GLOBAL EDITION

Anatomy and Physiology Coloring Workbook

A Complete Study Guide

ELEVENTH EDITION

Elaine N. Marieb

ALWAYS LEARNING

PEARSON

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Elaine N. Marieb, R.N., Ph.D.

Holyoke Community College

PEARSON

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PREFACE

Although never a simple task, the study of the human body is always fascinating. Over the years, thousands of students have benefited in their studies and enjoyed the process of working through this book. Whether you are taking a 1- or 2-semester course, you will find this book invaluable to the study of anatomy and physiology.

What's New to This Edition?

The eleventh edition of the *Anatomy & Physiology Coloring Workbook* continues to serve as a review and reinforcement tool to help health professional and life-science students master the basic concepts of human anatomy and physiology. We have helped students by making the following revisions:

- **New *Finale: Multiple Choice* questions** have been added throughout.
- **New *At the Clinic* application questions** appear throughout the book.
- **Updated terminology** has been added throughout the book.
- **New figure illustrating the major tissue types** has been added.

Scope

Although this book reviews the human body from microscopic to macroscopic levels (that is, topics range from simple chemistry and cells to body organ systems), it is not intended to be encyclopedic. In fact, to facilitate learning, this workbook covers only the most important and useful aspects of human anatomy and physiology. Pathophysiology is briefly introduced with each system so that students can apply their learning. Where relevant, clinical aspects (for example, muscles used for injection sites, the role of ciliated cells in protection of the respiratory tract, and reasons for skin ulcer formation) are covered. To encourage a view of the human body as a dynamic and continually changing organism, developmental aspects of youth, adulthood, and old age are included.

Learning Aids

As in previous editions, multiple pedagogical devices are used throughout the book to test comprehension of key concepts. The integration of a traditional study guide approach with visualization and coloring exercises is unique. The variety of exercises demands learning on several levels, avoids rote memorization, and helps maintain a high level of interest.

The exercises include completion from a selection of key choices, matching terms or descriptions, and labeling diagrams. Elimination questions require the student to discover the similarities or dissimilarities among a number of structures or objects and to select the one that is not appropriate. Correctable true/false questions add a new dimension to the more traditional form of this exercise. Also, students are asked to provide important definitions. In the completion sections,

the answer lines are long enough so that the student can write in either the key letter or the appropriate term. Both responses are provided in the answer section.

Coloring exercises are a proven motivating, effective approach to learning. Each illustration has been carefully prepared to show sufficient detail for learning without students becoming bored with coloring. There are more than 120 coloring exercises distributed throughout the text that should prove valuable to all students. Students who are visually oriented will find these exercises particularly beneficial. When completed, the color diagrams provide an ideal reference and review tool.

Visualization exercises are a truly unique feature of this book. With the exception of the introductory chapter on terminology, each chapter contains an "Incredible Journey." Students are asked to imagine themselves in miniature, traveling within the body through various organs and systems. These visualization exercises are optional, but they often summarize chapter content, allowing students to assimilate what they have learned in unusual and amusing ways.

Thought-provoking "At the Clinic" questions challenge students to apply their newly acquired knowledge to clinical situations. Additionally, the eleventh edition features a finale to each chapter with challenging multiple-choice questions.

Acknowledgments

To those educators, colleagues, and students who have provided feedback and suggestions during the preparation of all eleven editions of this workbook, I am sincerely grateful. In particular, I want to thank the following reviewers for their valuable comments and suggestions: LuAnne Clark, Lansing Community College; Catherine Elliott; Judy Garrett, University of Arkansas Community College; Judy Megaw, Indian River State College; Hal Nauman; Lyn Rivers, Henry Ford Community College; Tinna Ross, North Hennepin Community College; and Mary Weis, Collin College–Spring Creek Campus.

The staff at Pearson Education has continuously supported my efforts to turn out a study tool that will be well received and beneficial to both educator and student audiences. For this edition, Brooke Suchomel, Senior Acquisitions Editor, Ashley Williams, Assistant Editor, and Michael Penne, Project Manager, deserve special mention.

Pearson would like to thank and acknowledge the following people for their work on the Global Edition:

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INSTRUCTIONS FOR THE STUDENT—HOW TO USE THIS BOOK

Dear Student,

The *Anatomy & Physiology Coloring Workbook* has been created particularly for you. It is the outcome of years of personal attempts to find and create exercises helpful to my own students when they study and review for a lecture test or laboratory quiz.

I never cease to be amazed at how remarkable the human body is, but I would never try to convince you that studying it is easy. The study of human anatomy and physiology has its own special terminology. It requires that you become familiar with the basic concepts of chemistry to understand physiology, and often (sadly) it requires rote memorization of facts. It is my hope that this workbook will help simplify your task. To make the most of the exercises, read these instructions carefully before starting work.

Labeling and Coloring. Some of these questions ask you only to label a diagram, but most also ask that you do some coloring of the figure. You can usually choose whichever colors you prefer. Soft colored pencils are recommended so that the underlying diagram shows through. Most figures have several parts to color, so you will need a variety of colors—18 should be sufficient. In the coloring exercises, you are asked to choose a particular color for each structure to be colored. That color is then used to fill in both a color-coding circle found next to the name of the structure or organ, and the structure or organ on the figure. This allows you to identify the colored structure quickly and by name in cases where the diagram is not labeled. In a few cases you are given specific coloring instructions to follow.

Matching. Here you are asked to match a key term denoting a structure or physiological process with a descriptive phrase or sentence. Because you must write the chosen term in the appropriate answer blank, the learning is more enduring.

Completion. You select the correct term to answer a specific question, or you fill in blanks to complete a sentence. In many exercises, some terms are used more than once and others are not used at all.

Definitions. You are asked to provide a brief definition of a particular structure or process.

True or False. One word or phrase is underlined in a sentence. You decide if the sentence is true as it is written. If not, you correct the underlined word or phrase.

Elimination. Here you are asked to find the term that does not "belong" in a particular grouping of related terms. In this type of exercise, you must analyze how the various terms are similar to or different from the others.

Visualization. The "Incredible Journey" is a special type of completion exercise, found in every chapter except the first one. For this exercise, you are asked to imagine that you have been miniaturized and injected into the body of a human being (your host). Anatomical landmarks and physiological events are described from your miniaturized viewpoint, and you are then asked to identify your observations. Although this exercise is optional, my students have found them fun to complete and I hope you will too.

At the Clinic. "At the Clinic" sections ask you to apply your newly acquired knowledge to clinical situations.

The Finale: Multiple Choice. The multiple-choice questions test you from several vantage points and 1, 2, 3, or all of the answers may be correct—an approach that really tests your understanding of what you have studied.

Each exercise has complete instructions, which you should read carefully before beginning the exercise. When there are multiple instructions, complete them in the order given.

