2

Basics of Human Osteology and Odontology

Chapter 2 in the textbook provides an overview of the skeletal and dental structures of the human body. To facilitate your understanding of the skeleton, the standard anatomical position is described along with a list of terms of anatomical orientation and planes commonly used to discuss and describe the human body. Your command of this vocabulary and ability to use it appropriately is necessary to effectively communicate your knowledge and understanding of the human skeleton. Additionally, bones, important features, and select landmarks are described and illustrated. Your ability to identify complete and fragmentary bones is a fundamental skill essential to the analysis of human remains, ensuring the accuracy of your results, interpretations, and conclusions.

Learning Objectives

The laboratory projects presented in this chapter will facilitate your knowledge of the bones and important features of the human skeleton. During these exercises, you will learn those bones and skeletal features necessary to understand and apply the methods of analysis presented in the textbook and this lab manual.

Expected Outcomes

On completion of the assignments presented here, you should be able to:

- Clearly define, describe, and illustrate the standard anatomical position, the anatomical planes, and the terms of orientation.
- Identify, by name, the major bones of the human skeleton in a complete and (if available) fragmentary condition.
- Identify, by name, select features on the bones of the human skeleton in both a complete and (if available) fragmentary condition.

EXERCISE 2.1

Bones and Features of the Skull

As mentioned in the textbook, the skull is composed of 22 outwardly visible bones, and three ossicles in each ear (which are not easily viewed). During this segment of the lab, you will identify most of these bones and some of their important features. Also, you will learn the names of the suture lines that separate the bones, as well as landmarks identified on the skull. Using Figures 2.1 through 2.4 in the textbook, take the lab skull and identify the following bones.

Frontal This bone comprises the forehead of humans as well as the upper eye orbits; two important features of this bone are the supraorbital tori (also called brow ridges) and the supraorbital margin (the upper margin of the eye orbits).

Zygomatic bones These paired bones are the cheek bones that also form the lateral borders of the eye orbits and compose part of the zygomatic arch.

Lacrymals These are the paired bones of the anterior, medial eye orbits.

Ethmoid This is the complex bone at the rear of the eye orbits; this single bone comprises the posterior, medial walls of both eye orbits.

Nasals These paired bones comprise the majority of the boney nose (i.e., the root and bridge).

Maxilla These are the paired bones of the upper jaw that hold 16 of the 32 permanent teeth of the adult dentition. Together, they form the lower border of the nose and the nasal spine (if any). Observe the meeting of the nasal floor with the anterior maxilla; there may be a thin, vertical wall at this location.

Nasal conchae These are the turbinated bones within the nose.

Vomer This is the vertical bone that vertically divides the posterior nasal aperature in half.

Mandible This is the lower jaw with its prominent (or not so prominent) chin (also called the mental eminence). Notice how it articulates with the skull at the temporal mandibular joint (TMJ) and how the dental arcade of this bone and that of the maxillae contact.

Palatines These paired bones form the rear of the palate, posterior to the inferior maxillae.

Parietals These are the paired bones of the superior braincase.

Occipital This bone forms the posterior and inferior section of the braincase; features of note are the foramen magnum with its occipital condyles, and the roughened area on its inferioposterior surface for attachment of the neck muscles (the nuchal area).

Temporals These are the paired bones of the inferior side of the braincase; the ear opening and mastoid process are important features of these bones.

Sphenoid This single bone separates the temporals and occipital from the other bones of the face. The so-called "greater wing" can be seen on the lateral side of the skull between the anterior temporal and the zygomatic bone.

Now learn the suture lines of the skull. These are the special joints that connect the bones of the cranium (see Figures 2.6 through 2.10 in the textbook). The majority of these are named for the bones that they separate (e.g., the internasal suture separates the nasal bones). However, the following seven sutures have special names.

Coronal suture	This separates the frontal and parietals; it ends at the point where the frontal meets the greater wing of the sphenoid.
Sagittal suture	This suture separates the right and left parietal bones; it starts at the coronal suture and ends where the parietals meet the occipital.
Lambdoid suture	This separates the parietals from the occipital bone; it curves across the back of the skull, ending where the occipital and parietals meet the temporals.
Squamousal suture	This suture separates the superior portion of the temporals from the parietals.
Incisive suture	This suture separates that part of the maxillae that contain the incisors (called the premaxilla) from the rest of the bone. This is usually fused and invisible in adults.
Transverse palatine suture	This separates the maxillae from the palatines.
Median palatine suture	This separates the two maxillae in the palate.

Finally, learn the major landmarks of the skull, which are depicted in Figures 2.6 through 2.10 in the textbook. The most important of these are:

Bregma	The point where the sagittal suture meets anteriorly at the coronal suture in the sagittal plane.
Basion	The most inferior point on the anterior border of the foramen magnum.
Nasion	The point where the internasal suture (suture that separates the right from the left nasal bones) meets the nasofrontal suture in the midsagittal plane.
Subnasale	The point on the living that is roughly equivalent to a point below the lower margin of the nasal aperture in the midline.
Glabella	The most anterior point on the frontal in the midline; this point is located between the suparorbital tori (when present).
Opisthocranion	The farthest point on the back of the skull from glabella in the sagittal plane.
Lambda	The point where the sagittal and lambdoid sutures meet.
Orale	The point located in midsagittal plane where a line drawn across the posterior margins of the central incisors bisects the median palatine suture.
Prosthion	The most anterior point on the intermaxillary suture.
Pterion	The region where the greater wing of the sphenoid meets the frontal, parietal, and temporal.

Obelion	The point where a line drawn between the right and left parietal foramina bisects the sagittal suture.
Ectocanthion	The lateral most point on the lateral border of the eye.
Asterion	The point where the lambdoid suture meets the squamosal suture.
Gnathion	The lowest point on the mandible in the midline.
Zygoorbitale	The point where the zygomaxillary suture contacts the lower border of the eye.

Now, using Exercise Worksheets 2.1a through 2.1e, identify these bones, sutures, and landmarks on the five views of the skull. If you like, shade in each bone using a different color so that its boundaries are more easily distinguished.

EXERCISE 2.2

Axial Skeleton and Thorax

As described in the textbook, the axial skeleton is composed of the vertebral column while the thorax is composed of the rib cage and sternum. In this exercise, you will learn the basic units that make up these structures as well as features of the individual bones. Using Figure 2.14 in the textbook as a guide, take either a thoracic or lumbar vertebra and try to identify the major features common to all of these bones:

Body	The oval, boney segment that makes up the majority of the vertebra.
Neural arch	The complex part that arches posteriorly and creates the vertebral foramen.
Spinous process	That part of the neural arch that extends posteriorly and (usually) inferiorly.
Transverse process	Any one of several boney extensions that projects laterally from the right and left sides.

Now, have the instructor give you one of each of the three types of vertebrae and, using the textbook's Figures 2.15 through 2.18, try to identify which one is cervical, thoracic, or lumbar. Also, ask to see the superior two bones of the axial skeleton: the atlas and axis. Finally, view the sacrum; try to distinguish the five vertebrae that are fused to form this bone. Test your knowledge by completing Exercise Worksheets 2.2a and 2.2b.

