

Name: _____

Physiology: Skeletal Muscle Worksheet

Directions: Write in and circle best answer on this sheet.

1. Define the following terms as they apply to **skeletal muscle**.

Sarcolemma -

Sarcoplasm -

Myofibril -

Sarcoplasmic reticulum -

Transverse tubules -

2. Describe a **myofibril**, then describe the structures of **myosin** and **actin** in a myofibril.

Myofibril:

Myosin:

Actin:

3. What is a sarcomere? Show the relationship between actin and myosin in a myofibril by **drawing a diagrammatic sarcomere**. Include and label all important structures as shown in class.

4. Explain what creates the following structures of a sarcomere. How many of each is in one sarcomere?

A band -

I band -

H band -

M line -

Z disks -

5. Describe the roles of Contraction Regulation by Troponin and Tropomyosin

Troponin

Tropomyosin

6. Acetylcholine from Somatic Motor Neurons Initiates Excitation-Contraction Coupling

To initiate contraction, (nicotinic/muscarinic?) (adrenergic/cholinergic?) receptors on the motor end plate combine with (norepinephrine/ACh?) and open (Na^+/K^+ or Ca^{2+} ?) channels. Net (Na^+ entry/ Na^+ efflux/ K^+ entry/ K^+ efflux?) depolarizes the cell, creating an end-plate potential (EPP). The EPP the same as a/an (graded potential/action potential?) that spreads across the (cytoplasm/sarcolemma?). The electrical signal then spreads into the _____, where voltage sensitive _____ receptors open ($\text{Na}^+/\text{K}^+/\text{Ca}^{2+}$?) channels on the _____ inside the cell.

7. Briefly compare the ATP yield for **aerobic** and **anaerobic** metabolism of one glucose molecule.

8. What is muscle fatigue? List 4 factors that are believed to contribute to muscle fatigue.

9. Why do H^+ and inorganic phosphate (P_i) accumulate during exercise? [Hint: Catabolism of ATP]

10. What is **atrophy** of a skeletal muscle?

11. What is **Hypertrophy** of a skeletal muscle?

12. What is the role of **creatine phosphate** (phosphocreatine) in muscle?

13. What is the role of **myoglobin** in skeletal muscle? Which fiber type has the most myoglobin? Why?

14. Fill in **Table 1** below for the properties of slow (red) and fast (white) twitch skeletal muscle fibers.

Properties	Slow (Red)	Fast (White)
Contraction time (onset)		
Fatigue		
Muscle fiber diameter		
Mitochondrial content		
Myoglobin content		
Blood supply		
Color of muscle tissue		
Glycogen storage		
1° ATP source (Metabolism)		
Contraction duration		
Functional use		

15. For a single muscle fiber, explain why long and short sarcomeres develop less tension than sarcomeres at optimal length. Hint: Refer to a graph on p 351 that shows the relationship between sarcomere *length* and *tension*.

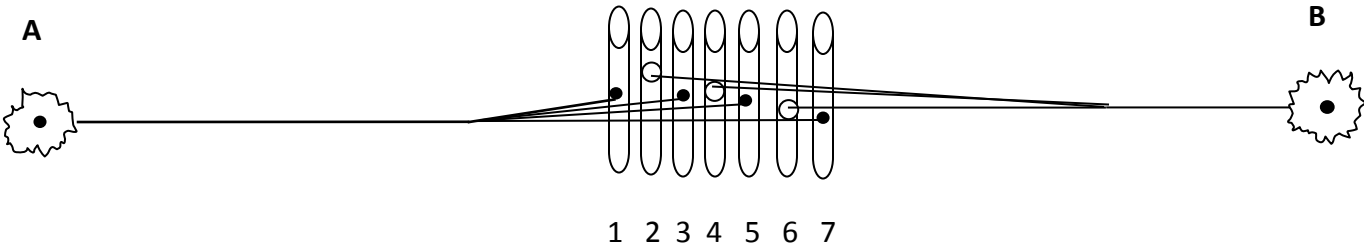
16. Briefly explain the process of temporal summation in a skeletal muscle fiber.

17. Sketch a graph showing the differences between a skeletal muscle *twitch*, *unfused tetanus* and *fused tetanus*. Describe the phases of a twitch and difference between unfused and fused (complete) tetanus.

18. What is a motor unit? What is motor unit recruitment and why is it used?

19. What type of summation is motor unit recruitment? _____.

20. Muscles responsible for fine movements will have (more/fewer?) muscle fibers in its motor units.



21. In the above illustration, 1-7 are individual muscle fibers. Which motor unit is smaller, A or B? _____.

22. Are the types of muscle fibers in a single motor unit the (same/different) fiber type? _____.

23. If muscle fiber #4 were slow twitch, what would muscle fiber # 2 be? _____.

24. Fill-in the following: *These details can be found on page 351 of OER text for Ch. 13 on the website.*

Laryngeal muscle: about _____ muscle fibers per motor neuron.

Rectus muscle (eye): about _____ muscle fibers per motor neuron.

Tensor tympani (ear): about _____ muscle fibers per motor neuron.

Gastrocnemius: about _____ muscle fibers per motor neuron.

Quadriceps (thigh) muscle: about _____ muscle fibers per motor neuron.

25. The area of the sarcomere that creates the H band consists of

- a)** all of the actin **b)** actin only **c)** the z disks **d)** myosin only **e)** all of the myosin

26. The membrane of the T-tubules contains receptors that are sensitive to _____.

- a)** mechanical distention **b)** voltage **c)** the release of Ca^{2+} **d)** influx of Na^+ **e)** dihydropyridine

27. Put these events in the correct order of occurrence:

1. ACh binds to nicotinic receptors and opens Na^+/K^+ channels, initiating an action potential
2. Ca^{2+} is released from the sarcoplasmic reticulum
3. binding sites on actin exposed, allowing myosin and actin crossbridge formation
4. T-tubules spread the action potential to the lateral sacs of the SR
5. Ca^{2+} binds to troponin, moving tropomyosin
6. ACh is released from synaptic end bulbs of a somatic motor neuron

- a)** 6, 4, 3, 2, 1, 5 **b)** 6, 1, 3, 4, 2, 5 **c)** 1, 6, 5, 3, 2, 4 **d)** 6, 1, 4, 2, 5, 3 **e)** 3, 4, 5, 6, 1, 2

28. Muscle fatigue may be associated with _____

- a)** increases in glycogen **b)** accumulation of H^+ **c)** increased levels of creatine phosphate
d) b and c **e)** all of these are true

29. When Ca^{2+} is released from the SR, what is its role in muscle contraction?

- a)** it diffuses into T-tubules **b)** it detaches the actin from myosin
c) it binds to tropomyosin **d)** it is re-sequestered into the sarcoplasmic reticulum
e) it removes the inhibition for the reaction (bond) between actin and myosin

30. A) Draw a neuromuscular junction for skeletal muscle and describe how muscle contraction functions.

30. B) Now, apply how the following would affect the neuromuscular junction for skeletal muscle.

- a)** Botulism toxin -
b) Curare -
c) Organophosphates -