

UNIVERSITY OF TEXAS AT ARLINGTON

DEPARTMENT OF BIOLOGY

PRINCIPLES OF ANIMAL PHYSIOLOGY  
(Biol 3442)

**Dr. David G. Bernard**

THIRD INTRASESSIONAL EXAMINATION

NOVEMBER 29, 2007

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There are 47 items in this booklet. Be careful not to overlook any pages in the examination booklet. You have 80 minutes to complete these questions.

During the course of the examination students will remain in their assigned seats. If assistance is needed, the student should raise his/her hand and a proctor will then attend the individual need of that student.

Upon completion of the exam, each student is to remain seated, raise her/his hand, and the exam materials will be collected by the proctors. At no time is the student to leave his/her seat and carry the exam materials to the proctors or other areas of the room.

After collection of exam materials, the student is to immediately and promptly leave the Examination Room.

**NO EXTRA TIME WILL BE ALLOWED AT THE END OF THE EXAMINING PERIOD FOR ANSWERS TO BE TRANSFERRED TO THE ANSWER SHEET.**

**GOOD LUCK!** 🍀

**DIRECTIONS:** Each of the numbered items or incomplete statements in this section is followed by answers or completions of the statement. Select the ONE lettered answer or completion that is BEST in each case. Each multiple choice question is worth 2 points.

1. During ventricular ejection, the ventricular cardiac muscle undergoes \_\_\_\_\_ contraction.
 

<del>A. isometric</del>	<del>B. isovolumetric</del>	<input checked="" type="radio"/> C. isotonic
<input checked="" type="radio"/> D. tetanic	<del>E. None of the above is correct.</del>	
2. Which of the following organs has both smooth and skeletal muscle?
 

<del>A. stomach</del>	<del>B. uterus</del>	<input checked="" type="radio"/> C. urinary bladder
<input checked="" type="radio"/> D. eye	<input checked="" type="radio"/> E. Both C and D are correct.	
3. Which of the following hormones enhances retention of water by the kidneys?
 

<input checked="" type="radio"/> A. oxytocin	<del>B. <math>\alpha</math>-MSH</del>	<input checked="" type="radio"/> C. ACTH
<del>D. vasopressin</del>	<del>E. luteinizing hormone</del>	
4. The middle, muscular portion of the heart wall is referred to as the:
 

<del>A. endocardium</del>	<del>B. myocardium</del>	<input checked="" type="radio"/> C. myometrium
<del>D. endometrium</del>	<del>E. myoma</del>	
5. Which of the following is NOT found in smooth muscle?
 

<del>A. myosin</del>	<del>B. actin filaments</del>	<del>C. dense bodies</del>
<input checked="" type="radio"/> D. calmodulin	<input checked="" type="radio"/> E. T-tubules	
6. The slow depolarization pacemaker potential of a cardiac conducting fiber is due to which of the following?
 

<del>A. calcium ions</del>	<del>B. potassium ions</del>	<input checked="" type="radio"/> C. sodium ions
<del>D. both A and B</del>	<del>E. both B and C</del>	
7. The liquid portion of the blood is composed of:
 

<del>A. white blood cells</del>	<del>B. red blood cells</del>	<del>C. platelet</del>
<input checked="" type="radio"/> D. all of the above	<input checked="" type="radio"/> E. none of the above	
8. The blood pressure (BP) of a hypertensive patient is 200/110 mmHg. The cardiac output is 6 liters/min and the heart rate is 60 beats per minute. The right atrial pressure is 0 mmHg. The stroke volume is:
 

<del>A. 120 ml</del>	<input checked="" type="radio"/> B. 100 ml	<del>C. 1 liter/min</del>
<del>D. 90 cm/sec</del>	<del>E. None of the above</del>	

*Goodman = CO x SV*
9. This is the volume of blood pumped in a given time from each ventricle.
 