At times it may appear that information is duplicated in the different types of exercises. Although there is some overlap, the understandings being tested are different in the different exercises. Remember, when you understand a concept from several different perspectives, you have mastered that concept.

I sincerely hope that the *Anatomy & Physiology Coloring Workbook* challenges you to increase your knowledge, comprehension, retention, and appreciation of the structure and function of the human body.

Good luck!

Elaine Marieb
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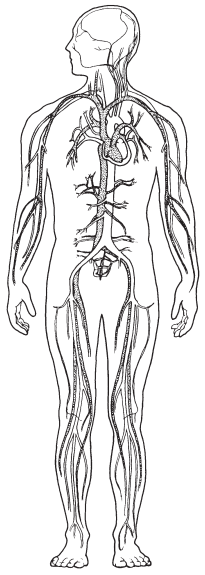
CONTENTS

1 THE HUMAN BODY: AN ORIENTATION



Most of us have a natural curiosity about our bodies, and a study of anatomy and physiology elaborates on this interest. Anatomists have developed a universally acceptable set of reference terms that allows body structures to be located and identified with a high degree of clarity. Initially, students might have difficulties with the language used to describe anatomy and physiology, but without such a special vocabulary, confusion is bound to occur.

The topics in this chapter enable students to test their mastery of terminology commonly used to describe the body and its various parts, and concepts concerning functions vital for life and homeostasis. Body organization from simple to complex levels and an introduction to the organ systems forming the body as a whole are also covered.

AN OVERVIEW OF ANATOMY AND PHYSIOLOGY

1. Match the terms in Column B to the appropriate descriptions provided in Column A. Enter the correct letter or its corresponding term in the answer blanks.

Column A

_____ 1. The branch of biological science that studies and describes how body parts work or function

_____ 2. The study of the shape and structure of body parts

_____ 3. The tendency of the body's systems to maintain a relatively constant or balanced internal environment

_____ 4. The term that indicates *all* chemical reactions occurring in the body

Column B

A. Anatomy

B. Homeostasis

C. Metabolism

D. Physiology

2. Circle all the terms or phrases that correctly relate to the study of *physiology*. Use a highlighter to identify those terms or phrases that pertain to the study of *anatomy*.

A. Measuring an organ's size, shape, and weight
B. Can be studied in dead specimens
C. Often studied in living subjects
D. Chemistry principles
E. Measuring the acid content of the stomach
F. Principles of physics
G. Observing a heart in action
H. Dynamic
I. Dissection
J. Experimentation
K. Observation
L. Directional terms
M. Static

LEVELS OF STRUCTURAL ORGANISATION

3. The structures of the body are organized into successively larger and more complex structures. Fill in the answer blanks with the correct terms for these increasingly larger structures.

Chemicals → _____ → _____ →
_____ → _____ → Organism

4. Circle the term that does not belong in each of the following groupings.

1. Electron Cell Tissue Alive Organ
2. Brain Stomach Heart Liver Epithelium
3. Epithelium Heart Muscle tissue Nervous tissue Connective tissue
4. Human Digestive system Horse Pine tree Amoeba

5. Using the key choices, identify the organ systems to which the following organs or functions belong. Insert the correct letter or term in the answer blanks.

Key Choices

A. Cardiovascular
B. Digestive
C. Endocrine
D. Integumentary
E. Lymphatic/Immune
F. Muscular
G. Nervous
H. Reproductive
I. Respiratory
J. Skeletal
K. Urinary

_____ 1. Rids the body of nitrogen-containing wastes

_____ 2. Is affected by the removal of the thyroid gland

_____ 3. Provides support and levers on which the muscular system can act

_____ 4. Includes arteries and veins

_____ 5. Protects underlying organs from drying out and mechanical damage

_____ 6. Protects the body; destroys bacteria and tumor cells

_____ 7. Breaks down foodstuffs into small particles that can be absorbed

_____ 8. Removes carbon dioxide from the blood

_____ 9. Delivers oxygen and nutrients to the body tissues

_____10. Moves the limbs; allows facial expression

_____11. Allows us to regulate body water volumes

_____12. Provides for conception and childbearing

_____13. Controls the body with chemicals called hormones

_____14. Is damaged when you cut your finger or get a severe sunburn

6. Using the key choices from Exercise 5, choose the organ system to which each of the following sets of organs belongs. Enter the correct letter or term in the answer blanks.

_____ 1. Blood vessels, heart

_____ 2. Pancreas, pituitary, adrenal glands

_____ 3. Kidneys, bladder, ureters

_____ 4. Testis, vas deferens, urethra

_____ 5. Esophagus, large intestine, rectum

_____ 6. Breast bone, vertebral column, skull

_____ 7. Brain, nerves, sensory receptors

7. Figures 1–1 to 1–6, on pages 4–6, represent the various body organ systems. First identify and name each organ system by labeling the organ system under each illustration. Then select a different color for each organ and use it to color the coding circles and corresponding structures in the illustrations.

