

This handbook provides important information for persons planning to take ARRT-administered state licensing examinations for purposes of state credentialing in Radiography, Nuclear Medicine Technology, Radiation Therapy or a postprimary discipline.

EXAMINATION HANDBOOK

*for State Licensing Exams
administered by ARRT in*

2022

Policies, procedures, and information in this handbook supersede previous editions.

Please review this information carefully; you are responsible for understanding the contents of this handbook. Direct questions and/or correspondence to the state agency with which you applied for licensing.

NOTE: *This handbook will no longer be mailed as of January 1, 2023.
Handbooks can be accessed at www.state.rrt.org.*

Important Notice: State Licensing is Not ARRT Credentialing

A passing score on a state licensing examination does not make an individual eligible for ARRT certification and registration. Individuals seeking ARRT certification and registration must have submitted an application directly to ARRT and must have met all other criteria for ARRT certification and registration. Those seeking only state licensing must meet criteria established by the state. Test scores earned as a state candidate may not be used for ARRT certification and registration, however the attempt will count towards the three-attempt, three-year policy for a future exam as an ARRT certification and registration candidate.

How to Use This Handbook

▼ **Licensing vs. ● Certification and Registration**

The information contained in this handbook pertains to state licensing only.

*This exam, its eligibility and application process bear **no relation** in any way to national credentialing in radiologic technology offered by ARRT.*

This Examination Handbook is designed to help state licensing candidates understand and prepare for the examination. It is published for each calendar year, but changes to content specifications and policies and procedures may occur during the year so be sure to check www.state.arrt.org for updates. To ensure that your exam experience is as successful as possible, you will want to read the following information very carefully and keep the handbook for future reference.

The information in this handbook supersedes that in any prior publications of the ARRT. Earlier versions may contain outdated information. It is your responsibility to obtain a handbook corresponding to the year in which your examination is to be taken, as noted on the front cover of the handbook; and to familiarize yourself with the contents.

ARRT does not discriminate against individuals on the basis of their race, color, creed, religion, national origin, sex, marital status, status with regard to public assistance, familial status, disability, sexual orientation, gender identity, veteran status, age, or any other legally protected basis.

ARRT is unable to respond to questions regarding individual state licensing requirements and application procedures. Direct your questions to your state licensing agency. A link to individual state licensing agency contact information can be found at www.state.arrt.org.

Watch for These Symbols



This exclamation point is your pointer to key pieces of information you need to know.



This icon tips you to ways you can streamline your journey through the examination process.

NCCA Accreditation

ARRT's Radiography, Nuclear Medicine Technology, Radiation Therapy, Sonography, Computed Tomography and Registered Radiologist Assistant certification programs have earned accreditation by the National Commission for Certifying Agencies (NCCA), the accrediting body of the Institute for Credentialing Excellence (ICE).

To receive NCCA accreditation, ARRT demonstrated that this certification program met strict standards in accordance with ICE's mission to promote excellence in competency assurance for practitioners in all occupations and professions.

For more information on ICE/NCCA and their accreditation programs, visit www.credentialingexcellence.org.

NOTE: 2022 will be the last year the handbook will be printed. Beginning 2023, the handbook will be online only at www.state.arrt.org.

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2022 Examination Handbook for State Licensing Candidates

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State Licensing vs. ARRT Credentialing

Examinations for radiologic technologist state licensing are administered by The American Registry of Radiologic Technologists® on behalf of your state licensing agency, but state licensing is *not* ARRT credentialing.

▼ Exam Fees

● Fees paid to the ARRT are not refundable under any circumstances, nor can they be transferred to another discipline of examination.

Upholding Exam Security

ARRT has strict security regulations and takes exam security seriously. ARRT prohibits you from cheating on your exam or taking action that would help another candidate cheat. If you violate the regulations, you can face legal action and/or risk being banned from future testing.

Certification and Registration vs. State-Related Licensing

More than 75 percent of the states have licensing laws covering the practice of radiologic technology. In those states, you must obtain a state license before you can work as a radiologic technologist. In addition, many states use ARRT exam scores and/or credentials when making licensing decisions.

Terminology used in establishing the authority of a technologist is often confusing.

ARRT uses the term “certification and registration” when an individual satisfies all eligibility requirements — which include ethics, education and examination. If you wish to become certified and registered with ARRT, you need to submit an application directly to ARRT. Submitting an application to an individual state licensing agency does not make you eligible for ARRT certification and registration.

Although you may have earned your ARRT credential, this does not automatically mean that you are eligible to work in your state. Most states have their own application policies and procedures that you must meet in order to work in the state. Verify with the state licensing agency in the state where you plan to work to make sure you meet their eligibility requirements.

Exam scores earned as a state candidate may not be used for later application to ARRT for certification and registration; however, if you attempt to pass an exam as a state licensing candidate it will be counted as an attempt for purposes of ARRT’s three-attempt, three-year limit for certification and registration (see page 16 for details).

Why Does Security Matter So Much?

It’s a matter of public health.

Security is critical to ensuring that the examination is an accurate and reliable measure of the critical knowledge and cognitive skills underlying the tasks typically required for the practice of medical imaging, interventional procedures, and radiation therapy. In fact, subverting the integrity of ARRT’s exams is illegal, based on a Minnesota law that went into effect August 1, 2010. More information can be found by visiting www.state.arrt.org.

Ask yourself: Would you want a loved one to receive care from an individual who passed the ARRT-administered exam because they got a sneak peek at questions and memorized the answers rather than having learned all the critical content that the questions scientifically sample?



Candidate Agreement On



Exam Disclosure

Disclosing exam information using language that is substantially similar to that used in questions and/or answers on the ARRT exams is considered an attempt to subvert the integrity of the exam when such information is gained as a direct result of having been a candidate. This includes (but is not limited to) disclosures to: students in educational programs, graduates of educational programs, educators or anyone else involved in the preparation of candidates to sit for the exam. It is also considered an attempt to subvert the integrity of the exam to receive, from an exam candidate, exam information that uses language that is substantially similar to that used in questions and/or answers on the ARRT exam, whether requested or not, or to relay such information.

Disclosing Exam Information: The Bright Line Between What's OK and What's Not

Candidates for state licensing and/or permit examinations see language in the ARRT state licensing examination handbooks, as well as the non-disclosure screens at the test center that clarify what they are agreeing to comply with regarding exam security. This language is reproduced in the box on page 15.

Failing to comply with these agreements can result in an ARRT investigation which may lead up to the invalidation of the results of the current and any prior examinations. This could also permanently bar the candidate from all future exams as well as result in the appropriate state licensing agency being notified. Violating these agreements could also lead to legal action. Appendix E has a list of potential exam disclosure scenarios.



Help Us Protect



Exam Security

If you know of any situations in which the security of ARRT exam materials might be compromised, we invite you to visit www.arrt.org.

If you have any questions about your responsibilities under ARRT's exam disclosure policy, visit www.state.arrt.org.

A video depicting the consequences of violating this policy is available at www.arrt.org/video-library.

Before the Examination

Schedule an appointment to test during your assigned 90-day window, at any of hundreds of test centers across the U.S. and internationally.



Status Report



Info Incorrect?

If the information on your State Candidate Status Report is incorrect, contact your state licensing agency — not ARRT — right away, and before trying to schedule an exam appointment.

Processes for Examination

Application to State:

Before paying ARRT for your examination, you must submit your license and/or permit application and any appropriate application fees directly to your state licensing agency. If your state licensing agency determines you're eligible for examination, they will notify you. The notification you receive from your state licensing agency should provide you with instructions for paying your examination fee to ARRT. ARRT will accept payment by credit card only. It is important to note that the examination fee paid to ARRT is different than the application fee you submit to your state licensing agency.

Create an Account at www.state.arrt.org:

After receiving notification from your state licensing agency that you are eligible to sit for an examination, ARRT requires that you create an online account at www.state.arrt.org. Third-party individuals, schools, or businesses will not be allowed to create the online account for you. Before paying your examination fee, you will be required to read and respond to:

- An *Agreement of State Candidates* which is your attestation to not divulge or receive examination information that uses language that is substantially similar to that used in questions and/or answers on ARRT examinations; and
- Electronically indicate yes or no regarding your potential need and consideration for testing accommodations based on the Americans with Disabilities Act (ADA) guidelines. (See page 6 for further details)

After responding to these questions, you will be directed to pay your examination fee. You are responsible for making sure your state licensing agency submitted your correct name and address, as well as correct examination discipline. This information will appear after you create your online account as well as appearing on the payment page for you to verify before submitting your fee. If any of the information appearing on your online account is incorrect, please notify your state licensing agency immediately and **before** paying your examination fee. Do not make your examination payment until your information has been corrected by your state licensing agency. All updates by your state licensing agency will automatically appear on your online account. Once you confirm any necessary updates have been completed, you can go online to pay for your examination. After making your online credit card payment, you will not be able to change the state-assigned examination. Examination fees are nonrefundable and non-transferrable.

After ARRT processes your examination fee, your information will be sent to Pearson VUE. You will also receive an examination handbook and a Candidate Status Report (CSR) via USPS mail, which has your personal ARRT ID#. Your CSR will also be available on your online account. Once you review your CSR and determine everything is correct, you can contact Pearson VUE to schedule your examination appointment. (See page 8 for more details.)

One Exam

at a Time

You may apply for one exam at a time. That means if you're planning to take a state exam (administered by ARRT) and an ARRT exam, you must choose which one to take first. If you choose to take your state exam first, your application and fee for an ARRT certification exam will be held and not processed until you complete your state exam. Similarly, if you have been assigned an exam window for an ARRT certification exam, your fee for your state exam will be returned to you. Once you complete your ARRT exam, you can re-submit your fee for your state licensing exam.

ARRT 90-Day Examination Window

ARRT will assign you a 90-day exam window, appearing on your CSR. You should schedule your exam appointment for a date within the 90-day exam window printed on your CSR. Generally, examination windows begin on the Wednesday after your application is processed at the ARRT and extend for 90 calendar days. For example, if an exam payment is processed on Thursday, April 14, 2022, the examination window will begin on Wednesday, April 20, 2022, and ends on Monday, July 18, 2022.

Your exam window will close automatically after 90 days, or if you miss your appointment, your appointment is not canceled in time, if you fail to comply with the non-disclosure agreement at the test center (see page 15), the name on your IDs do not match the name on your CSR, or you have an invalid ID. To open a new exam window, you would have to re-apply through your state licensing agency.

Test Centers

ARRT examinations are administered by Pearson VUE, the electronic testing business of Pearson Education. Their network of more than 200 high-security test centers is specifically designed and built for professional licensure and certification markets in the U.S. and its territories. Certain international test centers are equipped to deliver ARRT exams in selected cities in Canada, Europe, Asia, and Australia. Current test center locations and driving directions may be viewed at www.pearsonvue.com/arrt.

Testing Accommodations

To comply with the Americans With Disabilities Act (ADA), we'll provide testing accommodations if our partner organization, Paradigm Testing, determines that you meet ADA requirements. Testing accommodations include any changes to standard testing procedures, including requests for additional time, a reader, as well as medical aids such as insulin pumps, Pico magnifiers, lumbar pillows, asthma inhalers, etc.

After logging into your online account at www.state.arrt.org, and before paying your examination fee, you will see a question asking if you wish to be considered for testing accommodations. If you respond with "yes," you will be provided with instructions for submitting an online application and supporting documents to Paradigm via its secure website. You must indicate "yes" each time you apply – including re-examination attempts. If you indicate "no," you cannot request accommodations at a later time.

We'll place your examination authorization on hold until you submit your accommodation request and Paradigm processes it. In addition, you won't be able to schedule your exam until we send you a decision letter based on Paradigm's review of your documentation. If you're denied an accommodation based on your documentation, you'll be able to appeal the decision by providing additional documentation. It is in your best interest to submit as much supporting documentation as possible with your original request to avoid delays in having your examination authorization released to allow scheduling your exam appointment. Details on supporting documentation requirements can be found at www.arrt.org/accommodations. Most accommodations decisions are made within 10 business days.

If you don't submit a request to Paradigm within a year of submitting your application, we'll process your exam authorization without accommodations and assign you an exam window. You will be notified your application has been processed and an exam window has been assigned. At that point, we can't grant any accommodations.

Address or Name Changes

You must immediately notify your state licensing agency — not ARRT — of any changes to your name or address as submitted on your application form. Changes cannot be processed by ARRT or the Pearson VUE Call Center, or at the test center.

At the test center, the name on your IDs must match your name as it appears on your CSR (the only permissible exception is middle initial versus middle name, as long as the first letters match). Name change requests must be directed to your state licensing agency at least 10 business days before your scheduled appointment to allow enough time for your information to be submitted to Pearson VUE for processing. Requests received less than 10 business days before your exam may not be processed in time, which may result in you being turned away from the test center and forfeiting your fee. If the name on your IDs doesn't match your CSR, cancel your appointment (see page 9) and correct the discrepancy with your state licensing agency. Don't schedule a new appointment until you receive a new CSR and verify the changes are correct. Updates will also appear on your online CSR at www.state.arrt.org.

Extending an Exam Window

If circumstances make it impossible for you to schedule your examination during your assigned 90-day exam window, you may request a window extension. Direct requests to your state licensing agency for approval. If your state approves the change, it will contact ARRT to arrange a window extension. ARRT processes window extension requests only when they are received from your state licensing agency, not from you.

If you have an existing appointment, you must cancel it before requesting a window extension, scheduling a new exam date, or changing the test center location. (See "Canceling or Rescheduling Your Appointment" on page 9.)

ARRT must receive a written request from your state — not from you — for a new window on or before the last day of your current 90-day examination window. If your window expires on a weekend or holiday, the request must be received on or before the last business day prior to the expiration date. (Saturday, Sunday and holidays are not considered ARRT business days.) Your new exam window will begin on the day ARRT processes the extension request. ARRT will not accept requests for specific window dates.

ARRT cannot process requests it receives after the last day of your current 90-day exam window or if an examination appointment has been scheduled. ARRT will send you a new CSR when your request is processed. You can also check your online CSR for updates at www.state.arrt.org.

Name/Address Change?

Notify the State

You should notify your state licensing agency (not ARRT) immediately of any name and/or address changes and before scheduling an examination appointment.

TIP

Window Extensions: Maximum of Three Changes

If approved by your state licensing agency, you will be allowed a maximum of three window changes per exam application. If a third window change is allowed to expire, you forfeit your exam fee. To be considered for a new exam window, you must make your request to your state licensing agency.

The Exam Appointment

Scheduling Your Appointment

Pearson VUE schedules appointments on a first-come, first-served basis. As soon as you receive your CSR, you may schedule your appointment by:

- calling the Pearson VUE Call Center at the toll-free phone number shown on your CSR (Monday–Friday, 7 a.m.–7 p.m. Central Time); or
- online at www.pearsonvue.com/arrt (see tip at left for details).

TIP

Internet Scheduling

After you have been notified of your eligibility to sit for the exam, you may schedule online at www.pearsonvue.com/arrt. When you arrive at the web page, the process will differ depending on if you're a first-time or returning user.

First-time users should click on the "Create an Account" link, where you will be asked for your ID number and personal information listed on your Candidate Status Report. Make sure the information you enter on the screen matches the information on the front of your CSR. When creating your profile, follow the prompts until you have completed the process and can select the "Finish" link. You will be provided a link to follow the prompts for scheduling your exam.

Returning users should click on the "Sign In" link. If you have forgotten your password, click on the "Forgot my Password" link and follow the prompts.

To schedule online, candidates must provide an email address. Otherwise, phone the Pearson VUE Call Center directly to schedule an appointment.

Even if you don't want to take your exam immediately, it's better to schedule early to obtain your desired choice of exam date. If you delay too long in scheduling your examination, you may not find an available appointment prior to your expiration date. If your window is allowed to expire, you must re-apply with your state licensing agency.

You will be providing and receiving a great deal of important information when scheduling your appointment with Pearson VUE. It is your responsibility to manage that information each step along the way.

Have Your Information Available

You cannot schedule a testing appointment until you receive your CSR. You will be able to select a test center from those listed on the Pearson VUE website.

When calling to schedule your appointment, you will be asked to verify your name as listed on your CSR and address and to provide your ID number from your CSR. Calls may be recorded for quality assurance purposes.

Pearson VUE Call Center staff will help you schedule a date and time for your exam. Test centers are generally open Monday through Friday between the hours of 8 a.m. and 6 p.m. Some test centers offer extended evening or weekend hours.

NOTE: Call Center staff cannot make changes (except adding email and phone info) to the application information you provided to your state and to ARRT. Resolve any discrepancies in name or address with your state licensing agency before you schedule your appointment.

