JOINTS, MUSCLES AND MOVEMENT

JOINTS AND MOVEMENT

Bones of the Skeleton

<table>
<thead>
<tr>
<th>NAME OF BONE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranium</td>
<td>Skull</td>
</tr>
<tr>
<td>Clavicle</td>
<td>Collar Bone</td>
</tr>
<tr>
<td>Scapula</td>
<td>Shoulder Blade</td>
</tr>
<tr>
<td>Sternum</td>
<td>Breast Bone</td>
</tr>
<tr>
<td>Ribs</td>
<td>Ribs</td>
</tr>
<tr>
<td>Humerus</td>
<td>Upper Arm</td>
</tr>
<tr>
<td>Ulna</td>
<td>Lower Arm</td>
</tr>
<tr>
<td>Radius</td>
<td>Lower Arm</td>
</tr>
<tr>
<td>Carpals</td>
<td>Wrist</td>
</tr>
<tr>
<td>Metacarpals</td>
<td>Fingers</td>
</tr>
<tr>
<td>Phalanges</td>
<td>Finger Tips</td>
</tr>
<tr>
<td>Ilium/Pelvis</td>
<td>Pelvis</td>
</tr>
<tr>
<td>Sacrum</td>
<td>Lower Back near hips</td>
</tr>
<tr>
<td>Coccyx</td>
<td>Base of Vertebrae</td>
</tr>
<tr>
<td>Femur</td>
<td>Upper Leg</td>
</tr>
<tr>
<td>Patella</td>
<td>Knee Cap</td>
</tr>
<tr>
<td>Tibia</td>
<td>Lower Leg/Shin Bone</td>
</tr>
<tr>
<td>Fibula</td>
<td>Lower Leg</td>
</tr>
<tr>
<td>Tarsals</td>
<td>Ankle Bones</td>
</tr>
<tr>
<td>Metatarsals</td>
<td>Feet Bones</td>
</tr>
<tr>
<td>Phalanges</td>
<td>Toes</td>
</tr>
<tr>
<td>Talus</td>
<td>Bone below Tibia/Start of Ankle</td>
</tr>
<tr>
<td>Calcaneus</td>
<td>Heel Bone</td>
</tr>
</tbody>
</table>

Classification of Joints

<table>
<thead>
<tr>
<th>Structural Classification</th>
<th>Functional Classification</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrous or Fixed Joints</td>
<td>Immovable Joints</td>
<td>Between the skull</td>
</tr>
<tr>
<td>Cartilaginous Joints</td>
<td>Slightly Movable Joints</td>
<td>Vertebrae</td>
</tr>
<tr>
<td>Synovial Joints</td>
<td>Freely Movable Joints</td>
<td>Joints of arms etc</td>
</tr>
</tbody>
</table>

Structure of a Synovial Joint

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>STRUCTURE</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyaline Cartilage</td>
<td>Smooth cartilage, spongy and covers the ends of the bones at joints</td>
<td>1. Prevents friction between articulating surfaces of the bones</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Absorbs compression placed on the joint and protects bone ends form being crushed</td>
</tr>
<tr>
<td>Two-layered Joint Capsule</td>
<td>Outer layer is tough and fibrous called <strong>fibrous capsule</strong> and inner layer covers internal joint surfaces called <strong>synovial membrane</strong></td>
<td>1. Strengthens the joints so bones are not pulled apart 2. To secrete Synovial Fluid</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Synovial Fluid</td>
<td>A slippery fluid contained within the joint cavity</td>
<td>1. Reduces friction between articular cartilage 2. Nourishes the articular cartilage 3. Get rid of waste debris</td>
</tr>
<tr>
<td>Ligament</td>
<td>A band of strong fibrous tissue</td>
<td>1. To connect bone to another bone</td>
</tr>
<tr>
<td>Bursa</td>
<td>A flattened fibrous sac filled with synovial membrane and thin film of synovial fluid</td>
<td>1. Prevent friction where ligaments, muscle, tendons or bones might rub together</td>
</tr>
<tr>
<td>Meniscus</td>
<td>A wedge of white fibrocartilage that improves the fit between adjacent bone ends</td>
<td>1. Makes the joint more stable 2. Reduces wear and tear of to the joint surfaces</td>
</tr>
<tr>
<td>Pad of Fat</td>
<td>A fatty pad</td>
<td>1. Provides cushioning between fibrous capsule and a bone or muscle</td>
</tr>
</tbody>
</table>

