

A&P Exam 3 Study Guide

GUARANTEED QUESTIONS:

1. Mix and match about thirty.
2. Contrast smooth, cardiac, and skeletal muscle. (97)

Type	Striated	Intercalated disks	Neurogenic/myogenic	Contraction speed	Multi-nucleate?
Skeletal	Yes	No	Neurogenic	Fast	Yes
Smooth	No	No	Myogenic	Slow	No
Cardiac	Yes	Yes	Myogenic	Medium fast	No

- 3A. Draw a long bone and label at least six structures. (74 & 75)
(Proximal epiphysis, diaphysis, distal epiphysis, Periosteum, articular cartilage, spongy bone, epiphyseal disks, compact bone, medullary cavity)

3B. Draw and label the parts of a Haversian system. (76 & 77)
(Central canals, Lamellae, Osteocytes, Canaliculi, Lacunae)

4. Compare and contrast intramembranous ossification with endochondral ossification. (79)

Intramembranous ossification:

- **Formation of bone directly within loose fibrous connective tissue.**
- **The bone forms directly within mesenchyme (i.e. embryonic connective tissue).**
- **Occurs in skull, mandible, most flat bones**
- **Most occurs before birth.**

Endochondral ossification:

- **Mesenchyme → hyaline cartilage → bone.**
- **Mostly after birth**
- **Most of the bones form this way.**

5. Explain bone development in long bones. How does interstitial growth occur and how does appositional growth occur?

Interstitial growth:

- **Longitudinal growth**
- **Occurs at the epiphyseal plate**
- **Cartilage grows ahead of ossification**
- **Puberty causes ossification to occur faster than cartilage growth, resulting in ossification of epiphyseal plate and no more growth**

Appositional growth:

- **Growth in diameter**
- **Osteocytes in the periosteum on the outsides of the bone lay down new bone adding material to the outside of the bone.**
- **Osteoclasts in the endosteum in the medullary of bones remove bone material increasing the size of the medullary cavity**
- **The bone is remodeled through normal remodeling to accommodate the larger size for the Haversian system.**

6. Define the following and give their functions: (79)

6A. Osteoprogenitor cells:

Undifferentiated cells that develop into osteoblasts.

6B. Osteoblasts

**Young bone cells that secrete collagen and cartilage to make the bone matrix.
Develop into osteocytes.**

6C. Osteoclasts

Bone cells that use lysozymes to reabsorb bone and are important in bone remodeling.

6D. Osteocytes

Mature bone cells that lay down and maintain bone. They develop from osteoblasts.

7. Explain how bone remodeling occurs.

- **New bone replaces old bone.**
- **Osteoclasts remove bone.**
- **Osteocytes replace bone.**
- **The rate of replacement is different for different bones in the body. Femur is replaced about every four months.**
- **Regular exercise puts stress on bones, increasing the rate of bone replacement and the bone diameter.**

8. Explain how bone repair occurs. (82 & 83)

- **Fracture hematoma – a blood clot occurs where the bone is broken.**
- **Procallus of connective tissue – fibrocartilage grows through the break. This is repair tissue which will be replaced with structural tissue in the next step.**
- **Bony callus – bone fills the break, initially forms a large bump on the sides of the bones. This is later removed as the bone is remodeled.**
- **Bone remodeling – reforms the bone bringing it back to near its original shape.**

9. Explain the effects of parathyroid hormone and calcitonin in the regulation of calcium levels and bone formation. (81 & 82)

- **Parathyroid hormone. Comes from the parathyroid gland. Secreted when blood calcium levels get too low. Increases the breakdown of bone (creating calcium) by increasing the number and activity of osteoclasts. It also increases the reabsorption of calcium from the urine which causes the formation of calcitriol (active form of vitamin 'D').**

10. Contrast the following types of joint movements: (82&84)

10A. Gliding **The surface of one bone moves back and forth and from side to side over another bone**

10B. Flexion **Decreases the angle between two articulating bones.**

10C. Extension **Increases the angle between two articulating bones.**

10D. Rotation **One bone rotates relative to another along its longitudinal axis**

10E. Abduction **Movement of a bone away from the body midline.**

10F. Adduction **Movement of a bone toward a body midline.**

10G. Circumduction **Movement of the distal end of a body part in a circle. Involves abduction, adduction, flexion and extension.**

11. Contrast the following types of joints: (84)

11A. Fibrous **Joints that lack a synovial cavity and are held together by fibrous connective tissue. (joints in the skull)**

11B. Cartilaginous **Joints that lack a synovial cavity and are held together by hyaline cartilage. (Symphysis of the pelvis, vertebra??).**

