**Muscles Questions**

**During the race a swimmer has to dive off the starting blocks as quickly as possible.**

**Identify the ‘muscle fibre type’ used to complete this action and justify your answer. *(3 marks)***

A. Fast twitch fibres/type 2

B. Type 2b/fast twitch glycolytic/FTG

C. Fast speed of contraction

D. High force of contraction/powerful contraction/ strong contraction

**Sliding Filament**

**The winner of a weightlifting competition is determined by the performer who is unable to lift the heaviest weight.**

**Explain how a muscle contracts according to the ‘sliding filament theory’. *(4 marks)***

1. Action potential reaches the motor end plate and causes depolarisation

2. This causes calcium ions to be released

3. The calcium ions attach to troponin

4. This moves/changes the tropomyosin complex

5. This leaves the binding sites on the actin free

6. Myosin heads attach to the actin binding site to form cross bridges

7. ATP required to form cross bridge

8. Myosin head moves towards the centre/power stroke occurs

9. Actin slides over the myosin/actin moves towards the centre of the sarcomere

10. Cross bridge then broken but can be recreated if calcium ions are still present

11. ATP is also required to allow the myosin to break the cross bridge

**With reference to the Sliding Filament Hypothesis, explain the roles of tropomyosin and troponin during muscles contraction. *(4 marks)***

*4 marks for 4 of:*

A. Tropomyosin prevents myosin attaching to actin filaments

B. Nerve impulse/electrical impulse/action potential

C. Releases calcium ions (from sarcoplasmic reticulum)

D. (Calcium ions) attach to troponin (on actin filaments)

E. Causing shape of troponin to alter/moves out of the way

F. Tropomyosin binds to actin/winds around/neutralises the troponin

G. Exposes myosin binding site (on actin filament)

H. Allows myosin to bind to actin/cross-bridges formed

**The Sliding Filament Hypothesis suggests muscular contraction occurs in the sarcomeres of the muscle fibres.**

**Explain how actin and myosin filaments in the sarcomere bind together causing muscular contraction. *(4 marks)***

*4 marks for 4 of:*

A. Filaments unable to bind due to tropomyosin

B. Receipt of nerve impulse/action potential/electrical impulse/wave of

depolarisation

C. Sarcoplasmic reticulum (releases)

D. Calcium (ions released)

E. (Calcium) Attach to troponin (on actin filaments)

F. Causes change of shape of troponin/moves tropomyosin

G. Exposes myosin binding site (on actin filament)/ ATP

H. Cross bridge formation

I. Powerstroke occurs/Ratchet Mechanism/Reduce H zone/z lines closer together

**Motor Units**

**The strength of a muscle contraction involves the use of motor units. How are motor units used to produce muscle contractions of varying strength in a lift? *(3 marks)***

1. Number of motor units used could be varied

2. All or nothing law

3. Size of motor units could be varied

4. Spatial summation

5. Fast-twitch motor units produce more force/slow-twitch less force

*3 marks*

**How can a performer vary the strength of muscular contractions to ensure that a skill is completed correctly? *(4 marks)***

4 marks for 4 of:

A. (Greater the force needed) larger motor units recruited

B. More units recruited

C. Need fast twitch fibres rather than slow twitch fibres

D. Multiple unit summation/spatial summation

E. All or none law/All or nothing law/or explanation

F. Wave summation/frequency of impulse/innervations

G. Motor unit unable to relax/increase the force

H. Tetanus/titanic for powerful contraction

I. Muscle spindles detect changes in muscle length/speed of contraction

J. Send information to brain/CNS

K. Compares information to long term memory to ensure

correct force applied/past Experiences

L. Spatial summation – rotating the frequency of the impulse to motor units to delay fatigue