**Types of Synovial Joint**

<table>
<thead>
<tr>
<th>Ball and Socket Joint</th>
<th>-</th>
<th>E.g. Shoulder and Hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinge Joint</td>
<td>-</td>
<td>E.g. Elbow, Knee and Ankle</td>
</tr>
<tr>
<td>Pivot Joint</td>
<td>-</td>
<td>E.g. Radio-Ulnar Joint and Atlas/Axis Joint</td>
</tr>
<tr>
<td>Condyloid Joint</td>
<td>-</td>
<td>E.g. Wrist</td>
</tr>
<tr>
<td>Gliding Joint</td>
<td>-</td>
<td>E.g. Spine between adjacent bony processes</td>
</tr>
<tr>
<td>Saddle Joint</td>
<td>-</td>
<td>E.g. Thumb</td>
</tr>
</tbody>
</table>

**Terminology and Types of Movement**

<table>
<thead>
<tr>
<th>Anatomical Position (AP)</th>
<th>-</th>
<th>Upright standing position with head, shoulders, chest, palm of hands, hips, knees and toes facing forwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial</td>
<td>-</td>
<td>Situated in or movement towards the middle of the body</td>
</tr>
<tr>
<td>Lateral</td>
<td>-</td>
<td>Situated at or movement towards the outside of the body</td>
</tr>
<tr>
<td>Flexion</td>
<td>-</td>
<td>Makes a body part move forwards from the anatomical position</td>
</tr>
<tr>
<td>Extension</td>
<td>-</td>
<td>Makes a body part move in a backwards direction from the AP</td>
</tr>
<tr>
<td>Horizontal Flexion</td>
<td>-</td>
<td>When the shoulder is already flexed with the arm parallel to the ground and the shoulder joint moves towards the middle of the body</td>
</tr>
</tbody>
</table>
Horizontal Extension - When the shoulder joint with the arm parallel to the ground moves away from the middle of the body

Abduction - Makes a body part move away from the midline of the body in the AP

Adduction - Makes a body part move towards the midline of the body

Rotation - When a body part turns about its long axis from the AP. E.g. when using a screwdriver, rotation occurs at the shoulder joint

Pronation - Makes the palm move to face backwards or downwards from the AP

Supination - Makes the palm move to face forwards or upwards from the AP

Circumduction - Makes a body part move in the shape of a cone from the AP. The joint producing the movement will stay still while the furthest end of the body part moves in a circle

Dorsiflexion - Makes the toes move towards the shin (walking on your heels)

Plantar Flexion - Makes the toes move away from the shin (walking on tip-toes)

<table>
<thead>
<tr>
<th>JOINT</th>
<th>POSSIBLE MOVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist</td>
<td>Flexion, Extension, Abduction, Adduction and Circumduction</td>
</tr>
<tr>
<td>Radio-Ulnar</td>
<td>Rotation, Pronation and Supination</td>
</tr>
<tr>
<td>Elbow</td>
<td>Flexion and Extension</td>
</tr>
<tr>
<td>Shoulder</td>
<td>Flexion, Extension, Horizontal Flexion, Horizontal Extension, Abduction, Adduction, Rotation and Circumduction</td>
</tr>
<tr>
<td>Spine/Vertebrae</td>
<td>Flexion, Extension, Lateral Flexion and Rotation</td>
</tr>
<tr>
<td>Hip</td>
<td>Flexion, Extension, Abduction, Adduction, Rotation and Circumduction</td>
</tr>
<tr>
<td>Knee</td>
<td>Flexion and Extension</td>
</tr>
<tr>
<td>Ankle</td>
<td>Dorsiflexion and Plantar Flexion</td>
</tr>
</tbody>
</table>
MUSCLES AND MOVEMENT

