

How strange we would look without our skeleton! It is the skeleton that provides us with the rigid, supportive framework that gives shape to our bodies. But this is just the beginning, since it also protects the organs beneath it, maintains the homeostasis of blood calcium, produces blood cells, and assists the muscular system in providing movement for us.

After reviewing the microscopic structures of bone and cartilage, you will understand how skeletal tissues are formed, their differences, and their importance in the human body. Your microscopic investigation will make the study of this system easier as you logically progress from this view to macroscopic bone formation and growth and as you visualize the structure of the long bones.

The skeleton is divided into two main divisions: the axial skeleton and the appendicular skeleton. All of the 206 bones of the human body may be classified into one of these two categories. And, although we can divide the bones neatly by this system, we are still aware that subtle differences exist between men's and women's skeletons. These structural differences provide us with insight into the differences in function between men and women.

Finally, three types of joints exist in the body: synarthroses, amphiarthroses, and diarthroses. It is important to have a knowledge of these joints and to understand how movement is facilitated by these various articulations.

TOPICS FOR REVIEW

Before progressing to Chapter 6, you should familiarize yourself with the functions of the skeletal system, the structure and function of bone and cartilage, bone formation and growth, and the types of joints found in the body. Additionally, your understanding of the skeletal system should enable you to identify the two major subdivisions of the skeleton, the bones found in each area, and any differences that exist between men's and women's skeletons.


FUNCTIONS OF THE SKELETAL SYSTEM

TYPES OF BONES

STRUCTURE OF LONG BONES

Fill in the blanks.

- There are 98 types of bones.
- The medullary cavity is the hollow area inside the diaphysis of a bone.
- The thin layer of cartilage covering each epiphysis is the articular cartilage.
- The endosteum lines the medullary cavity of long bones.
- hemopoiesis is the process of blood cell formation.
- Blood cell formation is a vital process carried on in red bone marrow.
- The periosteum is the strong fibrous membrane that covers long bones everywhere except at joint surfaces.
- Osteoporosis occurs most frequently in old white females.
- Bones serve as a safety-deposit box for calcium, a vital substance required for normal nerve and muscle function.
- As muscles contract and shorten, they pull on bones and thereby move them.

 If you have had difficulty with this section, review pages 98 and 103.

MICROSCOPIC STRUCTURE OF BONE AND CARTILAGE


Match the term on the left with the proper selection on the right.

- Group A
- D 11. Trabeculae
 - B 12. Compact
 - E 13. Spongy
 - A 14. Periosteum
 - C 15. Cartilage

- Group B
- D 16. Osteocytes
 - A 17. Canaliculi
 - E 18. Lamellae
 - B 19. Chondrocytes
 - C 20. Haversian system

- A. Outer covering of bone
- B. Dense bone tissue
- C. Fibers embedded in a firm gel
- D. Needle-like threads of spongy bone
- E. Ends of long bones

- A. Connect lacunae
- B. Cartilage cells
- C. Structural unit of compact bone
- D. Bone cells
- E. Ring of bone

 If you have had difficulty with this section, review pages 99-101.

BONE FORMATION AND GROWTH

If the statement is true, write "T" in the answer blank. If the statement is false, correct the statement by circling the incorrect term and writing the correct term in the answer blank.

- T 21. When the skeleton forms in a baby before birth, it consists of cartilage and fibrous structures.
- F 22. Diaphyses are the ends of bones. *epiphyses*
- F 23. Bone-forming cells are known as osteoclasts. *osteoblasts*
- T 24. It is the combined action of osteoblasts and osteoclasts that sculpts bones into their adult shapes.
- F 25. The stresses placed on certain bones during exercise ~~decrease~~ [↑] the rate of bone deposition.
- F 26. The epiphyseal plate can be seen in both external and cutaway views of an ~~adult~~ *juvenile* long bone.
- F 27. The shaft of a long bone is known as the articulation. *diaphyses*
- T 28. Cartilage in the newborn becomes bone when it is replaced with calcified bone matrix that is deposited by osteoblasts.
- F 29. When epiphyseal cartilage becomes bone, growth begins.
- T 30. The epiphyseal cartilage is visible, if present, on x-ray films.



