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RADIOGRAPHY EXAMINATION

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D.A. SAIA

EDITION

10

PHOTOSTIMULABLE PHOSPHOR SCREEN LAYERS

- Protective coat
- BaF₂:Eu²⁺ phosphors in binder material
- Reflective backing
- Polyester base support material
- Antistatic layer
- Lead foil backing

TERMINOLOGY COMPARISON

S/F Imaging	CR/DR Imaging
Latitude	Dynamic range
Contrast	Grayscale
Receptor exposure	Receptor exposure
Recorded detail	Spatial resolution

CR SPATIAL FREQUENCY/RESOLUTION

CR spatial frequency/resolution increases as

- PSP crystal size decreases
- Laser beam size decreases
- Monitor matrix size increases

PICTURE ARCHIVING AND COMMUNICATION SYSTEM

PACS capabilities:

- Image acquisition
- Image display and interpretation
- Image archival and retrieval
- Image communication

CAUSES OF CR GRAININESS

- Underexposure
- Incorrect processing algorithm
- Excess SR; inadequate collimation
- Grid misalignment; cutoff

ELECTRONIC IMAGING

- Brightness/density changes with changes in window level
- Contrast changes with changes in window width
- Wide dynamic range
- Significant exposure latitude
- Fading with delayed processing
- PSPs are very sensitive to fog

CR Artifact	Cause
Fog	Exposure to scattered or environmental radiation
Image fading	Delayed processing
Black spots	Unused and not erased before use
Slight additional anatomic image	Incomplete erasure

Typical Image Matrix Sizes Used in Imaging

Nuclear medicine	128 × 128
Digital subtraction angiography	1,024 × 1,024
Computed tomography	512 × 512
Chest radiography	2,048 × 2,048

ADVANTAGES OF DIGITAL FLUOROSCOPY PHOTOSPOTS

- Decreased patient dose
- Postprocessing capability
- “Road-mapping” capability
- No chemical processing needed

GONADAL SHIELDING

Gonadal shielding should be used if:

- The gonads lie in, or within 5 cm of, the collimated field
- The patient has reasonable reproductive potential
- Diagnostic objectives permit

COMPARISONS BETWEEN LARGE AND SMALL IMAGE INTENSIFIER FOV

Larger Field of View

- Focal point closer to output screen
- Less magnification of perceived image
- Brighter image; less exposure required

Smaller Field of View

- Focal point farther from output screen
- Magnified image
- Less brightness; more exposure required

Radiation Weighting (W_r) Factors

X- or gamma	1
Protons	2
Neutrons: 10–100 keV	10
Neutrons: 100 keV–2 MeV	20
Alpha particles	20

Tissue Weighting (W_t) Factors

Skin	0.01
Thyroid	0.05
Breast	0.05
Lung	0.12
Gonads	0.20

TYPES OF DNA DAMAGE

- Main-chain, double-side rail break
- Main-chain, single-side rail break
- Main-chain breakage, cross-linking
- Base damage, point mutations

WAYS TO REDUCE RISK TO RECENTLY FERTILIZED OVUM

- Elective scheduling/10-day rule
- Patient questionnaire
- Posting

BEAM RESTRICTION

- Reduces patient dose
- Improves image quality

Beam Restrictor Types

- Collimator
- Cone
- Aperture diaphragm

Abbreviations

ADC	Analog-to-digital converter
APR	Anatomically programmed radiography
CCD	Charge coupled device
CR	Computed radiography
DEL	Detector element
DICOM	Digital imaging and communications in medicine
DIP	Distal interphalangeal joint
DQE	Detective quantum efficiency
EDR	Exposure data recognition
HIS	Hospital information system
IP	Image plate
MTF	Modulation transfer function
PACS	Picture archiving and communication system
PD	Photodiode
PIP	Proximal interphalangeal joint
PMT	Photomultiplier tube
PSL	Photostimulable luminescence
PSP	Photostimulable phosphor
RIS	Radiology information system
SF	Screen/film
SNR	Signal-to-noise ratio
SPS	Storage phosphor screen
TFT	Thin film transistor

TENTH EDITION

LANGE Q & ATM

RADIOGRAPHY EXAMINATION

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To Tony
All my love, always

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To access your complimentary online practice exam, visit www.MHEAlliedHealth.com.