Confirm Your Scheduling Information

After scheduling your appointment, Pearson VUE will immediately email a letter confirming your appointment. The letter will include the address, phone number, and directions to the test center, as well as the date and time of your exam and other important information. Driving directions are also available at www.pearsonvue.com/arrt.

NOTE: Occasionally the email confirmation may be filtered into a SPAM folder based on the security settings of your email account. Be aware that the email confirmation comes from PearsonVUEconfirmation@pearson.com. If you do not receive an email confirmation from VUE immediately, check your filter settings and/or contact the VUE Call Center to confirm your email address on file and your appointment date and time, and request that a new confirmation email be sent.

ARRT and your state licensing agency are not able to confirm testing dates, times, or locations for your exam, nor can we provide driving directions to test centers.

Missing Your Appointment

If you fail to keep your appointment or reschedule it as detailed in the next section, your file will close, and you will forfeit your exam fee. ARRT and your state licensing agency are not responsible for appointment time discrepancies between you and the test center.

Canceling or Rescheduling Your Appointment

You may cancel or reschedule an appointment up to 24 hours (one business day) prior to the scheduled appointment — either by phoning (800) 632-9055 (leaving a voicemail on an answering machine is not acceptable) or by visiting www.pearsonvue.com/arrt (be sure to follow the prompts to complete the process). Pearson VUE will immediately send you an email confirmation each time an appointment is scheduled, changed, or canceled. If you do not receive a confirmation, contact Pearson VUE the next day to confirm the transaction. Pearson VUE charges a \$10 fee for exam appointments that are canceled or rescheduled. Pearson VUE will collect fees by credit card payment (American Express, MasterCard, Visa or Discover) at the time the appointment is canceled or rescheduled. This includes all changes made online or via the Pearson VUE Call Center.

The table below shows that appointments for a given time on the scheduled exam day must be canceled by that same time on the preceding business day:

Exception

Due to call center hours, if your appointment is in a time zone ahead of Central (i.e., Eastern or further east), you must cancel any 8 a.m. appointment by 7 p.m. CT two days in advance.

Scheduled Exam Day	Cancel/Change Deadline (same time as appointment)
Monday	Friday of the preceding week
Tuesday	Monday of the same week
Wednesday	Tuesday of the same week
Thursday	Wednesday of the same week
Friday	Thursday of the same week
Saturday	Friday of the same week

For example, if your exam is scheduled for 9 a.m. on Monday, you must call by 9 a.m. on Friday to cancel. VUE will follow-up with a confirmation email detailing your cancellation or appointment change information.

NOTE: National holidays and weekends are not considered business days.

If you fail to appear for your scheduled appointment and do not reschedule through the procedure above, you will forfeit your examination fee. Neither ARRT, nor your state licensing agency are responsible for appointment errors.

ARRT does not grant exceptions for missed appointments under any circumstances.

Follow-Up and Confirm

Your Exam Appointment

You are responsible for confirming the date, time, and location of your exam with Pearson VUE. If you don't receive an email confirmation immediately after scheduling, call the Pearson VUE Call Center to confirm over the phone and request that a duplicate confirmation letter be sent.

This applies to appointments scheduled via the Call Center as well as those scheduled on the Pearson VUE website.

TIP

Calling to Reschedule? Remember to Cancel

Just because you call to reschedule a testing appointment doesn't necessarily mean that your initial appointment is automatically canceled. And an uncanceled appointment is your responsibility, potentially resulting in forfeiting the application fee.

If you call Pearson VUE intending to reschedule a testing appointment, your initial appointment will remain in effect until you formally approve a new appointment date/time. If you can't find an appropriate alternative appointment and plan to call back later, your initial appointment will still be on the books.

Play it safe when changing your appointment. Be sure to specifically request that the initial appointment is canceled. You will receive an email confirmation immediately after your cancellation request is processed.

Exam Administration Day

Here's a preview of what you'll encounter when you open the test center's front door on the day of your state licensing exam appointment.

TIP

What to Expect on Exam Day

Check out the "What to Expect on Exam Day" video at www.arrt.org/video-library to familiarize yourself with the process. **NOTE:** You will not see a preliminary score after your exam as depicted.

TIP

Invalid ID? Cancel Appointment

If you arrive at the test center with invalid forms of ID, you will not be admitted to take your exam, and you will forfeit your fee.

Your ID is invalid if:

- it is not current (expired), or
- the name on ID varies from that on your ARRT file, or
- there is no signature, or
- it is not an accepted form of ID (see box on next page).

Cancel your appointment in time and reschedule when you have acquired two forms of valid ID.

Test Center Environment

Pearson VUE test centers provide computerized testing for many organizations. Be aware that other exams may be administered in the test center at the same time as ARRT examinations.

Most test centers are located in buildings comprised of several other offices. Waiting areas at the test centers are small. Friends, relatives, or children will not be permitted to wait in the test center or to contact you during your examination.

Test center personnel try to maintain a comfortable temperature in the testing rooms. In spite of these efforts, the room may be too cool or too warm for an individual's preference, so dress accordingly. Be aware that outerwear (overcoat, windbreaker, jacket, etc.) is not allowed in the testing room; however, clothing typically worn indoors (sweater, sweatshirt without hood, blazer, etc.) is allowed.

Keep in mind that there will be other people at the test center taking exams, so typing, coughing and/or people entering and leaving the testing room may be heard. It is impossible to provide a completely noise-free exam environment. If you feel these distractions may be disruptive to your testing, be sure to request earplugs before beginning your exam. Noise reduction headphones can also be provided.

Follow Procedures

Test center personnel adhere to designated procedures to ensure that their operations meet ARRT criteria for standardized testing. Review the following information before the examination to become familiar with the procedures.

Arrive Early

Having already confirmed the location of the test center, plan your schedule and route to ensure that you arrive at least 30 minutes before your scheduled appointment, to allow time for check-in procedures. Be sure to allow ample time for your commute, especially if inclement weather is a factor.

If you arrive at the test center 15 minutes after your scheduled appointment, you may be required to forfeit your appointment. If an appointment is forfeited, the test center will report to ARRT your failure to take the examination and your file will close. ARRT does not refund examination fees on forfeited appointments. To be considered eligible for a new exam window, you must contact your state licensing agency.

ID, Photo, Signature, Palm Vein Recognition (PVR)

When you arrive at the test center, you will be required to show two forms of identification, both of which show your signature and your pre-printed name as it appears on your CSR. One of the IDs must be a current official government-issued photo ID. See next page for examples of the two types of IDs required.

Your name on your government-issued ID must be the same as that on record with ARRT, as reflected on your most recent CSR. Your ID may contain your full middle name as long as the middle initial on your CSR matches the first letter of your middle name. If your name has a cultural variation, ensure that the same variation appears on the CSR and both IDs.

If you arrive without proper ID or with discrepancies in your name listed on the IDs, you will not be admitted to the test center. You will not be allowed to re-schedule

your exam appointment and will forfeit your examination fee. If you are admitted with questionable ID, you may have your score canceled following investigation by ARRT.

Upon checking in, you will be asked to provide a digital signature, which constitutes a) your consent for ARRT and/or Pearson VUE to retain and transmit personal data and exam responses; and b) your agreement to abide by the ARRT Rules Agreement, which will be presented to you prior to your exam.

You will also have your palm vein scanned and be photographed. If you leave the testing area for any reason, your palm will be scanned upon leaving and again before re-entering.

The palm-vein information and photo are for authentication purposes only. The information is kept confidential and not shared with any organization.

Assignment to Testing Station

Test center personnel will give you a short orientation, provide you with a copy of the ARRT Rules Agreement (see Appendix F) to read, and then escort you to an assigned workstation. You must remain in your assigned seat during the examination, except when authorized to leave by a test center staff member.

You will be required to keep all personal items in a secure locker. Don't wear jewelry that may be noisy or disruptive in the testing room. You will be asked to remove jewelry that is wider than ¼" as such items can pose a threat to exam security. If you bring a phone or other electronic device, turn off the device and store it in your locker. You may not access any electronic device until you have completed your exam and are ready to leave the test center. You cannot access items placed in a secure locker or anywhere else in the test center building for the duration of your exam unless you receive written pre-approval from ARRT. This includes breaks. Test centers assume no responsibility for candidates' personal belongings.

If you need to leave the testing room for personal reasons, you must first raise your hand to get test center staff's permission. No additional time is allowed to make up for lost time due to this reason. Test center staff is required to file an incident report with ARRT on any candidate that leaves the testing room for more than 10 minutes.

Test center personnel are not trained to answer specific questions related to ARRT examination content.

Calculators and Notes

Personal calculators are not permitted. Examples of calculators are also presented in the tutorial at the beginning of the exam. Both scientific and basic four-function calculators are provided on the computer, or you may request a basic four-function calculator from test center personnel. Appendix D presents facsimiles of the computer calculators.

Test center personnel will provide a booklet and pen for notations, which may be replaced as needed during testing but may not be removed from the testing room at any time. You are not to use the booklet until after responding to the non-disclosure agreement, and may not hold your booklet up to the screen when responding to questions. Non-approved scratch paper, pens, or pencils are not allowed into the testing room.

Acceptable Forms of Identification

PRIMARY: Must be government-issued, have **pre-printed name, photo, and signature**, and not be expired.

- Government-issued driver's license
- State ID card
- Passport
- Military ID*

*Bar code for signature acceptable with Military IDs only.

Very Important! Please note that Permanent Residence Cards ("Green Cards") or any other IDs that do not have your signature **will not be accepted** at the test center as valid primary or secondary identification.

SECONDARY: Must have **pre-printed name and signature** and not be expired.

- Government-issued IDs (e.g., U.S. social security card)
- Employee ID or work badge
- Bank automated teller machine (ATM) card
- School ID
- Credit card
- Any form of ID on the primary list

Palm Vein Recognition Replaces Fingerprint

As of January 1, 2011, a new biometric procedure was added to the admissions process, replacing the fingerprint process. Called palm vein technology, it scans the veins inside the hand to create a digital template that represents your vein pattern. The pattern reader uses a safe, near-infrared light source, similar to a television remote.

Learn more about the process at www.state.arrt.org.

TIP

Don't Bring Yours... Calculators Are Provided

Personal calculators aren't permitted, so don't even bring one to the test center. You can use theirs.

Requesting Assistance

Raise your hand to notify test center personnel if:

- you need assistance adjusting the computer screen's brightness or contrast;
- you would like a hand-held calculator;
- you need earplugs;
- an image appears too large to be fully viewed;
- you suspect a problem with the computer;
- you need another booklet;
- you need a break;
- you have completed the exam; or
- you need a staff member for any other reason.

Test Center Misconduct and Score Cancellation

Numerous security measures are enforced during the exam administration to ensure the integrity of ARRT exams. Be aware that you will be observed at all times while completing the exam. This includes direct observation by test center staff, as well as video and audio recording of the testing session.

Zero Tolerance Policy

ARRT has a zero-tolerance policy regarding possession of cell phones and other electronic devices in the test center, as well as candidates leaving the test center building prior to completing the examination and attempting to re-enter the test center. Automatic score cancellation will result for any candidate violating this policy.

1. Under no circumstances are candidates permitted to access cell phones or any other type of electronic device after check-in at the test center. Test center personnel are instructed to dismiss any candidate found in possession of an electronic device after the candidate has completed the check-in procedures. This includes candidates on breaks.

Such electronic devices include, but are not limited to:

- cellular phones
- media players
- compact disc players or any other electronic communication/recording/listening device
- removable storage devices
- personal digital assistants (PDAs)
- calculator or computing watches
- scan pens
- laptop computers, tablets, or any computer device
- photographic devices

If a candidate is found possessing, or otherwise having access to, a cell phone or any other type of electronic device during the administration of their exam, the candidate will not be allowed to continue testing and the test center administrator will file an incident report. Possession of a cell phone or any other type of electronic listening device after check-in will result in automatic score cancellation.

2. If test center staff observes a candidate leaving the test center building and re-entering the test center prior to completing the exam, the candidate will not be allowed to continue testing and the test center administrator will file an incident report. Leaving the test center building and attempting to re-enter the test center will result in automatic score cancellation.
3. Candidates should not bring papers, pamphlets, books, notebooks, or study guides into the exam center. If you bring these items they must remain in your locker for the duration of your exam.
4. For any candidate demonstrating misconduct or irregular behavior during or in connection with the examination — as evidenced by observation, statistical analysis of exam responses or otherwise — the ARRT will withhold examination

scores and may revoke or suspend a certificate, deny, or reject an application for renewal of certification and registration, censure or take any other appropriate action. This includes permanently barring the candidate from all future examinations, terminating candidate participation in the exam, and invalidating the results of that exam and any prior exam. If you are found in possession of, or otherwise having access to, any prohibited item during the administration of your exam, you will not be allowed to continue testing and the test center administrator will file an incident report. This will also result in automatic score cancellation.

Examples of misconduct or irregular behavior include, but are not limited to:

- Removing items from a secured locker without prior authorization;
- Giving or receiving unauthorized help;
- Attempting to take the examination for someone else; or having someone else take an exam for you;
- Failing to follow test center staff instructions;
- Tampering with the operation of the computer or attempting to use it for any function other than completing the examination;
- Attempting to remove exam content (in any format) from the test center;
- Creating a disturbance of any kind; and
- Accessing notes, books, study guides or unauthorized electronic devices.

If found to be in violation of this policy, you may find yourself part of an ARRT ethics investigation, or even a federal court lawsuit for copyright infringement and/or breach of contract.

What if the Test Center is Closed?

If you are unsure whether a test center is closed because of inclement weather or some other factor, phone Pearson VUE's Call Center at (800) 632-9055. If the test center is open, it is your responsibility to keep the appointment. If it is closed, you will be given the opportunity to reschedule your appointment.

In the event of a test center closing, Pearson VUE will contact you via the email address you provided during scheduling to reschedule your exam appointment. You may also call Pearson VUE to reschedule your exam.

Exam Content

ARRT designs examinations in collaboration with consultants from various specialties. The exams consist of questions designed to measure the knowledge and cognitive skills underlying the intelligent performance of the major tasks typically required in radiologic technology.

The content specifications for the Radiography, Nuclear Medicine Technology, and Radiation Therapy exams are included in this book as Appendices A, B, and C. If you are scheduled for a postprimary discipline examination, the corresponding content specifications are included as a separate insert.

ARRT doesn't provide specific lists of study materials or textbooks because the exams are built using many references. ARRT neither recommends nor endorses any review programs, mock registries, or study guides for any of its examinations.

ARRT owns the copyright for the examinations. Law prohibits any attempt to reproduce all or part of the examinations. Anyone caught removing exam materials from the test center, whether by physical removal or by reproducing materials from memory, will be prosecuted to the full extent of the law and will be permanently barred from future examinations.

Pilot Questions

Pilot questions are unscored questions embedded in the exam. ARRT uses data from these pilot questions to evaluate new exam questions. This is a cost-effective way to develop exam materials for future candidates, just as past candidates assisted in piloting questions for today.

TIP

Severe Weather Looming?

If you anticipate severe weather and your appointment is more than 24 hours out, consider rescheduling to avoid transportation hassles. If you miss your appointment due to weather and the test center was open, you will forfeit your exam fee and you will need to contact your state licensing agency for a new eligibility period.

These questions are not identified as pilot questions, and they appear just like any other question on the exam. Up to 20 percent of your exam may be unscored pilot questions, and ARRT has allotted extra time for you to complete them. Your answers to these questions will not affect exam scores.

Exam Timing

Time allowed for completing an examination is based on the number of questions. (Also see section on “Exam Content” on previous page.)

The column labeled “exam time” indicates the time allowed for answering the exam questions. The “total time” column adds 20 minutes to exam time to allow eight minutes for the tutorial, followed by two minutes to respond to the non-disclosure agreement, and 10 minutes for the survey at the end of the exam. This extra 20 minutes is for completion of the tutorial and survey and cannot be used to answer exam questions.

Voluntary breaks are subtracted from the allowed exam time; that is, the clock is not stopped during voluntary breaks.

Examination	Exam Time	Total Time
Radiography	3 hrs, 50 mins	4 hrs 10 mins
Nuclear Medicine Technology	3 hrs, 50 mins	4 hrs 10 mins
Radiation Therapy	3 hrs, 50 mins	4 hrs 10 mins

TIP

Pace Yourself...

It's important to use your time economically. Time remaining is displayed in the upper right corner of the computer screen. If a question is difficult, guess at the answer, flag the question for review and go on to the next question. When you have finished the examination and there is still time left, go back to the questions that you flagged and review them. (See Appendix D for more information.)

