

CHAPTER 1: 1.1 Muscular skeletal system

Question - text book page 16

Using the information on pages 12 to 14 above, complete the table below.

joint	joint type	articulating bones	associated movement patterns
shoulder	ball + socket	humerus + scapula	3 axes: flexion + extension, abduction + adduction, medial + lateral rotation = circumduction
elbow	hinge	radius ulna, humerus	flexion + extension
hip	ball + socket	acetabulum of hip bone or sacrum	3 axes: flexion + extension, abduction + adduction, medial + lateral rotation = circumduction
knee	hinge	femur, patella, tibia	flexion + extension
trunk	cartilaginous	vertebrae	slightly moveable

Question - text book page 20

Explain the differences between the following terms:

a) Concentric and eccentric muscle contraction.

Answer:

- Concentric muscle contraction is a form of isotonic muscle contraction and occurs when a muscle **shortens** under tension.
- Eccentric muscle contraction is a form of isotonic muscle contraction and occurs when a muscle **lengthens** under tension.

b) Isometric and isotonic muscle contraction.

Answer:

- Isometric muscle contraction is a **static** contraction and so occurs when muscle length does not change, but the amount of tension increases during the contraction process.
- Isotonic muscle contraction occurs when the muscle **shortens** or **lengthens** as it contracts and so causes movement of a body part.

c) Agonist and antagonist muscle action.

Answer:

- Agonist muscle action (also known as the **prime mover**) is when the muscle under tension is doing the work.
- Antagonist muscle action is when a muscle relaxes to allow the agonist to work as movement occurs. In this way muscle work in pairs as one contracts and the **opposing** muscle relaxes.

d) Fixator and synergist muscle.

Answer:

- Fixator muscle **stabilises** the origin of the agonist and the joint that the origin spans (moves over) in order to help the agonist function most effectively.
- Synergist muscle also helps to create the movement and acts a muscle **stabiliser**.

e) Extension and hyperextension.

Answer:

- Extension means to **straighten**, resulting in an increased angle around the joint.
- Hyperextension is the **forced extension** of a joint beyond its normal range of motion.

f) Lateral and medial rotation.

Answer:

- Lateral rotation is the turning of a joint **away** from the **midline** of the body.
- Medial rotation is the turning of a joint **towards** the **midline** of the body.

Question - text book page 21

Using figure 1.13c, at the completion of the full stride of the left foot plant, identify:

- a) The bones that form the ankle joint.

Answer:

- *Ankle joint bones: tibia, fibula + talus.*

- b) The joint type for the ankle.

Answer:

- *Ankle joint type: hinge type joint.*

- c) The movement pattern produced as the left foot makes ground contact.

Answer:

- *Movement pattern: dorsiflexion.*

- d) The main agonist responsible for this movement pattern.

Answer:

- *Main agonist: tibialis anterior.*

- e) The antagonist responsible for this movement pattern.

Answer:

- *Antagonist muscle: gastrocnemius.*

- f) The type of muscular contraction taking place.

Answer:

- *Type of muscle contraction: isotonic, concentric.*

figure 1.13 – sprint – a full stride



Question - text book page 23

- 1) a) Explain how the type of muscle contraction changes as a weightlifter moves from the squat position, to the standing position, and back to the squat position.

Answer:

- *Squat position to standing: isotonic, concentric muscle contraction.*
- *Standing back to squat position: isotonic, eccentric muscle contraction.*

- b) Identify the main agonist muscle groups responsible for these movement patterns.

Answer:

- *Squat position to standing: agonist is gluteus maximus + hamstring muscle group.*
- *Standing back to squat position: agonist is quadriceps femoris muscle group.*

- c) Identify a fixator muscle that is acting as a stabiliser for the action of the prime mover or agonist muscle.

Answer:

- *Fixator muscle from squat to standing position from: piriformis, gluteus medius, gluteus minimus.*

Questions - text book page 24

1) Hockey involves movement at many joints in the body. Identify which bones articulate at each of the following joints:

a) Shoulder.

Answer:

- *Shoulder:* Scapula, humerus.

b) Knee.

Answer:

- *Knee:* Femur, tibia, patella.

c) Elbow.

Answer:

- *Elbow:* Radius, ulna, humerus.

d) Hip.