◯ Blood vessels

◯ Heart

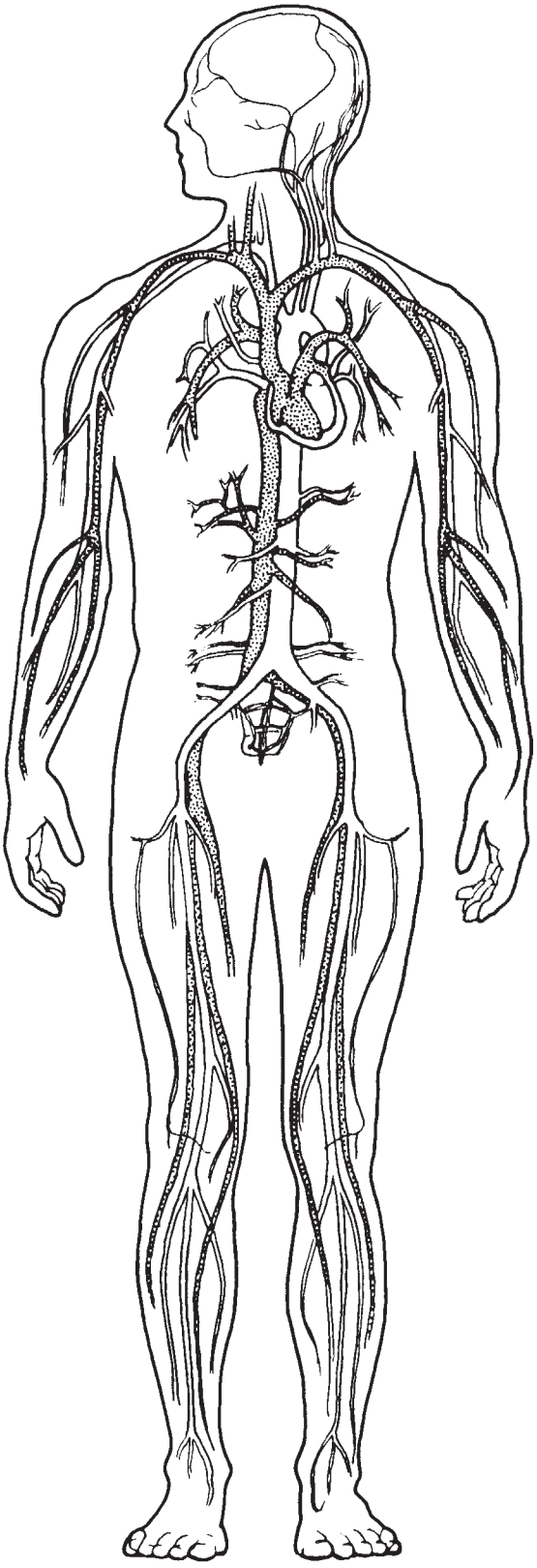


Figure 1–1

◯ Nasal cavity

◯ Lungs

◯ Trachea

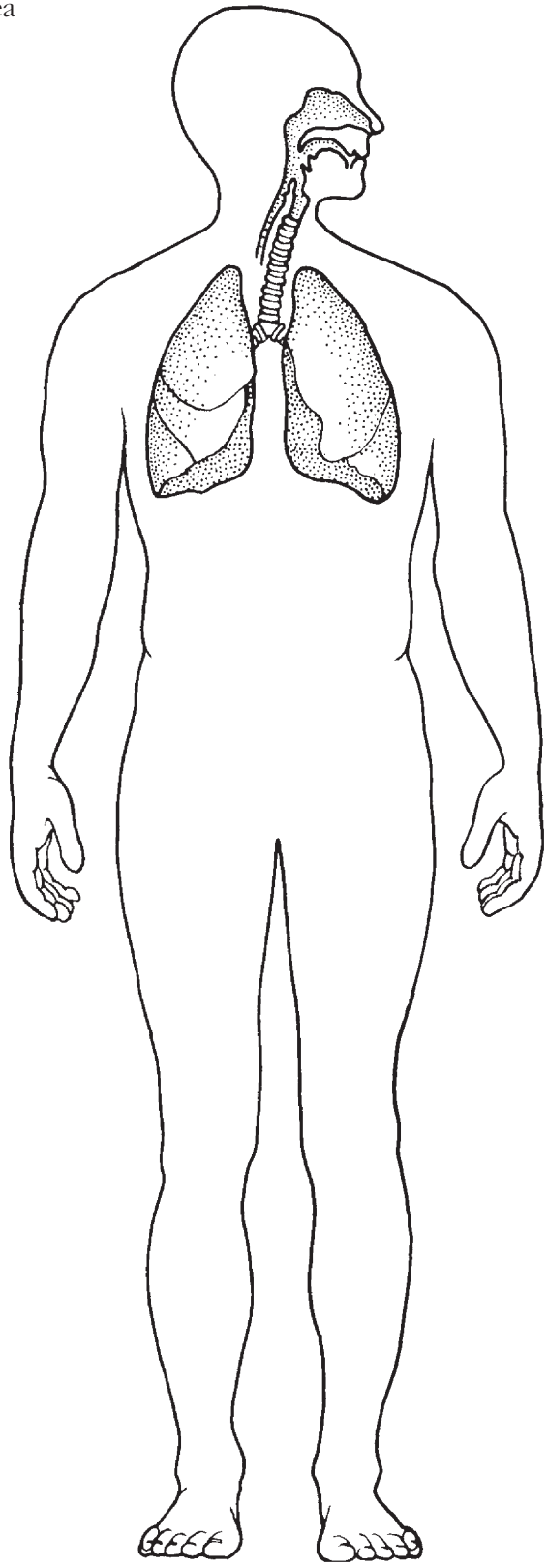


Figure 1–2

◯ Brain

◯ Spinal cord

◯ Nerves

◯ Kidneys

◯ Ureters

◯ Bladder

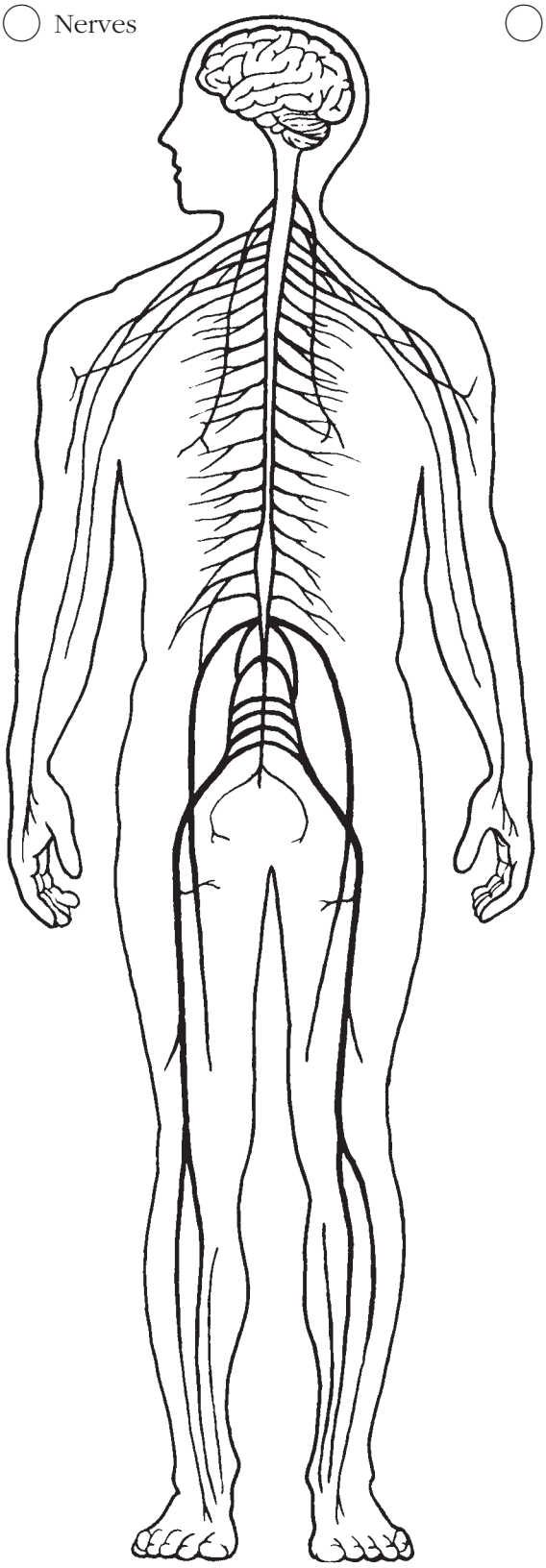


Figure 1–3

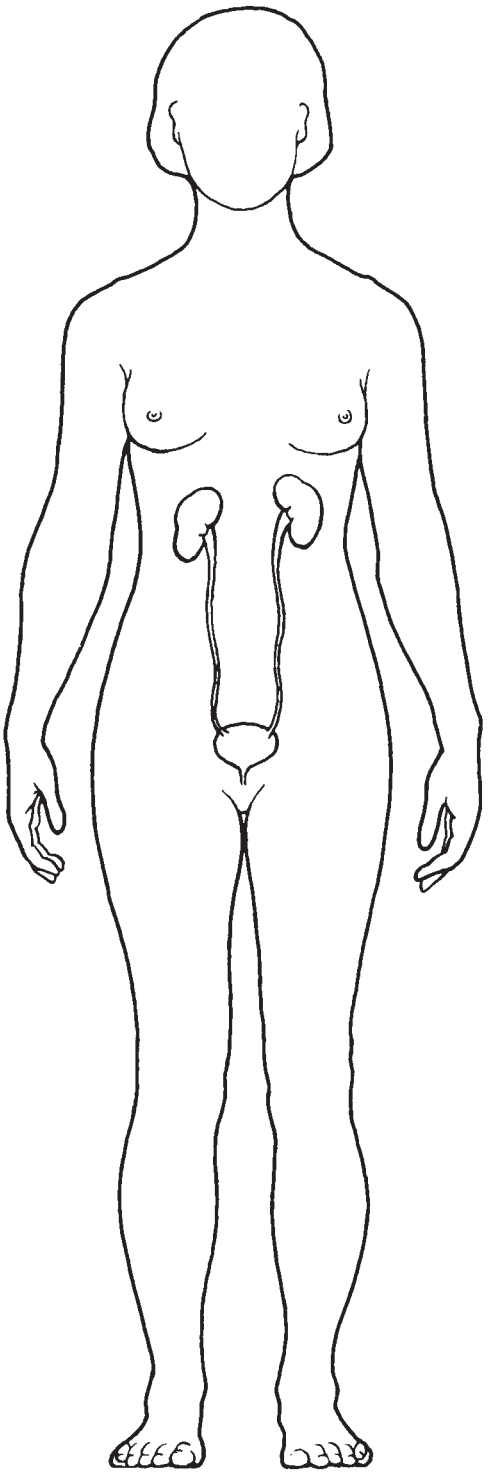


Figure 1–4

◯ Stomach ◯ Esophagus ◯ Ovaries