11C. Synovial **Joints that have a synovial cavity.**

12. Contrast the following types of joints: (88&89)

12A. Synarthroses **Immovable joints. Lack a synovial cavity.**

12B. Amphiarthroses **Slightly movable joints. Lack a synovial cavity.**

12C. Diarthroses **Movable joints with a synovial cavity.**

13. Contrast the following types of Synarthroses joints: (88)

13A. Suture **Joint consisting of a thin line of fibrous connective tissue. Bones of the skull.**

13B. Gomphosis **Cone shaped peg (tooth) that fits into a socket (alveolar process). Held there by ligaments.**

13C. Synchondrosis **A cartilage joint where the connecting material is hyaline cartilage. Epiphyseal plate**

14. Contrast the following types of Amphiarthroses joints: (88)

14A. Syndesmosis **A fibrous joint held together by ligaments in which there is some degree of movement. The distal end of the tibia/fibula.**

14B Symphysis **A cartilaginous joint in which the connecting material is a broad flat disk of fibrocartilage. Pubic symphysis of the pelvis, vertebra???**

15. Contrast the following types of Diarthroses: (91-93)

15A. Gliding joints (**arthrodial joint**) **Two flat surfaces capable of side to side or back and forth movement. Tarsal bones, carpal bones.**

15B. Hinge joints (**ginglymus**) **The convex surface of one bone fits into the concave surface of another bone. This type of joint only moves in one plane and is capable of flexion and extension. Knee, elbow.**

15C. Pivot joints **A rounded or pointed surface articulates with a ring formed partly by another bone and partly by ligaments. This type of joint moves by rotation. Atlas rotates around the axis & radius/ulna.**

15D. Condylod joint (ellipsoidal) An oval shaped condyle of one bone fits into an elliptical cavity of another bone. This type of joint moves by flexion/extension, abduction/adduction, or circumduction. Radius/ulna meets carpals.

15E. Saddle joint (Sellaris) The articular surface of one bone is saddle-shaped and the other bone is the legs of the rider. This type of joint moves by flexion/extension, abduction/adduction or circumduction. Temporomandibularjoint.

15F. Ball and socket joint A rounded ball that fits into a cup shaped depression in another bone. This type of joint can move by flexion/extension, abduction, adduction, circumduction or rotation. Femur/pelvis

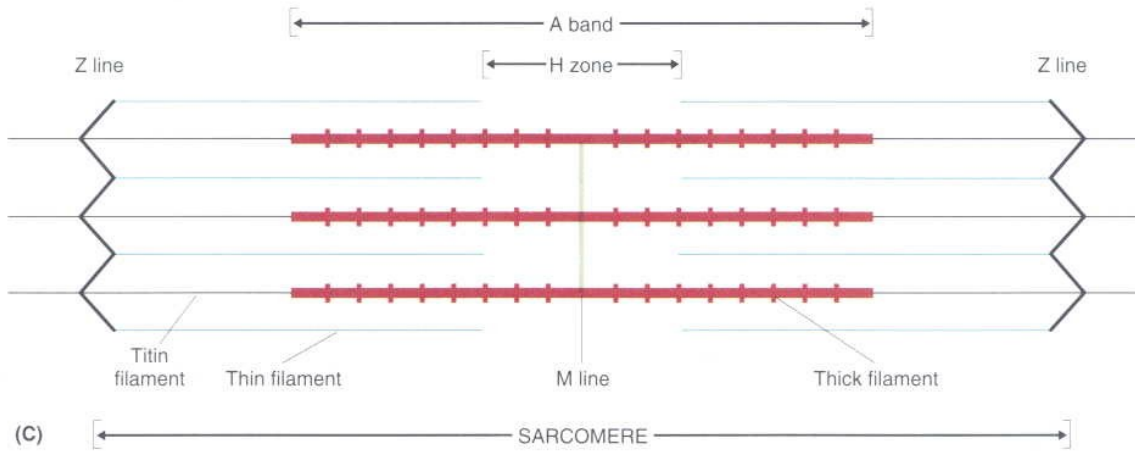
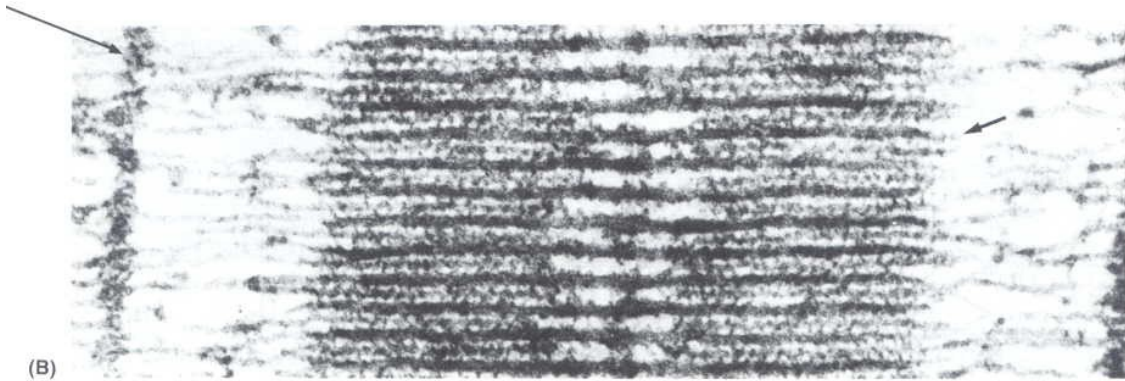
16. Explain the stages of integument repair. (98&99)

