

SciOly Summer Study Session Anatomy and Physiology

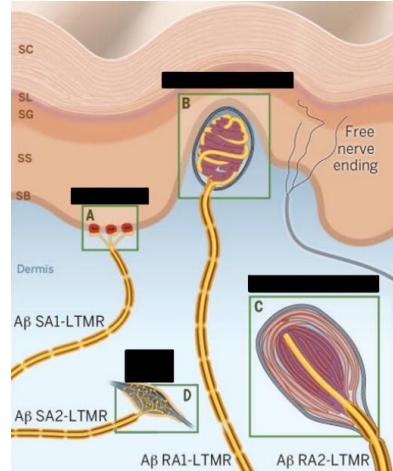
Test Packet

Written by tai yang

Instructions

- 1) This test is based on the Division C 2019-2020 rules for Anatomy and Physiology. All content included fits within the scope of the rules up to the national level. Much of the content within this test is unlikely to be asked about in real competitions. However, it may help you take your studying of Anatomy and Physiology a step further.
- 2) Individual point values are stated in each question. The point total for this test is 170.
- 3) All content in this test is supported by published medical articles, studies, and textbooks. Please reach out to me if you would like resources regarding any content on this test.
- 4) If you have any questions or need to contact me, please reach out to hawkenupperscioly@gmail.com.

1.) [4] Match the sensory fibers, associated with each letter as shown on the diagram, with the cutaneous sensory receptors that they innervate. An image is provided to assist you in answering this question.



- A) _____
- B) _____
- C) _____
- D) _____

2.) [3] Briefly explain what each of the following terms refers to above.

- A) $A\beta$: _____
- B) SA/RA: _____
- C) LTMR: _____

3.) [3] A real study conducted by N. A. Barnicot sampled 118 hair specimens from young adult males. These hair specimens were examined for the presence of trichosiderin, an iron-containing pigment, by acid extraction. It was found that higher levels of trichosiderin were found almost exclusively in a specific color of hair, but that the level of trichosiderin found in said hair color varied greatly. What can you conclude about the relationship between trichosiderin and red hair given this study?

4.) [3] A real study conducted in Japan recruited 23 healthy participants to a 10-week double-blind placebo-controlled study in which participants were either given a capsule containing 4 mg of astaxanthin (a reddish pigment associated with seafood) or the placebo. The results showed that the participants given the astaxanthin showed an increased minimal erythema dose (amount of UV light needed to produce minimal erythema) compared with the placebo. They also had a reduced loss of skin moisture in the area exposed to UV light. What can you conclude about the relationship between astaxanthin and UV damage given this study?

5.) [3] Fas and fas ligand interact in a death receptor/death ligand system. This system has long been viewed to mediate apoptosis induction in order to reduce the risk of sun-linked skin cancer. Another function of these molecules is to eliminate virus-infected cells and cancer cells. This gave a reason for scientists to consider using fas and fas ligand in cancer therapy. However, they were recently recognized to have another purpose that makes this inadvisable. Briefly explain how fas and fas ligand actually contribute to the survival of cancer cells.

6.) [2] Briefly describe the function of loricrin in the stratum corneum.

7.) [3] Briefly explain how the amount of cysteine found in keratin determines whether it is hard or soft.

8.) [6] Fill in the following table for total body surface area estimations in normal patients (rule of nines), obese patients (rule of fives), and infants (rule of eights).

	Head / Neck	Trunk	Each Leg	Each Arm
Normal				
Obese				
Infant				

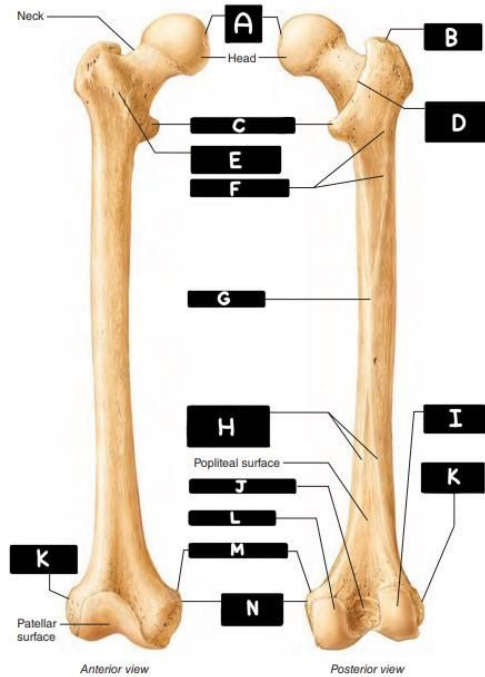
9.) [2] In recent years it has come to light that the bite of the lone star tick transmits a sugar molecule into one's body, initiating an Immunoglobulin E response. Which sugar molecule is responsible for mediating this response?

10.) [3] What are the 3 main factors that contribute to the T-cell immunogenicity of skin cancers?