If you have had difficulty with this section, review pages 101-103.

DIVISIONS OF SKELETON

Circle the correct answer.

31. Which one of the following is *not* a part of the axial skeleton?
A. Scapula
B. Cranial bones
C. Vertebra
D. Ribs
E. Sternum
32. Which one of the following is *not* a cranial bone?
A. Frontal
B. Parietal
C. Occipital
D. Lacrimal
E. Sphenoid
33. Which of the following statements is *not* true?
A. A baby is born with a straight spine.
B. In an adult, the sacral and thoracic curves are convex.
C. The normal curves of the adult spine provide greater strength than does a straight spine.
D. A curved structure has more strength than a straight one of the same size and materials.

34. True ribs:
A. Attach to the cartilage of other ribs
B. Do not attach to the sternum
C. Attach directly to the sternum without cartilage
 D. Attach directly to the sternum by means of cartilage
35. The bone that runs along the lateral side of your forearm is the:
A. Humerus
B. Ulna
 C. Radius
D. Tibia
36. The shinbone is also known as the:
A. Fibula
B. Femur
 C. Tibia
D. Ulna
37. The bones in the palm of the hand are called:
A. Metatarsals
B. Tarsals
 C. Carpals
 D. Metacarpals
38. Which one of the following is not a bone of the upper extremity?
A. Radius
B. Clavicle
C. Humerus
 D. Ilium
39. The heel bone is known as the:
 A. Calcaneus
B. Talus
C. Metatarsal
D. Phalanges
40. The mastoid process is part of the _____ bone.
A. Parietal
 B. Temporal
C. Occipital
D. Frontal
41. When a baby learns to walk, the _____ area of the spine becomes concave.
 A. Lumbar
B. Thoracic
C. Cervical
D. Coccyx
42. Which bone is the "funny" bone?
A. Radius
B. Ulna
 C. Humerus
D. Carpal
43. There are _____ pairs of true ribs.
A. 14
B. 7

C. 5

D. 3

44. The 27 bones in the wrist and the hand allow for more:

- A. Strength
- B. Dexterity
- C. Protection
- D. Red blood cell products

45. The longest bone in the body is the:

- A. Tibia
- B. Fibula
- C. Femur
- D. Humerus

46. Distally, the _____ articulates with the patella.

- A. Femur *- distal end*
- B. Fibula
- C. Tibia
- D. Humerus

47. The _____ bones form the cheek bones.

- A. Mandible
- B. Palatine
- C. Maxillary
- D. Zygomatic

48. In a child, there are five of these bones. In an adult, they are fused into one.

- A. Pelvic bones
- B. Lumbar vertebrae
- C. Sacrum
- D. Carpals

49. The spinal cord enters the cranium through a large hole (foramen magnum) in the _____ bone.

- A. Temporal
- B. Parietal
- C. Occipital
- D. Sphenoid

Circle the one that does not belong.

- | | |
|--|--|
| 50. Cervical | Thoracic |
| 51. Pelvic girdle | Ankle |
| 52. Frontal | Occipital |
| 53. Scapula | Pectoral girdle |
| 54. Malleus | <input checked="" type="radio"/> Vomer |
| 55. <input checked="" type="radio"/> Ulna | Ilium |
| 56. Carpal | Phalanges |
| 57. Ethmoid | Parietal |
| 58. <input checked="" type="radio"/> Anvil | Atlas |

- Coxal
- Wrist
- Maxilla
- Ribs
- Incus
- Ischium
- Metacarpal
- Occipital
- Axis

- Coccyx *spine*
- Axial *upper*
- Sphenoid *cranial*
- Clavicle *shoulder*
- Stapes *ear*
- Pubis *coxal*
- Ethmoid *hands*
- Nasal *cranial*
- Cervical *cervical vertebrae*



If you have had difficulty with this section, review pages 104-115.

DIFFERENCES BETWEEN A MAN'S AND A WOMAN'S SKELETON

Select the correct term from the choices given and write the letter in the answer blank.