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To the Student

Your feedback on the previous nine editions of this book has been inspiring and appreciated, and I have enjoyed my correspondence with so many of you.

I hope that all who use this book, its companion book PREP: Radiography, companion web site RadReviewEasy.com, and the recent addition of Radiography Flashcards—educators and students alike—will continue to provide feedback in order that these tools may continue to meet their needs. I invite and encourage you to contact me through McGraw-Hill or at dasaia921@yahoo.com with comments, questions, and suggestions for future editions of these learning materials.

The tenth edition of this Q&A contains new and revised material to reflect changes in the American Registry of Radiologic Technologists (ARRT) Content Specifications published in January 2013 and implemented in January 2014. It includes questions on digital/electronic imaging, including computed and direct digital radiography. Also included is the processing of electronic images including their acquisition, manipulation, and exposure indication. In recognition of the ever increasing importance and application of Computed Tomography in diagnostic imaging, this edition includes some fundamental CT questions and explanations. Future edition will address ARRT Content Specifications currently being developed and refined for implementation in January 2017.

You have provided us with a very favorable response to the companion online adaptive question bank: RadReviewEasy. I was very excited about the implementation of this personalized learning tool and your response has confirmed its usefulness. Additionally, RadReviewEasy has given me the enjoyable opportunity to “meet” so many more of you online.

RadReviewEasy’s robust performance profile allows users to track their results performance by topic and test scores over time and to compare their scores to others

using RadReviewEasy, including test-takers at the users’ specific institutions.

Customization features allow Students to:

- Choose the length and subject areas of a test or create a set of randomly selected questions.
- Retake tests composed of questions previously answered incorrectly so you can focus on weak areas.
- Time your tests or practice at your own pace.
- Take tests composed of questions that you are seeing for the first time.
- Create a Personal Study Plan which will support your test preparation and allow you to progress according to your customized study plan.

Customization features allow Instructors to:

- Access the Instructor Reporting Tool
- Track individual student progress
- Generate reports on class activity or subject area performance
- Generate assignments

RadReviewEasy affords the student an opportunity to practice CBT prior to taking the computerized ARRT examination. Visit RadReviewEasy.com for information on pricing and subscription terms.

I know you realize that review books are not intended to be a “quick fix” preparation for the certification examination administered by the ARRT. It takes at least 2 years of didactic instruction and testing, and hours of clinical practice, to prepare oneself as an entry-level radiographer. During about the last 4 months of radiography education, the actual certification examination becomes a rather scary anticipation. Confident, competent, even cavalier students suddenly become sober when the “the Registry” is mentioned. They begin to question all they ever felt confident about. If you use this book the way it is designed to be

used, and perhaps in conjunction with its companion learning tools: RadReviewEasy.com, the companion book, Radiography PREP (Program Review and Examination Preparation), and the companion Radiography Flashcards, you should be able to set aside any fears you may have.

I believe that proper use of the materials presented here, and the above companion tools, will help you overcome your anxieties. First, read the introductory section carefully. It presents proven, sensible suggestions to help improve test-taking performance. It elaborates on simple processes to help selection of the correct answer, and several methods and strategies that may be employed while taking “the” test. Probably the most important key to reducing apprehension is to reduce the unknowns to the fewest number. You will also find an introduction to CBT with a description of what to expect, and helpful hints to enhance preparation and reduce anxiety. Second, the format and content of the book and the questions on RadReviewEasy have been specially designed to provide focus and direction for your review, and thus to help you do your very best on your certification examination. The ARRT has no secrets and springs no surprises on you. Just as your instructors have made known what is expected of you during your education, the ARRT has made known the content, question format, and terminology used on the certification examination. Every student and educational program has access to the ARRT online, where they publish regular updates to keep educators and students current on activities and policies. The ARRT publishes its policies and procedures and several other documents that are useful to educators and students in preparation for their certification examination: *Content Specifications for the Examination in Radiography*, *Conventions Specific to the Radiography Examination*, and *Standard Terminology for Positioning and Protection*—as well as information on accreditation, ethics review pre-application, certification and registration eligibility, advanced placement, brochures, and handbooks. These documents are revised periodically and advise educators and students of terminology, categories, content, and approximate weight of content areas on the ARRT examination. Although the *Content Specifications* by no means serves as a comprehensive radiography curriculum, it does serve as a suitable guide for examination review and preparation. It makes sense to design a review book in which the content, question format, and

terminology are similar to that which students can expect to find on their certification examination.