11.) [2] You have been asked to develop a therapeutic HPV vaccine. Which 2 HPV oncoproteins would you ideally target in order to develop an effective HPV vaccine against cervical cancer?

12.) [14] Label the diagram of the surface anatomy of the femur bone.

- A) _____
- B) _____
- C) _____
- D) _____
- E) _____
- F) _____
- G) _____
- H) _____
- I) _____
- J) _____
- K) _____
- L) _____
- M) _____
- N) _____



13.) [6] Identify which pelvis belongs to a male and which pelvis belongs to a female. Next, explain the differences between a male and a female pelvis.

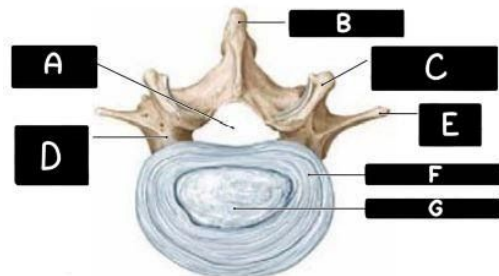


14.) [3] Approximate the amount of motion that the sacroiliac joint is normally capable of. Next, explain what causes the increased mobility of the sacroiliac joint during pregnancy.

15.) [6] Estimate the minimum range of motion, in degrees, for elbow flexion, forearm rotation, and wrist flexion-extension needed to complete all basic ADLs. Basic activities of daily living include ambulating, feeding, dressing, personal hygiene, continence, and toileting. You are encouraged to pretend to perform some of these actions to grasp a more accurate estimate.

16.) [7] Label the diagram given of the intervertebral disk.

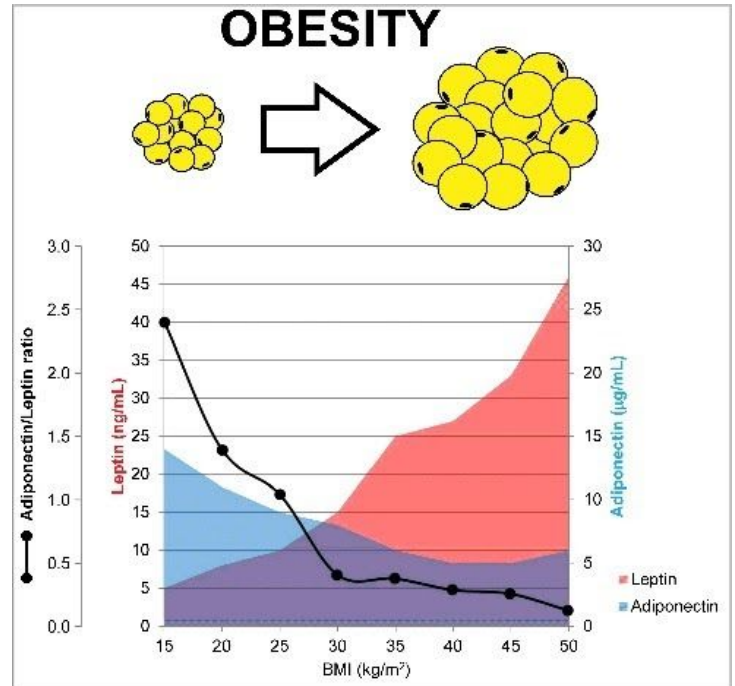
- A) _____
- B) _____
- C) _____
- D) _____
- E) _____
- F) _____
- G) _____



17.) [2] Osteocytes are responsible for secreting many factors involved in bone formation, bone resorption, and phosphate homeostasis. What two important bone resorption factors (that are produced by osteocytes) are receptors of RANKL (a.k.a TNFSF11, TRANCE, OPGL, ODF)?

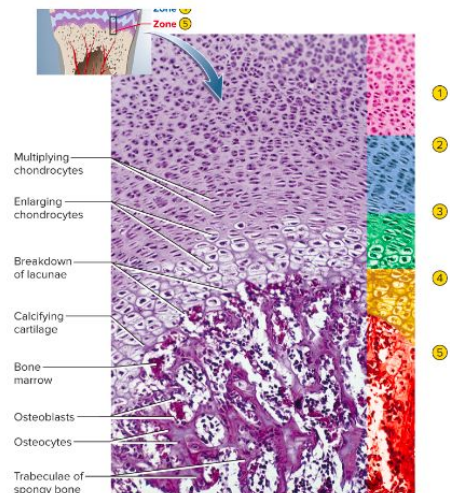
18.) [4] Adipocytes can be classified as brown, white, and beige. The body may convert white adipocytes into beige adipocytes as a form of adaptation. What causes may be responsible for initiating this process?

19.) [4] Give a possible explanation for the notable decrease in the ratio of adiponectin/leptin in the bloodstream as BMI increases.