<del>A. stroke volume</del>	<input checked="" type="radio"/> B. cardiac output
<del>C. end-diastolic volume</del>	<del>D. end systolic volume</del>
<del>E. cannot be determined</del>	

*CO*
10. At rest, the active binding sites on the actin molecules are blocked by:
 

<del>A. myosin molecules</del>	<del>B. troponin molecules</del>
<input checked="" type="radio"/> C. tropomyosin molecules	<del>D. calcium binding to the troponin molecules</del>
<del>E. calcium ions</del>	
11. During contraction, cycles of cross-bridge binding and bending:
 

<del>A. pull thick filaments closer together</del>	<del>B. pull thin filaments together</del>
<input checked="" type="radio"/> C. pull Z discs closer together	<del>D. make thin filaments shorter</del>
<del>E. Both B and C are correct.</del>	

12. Muscle fibers differ from "typical cells" in that muscle fibers:
- ~~A.~~ lack a cell membrane
  - ~~C.~~ are very small
  - ~~E.~~ both B and C
  - B. have many nuclei
  - D. lack mitochondria
13. A myofibril is a:
- ~~A.~~ cell that ensheaths an axon in myelin
  - ~~B.~~ multinucleate, muscle cell
  - ~~C.~~ mononucleate, muscle cell
  - D. bundle of thin and thick filaments surrounded by sarcoplasmic reticulum
  - ~~E.~~ bipolar aggregation of myosin
14. A vertebrate motor unit is:
- ~~A.~~ a muscle and the motor neurons that innervate it
  - ~~B.~~ a muscle fiber and the motor neurons that innervate it
  - C. a motor neuron and the muscle fibers it innervates
  - ~~D.~~ a motor neuron and the muscle it innervates
  - ~~E.~~ None of the above.
15. Which of the following does NOT affect the tension that can be developed by a muscle fiber?
- ~~A.~~ the number of motor units recruited
  - ~~B.~~ the frequency of action potentials conducted by the motor neuron
  - ~~C.~~ the length of the fiber at the onset of contraction
  - ~~D.~~ diameter of the muscle fiber
  - E. All of the above affect tension development by a muscle fiber.
16. An isometric contraction is a contraction in which:
- A. tension (or force) increases, but length stays the same
  - ~~B.~~ tension (or force) stays the same, but length increases
  - ~~C.~~ tension (or force) stays the same, and length stays the same
  - ~~D.~~ tension (or force) stays the same, but length decreases
  - ~~E.~~ tension (or force) decreases, and length decreases
17. Fast muscle fibers differ from slow muscle fibers in that the former:
- ~~A.~~ are able to take up oxygen more quickly from the blood
  - ~~B.~~ are equipped with a myosin-ATPase with more rapid kinetics
  - ~~C.~~ are able to generate ATP more rapidly
  - D. conduct action potentials more rapidly
  - ~~E.~~ are recruited by the nervous system more rapidly
18. Which of the following characteristics do skeletal muscle and smooth muscle have in common?
- ~~A.~~ Calcium is bound by the protein calmodulin prior to formation of cross-bridges.
  - ~~B.~~ Tropomyosin is removed from the myosin-binding site on actin, permitting formation of cross-bridges.
  - ~~C.~~ Sliding of thick and thin filaments relative to one another depends on a rise in cytosolic calcium..
  - ~~D.~~ Sliding of thick and thin filaments relative to one another results in shortening of the sarcomeres.
  - E. All of the above
19. Multiunit smooth muscle is considered neurogenic, which means the smooth muscle cells which it comprises:
- A. are derived developmentally from the neuroectoderm ✓
  - B. have genes in common with the nervous system ✓
  - C. are stimulated to contract as a consequence of direct nervous input unit ✓
  - ~~D.~~ All of the above are correct.
  - ~~E.~~ None of the above is correct.