Terminology of Muscles

ORIGIN - Point of attachment of a muscle that remains relatively fixed during muscular contraction

INSERTION - Point of attachment of a muscle that tends to move toward the Origin during muscular contraction

ANTAGONISTIC MUSCLE ACTION - As one muscle shortens to produce movement, another muscle lengthens to allow that movement to take place

AGONIST/PRIME MOVER - The muscle that is directly responsible for the movement at a joint

ANTAGONIST MUSCLE - The muscle that has an action opposite to that of the agonist and helps in the production of a coordinated movement

FIXATOR MUSCLE - The muscle that allows the agonist to work effectively by stabilising the origin of the agonist, so that the agonist muscle can pull against the bone without it moving to achieve an effective contraction

Table of Muscle and Movement

S E = Strengthening Exercises

<table>
<thead>
<tr>
<th>MUSCLE</th>
<th>LOCATION</th>
<th>ORIGIN</th>
<th>INSERTION</th>
<th>ACTION</th>
<th>S E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist Flexors</td>
<td>Anterior forearm</td>
<td>Humerus, Radius and Ulna</td>
<td>Carpals, Metacarpals, Phalanges</td>
<td>Flexion of wrist</td>
<td>Wrist Curls</td>
</tr>
<tr>
<td>Wrist Extensors</td>
<td>Posterior forearm</td>
<td>Humerus, Radius and Ulna</td>
<td>Metacarpals, Phalanges</td>
<td>Extension of wrist</td>
<td>Reverse wrist Curls</td>
</tr>
<tr>
<td>Pronator Teres</td>
<td>Top of anterior forearm</td>
<td>Humerus and Ulna</td>
<td>Radius</td>
<td>Pronation of radio-ulnar joint</td>
<td>Supination of radio-ulnar joint</td>
</tr>
<tr>
<td>Supinator</td>
<td>Lateral side of anterior forearm</td>
<td>Humerus and Ulna</td>
<td>Radius</td>
<td>Dumbbell Curls (downward phase)</td>
<td>Dumbbell Curls (upward phase)</td>
</tr>
<tr>
<td>Biceps brachii</td>
<td>Anterior upper arm</td>
<td>Scapula</td>
<td>Radius</td>
<td>Flexion of elbow joint</td>
<td>Biceps curls</td>
</tr>
<tr>
<td>Triceps brachii</td>
<td>Posterior upper arm</td>
<td>Scapula and Humerus</td>
<td>Ulna</td>
<td>Extension of elbow joint</td>
<td>Triceps extensions</td>
</tr>
<tr>
<td>Muscles</td>
<td>Action</td>
<td>Bone(s)</td>
<td></td>
<td></td>
<td></td>
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<td>-------------------------</td>
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<td></td>
</tr>
<tr>
<td><strong>Subscapularis and teres major</strong></td>
<td>Covers Scapula beneath Trapezius</td>
<td>Scapula, Humerus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Infraspinatus and teres minor</strong></td>
<td>Scapula, Humerus</td>
<td>Lateral rotation of shoulder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Deltoid</strong></td>
<td>Covers shoulder joint</td>
<td>Clavicle and Scapula</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anterior: Flexion of shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle: Abduction of shoulder</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Posterior: Extension of shoulder</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Latissimus dorsi</strong></td>
<td>Posterior trunk</td>
<td>Thoracic and Lumbar spine, Sacrum and Pelvis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anterior: Flexion of shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle: Abduction of shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Posterior: Extension of shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pectoralis Major</strong></td>
<td>Top of chest</td>
<td>Clavicle, sternum and ribs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anterior: Horizontal flexion of shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trapezius</strong></td>
<td>Top of back</td>
<td>Skull, cervical &amp; thoracic spine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle: Horizontal extension of shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rectus abdominis</strong></td>
<td>Middle of abdomen</td>
<td>Pelvis, sternum and ribs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anterior: Flexion of spine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Erector spinae group</strong></td>
<td>Middle of back, covering spine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extension of spine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>External Obliques</strong></td>
<td>Lateral abdomen</td>
<td>Ribs, Pelvis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lateral flexion and rotation of spine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Internal Obliques</strong></td>
<td>Lateral abdomen, beneath external obliques</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lateral flexion and rotation of spine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Iliopsoas</strong></td>
<td>Anterior pelvis</td>
<td>Pelvis and lumbar vertebrae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extension of hip</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gluteus maximus</strong></td>
<td>Posterior pelvis</td>
<td>Pelvis, sacrum and coccyx</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extension &amp; Lateral rotation of hip</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Gluteus medius and minimus | Lateral hip (gluteus minimus is beneath gluteus medius) | Pelvis | Femur | Abduction of hip. Medial rotation of hip | Floor hip abductions
---|---|---|---|---|---
Adductor group (Adductor Longus, Brevis and Magnus) | Medial thigh | Pelvis | Femur | Adduction of hip | Floor hip adductions
Hamstring group (need to know individual muscles) | Posterior thigh | Pelvis and Femur | Tibia and Fibula | Flexion of knee | Leg Curls
Quadriceps group (need to know individual muscles) | Anterior thigh | Pelvis and Femur | Tibia | Extension of knee | Dumbbell squats
Tibialis anterior | Covers shin bone | Tibia | Tarsals and metatarsals | Dorsiflexion of ankle | One leg toe raises
Gastrocnemius and Soleus | Calf muscle | G: Femur S: Tibia and Fibula | G: Calcaneus S: Calcaneus | Plantar flexion of ankle |  