The rib cage is composed of 12 ribs which connect posteriorly to the vertebral column. Anteriorly, 10 of these are connected to the sternum through the costal cartilage; the 11th and 12th do not and, because of this, are called floating ribs. Each rib has two basic components (see Figure 2.19 in the textbook), the head and body. Have the lab instructor give you an assortment of ribs, and try to identify these two structures on the bones. Also, view the sternum (see Figure 2.13 in the textbook) and attempt to identify the joint between the manubrium and sternal body. Now, complete Exercise Worksheets 2.2c and 2.2d.

EXERCISE 2.3

Appendicular Skeleton: Upper Limbs

The upper limb bones of the appendicular skeleton are the clavicle, scapula, humerus, ulna, radius, carpals (bones of the wrist), metacarpals (bones of the hand), and phalanges (bones of the fingers). In this exercise, you will concentrate on the first five of these bones; identification of the wrist, hand, and finger bones are beyond a lab of this nature. Before commencing this task, view Figures 2.20 through 2.23 in the textbook.

Clavicle This is the collarbone; it articulates medially with the manubrium of the sternum and laterally with the scapula.

Scapula This is the shoulder blade; it has five important features: the spine, the glenoid cavity, the acromion, the coracoid process, and the ventral infraspinous plane.

Humerus This is the upper bone of the arm; its major features are the head, the greater tuberosity, the lesser tuberosity, the deltoid tuberosity, the trochlea, and the olecranon fossa.

Ulna This is the medial bone of the lower arm (when it is in the anatomical position); its major features are the olecranon process and the styloid process.

Radius This is outside (lateral) bone of the lower arm; its major features are the head, the styloid process, the ulnar notch, and the radial tuberosity.

Now complete Exercise Worksheets 2.3a through 2.3d; try to identify the bone pictured, and fill in each of the features indicated by an arrow.

EXERCISE 2.4

Appendicular Skeleton: Lower Limbs

The lower limb bones of the appendicular skeleton are the os coxa, femur, tibia, patella, fibula, tarsals (bones of the ankle), metatarsals (bones of the foot), and phalanges (bones of the toes). In this exercise, you will concentrate on the first three of these bones; identification of the others are beyond a lab of this nature. View Figures 2.25, 2.26, 2.27, and 2.29 in the textbook before commencing this assignment.

Os coxa This bone is composed of three bones: the ilium, ischium, and pubis; important features of this bone are the greater sciatic notch, the pubic symphysis, the hip socket (called the acetabulum), the auricular surface, the preauricular sulcus, and the obturator foramen.

Femur This is the thigh bone; its important features are the head, the greater and lesser trochanters, the linea aspera, the medial and lateral condyles, the intercondylar fossa, the supracondylar lines, and the popliteal surface.

Tibia This is the main bone of the lower leg; its important features are the condyles, the intercondylar eminence, the tuberosity, the anterior crest, and the malleolus.

Now complete Exercise Worksheets 2.4a through 2.4c; try to identify the bone pictured, and identify each of the features and cardinal directions indicated by an arrow.

EXERCISE 2.5

Human Odontology

In this exercise, you will learn basic dental anatomy and recognize the types and placement of human teeth. Start by reviewing the anatomy of a tooth as illustrated in Figure 2.34 in the textbook. Now, look at the teeth provided by your lab instructor. Can you recognize the crown, with its white enamel and the peaks in the chewing surface (called cusps)? Now, locate the neck, and, if you have been provided individual teeth (i.e., not situated in the maxillae or mandible), notice the root(s).

Now learn the five basic directions in the dentition. These are similar to the cardinal directions used in the body.

Mesial Toward the midline.

Distal Away from the midline.

Lingual Toward the tongue.

Labial Toward the lips.

Buccal Toward the cheeks.

Occlusal The chewing surface of teeth.

Next, learn the four quadrants of the mouth: upper left, upper right, lower left, and lower right. Within each of these, the sequence of teeth is the same; start mesially and work distally to learn the four basic types of teeth: incisors, canines, premolars, and molars (see Figure 2.35 of the textbook).

Incisors The flat, spatula-like teeth in the front of the mouth; these have a chisel-like edge without cusps.

Canines The pointed teeth next to the second incisor; these are single-cusped teeth.

Premolars The rectangular teeth next to the canine; these usually have two cusps, the labial one of which is often larger than its lingual counterpart.

Molars The square or rectangular chewing teeth found at the rear of the mouth.

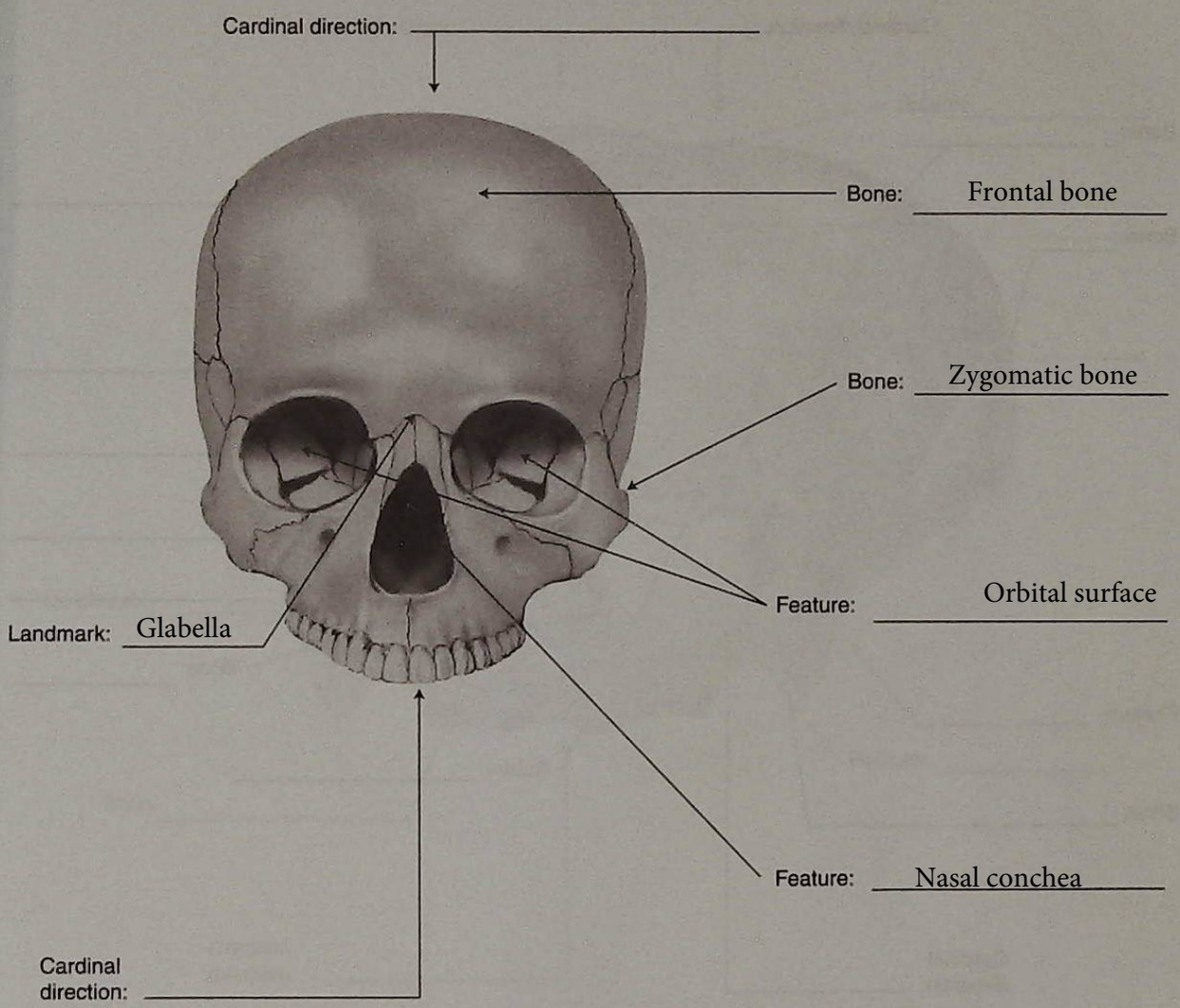
Now complete Exercise Worksheet 2.5 by identifying the different teeth illustrated and the cardinal directions.