Answer:

- *Hip:* Femur, acetabulum of hip bone or sacrum.

e) Ankle.

Answer:

- *Ankle:* Talus, tibia and fibula

2) Complete gaps in the table below naming the main agonist and antagonist in the named activity:

action	main agonist	main antagonist
elevating the shoulder	trapezius	lattissimus dorsi
extending the elbow joint	triceps	biceps
flexing the knee joint	hamstrings group	quadriceps group
dorsiflexing the ankle joint	tibialis anterior	calf muscles - gastrocnemius, soleus
flexing the trunk	rectus abdominus	erector spinae

Exam style questions - text book page 25

figure 1.20 – a shotputter

1) a) The diagram in figure 1.20 shows a shot putter during the delivery phase of the technique. List the bones that articulate in the shoulder joint. 2 marks

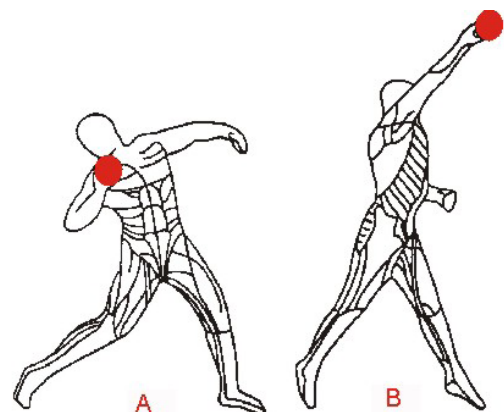
Answer:

Bones which articulate at the Shoulder:

- Scapula.
- Humerus.

Bones which articulate at the Knee:

- Femur.
- Tibia.
- Patella.



1) b) Briefly explain the movement sequence of the right arm during the delivery phase of the shot put. 3 marks

Answer:

From diagram A:

- Shoulder is extended and abducted, elbow is flexed, wrist is pronated and hyper extended.

From diagram B:

- Shoulder is flexed and elevated, elbow extended,.
- Wrist is pronated and extended, and phalanges are extended.

2) Describe the following movement terminology, and give a physical activity for each movement:
Abduction, circumduction, rotation and plantarflexion. 8 marks

Answer:

- **Abduction** is a movement pattern in which a body segment moves away from the midline of the body.
- Example: leg action going into a cartwheel.
- **Circumduction** is a movement pattern which consists of flexion, abduction, extension and adduction to create a cone shape in space.
- Example: a small circular hand dance gesture.
- **Rotation** is a movement pattern around the axis down the centre of a long bone.
- Example: delivery phase of a discus throw.
- **Plantarflexion** is a movement pattern of the foot that results in the toe being pointed downwards.
- Example: diving off a springboard.

3) Figure 1.21 a-c shows the final stride, take-off and flight phase of a long jump.

Use these three pictures to help you complete the following joint analysis.

a) Name the type of muscle contraction occurring in the left leg (foot in contact with the ground) in figure 1.21 a name an agonist muscle responsible for this muscle contraction and explain why you have selected this muscle. 3 marks

Answer:

- **Type of muscle contraction:** isotonic, eccentric muscle contraction.
- **Main agonist muscle:** quadriceps group: rectus femoris, vastus medialis, vastus intermedius, vastus lateralis.
- **Explanation:** on this final stride prior to take-off, the hips and take-off leg sink into the board, during which time muscles of the quadriceps muscle group are lengthening under tension.

b) Complete the following joint analysis below in table 1.11 for figure 1.21 b. 9 marks