**Role of Some Muscles**

**Shoulder**
The Rotator Cuff is made up of the Supraspinatus, Infraspinatus, Teres minor and the Subscapularis. They work to stabilise the shoulder joint to prevent the larger muscles from displacing the head of the humerus during physical activity.

Throwers (e.g. Shot Putters) are at risk of injury to the rotator cuff due to repetitive use and sudden force placed on the muscles.

**Spine**
Sacrospinalis (the role of the transverse abdominis and multifidus in relation to core stability). The transverse abdominis and multifidus play a significant role in posture and core stability. Good muscle tone in the transverse abdominis can also reduce lower back pain.
Types of Muscular Contraction

ISOTONIC - Where a muscle is exerting a force and changing length.
MUSCULAR CONTRACTION - Concentric contraction is where the muscle shortens during this movement - Eccentric contraction is where the muscle lengthens during this movement

ISOMETRIC - Where a muscle is exerting a force but there is no change in muscle length

Muscle Fibre Types

SLOW TWITCH MUSCLE FIBRES - Designed for aerobic work, it uses oxygen to produce a small amount of force over a long time E.g. Marathon Runners - Also known as Slow Oxidative (SO) or Type I

FAST TWITCH MUSCLE FIBRES - Designed for anaerobic work, it produces a large amount of force in a very short time E.g. Shot Putters - There are two types: - Fast Oxidative Glycolytic (FOG) or Type IIa - Fast Glycolytic (FG) or Type IIb

Here is an example of the percentage of muscle fibre types for a variety of sports.

<table>
<thead>
<tr>
<th>ATHLETE</th>
<th>GENDER</th>
<th>MUSCLE</th>
<th>SLOW TWITCH (%)</th>
<th>FAST TWITCH (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprinters</td>
<td>M</td>
<td>Gastrocnemius</td>
<td>24</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Gastrocnemius</td>
<td>27</td>
<td>73</td>
</tr>
<tr>
<td>Distance Runners</td>
<td>M</td>
<td>Gastrocnemius</td>
<td>79</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Gastrocnemius</td>
<td>69</td>
<td>31</td>
</tr>
<tr>
<td>Shot Putters</td>
<td>M</td>
<td>Gastrocnemius</td>
<td>38</td>
<td>62</td>
</tr>
<tr>
<td>Canoeists</td>
<td>M</td>
<td>Posterior Deltoid</td>
<td>71</td>
<td>29</td>
</tr>
</tbody>
</table>

- Explain how an individual’s mix of muscle fibre type might influence their reasons for choosing to take part in a particular type of physical activity.
Movement Analysis

You should be able to carry out a movement analysis making reference to:

- Joint type
- Type of movement produced
- Agonist and Antagonist muscle (or muscles) in action
- Type of muscular contraction taking place

Using actions in your sport, complete a Movement Analysis for preparation, execution and recovery phases.

