

# **STUDENT WORKBOOK**

*for*

**RADIOGRAPHY  
IN THE DIGITAL AGE**

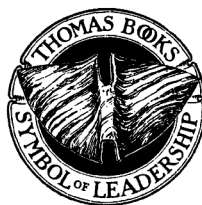


Third Edition

*Student Workbook for*  
**RADIOGRAPHY IN THE DIGITAL AGE**

*By*

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# INTRODUCTION

## How to Use this Student Workbook

This **Student Workbook for Radiography in the Digital Age** is designed for use in the following typical radiography courses:

1. Physics of Radiography
  - A. Radiation Production and Characteristics
  - B. Imaging Equipment
2. Principles of Imaging
3. Digital Image Acquisition and Display
4. Radiation Biology and Protection

The **Workbook** is entirely organized in a “fill-in-the-blank” format. The wording of each question closely matches both the textbook and the lecture slide series for each course. This format is designed for *short-term* reinforcement of the student’s retention of lecture and reading material by focusing on key words. The **Workbook** should therefore be used on a *daily basis*, not as a self-test or review after whole units have been covered. The following are specific recommendations on how the student can most fully benefit from the Workbook and other ancillaries:

### 1. IN-CLASS USE:

*This is the most recommended method, for use with the **Lecture Slides for Radiography in the Digital Age**.* The sequence and wording of questions closely matches the slides. The questions have been kept short, with most blanks for filling in only with *key words* from the slide series. This is an effective “note-taking” tool that strikes a perfect balance between allowing the student to concentrate on the lecture by doing minimal writing, and still provoking the student to *participate* in classroom learning.

Instructors may elect to require this type of classroom participation and award points for completing each unit.

Some additional space at the bottom of each page is provided for any other notes the student might wish to take during lectures.

## 2. HOMEWORK USE:

If the **Workbook** is used as a reinforcement tool for *homework*, it is strongly recommended that the student answer the corresponding questions after reading *each major section* of a chapter. To facilitate this, the major unit subheadings are included in the **Workbook**. Do not wait until completing the entire chapter, or you may have trouble recalling the **key words** that are elicited by each question.

## 3. UNIT REVIEW AND SELF-TESTING:

For the purposes of review, self-testing or preparation immediately prior to a test, **Chapter Review Questions** are available at the end of each chapter in the textbook. Answer keys to these questions may be made available from your instructor. These are better suited for unit review than the workbook material.

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## Chapter 1

### AN INTRODUCTION TO RADIOGRAPHIC SCIENCE

#### *The Scientific Approach*

1. Fill in the terms for the following definitions:

\_\_\_\_\_ : The attempt to simplify concepts and formulas, to economize explanations; the philosophy that simple explanations are more likely to be true than elaborate, complex ones.

\_\_\_\_\_ : The requirement that proofs (experiments) can be duplicated by different people at different times and in different locations with precisely the same results.

\_\_\_\_\_ : The requirement that any theory or hypothesis can logically and logistically be proven false. Anything that cannot be proven false is not science, but belongs in another realm of human experience.

\_\_\_\_\_ : The requirement that experiments and their results can be directly observed with the human senses.

\_\_\_\_\_ : The requirement that results can be quantified mathematically and measured.

Additional NOTES:

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2. Perhaps the strongest aspect of the scientific method is that when it is used correctly, it is \_\_\_\_\_ - \_\_\_\_\_.
3. Radiography is primarily a science because the radiographic image contains a \_\_\_\_\_ amount of diagnostically useful details, a \_\_\_\_\_ amount of information.
4. The standard of practice for all radiographers is to use good \_\_\_\_\_, sound \_\_\_\_\_, logical \_\_\_\_\_ and objective \_\_\_\_\_ in providing the best possible care for their patients.

### ***A Brief History of X-Rays***

5. In 1895, Wilhelm Roentgen was one of several researchers studying \_\_\_\_\_-rays which streamed across their \_\_\_\_\_ tubes when electricity was applied.
6. Roentgen accidentally discovered x-rays on November \_\_\_\_, \_\_\_\_ in \_\_\_\_\_, Germany.
7. The following year, Becquerel discovered natural \_\_\_\_\_ which was later found to consist of 3 distinct types, \_\_\_\_\_ particles, \_\_\_\_\_ particles, and \_\_\_\_\_ rays.

