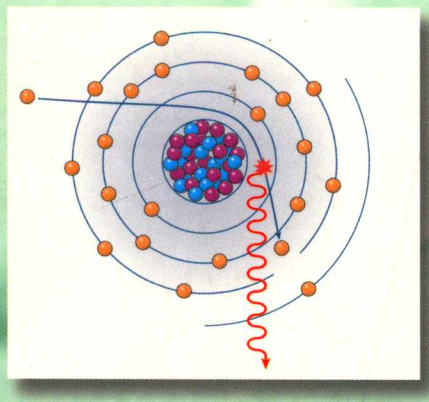
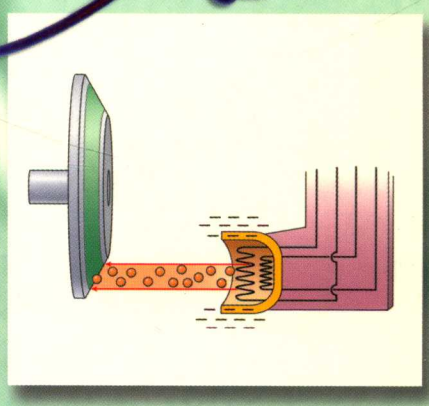
Essentials of Radiologic Science

Workbook





Robert Fosbinder • Starla Mason

Wolters Kluwer Health | Lippincott Williams & Wilkins

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Starla Mason


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Essentials of Radiologic Science

Workbook

Dedication

This Workbook is dedicated to my husband, Tom, and my children, Camden and Colin, who grew up with radiography as daily dinner conversation. This Workbook is also dedicated to all of my current and past radiography students for being the guinea pigs for most of these labs—we all learned and experimented together!

Starla Mason

Preface

The ***Essentials of Radiologic Science Workbook*** is designed to supplement the textbook, ***Essentials of Radiologic Science*** by Robert Fosbinder and Denise Orth. Each worksheet is directly correlated to a chapter in the textbook and contains Registry-style multiple choice questions, image labeling exercises of selected illustrations in *Essentials of Radiologic Science*, and a crossword puzzle of important terms.

The worksheets can be used as a natural extension of the textbook for outside assignment purposes, and some of the labeling activities can be used to supplement and enhance class activities. Every effort has been made to make the material correlate to the textbook to allow for self-directed student learning, but also challenging enough for test review purposes. The crossword puzzles provide an enjoyable way for students to learn and/or review terms and concepts relevant to each chapter.

The *Workbook* also contains twenty laboratory experiments relevant to the concepts covered in *Essentials of Radiologic Science*, providing students with opportunities to directly apply their learning with hands-on activities. They are arranged in order of the concepts covered in the textbook and cover basic physics principles in addition to some of the more traditional technique and exposure lab experiments. Each laboratory experiment provides instructions for completing the lab, tables or space for collecting data, and four to seven analysis questions to enhance students' critical thinking skills. Recognizing that digital imaging is now the norm in most radiology departments, five of the experiments are dedicated to CR and DR imaging concepts, and the ability to use computed radiography or direct radiography for collecting data for several of the other labs has also been incorporated.

The *Workbook* has been developed to assist both the educator and student in reinforcing radiologic concepts and to also ensure that the student remains an active participant in the learning process. When used in conjunction with *Essentials of Radiologic Science* and the other ancillaries, such as the videos, animations, PowerPoint slides, test bank, and lesson plans, the *Workbook* is an essential component to complete the teaching-learning cycle.

Starla Mason

User's Guide

This User's Guide introduces you to the helpful features of *Essentials of Radiologic Science Workbook* that enable you to quickly master new concepts and put your new skills into practice.

Workbook features to increase understanding and enhance retention of the material include:

Registry-style multiple choice review questions

1

Radiation Units, Atoms, and Atomic Structure

1. The Bohr model of the atom consists of a dense _____
   a. positive nucleus surrounded by a diffuse cloud of negative charge
   b. positive nucleus surrounded by electrons in definite shells
   c. negative nucleus surrounded by a diffuse cloud of positive charge
   d. negative nucleus surrounded by protons in definite shells

2. The electron binding energy is
   a. the energy of attraction between electrons in the shells
   b. the energy required to remove the nucleus from an atom
   c. the energy required to remove an electron from the nucleus
   d. the energy required to remove an electron from its orbital shell

3. The atomic number is the number of _____ in the nucleus.
   a. protons
   b. neutrons
   c. protons and electrons
   d. protons and neutrons

4. The nucleus of an atom contains which of the following?
   1. Protons
   2. Neutrons
   3. Electrons
   4. Gamma rays
   a. 1
   b. 1 and 2
   c. 2 and 3
   d. 1, 2, and 3

5. The periodic table of elements lists the elements in order of increasing
   a. atomic number
   b. atomic weight
   c. atomic neutrons
   d. atomic ionization

6. The atomic mass of an element is designated by which letter?
   a. A
   b. M
   c. Z
   d. K

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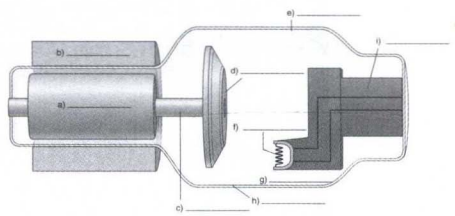
38 Part II: Circuits and X-Ray Production