20. Cortisol is secreted by the adrenal cortex in response to stress. In addition to its function in a stress response, it functions in negative feedback by:
- A. inhibiting the hypothalamus so that corticotropin releasing hormone (CRH) secretion is reduced
  - B. inhibiting the anterior pituitary's ability to respond to CRH by reducing the pituitary's sensitivity to CRH
  - C. Both a and b are correct.
  - D. None of the above.
21. Which of the following features distinguishes cardiac muscle cells from skeletal muscle fibers?
- A. The former are mononucleate while the latter are multinucleate.
  - B. Only the latter have T-tubules.
  - C. Only the former have sarcoplasmic reticulum.
  - D. Only the latter require elevated cytoplasmic calcium for excitation contraction coupling.
  - E. Only the former have mitochondria.
22. Which of the following statements regarding closed circulatory systems is **FALSE**?
- A. They function in the transportation of nutrients, hormones, antibodies and salt throughout the various organ systems within the body.
  - B. In a closed circulatory system, blood pumped by the heart directly bathes individual cells.
  - C. They function in thermoregulation.
  - D. They comprise a heart, arterial system, capillaries and venous system
  - E. They are made necessary by the large size of organisms that have them and the large distances between nutrient sources and cells.
23. Hematocrit is:
- A. the oxygen-binding pigment found in red blood cells
  - B. the circulatory fluid of arthropods
  - C. the space inside arthropods filled with circulatory fluid
  - D. the packed cell volume of blood
  - E. another name for red blood cells
24. Theoretically, if a muscle were stretched to the point where thick and thin filaments no longer overlapped:
- A. maximum force production would result when stimulated since the muscle has a maximum range of travel
  - B. A bands and thin filaments would remain in a condition of maximum overlap
  - C. crossbridge attachment would be optimum because of all the free binding sites
  - D. ATP consumption would increase since the sarcomere is "trying" to contract
  - E. no muscle tension would be generated
25. Veins are defined as:
- A. blood vessels that carry deoxygenated blood
  - B. blood vessels that connect multiple capillary beds
  - C. blood vessels that function in returning blood to the heart
  - D. blood vessels that carry oxygenated blood
  - E. blood vessels that function in carrying blood away from the heart
26. The P wave of an ECG represents:
- A. the pumping activity of the heart
  - B. the polarization of the cardiac cell membranes
  - C. the depolarization of the ventricles
  - D. the depolarization of the atria
  - E. the repolarization of the ventricles

27. At the onset of ventricular diastole, the A-V valves snap shut. This closure is due to:

- A. higher pressure in the atria relative to the ventricles
- B. higher pressure in the ventricles relative to the atria
- C. higher pressure in the venae cavae relative to the atria
- D. higher pressure in the arteries (pulmonary and aorta) relative to the ventricles
- E. contraction of the small muscles which attach to the valves

28. Which of the following statements about cardiac output is true?

- A. Cardiac output is the mathematical product of heart rate and stroke volume.
- B. Cardiac output is the mathematical sum of heart rate and stroke volume.
- C. Cardiac output is regulated exclusively by adjusting heart rate.
- D. Cardiac output is regulated exclusively by adjusting stroke volume.
- E. None of the above are true.

29. Sympathetic stimulation of the heart increases cardiac output by:

- A. increasing heart rate
- B. increasing the rate at which the pacemaker potential depolarizes to threshold
- C. increasing the number of cross-bridges that can form during contraction
- D. increasing the strength of contraction
- E. All of the above are correct.

30. During the bending (power stroke) of contraction:

- A. ATP molecule binds to myosin cross bridge
- B.  $P_i$  and ADP are released from myosin
- C.  $P_i$  and ADP attach to actin
- D.  $P_i$  and ADP attach to myosin
- E. None of the above

31. At optimal muscle length when maximum tension can be developed:

- A. thin filaments do not overlap thick filaments
- B. thick filaments become forced against Z lines
- C. the central region of thick filaments is devoid of cross bridges
- D. thin filaments from opposite sides of the sarcomere become overlapped
- E. thin filaments are pulled out maximally from thick fibers

32. Single-unit smooth muscle is found:

- A. in the iris of the eye
- B. in the uterus
- C. in the wall of large blood vessels
- D. at the base of hair follicles
- E. in large airways to the lungs

33. The alternating dark and light pattern of striated muscle is due to which of the following?

- A. Dark regions are the dense A bands and the light regions are the I bands
- B. Dark regions are the dense I bands and the light regions are the A bands
- C. Dark regions are thick filaments and light regions are the thin filaments
- D. Dark regions are thin filaments and light regions are thick filaments
- E. Dark regions consist of both thick and thin filaments and light regions consist of just thick filaments

34. Actin and myosin are mixed in a solution that does not contain ATP. What would be expected to occur?

- A. myosin heads would transiently bind to actin
- B. myosin tails would transiently bind to actin
- C. the proteins would form a stable complex
- D. the proteins would remain disassociated
- E. the proteins would become denatured