- | | |
|--|-----------|
| A. Male | B. Female |
| <u>A</u> 59. Funnel-shaped pelvis | |
| <u>B</u> 60. Broader-shaped pelvis | |
| <u>B</u> 61. Osteoporosis occurs more frequently | |
| <u>A</u> 62. Larger overall bone structure | |
| <u>B</u> 63. Wider pelvic inlet | |



If you have had difficulty with this section, review pages 103, 118-119.

BONE MARKINGS

From the choices given below, match the bone name with the identifying marking. There may be more than one marking for some of the bones.

- | | | |
|----------------------|-----------------------|----------------------|
| A. Mastoid | H. Glenoid cavity | O. Medial malleolus |
| B. Pterygoid process | I. Olecranon process | P. Calcaneus |
| C. Foramen magnum | J. Ischium | Q. Acromion process |
| D. Sella turcica | K. Acetabulum | R. Frontal sinuses |
| E. Mental foramen | L. Symphysis pubis | S. Condylod process |
| F. Conchae | M. Ilium | T. Tibial tuberosity |
| G. Xiphoid process | N. Greater trochanter | |
-
- | | |
|---------------------|--------------------|
| _____ 64. Occipital | _____ 71. Sphenoid |
| _____ 65. Sternum | _____ 72. Ethmoid |
| _____ 66. Coxal | _____ 73. Scapula |
| _____ 67. Femur | _____ 74. Tibia |
| _____ 68. Ulna | _____ 75. Frontal |
| _____ 69. Temporal | _____ 76. Mandible |
| _____ 70. Tarsals | |



If you have had difficulty with this section, review pages 103-119.

JOINTS (ARTICULATIONS)

Circle the correct answer.

77. Freely moving joints are (amphiarthroses or diarthroses).
78. The sutures in the skull are (synarthrotic or amphiarthrotic) joints.
79. All (diarthrotic or amphiarthrotic) joints have a joint capsule, a joint cavity, and a layer of cartilage over the ends of the two joining bones.

80. (Ligaments or tendons) grow out of periosteum and attach two bones together.
81. The (articular cartilage or epiphyseal cartilage) absorbs jolts.
82. Gliding joints are the (least movable or most movable) of the diarthrotic joints.
83. The knee is the (largest or smallest) joint.
84. Hinge joints allow motion in (2 or 4) directions.
85. The saddle joint at the base of each of our thumbs allows for greater (strength or mobility).
86. When you rotate your head, you are using a (gliding or pivot) joint.

▶ If you have had difficulty with this section, review pages 120-126.

UNSCRAMBLE THE BONES

87. ETVERRBAE
 V E R T E B R A E

88. BPSUI
 P U B I S

89. SCALUPA
 S C A P U L A

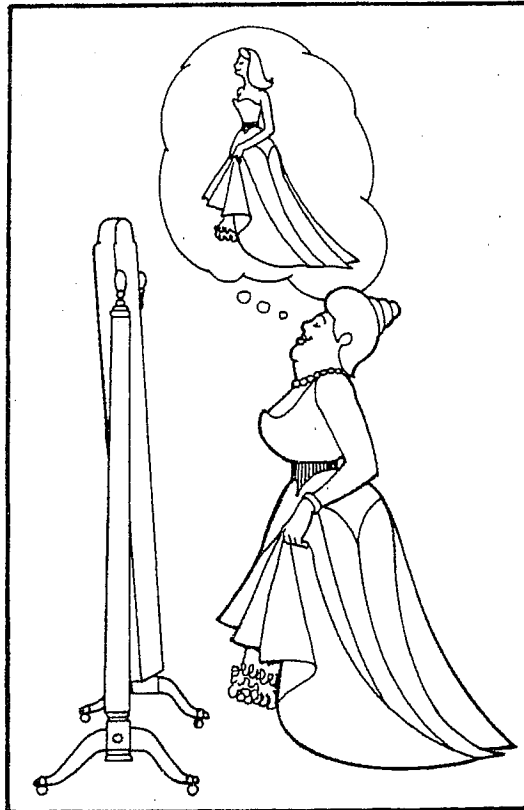
90. IMDBALNE
 M A N D I B L E

91. APNHGAELS
 P H A L A N G E S

Take the circled letters, unscramble them, and fill in the statement.

What the fat lady wore to the ball.

