Multiple Choice. Read each question thoroughly before answering. From the choices available, choose the answer that is the most correct. Place all answers on the accompanying answer sheet.

1. Which is not a function of the integument?
   a. Protection  
   b. Water loss prevention  
   c. Temperature regulation  
   d. Synthesis of vitamin D  
   e. all are functions of the integument

2. List the following skeletal muscle structures in order from smallest to largest:
   (1) muscle fiber  
   (2) myofilament  
   (3) myofibril  
   (4) muscle fasciculus
   a. 4, 2, 3, 1  
   b. 2, 1, 4, 3  
   c. 3, 1, 4, 2  
   d. 2, 3, 1, 4  
   e. 1, 2, 3, 4

3. From deep to superficial, the order of the strata of the epidermis is
   a. Basale - spinosum - granulosum - lucidum - corneum  
   b. Spinosum - granulosum - basale - lucidum - corneum  
   c. Corneum - lucidum - granulosum - spinosum - basale  
   d. Basale - granulosum - spinosum - lucidum - corneum  
   e. Corneum - granulosum - lucidum - spinosum - basale

4. Keratinocytes are:
   a. the most abundant cell type in the epidermis.  
   b. found throughout all epidermal strata.  
   c. sometimes alive and sometimes dead, depending on where they are found.  
   d. able to synthesize the protein keratin.  
   e. All of the choices are correct.

5. The binding sites to which myosin cross-bridges attach are found on the
   a. sarcoplasmic reticulum.  
   b. actin myofilaments.  
   c. ligand-gated Na⁺ channels.  
   d. T tubules.  
   e. myosin myofilaments.

6. The dermis consists of:
   a: sweat glands  
   b: hair follicles  
   c: collagen fibers  
   d: sensory nerve endings  
   e: arrector pili muscles
   a. a, b, d  
   b. a, c, d  
   c. a, b, d, e  
   d. a, b, c, e  
   e. a, b, c, d, e

7. Blood capillaries that supply nourishment for the epidermis are located in the:
   a. dermal papillae.  
   b. subcutaneous layer.  
   c. reticular connective tissue.  
   d. epidermis proper.  

8. Lines of cleavage in the dermis are a result of:
   a. the alignment of dermal papillae.  
   b. the orientation of collagen fibers in the dermis.  
   c. the alignment of epidermal ridges.

9. What is the composition of the subcutaneous layer?
   a. adipose connective tissue  
   b. areolar connective tissue  
   c. dense irregular connective tissue  
   d. areolar connective tissue and dense irregular connective tissue  
   e. areolar connective tissue and adipose connective tissue

10. T/F. One of the components of sweat is the nitrogenous waste urea.
11. In order to retain heat, what occurs in the skin on a cold day?
   a. blood vessels of the dermis constrict.  
   b. blood vessels of the dermis dilate.  
   c. blood vessels of the epidermis constrict.  
   d. blood vessels of the epidermis dilate.

12. In the I band of the sarcomere, there is a visible line of protein that binds actin myofilaments together called the
   a. T-tubules.  
   b. terminal cisternae.  
   c. titin complexes.  
   d. Z-discs.

13. Which is not a function of bone?
   a. protection  
   b. calcium storage  
   c. body movement  
   d. hormone synthesis  
   e. hemopoiesis

14. The troponin of skeletal muscle functions by
   a. sliding on myosin to shorten the sarcomere.  
   b. pumping Ca\(^{2+}\) into the sarcoplasmic reticulum at the end of the contraction phase.  
   c. binding to Ca\(^{2+}\) and undergo conformational shift to initiate contraction.  
   d. acting as an ATPase enzyme harvesting energy from ATP to power the myosin hinge area.

15. Which type of cell produces new bone tissue by secreting matrix?
   a. osteocytes  
   b. osteoclasts  
   c. osteoblasts  
   d. osteochondroprogenitor cells

16. As the bone matrix calcifies and the secreting cells become walled in:
   a. osteoblasts become osteocytes.  
   b. osteogenic progenitors become osteoclasts.  
   c. osteoblasts become osteoclasts.  
   d. osteoclasts become osteocytes.

17. Complete tetanus occurs when
   a. you get scraped by a rusty nail.  
   b. a motor unit is stimulated frequently enough to prevent it from relaxing between stimuli.  
   c. a long rest period results in the myofibrils of a skeletal muscle having a low Ca\(^{2+}\) concentration.  
   d. the ATP stores and ability to produce ATP are eliminated.

18. In compact bone, __________ connect adjacent lacunae, thereby providing pathways for nutrients and other materials to pass between osteocytes.
   a. central canals  
   b. blood vessels  
   c. lamellae  
   d. canaliculi  
   e. perforating canals

19. The differences between cancellous and compact bone include all of the following except
   a. the spaces between the trabeculae of spongy bone often contain red bone marrow in children; compact bone does not have such spaces.  
   b. the cells within the matrix of compact bone communicate with each other and the central canal via canaliculi; the canaliculi of cancellous bone link the cells in the matrix to the spaces between the trabeculae.  
   c. cancellous bone is lighter than compact bone of the same thickness.  
   d. compact bone uses lamellae for strength; spongy bone uses protein.  
   e. cancellous bone makes up the majority of the epiphyses of long bones; compact bone makes up the diaphyses.

