

Scantron format, two examinees per table.

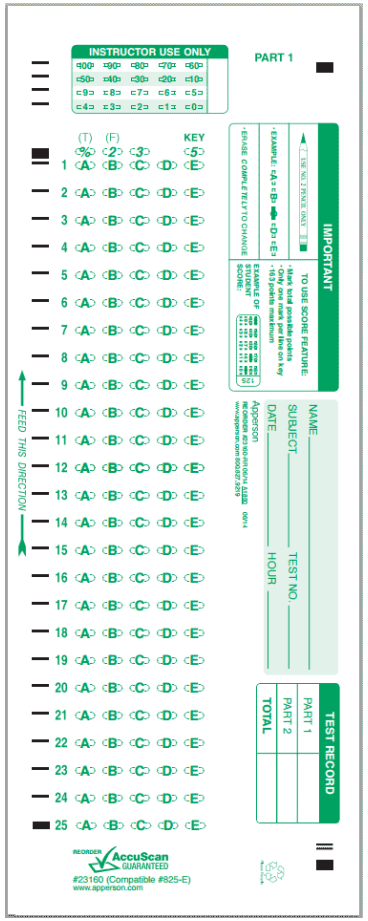
Coffee and water available.

Bring your own calculator – it must be approved by examiners

Part 1: General Examination – Morning. 3 hours. 180 Questions.

One or one and a half hour break for lunch.

Part 2: Specialty Examination – Afternoon. 2.5 hours. 100 Questions.

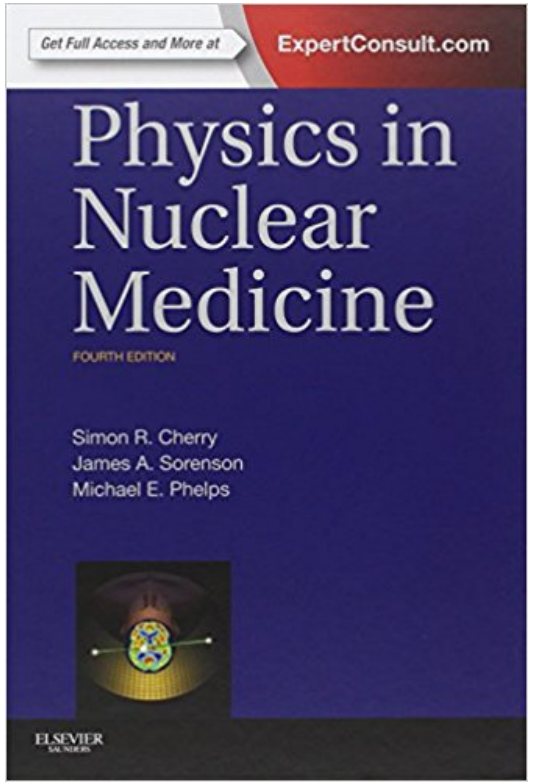


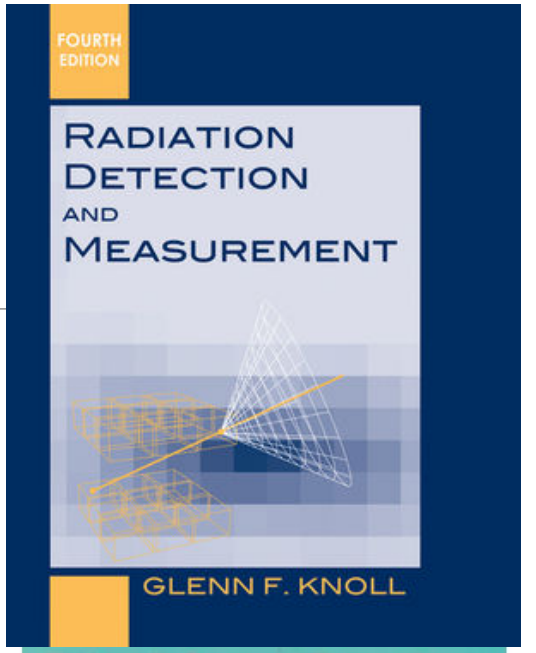
Recommended Study Materials

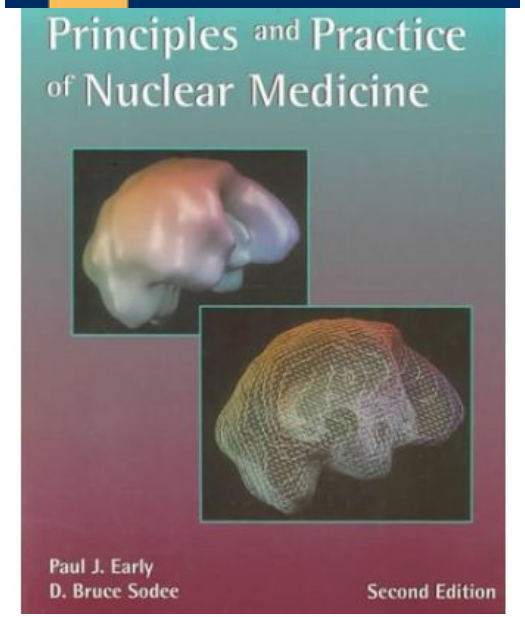
-Cherry, Sorensen, and Phelps, *Physics in Nuclear Medicine*, know this. All of this. This is the Bushberg equivalent for MNP.