ARRT recommends that you complete the tutorial to familiarize yourself with the testing program and the online calculators. You must also click “A” for the non-disclosure agreement (see box on next page), which appears after the tutorial before starting the exam.

Taking the Exam

Order of Questions

ARRT examinations present questions in random order, which is consistent with the purposes of education and evaluation. When an individual learns an important concept, the intent is that he or she will take that knowledge beyond a specific context or environment and generalize that knowledge to the practice setting.

Question Format

Most exam items are standard multiple-choice with one best answer. ARRT is also introducing new formats on a limited basis. Some items may require that you select multiple answers from a list or use the mouse to sort a list of options into a particular order. A few items may require that you identify anatomic structures on an image by placing the mouse arrow (cursor) over the correct location on the screen and clicking. Others may require you to answer a multiple-choice question after viewing a short video clip. Appendix D provides additional information on exam item formats.

Selecting Answers

An answer must be recorded for a question before the computer allows display of the next question. You may mark questions for later review if you are unsure of the answer. For further information, refer to Appendix D.

Pacing

It's important to use your time economically. Time remaining is displayed in the upper right corner of the screen. If a question is difficult, guess at the answer, flag the question for review, and go on to the next question. When you have finished the exam and there is still time left, go back to the questions that you flagged and review them by clicking on the “Review Flagged” button (see Appendix D).

Breaks

Exam timing is based on the number of questions in the exam. If you take a break, the exam clock is not stopped – which means you will have less time to spend on your exam.

Guessing

Exam scores are based upon the total number of correct answers. Therefore, it is to your advantage to answer every question, even if that means selecting an answer of which you are not sure. You must indicate some response to each question before the computer will proceed to the next question.

Candidate Comments

You may comment on a specific question at the time you answer the question by clicking on the “Comment” button at the top of that page. No additional testing time is allowed during the exam for making comments on questions. You may comment on your test center experience in the evaluation survey at the end of your exam.

Leaving the Test Center

When you are finished with the examination and evaluation survey, raise your hand and test center staff will collect the booklet before dismissing you. Do not leave your seat until you have been dismissed. You may not remove your booklet from the testing room. Your palm will be scanned again before leaving the test center.

Appeals of Exam Administration

ARRT makes every effort to assure that examinations are fairly administered in a comfortable and safe environment.

On rare occasions, candidates may encounter technical difficulties at the test center. If you experience a technical difficulty, notify the test center administrator immediately. Test center personnel will make every effort to correct any difficulties as quickly as possible.

Should the test center experience a loss of power, back-up systems are in place, so every reasonable effort will be made to retrieve testing data. Once power is restored, you will be able to continue your testing session from the point where you were interrupted. If you are unable to continue the testing session due to severe technical difficulties, reasonable accommodations will be made, including re-scheduling of an exam appointment. ARRT will evaluate individual requests for re-scheduling at no cost.

If you believe that your examination was administered in a manner that substantially deviated from normal testing procedures, you may request a review of the procedures. If you experience a problem, verify with the test center administrator before you leave the test center that they will file a report regarding your issue—and request a copy of the incident number from that report.

If you wish to request a review, submit a completed Eligibility Appeal Request form (at www.state.arrt.org) detailing the specific nature of the alleged deviation from normal testing procedures.

Because ARRT will investigate complaints only if they are received before your results have been released, you have only two days to submit the request. You may fax the appeal form to 651.681.3295.

If ARRT finds that any such deviation unfairly interfered with your ability to complete the exam to the best of your ability in the allotted time, your original score will be canceled and you will be allowed to retake the examination at no cost. Under no circumstances will your score be adjusted based upon the findings of the review.

Non-Disclosure Agreement

After the tutorial, a non-disclosure agreement will appear on the computer screen. You must accept the terms of the agreement in order to proceed with the exam. By accepting these terms, you agree not to disclose exam questions in any form or remove them from the test center. You have two minutes to indicate your acceptance of the agreement. If you do not respond within two minutes, the exam will end and you will have to submit a re-application form and fee to obtain a new exam window.

The agreement states: “This exam is confidential and is protected by copyright law. You are expressly prohibited from disclosing, publishing, reproducing, or transmitting this exam, in whole or in part, in any form or by any means, oral or written, electronic or mechanical, for any purpose.”

The screen will instruct you to click the “A” (for Accept) button to symbolize your signature and to accept the terms. Selecting “A” will allow you to continue with the exam. If you do not accept these terms, click “N” (for Not Accept) to let test center staff know that you are through with the exam. If you click “N” but later decide to examine at a future date, you will need to submit a re-application form and fee.

Learn more about the non-disclosure agreement in the “What to Expect on Exam Day” video at www.arrt.org/video-library.

After the Examination

After the examination, all exam data is returned to ARRT, where scoring and analysis is completed. ARRT follows strict procedures to ensure accuracy of scoring.

TIP

How/When Will I Receive Exam Results

Examination results are sent to your state for final pass/fail determination. Please allow up to four weeks for processing, then contact your state — not ARRT — for information on your exam results.

State Attempts Count

Against Three-Attempt Limit

As of January 1, 2010, if you attempt the exam as a state candidate instead of taking the exam for ARRT certification, you will have your state attempt count as an attempt toward future ARRT certification attempts.

Cancellation of Scores

ARRT may withhold or cancel scores if there is evidence that the security of the examination has been compromised. Such action may be necessary even in the absence of evidence indicating that a candidate was knowingly involved in the compromising activities. ARRT expects candidates to cooperate in any investigation. Once scores are cancelled, they are not available for reporting at a later date.

Some scores may be rendered invalid because of circumstances beyond a candidate's control, such as technical difficulties. ARRT investigates each of these situations. When this results in a cancellation of scores, ARRT arranges for a makeup administration of the exam at no additional cost.

Score Reporting

You will not see a preliminary score at the end of your exam at the test center. ARRT does not release scores to state candidates. Your score information is forwarded to your state licensing agency, which determines the pass/fail status and notifies you of your official pass/fail status. Contact your state licensing agency — not ARRT — if you have not received your results within four weeks.

Interpreting Scores

ARRT uses “scaled scores” to report examination results. Scaled scores are more meaningful than raw scores (i.e., number or percentage correct) because they take into account the difficulty of a particular test compared to other forms of the same exam. Therefore, a scaled score of 75 represents the same level of exam performance, regardless of what examination form was administered.

Total scores are reported on a scale that ranges from 1 to 99. The total scaled score does *not* equal the number or percentage of questions answered correctly. A total scaled score of 75 is required to pass the exam. The number of correct answers required to achieve a score of 75 was determined through a standard-setting (or passing score) study. ARRT and panels of consultants periodically review the passing score to assure its validity.

Performance on each section of the exam is also reported using scaled scores. These section scores provide information to candidates regarding their strengths and weaknesses in particular content categories. Pass/fail decisions are *not* based on individual sections of the exam. Section scores can range from 1 to 10 and are reported in one-tenth point intervals (e.g., 8.1, 8.6). Section scores are intentionally placed on a narrower scale because they are based on fewer exam questions. Therefore, section scores are not as reliable as the total scaled score and should be interpreted with some discretion.

For more information on ARRT exam scoring, contact the ARRT office to request a copy of the “Settle the Score” brochure. Or, look for it on the web site at www.arrt.org.

Appeals of Exam Scoring

The ARRT employs several quality control procedures to ensure that all examinations are scored with complete accuracy. However, you may request a review of the accuracy of the scoring process if you feel an error has occurred.

If you wish a review of scoring, you must complete the Eligibility Appeal Request form located at www.state.arrt.org — detailing the specific reason a scoring error is suspected. Requests must be accompanied by a \$25 fee, payable to ARRT. The ARRT will review your responses to each question, compare those responses to the answer key, and recalculate both raw scores and scaled scores.

ARRT will report its findings to you and your state licensing agency within 30 days of receiving the written request. If ARRT finds evidence of any scoring error, it will cancel the original score and notify your state of the corrected score.

Re-examination

If you fail the examination, do not appear as scheduled, answer no or do not respond to the non-disclosure agreement, or allow your 90-day exam window to expire or you were turned away due to invalid IDs, you should contact your state licensing agency for information on their re-examination process. Once your state has determined you are eligible for re-examination, they will notify ARRT. Once ARRT processes your new exam fee, a new handbook and CSR indicating your new 90-day exam window will be mailed to you.

Appendices

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Radiography

The purpose of the exam is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of the staff technologist at entry into the profession. The tasks typically performed were determined by administering a comprehensive practice analysis survey to a nationwide sample of radiographers.¹ An advisory committee then determined the knowledge and cognitive skills needed to perform the tasks on the task inventory and these are organized into the content categories within this document. Every content category can be linked to one or more tasks on the task inventory. The document is used to develop the examination. The *Task Inventory for Radiography* may be found on the ARRT's website (www.art.org).

The ARRT avoids content when there are multiple resources with conflicting perspectives. Educational programs accredited by a mechanism acceptable to ARRT offer education and experience beyond the minimum requirements specified in the content specifications and clinical competency requirements documents.

This document is not intended to serve as a curriculum guide. Although ARRT programs for certification and registration and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address the subject matter that is included in these content specifications, but do not limit themselves to only this content.

The table below presents the major content categories and subcategories covered on the examination. The number of test questions in each category are listed in bold and the number of test questions in each subcategory in parentheses. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

Content Category	Number of Scored Questions²
Patient Care	33
<i>Patient Interactions and Management (33)</i>	
Safety	50
<i>Radiation Physics and Radiobiology³ (21)</i>	
<i>Radiation Protection (29)</i>	
Image Production	51
<i>Image Acquisition and Evaluation (26)</i>	
<i>Equipment Operation and Quality Assurance (25)</i>	
Procedures	66
<i>Head, Spine and Pelvis Procedures (18)</i>	
<i>Thorax and Abdomen Procedures (20)</i>	
<i>Extremity Procedures (28)</i>	
Total	200

¹ A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.

² Each exam includes an additional 30 unscored (pilot) questions.

³ SI units are the primary (principle) units of radiation measurement used on the radiography examination.



Patient Care

1. Patient Interactions and Management

- A. Ethical and Legal Aspects
 - 1. patients' rights
 - a. consent (*e.g., informed, oral, implied)
 - b. confidentiality (HIPAA)
 - c. American Hospital Association (AHA) Patient Care Partnership (Patients' Bill of Rights)
 - 1. privacy
 - 2. extent of care (e.g., DNR)
 - 3. access to information
 - 4. living will, health care proxy, advanced directives
 - 5. research participation
 - 2. legal issues
 - a. verification (e.g., patient identification, compare order to clinical indication)
 - b. common terminology (e.g., battery, negligence, malpractice, beneficence)
 - c. legal doctrines (e.g., respondeat superior, res ipsa loquitur)
 - d. restraints versus positioning aids used to eliminate motion artifact
 - e. manipulation of electronic data (e.g., exposure indicator, processing algorithm, brightness and contrast, cropping or masking off anatomy)
 - f. documentation (e.g., changes to order, medical event)
 - 3. ARRT Standards of Ethics
- B. Interpersonal Communication
 - 1. modes of communication
 - a. verbal/written
 - b. nonverbal (e.g., eye contact, touching)
 - 2. challenges in communication
 - a. interactions with others
 - 1. language barriers
 - 2. cultural and social factors
 - 3. physical, sensory, or cognitive impairments
 - 4. age
 - 5. emotional status, acceptance of condition (e.g., stage of grief)
 - b. explanation of medical terms
 - c. strategies to improve understanding
 - 3. patient education
 - a. explanation of current procedure (e.g., purpose, length of time, radiation dose)
 - b. pre- and post-examination instructions (e.g., preparation, diet, medications and discharge instructions)
 - c. respond to inquiries about other imaging modalities (e.g., dose differences, types of radiation, patient preps)
- C. Ergonomics and Monitoring
 - 1. body mechanics (e.g., balance, alignment, movement)
 - a. patient transfer techniques
 - b. safe patient handling devices (e.g., transfer board, Hoyer lift, gait belt)
 - 2. assisting patients with medical equipment
 - a. infusion catheters and pumps
 - b. oxygen delivery systems
 - c. other (e.g., nasogastric tubes, urinary catheters, tracheostomy tubes)
 - 3. patient monitoring and documentation
 - a. vital signs
 - b. physical signs and symptoms (e.g., motor control, severity of injury)
 - c. fall prevention
- D. Medical Emergencies
 - 1. non-contrast allergic reactions (e.g., latex)
 - 2. cardiac/respiratory arrest (e.g., CPR, AED)
 - 3. physical injury or trauma
 - 4. other medical disorders (e.g., seizures, diabetic reactions)

*The abbreviation "e.g.," is used to indicate that examples are listed in parentheses, but that it is not a complete list of all possibilities. (Patient Care continues on the following page.)



Patient Care (continued)

E. Infection Control

1. chain of infection (cycle of infection)
 - a. pathogen
 - b. reservoir
 - c. portal of exit
 - d. mode of transmission
 1. direct
 - a. droplet
 - b. direct contact
 2. indirect
 - a. airborne
 - b. vehicle borne (fomite)
 - c. vector borne (mechanical or biological)
 - e. portal of entry
 - f. susceptible host
 2. asepsis
 - a. equipment disinfection
 - b. equipment sterilization
 - c. medical aseptic technique
 - d. sterile technique
 3. CDC Standard Precautions
 - a. hand hygiene
 - b. use of personal protective equipment (e.g., gloves, gowns, masks)
 - c. safe handling of contaminated equipment/surfaces
 - d. disposal of contaminated materials
 1. linens
 2. needles
 3. patient supplies
 4. blood and body fluids
 - e. safe injection practices
 4. transmission-based precautions
 - a. contact
 - b. droplet
 - c. airborne
 5. additional precautions
 - a. neutropenic precautions (reverse isolation)
 - b. healthcare-associated (nosocomial) infections
- ### F. Handling and Disposal of Toxic or Hazardous Material
1. types of materials
 - a. chemicals
 - b. chemotherapy
 2. safety data sheet (material safety data sheet)

G. Pharmacology

1. patient history
 - a. medication reconciliation (current medications)
 - b. premedications
 - c. contraindications
 - d. scheduling and sequencing examinations
2. administration
 - a. routes (e.g., IV, oral)
 - b. supplies (e.g., enema kits, needles)
 - c. procedural technique (e.g., venipuncture)
 - d. contrast media dose calculation
3. contrast media types and properties (e.g., iodinated, water soluble, barium, ionic versus non-ionic)
4. appropriateness of contrast media to examination
 - a. patient condition (e.g., perforated bowel)
 - b. patient age and weight
 - c. laboratory values (e.g., BUN, creatinine, eGFR)
5. complications/reactions
 - a. local effects (e.g., extravasation/infiltration, phlebitis)
 - b. systemic effects
 1. mild
 2. moderate
 3. severe
 - c. emergency medications
 - d. radiographer's response and documentation



Safety

1. Radiation Physics and Radiobiology

- A. Principles of Radiation Physics
 - 1. x-ray production
 - a. source of free electrons (e.g., thermionic emission)
 - b. acceleration of electrons
 - c. focusing of electrons
 - d. deceleration of electrons
 - 2. target interactions
 - a. bremsstrahlung
 - b. characteristic
 - 3. x-ray beam
 - a. frequency and wavelength
 - b. beam characteristics
 - 1. quality
 - 2. quantity
 - 3. primary versus remnant (exit)
 - c. inverse square law
 - d. fundamental properties (e.g., travel in straight lines, ionize matter)
 - 4. photon interactions with matter
 - a. photoelectric
 - b. Compton
 - c. coherent (classical)
 - d. attenuation by various tissues
 - 1. thickness of body part
 - 2. type of tissue (atomic number)

- B. Biological Effects of Radiation
 - 1. SI units of measurement (NCRP #160)
 - a. absorbed dose (Gy)
 - b. dose equivalent (Sv)
 - c. exposure (C/kg)
 - d. effective dose (Sv)
 - e. air kerma (Gy)
 - 2. radiosensitivity
 - a. dose-response relationships
 - b. relative tissue radiosensitivities (e.g., LET, RBE)
 - c. cell survival and recovery (LD₅₀)
 - d. oxygen effect
 - 3. somatic effects
 - a. cells
 - b. tissue (e.g., eye, thyroid, breast, skin, marrow, gonad)
 - c. embryo and fetus
 - d. carcinogenesis
 - e. early versus late or acute versus chronic
 - f. deterministic (tissue reactions) versus stochastic
 - g. short-term versus long-term exposure
 - h. acute radiation syndromes
 - 1. hemopoietic
 - 2. gastrointestinal (GI)
 - 3. central nervous system (CNS)

(Safety continues on the following page.)