- **Blood Clot Forms**
 - Protein fibrin holds the blood cells together
 - Clot dries, forming a protective layer that helps keep bacteria from getting into body
- **Epidermis grows under the wound**
 - Macrophages & Neutrophils move in and remove dead tissue
- **Connective tissue & blood vessels grow under the wound.**
- **The blood clot is replaced by repair tissue called granulation tissue**
 - In a primary union the granulation tissue is formed by regeneration
 - In a secondary union the granulation tissue is formed by replacement

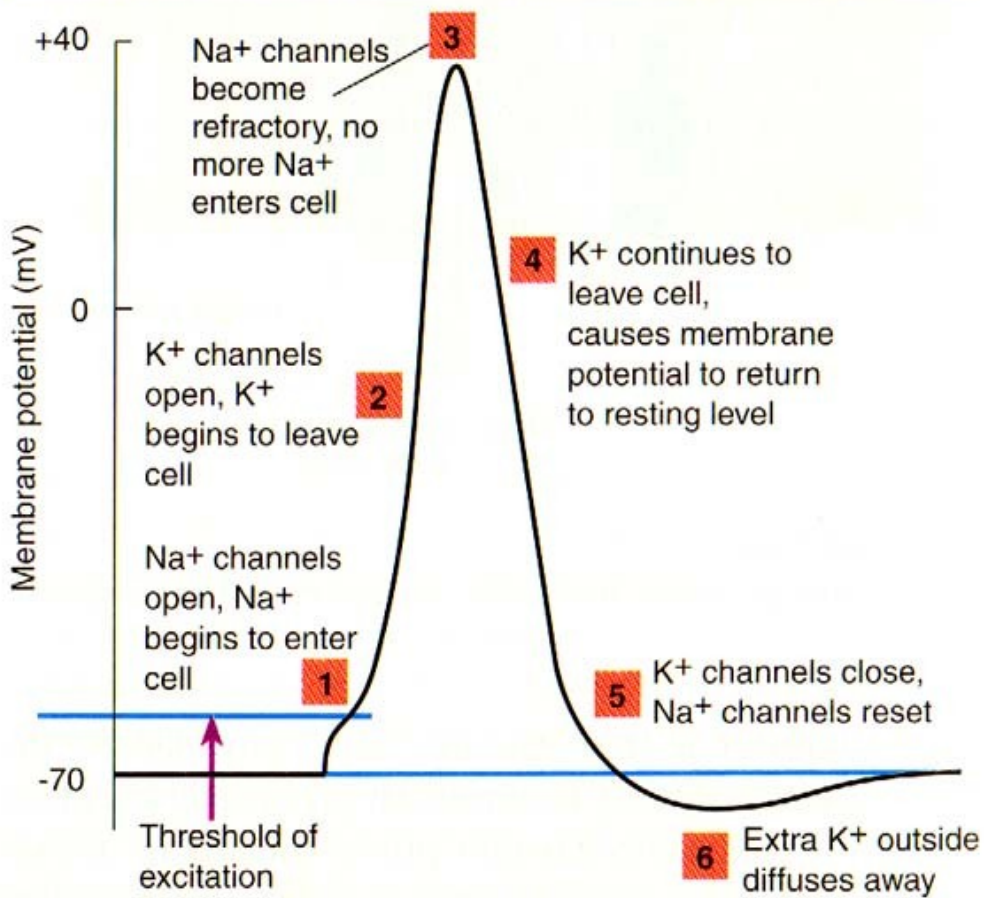
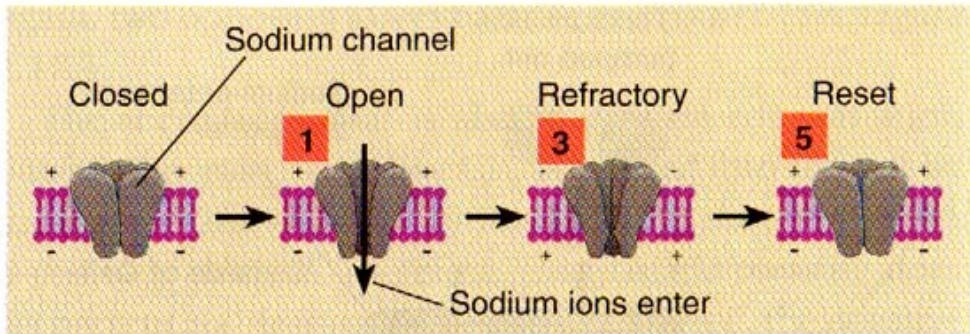
17A. In skeletal muscle what is stored in the sarcoplasmic reticulum? What is the function of the transverse tubules of the sarcolemma? (100 & 103)