Image Labeling

1. Label the components of the x-ray tube.



2. Identify the anode angles and their respective actual and effective focal spots.

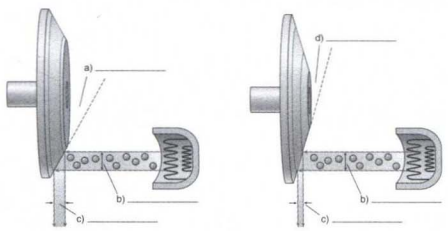
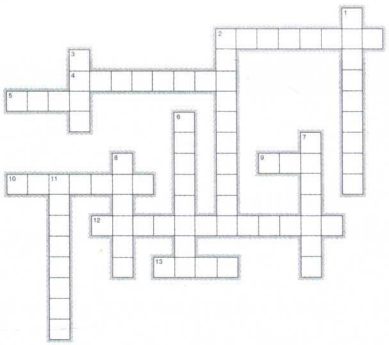


Image labeling exercises

Crossword puzzles

Crossword Puzzle



Across

2. Elements with the same number of protons, but different numbers of neutrons
4. Conventional unit of radiation exposure
5. Emitted from a radioisotope; equivalent to an electron
   c mass unit
   t of effective dose
   to the number of protons in an atom
   hemical symbol for this element is Pb

Down

1. SI unit for radioactivity; equal to 1 dps
2. Process of adding or removing electrons from an atom
3. SI unit for absorbed dose
6. Time required for a radioisotope to decay to one half of its initial activity
7. The positively charged center of an atom
8. A nucleon with a positive charge
11. Has an atomic mass of 1/2,000 amu

EXPERIMENT 1

Electric and Magnetic Fields

Name: _____ Date: _____

Electrostatics is the study of stationary or resting electric charges. An electric field exists around all electric charges. An English scientist, Michael Faraday (1791–1867), introduced the concept of using lines of force as an aid in visualizing the magnitude and direction of an electric field. Similarly, the magnetic force per unit pole is called the magnetic field. In this case, the field is mapped out by using the poles of magnets. The purpose of this activity is to allow the student to visualize and map both electric and magnetic fields and compare their similarities and differences.

Objectives:

Upon completion of this lab, the student will be able to:

1. Draw the electric field surrounding both positive and negative charges.
2. Visualize and draw the magnetic field surrounding magnets.
3. Apply the laws of electrostatic and magnetic fields to his or her drawing.
4. Compare and contrast the similarities and differences in electric and magnetic fields and their respective laws of interaction.

Part I: Electrostatic Fields

Draw the electric fields for each charge configuration below, indicating the lines of force, and/or their interactions as applicable. After you have completed your sketches, answer the questions.

a. The electric field of a single point charge

+

b. The electric field of two like point charges

+ +

c. The electric field of two unlike point charges

+ −

Laboratory Experiments relevant to the concepts covered in *Essentials of Radiologic Science* provide students with opportunities to directly apply their learning with hands-on activities.

Reviewers

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Many thanks to my family, friends, and colleagues for their support. Thanks also needs to go to my early radiography mentors—your willingness to share your knowledge set me on the path of this most rewarding career. Finally, I am grateful to my husband, Tom. No one could ask for a better supporter or cheerleader.

Starla Mason

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PART V: RADIATION PROTECTION

PART VI: PATIENT CARE

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PART I

Basic Physics

1

Radiation Units, Atoms, and Atomic Structure

1. **The Bohr model of the atom consists of a dense _____.**

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   c. protons and electrons
   d. protons and neutrons

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   1. **Protons**
   2. **Neutrons**
   3. **Electrons**
   4. **Gamma rays**

   a. 1
   b. 1 and 2
   c. 2 and 3
   d. 1, 2, and 3

5. **The periodic table of elements lists the elements in order of increasing**

   a. atomic number
   b. atomic weight
   c. atomic neutrons
   d. atomic ionization

6. **The atomic mass of an element is designated by which letter?**

   a. A
   b. M
   c. Z
   d. K

7. **Which types of particulate radiation are given off when a radioisotope decays?**

   1. **Beta**
   2. **Gamma**
   3. **Alpha**

   a. 1 only
   b. 2 only
   c. 1 and 2
   d. 1 and 3

8. **Calculate the total number of electrons present in an atom when there are five orbital shells.**

   a. 48
   b. 50
   c. 72
   d. 98

9. **Which electron shell has the highest binding energy?**

   a. P shell
   b. L shell
   c. K shell
   d. Q shell

10. **What is the unit of absorbed dose in the SI system?**

    a. Curie
    b. rad
    c. rem
    d. Gray

11. **If one electron is taken away from a helium atom, the result is**

    a. hydrogen
    b. an isotope
    c. an ion
    d. radioactive

12. **The letter designation for the fourth shell out from the nucleus is**

    a. D
    b. K
    c. L
    d. N

13. **The maximum number of electrons that the P orbital shell can theoretically hold is**

    a. 2
    b. 8
    c. 36
    d. 72

14. **Sodium, potassium, lithium, and cesium are placed in the same group in the periodic table because they**

    a. contain the same number of protons
    b. share similar chemical properties
    c. have identical atomic mass numbers
    d. are all radioactive elements

15. **Which of the following radiations would not penetrate the skin?**

    a. gamma
    b. beta particles
    c. alpha particles
    d. x-rays

16. **Atoms of the same element but different mass numbers are called**

    a. isotopes
    b. isotones
    c. isometric
    d. isobaric

17. **Radioactivity can be defined as**

    a. the ability to do work
    b. potential energy
    c. the quantity of any radionuclide decaying in disintegrations per second
    d. the spontaneous transformation of one element into another

18. **How much radioactivity would be left after 6 hours for a sample of technetium-99 if the half-life of this radioisotope is 6 hours?**

    a. 100%
    b. 50%
    c. 25%
    d. 12.5%