-Knoll *Radiation Detection and Measurement* recommended for counting statistics, error propagation, and electronic circuits.

-Early and Sodee, *Principles and Practice of Nuclear Medicine*, recommended for clinical chapters, especially bone, thyroid, and cardiovascular.





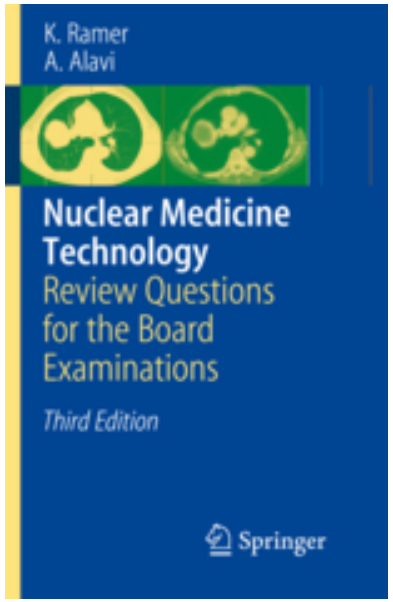


Recommended Study Materials

ABSNM has more clinical breadth and depth than ABR MNP

-Steves, *Review of Nuclear Medicine Technology,* designed for NM techs, this is useful for radipharmacuetical knowledge, clinical images, etc.

-Ramer and Alavi, *Nuclear Medicine Technology: Review Questions for the Board Examinations*, this is a pocket reference full of NM tech-type board exam questions.



Study Tips

Both these exams are hard! Do you regularly work in Nuclear Medicine? If not, then these exams will be REALLY hard.

I spent 80 -100 hours over 3-4 months studying for ABSNM and MNP Part 2 – I took them both the same summer.

NM exams have less study material online than diagnostic or therapy exams. Find a study buddy and share study guides and outlines. Create practice problems for written or oral exams and quiz each other.

Know common statistical formulas: standard deviation, chi-squared, MDA, etc.

Develop qualitative understanding of reconstruction methods: how the different parameters affect reconstruction for both filtered back projection and iterative techniques.

Know order of magnitude performance characteristics (sensitivity, resolution, dead-time, etc) for common imaging modalities.

ABR Study Tips

For ABR Part 2 work all the problems you can – ABR sample problems, CSP and Knoll's problems and examples, etc. If you're like me, you've been out of school a few years and your math will be rusty.

Know what's on the ABR list of constants for Part 2 and don't memorize those (although maybe do for ABSNM).

For Part 3, practice talking through answers to imaginary questions. Look at a clinical image – describe the image, how it was acquired, what the exam is for, etc.

ABSNM Study Tips

For 20 most common NM procedures know:

-Clinical indications

-Radionuclides and tracer

-Biologic pathways

-Standard image acquisition techniques and appearances

There may be questions on procedures no longer regularly performed at many sites: Thallium heart studies, first-pass cardiac studies, etc.

Some quantitative problems, but fewer and a lower degree of difficulty than ABR.

ABR Part 2 Sample Questions - Simple

Simple Questions

1. How are ^{201}Tl and ^{123}I produced?

A. In fission by-products
B. In particle accelerators
C. In radionuclide generators
D. In neutron activation

2. A spatial resolution measurement of a SPECT system is performed using line sources of ^{99m}Tc according to the NEMA protocol. If the spatial resolution (FWHM) is 10.5 mm in the center of the phantom, what is the peripheral tangential spatial resolution (FWHM) at 7.5 cm from the center of the phantom?

A.8 mm
B.12 mm
C.14 mm
D.16 mm

3. What is the effect of increasing an image matrix from 128 x 128 to 256 x 256?

A. Improved contrast
B. Improved resolution
C. Improved signal-to-noise ratio
D. Decreased noise

4. If the minimum, mean, and maximum pixel counts in the central field of view of a smoothed intrinsic flood image are 4500, 5200, and 5500, respectively, what is the integral uniformity?

A. 5%
B. 6%
C. 10%
D. 14%
E. 15%

5. In a gate-synchronized ventricular function study, the color-coded phase image shows a group of pixels in the apex of the left ventricle displayed in the hue assigned to the atria. What is the most likely explanation for this observation?

A. Global left ventricular hypokinesis
B. Valvular insufficiency
C. Malfunctioning software
D. Cardiac arrhythmia
E. Apical dyskinesis

ABR Part 2 Sample Questions - Complex

1. A ^{99m}Tc radioactive tracer is removed from the kidneys by three pathways: 1) absorption in the blood at 50% every 3 hours; 2) excretion to the bladder at 50% every 2 hours; and 3) physical decay. How long is the effective half-time of the radioactive tracer in the kidney?