◯ Intestines ◯ Oral cavity ◯ Uterus

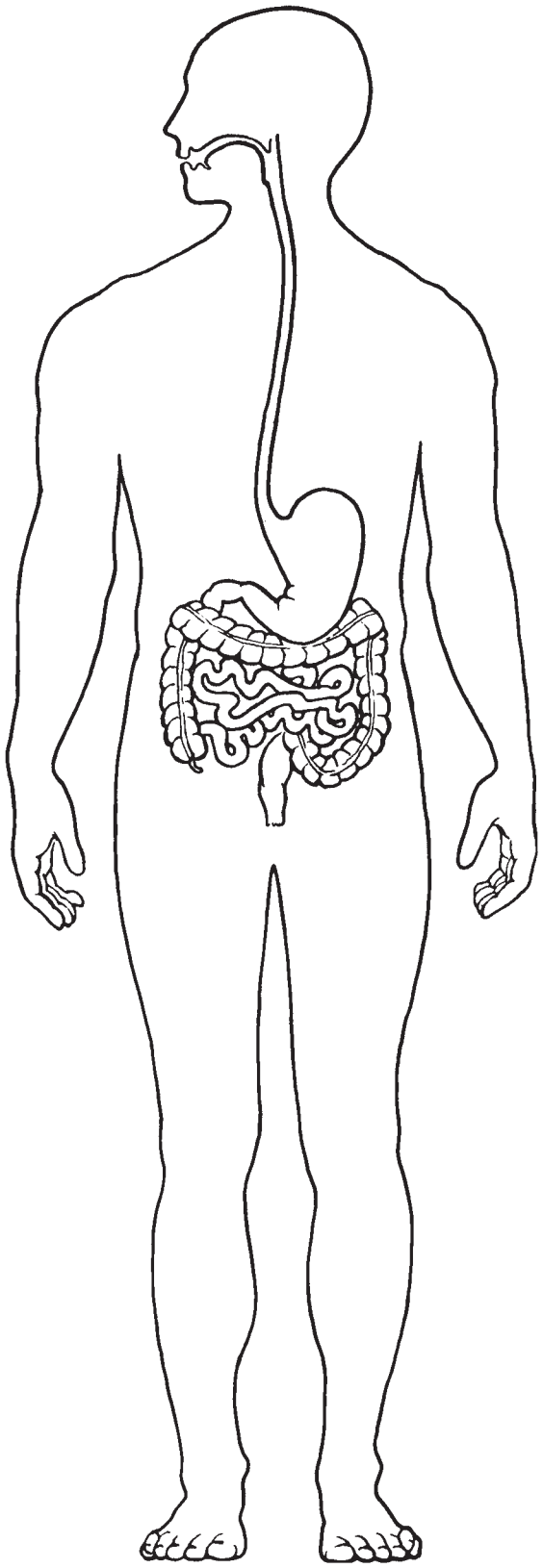


Figure 1–5

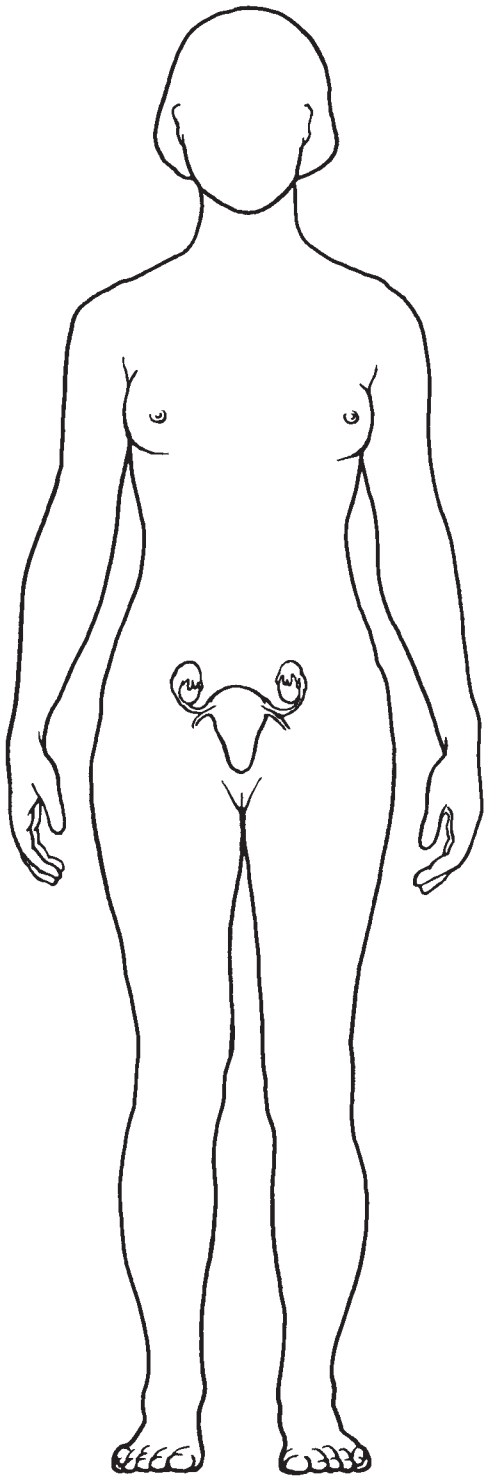


Figure 1–6

MAINTAINING LIFE

8. Match the terms pertaining to functional characteristics of organisms in Column B with the appropriate descriptions in Column A. Fill in the answer blanks with the appropriate letter or term.