Physiological Effects of a Warm Up on Skeletal Muscle

An increase in core body temperature will produce the following physiological effects on skeletal muscle tissue:

- A reduction in muscle viscosity, leading to an improvement in the efficiency of muscular contraction
- A greater speed and force of muscular contraction due to a higher speed of nerve transmission
- An increased flexibility that reduces the risk of injury due to increased extensibility of tendons and ligaments

Physiological Effects of a Cool Down on Skeletal Muscle

- An increase in the speed of removal of lactic acid and carbon dioxide that raise the acidity levels of the muscle and affect pain receptors due to oxygen rich blood being flushed through the muscle
- A decrease in the risk of DOMS, which is the muscular pain experienced 24 - 48 hours after intense exercise due to microscopic tears in the muscle fibres.
Evaluate Critically the Impact of Different Types of Physical Activity

Evaluate critically the impact of different types of physical activity (contact sports, high impact sports and activities involving repetitive actions) on the skeletal and muscular systems (osteoporosis, osteoarthritis, growth plate, joint stability, posture and alignment) with reference to lifelong involvement in an active lifestyle.

Bone Health and Bone Disorders

OSTEOPOROSIS - This is a common bone disorder that is caused by a low bone density and a deterioration of bone tissue. The bone is severely weakened and prone to fractures. This is mostly affected in the bones of the hip, spine and wrist joints. Therefore, contact or impact sports would cause fractures. People who may be at risk of Osteoporosis are those who are inactive during childhood, adolescence or adulthood and those who have a serious injury that leads to a sedentary lifestyle or immobility.

Physical activity and a healthy diet are very important in maintaining healthy bones and reducing the risk of Osteoporosis; particularly during childhood and adolescence. Early adulthood is when bone growth is completed and where bones have their peak density. High peak density helps minimise the risk of Osteoporosis later in life. Participation in resistance or strength training, weight-bearing activities and high impact activities has a positive effect on bone health and is associated with a long term reduced risk of Osteoporosis.

GROWTH PLATE – When the Growth Plate is complete it closes and is replaced by solid bone.

Injuries to the Growth Plate are common in young people as it is the weakest area of the growing skeleton. Growth Plate injuries are fractures and are caused by a sudden force travelling through the bone in competitive, contact and impact activities like Rugby, Hockey etc. Injuries in young performers can also be due to overuse caused by repetitive practice of specific skills.

Joint Health and Joint Disorders

OSTEOARTHRITIS – This is caused by the breakdown and eventual loss of articular cartilage at one or more joints. It is a degenerative disease that commonly affects large weight-bearing joints (e.g. hips and knees). Repetitive use of these joints through physical activity causes wear and tear on the articular cartilage, which results in swelling and pain. Eventually it leads to friction between bones and limits flexibility and movement.

People at risk from Osteoarthritis are people overweight, those who experience a major injury to a joint and sports people of high impact activities/large forces acting on joints. Regular exercise will improve aerobic capacity, which manages weight and reduces body fat therefore reducing the strain on joints. It will also improve joint stability by strengthening the surrounding muscles and joint mobility.
JOINT STABILITY – This is important in lifelong involvement in physical activity as joints are able to be constantly compressed and stretched without injury. Deeper joints are more stable due to the large surface area; as are joints that have more ligaments around it. Although ligaments provide stability to a joint, they are not very elastic and are prone to stretching and even snapping. Muscle tone can help provide stability due to tighter tendons around the joint.