- **The sarcoplasmic reticulum is a special type of endoplasmic reticulum that stores calcium ions.**
- **The sarcolemma is the plasma membrane that surrounds a muscle cell. The transverse tubules carry the contraction signals nearer to the sarcoplasmic reticulum.**

17B. On a diagram of a sarcomere be able to identify the following: H-zone, M-line, Z-line, A-band, and I-band. (103)



18. Explain what is happening at different points on an action potential diagram for a skeletal muscle cell. How and where are ions moving? Why do ion gates open or close?



Pre 1.

- Cell is at resting potential (-90mv)
- Na^+ outside cell
- K^+ inside cell
- Ca^{++} inside SR.

1.

- Nerve cell signal (neurotransmitter bonds) reaches cell
- acetylcholine from the nerve opens the Na⁺ gates on the muscle cell.
- Na⁺ diffuses into the cell making it more positive.

3.

- Cell reaches action potential (+40mv)
- Na⁺ gates close (Na⁺ stops diffusing into cell)
- K⁺ gates open (K⁺ diffuses out of cell)
- Ca⁺⁺ gates on Sarcoplasmic reticulum (SR) opens and Ca⁺⁺ moves (diffuses) from the SR to the cell cytoplasm (Ca⁺⁺ causes muscles to contract).

5.

- K⁺ gates close (K⁺ stops diffusing out of cell)
- Na⁺/K⁺ pump starts active transport (Requiring ATP) of Na⁺ and K⁺ ions (3 Na⁺ out / 2 K⁺ in)
- Cell returns to resting potential (-90mv)
- Ca⁺⁺ gates on SR close (Ca⁺⁺ stops diffusing out of SR).
- Ca⁺⁺ is actively transported back into SR (stops the muscle contraction)

19. Using the terms myosin, Actin, Troponin, and Tropomyosin where appropriate answer the following questions: (106-110)

19A. Draw the 4 muscle proteins listed above showing their position when NO calcium is present in the cell cytoplasm (label the muscle proteins and the bonding sites).

19B. Draw the 4 muscle proteins listed above showing their position when calcium is present in the cell cytoplasm. Be sure to clearly show anything that has bonded (label the muscle proteins and the bonding sites).

19C. Draw a diagram and explain how myosin heads move. Be sure to tell what is necessary to allow them to move forward again.

19D. Clearly explain why rigor mortis occurs a few hours after death?

- **Rigor mortis is postmortem rigidity due to buildup of lactic acid, which causes the actin and myosin filaments of the muscle fibers to remain linked until the muscles begin to decompose.**

19E. In smooth muscle where does most of the calcium that causes muscle contraction come from? (117)

Although some of the calcium comes from the sarcoplasmic reticulum, most of it comes from outside the cell and moves into the cell when the cell reaches action potential.

19F. Explain in detail how calcium in smooth muscle cells leads to their contraction.

19G. What causes muscle fatigue?

20. Contrast white muscle and red muscle. (112-113)

White Muscle

- **Fast twitch muscle**
- **Less myoglobin (protein like hemoglobin that stores oxygen in muscle tissue)**
- **Fewer capillaries bring blood into it**
- **Cells with larger sarcoplasmic reticulums to store calcium in them**
- **Fewer mitochondria to produce ATP (energy)**
- **Twice the diameter of cells**
- **Tends to run anaerobically (w/o O₂)**
- **Contracts 3x faster**

Red Muscle

- **Slow twitch muscle**
- **More myoglobin**
- **More capillaries**
- **Smaller sarcoplasmic reticulums, less local calcium storage**
- **More mitochondria, more power production**
- **Half as wide as white muscle cells**
- **Tends to run aerobically (w/ O₂)**
- **Contracts slower**

21. How are contractions in cardiac muscle different from skeletal muscle contractions? (118)

- **Cardiac muscle is myogenic (produces its own signal rather than receiving a signal from the brain).**
- **Most of the calcium required comes from outside the cell and moves into the cell when it reaches action potential.**
- **Autonomic nerve signals/hormones can alter the rate of cardiac muscle contraction.**
- **Has intercalated disks that carry the contraction signal from cell to cell so the contraction signals move quickly through the whole muscle.**