The number of questions found in each chapter is proportional to the number found in that category on the actual ARRT examination. The questions are designed to test your problem-solving skills and your ability to integrate facts that fit the situation.

Most important and practical, I believe, are the detailed explanations found at the end of each chapter. By themselves, the explanations are good reviews of essential material; they provide a “mini-lecture” for each question. Use them to confirm your correct answers and to better understand your weaker areas. You will see that most explanations will tell you not only why the correct answer is correct, but also why the other answer choices (distractors) are incorrect. Radiography: PREP can be used either before this book—as a review of the material this book will test you on—or it can be used with this book to help you strengthen particular essential areas of study. Similarly, the Flashcards and RadReviewEasy can be used for supplemental study and review.

Once you have finished reviewing the first five chapters, set aside special time for the practice tests in Chapters 6 and 7. Try to simulate the actual examination environment as much as possible. Choose a quiet place free from distractions and interruptions, gather the necessary materials, and arrange to be uninterrupted for up to 3 hours. When you’re ready to practice in an exam-simulating digital environment, visit www.MHEAlliedHealth.com to access your free practice test.

In summary, use this book as recommended to help ease your precertification examination jitters. Excessive anxiety can impair clear thinking and lower your score. Avoiding excessive stress can improve your concentration and information retrieval process. Remember, you have been well prepared by your program director and instructors, and you have studied and worked hard for at least 2 years. So follow the advice found in the Introduction: Prepare yourself sensibly and keep a positive attitude. I totally agree with a remark the famous automaker Henry Ford once said: “Whether you think you can or whether you think you can’t, you’re right!”

I wish you much satisfaction and success in your radiography career!

D. A. Saia

Acknowledgments

Once again, it is a pleasure to recognize and express my sincere appreciation to those who have been so helpful and supportive during the preparation of this tenth edition.

Special recognition goes to my former coworkers Olive Peart, MS, RT(R)(M) and Teresa Whiteside, BA, RT(R)(BD), (CDBT) for their generous day-to-day support and warm friendship.

I am grateful to all the professional staff of McGraw-Hill. There would have never been a tenth edition without their expert direction and support. Special appreciation is expressed to my editor, Catherine A. Johnson—her calm patience during stressful periods is gratefully appreciated. Thank you also to Midge Haramis, Christina Thomas, and Aptara project manager Amit Kashyap.

A special note of appreciation goes to Andrew Moyer for his support in the development of Radiography Review Flashcards. Another thank you goes to Jennifer Pollock for her development and maintenance of the books' companion web site, www.RadReviewEasy.com. Andrew's and Jennifer's foresight and expertise have brought successful added dimensions to both texts—PREP and the Q&A. Everyone at McGraw-Hill has been helpful in the development of these projects; it is always a pleasure to work with their creative and skilled staff.

An outstanding group of reviewers was recruited for this edition of Lange Q&A. Gloria Albrecht, Gail Faig, Jayme Frangione, Merryl Fulmer, Brenda Grant, Paula McPeak, and Dan Sorrentino are all invaluable resources to the health care and the radiologic imaging communities. They reviewed the manuscript and offered suggestions to improve style and remove ambiguities and inaccuracies. Their participation on this project is deeply appreciated.

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The support and assistance offered in previous editions by the late George Spahn of Fuji Medical Systems, USA will always be greatly appreciated. George was instrumental in the introduction and expansion of electronic imaging content in this book and especially in its companion text, PREP: Radiography. George Spahn is a great loss to Fuji Medical Systems, USA and the radiology community, and is missed by so many.

Many of the images are reproduced here through the courtesy of Stamford Hospital, Department of Radiology. A number of images found in Chapter 4, Image Acquisition and Evaluation, have been reproduced through the courtesy of American College of Radiology. A special thank you is also sent to Conrad P. Ehrlich, MD for images added to this book and to PREP.