	Column A	Column B
_____	1. Keeps the body's internal environment distinct from the external environment	A. Digestion
_____	2. Provides new cells for growth and repair	B. Excretion
_____	3. Occurs when constructive activities occur at a faster rate than destructive activities	C. Growth
_____	4. The tuna sandwich you have just eaten is broken down to its chemical building blocks	D. Maintenance of boundaries
_____	5. Elimination of carbon dioxide by the lungs and elimination of nitrogenous wastes by the kidneys	E. Metabolism
_____	6. Ability to react to stimuli; a major role of the nervous system	F. Movement
_____	7. Walking, throwing a ball, riding a bicycle	G. Responsiveness
_____	8. All chemical reactions occurring in the body	H. Reproduction
_____	9. At the cellular level, membranes; for the whole organism, the skin	

9. Using the key choices, correctly identify the survival needs that correspond to the following descriptions. Insert the correct letter or term in the answer blanks.

Key Choices

A. Appropriate body temperature
B. Atmospheric pressure
C. Nutrients
D. Oxygen
E. Water

_____ 1. Includes carbohydrates, proteins, fats, and minerals

_____ 2. Essential for normal operation of the respiratory system and breathing

_____ 3. Single substance accounting for more than 60% of body weight

_____ 4. Required for the release of energy from foodstuffs

_____ 5. Provides the basis for body fluids of all types

_____ 6. Needs to be maintained within a small range to ensure that metabolic reactions occur at appropriate rates to sustain life

HOMEOSTASIS

10. The following statements refer to homeostatic control systems. Complete each statement by inserting your answers in the answer blanks.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.
_____ 9.

There are three essential components of all homeostatic control mechanisms: control center, receptor, and effector. The __(1)__ senses changes in the environment and responds by sending information (input) to the __(2)__ along the __(3)__ pathway. The __(4)__ analyzes the input, determines the appropriate response, and activates the __(5)__ by sending information along the __(6)__ pathway. When the response causes the initial stimulus to decline, the homeostatic mechanism is referred to as a __(7)__ feedback mechanism. When the response enhances the initial stimulus, the mechanism is called a __(8)__ feedback mechanism. __(9)__ feedback mechanisms are much more common in the body.

THE LANGUAGE OF ANATOMY

11. Complete the following statements by filling in the answer blanks with the correct term.

_____ 1.
_____ 2.
_____ 3.

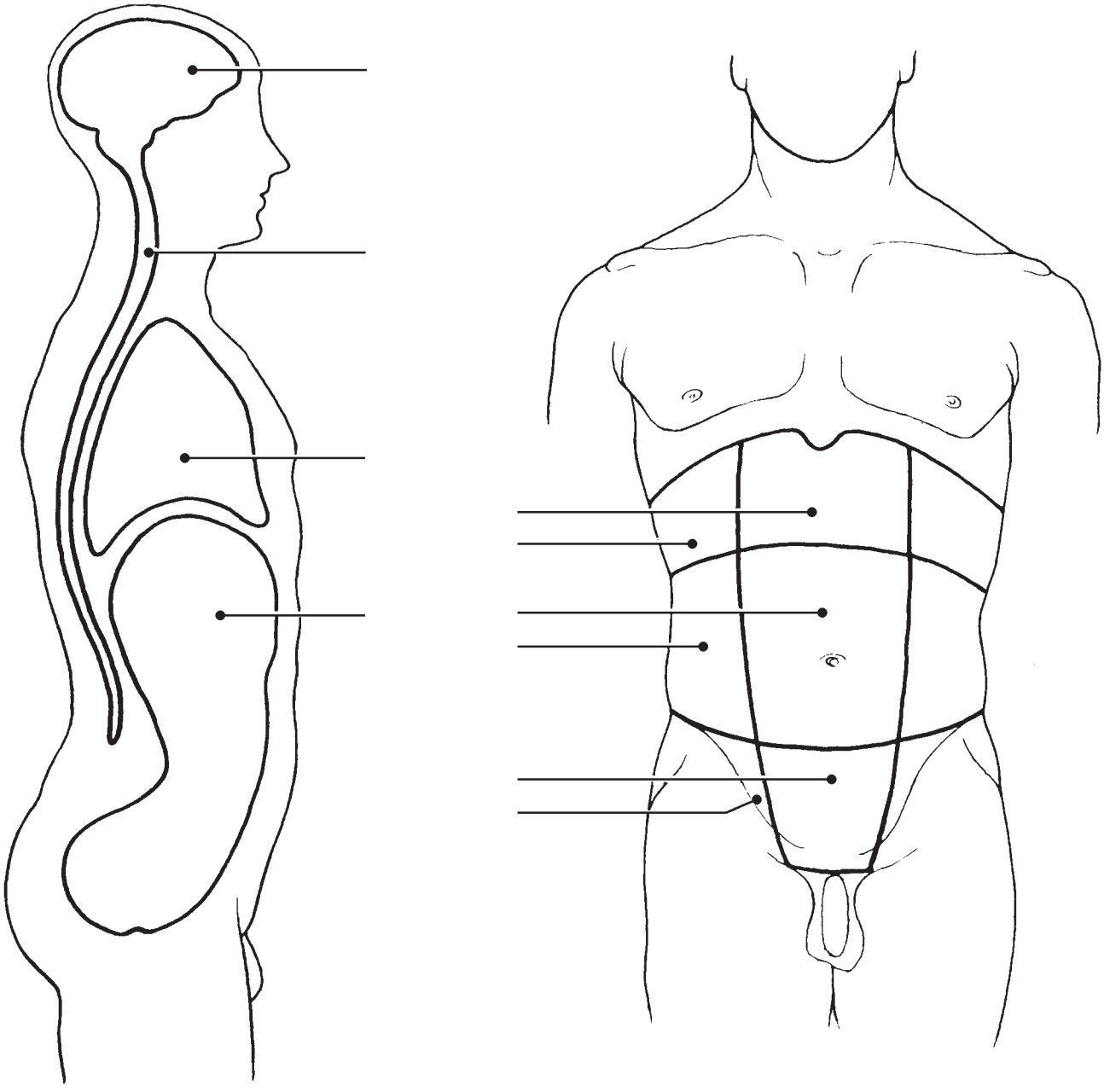
The abdominopelvic and thoracic cavities are subdivisions of the __(1)__ body cavity; the cranial and spinal cavities are parts of the __(2)__ body cavity. The __(3)__ body cavity is totally surrounded by bone and provides very good protection to the structures it contains.