EXERCISE WORKSHEET 2.1A

Cranial Skeleton

Name: _____ **Date:** _____

Identify the bones, cardinal directions (where indicated), features, landmarks, and sutures.



View (circle one):

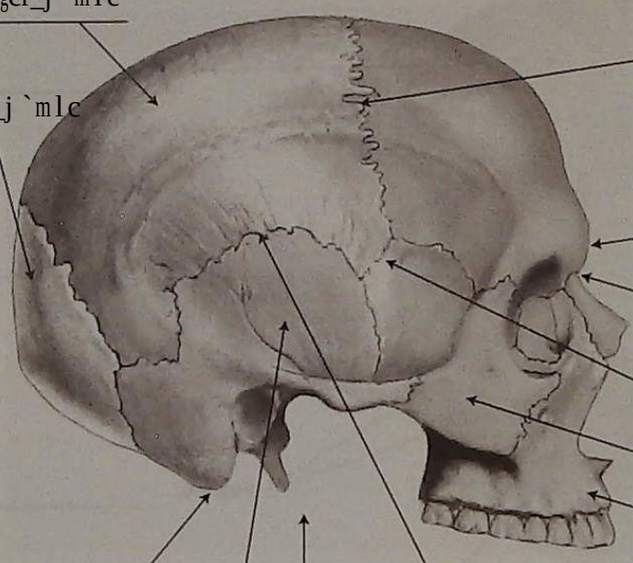
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.1B

Cranial Skeleton

Name: _____ **Date:** _____

Identify the bones, cardinal directions (where indicated), features, landmarks, and sutures.



Cardinal direction: Top

Bone: N_pgcr_j`mlc

Suture: Ampml_j qrpsarspc

Bone: Maagngr_j`mlc

Feature: Glabella

Landmark: Nosal bone

Landmark: Sphenoid

Bone: Zygomatic bone

Bone: Mandible

Feature: K_qrmgb npmacqq

Suture: Squamous suture

Bone: Occipital bone

Cardinal direction: Bottom

View (circle one):

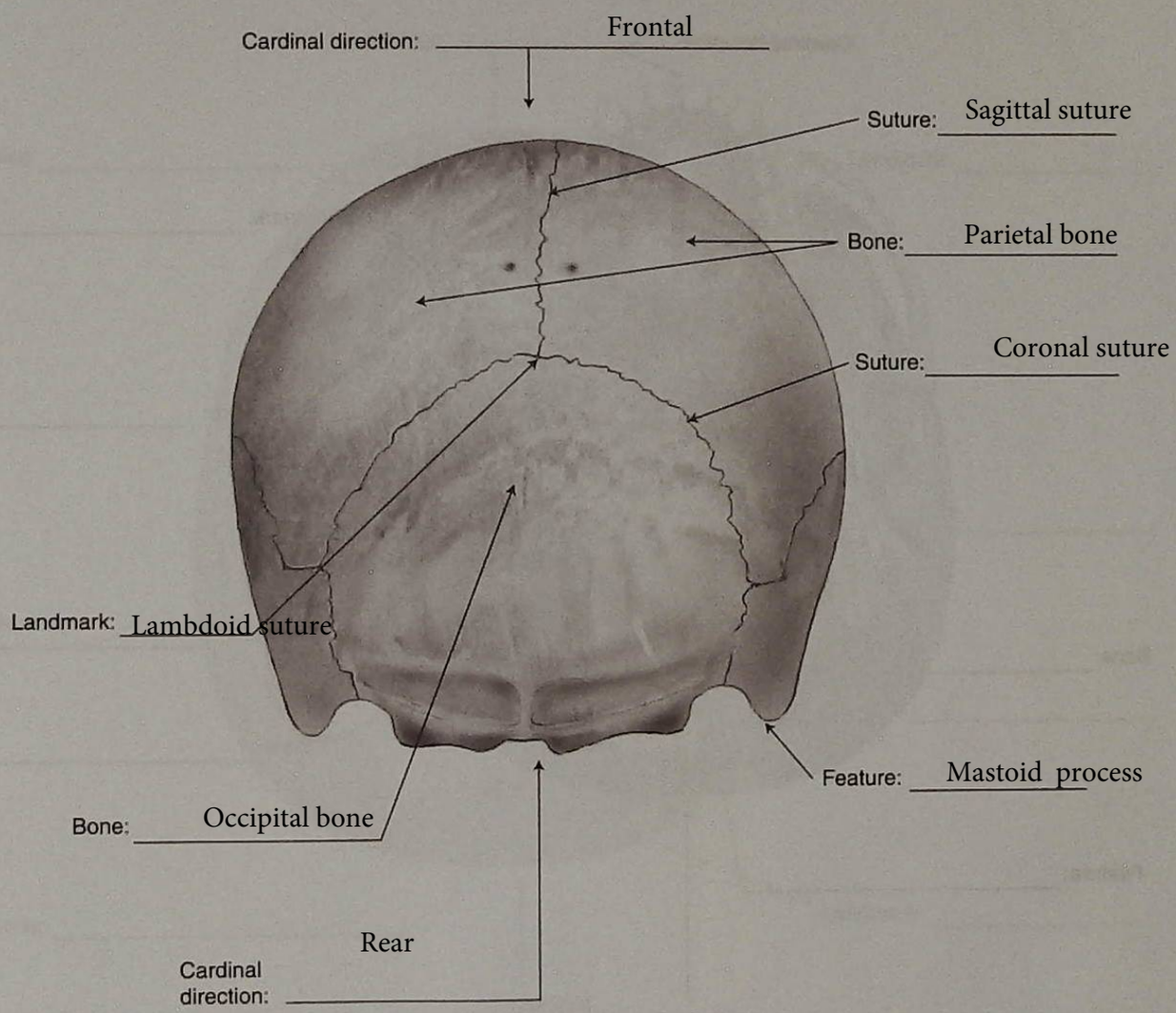
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.1C

Cranial Skeleton

Name: _____ **Date:** _____

Identify the bones, cardinal directions (where indicated), features, landmarks, and sutures.