Appreciative and affectionate acknowledgment is sent to all my students—past, present, and those still to come. Their questions, enthusiasm, and desire to learn not only make my job a most pleasant task, but also served as the original stimulus for the preparation of this text.

Finally, and most especially, a loving message of appreciation goes to my husband Tony. The preparation and revision of two books and a companion web site and Flashcards is extraordinarily time consuming. His love, understanding, and encouragement (and cooking!) were invaluable and deeply appreciated throughout the preparation of this, and every, edition.

D. A. Saia

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Introduction

Completion of the ARRT radiography certification examination is often a high point in the career of a radiologic professional. Certification indicates that the individual has acquired a recognized level of knowledge and expertise and is qualified to deliver ionizing radiation in the performance of medical diagnostic testing. On what does success or failure depend?

Relax! It isn't as bad as it seems! As the student radiographer nears graduation, there is, understandably, an anxiety that begins to grow. It is a time when you wonder if you are smart enough and if you are skillful enough. Although there will always be room for growth, these concerns arise from the realization that an important landmark has been reached. Formal education will soon be at an end—no more written examinations and no more clinical competencies to complete. You will be on your own, proclaimed competent. How will you perform on the certification examination? How will you perform in the clinical arena? These are indeed sobering thoughts.

I believe that proper use of the materials presented here will help you overcome your anxieties. You will find several easy and effective suggestions for intelligent preparation and test taking. These suggestions are proven, sensible recommendations to help improve test-taking performance. Special focus has been placed on suggestions for the ARRT computer-based testing (CBT) system. They elaborate on simple processes to help in selection of the correct answer, and several methods and strategies that may be employed while taking your certification examination. Probably the most important key to reducing apprehension is to reduce the unknowns to the fewest number.

You will find that the format and content of this review book helpful and specially designed to provide focus and direction for your review, thus helping you do your very best on the certification examination. The ARRT has no secrets and springs no surprises on you. Just as your instructors have made known what is expected of

you during your education, the ARRT has made known the content, question format, and terminology used on the certification examination.

HOW THIS BOOK IS ORGANIZED

There are three primary sections in this book: a topic-by-topic review with 1,000 examination-type questions and paragraph-length explanations; two 200-question practice tests, also with paragraph-length explanations; and this Introduction, which includes information necessary to help you get the most out of the book and to do your best on the certification examination.

This is a current book of practice questions that are designed to mimic actual test questions. In addition, its companion RadReviewEasy.com has additional questions and answers for further practice in simulated certification conditions; visit the site for pricing and subscription terms.

In summary, this book will provide you, the student, with a review that will better enable you to simulate and prepare for the certification examination by providing an excellent and comprehensive review of radiography.

ABOUT THE EXAMINATION

It is essential to carefully read the ARRT Radiography Handbook. It describes in detail all the essential testing information required before, during, and after the actual test. Failure to follow the required steps can result in forfeiture of test appointment, and re-application.

ARRT certification examinations are administered at Pearson VUE test centers. To schedule your examination you will need your ARRT ID from the Candidate Status Report. Several types of examinations are administered at

these test centers. If you believe keyboard sounds might distract you, you are encouraged to request earplugs prior to entering the examination room.

As noted later in this section, you should plan to arrive at least 15 minutes early. Many test centers require you to be there 30 minutes ahead of the scheduled test time. If you are 15 minutes late, you run the risk of forfeiting your appointment time, and being required to reapply.

Be prepared to show at least two forms of identification, one of which must be government-issued photo ID (e.g., driver's license, state ID card, passport).

Security requirements upon entry at the examination site include a photograph, digital signature, and palm vein scanning.

Paper, pencils, etc. are not permitted in the examination room—an erasable board and pen are provided. A calculator is available on the test computer, or you may request a simple four function calculator from the test center. If you have any request/problem during the test, you should raise your hand for assistance (e.g., screen brightness needs adjustment, other problem with computer, need earplugs, etc.).