Safety (continued)

2. Radiation Protection

- A. Minimizing Patient Exposure
 - 1. exposure factors
 - a. kVp
 - b. mAs
 - c. automatic exposure control (AEC)
 - 2. beam restriction
 - a. purpose of primary beam restriction
 - b. types (e.g., collimators)
 - 3. patient considerations
 - a. positioning
 - b. communication
 - c. pediatric
 - d. morbid obesity
 - 4. filtration
 - a. effect on skin and organ exposure
 - b. effect on average beam energy
 - c. NCRP recommendations (NCRP #102, minimum filtration in useful beam)
 - 5. radiographic dose documentation
 - 6. image receptors
 - 7. grids
 - 8. fluoroscopy
 - a. pulsed
 - b. exposure factors
 - c. grids
 - d. positioning
 - e. fluoroscopy time
 - f. automatic brightness control (ABC) or automatic exposure rate control (AERC)
 - g. receptor positioning
 - h. magnification mode
 - i. air kerma display
 - j. last image hold
 - k. dose or time documentation
 - l. minimum source-to-skin distance (21 CFR)
 - 9. dose area product (DAP) meter
- B. Personnel Protection (ALARA)*
 - 1. sources of radiation exposure
 - a. primary x-ray beam
 - b. secondary radiation
 - 1. scatter
 - 2. leakage
 - c. patient as source
 - 2. basic methods of protection
 - a. time
 - b. distance
 - c. shielding
 - 3. protective devices
 - a. types (e.g., aprons, barriers)
 - b. attenuation properties
 - c. minimum lead equivalent (NCRP #102)
 - 4. special considerations
 - a. mobile units
 - b. fluoroscopy
 - 1. protective drapes
 - 2. protective Bucky slot cover
 - 3. cumulative timer
 - 4. remote-controlled fluoroscopy
 - c. guidelines for fluoroscopy and mobile units (NCRP #102, 21 CFR)
 - 1. fluoroscopy exposure rates (normal and high-level control)
 - 2. exposure switch guidelines
 - 5. radiation exposure and monitoring
 - a. dosimeters
 - 1. types
 - 2. proper use
 - b. NCRP recommendations for personnel monitoring (NCRP #116)
 - 1. occupational exposure
 - 2. public exposure
 - 3. embryo/fetus exposure
 - 4. dose equivalent limits
 - 5. evaluation and maintenance of personnel dosimetry records
 - 6. handling and disposal of radioactive material

* (August 24, 2016) Note: Although it is the radiographer's responsibility to apply radiation protection principles to minimize bioeffects for both patients and personnel, the ALARA concept is specific to personnel protection and is listed only for that section.



Image Production

1. Image Acquisition and Evaluation

- A. Factors Affecting Radiographic Quality
(X indicates topics covered on the examination.)

	1. Receptor Exposure	2. Spatial Resolution	3. Distortion
a. mAs	X		
b. kVp	X		
c. OID		X	X
d. SID	X	X	X
e. focal spot size		X	
f. grids*	X		
g. tube filtration	X		
h. beam restriction	X		
i. motion		X	
j. anode heel effect	X		
k. patient factors (size, pathology)	X	X	X
l. angle (tube, part, or receptor)		X	X

* Includes conversion factors for grids

B. Technique Charts

1. anatomically programmed technique
2. fixed versus variable kVp
3. special considerations
 - a. casts
 - b. pathologic factors
 - c. age (e.g., pediatric, geriatric)
 - d. body mass index (BMI)
 - e. contrast media
 - f. grids
 - g. OID

C. Automatic Exposure Control (AEC)

1. effects of changing exposure factors on radiographic quality
2. detector selection
3. anatomic alignment
4. exposure adjustment (e.g., density, +1 or -1)

D. Digital Imaging Characteristics

1. spatial resolution
 - a. pixel characteristics (e.g., size, pitch)
 - b. detector element (DEL) (e.g., size, pitch, fill factor) CCD, CMOS (e.g., size, pitch)
 - c. sampling frequency (CR)

- d. matrix size
- e. modulation transfer function (MTF)
2. contrast resolution
 - a. bit depth
 - b. detective quantum efficiency (DQE)
 - c. grids
3. image signal
 - a. dynamic range
 - b. quantum noise (quantum mottle)
 - c. signal to noise ratio (SNR)

E. Image Identification

1. methods (e.g., radiographic, electronic)
2. legal considerations (e.g., patient data, examination data)

F. Criteria for Image Evaluation

1. exposure indicator
2. quantum noise (quantum mottle)
3. gross exposure error (e.g., loss of contrast, saturation)
4. contrast
5. spatial resolution
6. distortion (e.g., size, shape)
7. identification markers (e.g., anatomical side, patient, date)
8. image artifacts
9. radiation fog (CR)



Image Production (continued)

2. Equipment Operation and Quality Assurance

A. Imaging Equipment

1. x-ray generator, transformers and rectification system
 - a. basic principles
 - b. phase, pulse and frequency
 - c. tube loading
2. components of radiographic unit (fixed or mobile)
 - a. operating console
 - b. x-ray tube construction
 1. electron source
 2. target materials
 3. induction motor
 4. filtration
 - c. automatic exposure control (AEC)
 1. radiation detectors
 2. back-up timer
 3. exposure adjustment (e.g., density, +1 or -1)
 4. minimum response time
 - d. manual exposure controls
 - e. image receptors
 1. computed radiography (CR)
 - a. plate (e.g., photo-stimulable phosphor (PSP))
 - b. plate reader
 2. digital radiography (DR)
 - a. direct conversion
 - b. indirect conversion
 1. amorphous silicon (a-Si)
 2. charge coupled device (CCD)
 3. complementary metal oxide semiconductor (CMOS)
 - f. beam restriction
3. components of fluoroscopic unit (fixed or mobile)
 - a. image receptors
 1. image intensifier
 2. flat panel
 - b. viewing systems
 - c. recording systems
 - d. automatic brightness control (ABC) or automatic exposure rate control (AERC)
 - e. magnification mode
 - f. table

4. accessories
 - a. stationary grids
 - b. Bucky assembly
 - c. compensating filters
- B. Image Processing and Display
 1. raw data (pre-processing)
 - a. analog-to-digital converter (ADC)
 - b. quantization
 - c. corrections (e.g., rescaling, flat fielding, dead pixel correction)
 - d. histogram
 2. corrected data for processing
 - a. grayscale
 - b. edge enhancement
 - c. equalization
 - d. smoothing
 3. data for display
 - a. values of interest (VOI)
 - b. look-up table (LUT)
 4. post-processing
 - a. brightness
 - b. contrast
 - c. region of interest (ROI)
 - d. electronic cropping or masking
 - e. stitching
 5. display monitors
 - a. viewing conditions (e.g., viewing angle, ambient lighting)
 - b. spatial resolution (e.g., pixel size, pixel pitch)
 - c. brightness and contrast
 6. imaging informatics
 - a. information systems, (e.g., HIS, RIS, EMR, EHR)
 - b. networking
 1. PACS
 2. DICOM
 - c. downtime procedures



Image Production (continued)

- C. Quality Control of Imaging Equipment and Accessories
 - 1. beam restriction
 - a. light field to radiation field alignment
 - b. central ray alignment
 - 2. recognition and reporting of malfunctions
 - 3. digital imaging receptor systems
 - a. maintenance (e.g., detector calibration, plate reader calibration)
 - b. QC tests (e.g., erasure thoroughness, plate uniformity, spatial resolution)
 - c. display monitor quality assurance (e.g., grayscale standard display function, luminance)
 - 4. shielding accessories (e.g., testing lead apron, gloves)



Procedures

This section addresses imaging procedures for the anatomic regions listed below. Questions will cover the following topics:

1. Positioning (e.g., topographic landmarks, body positions, path of central ray, positioning aids, respiration).
2. Anatomy (e.g., including physiology, basic pathology, related medical terminology).
3. Procedure adaptation (e.g., body habitus, body mass index, trauma, pathology, age, limited mobility).
4. Evaluation of displayed anatomical structures (e.g., patient positioning, tube-part-image receptor alignment).

The specific radiographic positions and projections within each anatomic region that may be covered on the examination are listed in *Attachment A*. A guide to positioning terminology appears in *Attachment B*.

1. Head, Spine and Pelvis Procedures

A. Head

1. skull
2. facial bones
3. mandible
4. temporomandibular joints
5. nasal bones
6. orbits
7. paranasal sinuses

B. Spine and Pelvis

1. cervical spine
2. thoracic spine
3. scoliosis series
4. lumbar spine
5. sacrum and coccyx
6. myelography
7. sacroiliac joints
8. pelvis and hip

2. Thorax and Abdomen Procedures

A. Thorax

1. chest
2. ribs
3. sternum
4. soft tissue neck
5. sternoclavicular joints

B. Abdomen and GI Studies

1. abdomen
2. esophagus
3. swallowing dysfunction study
4. upper GI series, single or double contrast
5. small bowel series
6. contrast enema, single or double contrast
7. surgical cholangiography
8. ERCP

C. GU Studies

1. cystography
2. cystourethrography
3. intravenous urography
4. retrograde urography
5. hysterosalpingography

3. Extremity Procedures

A. Upper Extremities

1. fingers
2. hand
3. wrist
4. forearm
5. elbow
6. humerus
7. shoulder
8. scapula
9. clavicle
10. acromioclavicular joints

B. Lower Extremities

1. toes
2. foot
3. calcaneus
4. ankle
5. tibia/fibula
6. knee/patella
7. femur
8. long bone measurement

C. Other

1. bone age
2. bone survey (e.g., metastatic, non-accidental trauma)
3. arthrography



Attachment A
Radiographic Positions and Projections

1. Head, Spine and Pelvis

A. Head

1. Skull
 - a. AP axial (Towne)
 - b. lateral
 - c. PA axial (Caldwell)
 - d. PA
 - e. submentovertex (full basal)
 - f. trauma cross-table (horizontal beam) lateral
 - g. trauma AP axial (reverse Caldwell)
 - h. trauma AP
 - i. trauma AP axial (Towne)
2. Facial Bones
 - a. lateral
 - b. parietoacanthial (Waters)
 - c. PA axial (Caldwell)
 - d. modified parietoacanthial (modified Waters)
3. Mandible
 - a. axiolateral oblique
 - b. PA
 - c. AP axial (Towne)
 - d. PA axial
 - e. PA (modified Waters)
 - f. submentovertex (full basal)
4. Temporomandibular Joints
 - a. axiolateral oblique (modified Law)
 - b. axiolateral (modified Schuller)
 - c. AP axial (modified Towne)
5. Nasal Bones
 - a. parietoacanthial (Waters)
 - b. lateral
 - c. PA axial (Caldwell)
6. Orbits
 - a. parietoacanthial (Waters)
 - b. lateral
 - c. PA axial (Caldwell)
 - d. modified parietoacanthial (modified Waters)
7. Paranasal Sinuses
 - a. lateral, horizontal beam
 - b. PA axial (Caldwell), horizontal beam
 - c. parietoacanthial (Waters), horizontal beam
 - d. submentovertex (full basal), horizontal beam

B. Spine and Pelvis

1. Cervical Spine
 - a. AP axial
 - b. AP open mouth
 - c. lateral
 - d. cross-table (horizontal beam) lateral
 - e. PA axial obliques
 - f. AP axial obliques
 - g. lateral swimmers

- h. lateral flexion and extension
- i. AP dens (Fuchs)
2. Thoracic Spine
 - a. AP
 - b. lateral, breathing
 - c. lateral, expiration
3. Scoliosis Series
 - a. AP or PA
 - b. lateral
4. Lumbar Spine
 - a. AP
 - b. PA
 - c. lateral
 - d. L5-S1 lateral spot
 - e. posterior oblique
 - f. anterior oblique
 - g. AP axial L5-S1
 - h. AP right and left bending
 - i. lateral flexion and extension
5. Sacrum and Coccyx
 - a. AP axial sacrum
 - b. AP axial coccyx
 - c. lateral sacrum and coccyx, combined
 - d. lateral sacrum or coccyx, separate
6. Myelography
7. Sacroiliac Joints
 - a. AP axial
 - b. posterior oblique
 - c. anterior oblique
8. Pelvis and Hip
 - a. AP hip only
 - b. cross-table (horizontal beam) lateral hip
 - c. unilateral frog-leg, non-trauma
 - d. axiolateral inferosuperior, trauma (Clements-Nakayama)
 - e. AP pelvis
 - f. AP pelvis, bilateral frog-leg
 - g. AP pelvis, axial anterior pelvic bones (inlet, outlet)
 - h. posterior oblique pelvis, acetabulum (Judet)

2. Thorax and Abdomen

A. Thorax

1. Chest
 - a. PA or AP upright
 - b. lateral upright
 - c. AP lordotic
 - d. AP supine
 - e. lateral decubitus
2. Ribs
 - a. AP and PA, above and below diaphragm
 - b. anterior and posterior obliques

3. Sternum
 - a. lateral
 - b. RAO
4. Soft Tissue Neck
 - a. AP upper airway
 - b. lateral upper airway
5. Sternoclavicular joints
 - a. PA
 - b. LAO and RAO

B. Abdomen and GI Studies

1. Abdomen
 - a. AP supine
 - b. AP upright
 - c. lateral decubitus
 - d. dorsal decubitus
2. Esophagus
 - a. RAO
 - b. left lateral
 - c. AP
 - d. PA
 - e. LAO
3. Swallowing Dysfunction Study
4. Upper GI series*
 - a. AP or PA scout
 - b. RAO
 - c. PA
 - d. right lateral
 - e. LPO
 - f. AP
5. Small Bowel Series
 - a. PA scout
 - b. PA (follow through)
 - c. ileocecal spots
6. Contrast Enema*
 - a. left lateral rectum
 - b. left lateral decubitus
 - c. right lateral decubitus
 - d. LPO and RPO
 - e. PA
 - f. RAO and LAO
 - g. AP axial (sigmoid)
 - h. PA axial (sigmoid)
 - i. PA or AP post-evacuation
7. Surgical Cholangiography
8. ERCP

*single or double contrast



C. GU Studies

1. Cystography
 - a. AP
 - b. LPO and RPO
 - c. lateral
 - d. AP axial
2. Cystourethrography
 - a. AP voiding
cystourethrogram female
 - b. RPO voiding
cystourethrogram male
3. Intravenous Urography
 - a. AP, scout, and series
 - b. RPO and LPO
 - c. post-void
4. Retrograde Urography
 - a. AP scout
 - b. AP pyelogram
 - c. AP ureterogram
5. Hysterosalpingography

3. Extremities

A. Upper Extremities

1. Fingers
 - a. PA entire hand
 - b. PA finger only
 - c. lateral
 - d. medial and/or lateral oblique
 - e. AP thumb
 - f. medial oblique thumb
 - g. lateral thumb
2. Hand
 - a. PA
 - b. lateral
 - c. lateral oblique
3. Wrist
 - a. PA
 - b. lateral oblique
 - c. lateral
 - d. PA–ulnar deviation
 - e. PA axial (Stecher)
 - f. tangential carpal canal (Gaynor-Hart)
4. Forearm
 - a. AP
 - b. lateral
5. Elbow
 - a. AP
 - b. lateral
 - c. lateral oblique
 - d. medial oblique
 - e. AP partial flexion
 - f. trauma axial laterals (Coyle)
6. Humerus
 - a. AP
 - b. lateral
 - c. neutral
 - d. transthoracic lateral

7. Shoulder

- a. AP internal and external rotation
- b. inferosuperior axial (Lawrence)
- c. posterior oblique (Grashey)
- d. AP neutral
- e. PA oblique (scapular Y)
- f. supraspinatus outlet (Neer)

8. Scapula

- a. AP
- b. lateral

9. Clavicle

- a. AP or PA
- b. AP axial
- c. PA axial

10. Acromioclavicular Joints – AP bilateral with and without weights

B. Lower Extremities

1. Toes

- a. AP, entire forefoot
- b. AP or AP axial toe
- c. oblique toe
- d. lateral toe
- e. sesamoids, tangential

2. Foot

- a. AP axial
- b. medial oblique
- c. lateral oblique
- d. lateral
- e. AP axial weight bearing
- f. lateral weight bearing

3. Calcaneus

- a. lateral
- b. plantodorsal, axial
- c. dorsoplantar, axial

4. Ankle

- a. AP
- b. mortise
- c. lateral
- d. medial oblique
- e. AP stress
- f. AP weight bearing
- g. lateral weight bearing

5. Tibia/Fibula

- a. AP
- b. lateral

6. Knee/patella

- a. AP
- b. lateral
- c. AP weight bearing
- d. lateral oblique
- e. medial oblique
- f. PA axial–intercondylar fossa (Holmblad)
- g. PA axial–intercondylar fossa (Camp Coventry)
- h. AP axial–intercondylar fossa (Béclère)
- i. PA patella
- j. tangential (Merchant)
- k. tangential (Settegast)

7. Femur

- a. AP
- b. lateral

8. Long Bone Measurement

C. Other

1. Bone Age
2. Bone Survey
3. Arthrography



Attachment B
Standard Terminology
for Positioning and Projection

Radiographic View: Describes the body part as seen by the image receptor. Restricted to the discussion of a *radiograph* or *image*.