View (circle one):

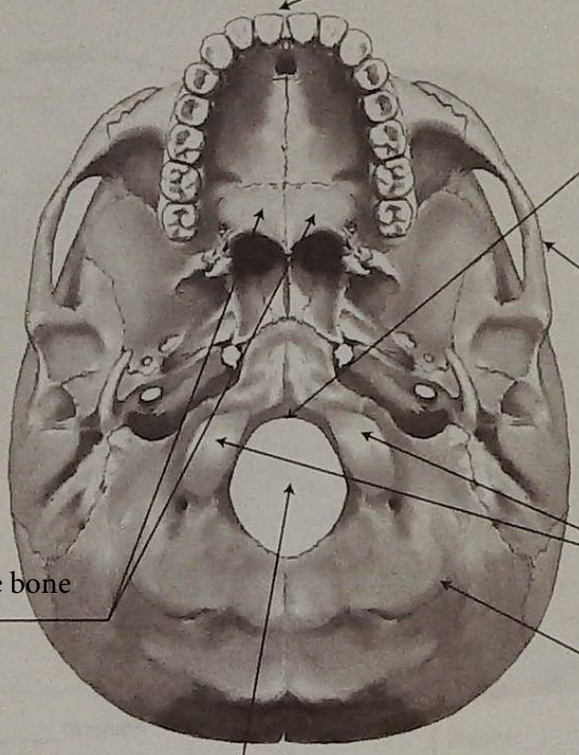
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.1D

Cranial Skeleton

Name: _____ **Date:** _____

Identify the bones, cardinal directions (where indicated), features, landmarks, and sutures.



Cardinal direction: Frontal

Landmark: Lambdoid Sture

Feature: Zygomatic process

Feature: Occipital condyle

Bone: Occipital bone

Bone: Palatine bone

Feature: Foramen magnum

Cardinal direction: Rear

View (circle one):

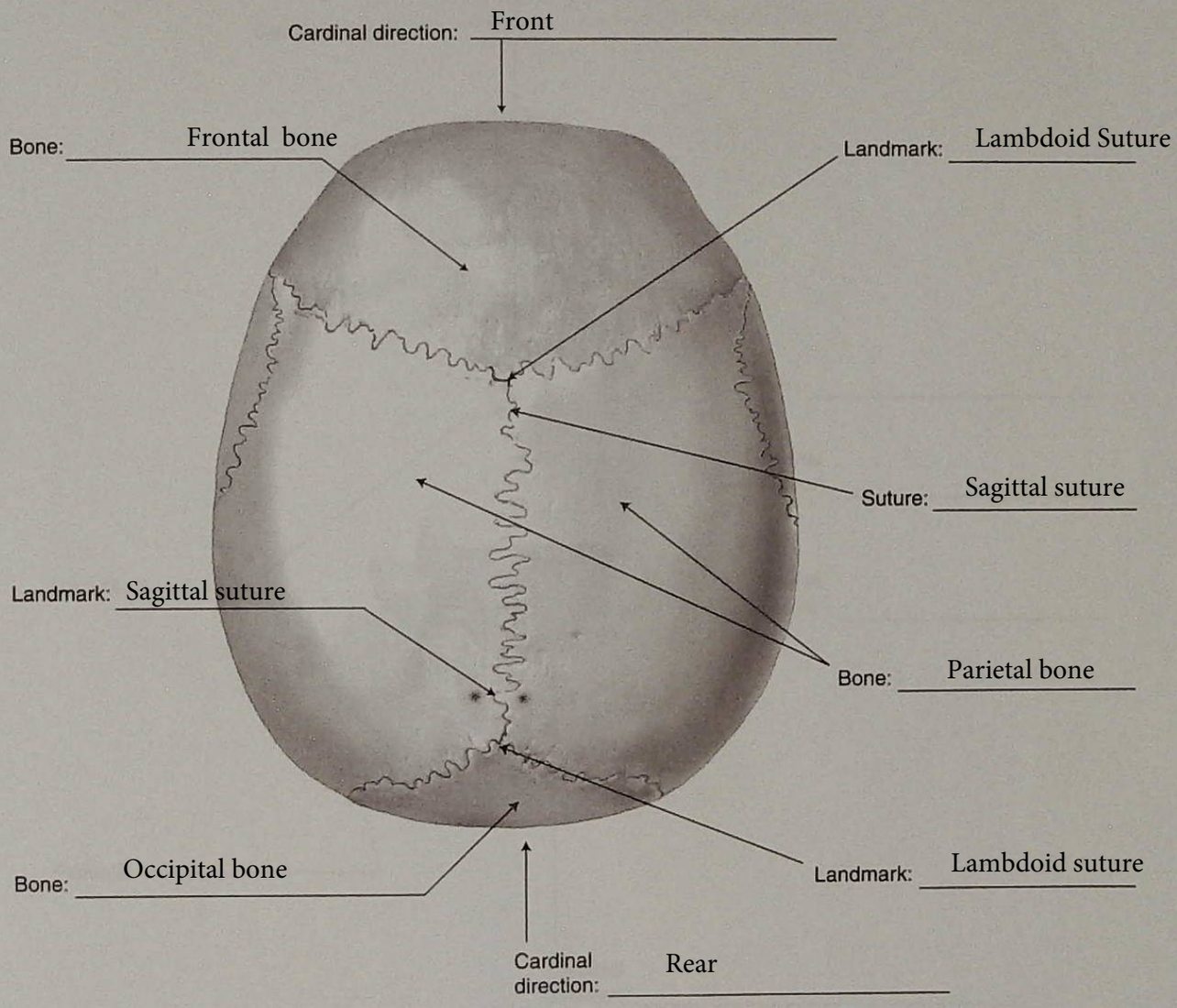
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.1E

Cranial Skeleton

Name: _____ **Date:** _____

Identify the bones, cardinal directions (where indicated), features, landmarks, and sutures.



View (circle one):