There is a 20-minute tutorial before the start of the examination and a 10-minute survey after completion of the examination. Candidates are presented with multiple-choice questions on a computer screen and directed to select an answer using either the keyboard or a mouse. The process allows candidates to review or change any answers to any questions prior to submitting the completed examination for scoring.

The tutorial offered at the beginning of the examination allows the candidate to answer several practice questions. This ensures that the candidate is thoroughly familiar with the process.

The national certification examination for radiography is a standardized test administered by the ARRT and includes 220 multiple-choice questions; 200 questions are scored and 20 questions are unidentified pilot questions. The time allotted for the test is 3½ hours; passing score is 75%. Total time, including tutorial and survey, is 4 hours.

Beginning January 2000, the ARRT discontinued paper and pencil testing and began to use CBT for the administration of its radiography examinations. Pearson VUE testing centers currently administer the ARRT examination. There is no postmarking deadline for ARRT examination applications. Applicants may apply for the examination prior to graduation, but will schedule their examination date within an assigned 90-day window that starts at graduation. Once the ARRT application is processed, and the applicant deemed eligible, the ARRT sends the candidate their CSR—Candidate Status Report.

The CSR indicates the candidates ARRT number and their examination “window” dates. Most educators advise taking the certification examination shortly after completing all didactic and clinical requirements.

To gain admittance to the test center, the candidate must show two current identifications; at least one must show a photo, and both must show signatures. Positive identification will include photograph, digital signature, and palm vein scanning at the test site. A four-function nonprogrammable calculator is available on the computer, or can be provided to the examinee upon request. Test questions are administered in random order, that is, they are not grouped together by subject (and that is the way the two practice tests in this book are designed).

Multiple-choice questions are presented on the computer screen and the candidate is directed to select the best answer—the mouse or keyboard may be used. There are other types of questions in addition to typical multiple-choice questions. Select-multiple questions require you to select all correct options from a list of four to eight possible responses. Sorted-list questions require you to place in order a given list of four to eight options. Images with “hot spots” require you to click on a particular spot or region. Videos require that you view a video, then answer the question that follows. Videos provide you with a control bar that allows to play, pause, and stop. The candidate is permitted to review or change answers to questions before indicating that he/she is finished with the examination.

STRATEGIES FOR STUDYING AND TEST TAKING

The purpose of a test strategy is to make the most of your knowledge, although no strategy, however elaborate, can help you if you do not know your subject.

A good test strategy can do the following:

1. Prevent you from making mistakes
2. Help you to use your time efficiently
3. Improve your odds of getting the right answer

The single most important trait of a good test strategy is simplicity. There are two ways to make and keep a procedure simple: The first way is to design it to be simple. The second is to practice the procedure as it is designed. The second part is up to you. If you use the following test strategies (particularly the elimination strategy) while using this review book, the strategies will become second nature to you, and you can then concentrate all your attention on passing your certification examination.

PREPARING FOR THE EXAMINATION

Designing a Study Schedule

It is important to establish a routine study schedule. This schedule should allow you to study at a time when you are at your optimum. Some students are more alert in the morning for this kind of work, while others have better success in the afternoon. It would not be a good plan to try and study late at night after a full day unless this is an optimum time for you.

There are several advantages to designing a schedule. The first is that it forces you to face the reality of your study load. Many students underplay the amount of time it will take to complete a thorough study, and this can adversely affect their performance. If you write out a schedule that includes both your daily responsibilities and the time you need to study, you will have a sense of the pace needed to complete your review. The second advantage to designing a schedule is that it will allow you to increase your concentration because the schedule defines the allotted amount of time for each topic you need to cover. Otherwise, a lot of time can be wasted in determining what to study during each session.

Setting up a Study Plan

After completing the best of radiography programs, even the best of students will have gaps in his or her knowledge, subjects that were somehow missed or forgotten, or that will not come to mind when needed. These gaps in your knowledge are often small; but since one piece of information often builds upon other pieces, a small gap in your knowledge can sometimes lead to a large drop in your test score. The best way to get around this problem is to use a well-defined study plan. Listed below are two alternative plans for you to consider. The first is diagnosis and remediation, and the second is SQ3R.

Diagnosis and Remediation

This is a two-step approach: diagnosis (finding out what you do not know) and remediation (learning the material).