12. Circle the term or phrase that does not belong in each of the following groupings.

1. Transverse Distal Frontal Sagittal
2. Lumbar Thoracic Antecubital Abdominal
3. Calf Brachial Femoral Popliteal
4. Epigastric Hypogastric Right iliac Left upper quadrant
5. Orbital cavity Nasal cavity Ventral cavity Oral cavity

13. Select different colors for the *dorsal* and *ventral* body cavities. Color the coding circles below and the corresponding cavities in part A of Figure 1–7. Complete the figure by labeling those body cavity subdivisions that have a leader line. Complete part B by labeling each of the abdominal regions indicated by a leader line.

◯ Dorsal body cavity ◯ Ventral body cavity



A **B**

Figure 1–7

14. Select the key choices that identify the following body parts or areas. Enter the appropriate letter or corresponding term in the answer blanks.

Key Choices

A. Abdominal	E. Buccal	I. Inguinal	M. Pubic
B. Antecubital	F. Cervical	J. Lumbar	N. Scapular
C. Axillary	G. Femoral	K. Occipital	O. Sural
D. Brachial	H. Gluteal	L. Popliteal	P. Umbilical

_____ 1. Armpit

_____ 2. Thigh region

_____ 3. Buttock area

_____ 4. Neck region

_____ 5. "Belly button" area

_____ 6. Genital area

_____ 7. Anterior aspect of elbow

_____ 8. Posterior aspect of head

_____ 9. Area where trunk meets thigh

_____10. Back area from ribs to hips

_____11. Pertaining to the cheek

15. Using the key terms from Exercise 14, correctly label all body areas indicated with leader lines on Figure 1–8.

In addition, identify the sections labeled A and B in the figure.

Section A: _____

Section B: _____

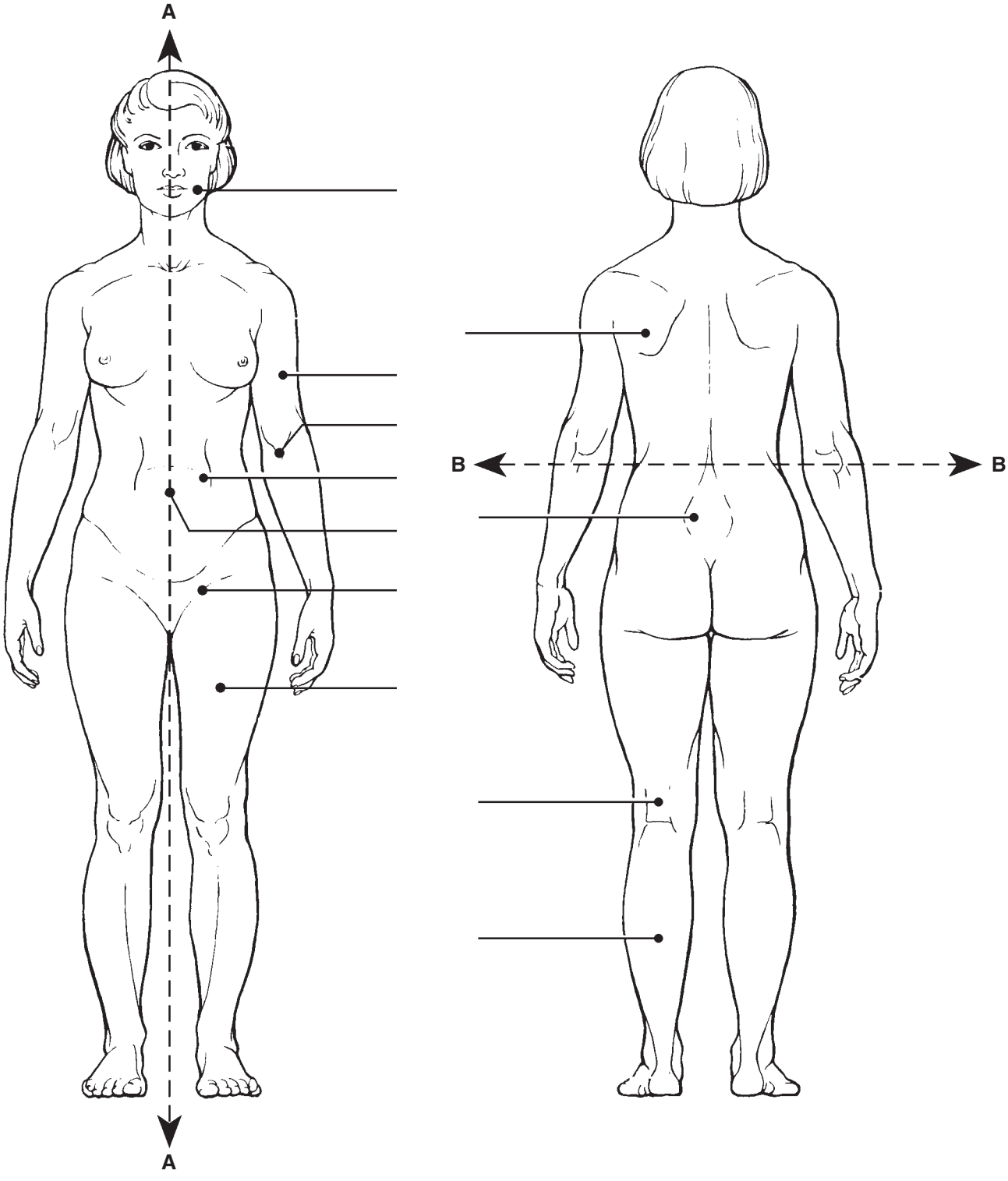


Figure 1–8

16. From the key choices, select the body cavities where the following surgical procedures would occur. Insert the correct letter or term in the answer blanks. Be precise. Also select the name of the cavity subdivision if appropriate.

Key Choices

A. Abdominal	C. Dorsal	E. Spinal	G. Ventral
B. Cranial	D. Pelvic	F. Thoracic	

_____ 1. Insertion of a shunt for hydrocephalus (water on the brain)

_____ 2. A gall bladder operation

_____ 3. Removal of a lung tumor

_____ 4. Investigation of an ovarian cyst

_____ 5. Removal of a kidney stone

17. Complete the following statements by choosing an anatomical term from the key choices. Enter the appropriate letter or term in the answer blanks.