20. The formation of bone from a cartilaginous model is termed:
   a. sliding filament model.  
   b. intramembranous ossification.  
   c. bone remodeling.  
   d. endochondral ossification.
21. The process of bone repair includes these steps:

   a: Hematoma forms  b: Bone is remodeled  c: Fibrocartilaginous callus forms  d: Bony callus forms

The correct chronological order for these steps is

a. a - c - d - b  
b. a - b - d - c  
c. c - d - b - a  
d. d - a - b - c  
e. b - a - c - d

22. T/F. The flat bones of the cranium form by intramembranous ossification.

23. In fibrous joints, the articulating surfaces are held together by:

   a. dense regular connective tissue.  
b. areolar connective tissue.  
c. dense irregular connective tissue.  
d. fibrocartilage.  
e. articular cartilage.

24. Given the numbered events below, choose the arrangement that lists these events in the order they occur following a single stimulation of a skeletal muscle cell

   1. action potential travels along the sarcolemma  
   2. T tubules undergo depolarization  
   3. voltage-gated Ca\(^{2+}\) ion channels in sarcoplasmic reticulum open  
   4. Ca\(^{2+}\) ions diffuse into the sarcoplasm  
   5. Ca\(^{2+}\) ions bind to troponin molecules

   a. 1,2,3,4,5  
b. 1,3,5,4,2  
c. 2,1,3,4,5  
d. 3,1,5,2,4  
e. 4,5,1,2,3

25. The interosseous membrane between the radius and the ulna is an example of a:

   a. synchondrosis.  
b. suture.  
c. synostosis.  
d. synarthrosis.  
e. syndesmosis.

26. Some marrow of long bones is termed "yellow” marrow. The function of this is to

   a. manufacture blood cells  
b. manufacture tissue cells for the skin  
c. store adipose tissue  
d. store bone forming cells

27. Fluid-filled sacs that cushion synovial joints are called:

   a. fat pads.  
b. articular discs.  
c. bursae.  
d. menisci.

28. Which of the following describes a meniscus?

   a. attach one bone to another at a joint  
b. fibrocartilage pads  
c. flat, fluid-filled sacs  
d. found only at the temporomandibular joint  
e. attach muscles to bones

29. The structure responsible for attaching bone to bone is a:

   a. sphincter.  
b. ligament.  
c. fascia.  
d. tendon.  
e. myofibril.

30. Myoglobin is a molecule within muscle cells that can bind:

   a. creatine phosphate.  
b. oxygen.  
c. hemoglobin.  
d. acetylcholine.  
e. ATP.

31. Invaginations of the muscle cell membrane that extend deep into the cell are known as the:

   a. T-tubules.  
b. terminal cisternae.  
c. titin complexes.  
d. Z-discs.
32. When comparing cardiac and skeletal muscle cells, which of the following statements is false?

a. cardiac muscle cells have striations
b. the myofilaments in cardiac muscle are not arranged into myofibrils
c. skeletal muscle cells are unbranched
d. cardiac muscle cells usually possess a single nucleus

33. The nervous system, using motor neurons, stimulates whole skeletal muscles to apply the force necessary to pick up objects of varying weight by

a. stimulating the release of calcium from the bone.   b. varying the number of motor units recruited.
c. increasing the strength of the action potential.   d. varying the frequency of stimulus to individual motor units.
e. both b and d are correct.   f. a, b, c, and d are all correct.

34. The presence of mitochondria and myoglobin facilitate _________ respiration in muscle cells.

a. aerobic  b. anaerobic

35. When the electrical potential across the sarcolemma reaches threshold, _______ gated Na⁺ channels open.

a. ligand  b. receptor  c. voltage  d. picket  e. iron

36. The narrow space that separates the motor neuron and the skeletal muscle fiber in a neuromuscular junction is called the:

a. motor end plate.  b. synaptic vesicle.  c. synaptic cleft.  d. presynaptic terminal.

37. The mitochondria of Type I (slow twitch, high oxidative) skeletal muscles are larger and greater in number than those of other muscle types

a. because this muscle relies on fat for energy and aerobic metabolism to produce ATP.
b. to provide the muscle with oxygen during periods of low oxygen.
c. because this muscle uses glucose and anaerobic metabolism as its primary energy source for ATP production.
d. because fat like glycogen is stored next to muscle to cushion it.

38. When an impulse arrives at the presynaptic terminal of the motor neuron, calcium:

a. enters through active transport pumps and triggers the release of transmitter.
b. enters through voltage-gated channels and triggers the release of transmitter.
c. exits through active transport pumps and brings transmitter with it.
d. exits through voltage-gated channels and triggers transmitter release.
e. is released from synaptic vesicles.