Diagnosis. Many students graduate from their programs without a good idea of what they do or do not know. Fortunately, this book has been designed to make diagnosis simple. By following the steps listed below, you will know what you need to learn before you take the certifying examination.

Step 1. Begin with Chapter 1, Patient Care, or any of the other first five chapters. Go through the questions in

one sitting, making the experience as similar to the actual examination as possible. Remember to practice test strategies while answering the questions. This will produce a more valid diagnosis.

While taking the test, you should note or highlight words and phrases from the questions that you do not understand. After you have finished the questions (but before you have graded your work) make a list of the terms you noted and the numbers of the questions that contained them.

Step 2. Analyze your results. Read the answers and make a list of the questions you missed. Compare this list with the subspecialty list at the end of the chapter. This will tell you if you are weak in a particular area. Once you have defined an area of weakness, pay special attention to the explanations provided. If the answer is still unclear, use the exact page references to your textbook for further study.

Anytime you go through your work, picking out and correcting your mistakes, you will gain a greater understanding of your strengths and weaknesses. However, by approaching the analysis systematically, the improvement can be dramatic. Concentrate on your areas of weakness, but be sure to read all the explanations at least once. This will allow you to compare your reasoning on right and wrong answers and to check for the possibility that you put down the right answer for the wrong reason.

Step 3. Repeat the process. The purpose of this study plan is to get important information into your long-term memory. The best way to ensure this is to begin your study plan early enough to allow your self-time to repeat your chapter study one more time before the examination. Keep and compare your results from each review and focus on any weaknesses still apparent from the comparison.

Remediation

Step 1. Read and cross read. Starting with the subspecialty that you missed most often, make a reading list. For those areas in which you missed three or four questions, a single reference will probably be enough, but if you missed more than four, you should cross read to cover the same information in more than one text. (You might also want to review these topics in your old class notes.)

When you study from texts, use the index and the table of contents to find the section you need. If you are using more than one text, compare and look for common ideas. Sometimes, writing a summary of your reading helps to clarify the information. This technique has been proven to improve retention and understanding, but it can be time consuming.

Step 2. Once you have finished your reading, go back to the questions that you missed. If they still are not clear, consult an expert. Most students are reluctant to approach an instructor with a question that does not relate directly to a class. However, most instructors are glad to answer questions that will improve the chances for their students to obtain a high passing score on the certification examination. Instructors appreciate questions that are specific, well thought out, and which show that the student has done some independent work.

SQ3R

The second method for study is best suited for reviewing your textbooks for further study once you have identified a weakness. It is called the SQ3R and is presented by Frances P. Robinson in his book *Effective Study*. It makes study reading more efficient and long-term remembering more probable. SQ3R stands for Survey, Question, Read, Recite, and Review. The steps are as follows:

Survey. First, skim through an entire chapter.

1. Think about the title of the chapter. What do you already know about the subject? Write ideas in the margins. Read the conclusion. What better way is there to discover the main ideas of a chapter?
2. Read the headings. These are the main topics that have been developed by the author.
3. Read the captions under the diagrams, charts, and graphs.

Allow approximately 10 to 12 minutes for the survey step. Surveying will help increase your focus and interest in the material.

Question. Write out two or three questions relating to each heading. These should be questions that you believe will be answered within each section. Use the “who, what, when, where, why, and how” application when generating these questions.

Read. Now, read the first section. Keep in mind the questions you have created and read, with a purpose, as quickly as possible.

Recite. At the end of the section, look away from the book for a few seconds. Recite and think about what you have just learned. It is best to recite aloud because hearing the information will help increase your memorization.

Review. Reviewing is a key step if you want to retain the material you have read. Reviewing as you study results in less time needed for test preparation.

Learning to use the SQ3R method is a skill that takes practice. Often, students feel that it takes too long and is too complicated, but its use results in an increase in comprehension, interest, and memorization. The SQ3R method allows you to study at the same time that you are doing your course reading.