Key Choices

A. Anterior	D. Inferior	G. Posterior	J. Superior
B. Distal	E. Lateral	H. Proximal	K. Transverse
C. Frontal	F. Medial	I. Sagittal	

_____ 1.

_____ 2.

_____ 3.

_____ 4.

_____ 5.

_____ 6.

_____ 7.

_____ 8.

_____ 9.

_____10.

_____11.

In the anatomical position, the face and palms are on the __(1)__ body surface, the buttocks and shoulder blades are on the __(2)__ body surface, and the top of the head is the most __(3)__ part of the body. The ears are __(4)__ to the shoulders and __(5)__ to the nose. The heart is __(6)__ to the spine and __(7)__ to the lungs. The elbow is __(8)__ to the fingers but __(9)__ to the shoulder. In humans, the dorsal surface can also be called the __(10)__ surface; however, in four-legged animals, the dorsal surface is the __(11)__ surface.

_____12.
_____13.
_____14.
_____15.

If an incision cuts the heart into right and left parts, the section is a __(12)__ section, but if the heart is cut so that anterior and posterior parts result, the section is a __(13)__ section. You are told to cut an animal along two planes so that the paired kidneys are observable in both sections. The two sections that meet this requirement are the __(14)__ and __(15)__ sections.

18. Using the key choices, identify the body cavities where the following body organs are located. Enter the appropriate letter or term in the answer blanks.

Key Choices

A. Abdominopelvic B. Cranial C. Spinal D. Thoracic

_____ 1. Stomach
_____ 2. Small intestine
_____ 3. Large intestine
_____ 4. Spleen
_____ 5. Liver
_____ 6. Spinal cord
_____ 7. Bladder
_____ 8. Trachea
_____ 9. Lungs
_____ 10. Pituitary gland
_____ 11. Rectum
_____ 12. Ovaries

19. Number the following structures, from darkest (black) to lightest (white), as they would appear on an X-ray. Number the darkest one 1, the next darkest 2, etc.

_____ A. Soft tissue
_____ B. Femur (bone of the thigh)
_____ C. Air in lungs
_____ D. Gold (metal) filling in a tooth

AT THE CLINIC

20. A man is carrying some heavy groceries upstairs to his second-floor apartment. Which organ systems need to respond?

21. An 18-year-old student reports to the medical center complaining of a severe headache, and the appearance of a rash across his body. The staff suspects he has meningitis. Which systems are affected as a result of his symptoms?

22. The Chan family was traveling in their van and had a minor accident. The children in the backseat were wearing lap belts, but they still sustained bruises around the abdomen and had some internal organ injuries. Why is this area more vulnerable to damage than others?

23. Sylvia has had her lymph nodes removed from her left armpit. She is also having a lump removed from her left breast, and will have targeted radiotherapy in this region. Identify the correct anatomical terms for the affected areas.

24. The hormone thyroxine is released in response to a pituitary hormone called TSH. As thyroxine levels increase in the blood, they exert negative feedback on the release of TSH by the pituitary gland. What effect will this have on the release of TSH?

25. In congestive heart failure, the weakened heart is unable to pump with sufficient strength to empty its own chambers. As a result, blood backs up in the veins, blood pressure rises, and circulation is impaired. Describe what will happen as this situation worsens owing to positive feedback. Then, predict how a heart-strengthening medication will reverse the positive feedback.

26. The following advanced imaging techniques are discussed in the text: CT, DSA, PET, ultrasound, and MRI. Which of these techniques uses X-ray? Which uses radio waves and magnetic fields? Which uses radioisotopes? Which displays body regions in sections? (You may have more than one answer for each question.)

27. A patient reports a crushing sensation across the chest and down their left arm. Which organ is most likely to be affected?

28. Tyler has to have an injection for tetanus after falling from his skateboard. The nurse tells him he will have the injection given into his gluteal region. Which clothing should Tyler remove to have his injection?

THE FINALE: MULTIPLE CHOICE

29. Select the best answer or answers from the choices given.

1. Which of the following activities would *not* represent an anatomical study?
   A. Making a section through the heart to observe its interior
   B. Drawing blood from recently fed laboratory animals at timed intervals to determine their blood sugar levels
   C. Examining the surface of a bone
   D. Viewing muscle tissue through a microscope

2. The process that results in production of small molecules from large ones is:
   A. digestion
   B. excretion
   C. respiration
   D. anabolism

3. Which of the following is (are) involved in maintaining homeostasis?
   A. Effector
   B. Control center
   C. Receptor
   D. Feedback
   E. Lack of change

4. When a capillary is damaged, a platelet plug is formed. The process involves platelets sticking to each other. The more platelets that stick together, the more the plug attracts additional platelets. This is an example of:
   A. negative feedback
   B. positive feedback

5. A sagittal section through the body would pass:
   A. through the liver, both kidneys, and pancreas
   B. down the body's midline
   C. through the heart and the pancreas
   D. across the thoracic cavity

6. Which of the following statements is correct?
   A. The knee is superior to the ankle.
   B. The heart is superficial to the kidneys.
   C. The sternum is posterior to the coccyx.
   D. The ankles are rostral to the shoulders.
   E. The eyes are inferior to the teeth.

7. Which of the following body regions is/are associated with the limbs?
   A. Popliteal
   B. Acromial
   C. Gluteal
   D. Olecranal
   E. Inguinal

8. A neurosurgeon orders a spinal tap for a patient. Into what body cavity will the needle be inserted?
   A. Ventral
   B. Thoracic
   C. Dorsal
   D. Cranial
   E. Pelvic

9. An accident victim has a collapsed lung. Which cavity has been entered?
   A. Mediastinal
   B. Pericardial
   C. Pleural
   D. Vertebral
   E. Ventral

10. Which organ system is affected by the common cold?
    A. Endocrine
    B. Reproductive
    C. Respiratory
    D. Digestive
    E. Cardiovascular

11. The position of the heart relative to the structures around it would be described accurately as:
    A. deep to the sternum (breast bone)
    B. lateral to the lungs
    C. superior to the diaphragm
    D. inferior to the ribs
    E. anterior to the vertebral column

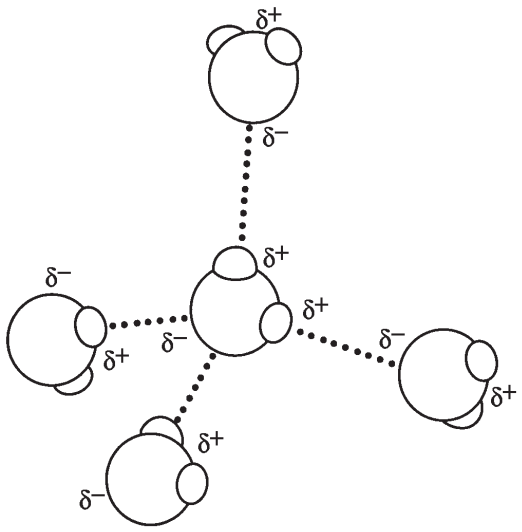
12. What term(s) could be used to describe the position of the nose?
    A. Intermediate to the eyes
    B. Inferior to the brain
    C. Superior to the mouth
    D. Medial to the ears
    E. Anterior to the ears