39. Arrange the following events in endochondral ossification in proper sequence:

(1) Cartilage matrix is calcified and chondrocytes die.
(2) Chondrocytes hypertrophy.
(3) Cartilage model is formed.
(4) Osteoblasts deposit bone on the surface of the calcified cartilage called the primary ossification center.
(5) Blood vessels from the periosteum invade calcified cartilage bringing in osteoblasts and osteoclasts.

a. 3, 2, 1, 5, 4  b. 3, 2, 5, 4, 1  c. 3, 2, 5, 1, 4  d. 3, 5, 2, 4, 1  e. 1, 3, 4, 5, 2

40. The repolarization of the action potential involves the opening of:

a. ligand gated Na⁺ channels.  b. voltage-gated Na⁺ channels.
c. ligand gated K⁺ channels.  d. voltage-gated K⁺ channels.
41. The poison, curare, blocks acetylcholine receptors at the motor end plate. This results in
   a. increased stimulation of the muscle.  
   b. more acetylcholinesterase production.  
   c. lack of calcium uptake by the muscle fiber.  
   d. inability of the muscle fiber to respond to nervous stimulation. 
   e. sustained contraction of the muscle.

42. Glycolysis is an:
   a. aerobic process that occurs in the cytosol.  
   b. aerobic process that occurs in the mitochondria. 
   c. anaerobic process that occurs in the cytosol.  
   d. anaerobic process that occurs in the mitochondria.

43. The resting membrane potential of skeletal muscle cells and neurons is the result of
   a. secretory vesicles in the axon terminal containing acetylcholine. 
   b. voltage-gated ion channels present on the plasma membrane. 
   c. active transport of ions resulting in unequal distribution of \(Na^+\) and \(K^+\) across the sarcolemma. 
   d. ultraviolet energy transferred to the cell by the pigment melanin. 
   e. calcium ion active transport at the membranes of the sarcoplasmic reticulum.

44. The vascular supply to slow twitch, high oxidative muscle fibers is ______ the network of capillaries around fast muscle fibers.
   a. more extensive than  
   b. less extensive than  
   c. the same as that of

45. Events of excitation contraction coupling, such as the release of calcium from intracellular stores, occur during the __________ period of a muscle twitch.
   a. relaxation  
   b. contraction  
   c. lag or latent

(3.2 points each) Matching Terms. Match the letters of the definitions to the appropriate numbered terms. Place all answers on the attached answer sheet.

Match the following joints to their classification: 
   a. fibrous  
   b. cartilaginous  
   c. synovial

46. hip ball and socket  
47. epiphyseal plate  
48. vertebrae and intervertebral disks  
49. radioulnar syndesmosis

continued
Match the following terms to their definitions below

50. Primary ossification center
51. Stem cells
52. Callus
53. Tendon
54. Axon of motor neuron
55. Motor unit
56. Depolarization
57. Synchondrosis
58. Periosteum
59. Papillary dermis
60. Myosin myofilament

A. A collection of blood forming a clot.
B. Dermal layer containing blood capillaries that projects into the epidermis; its parallel arrangement in the thick skin results in fingerprints.
C. Located in the diaphysis of the cartilage model of developing bone, ossification begins here with the formation of a bone collar.
D. The space between the axon bulb and the motor end plate.
E. The name given the collection of muscle fibers innervated by a single motor neuron.
F. A fibrous connective tissue connecting bone to bone.
G. A joint connecting two bones using hyaline cartilage.
H. The location of the synapse.
I. Reversal of membrane potential caused by the movement of ions across the membrane.
J. Created and maintained by ion pumping proteins in the membrane.
K. The hard new bone substance that forms in an area of bone fracture.
L. The thin myofilament.
M. Special cells that can undergo division and produce chondroblasts or osteoblasts as needed.
N. A fibrous connective tissue membrane surrounding cartilage except at articulations.
O. The blood producing tissue found in red bone marrow.
P. A fibrous connective tissue membrane surrounding bone except at articulations.
Q. A process of a motor neuron that carries nervous impulse to a single skeletal muscle fiber or group of fibers.
R. A fibrous connective tissue connecting muscle to bone.
S. Consisting of helical heavy chain proteins, light chain proteins, hinge regions, and heads

(10 points each) Written Answer. Prepare a written answer to the following questions. DO NOT WRITE YOUR ANSWERS TO THESE QUESTIONS ON THIS PAGE!

61. Why is melanin beneficial to humans? Describe the specific location and specific function of melanocytes. How does their function contribute to the function of the integument?

62. There are 14 facial bones. Except for the mandible, none of them move at their articulations. Why does the human skeleton include so many facial bones?

63. How do the gated Na⁺ channels in the postsynaptic membrane of the neuromuscular junction and those in the remainder of the sarcolemma differ? Why are the differences consistent with your understanding of the initiation and propagation of skeletal muscle fiber action potential?

64. How does intramembranous ossification differ from endochondral ossification? Which one contributes to successful labor and delivery of a fetus? How?

65. There are three skeletal muscle fiber types. Which type controls the posture of a student sitting upright in a chair during a two-hour lecture period? What specific characteristics of this muscle fiber type make it well suited for long-term sustained contraction?

66. Describe the structures of the synovial joint that directly relate to the ability of the joint to move without damage.