35. Which of the following is an important difference between the nervous system and the endocrine system?
- A. The nervous system responds to danger, whereas the endocrine system responds to "normal" activities.
  - B. The speed of response is different.
  - C. The chemicals that transmit the signal are different.
  - D. The nervous system is involved with control, whereas the endocrine is involved with coordination.
  - E. The nervous system is entirely electrical in nature, whereas the endocrine system is entirely chemical in nature.
36. The tricuspid valve separates the:
- A. right atrium and right ventricle
  - B. left atrium and left ventricle
  - C. left ventricle and aorta
  - D. pulmonary trunk and right ventricle
  - E. right ventricle and pulmonary artery
37. Which is greatest?
- A. the number of spontaneous action potentials delivered by the AV node
  - B. the number of action potentials spontaneously generated by the AV node
  - C. the number of action potentials spontaneously generated by the SA node
  - D. the number of action potentials received by the SA node
  - E. They are all the same - no differences.
38. The plateau phase of the cardiac muscle action potential is due to:
- A. the movement of fewer sodium ions across the cell membrane
  - B. the calcium channels remain open longer than the sodium channels
  - C. the increased membrane permeability to potassium ion
  - D. a decrease in the amount of calcium diffusing across the membrane
  - E. an increased membrane permeability to sodium ions
39. In the mammalian cardiac cycle, stroke volume:
- A. causes rupturing of vessels
  - B. is also known as end-systolic volume
  - C. is also known as end-diastolic volume
  - D. is equal to end-diastolic volume minus end-systolic volume
  - E. is equal to end-systolic volume minus end-diastolic volume
40. The principal role of calcium in skeletal muscle contraction is to:
- A. participate in the propagation of an action potential along the surface of the muscle fiber
  - B. bind troponin, which in turn permits tropomyosin to uncover the cross-bridge binding site on the thin filament
  - C. bind tropomyosin, which in turn permits troponin to uncover the cross-bridge binding site on the thin filament
  - D. activate a calcium-calmodulin-dependent protein kinase, which in turn phosphorylates and activates myosin
  - E. None of the above
41. Smooth muscle cells:
- A. have a well-developed sarcoplasmic reticulum
  - B. are multinucleate
  - C. are triggered to contract by a lowering of cytosolic  $Ca^{2+}$
  - D. have a poorly developed sarcoplasmic reticulum
  - E. have clearly visible striations

42. Coordinating centers in the hypothalamus regulate the activities of the nervous and endocrine systems by all of the following, **EXCEPT**:
- A. ~~autonomic neurons that directly control the endocrine cells of the adrenal medulla~~
  - B. ~~acting as an endocrine organ itself and releasing hormones~~
  - C. ~~a modified positive feedback loop involving the pars intermedia of the pituitary gland~~
  - D. ~~secreting inhibiting hormones that inhibit the production and release of hormones from the anterior pituitary gland~~
  - E. secreting releasing hormones that stimulate the production and release of hormones from the anterior pituitary gland

43. The T-wave of the EKG tracing represents:
- A. ~~atrial depolarization~~
  - B. repolarization of the ventricles
  - C. ~~atrial repolarization~~
  - D. ~~contraction of the ventricles~~
  - E. ~~atrial pumping~~

Match each with its function (Questions 43 to 44):

- A. Skeletal
- B. Cardiac
- C. Smooth
- D. All of the above
- E. Two of the above