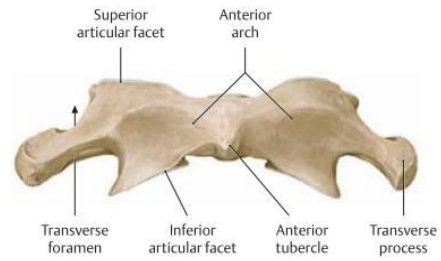


20.) [3] As one grows older, their red bone marrow is replaced with yellow bone marrow. By the time they reach adulthood, red bone marrow is found only in a few select bones. However, the body can convert yellow bone marrow back to red bone marrow. In what extreme case would the body perform this process?

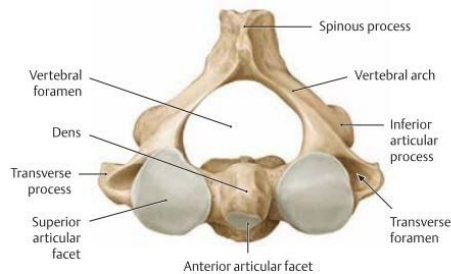
21.) [2] The Indian hedgehog ligand, IHH, plays an important role in endochondral ossification. Which of the labels on the left of the diagram given describes the role played by IHH?



22.) [2] Identify the vertebrae shown in the picture to the right.



23.) [2] Identify the vertebrae shown in the picture to the right.



24.) [6] What prevalent chronic disease is characterized by joint pain, tenderness, crepitus, stiffness, and limitation of movement? Why is this disease notably more prevalent in women than men?

25.) [2] The diagnosis of a Jones fracture includes palpating the peroneus brevis tendon to see if it is intact, as well as demonstrating if the area is tender. In which bone does this fracture occur?

26.) [6] Briefly describe the process of measuring a Cobb's angle in a patient who has screened positive in the forward-bending test, starting with the X-ray.

27.) [2] What spinal condition is the most common reason for spinal surgery in patients over 65 years of age?

28.) [3] Describe the important role of osteoclasts in the development and metastasis of osteosarcoma.

29.) [2] What type of muscle fibers—fast oxidative, slow oxidative, or fast glycolytic—would be best suited for maintaining posture?

30.) [2] What type of muscle fibers—fast oxidative, slow oxidative, or fast glycolytic—would be best suited for a short sprint?

31.) [2] What type of skeletal muscle contraction—concentric, isometric, or eccentric—generates the most force with the least amount of energy?

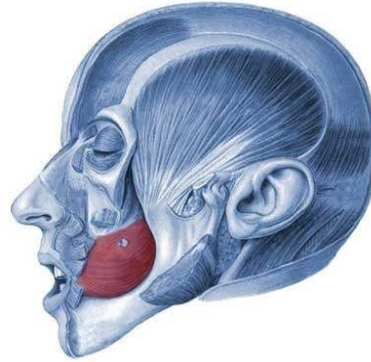
32.) [3] What is the function of titin in the contraction of skeletal and cardiac muscle?

33.) [2] What is the essential function of the neuromuscular junction?

34.) [2] What is the primary function of the orbicularis oculi muscle?

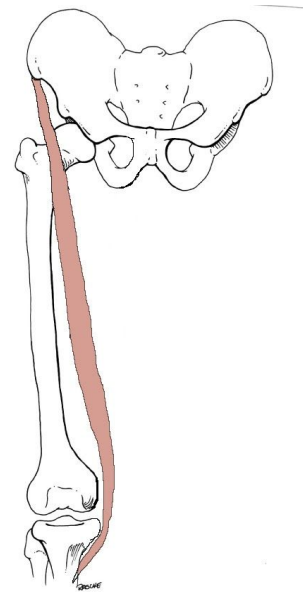
35.) [2] What is the primary function of the orbicularis oris muscle?

36.) [4] Identify the muscle highlighted in red on the picture to the right. Identify the origin and insertion of this muscle.



37.) [2] What muscle is the prime mover of arm flexion?

38.) [6] Identify the muscle highlighted in red on the picture to the right. Identify the nerve supplying this muscle. List the action that this muscle performs.



39.) [3] As one exercises, their muscle fibers undergo eccentric contraction, causing small tears in the muscle fibers. This is partially responsible for the muscle soreness that one experiences after exercise. Explain how this muscle damage actually leads to an increase in muscle mass.

40.) [3] Briefly explain why ankle sprains are so common.

41.) [4] Describe the major concern associated with the oral polio vaccine.

42.) [3] List the muscles that can be affected by ocular myasthenia gravis.

43.) [4] Describe what happens to a newborn who is infected with neonatal tetanus that is left untreated.

44.) [5] What diagnostic tests are likely to be performed in the process of diagnosing polymyositis in a patient presenting with muscle weakness?

45.) [3] Which ligament is cut during carpal tunnel surgery? Why is it cut?

46.) [2] What percentage of people with untreated botulism die?

47.) [3] What is the role of proprioceptors in the maintenance of body posture?

48.) [3] Describe the basic function of muscle spindles.

49.) [2] What is the principal mechanotransduction channel for proprioception?