92. P E L V I C G I R D L E



APPLYING WHAT YOU KNOW

93. Mrs. Perine had advanced cancer of the bone. As the disease progressed, Mrs. Perine required several blood transfusions throughout her therapy. One day she asked the doctor to explain the necessity for the transfusions. What explanation might the doctor give to Mrs. Perine?

Bones = blood formation

94. Dr. Kennedy, an orthopedic surgeon, called the admissions office of the hospital to advise that within the next hour he would be admitting a patient with an epiphyseal fracture. Without any other information, the patient is assigned to the pediatric ward. What prompted this assignment?

bones close in adulthood

95. Mrs. Van Skiver, who is 60 years old, noticed when she went in for her physical examination that she was half an inch shorter than she had been on her last visit. Dr. Veazey suggested that Mrs. Van Skiver begin a regimen of dietary supplements of calcium and vitamin D, and he also gave Mrs. Van Skiver a prescription for sex hormone therapy. What bone disease did Dr. Veazey suspect?

osteoporosis

96. WORD FIND

Can you find 14 terms from this chapter? Words may be spelled top to bottom, bottom to top, right to left, left to right, or diagonally.

A R T I C U L A T I O N N U T
M M L T N I N G U I H J N C G
P R P E R I O S T E U M A N B
H V P G U A T B M E O P R F G
I N V R N O B O F S M H X E R
A G J O A J P E T O E O H T Q
R U R B X O E E C A S G I S B
T S S Y I M O Q N U O O L X Q
H J I E A B P U N Q L E Q K S
R I S I L U C I L A N A C X R
O I N A M A S Q M A Q K E C T
S T S A L C O E T S O U I D G
E T S Y F W L N M P U F N U F
S B H Q H L O U S A R X I T V
R P M P A F M G X K D S L G A

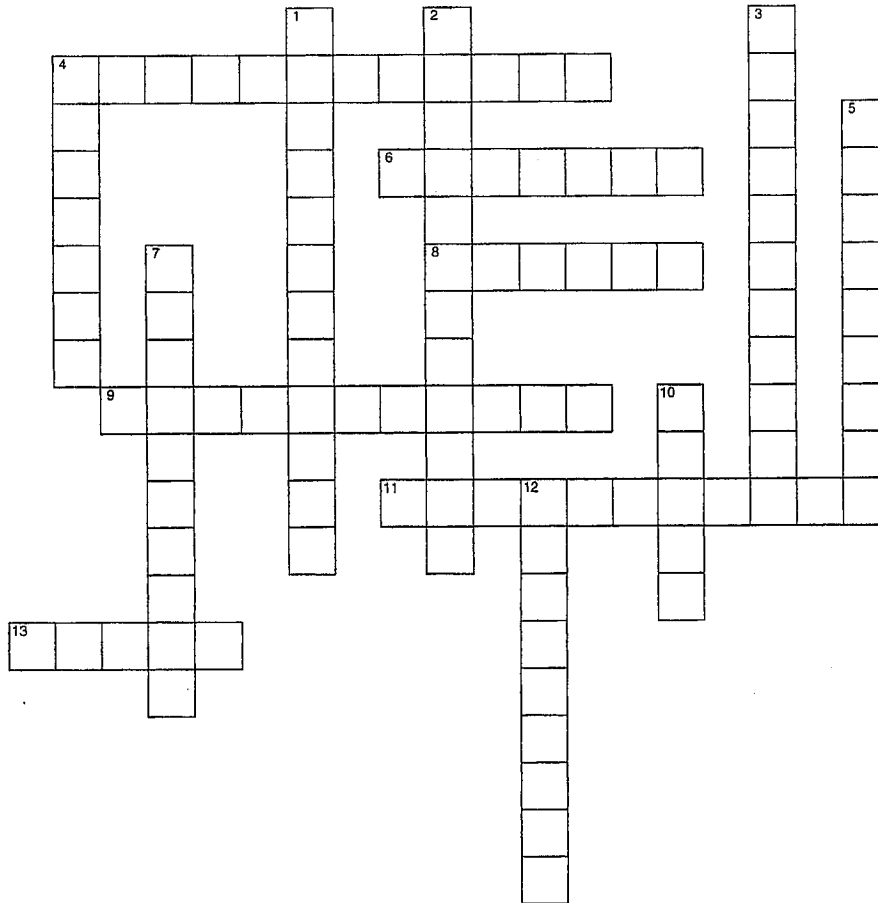
| | | |
|----------------|-------------|-------------|
| Amphiarthroses | Fontanels | Osteoclasts |
| Articulation | Hemopoiesis | Periosteum |
| Axial | Lacunae | Sinus |
| Canaliculi | Lamella | Trabeculae |
| Compact | Osteoblasts | |

DID YOU KNOW?