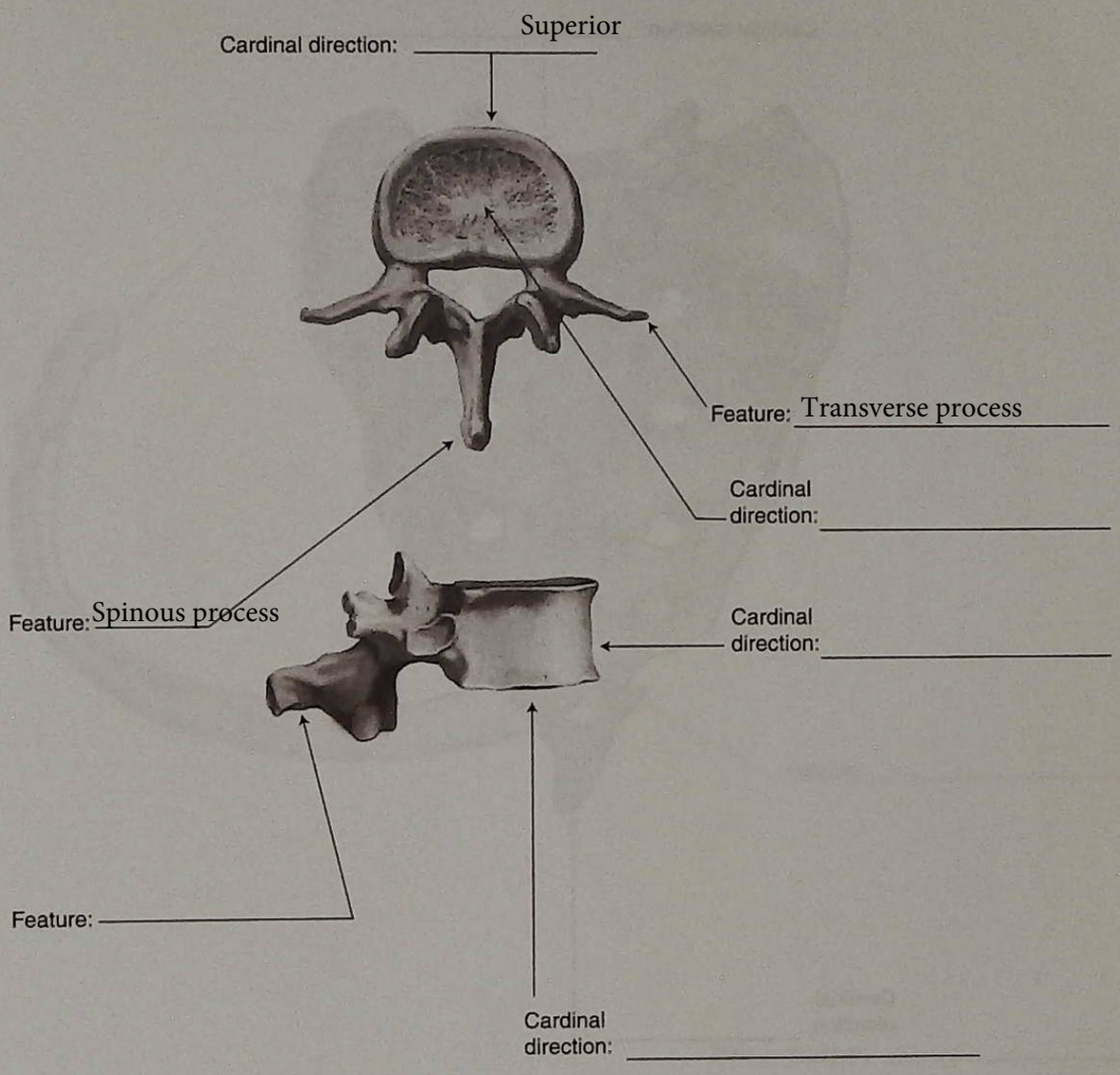
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.2A

Axial Skeleton and Thorax

Name: _____ **Date:** _____

Identify the bones, cardinal directions, and bone features.



Bone name: Axis

EXERCISE WORKSHEET 2.2B

Axial Skeleton and Thorax

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and bone features.

Bone name: Sternum

View (circle one):

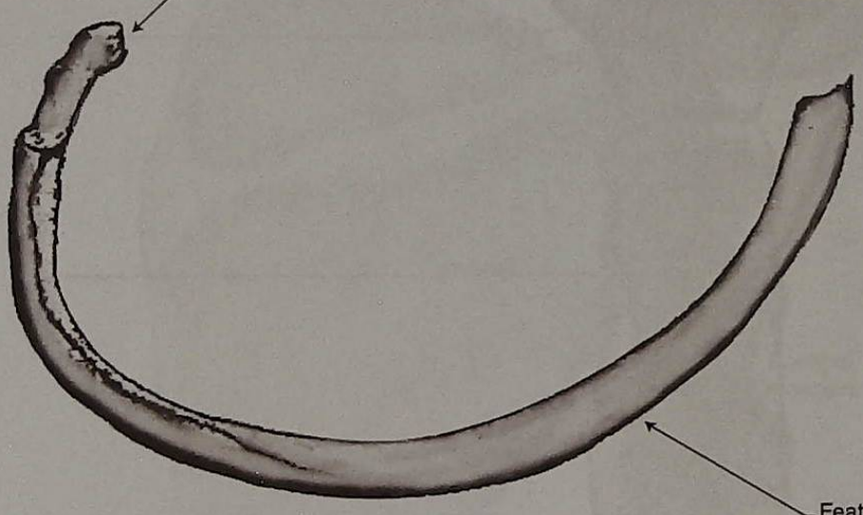
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.2C

Axial Skeleton and Thorax

Name: _____ **Date:** _____

Identify the bone and the indicated features.



Bone name: Rib

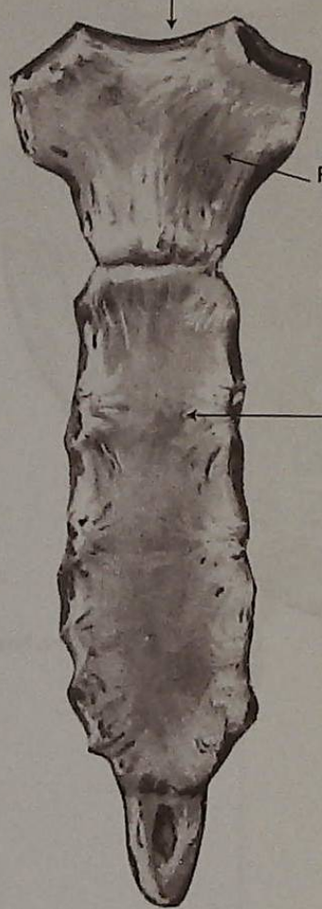
EXERCISE WORKSHEET 2.2D

Axial Skeleton and Thorax

Name: _____ **Date:** _____

Identify the bone, cardinal directions (where indicated), components, and features.

Cardinal direction: Superior



Feature: Manubrium

Feature: Body

Cardinal direction: Inferior

Bone name: Sternum

View (circle one):