44. Contain T-tubules

45. Contain troponin

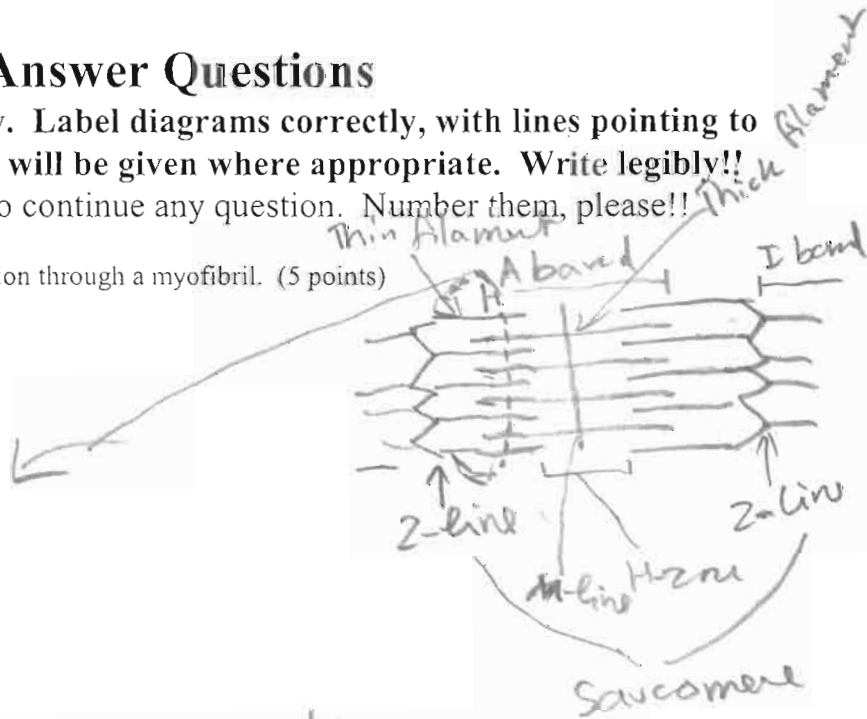
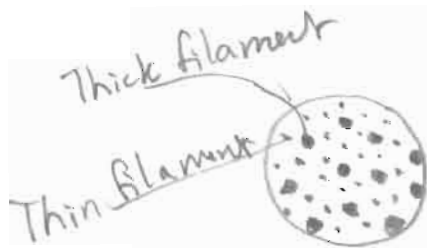
46. Contain tropomyosin

## Short Answer Questions

Please answer these questions briefly. Label diagrams correctly, with lines pointing to the proper structures. Partial credit will be given where appropriate. Write legibly!! You can use the back of the last page to continue any question. Number them, please!!