Summary

Everyone does not have the same learning style, and, as a result, effective study techniques are not the same for everyone. It is important to choose the method that is best for you, and this will take some experimentation. For instance, some students become frustrated when they cannot comprehend the textbook material while reading when seated at a desk. Sometimes, just getting up and pacing while memorizing can facilitate the learning process if you are having trouble at your desk. Other students learn faster with audio aids. If these are available to you and you are having trouble with learning just from your books, it may be worth the experiment to see if hearing the material will enhance your learning.

Study Groups

While preparing for an examination, properly organizing or attending a study group can be extremely helpful. However, a study group needs to be very focused with a specific agenda for each session. Otherwise, it can be a time waster. Listed below are some important points to keep in mind when organizing and conducting a study group:

1. Limit the group size to four or five people.
2. Select classmates who share your academic goals.
3. Meet the first time to discuss the meeting times, meeting place, and group goals.
4. Select a group leader and a time keeper. The group should meet for 2 to 3 hours for each session to ensure a thorough review.
5. Establish an agenda for each meeting that specifies the topics of discussion. This will save time and lend focus to the group. It ensures that the group reviews all pertinent topics by slotting time for all areas.
6. Establish group norms that define how the group will act. This would include things such as getting there on time, being prepared, and ending on time. It is important to emphasize that all members must do their fair share of the work for the group to gain the maximum benefit.

Study groups are useful to review and compare both lecture and reading notes, to review textbook information together, and to review examination topics. Group sessions are a

good time to review the question types used on the certification examination, to discuss test-taking strategies, to help each other design study plans, and to drill or review together all material expected to be on the examination.

Explain the material to a friend! This will help you discover what you know and don't know.

The support of a study group is extremely helpful in building self-confidence and in overall preparation for examinations. They are not intended to replace individual study time, but serve as a supplement. If properly utilized, study groups are an enormous asset for test preparation. Finally, when working within a group, many students are more likely to exert their best effort because they are accountable to the other members of the group.

Practice Tests

The practice tests (Chapters 6 and 7) can be used in one of the following two ways: (1) as a way of determining strengths and weaknesses before you go through the review book or (2) as a final preparation for the test after you have done your chapter-by-chapter review.

The practice tests have been designed in an effort to duplicate the experience of taking the certification examination. Test questions are administered in random order, questions are not ordered according to topic. Therefore, the practice test questions in this book are in randomized sequence—just as you will find questions presented on the ARRT certification examination. Taking the practice tests will make the process more familiar, so you would not be as nervous when you face the real test. The practice test will help you to determine whether or not you are answering the questions quickly enough, and whether your score is high enough to pass. In summary, the practice tests simply give you a chance to practice, giving you an opportunity to practice for the actual examination.

TEST-TAKING STRATEGIES

Time Management

Keeping track of your time and progress is harder than it might first appear. Most of us have been surprised while taking a test by how little time was left. This experience is even more upsetting in the middle of a certification examination. Knowing when there is a problem and knowing what to do about it are the objectives of time management.

Even with your eye on the clock, calculating the time you have left is not always easy. On the radiography examination, you have 3½ hours to complete 220 questions.

This gives you about 57 seconds (0.9 minute) per question. In other words, you have to answer approximately 66 questions per hour.

Another way to look at this is by breaking the time into two blocks. If, when you are halfway through the allotted examination time, you have finished a minimum of 110 questions, you are working on time. However, there is one additional complication. Not all questions require equal time to work. It is quite possible to run across a string of difficult questions early in the test and fall behind, and then make up the time with easy questions later in the test. For this reason, being a few questions short at the halfway mark is not a cause for concern. However, if you have finished significantly less than 110 questions after 90 minutes, you may be starting to fall behind.

If you do fall behind, what can you do to catch up? Sometimes, simply seeing that you are behind and trying to work faster will be enough to motivate you to catch up. If not, you have other options. Try to read through the questions and answers a bit faster. If you have checked only one answer as likely to be right, put that choice down immediately; do not reconsider your answer. Always mark your best choice and move forward.

As a rule of thumb, if a fact question (one requiring you to recall a fact) takes more than a minute or two, select your best answer, “mark” the question (CBT has a “mark” button you can click), and go on. You may not skip a question; you must indicate an answer but you may mark the question and return to it later for further consideration. For a calculation problem (one requiring you to calculate some quantity), give yourself an extra minute or two. The computer monitor will indicate the question number you are currently answering, compared to the total number of questions (e.g., number 62 of 220). The computer counts down from your allotted time, and the computer screen will indicate the amount of time you have remaining.