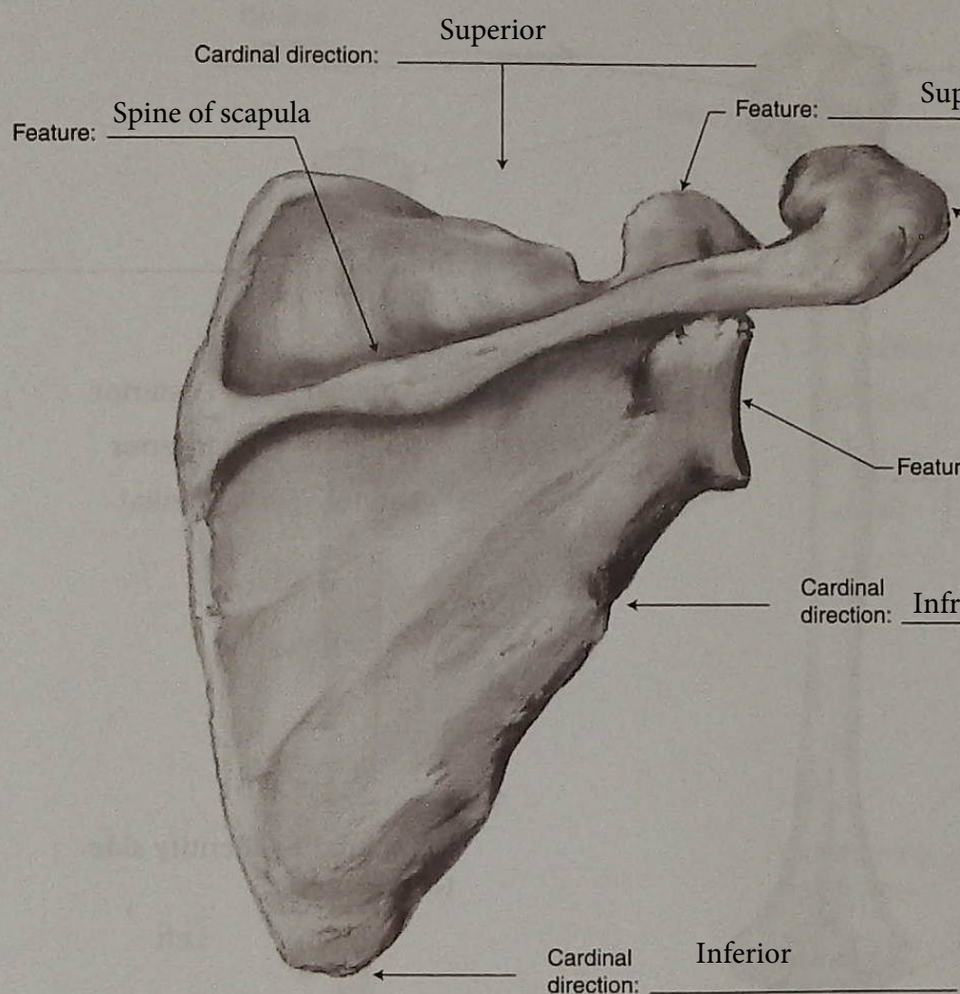
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.3A

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and features.



Bone name: Scapula

View (circle one):

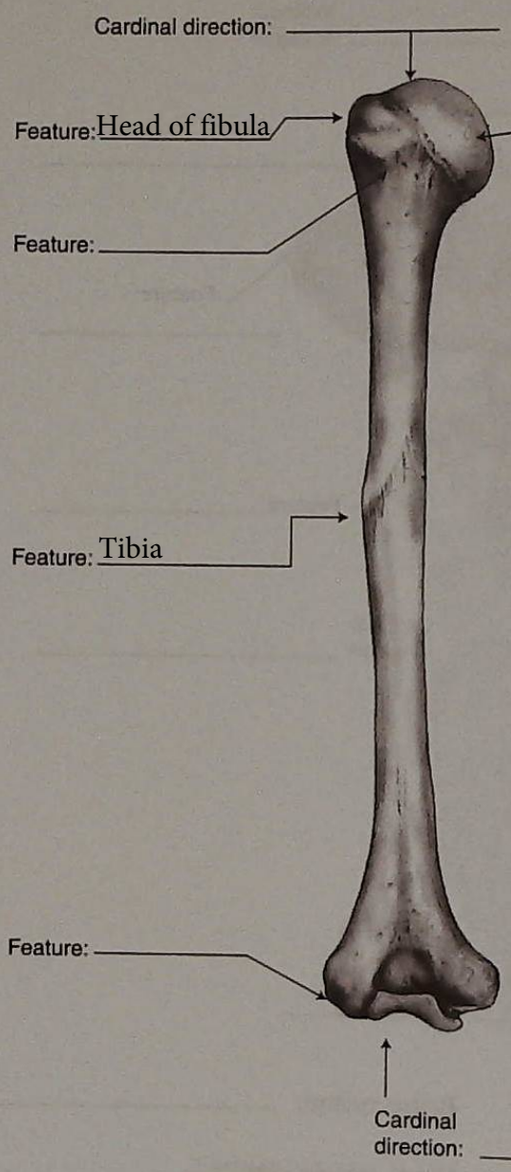
Anterior	Posterior
Superior	Inferior
Lateral	Medial

EXERCISE WORKSHEET 2.3B

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and features.



Bone name: Fibula bone

View (circle one):

Anterior	Posterior
Superior	Inferior
Lateral	Medial

Extra credit—Identify side (circle one):

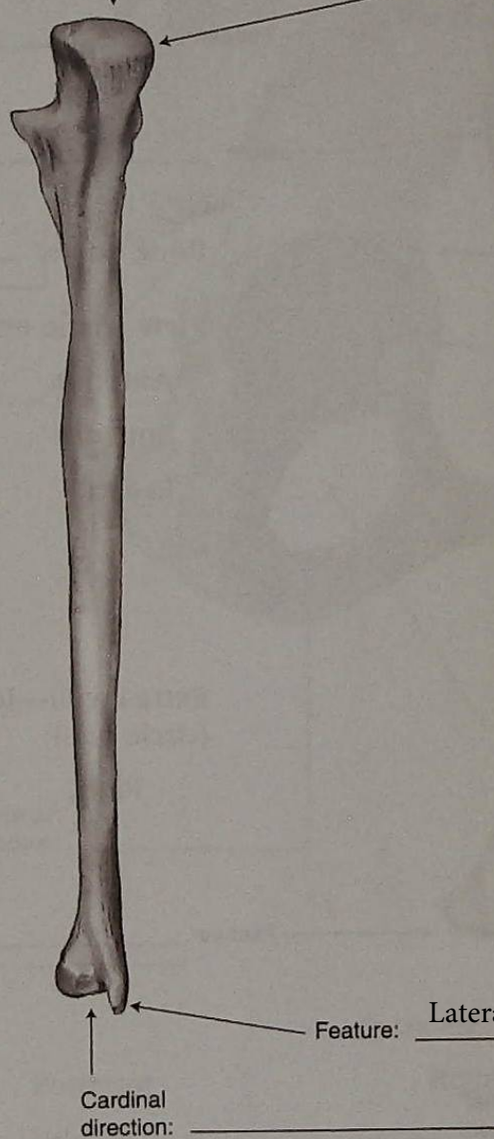
Right	Left

EXERCISE WORKSHEET 2.3C

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and features.



