

ANSWERS TO CHAPTER 6

CONTENT LEARNING ACTIVITY

Connective tissue

- A. 1. Ligaments and tendons; 2. Cartilage; 3. Bone; 4. Tendons
- B. 1. Hydroxyapatite; 2. Lamellae; 3. Osteocytes; 4. Lacunae; 5. Canaliculi

General Features of Bone

- A. 1. Long bones; 2. Short bones; 3. Flat bones; 4. Irregular bones
- B. 1. Diaphysis; 2. Epiphysis; 3. Epiphyseal plate; 4. Epiphyseal line; 5. Medullary cavity; 6. Marrow; 7. Fat; 8. Blood-forming; 9. Periosteum; 10. Endosteum; 11. Osteoblasts
- C. 1. Lamellae; 2. Osteocytes; 3. Lacunae; 4. Canaliculi

Compact Bone and Cancellous Bone

- A. 1. Central canal; 2. Blood vessels; 3. Osteon; 4. Canaliculi; 5. Periosteum and endosteum
- B. 1. Trabeculae; 2. Marrow; 3. Osteocytes; 4. Blood vessels; 5. Canaliculi

Bone Ossification

- A. 1. Intramembranous ossification; 2. Intramembranous ossification; 3. Endochondral ossification
- B. 1. Connective tissue; 2. Cartilage model; 3. Calcified; 4. Osteoblasts; 5. Osteoclasts; 6. Primary ossification center; 7. Secondary ossification centers

Bone Growth, Remodeling, and Repair

- A. 1. Diameter; 2. Length; 3. Epiphyseal plate; 4. Chondrocytes; 5. Proliferating; 6. Calcified; 7. Osteoblasts; 8. Ossification
- B. 1. Osteoclasts; 2. Osteoblasts; 3. Calcium; 4. Decrease; 5. Clot; 6. Callus; 7. Cancellous

General Considerations of Bone Anatomy

- 1. Foramen; 2. Canal or meatus; 3. Fossa; 4. Tubercle or tuberosity; 5. Process; 6. Condyle

Skull

- A. 1. Cranial vault (braincase); 2. Facial bones; 3. Hyoid bone; 4. Orbit; 5. Nasal conchae; 6. Paranasal sinuses; 7. Sella turcica; 8. Nasal septum
- B. 1. Orbital fissures; 2. Optic foramen; 3. Foramen magnum; 4. Mandibular fossa; 5. Orbit; 6. Nasolacrimal canal; 7. External auditory meatus
- C. 1. Coronal suture; 2. Parietal bone; 3. Squamous suture; 4. Lambdoid suture; 5. Occipital bone; 6. Temporal bone; 7. External auditory meatus; 8. Mastoid process; 9. Styloid process; 10. Zygomatic arch; 11. Mandible; 12. Maxilla; 13. Zygomatic bone; 14. Nasal bone; 15. Sphenoid bone; 16. Frontal bone
- D. 1. Horizontal plate of palatine and palatine process of maxilla; 2. Perpendicular plate of ethmoid and vomer; 3. Temporal and zygomatic

Vertebral Column

- A. 1. Thoracic and sacral; 2. Cervical; 3. Thoracic; 4. Lumbar
- B. 1. Cervical vertebrae; 2. Atlas; 3. Thoracic vertebrae; 4. Lumbar; 5. Sacrum; 6. Coccyx
- C. 1. Body; 2. Lamina and pedicle; 3. Vertebral foramen; 4. Intervertebral foramina; 5. Articular process; 6. Spinous process; 7. Intervertebral disk
- D. 1. Articular facet; 2. Articular process; 3. Transverse process; 4. Vertebral foramen; 5. Body; 6. Vertebral arch; 7. Pedicle; 8. Lamina; 9. Spinous process

Thoracic Cage

- A. 1. True ribs; 2. Floating ribs; 3. Body; 4. Manubrium; 5. Jugular notch; 6. Sternal angle
- B. 1. True ribs; 2. Costal cartilage; 3. False ribs; 4. Floating ribs; 5. Sternum; 6. Xiphoid process; 7. Body; 8. Manubrium

Pectoral Girdle

- 1. Spine; 2. Acromion process; 3. Coracoid process; 4. Glenoid fossa

Upper Limb

- A. 1. Head of humerus; 2. Distal end of humerus; 3. Head of radius; 4. Head of ulna
- B. 1. Greater and lesser tubercles; 2. Epicondyles; 3. Radial tuberosity; 4. Styloid processes