13. The radiographic technique used to provide information about blood flow is:
    A. DSR
    B. CT
    C. PET
    D. ultrasonography
    E. any X-ray technique

14. A patient complains of pain in the upper left quadrant. Which system is most likely to be involved?
    A. Lymphatic
    B. Reproductive
    C. Endocrine
    D. Cardiovascular
    E. Nervous

15. Harry was sweating profusely as he ran in the 10-K race. The sweat glands producing the sweat would be considered which part of a feedback system?
    A. Stimulus
    B. Effectors
    C. Control center
    D. Receptors

2 BASIC CHEMISTRY



Everything in the universe is composed of one or more elements, the unique building blocks of all matter. Although over 100 elemental substances exist, only four of these (carbon, hydrogen, oxygen, and nitrogen) make up more than 96% of all living material.

The student activities in this chapter consider basic concepts of both inorganic and organic chemistry. Chemistry is the science that studies the composition of matter. Inorganic chemistry studies the chemical composition of nonliving substances that (generally) do not contain carbon. Organic chemistry studies the carbon-based chemistry (or biochemistry) of living organisms, whether they are maple trees, fish, or humans.

Understanding of atomic structure, bonding behavior of elements, and the structure and activities of the most abundant biological molecules (proteins, fats, carbohydrates, and nucleic acids) is tested in various ways. Mastering these concepts is necessary to understand how the body functions.

CONCEPTS OF MATTER AND ENERGY

1. Select *all* phrases that apply to each of the following statements and insert the letters in the answer blanks.

_____ 1. The energy located in the bonds of food molecules:
- A. is called thermal energy
- B. is a form of potential energy
- C. causes molecular movement
- D. can be transformed to the bonds of ATP (adenosine triphosphate)

_____ 2. Heat is:
- A. thermal energy
- B. infrared radiation
- C. kinetic energy
- D. molecular movement

_____ 3. Whenever energy is transformed:
- A. the amount of useful energy decreases
- B. some energy is lost as heat
- C. some energy is created
- D. some energy is destroyed

2. Use choices from the key to identify the energy *form* in use in each of the following examples.

Key Choices

A. Chemical B. Electrical C. Mechanical D. Radiant

_____ 1. Clapping your hands

_____ 2. Vision (two types, please—think!)

_____ 3. Bending your fingers to make a fist

_____ 4. Breaking the bonds of ATP molecules to energize your muscle cells to make that fist

_____ 5. Lying under a sunlamp

COMPOSITION OF MATTER

3. Complete the following table by inserting the missing words.

Particle	Location	Electrical charge	Mass
		0	
			0 amu

4. Insert the *chemical symbol* (the chemist's shorthand) in the answer blank for each of the following elements.

_____ 1. Oxygen _____ 4. Iodine _____ 7. Calcium _____ 10. Magnesium

_____ 2. Carbon _____ 5. Hydrogen _____ 8. Sodium _____ 11. Chlorine

_____ 3. Potassium _____ 6. Nitrogen _____ 9. Phosphorus _____ 12. Iron

5. Using the key choices, select the correct responses to the following descriptive statements. Insert the appropriate answers in the answer blanks.

Key Choices

A. Atom C. Element E. Ion G. Molecule I. Protons

B. Electrons D. Energy F. Matter H. Neutrons J. Valence

_____ 1. An electrically charged atom or group of atoms

_____ 2. Anything that takes up space and has mass (weight)

_____ 3. A unique substance composed of atoms having the same atomic number

_____ 4. Negatively charged particles, forming part of an atom

_____ 5. Subatomic particles that determine an atom's chemical behavior, or bonding ability

_____ 6. The ability to do work

_____ 7. The smallest particle of an element that retains the properties of the element

_____ 8. The smallest particle of a compound, formed when atoms combine chemically

_____ 9. Positively charged particles forming part of an atom

_____10. Name given to the electron shell that contains the most reactive electrons

_____11. _____12. Subatomic particles responsible for most of an atom's mass

6. For each of the following statements that is true, insert *T* in the answer blank. If any of the statements are false, correct the underlined term by inserting your correction in the answer blank.

_____ 1. Na^+ and K^+ are needed for nerve cells to conduct electrical impulses.

_____ 2. The atomic number of oxygen is 8. Therefore, oxygen atoms always contain 8 neutrons.

_____ 3. The greater the distance of an electron from the nucleus, the less energy it has.

_____ 4. Electrons are located in more or less designated areas of space around the nucleus called orbitals.

_____ 5. An unstable atom that decomposes and emits energy is called retroactive.

_____ 6. Iron is necessary for oxygen transport in red blood cells.

_____ 7. The most abundant negative ion in extracellular fluid is calcium.

_____ 8. The element essential for the production of thyroid hormones is magnesium.

_____ 9. Calcium is found as a salt in bones and teeth.

MOLECULES, CHEMICAL BONDS, AND CHEMICAL REACTIONS

7. Match the terms in Column B to the chemical equations listed in Column A. Enter the correct letter or term in the answer blanks.

	Column A	Column B
_____	1. A + B → AB	A. Decomposition
_____	2. AB + CD → AD + CB	B. Exchange
_____	3. XY → X + Y	C. Synthesis

8. Figure 2–1 is a diagram of an atom. Select two different colors and use them to color the coding circles and corresponding structures on the figure. Complete this exercise by responding to the questions that follow, referring to the atom in this figure. Insert your answers in the answer blanks provided.

◯ Nucleus

◯ Electrons

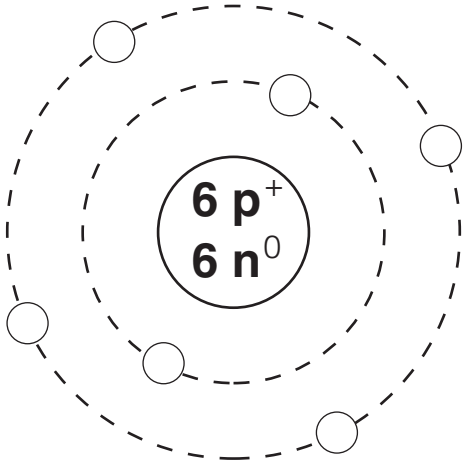


Figure 2–1

1. What is the atomic number of this atom? _____
2. What is its atomic mass? _____
3. What atom is this? _____
4. If this atom had one additional neutron but the other subatomic particles remained the same as shown, this slightly different atom (of the same element) would be called a(n) _____
5. Is this atom chemically active or inert? _____
6. How many electrons would be needed to fill its outer (valence) shell? _____