47. Draw and completely label the cross section through a myofibril. (5 points)

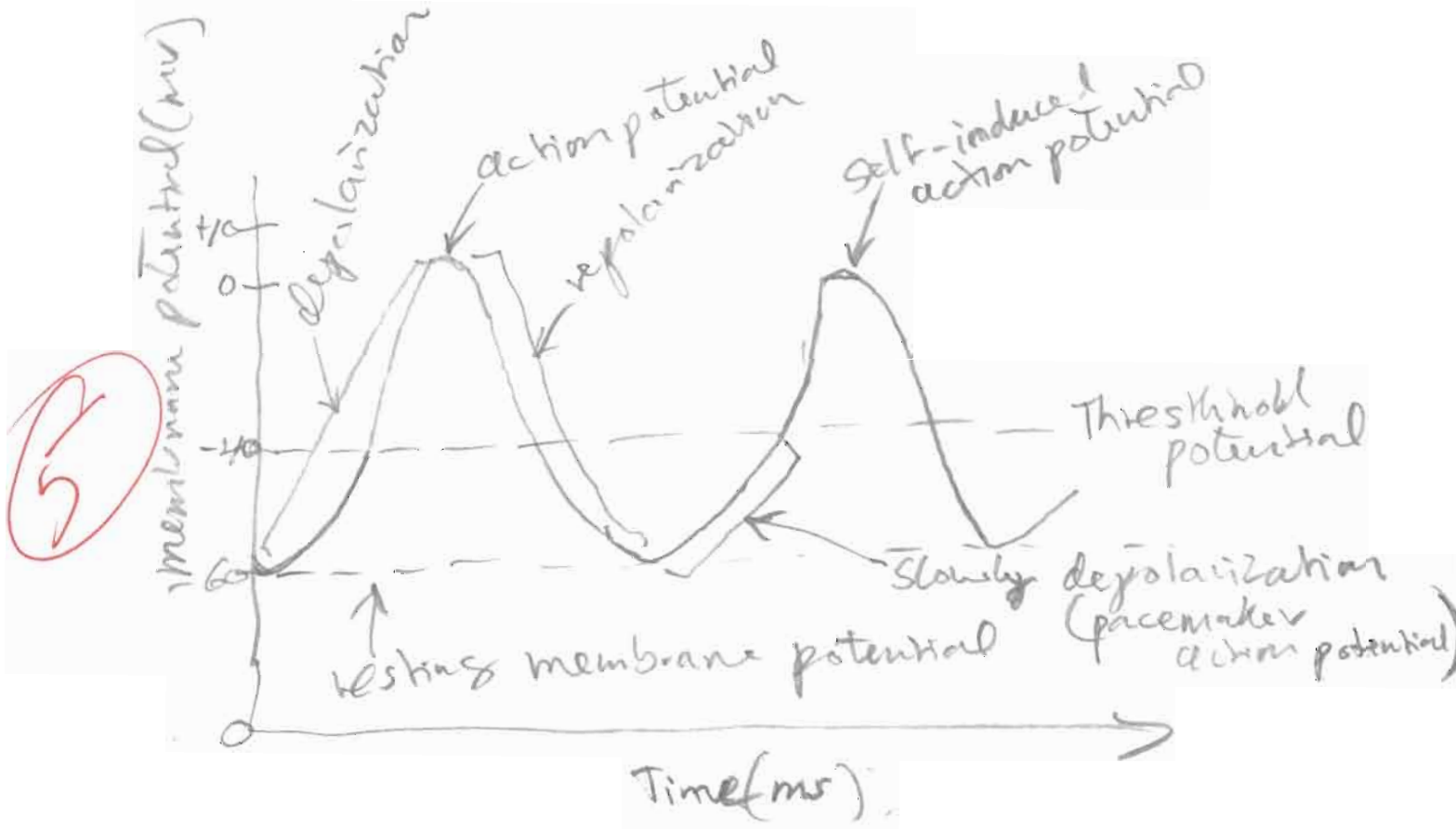
4



\* 6 thin filaments surround one thick filament.

\* 3 thick filaments surround one thin filament.

48. Draw and completely label action potentials you would expect from a pacemaker cell of the heart. (5 points)



49. Trace a drop of blood from the time it enters the systemic circulation until it enters the pulmonary circulation. (10 points)

Left ventricle → Enter into aortic semilunar valve → (ascending aorta → aortic arch → descending aorta) → aorta → organ systems → (if from upper body body will enter right atrium via superior vena cava or if from the lower body will enter right atrium via inferior vena cava) → Right atrium → Right AV valve → Right ventricle → ~~pulmonary~~ → pulmonary semilunar valve → enter → The pulmonary circulation (STOP)

PART 1

SUBJECTIVE SCORE INSTRUCTOR USE ONLY				
100	90	80	70	60
50	40	30	20	10
9	8	7	6	5
4	3	2	1	0

(T) (F) KEY

100 90 80 70 60  
50 40 30 20 10  
9 8 7 6 5  
4 3 2 1 0

	(T)	(F)	KEY
1	A	B	D
2	A	B	C
3	A	B	C
4	A	B	C
5	A	B	C
6	A	B	C
7	A	B	C
8	A	B	C
9	A	B	C
10	A	B	C
11	A	B	C
12	A	B	C
13	A	B	C
14	A	B	C
15	A	B	C
16	A	B	C
17	A	B	C
18	A	B	C
19	A	B	C
20	A	B	C
21	A	B	C
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27	A	B	C
28	A	B	C
29	A	B	C
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31	A	B	C
32	A	B	C
33	A	B	C
34	A	B	C
35	A	B	C
36	A	B	C
37	A	B	C
38	A	B	C
39	A	B	C
40	A	B	C
41	A	B	C
42	A	B	C
43	A	B	C
44	A	B	C
45	A	B	C
46	A	B	C
47	A	B	C
48	A	B	C
49	A	B	C
50	A	B	C

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FEED THIS DIRECTION

1

07/08/06 M12 4806 899 12/11/10 987554321

**IMPORTANT**

USE NO. 2 PENCIL ONLY

- MAKE DARK MARKS
- ERASE COMPLETELY TO CHANGE
- EXAMPLE: A, B, C, D, E

**TO USE SUBJECTIVE SCORE FEATURE:**

- Mark total possible subjective points
- Only one mark per line on key
- 163 points maximum

**EXAMPLE OF STUDENT SCORE:**

100	90	80	70	60
50	40	30	20	10
9	8	7	6	5
4	3	2	1	0

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TEST RECORD	
PART 1	2(39+1)
PART 2	12
TOTAL	92

39

# Quiz

Chowry he  
011/13/07

~~Thin~~

7-8

- ~~thin~~ fa

- Thin filament consists of 3 main proteins (actin, tropomyosin, and troponin). If making a ~~to~~ cross section, we can see that ~~6~~ six thin filament ~~are~~ surround ~~to~~ one thick filament.