Radiographic Position: Refers to a specific body position, such as supine, prone, recumbent, erect or Trendelenburg. Restricted to the discussion of the *patient's physical position*.

Radiographic Projection: Restricted to the discussion of the *path of the central ray*.

POSITIONING TERMINOLOGY

A. Lying Down

1. *supine* – lying on the back
2. *prone* – lying face downward
3. *decubitus* – lying down with a horizontal x-ray beam
4. *recumbent* – lying down in any position

B. Erect or Upright

1. *anterior position* – facing the image receptor
2. *posterior position* – facing the radiographic tube

C. Either Upright or Recumbent

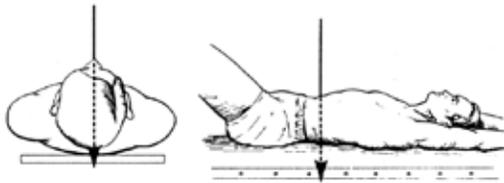
1. oblique torso positions
 - a. anterior oblique (facing the image receptor)
 - i. *left anterior oblique (LAO)* body rotated with the left anterior portion closest to the image receptor
 - ii. *right anterior oblique (RAO)* body rotated with the right anterior portion closest to the image receptor
 - b. posterior oblique (facing the radiographic tube)
 - i. *left posterior oblique (LPO)* body rotated with the left posterior portion closest to the image receptor
 - ii. *right posterior oblique (RPO)* body rotated with the right posterior portion closest to the image receptor
2. oblique extremity positions
 - a. lateral (external) rotation from either prone or supine, outward rotation of the extremity
 - b. medial (internal) rotation from either prone or supine, inward rotation of the extremity



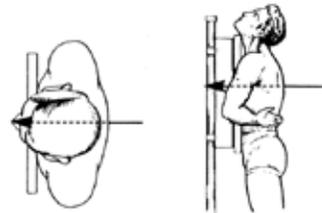
RADIOGRAPHY
CONTENT OUTLINE

ARRT® BOARD APPROVED: **JANUARY 2021**
IMPLEMENTATION DATE: **JANUARY 1, 2022**

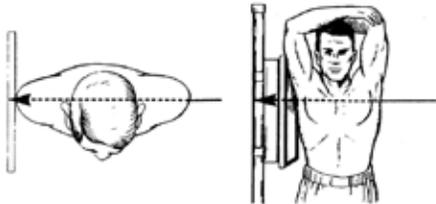
Anteroposterior Projection



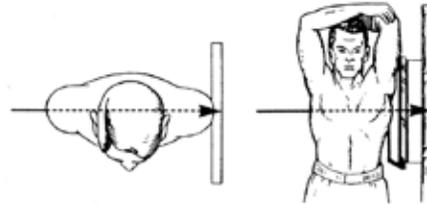
Posteroanterior Projection



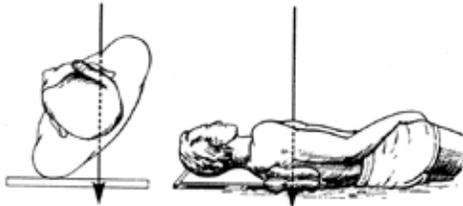
Right Lateral Position



Left Lateral Position



Left Posterior Oblique Position



Right Posterior Oblique Position



Left Anterior Oblique Position



Right Anterior Oblique Position





Nuclear Medicine Technology

The purpose of the exam is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of the staff technologist at entry into the profession. The tasks typically performed were determined by administering a comprehensive practice analysis survey to a nationwide sample of nuclear medicine technologists.¹ An advisory committee then determined the knowledge and cognitive skills needed to perform the tasks on the task inventory and these are organized into the content categories within this document. Every content category can be linked to one or more tasks on the task inventory. The document is used to develop the examination. The *Task Inventory for Nuclear Medicine Technology* may be found on the ARRT's website (www.arrt.org).

The ARRT avoids content when there are multiple resources with conflicting perspectives. Educational programs accredited by a mechanism acceptable to ARRT offer education and experience beyond the minimum requirements specified in the content specifications and clinical competency documents.

This document is not intended to serve as a curriculum guide. Although ARRT programs for certification and registration and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address the subject matter that is included in these content specifications, but do not limit themselves to only this content.

The table below presents the major content categories and subcategories covered on the examination. The number of test questions in each category are listed in bold and the number of test questions in each subcategory in parentheses. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

Content Category	Number of Scored Questions²
Patient Care	24
<i>Patient Interactions and Management (24)</i>	
Safety³	25
<i>Radiation Physics, Radiobiology, and Regulations (25)</i>	
Image Production	33
<i>Instrumentation (33)</i>	
Procedures	118
<i>Radionuclides and Radiopharmaceuticals (28)</i>	
<i>Cardiac Procedures (25)</i>	
<i>Endocrine and Oncology Procedures (25)</i>	
<i>Gastrointestinal and Genitourinary Procedures (18)</i>	
<i>Other Imaging Procedures (22)</i>	
Total	200

¹ A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.

² Each exam includes an additional 30 unscored (pilot) questions.

³ SI and conventional units of radiation measurement will continue to be used on the nuclear medicine technology examination.



Patient Care

1. Patient Interactions and Management

A. Ethical and Legal Aspects

1. patients' rights
 - a. consent (*e.g., informed, oral, implied)
 - b. confidentiality (HIPAA)
 - c. American Hospital Association (AHA) Patient Care Partnership (Patients' Bill of Rights)
 1. privacy
 2. extent of care (e.g., DNR)
 3. access to information
 4. living will, health care proxy, advanced directives
 5. research participation
 2. legal issues
 - a. verification (e.g., patient identification, compare order to clinical indication)
 - b. common terminology (e.g., battery, negligence, malpractice, beneficence)
 - c. legal doctrines (e.g., respondeat superior, res ipsa loquitur)
 - d. restraints versus positioning aids used to prevent motion
 3. ARRT Standards of Ethics
- B. Interpersonal Communication
 1. modes of communication
 - a. verbal/written
 - b. nonverbal (e.g., eye contact, touching)
 2. challenges in communication
 - a. interaction with others
 1. language barriers
 2. cultural and social factors
 3. physical, sensory, or cognitive impairments
 4. age
 5. emotional status, acceptance of condition
 - b. explanation of medical terms
 - c. strategies to improve understanding

*e.g., This is used here and in the remainder of this document to indicate examples of the topics covered, but not a complete list.

3. patient education
 - a. explanation of current procedure (e.g., risks, benefits, radiation dose)
 - b. pre- and post-examination instructions (e.g., preparations, diet, medications, discharge instructions)
 - c. respond to inquiries about other imaging modalities (e.g., types of radiation, patient preparation)
- C. Ergonomics and Monitoring
 1. body mechanics (e.g., balance, alignment, movement)
 - a. patient transfer techniques
 - b. ergonomic devices (e.g., transfer board, Hoyer lift, gait belt)
 2. assisting patients with medical equipment
 - a. infusion catheters and pumps
 - b. oxygen delivery systems
 - c. other (e.g., nasogastric tubes, urinary catheters, tracheostomy tubes)
 3. patient monitoring and documentation
 - a. vital signs
 - b. physical signs and symptoms (e.g., motor control, severity of injury)
 - c. fall prevention
 - d. sedation
- D. Medical Emergencies
 1. allergic reactions (e.g., pharmaceuticals, latex)
 2. cardiac/respiratory arrest (e.g., CPR, AED)
 3. physical injury or trauma
 4. other medical disorders (e.g., seizures, diabetic reactions)



Patient Care (continued)

E. Infection Control

1. chain of infection (cycle of infection)
 - a. pathogen
 - b. reservoir
 - c. portal of exit
 - d. mode of transmission
 1. direct
 - a. direct contact
 - b. droplet
 2. indirect
 - a. airborne
 - b. vehicle-borne (fomite)
 - c. vector-borne (mechanical or biological)
 - e. portal of entry
 - f. susceptible host
2. asepsis
 - a. equipment disinfection
 - b. equipment sterilization
 - c. medical aseptic technique
 - d. sterile technique
3. CDC Standard Precautions
 - a. hand hygiene
 - b. use of personal protective equipment (e.g., gloves, gowns, masks)
 - c. safe handling of contaminated equipment/surfaces
 - d. disposal of contaminated materials
 1. linens
 2. needles
 3. patient supplies
 4. blood and body fluids
 - e. safe injection practices
4. transmission-based precautions
 - a. contact
 - b. droplet
 - c. airborne
5. additional precautions
 - a. neutropenic precautions (reverse isolation)
 - b. healthcare-associated (nosocomial) infections

F. Handling and Disposal of Toxic or Hazardous Material

1. types of materials (e.g., cleaning materials)
2. safety data sheet (e.g., material safety data sheets)

G. Pharmacology

1. patient history
 - a. medication reconciliation (current medications)
 - b. premedications
 - c. contraindications
 - d. lab values (e.g., glucose, TSH)
 - e. scheduling and sequencing examinations
2. complications/reactions
3. technologist's response and documentation



Safety

1. Radiation Physics, Radiobiology, and Regulations

- A. Principles of Radiation Physics
 - 1. decay of radioactivity
 - a. atomic structure
 - b. decay modes (e.g., alpha, beta, gamma)
 - c. decay rate
 - d. half-life
 - e. parent-daughter relationship
 - 2. target interaction in CT
 - a. bremsstrahlung
 - b. characteristic
 - 3. interaction of radiation with matter
 - a. photoelectric effect
 - b. Compton (incoherent) scattering
 - c. coherent (Rayleigh) scattering
 - d. pair production and annihilation
 - e. internal conversion
 - f. Auger electron
 - g. bremsstrahlung (from beta particles)
 - 4. attenuation
- B. Biological Effects of Radiation
 - 1. units of measurement
 - a. absorbed dose
 - b. dose equivalent
 - c. exposure
 - d. effective dose
 - 2. radiosensitivity (e.g., law of Bergonié and Tribondeau)
 - a. dose-response relationships
 - b. relative tissue sensitivities (e.g., LET and RBE)
 - 3. somatic effects
 - a. cells
 - b. tissue (e.g., critical, target)
 - c. embryo and fetus
 - d. carcinogenesis
 - e. early versus late or acute versus chronic
 - f. deterministic versus stochastic
 - g. acute radiation syndromes
 - 1. hemopoietic
 - 2. gastrointestinal (GI)
 - 3. central nervous system (CNS)
 - 4. genetic effects

- C. Basic Concepts of Radiation Protection
 - 1. principles of time, distance, and shielding
 - 2. personal protection equipment (e.g., gloves, lab coats)
 - 3. personnel monitoring devices
 - a. types
 - b. use, care, and placement
 - 4. ALARA
 - 5. release of patients
 - 6. patient dose reduction and optimization
 - a. Image Gently®
 - b. Image Wisely®
- D. NRC Regulations for Radiation Exposure
 - 1. occupational
 - 2. public
 - 3. pregnancy or nursing
 - 4. internal dosimetry and bioassays
 - 5. personnel exposure records



Safety (continued)

- E. Medical Events
 - 1. definition
 - 2. NRC regulations for reporting and notification
- F. Facilities and Area Monitoring
 - 1. Basic Concepts
 - a. units of measurement
 - b. exposure rates
 - c. definition of contaminated area
 - 2. Survey Equipment and Techniques
 - a. well counters
 - b. survey meters
 - c. wipe test technique
 - 3. NRC Regulations
 - a. frequency of surveys and wipes
 - b. documentation of survey and wipes results
 - 1. interpretation
 - 2. reporting (corrective action)
 - 3. record retention
 - c. posting of signs (e.g., types, locations)
 - 4. Radioactive Spills
 - a. major spills
 - b. minor spills
 - c. processes for decontamination
 - d. reporting procedures
- G. Radioactive Materials
 - 1. shipping and receiving materials (e.g., DOT and NRC regulations)
 - a. shipping categories
 - b. measurement of exposure rate
 - c. measurement of surface contamination
 - d. removable contamination limits/trigger levels
 - e. documentation
 - 2. handling and storage
 - a. radiopharmaceuticals
 - b. sealed sources
 - c. consequences of improper handling and storage
 - 3. disposal of radioactive waste
 - a. release to environment
 - b. decay in storage
 - c. transfer to authorized recipient
- H. Pharmaceuticals
 - 1. storage
 - 2. disposal



Image Production

1. Instrumentation

- A. Survey Meter
 - 1. operating principles
 - a. Geiger Müller
 - b. ionization chambers (cutie pies)
 - 2. quality control
 - a. frequency and types of checks
 - b. interpretation and record keeping
- B. Dose Calibrator
 - 1. operating principles
 - 2. quality control
 - a. tests
 - 1. accuracy
 - 2. constancy
 - 3. linearity
 - 4. geometry
 - b. interpretation and record keeping
- C. Scintillation Detector System
 - 1. operating principles
 - a. well counter
 - b. uptake probe (e.g., thyroid, surgical)
 - 2. quality control
 - a. radionuclide sources
 - 1. energies
 - 2. type (e.g., rod, button)
 - b. parameters
 - 1. energy resolution
 - 2. efficiency
 - 3. high voltage calibration
 - 4. resolving time
 - 5. sensitivity
 - 6. energy linearity
 - 7. chi-square
 - c. interpretation and record keeping
- D. Gas and Aerosol Delivery Systems
 - 1. operating principles
 - 2. exhaust system (e.g., negative pressure, gas traps)
 - 3. interpretation and record keeping
- E. Gamma Camera
 - 1. operating principles
 - 2. quality control
 - a. frequency and types of checks
 - b. performance characteristics
 - 1. flood field uniformity
 - 2. high count uniformity correction
 - 3. spatial linearity
 - 4. spatial resolution
 - 5. energy resolution (e.g., FWHM)
 - 6. detector sensitivity
 - 7. extrinsic versus intrinsic methods
 - 8. center of rotation
 - 9. SPECT phantom measurements
 - c. interpretation and record keeping
 - 3. image acquisition
 - a. detector system
 - 1. count or time mode
 - 2. detector orientation
 - 3. photopeak energy setting and window width
 - 4. multi-energy acquisition
 - b. collimator selection
 - 1. types (e.g., parallel hole, pinhole)
 - 2. parameters (e.g., energy, resolution, sensitivity)
 - c. dynamic/static acquisition
 - 1. matrix selection
 - 2. framing (e.g., number and length)
 - 3. gating
 - 4. list mode
 - d. SPECT acquisition
 - 1. angular sampling/number of views (e.g., 180° versus 360°)
 - 2. matrix selection
 - 3. attenuation correction
 - 4. duration of acquisition

(Image Production continues on the following page.)



Image Production (continued)

F. PET/CT Scanner

1. PET operating principles
2. PET quality control
 - a. frequency and types of tests
 - b. characterization and correction calibration
 1. energy window calibration
 2. reference (blank) scan
 3. normalization calibration
 4. absolute activity calibration
 - c. interpretation and record keeping
3. PET image acquisition
 - a. list mode
 - b. cardiac gating
 - c. respiratory gating
 - d. time-of-flight
4. CT operating principles*
5. CT quality control*
 - a. tube warm-up
 - b. CT number (Hounsfield unit)
 - c. air calibration
6. CT image acquisition*
 - a. kVp
 - b. mA
 - c. pitch
 - d. slice thickness
 - e. noise and uniformity
 - f. artifacts

G. Data Processing

1. quantitative analysis (e.g., region of interest selection, ejection fraction, time activity curves, SUV)
2. qualitative analysis
 - a. motion correction
 - b. gated images
3. reconstruction
 - a. CT windowing and leveling
 - b. registration (image fusion)
 - c. orientation
 - d. filter parameters
 - e. attenuation correction
 - f. trues, scatters, randoms

H. Imaging Informatics

1. information systems (e.g., RIS, HIS, EMR, EHR)
2. networking
 - a. DICOM
 - b. PACS
 - c. HL7

*Diagnostic CT is not assessed on the Nuclear Medicine Technology Examination. CT content is assessed for attenuation correction/anatomic localization.