### ***The Development of Modern Imaging Technology***

8. The first fluoroscope was invented by \_\_\_\_\_.
9. Early fluoroscopes required high doses of radiation to patients, and were not substantially improved upon until 1948 when the \_\_\_\_\_ was developed.
10. A dentist, William Rollins, developed both the first \_\_\_\_\_ and the first \_\_\_\_\_.

Additional NOTES: \_\_\_\_\_

11. The high-efficiency hot-filament x-ray tube was invented by \_\_\_\_\_.
12. American professor \_\_\_\_\_ sandwiched x-ray film between fluorescent intensifying screens (developed by Thomas Edison) to create the first x-ray cassette.

### ***The Development of Modern Digital Imaging***

13. The first digital imaging technology to be demonstrated, in 1979, was digital \_\_\_\_\_, using the TV camera signals from image intensifiers.
14. "PACS" stands for "\_\_\_\_\_ and \_\_\_\_\_ system."
15. \_\_\_\_\_ was appropriately dubbed as "cassette-less radiography."
16. Compared to film-based radiography, the main advantage of all digital imaging systems is their capacity for \_\_\_\_\_ - \_\_\_\_\_ of images, which spares repeated exposures to the patient.

### ***Living with Radiation***

17. Radiation can be broadly divided into three types:
  1. \_\_\_\_\_
  2. \_\_\_\_\_
  3. \_\_\_\_\_
18. One example of #1 above is \_\_\_\_\_
19. One example of #2 above is \_\_\_\_\_
20. One example of #3 above is \_\_\_\_\_

Additional NOTES: \_\_\_\_\_

21. To be particularly harmful, radiation must be capable of \_\_\_\_\_ atoms.
22. Nature accounts for about \_\_\_\_\_ of all radiation we receive.
23. Although radiography is defined as a safe profession, radiographers must use good common sense to protect themselves from accumulating unnecessary amounts of radiation and keeping both their own exposure and every patient's exposure *ALARA*, which stands for:  
  
\_\_\_\_\_.

Additional NOTES: \_\_\_\_\_

## Chapter 2

### BASIC PHYSICS FOR RADIOGRAPHY

#### *The Base Quantities and Forces*

1. The three standards for measurement are:      Standard Unit:

1. \_\_\_\_\_ : \_\_\_\_\_

2. \_\_\_\_\_ : \_\_\_\_\_

3. \_\_\_\_\_ : \_\_\_\_\_

2. The difference between mass and weight is that mass remains \_\_\_\_\_, regardless of its location..

3. An example of a derived unit is \_\_\_\_\_, defined as \_\_\_\_\_.

4. The four fundamental forces in the universe are:

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

Additional NOTES:

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**Unit Systems**

5. One \_\_\_\_\_ has traditionally been the standard tabletop distance for the center of the x-ray tube.
6. One \_\_\_\_\_ is about the width of your smallest fingernail.
7. One \_\_\_\_\_ is about the width (diameter) of a pinhead.
8. For length: 1 centimeter = \_\_\_\_\_ inches  
1 meter = \_\_\_\_\_ inches  
1 kilometer = \_\_\_\_\_ miles
9. For mass: 1 kilogram = \_\_\_\_\_ pounds
10. A special unit for measuring such extremely small lengths as x-rays have is the \_\_\_\_\_, abbreviated \_\_\_\_\_.
11. The angstrom is \_\_\_\_\_ meters, read as “one ten-\_\_\_\_\_ of a meter.”
12. In Table 2-1, the angstrom falls between \_\_\_\_\_ (billionths of a meter) and \_\_\_\_\_ (trillionths of a meter).

**The Physics of Energy**

13. Energy is the ability to do \_\_\_\_\_.
14. The generic unit for energy is the \_\_\_\_\_.
15. Within a closed system, energy is a \_\_\_\_\_ quantity, so the total energy contained must always be the same.

Additional NOTES: \_\_\_\_\_