

5.2 Muscles and movement

Name: _____ Class: _____ Date: _____

Total: 22 marks

KEY WORDS tendon • ligament • myofibril • sarcomere
• sliding filament

Objective

Practise statements 7.9-7.11: how muscles, tendons, ligaments and the skeleton interact, the structure of skeletal muscle fibres, and the sliding-filament theory of contraction.

1 Key knowledge and worked examples

■ Who joins what

Tendon : muscle to bone. **Ligament** : bone to bone, holding joints together. Muscles work in antagonistic pairs across joints – one contracts while its partner relaxes.

■ Inside a fibre

A skeletal muscle fibre is a fused cell with many nuclei, filled with **myofibrils**. Each myofibril is a repeating line of **sarcomeres** : actin (thin) filaments anchored at the Z-lines, myosin (thick) filaments between them with globular heads.

■ The sliding filament cycle

Action potential arrives, Ca^{2+} is released, calcium binds troponin, tropomyosin moves, actin's binding sites are exposed; the energised myosin head attaches to actin, its stored $\text{ADP} + \text{P}_i$ released as it pulls (the power stroke); a fresh ATP binds the head and it detaches; ATP is split again to re-cock the head.

■ Worked example: naming what a poison does

A drug that blocks ATP binding to myosin heads: heads cannot detach, actin and myosin stay locked – the muscle stiffens (rigor). An answer that names the step blocked AND the observable outcome earns both marks.

2 Practice

2.1 State two structural differences between a tendon and a ligament's job. [2]

2.2 Name the two protein filaments of a myofibril. [2]

2.3 Describe the role of calcium ions in muscle contraction. [2]

3 Exam-style questions

3.1 Describe the sliding filament mechanism of muscle contraction from the arrival of an action potential at a muscle fibre to the relaxation of the fibre. [6]

3.2 Slow-twitch and fast-twitch fibres differ in mitochondria and blood supply. Compare the two fibre types for endurance and power events, explaining how each structural difference supports its role. [5]

3.3 A weightlifter holds a heavy bar still at arm's length. Both the biceps and triceps of the arm are contracting. Explain why both muscles contract to hold a joint still, and how this differs from the antagonistic action that bent the arm to lift the bar. [5]