Procedures

1. Radionuclides and Radiopharmaceuticals

- A. Production of Radionuclides
 1. methods
 - a. reactor
 - b. accelerator
 - c. cyclotron
 - d. generator
 2. purity
 - a. radionuclide
 - b. chemical
 3. physical form (e.g., gas, solution, capsule)
- B. Radiopharmaceutical Characteristics
 1. method of localization
 - a. capillary blockade
 - b. active transport
 - c. phagocytosis
 - d. diffusion
 - e. compartmentalization
 - f. chemisorption
 - g. receptor binding
 - h. antigen antibody
 - i. filtration
 - j. metabolism
 - k. sequestration
 2. half-life
 - a. physical
 - b. biological
 - c. effective
 3. biodistribution
 - a. pharmacokinetics and pharmacodynamics
 - b. critical organs
 - c. target organs
- C. Preparation and Administration
 1. kit preparation
 - a. labeling process
 1. principles
 - a. oxidation/reduction
 - b. pH
 - c. time for reaction
 - d. temperature
 2. compounding techniques
 - a. venting
 - b. heating
 - c. mixing
 - d. USP regulations (e.g., USP 825)
 - b. shelf life and storage
 - c. quality control
 1. radiochemical purity
 2. particle size
 3. specific activity (e.g., millicuries per mass)
 4. color and clarity
 5. radiochromatography
 2. calculation of pharmaceutical and radiopharmaceutical dosage
 - a. units
 1. conversions
 2. calculations
 - b. volume determination
 1. formula
 2. decay tables
 3. concentration
 4. activity
 3. pharmaceutical and radiopharmaceutical administration
 - a. preparation
 1. syringe
 2. needle selection
 3. shielding
 - b. radiopharmaceutical label
 1. name of radiopharmaceutical
 2. assay date and time
 3. lot number and expiration date
 4. concentration
 5. volume
 6. activity
 - c. administration techniques
 1. routes
 2. aseptic
 3. uniform distribution (e.g., mixing, agitation)
 4. complications and reactions
 5. documentation

(Procedures continue on the following page.)



Procedures (continued)

TYPE OF STUDY

- 2. Cardiac Procedures**
 - A. Gated Blood Pool
 - B. Myocardial Perfusion
 - C. Viability
 - D. Amyloid Imaging
- 3. Endocrine and Oncology Procedures**
 - A. Endocrine
 - 1. thyroid uptake/imaging
 - 2. parathyroid
 - 3. neuroendocrine
 - 4. adrenal imaging
 - B. Tumor
 - 1. total/whole body
 - 2. SPECT or SPECT/CT
 - 3. PET/CT
 - C. Therapy
 - 1. procedures
 - a. palliative bone
 - b. thyroid ablation
 - c. hyperthyroidism
 - d. selective internal radiation therapy (SIRT) with hepatic artery perfusion study (HAPS)
 - e. targeted radiotherapy (e.g., neuroendocrine)
 - 2. regulations

FOCUS OF QUESTIONS

Questions about a specific study or procedure may address any of the following factors:

- A. Instrumentation
 - detector system
 - data acquisition
 - data analysis
 - ancillary equipment
- B. Radiopharmaceuticals and Pharmaceuticals
 - selection
 - dosage
 - administration
 - biodistribution
- C. Patient Preparation, Monitoring, and Education
 - indications and contraindications
 - pregnancy and nursing
 - dietary restrictions
 - adverse reactions
 - medications
 - age specific considerations
 - lab values
- D. Imaging Techniques
 - anatomical landmarks
 - views
 - patient-detector orientation
 - fusion imaging
- E. Anatomy and Pathophysiology
 - general anatomy
 - cross-sectional anatomy
- F. Nationally-Recognized Standards (e.g., ASRT Practice Standards, SNMMI Procedure Standards, The Joint Commission)

(Procedures continue on the following page.)



Procedures (continued)

TYPE OF STUDY

4. Gastrointestinal and Genitourinary Procedures

- A. Gastric Emptying
- B. Gastroesophageal Reflux
- C. Meckel Diverticulum
- D. GI Bleed
- E. Hepatobiliary
- F. RBC Hemangioma
- G. Liver/Spleen
- H. Renal Function
- I. Renal Cortical

5. Other Imaging Procedures

- A. Abscess/Infection
- B. Bone
 - 1. planar
 - 2. 3-phase
 - 3. total/whole body
 - 4. SPECT or SPECT/CT
 - 5. PET/CT
- C. Central Nervous System
 - 1. brain death
 - 2. SPECT or SPECT/CT
 - 3. PET/CT
 - 4. cisternography/CSF leak
 - 5. shunt patency
- D. Lung
 - 1. ventilation – gas and aerosol
 - 2. perfusion
 - 3. quantitative
 - 4. hepatic artery perfusion study (HAPS) for pretherapy lung shunt fraction
- E. Lymphoscintigraphy
 - 1. breast
 - 2. skin lesion
 - 3. lymphangiography

FOCUS OF QUESTIONS

Questions about a specific study or procedure may address any of the following factors:

- A. Instrumentation
 - detector system
 - data acquisition
 - data analysis
 - ancillary equipment
- B. Radiopharmaceuticals and Pharmaceuticals
 - selection
 - dosage
 - administration
 - biodistribution
- C. Patient Preparation, Monitoring, and Education
 - indications and contraindications
 - pregnancy and nursing
 - dietary restrictions
 - adverse reactions
 - medications
 - age specific considerations
 - lab values
- D. Imaging Techniques
 - anatomical landmarks
 - views
 - patient-detector orientation
 - fusion imaging
- E. Anatomy and Pathophysiology
 - general anatomy
 - cross-sectional anatomy
- F. Nationally Recognized Standards (e.g., ASRT Practice Standards, SNMMI Procedure Standards, The Joint Commission)



Attachment A: Nuclear Medicine Pharmaceuticals*

Radiopharmaceuticals

1. Tc-99m sodium pertechnetate
2. Tc-99m medronate (MDP)
3. Tc-99m pyrophosphate (PYP)
4. Tc-99m sestamibi (Cardiolite®)
5. Tc-99m tetrofosmin (Myoview™)
6. Tc-99m labeled RBCs
7. Tc-99m pentatate (DTPA)
8. Tc-99m succimer (DMSA)
9. Tc-99m mertiatide (MAG3)
10. Tc-99m exametazime (Ceretek™)
11. Tc-99m bicisate (Neurolite®)
12. Tc-99m exametazime (Ceretek™) tagged WBCs
13. Tc-99m MAA
14. Tc-99m sulfur colloid
15. Tc-99m tilmanocept (Lymphoseek®)
16. Tc-99m mebrofenin (Choletec®)
17. In-111 pentatate (DTPA)
18. In-111 oxine labeled WBCs
19. In-111 pentetreotide (OctreoScan™)
20. Tl-201 thallous chloride
21. Xe-133 gas
22. I-123 sodium iodide
23. I-131 sodium iodide
24. I-123 ioflupane (DaTscan™)
25. I-123 iobenguane (MIBG, AdreView™)
26. Ga-67 gallium citrate
27. Ga-68 dotatate (NETSPOT™)
28. F-18 fluorodeoxyglucose (FDG)
29. F-18 sodium fluoride (NaF)
30. F-18 fluciclovine (Axumin®)
31. F-18 florbetapir (Amyvid®)
32. F-18 florbetaben (Neuroceq™)
33. F-18 flutemetamol (Vizamyl™)
34. Rb-82 chloride

Therapeutic Radiopharmaceuticals

35. Ra-223 dichloride (Xofigo®)
36. I-131 iobenguane (MIBG, AZEDRA®)
37. I-131 sodium iodide
38. Lu-177 dotatate (LUTATHERA®)
39. Y-90 microspheres (TheraSphere®, SIR-Spheres®)

Interventional Pharmaceuticals

40. Adenosine
41. Aminophylline
42. Atropine sulfate
43. Dipyridamole (Persantine®)
44. Dobutamine
45. Beta blocker
46. Nitroglycerin
47. Fatty meal substitute
48. Furosemide (Lasix®)
49. Sincalide (Kinevac®)
50. Morphine sulfate
51. Regadenoson (Lexiscan®)
52. Potassium iodide (Lugol solution/SSKI)
53. Heparin
54. Recombinant TSH (Thyrogen®)
55. Oral CT contrast media

*This is a list of commonly used pharmaceuticals that may appear on the exam. However, other pharmaceuticals may appear as practice changes.



EXAMINATION CONTENT SPECIFICATIONS

ARRT BOARD APPROVED: **JANUARY 2021**
IMPLEMENTATION DATE: **JANUARY 1, 2022**

Radiation Therapy

The purpose of the *radiation therapy exam* is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of the staff technologist at entry into the profession. The tasks typically performed were determined by administering a comprehensive practice analysis survey to a nationwide sample of radiation therapists.¹ An advisory committee then determined the knowledge and cognitive skills needed to perform the tasks on the task inventory and these are organized into the content categories within this document. Every content category can be linked to one or more tasks on the task inventory. The document is used to develop the examination. The *Task Inventory for Radiation Therapy* may be found on the ARRT's website (www.arrt.org).

The ARRT avoids content when there are multiple resources with conflicting perspectives. Educational programs accredited by a mechanism acceptable to ARRT offer education and experience beyond the minimum requirements specified in the content specifications and clinical competency documents.

This document is not intended to serve as a curriculum guide. Although ARRT programs for certification and registration and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address the subject matter that is included in these content specifications, but do not limit themselves to only this content.

The table below presents the major content categories and subcategories covered on the examination. The number of test questions in each category are listed in bold and number of test questions in each subcategory in parentheses. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

Content Category	Number of Scored Questions²
Patient Care	46
<i>Patient Interactions and Management (29)</i>	
<i>Patient and Medical Record Management (17)</i>	
Safety	51
<i>Radiation Physics and Radiobiology (21)</i>	
<i>Radiation Protection³, Equipment Operation, and Quality Assurance (30)</i>	
Procedures	103
<i>Treatment Sites and Tumors (26)</i>	
<i>Treatment Volume Localization (18)</i>	
<i>Prescription and Dose Calculation (24)</i>	
<i>Treatments (35)</i>	
Total	200

¹ A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.

² The exam includes an additional 30 unscored (pilot) questions.

³ SI units are the primary (principal) units of radiation measurement used on the radiation therapy examination.



Patient Care

1. Patient Interactions and Management

A. Ethical and Legal Aspects

1. patients' rights
 - a. consent
(*e.g., informed, oral, implied)
 - b. confidentiality (HIPAA)
 - c. American Hospital Association (AHA) Patient Care Partnership (Patients' Bill of Rights)
 1. privacy
 2. extent of care (e.g., DNR)
 3. access to information
 4. living will, health care proxy, advanced directives
 5. research participation
 6. goal of care (e.g., definitive, palliative)
2. legal issues
 - a. verification (e.g., patient identification, treatment site, prescription)
 - b. common terminology (e.g., battery, negligence, malpractice, beneficence)
 - c. legal doctrines (e.g., respondeat superior, res ipsa loquitur)
 - d. restraints versus immobilization (e.g., positioning aids used to prevent motion)
3. ARRT Standards of Ethics

B. Interpersonal Communication

1. modes of communication
 - a. verbal/written
 - b. nonverbal (e.g., eye contact, touching)
2. challenges in communication
 - a. interactions with others
 1. language barriers
 2. cultural and social factors
 3. physical, sensory, or cognitive impairments
 4. age
 5. emotional status, acceptance of condition (e.g., stage of grief)
 - b. explanation of medical terms
 - c. strategies to improve understanding
3. patient education
 - a. explanation of treatment or procedure (e.g., purpose, length of time, radiation dose)

- b. pre- and post-treatment or procedure instructions (e.g., preparation, diet, and medications)
 - c. respond to inquiries about other imaging modalities (e.g., dose differences, types of radiation, patient preparation)
 - d. treatment compliance (e.g., positioning, skin marks)
4. support services
 - a. hospice
 - b. other professionals (e.g., dietitian, clergy, social services)
- #### C. Ergonomics and Monitoring
1. body mechanics (e.g., balance, alignment, movement)
 - a. patient transfer techniques
 - b. ergonomic devices (e.g., transfer board, Hoyer lift, gait belt)
 2. assisting patients with medical equipment
 - a. infusion catheters and pumps
 - b. oxygen delivery systems
 - c. other (e.g., nasogastric tubes, urinary catheters, tracheostomy tubes)
 3. patient monitoring and documentation
 - a. vital signs
 - b. signs and symptoms (e.g., motor control, cognitive changes)
 - c. fall prevention
 - d. weight
- #### D. Medical Emergencies
1. non-contrast allergic reactions (e.g., latex)
 2. cardiac/respiratory arrest (e.g., CPR, AED)
 3. physical injury or trauma
 4. other medical disorders (e.g., seizures, diabetic reactions)

*The abbreviation "e.g.," is used to indicate that examples are listed in parentheses, but that it is not a complete list of all possibilities.

(Patient Care continues on the following page.)



Patient Care (continued)

E. Infection Control

1. chain of infection (cycle of infection)
 - a. pathogen
 - b. reservoir
 - c. portal of exit
 - d. mode of transmission
 1. direct
 - a. droplet
 - b. direct contact
 2. indirect
 - a. airborne
 - b. vehicle borne (fomite)
 - c. vector borne (mechanical or biological)
 - e. portal of entry
 - f. susceptible host
2. asepsis
 - a. equipment disinfection
 - b. equipment sterilization
 - c. medical aseptic technique
 - d. sterile technique
3. CDC Standard Precautions
 - a. hand hygiene
 - b. use of personal protective equipment (e.g., gloves, gowns, masks)
 - c. safe handling of contaminated equipment/surfaces
 - d. disposal of contaminated materials
 1. linens
 2. needles
 3. patient supplies
 4. blood and body fluids
 - e. safe needle practices
4. transmission-based precautions
 - a. contact
 - b. droplet
 - c. airborne
5. additional precautions
 - a. neutropenic precautions (reverse isolation)
 - b. healthcare-associated (nosocomial) infections

F. Handling and Disposal of Toxic or Hazardous Material

1. types of materials
 - a. chemicals
 - b. chemotherapy
 - c. metals (e.g., block alloy)
2. safety data sheet (e.g., material safety data sheet)

G. Pharmacology

1. contrast media types and properties (e.g., iodinated, water soluble, barium, ionic versus non-ionic)
2. appropriateness of contrast media to procedure
 - a. patient condition
 - b. patient age and weight
 - c. laboratory values (e.g., BUN, creatinine, eGFR)
3. complications/reactions
 - a. local effects (e.g., extravasation/infiltration, phlebitis)
 - b. systemic effects
 1. mild
 2. moderate
 3. severe
 - c. emergency medications
 - d. radiation therapist's response and documentation

(Patient Care continues on the following page.)



Patient Care (continued)

2. Patient and Medical Record Management

A. Evaluation

1. epidemiology and etiology
 - a. cancer risk factors
 - b. prevalence and incidence
2. cancer screening
3. signs and symptoms
4. history and physical examination
5. imaging studies (e.g., CT, MRI, PET/CT)
6. other diagnostic studies
 - a. lab results
 - b. surgical reports
 - c. pathology reports

B. Assessment

1. treatment side effects
 - a. signs and symptoms
 - b. causes
 - c. management
2. blood studies
 - a. types of studies
(e.g., CBC, BUN, PSA)
 - b. factors affecting blood values
3. dietary counseling
 - a. common problems
 - b. causes
 - c. dietary management

C. Documentation

1. information included in treatment record
 - a. prescription
 - b. monitor units
 - c. target dose (daily and accumulated)
 - d. energy and type of radiation
 - e. date
 - f. time of day for b.i.d. treatment
 - g. fraction
 - h. elapsed days
 - i. field number and description
 - j. doses to other regions of interest
 - k. set-up instructions
 - l. imaging orders
2. elements of record keeping
 - a. patient identification
 - b. accountability (e.g., signatures)
 - c. accuracy and legibility
 - d. variance from prescription (errors, prescription changes)
 - e. medical events (definition and required documentation)
3. basic charge capture terminology ¹
 - a. professional and technical components
 - b. general principles and purpose (e.g., billable services, procedures, and devices)

¹ Specific CPT® codes are not covered.