Elimination: Finding the Correct Answer

Good test performance is sometimes determined by the ability to recognize the incorrect answers as well as the correct ones. Eliminating incorrect answers (termed distractors) not only improves your score, it actually makes the test a more accurate measure of your knowledge.

Eliminating a distractor reduces the possible wrong choices. If your knowledge allows you to eliminate two incorrect responses, your odds of a correct response would be increased from one out of four to one out of two. If you can eliminate three distractors, you would have a 100% probability of getting the right answer. Every distractor you eliminate increases your odds of picking the right answer.

Multiple-choice questions usually have one distractor that is obviously wrong, one distractor that is closer to the correct response, and one distractor that is very close to the correct answer. If you know the subject, you can eliminate the distractors that are most incorrect and improve your chances. If you prepare thoroughly, you will be able to eliminate the others. The more you know, the better you will do.

Many books on test taking suggest complicated systems to eliminate bad answers and rank good ones, but in order to use elimination effectively, you need a procedure that is both quick and simple. For the ARRT CBT examination, you must select an answer in order for the next question to be displayed. If you are unsure of your selection, or just want to come back later to review it, you are able to mark the question. All the questions you have marked in this manner will be displayed one by one after you have completed all 220 questions. There is an optional tutorial that you may take prior to starting the examination. Taking the tutorial is a good way to become more familiar with navigating through the examination with greater ease and assurance.

Changing Answers

Everyone has had the experience of trying to remember the answer to a question without success and then *finding* that piece of information further along in the test. A problem that you stare at for an hour without progress might seem simple if you go on to other problems and come back to it later. Very often, another question will jog your memory; this technique can work for you during the CBT examination.

If you are unsure of the correct way to answer a question:

1. If one of the answers seems better than the rest, put it down and mark the question for future reference. Come back and check the question at the end if you have time.
2. If you can eliminate two of the possible answers, make an educated guess between the two remaining possibilities. Then, mark the question for future reference.
3. Ask yourself, “Will more time really help me answer this question?” If your answer is no, do the best you can with what you know, using the process of elimination and making an educated guess. Again, mark the question for future reference so that you can reread it if there is time at the end.

Guessing

You have probably been given a great deal of information and advice about guessing on tests. Most of what you have been told may be confusing or contradictory. It may make the problem easier to think in terms of rolling a

die. Imagine a game in which you get a point every time the number 1, for example, comes up. How could you improve your score in this game? One way would be to roll the die as many times as you could. Another way would be to reduce the number of sides on the die so the “right” side would be more likely to come up; this way is called the process of elimination, and it plays a good part in test taking when you are unsure of the correct response.

Although we do not suggest guessing as an effective method of test taking, we do recognize that there will be times when it can be effective for you. Keep in mind the following things if you need to use this method:

1. The process of elimination will help you significantly in determining the right answer. Use this technique to narrow down the possible choices.
2. Mark the question so that, if you have time, you can come back to it. It is possible that the correct response may reveal itself through a question further ahead on the test.
3. Remember that guessing really does not work as an effective strategy by itself. You will need to study hard and use guessing in conjunction with other methods for it to be effective.

PRACTICE TESTS

Taking the Practice Test

In order to use the practice test to determine how long the test will take you to complete or how high you will score, you must take it under conditions matching, as closely as possible, the actual test conditions. If you try to eat supper while taking the test, take a 5-hour break in the middle of the test, or stop after every question to look up the answer, you will not get a clear picture of your current standing or potential to pass the examination. Following are some suggestions on how you can get the most out of the practice test:

1. Keep your schedule completely free. Find a time and a place that will guarantee that you will not be disturbed for the duration of the test. Most libraries work well for this purpose, as do unoccupied classrooms if you can get access to them. If you have to take the test at home, make sure that you would not be bothered by friends or family.
 2. Minimize your distractions, do not take phone calls, and do not try to watch TV or concentrate on anything else other than the test.
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