- The bones of the hands and feet make up more than half of the 206 total bones of the body.
- Approximately 25 million Americans have osteoporosis; four out of five of them are women.
- The bones of the middle ear are mature at birth.

SKELETAL SYSTEM

Fill in the crossword puzzle.



Across

4. Cartilage cells
6. Spaces in bones where osteocytes are found
8. Chest
9. Freely movable joints
11. Process of blood cell formation
13. Space inside cranial bone

Sinus

Down

1. Joint *articulation*
2. Suture joints
3. Bone-absorbing cells *osteoclasts*
4. Type of bone *compact*
5. Ends of long bones
7. Covers long bone except at its joint surfaces
10. Division of skeleton
12. Bone cell

CHECK YOUR KNOWLEDGE

Multiple Choice

Circle the correct answer.

- Which of the following statements about the ribs is *true*?
 A. The first seven pairs attach to the sternum by cartilage.
B. The last four pairs are called floating ribs because they are free in the front.
C. The eighth, ninth, and tenth pairs do not move because they are not attached to the sternum.
D. All of the above statements about the ribs are true.
- Which of the following is the largest bone in the lower extremities?
A. Humerus
B. Ulna
 C. Femur
D. Radius
- Yellow bone marrow is made primarily of:
 A. Fatty tissue
B. Blood cells
C. Epithelial tissue
D. Fibrous tissue
- Which of the following statements regarding the female pelvis is *not true*?
A. Its shape can be described as broader, shallower, and more basin-like as compared with the pelvis of the male.
B. Its pelvic inlet (or brim) is usually wider than that of the male pelvis.
 C. Its individual hipbones are usually larger and heavier than those of the male.
 D. All of the above
- Which of the following statements about the normal curves of the spine (two concave and two convex) are *true*?
A. They are present at birth.
B. They extend from the skull to the bottom of the ribcage.
 C. They give the spine strength to support the weight of the rest of the body.
D. All of the above
- Which of the following statements about diarthroses is *not true*?
A. They contain a synovial membrane that secretes a lubricating fluid called synovial fluid.
B. A diarthrotic joint may permit flexion, extension, abduction, adduction, or rotation.
C. These joints make up the largest category of body joints.
 D. All of the above
- Which of the following bones are components of the axial skeletal system?
A. Ilium, ethmoid, clavicle
B. Ulna, palatine, occipital
 C. Sacrum, vomer, sphenoid
D. Scapula, patella, fibula
- Which of the following bones is *not* classified as a cranial bone?
A. Sphenoid
B. Parietal
 C. Palatine
D. Temporal