Safety

1. Radiation Physics and Radiobiology

- A. Sources of Radiation
 - 1. radioactive material
 - 2. machine-produced radiation
 - a. target interactions (i.e., bremsstrahlung, characteristic)
 - b. particles (e.g., protons)
- B. Principles of Radiation Physics
 - 1. wave characteristics
 - 2. attenuation
 - 3. inverse-square law
 - 4. x-ray beam quality
 - 5. interactions with matter
 - a. photon interactions (e.g., Compton, photoelectric effect, pair production)
 - b. electron interactions
 - c. particle interactions (e.g., proton, neutron)
 - d. attenuation by various tissues
- C. Biological Effects of Radiation
 - 1. Units of measurement (NCRP #160)
 - a. absorbed dose (Gy)
 - b. dose equivalent (Sv, rem)
 - c. exposure (C/kg)
 - d. effective dose (Sv, rem)
 - e. air kerma (Gy)
 - 2. radiosensitivity
 - a. dose-response relationships
 - b. relative tissue radiosensitivities (e.g., LET, RBE)
 - c. oxygen effect
 - 3. somatic effects
 - a. cells
 - b. tissue (e.g., hemopoietic, skin, reproductive organs)
 - c. embryo and fetus
 - d. carcinogenesis
- e. early versus late or acute versus chronic
- f. deterministic versus stochastic
- g. short-term versus long-term exposure
- h. acute radiation syndromes
 - 1. hemopoietic
 - 2. gastrointestinal (GI)
 - 3. central nervous system (CNS)
- 4. genetic effects (e.g., genetically significant dose)
- D. Radiation Tissue Tolerance
 - 1. tolerance levels (i.e., whole organ TD_{5/5})
 - 2. adverse effects
 - 3. dose to critical structures
 - 4. radiobiological factors (e.g., dose, fractionation schemes, volume)
 - 5. biological factors (e.g., age, anatomic variation, medical conditions)
 - 6. medical factors (e.g., prior surgery, pacemakers)
 - 7. other factors (e.g., radiosensitizers, radioprotectors)
 - 8. contribution from other sources
 - a. chemotherapy
 - b. brachytherapy ²
 - c. other fields (e.g., prior or abutting)
 - d. radiation effect modifiers
 - e. daily imaging
 - f. CT simulation

² Only basic concepts related to common uses of brachytherapy are covered, including dose to surrounding tissue and radiation protection issues. Specific procedures and isotope characteristics are not covered.

(Safety continues on the following page.)



Safety (continued)

2. Radiation Protection, Equipment Operation, and Quality Assurance

- A. Minimizing Patient Exposure
 - 1. exposure factors
 - a. kVp
 - b. mAs
 - 2. shielding
 - a. rationale for use
 - b. types
 - c. placement
 - 3. collimation/beam width
 - 4. patient considerations
 - a. positioning
 - b. communication
 - c. pediatric
 - d. morbid obesity
- B. Personnel Protection (ALARA)
 - 1. sources of radiation exposure
 - 2. basic methods of protection (i.e., time, distance, shielding)
 - 3. personnel monitoring (NCRP recommendations for personnel monitoring, Report #116)
 - a. occupational exposure
 - b. public exposure
 - c. embryo/fetus exposure
 - d. dose equivalent limits
 - e. evaluation and maintenance of personnel dosimetry records
- C. Facilities and Area Monitoring
 - 1. NRC regulations (10 CFR, parts 20 and 35)
 - a. classification of areas (restricted, controlled, unrestricted)
 - b. required postings (signs)
 - c. area monitoring devices
 - 2. barrier requirements
 - a. primary
 - b. secondary
- D. MRI Magnetic Field Screening
 - 1. biomedical implants
 - 2. ferrous foreign bodies
 - 3. medical conditions (e.g., pregnancy)
 - 4. prior diagnostic or surgical procedures
 - 5. topical or externally applied items (e.g., tattoos, medication patches, body piercing jewelry, monitoring devices, clothing)
 - 6. ancillary equipment (e.g., oxygen tank, IV pole)
- E. Handling and Disposal of Radioactive Materials
- F. Components and Operation
 - 1. linear accelerator
 - 2. CT simulator
- G. Instrumentation
 - 1. ionization chamber
 - 2. Geiger-Müller detector
 - 3. TLD/OSL (optically stimulated luminescence)
 - 4. diodes
 - 5. neutron detectors

(Safety continues on the following page.)



Safety (continued)

- H. Quality Control Procedures
 - 1. warm-up and inspection of linear accelerators
 - a. interlock systems
 - b. safety lights
 - c. emergency switches
 - d. laser alignment
 - e. critical machine parameters (e.g., pressure, temperature)
 - f. electrical and mechanical hazards
 - g. imaging systems
 - h. audio/visual systems
 - 2. warm-up and inspection of CT simulators
 - a. safety lights
 - b. emergency switches
 - c. laser alignment
 - d. QC water phantom (e.g., CT number, noise)
 - e. tube warm-up
 - 3. radiation output verification
 - a. methods
 - b. frequency
 - c. effect of environment (e.g., humidity) on measurements
 - 4. light and treatment field checks
 - a. light and radiation field agreement
 - b. collimator indicator agreement
 - c. multileaf collimator performance
 - d. sidelight/laser accuracy check (isocenter)
 - 5. rotation check
 - a. safety procedures
 - b. operation of gantry/console
 - 6. evaluation of quality assurance results
 - a. interpretation
 - b. course of action
 - c. documentation



Procedures

1. Treatment Sites and Tumors

- A. Anatomy, Pathophysiology, Lymphatic Drainage, and Metastatic Patterns
 1. brain and spinal cord
 2. head and neck (including thyroid and salivary glands)
 3. breast
 4. lung
 5. abdomen, pelvis, GI, and GU
 - a. esophagus, stomach, small bowel, large bowel, rectum, and anus
 - b. pancreas, adrenals, liver, and gallbladder
 - c. ureters, kidneys, bladder, and urethra
 6. reproductive
 - a. prostate, testes, penis
 - b. endometrium, cervix, ovaries, uterus, vagina, and vulva
 7. skeletal
 8. miscellaneous
 - a. lymphoma (Hodgkin and non-Hodgkin)
 - b. sarcomas (bone and soft tissue)
 - c. multiple myeloma
 - d. skin
 - e. leukemia
 - f. mycosis fungoides
 - g. bone marrow transplant
 - h. benign (e.g., heterotopic bone, keloid, AVM, meningioma)
 - i. oncologic emergencies (e.g., whole brain, SVC, cord compression)
- B. Tumor Classification
 1. histopathologic types (e.g., benign, sarcomas, carcinomas)
 2. histopathologic grade
 - a. purpose (differentiation and growth rate)
 - b. grading system (e.g., GX, G1-G4)
 3. staging (basic concepts; not specific sites)
 - a. purpose
 - b. systems (e.g., TNM, Ann Arbor)

2. Treatment Volume Localization

- A. Treatment Techniques and Anatomic Relationships
 1. radiation therapy techniques
 2. sectional and topographic anatomy
 3. critical organs
 4. patient positioning and immobilization
 5. types and uses of contrast media
- B. CT Simulation
 1. CT image acquisition (e.g., mA, slice thickness)
 2. CT image processing and display (e.g., reconstruction, window level, field of view, CT number)
 3. contour volume and isocenter determination
 4. image transmission, storage, and retrieval
 5. programmable lasers
- C. Documentation and Verification of Simulation Procedure
 1. implement according to physician order
 2. anatomic position
 3. equipment orientation
 4. accessory equipment
 5. field parameters
 6. set-up instructions
 7. set-up photographs
 8. temporary and/or permanent reference marks

(Procedures continues on the following page.)



Procedures (continued)

3. Prescription and Dose

Calculation

A. Treatment Prescription

1. total target dose
2. fractionation schedules
3. beam energy
4. types of radiation
5. treatment volume (e.g., GTV, CTV, PTV)
6. number of fields
7. fixed/rotational fields
8. field weighting
9. field orientation
10. treatment unit capabilities and limitations
11. plan modifications
12. beam modifiers

B. Geometric Parameters and Patient

Measurements

1. field size and shape
2. target depth
3. patient thickness
4. SSD (TSD) and SAD (TAD)
5. collimator setting
6. abutting fields (e.g., gap calculations)
7. fusion with outside diagnostic studies

C. Dose Calculation and Verification

1. selection of energy
2. equivalent square (open and blocked field)
3. scatter factors (e.g., collimator, phantom)
4. depth of maximum equilibrium (d_{max})
5. percentage depth dose
6. TAR, TMR
7. SSD (TSD), SAD (TAD)
8. inverse square
9. extended distance factors
10. wedges (e.g., wedge angle or factor)
11. off-axis calculation
12. isodose curve characteristics (e.g., penumbra, DVH)
13. factors for beam modifiers (e.g., tray factor, bolus, compensator)
14. inhomogeneity correction factors
15. machine output data
16. verification and documentation

4. Treatments

A. Treatment Options (indications, benefits, risks)

1. chemotherapy
2. surgery
3. radiation therapy
 - a. external beam (e.g., photon, electron)
 - b. brachytherapy²
4. multimodality treatment

B. Verification and Application of the Treatment Plan

1. patient position
2. isocenter location and shifts
3. treatment parameters (e.g., beam orientation, energy)
4. prescription
5. techniques
 - a. 2D
 - b. 3D
 - c. non-volumetric arc therapy
 - d. 4D (e.g., respiratory gating)
 - e. IMRT
 - f. volumetric arc therapy
 - g. stereotactic
6. imaging procedures
 - a. kV imaging
 - b. cone beam CT (CBCT)
 - c. MV imaging

² Only basic concepts related to common uses of brachytherapy are covered, including dose to surrounding tissue and radiation protection issues. Specific procedures and isotope characteristics are not covered.

(Procedures continues on the following page.)



Procedures (continued)

- C. Treatment Machine Set-Up
 - 1. auxiliary set-up devices
 - a. couch indexing
 - b. positioning aids
 - c. alignment lasers
 - d. motion management
 - 1. surface guided radiation therapy (SGRT)
 - 2. gating systems
 - 3. abdominal compression
 - 2. machine operations
 - a. collimator or cone settings
 - b. optical or mechanical distance indicator
 - c. gantry angle
 - d. collimator angle
 - e. field light
 - f. treatment couch
 - g. six degrees of freedom couch
 - h. console controls
 - i. pendant controls
 - 3. parameters
 - a. SSD (TSD), SAD (TAD), depth
 - b. gantry, collimator, and field size settings
 - c. beam energy and type
- D. Treatment Accessories
 - 1. beam modifiers
 - a. compensating filters
 - b. shielding
 - c. blocks (e.g., thickness, half value layer (HVL), half-value thickness (HVT))
 - d. multileaf collimation
 - e. bolus
 - f. wedges (enhanced dynamic wedge, physical wedge)
 - 2. immobilization devices
 - a. custom
 - b. standard
- E. Treatment Administration
 - 1. patient monitoring
 - a. visual
 - b. audio
 - c. back-up systems
 - d. monitoring regulations
 - e. emergency situations
 - 2. record and verify systems
 - 3. image acquisition and registration
 - 4. site verification
 - 5. dose verification (e.g., diodes)
 - 6. equipment malfunctions
 - a. types (e.g., radiation, electrical, mechanical, software)
 - b. troubleshooting and correction
 - c. documentation and reporting

Computer-Based Testing Overview

After you have completed check-in procedures, test-center staff will show you to a work station and will make sure the computer is ready to deliver your exam. The testing session consists of four segments:

1. **Introduction, Tutorial, and Non-Disclosure Agreement:** During this segment, the computer will verify your name and allow you to complete a tutorial if you choose. We strongly urge candidates to spend the few minutes to take the tutorial. You will also be asked to read and accept a non-disclosure agreement – it requires that all candidates agree to **not** copy any test questions or otherwise disclose the content of the exam. You must accept the terms of the non-disclosure agreement; if you do not respond within 2 minutes your exam session will end. You will have up to eight minutes to complete the tutorial.
2. **Examination Session:** You will be given the exam during this period. In addition to answering questions, you can mark questions for later review or even comment on questions. The clock will be running, so pace yourself. Most questions are in the standard multiple-choice format and require you to select one best answer. In addition, a small portion of the exam may consist of the question formats noted below:

- a. **Select Multiple:** This format consists of a question or statement followed by a list of 4 to 10 response options. You are required to select all options that are correct.
- b. **Sorted List:** This format presents a list of 4 to 8 options and requires you to place them in correct sequence. You accomplish this by using the mouse to “click-and-drag” the options into a box so that they end up in a specified order, such as numerical, alphabetical or chronological.
- c. **Items with Hot Areas or Videos:** This format consists of a question accompanied by a medical image, drawing, graphic, or video.

To answer a ‘hot area’ question, place the cursor over the selected area and click the mouse; the highlighted areas are possible answers to the question. When selected, the area will become outlined and change color. To change your answer, move the mouse to another shaded area and click the mouse. The final selected shaded area will be recorded as your final answer.

For video items, you will need to read the question, open the exhibit, press the play arrow on the video, watch the video in its entirety, and then answer the question. You will not be able to move forward on the exam until you have opened and watched the entire video. The video controls are shown and described below. **Note: The videos are silent (no sound).**



Sample questions illustrating these formats can be obtained from the ARRT website (Examinations>Exam Format and Length), or by contacting the ARRT. In addition, the tutorial at the test center presents an example of each format.

3. **Item Review and End Review:** After responding to all questions, you will have the opportunity to go back and review questions in the time remaining. You can change answers during the review. Once you select the “End Review” button you will no longer be able to go back to the exam. A sample review screen appears later in this Appendix.
4. **Survey:** After the exam a short survey consisting of 13 questions will appear. Most people complete it in just a few minutes. The survey is important because it gives you the opportunity to let ARRT know about the quality of your testing experience. If something went wrong – or exceptionally right – this is the place to tell us.

The following pages illustrate the approximate appearance of a few of the more important computer screens. Taking a few minutes now to review these pages will help prepare you for exam day. This information is also provided during the tutorial review at the test center

Appearance of Test Questions

When the examination starts, the clock will be reset to the time allowed for the exam you are taking (see Exam Timing under the Exam Administration Day Section of the handbook to find the time allotted for your exam). Exam questions are presented in random order. The exam consists of a set number of scored questions plus several unscored pilot questions. The content specifications provide additional information about the number of questions and topics covered.