Pelvic Girdle

- 1. Coxa; 2. Iliac crest; 3. Anterior superior iliac spine; 4. Acetabulum; 5. Obturator foramen; 6. Female

Lower Limb

- A. 1. Acetabulum; 2. Condyles of femur; 3. Tibia; 4. Talus
- B. 1. Epicondyles; 2. Trochanters; 3. Patella; 4. Tibial tuberosity; 5. Malleolus; 6. Calcaneus

Location of Major Bones of Skeletal System

- 1. Clavicle; 2. Scapula; 3. Humerus; 4. Ulna; 5. Radius; 6. Carpals; 7. Metacarpals; 8. Phalanges; 9. Coxa; 10. Femur; 11. Patella; 12. Tibia; 13. Fibula; 14. Tarsals; 15. Metatarsals; 16. Phalanges

Articulations

- A. 1. Fibrous; 2. Cartilaginous; 3. Synovial
- B. 1. Sutures; 2. Fontanels; 3. Syndesmoses; 4. Gomphoses
- C. 1. Articular cartilage; 2. Joint cavity; 3. Joint capsule; 4. Synovial membrane; 5. Bursa
- D. 1. Bursa; 2. Joint cavity; 3. Articular cartilage; 4. Joint capsule; 5. Synovial membrane

Types of Synovial Joints

- 1. Plane joint; 2. Saddle joint; 3. Hinge joint; 4. Pivot joint; 5. Ball-and-socket joint; 6. Ellipsoid joint

Types of Movement

- 1. Circumduct; 2. Abduct; 3. Adduct; 4. Flex; 5. Flex; 6. Extend; 7. Extend; 8. Flex; 9. Flex; 10. Pronate

QUICK RECALL

1. Support, protection, lever system, mineral storage, blood cell formation
2. Model for bone growth, smooth joint surfaces, and support
3. Osteoblasts, osteocytes, and osteoclasts
4. Compact and cancellous bone
5. Intramembranous and endochondral
6. Diameter: apposition of new bone matrix on old bone surface beneath the periosteum; Length: cartilage growth at the epiphyseal plate followed by ossification of the cartilage
7. Cervical—7; thoracic—12; lumbar—5; sacrum:—1; coccyx—1
8. True ribs: 7; false ribs: 5; floating ribs: 2
9. Pectoral girdle: clavicle and scapula; Pelvic girdle: sacrum and coxa
10. Upper limb: carpals—8, metacarpals—5, phalanges—14; lower limb: tarsals—7, metatarsals—5, phalanges—14
11. Fibrous, cartilaginous, and synovial
12. Plane, or gliding joints: articular processes between vertebrae; saddle joints: joint at base of thumb; hinge joints: elbow and knee; pivot joints: between atlas and axis; ball-and-socket joints: shoulder and hip; ellipsoid or condyloid: between occipital condyles and atlas

WORD PARTS

1. endochondral
2. osteocyte; osteoclast; osteoblast; osteomalacia; osteomyelitis; osteoporosis; osteogenesis
3. cancellous
4. lacuna
5. styloid
6. articulation; articular process