Bone name: Fibula

View (circle one):

Anterior Posterior

Superior Inferior

Lateral Medial

Extra credit—Identify side (circle one):

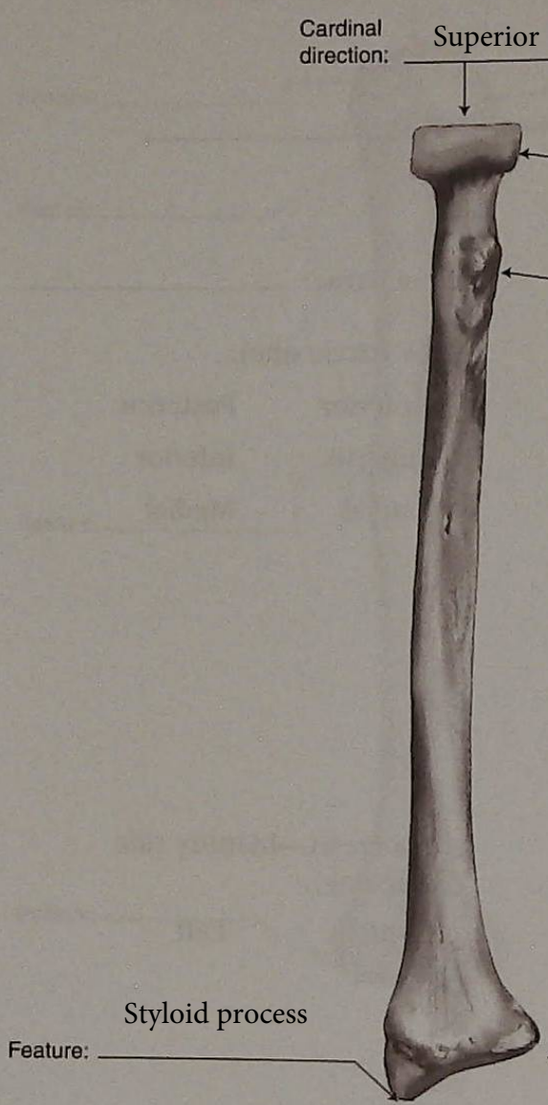
Right Left

EXERCISE WORKSHEET 2.3D

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and bone features.



Cardinal direction: Superior

Feature: Articular circumfrence

Feature: Bicipital tuberosity

Bone name: Radius

View (circle one):

Anterior Posterior

Superior Inferior

Lateral Medial

Extra credit—Identify side (circle one):

Right Left

Feature: Styloid process

Feature: Articular surface for carpals

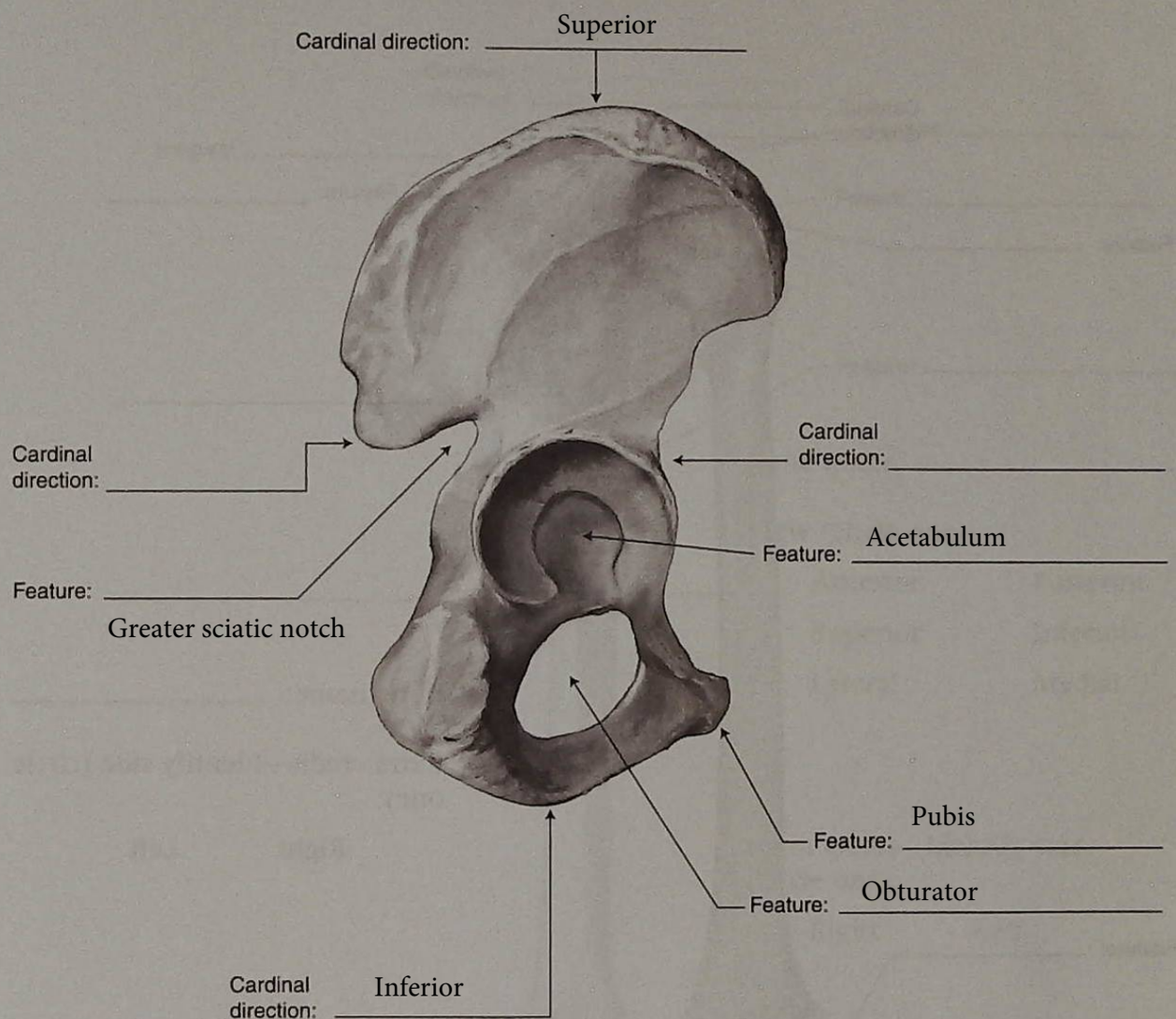
Cardinal direction: Inferior

EXERCISE WORKSHEET 2.4A

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and features.



Bone name: Pelvis

View (circle one):

Anterior Posterior

Superior Inferior

Lateral Medial

Extra credit—Identify side (circle one):