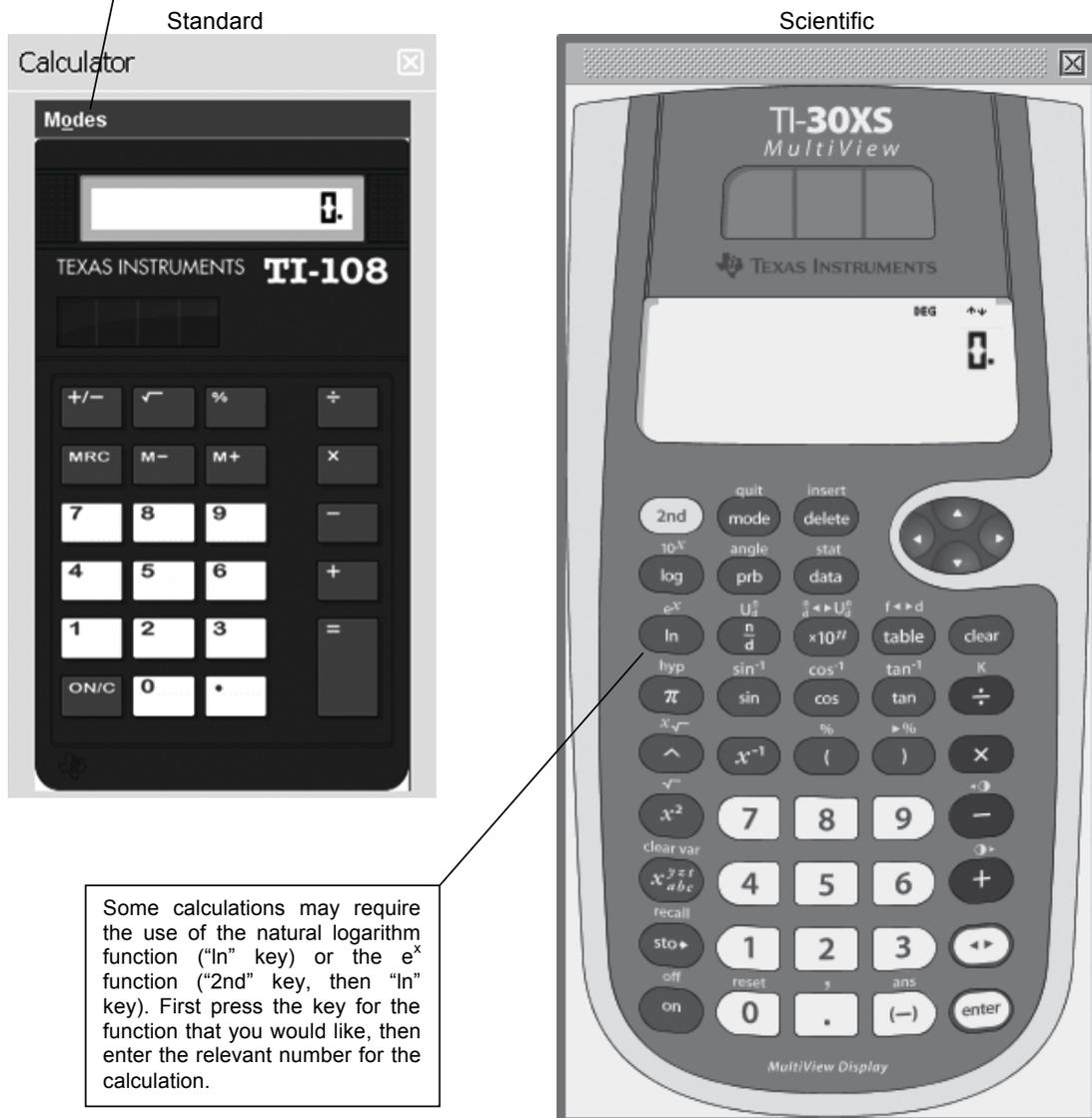
The screenshot shows a testing interface with a dark grey header bar. On the right side of the header, there is a clock icon and the text "Time Remaining 03:29:20" and "3 of 180". On the left side, there are icons for "Comment" and "Calculator". On the right side, there is an "Flag for Review" icon. Below the header, the main content area displays a question: "The Alamo is located in the state labeled as number." followed by four radio button options: "A 1", "B 2", "C 3", and "D 4". To the right of the question is a map of the United States with four states labeled 1, 2, 3, and 4. At the bottom of the interface, there are "Previous" and "Next" navigation buttons. Callout boxes provide the following explanations:

- Top Left:** This button allows you to mark questions for later review. If uncertain of the best answer, then choose your best guess and flag the question for later review by clicking on the flag icon.
- Top Right:** The clock indicates the time left to complete the exam.
- Middle Left:** You can comment on specific exam questions by clicking on the "Comment" button. The "Calculator" button gives access to an on-screen calculator (see next page).
- Middle Right:** The counter indicates which question you are on and the total number of questions on the exam.
- Bottom Left:** Here is the exam question. Choose one best answer by clicking the appropriate oval or letter (A, B, C, D).
- Bottom Right:** Click on these buttons to go back to the previous question or ahead to the next one.

Online Calculator

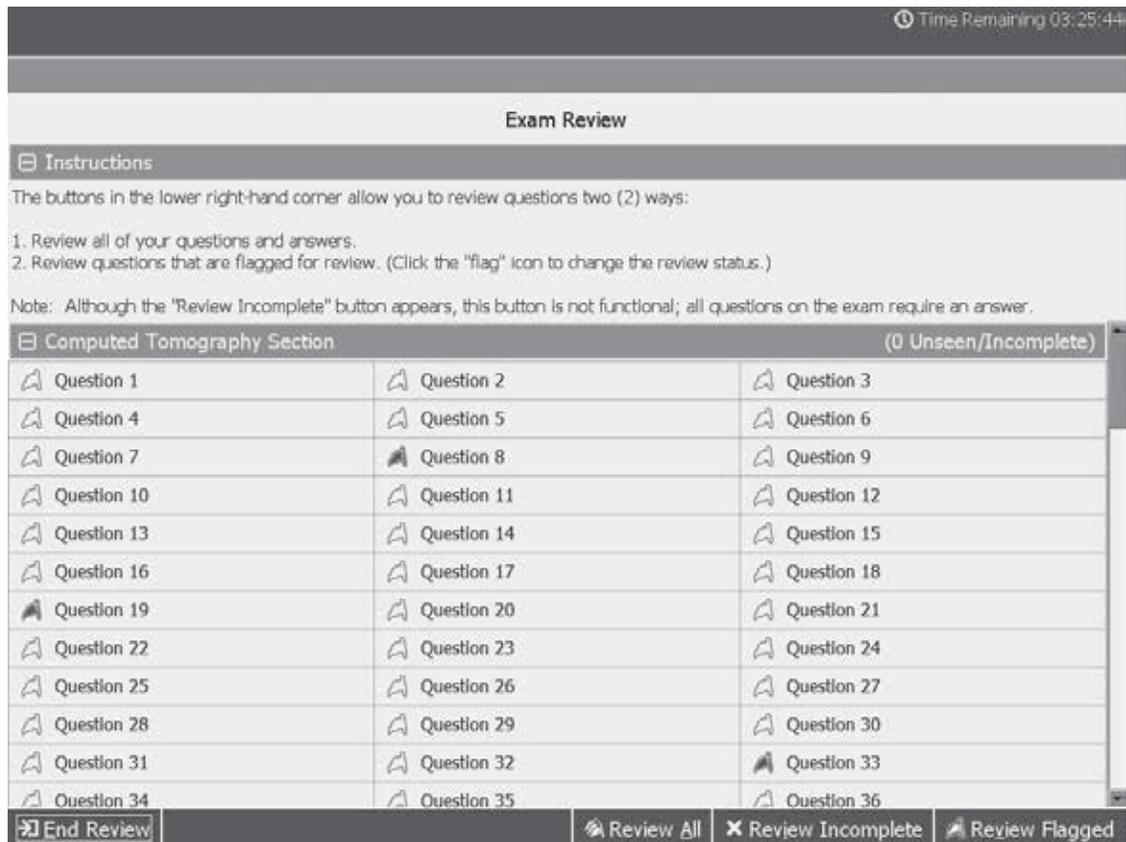
To use the calculator, click on the “Calculator” button at the upper left side of the exam screen. You can operate the calculator by using the mouse to click on numbers or arithmetic operations. Alternatively, the keyboard can be used. **Note: Please make sure to check the display screen on the calculator to verify the correct entry of numbers.**

The “Modes” button on the calculator allows you to toggle between the Standard and Scientific calculators. Note that most calculations on the exam can be done with the Standard calculator. However, some candidates may wish to use the Scientific calculator for certain calculations.



Exam Review

After you have completed all questions on the exam, a screen appears that allows you to go back to review questions. A filled-in flag icon appears next to any questions that you selected for review.



This button ends the exam. When you are done with your review, click this button to exit.

Once you click "End Review" you will no longer be able to review questions or change answers, **so be sure you are really ready to stop!**

You can return and review all questions on the exam by clicking on the "Review All" button.

You can return to the questions you selected for review by clicking on the "Review Flagged" button. To review all items on the exam, just click on "Review All."

If you click this button you will see that you have no incomplete questions, because skipping of questions is not an option on ARRT exams.

After the Examination

After you click "End Review" and confirm that you will not be able to return to the exam, a screen will appear to remind you not to discuss questions and/or answers with anyone.

A short survey appears on the screen. It asks a few important questions about the quality of the test administration and provides a place for you to type any general comments. We appreciate your feedback.

Potential Exam Disclosure Scenarios

Scenario	When it's OK	When it's not OK	Bottom line
Educator asking candidates to “stop by” after the exam to “let me know how it went.”	If the invitation and the feedback to the educator relates to their general experience (“I thought the test was not as difficult as I expected...”)	This type of invitation from an educator may be misinterpreted by the candidate — and the student may think that the educator is asking the candidate to reveal copyrighted information.	If the candidate is asked to reveal ARRT’s items or their answer options, then he or she will need to report the educator to the ARRT Ethics Committee. The educator should stop the candidate immediately from revealing any exam content, since doing so may subject the educator to ARRT’s ethics process.
Candidate tells another candidate, “The test was very difficult — I felt like I didn’t have enough time.”	The candidate is simply telling another candidate how they felt about the exam. This is all right because the candidate is not revealing any of ARRT’s items or the answer options.	One candidate (or potential candidate) asks another candidate questions about the specific items.	If ARRT’s items or answer options are shared, these individuals may find themselves part of an ARRT investigation and/or legal complaint as well as possible notification to their state licensing agency.
Candidate to educator: “You didn’t teach me about this item that asked [specific item]. I felt unprepared.”	Never.	It is not all right and it will never be all right to reveal ARRT’s copyrighted items (or answer options) to anyone.	Candidates agree to the Non-Disclosure Agreement at the beginning of their exam stating that they will not share exam items, and ARRT expects the examinees to abide by the agreement. Those who don’t may find themselves part of an ARRT investigation and/or legal complaint as well as possible notification to their state licensing agency.
Candidate tells a potential candidate that there were multiple-choice and sorted-list items on the test.	This is public information, noted in the handbook.	It’s not all right to reveal anything beyond what’s in the handbook.	Keep the conversation limited to what’s public information, such as the content specifications, and there’s no problem.
Candidate asks another candidate, “I don’t think that I understood this question...[relates question]... Do you know what they were asking?”	Never.	It is not all right and it will never be all right to reveal ARRT’s copyrighted items (or answer options) to anyone.	As noted two boxes up, candidates agree to the Non-Disclosure Agreement stating that they will not share exam items, and ARRT expects the candidates to abide by the agreement. Those who don’t may find themselves part of an ARRT investigation and/or legal complaint as well as possible notification to their state licensing agency.
Candidate says to a potential candidate, “If I were you, I would bring a sweater — it was cold at the test site.”	This candidate is simply telling another candidate about their surroundings at the test site. This is all right because the candidate is not revealing any of ARRT’s items or the answer options.	If it leads a candidate (or potential candidate) to ask another candidate questions about the specific items.	If ARRT’s items or answer options are shared, these individuals may find themselves part of an ARRT investigation and/or legal complaint as well as possible notification to their state licensing agency.
Potential candidate says to a candidate, “Were there a lot of questions on [specific topic]?”	Never.	This candidate should be aware of the topics that are contained in the exam from the content specifications published in the handbook and should not be asking for more specific information than is contained in that publication.	If the potential candidate is asking the candidate to reveal ARRT’s items or the answer options, then this conversation violates the Non-Disclosure Agreement the candidate agreed to at the beginning of the exam. If asked this type of question, the potential candidate should be shown the content specifications and should be warned of the consequences of revealing ARRT’s copyrighted items or their answer options.



ARRT Rules Agreement

Please review the following information and ask the Test Administrator if you have questions.

1.	ARRT has a zero-tolerance policy regarding possession of cell phones and other electronic devices at the test center. If you are found to be in possession of, or otherwise have access to, one of these devices after initial check-in (including during scheduled or unscheduled breaks), you will not be allowed to resume your exam or assessment, you will forfeit your exam or assessment fee, your score will be canceled, and it will count as an attempt in your three-attempt, three-year time period. For SSA participants, you will be assigned the full prescription for your discipline. Should you bring an electronic device into the test center, you must turn off the device and store it in one of the test center's lockers before you enter the testing room. Do not access your electronic device again until you have fully completed your exam or assessment.
2.	Jewelry that is wider than 1/4 in (1 cm) is not permitted inside the testing room, and you will be asked to remove it.
3.	Do not use the booklet provided by the Test Administrator until after you have responded to the Non-Disclosure Agreement. If you need a clean booklet during the exam or assessment, you should raise your hand to get the Test Administrator's assistance. You must return all items to the Test Administrator after completing your exam or assessment.
4.	Eating, drinking, smoking, chewing gum, and making noise that creates a disturbance for other candidates is prohibited during the exam or assessment.
5.	The Test Administrator will monitor you continuously while you complete your exam or assessment. The session may be videotaped or otherwise recorded for security or other purposes.
6.	If you experience problems that affect your ability to complete your exam or assessment, notify the Test Administrator immediately by raising your hand. The Test Administrator cannot answer questions related to exam or assessment content and performance.
7.	To request an unscheduled break, you must raise your hand to get the Test Administrator's attention. The exam or assessment timer will not stop while you are on an unscheduled break. The Test Administrator will sign you out after you leave the testing room. Before returning to your seat, the Test Administrator will sign you in; after being signed in, you may resume your exam or assessment.
8.	You should not remove any items from your secure locker. If you must access a personal item, such as an item needed to take to the restroom, this is allowed after notifying the Test Administrator. However, if you access any other prohibited item from the secure locker (cell phone, books, notes, etc.), your score will be canceled, your testing fees will not be refunded, and it will count as an attempt in your three-attempt, three-year time period. Note: During scheduled breaks, Registered Radiology Assistant (RA) and Sonography (SON) candidates may access their locker in order to retrieve snacks. You may not access any electronic devices during your scheduled break.
9.	You may not leave the building for any reason (unless directed to leave by the Test Administrator); this includes all scheduled and unscheduled breaks. If you leave the building you will not be allowed to resume your exam or assessment, you will forfeit your exam or assessment fee, and your score will be canceled. The exam will count as an attempt in your three-attempt, three-year period. For SSA participants, you will be assigned the full prescription for your discipline.
10.	Do not remove copies of exam or assessment questions and answers from the testing room (including by writing on your person or clothing). Do not share exam or assessment questions and answers with anyone. Reproduction of exam or assessment questions and answers, in whole or part, constitutes a breach of your agreement, and you can/will be prosecuted in federal or state court. Depending upon your candidate or participant status, this will also result in score cancelation, future certification and registration ineligibility, and/or discontinuation of your certification and registration.
11.	After completing your exam or assessment, raise your hand. The Test Administrator will come to your workstation to ensure your exam or assessment has ended properly and will escort you from the testing room.
12.	If you do not follow the rules, are suspected of cheating or tampering with the computer, and/or demonstrate irregular behavior the issue will be reported to Pearson VUE, the ARRT, and your state licensing agency (if applicable). Your exam or assessment may be invalidated, the ARRT may take other action such as canceling your score, and you will not be refunded your exam or assessment fee.

Candidate/Participant Statement: *By providing a digital signature, I give Pearson VUE my explicit consent to retain and transmit my personal data and test responses to the Pearson VUE corporate office and the ARRT (either of which may be outside of the country in which I am testing). I understand the information provided above and agree to abide by the ARRT Rules Agreement. In addition, I understand that if I am found to be in violation of any rule listed above, this will constitute grounds for the ARRT to take appropriate punitive action up to and including terminating my participation in the exam or assessment, invalidating the results of this exam or assessment and any prior exam or assessment, and permanently barring me from all future exams or assessments. In addition, I understand I may be subject to an ARRT ethics investigation or even a federal court lawsuit for copyright infringement and/or breach of contract. Any information collected by an ARRT investigation may be forwarded to my state licensing agency for review of state ethics violations.*

State Examination Handbook Checklist

When you receive your Candidate Status Report (CSR) from ARRT...and before scheduling your exam you will want to check...

- Does your name on your CSR match the name appearing on your two forms of required ID?
 - If your names do not match, do not schedule an appointment. Contact your state licensing agency to make the necessary changes and have them notify ARRT so we can mail you a new CSR with your updated info. Updates will also appear on your online CSR.
 - Once you verify the changes to your CSR are correct, go ahead and schedule your exam.
- Name or address change after you receive your information from ARRT?
 - All changes must be made via your state licensing office.
- Be sure to note the dates of your 90-day exam window.
 - You must schedule your exam for a time within the 90-day exam window appearing on your CSR.
- If you can't take your exam within your 90-day exam window, you are allowed up to 3 extensions – but they must be approved by your state licensing agency.
 - Cancel any existing appointment.
 - Contact your state licensing agency directly to request a window extension.
 - A new CSR will be mailed to you once ARRT has been notified and processed the request.
 - Updates will also appear on your online CSR at **www.state.rrt.org**.
- Required IDs at the test center.
 - Make sure your IDs meet ARRT's requirements listed in the handbook to prevent being turned away from the test center and losing your fee.
 - If you are unsure, cancel your appointment and reschedule when you are certain your IDs will be acceptable.
- Questions on exam results?
 - ARRT processes results each week and provides your score information to your state licensing agency.
 - Your state licensing agency determines your pass/fail status, not ARRT.
 - Please allow up to 45 days for your state licensing agency to notify you of your results.
 - Contact information for your state licensing agency is in the upper right-hand side on the front of your CSR.

Important Notice: State Licensing is Not ARRT Credentialing

A passing score on a state licensing examination does not make a candidate eligible for ARRT certification and registration. Candidates seeking ARRT certification and registration must have submitted an application directly to ARRT and must have met all other criteria for ARRT certification and registration. Those seeking only state licensing must meet criteria established by the state. Test scores earned as a state candidate may not be used for ARRT certification and registration.