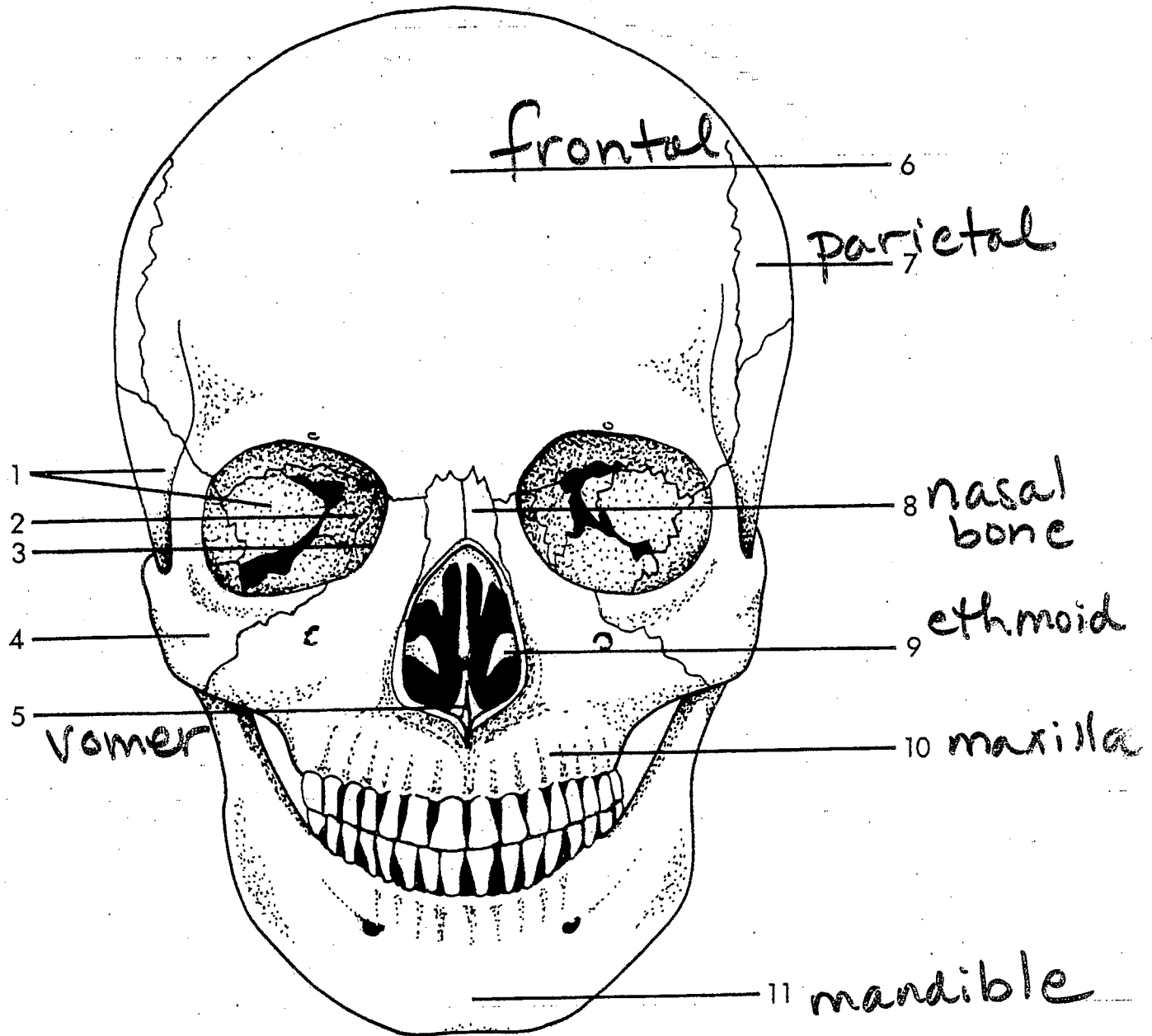
9. Which of the following statements characterizes the skeleton of a growing child?
- A. Epiphyses are separated from diaphysis by a layer of cartilage.
 - B. Osteoblasts deposit calcium in the gel-like matrix of cartilage.
 - C. The periosteum is present.
 - D. All of the above
10. What are the joints between the cranial bones called?
- A. Synarthroses
 - B. Diarthroses
 - C. Amphiarthroses
 - D. All of the above

Matching

Select the most appropriate answer from column B for each item in column A. There is only one correct answer for each item.

| Column A | Column B |
|------------------------------|------------------------|
| <u>J.</u> 11. Diarthroses | A. Haversian canal |
| <u>B.</u> 12. Spongy bone | B. Trabeculae |
| <u>I.</u> 13. Synarthrosis | C. Perpendicular plate |
| <u>L.</u> 14. Foramen magnum | D. Red bone marrow |
| <u>E.</u> 15. Calcaneus | E. Tarsal |
| <u>H.</u> 16. Chondrocyte | F. Ilium |
| <u>A.</u> 17. Compact bone | G. Synovial fluid |
| <u>C.</u> 18. Ethmoid | H. Cartilage |
| <u>F.</u> 19. Coxal | I. Suture |
| <u>D.</u> 20. Hemopoiesis | J. Occipital bone |