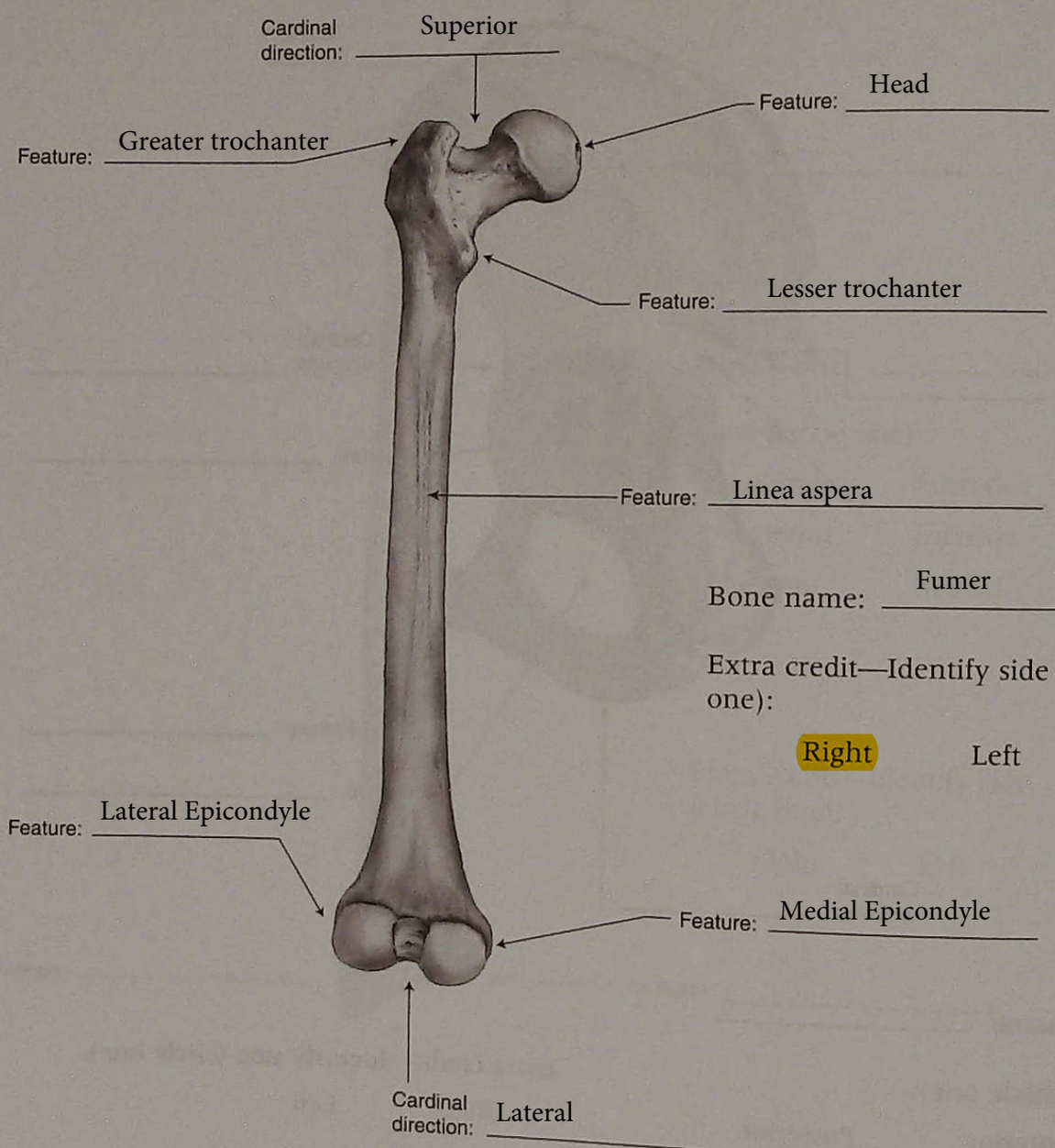
Right Left

EXERCISE WORKSHEET 2.4B

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and features.



Bone name: Fumer

Extra credit—Identify side (circle one):

Right Left

EXERCISE WORKSHEET 2.4C

Appendicular Skeleton

Name: _____ **Date:** _____

Identify the bone, cardinal directions, and features.

Cardinal direction: Superior

Feature: Lateralcondyle

Feature: Intercondylar eminence

Feature: Medial condyle

Feature: Anterior border

Bone name: Tibia

View (circle one):

Anterior Posterior

Superior Inferior

Lateral Medial

Extra credit—Identify side (circle one):

Right Left

Feature: Medial malleolus

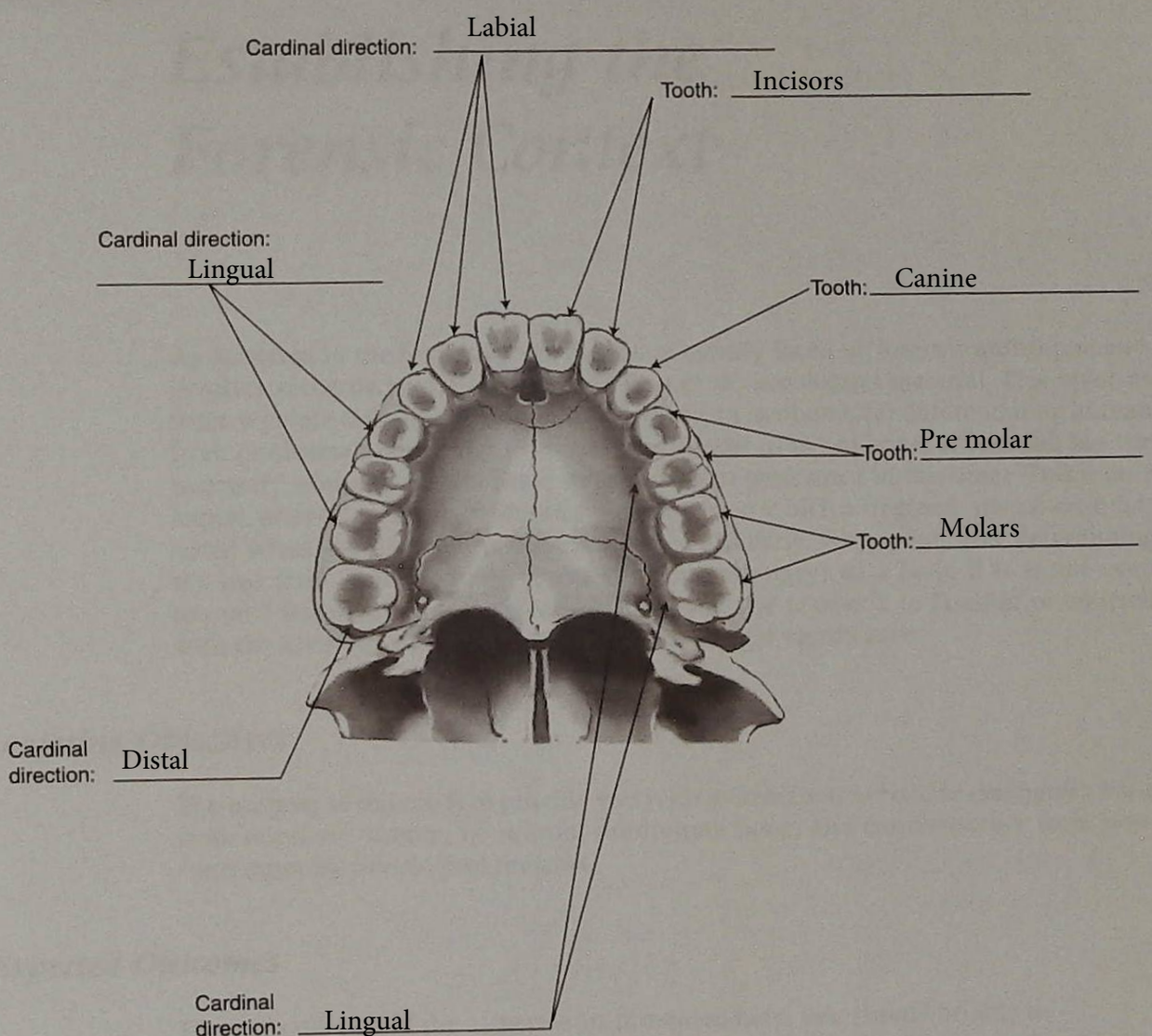
Cardinal direction: Inferior

EXERCISE WORKSHEET 2.5

Dentition

Name: _____ **Date:** _____

Identify the teeth and the cardinal directions.



View (circle one):

Anterior	Posterior
Superior	Inferior
Lateral	Occlusal