MASTERY LEARNING ACTIVITY

1. E. Bone performs all of the functions listed.
2. E. The mineral (calcium and phosphate) part of the matrix contributes weight-bearing strength, and the collagen lends flexible strength to the matrix. Chondrocytes and proteoglycans are found only in cartilage.
3. C. The shaft of a long bone is the diaphysis. It is covered by periosteum. Perichondrium covers cartilage. The ends of long bones are epiphyses; they are covered by articular cartilage.
4. D. Periosteum covers the surface of mature bones, regardless of how they are formed. Hyaline cartilage (articular cartilage) covers the ends of long bones. Perichondrium covers cartilage.
5. D. Canaliculi ("small canals") are tiny canals that allow cell processes from osteocytes to connect with each other through the lamellae. Canaliculi provide a pathway for nutrients to diffuse to, and for waste products to diffuse away from the osteocytes. Lamellae are thin sheets of matrix arranged concentrically around the central canals. Central canals contain blood vessels, and lacunae are spaces in which the osteocytes are located.
6. B. Intramembranous ossification gives rise to the flat bones of the skull. The other terms describe endochondral ossification. Endochondral bone is formed from a cartilage model.
7. A. Primary ossification centers form in the diaphysis of a long bone. Secondary ossification centers are located in the epiphyses. Periosteum is the connective tissue layer which covers the outer surface of bones. Articular cartilage is the cartilage that remains over the articular surfaces of the ends of long bones, even after other cartilage has been replaced by bone.
8. A. As a long bone increases in diameter, the size of the medullary cavity increases; this occurs when osteoclasts break down bone lining the medullary cavity. The increase in size of the medullary cavity prevents the bone from becoming too heavy.
9. D. The epiphyseal plate is composed of cartilage. The chondrocytes in the epiphyseal plate increase in number, hypertrophy, and die, and the cartilage becomes calcified. The calcified cartilage is then replaced by bone. Osteoblasts produce bone, osteoclasts remove bone, and osteocytes maintain the matrix of bone.
10. B. Osteoclasts break down bone, and osteoblasts build bone. The interaction between these two types of cells is responsible for bone growth and remodeling.
11. E. Following a fracture, bleeding from blood vessels in the bone produces a blood clot. Cells from surrounding tissues invade the clot, and form a fibrous network containing cartilage. This region of repair is called a callus. Osteoblasts invade the callus and begin producing cancellous bone which is later remodeled.
12. A. A condyle is the rounded end of a bone that articulates with another bone, a foramen is a hole in a bone, a fossa is a depression in a bone, and a process is a projection from a bone.
13. C. The appendicular skeleton consists of the pectoral (clavicles, scapulae) and pelvic (coxae, sacrum) girdles plus the upper and lower limbs. The axial skeleton consists of the skull, vertebrae, and rib cage.

14. D. The vomer and the perpendicular plate of the ethmoid form the bony part of the nasal septum. The nasal bones form the bridge of the nose, and the nasal conchae are three bony shelves in the lateral walls of the nasal cavity. The zygomatic arch is formed from the zygomatic and temporal bones, and forms a bridge across the cheek.
15. C. The temporal bone does not have a paranasal sinus (cavity connected to the nasal cavity).
16. C. The squamous suture joins the parietal and temporal bones, the coronal suture joins the parietal and frontal bones, the lambdoid suture joins the parietal and occipital bones, and the frontal and temporal bones do not touch.
17. A. The nasolacrimal canal passes from the orbit into the nasal cavity. The optic foramen is the passageway for the optic nerve, the orbital fissure is a passageway for nerves and vessels between the orbit and brain, and the foramen magnum is the opening through which the spinal cord communicates with the brain.
18. C. The body is the weight-bearing portion. The vertebral arch protects the spinal cord; the articular processes connect adjacent vertebrae, allowing movement but providing stability, and the transverse and spinous processes are points of muscle attachment.
19. A. Only cervical vertebrae have transverse foramina, through which the vertebral arteries pass.
20. C. There are eight carpal bones in the wrist.
21. D. The lateral malleolus of the fibula forms the outer ankle and the medial malleolus of the tibia forms the inner ankle.
22. D. The head of the ulna articulates with the carpal bones of the wrist. The semilunar notch of the ulna articulates with the humerus. All of the other pairs are correctly matched.
23. E. Sutures (between skull bones) and syndesmosis joints (between tibia and fibula or radius and ulna) both contain fibers. Gomphoses are found between the teeth and jaws (periodontal ligaments).
24. E. The joint capsule surrounds and supports the joint. The articular cartilage covers the ends of bones within the joint. The synovial membrane secretes synovial fluid, which lubricates the joint.
25. D. Supination of the forearm turns the knob clockwise, unlatching the door.



FINAL CHALLENGES



1. The major components of hyaline (articular) cartilage found in joints are collagen and proteoglycans. The collagen provides structural strength, whereas the proteoglycans trap water and are responsible for the resilient property of cartilage. Resilience is the ability of the cartilage to resume its shape after being compressed. Aging results in a decrease in proteoglycans and a loss of resiliency. As a consequence, the cartilage is compressed, the collagen and other cartilage components are subjected to more wear and tear, and the cartilage degenerates.
2. Scoliosis would be expected, because with one lower limb shorter than the other limb, the hips would be abnormally tilted sideways, causing the vertebral column to curve laterally.
3. The coccyx can bend out of the way to increase the size of the pelvic outlet during childbirth.
4. Premature fusion of the cranial bones is called craniosynostosis. The skull may be severely deformed because of the pressure exerted by the growing brain. Surgery to allow normal development is usually successful, however.