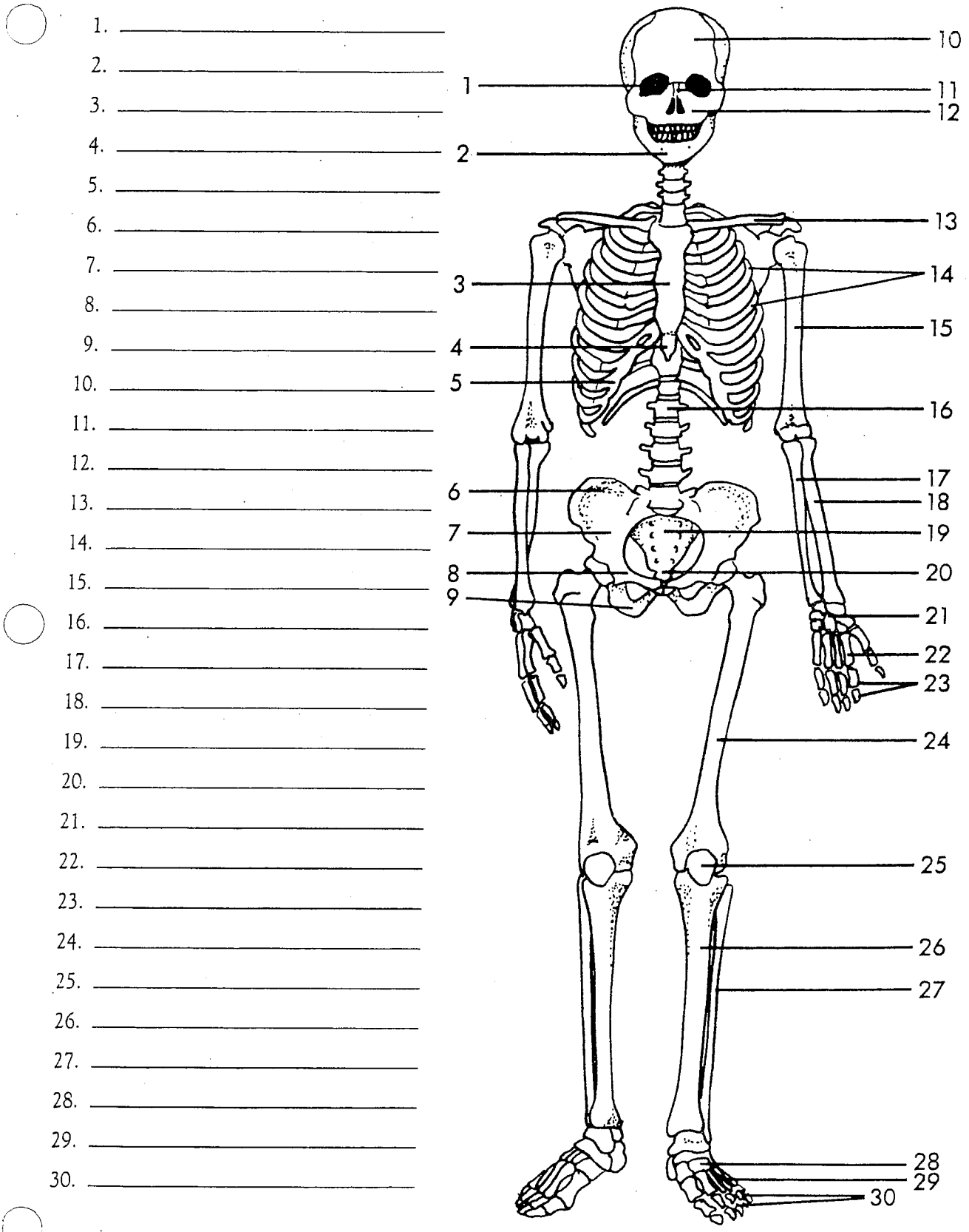
Skull Viewed from the Front



1. sphenoid
2. ethmoid
3. lacrimal
4. zygomatic
5. vomer
6. frontal

7. parietal
8. nasal bone
9. ethmoid
10. maxilla
11. mandible

Anterior View of Skeleton



Posterior View of Skeleton

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____