figure 1.21 – long jump take-off and flight

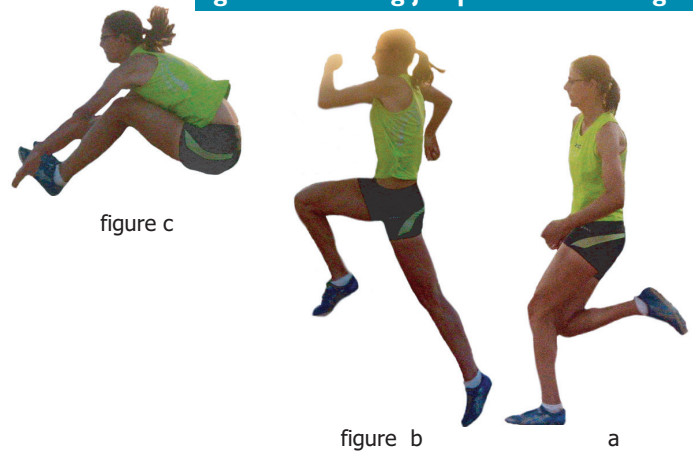


Table 1.11 – joint table

joint	joint type	articulating bones	main agonist muscle
left ankle	synovial hinge	talus, tibia, fibula	tibialis posterior, gastrocnemius, soleus
left knee	synovial hinge	tibia, femur	quadriceps group: rectus femoris, vastus lateralis, vastus medialis, vastus intermedius
left hip	synovial ball and socket	femur, acetabulum of pelvis	gluteus maximus, hamstring group: biceps femoris, semimembranosus, semitendinosus

3) c) Describe the changes in movement patterns in the left ankle, knee, hip and trunk from figures 1.21 b to c. 4 marks

Answer:

- Left ankle changes from plantarflexion to dorsiflexion.
- Left knee changes from extension to flexion.
- Left hip changes from extension to flexion.
- Trunk changes from extension to flexion.

d) Suggest two factors which could affect the range of movement at the hip joint.

2 marks

Answer:

- **Shape** of ball and socket joint, or the shape of bones.
- **Extensibility** of attached muscles or muscle tendons.
- **Elasticity** of attached ligaments.
- **Length** of muscle or **bulk** of muscle.

e) Identify the predominant fibre type (refer to page 63) stressed during the take-off and give two reasons why this fibre type would be used. Identify the type of muscle contraction occurring during the take-off phase of the long jump

4 marks

Answer:

- **Fast twitch glycolytic fibre (type IIb)** during the take-off phase.

Reasons:

- **Fast** contraction speed.
- High **power** output/force exerted.
- High **anaerobic** capacity.

Type of muscle contraction:

- **Isotonic concentric** muscle contraction.

f) Why is it important to warm-up muscle tissue prior to long jumping?

2 marks

Answer:

- Raises muscle **temperature**.
- Increases glycolytic **enzyme** action.
- And **ATP conversion**.
- Reduces muscle **response time**.
- The stretching part of the warm-up enables musculature to operate over its full **range**.

4) Figure 1.22 shows a tennis player completing a forehand drive. Use the figure to help you complete the following joint analysis.

a) For the shoulder joint during horizontal flexion, identify the type of joint, the articulating bones, an agonist muscle, and the type of contraction for the agonist.

4 marks

Answer:

- **Type of joint:** synovial, ball and socket.
- **Articulating bones:** scapula, humerus.
- **Agonist from one of the following muscles:** pectoralis major, anterior deltoid.
- **Type of contraction at agonist:** isotonic, concentric.

b) Using the muscles that create flexion of the elbow during the forehand drive, Explain what is meant by antagonistic muscle action.

4 marks

Answer:

- The **agonist** is the active muscle, the muscle under tension or doing work and functioning as the prime mover of a joint during the desired movement.
- The **antagonist** muscle relaxes to allow the agonist muscle to work as movement occurs.
- When the elbow is flexing during the forehand drive, the agonist = **biceps brachii** muscle, and the antagonist = **triceps brachii** muscle.

c) Identify the movement pattern produced and an agonist muscle responsible for the action on the right hand side of the trunk.

2 marks

Answer:

- **Movement pattern:** lateral flexion.
- **Agonist:** internal obliques.

figure 1.22 – tennis forehand



- 4) d) For the right wrist, identify the articulating bones, a fixator or stabilising muscle, and the movement pattern at the completion of the forehand drive. 3 marks

Answer:

- *Articulating bones:* ulna, radius and carpals.
- *Agonist:* wrist extensors.
- *Movement pattern:* extension.

- 5) Differentiate between concentric, eccentric and isometric muscle contraction, using practical examples to support your answer. 6 marks

Answer:

- *Concentric* muscle contraction: a muscular contraction which shortens whilst producing tension.
Example: driving upward phase in a jump or squat.
- *Eccentric* muscle contraction: a muscular contraction which lengthens whilst producing tension.
Example: landing from a jump off a box.
- *Isometric* muscle contraction: a muscle contraction which stays the same length whilst producing tension.
Example: holding a plank position.