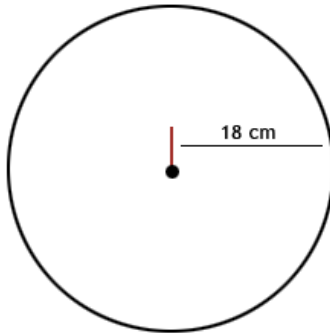
A. 1 hour
B. 2 hours
C. 4 hours
D. 6 hours
E. 11 hours

2. A generator is eluted and yields 300 mCi of ^{99m}Tc. For clinical studies to be done up to 6 hours after elution, what is the maximum acceptable number of microcuries of ^{99}Mo allowable at the time of elution?

A. 5.6 µCi
B. 12 µCi
C. 24 µCi
D. 30 µCi
E. 45 µCi

3. If annihilation radiation originates in the center of the water-filled phantom diagrammed below, what will be the PET attenuation correction factor? (μ = 0.096 cm -1)

A. 15.9
B. 24.1
C. 31.7
D. 40.3
E. 48.5



4. A χ^2 test is performed with a sample size of 10, using a long-lived source. The following results are obtained:

Standard Deviation = 205.5
Mean = 3752.6

What is the χ^2 value?

A. 14.3
B. 101
C. 205
D. 3753
E. 42,256

ABR Part 2 Sample Questions – New Item Types

Multiple Correct Options

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

1. According to AAPM Report No. 181, what are the three required QC tests on a dose calibrator? (Please select three options.)

   A. Constancy
   B. Geometric calibration
   C. Uniformity
   D. Linearity
   E. Accuracy
   F. Chi-square

Answer: A, D, and E

Fill in the Blank

The candidate must type in the correct response:

1. If the field of view of a scintillation camera is 20 cm and the matrix is 128 × 128, what is the pixel size of the image? _____ mm (Round to two decimal places.)

Answer: 1.56, (1.54, 1.55, 1.56, 1.57, and 1.58 will also be accepted.)

R-Type

Lead-in:
For each question, choose the correct radiopharmaceutical from the drop-down list. Each option can be used once, more than once, or not at all. Please advance to the next screen.

A. ^{111}In leukocytes
B. ^{111}In pentetate (DTPA)
C. ^{123}I ioflupane
D. ^{123}I NaI
E. ^{99m}Tc MAA
F. ^{99m}Tc MDP
G. ^{99m}Tc sestamibi

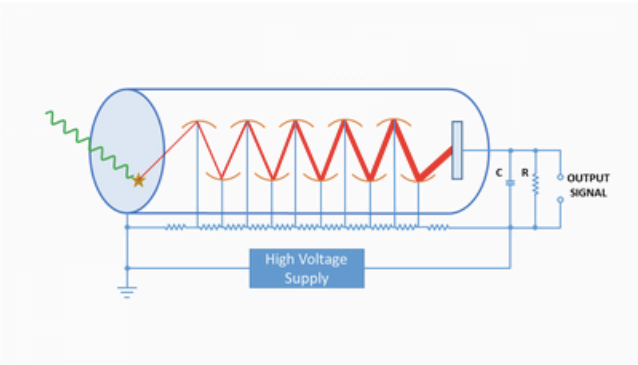
1. This radiopharmaceutical is used primarily for the diagnosis of infection.
2. This radiopharmaceutical is used primarily for the diagnosis of thyroid function.
3. This radiopharmaceutical is used primarily for the diagnosis of pulmonary embolism.

Answer:

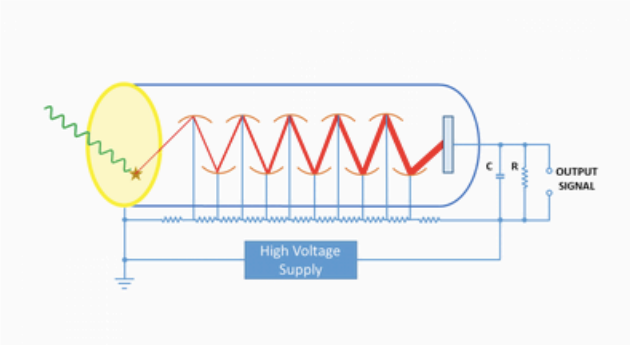
1. A
2. D
3. E

Point-and-Click

1. The figure shows a common device employed in nuclear radiology instrumentation. Point and click on the cathode.



Answer: The candidate can click anywhere within the yellow oval.



ABR – Maintenance of Certification

Same as MOC for Diagnostic

Note that diplomates with multiple certificates will have twice as many OLA MOC questions!

ABSNM - Maintenance of Certification

100 Category 1 Continuing Education Credits every 4 years (25 CEs per year). 70% must be in diplomat's primary specialty.

$75 annual MOC fee

Initial certification renewed every four years for four year term based on recertification application

Thanks!

Special thanks to Dustin Gress for ABSNM preparation recommendations