Exercise strengthens joint structures and will lead to an increase in stability of the joint. Without regular exercise, ligaments will shorten and become even less elastic, making them more prone to injury and a loss in muscle tone will occur which decreases the stability of a joint. Inactivity also leads to a lack of synovial fluid being released into the joint which makes the joint prone to other disorders. Large forces exerted on a joint can lead to ligament damage and dislocation of less stable joints. The knee and ankle joints are susceptible to ligament damage and the shallow joint of the shoulder is prone to dislocation.

Muscle Health

POSTURE AND ALIGNMENT – Skeletal muscles are used as stabilisers to maintain good posture, this can be thought of in terms of alignment. The muscles responsible for posture are centred around the trunk area (e.g. multifidis and the transverse abdominis). At rest our muscles are in a state of partial contraction, known as muscle tone. The greater the muscle tone in the muscle that stabilise the trunk, the better your posture and core stability. This is important to lifelong involvement in exercise as it prevents excess pressure being put on the lumbar vertebrae.

Aerobic exercise helps control body weight, meaning less strain is put on the muscles and joints and it becomes a lot easier to maintain the correct body alignment. Strength training improves muscle tone in the muscles that stabilise the trunk, this improves the alignment of the vertebrae and minimises the risk of lower back pain.
EXAM QUESTIONS

JANUARY 2002

1 Movement analysis helps a Physical Education student to understand the demands of their chosen practical activity.

   a) (i) Applying knowledge from your practical activities complete the table below. (5 marks)

<table>
<thead>
<tr>
<th>JOINT TYPE</th>
<th>JOINT TYPE</th>
<th>ARTICULATING BONES</th>
<th>MOVEMENT PRODUCED</th>
<th>PRIME MOVER</th>
<th>ANTAGONIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle</td>
<td>A</td>
<td>Talus, tibia and fibula</td>
<td>B</td>
<td>C</td>
<td>Tibialis anterior</td>
</tr>
<tr>
<td>Radio-ulnar</td>
<td>D</td>
<td>Ulna, radius</td>
<td>Supination</td>
<td>E</td>
<td>Pronator teres</td>
</tr>
</tbody>
</table>

MAY 2002

1 a) (i) Identify the joint type, the articulating bones and the prime mover causing extension of the hip joint as an athlete drives from the blocks at the start of a 100m sprint. (3 marks)

(ii) Describe the features of the hip joint that provide the stability to allow the athlete to complete the race. (3 marks)

(iii) Identify the predominant muscle fibre type being used during the race and explain why the fibre type is recruited. (3 marks)

JANUARY 2003

1 a) Identify the joint type, articulating bones and the agonist (prime mover) causing extension at the shoulder joint. (3 marks)

b) The shoulder joint is commonly classed as a synovial joint. Identify three structural features of the shoulder joint and explain their function during physical activity. (3 marks)

<table>
<thead>
<tr>
<th>Structural Feature</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
</tbody>
</table>
**MAY 2003**

1 a) (i) To develop strength in specific muscle groups a performer must undertake specific exercises. Complete the table below regarding the upward phase of a sit up and upward phase of a bicep curl. (5 marks)

<table>
<thead>
<tr>
<th>Movement</th>
<th>Joint</th>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Movement Produced</th>
<th>Agonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upward phase of sit up</td>
<td>Spine</td>
<td>Cartilaginous/Gliding</td>
<td>Vertebrae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upward phase of bicep curl</td>
<td>Elbow</td>
<td></td>
<td></td>
<td></td>
<td>Biceps brachii</td>
</tr>
</tbody>
</table>

(ii) During the downward phase of a bicep curl the role of the biceps brachii alters. Identify the type of contraction being performed by the biceps brachii during the controlled downward phase and explain how its role has changed. (2 marks)

(iii) Identify the predominant muscle fibre being used during the biceps curl to produce a maximum lift (one repetition maximum weight). Give one structural and one functional characteristic of that fibre type. (3 marks)

**JANUARY 2004**

1 a) (i) When performing a jump, at the ankle joint identify the joint type, the agonist (producing plantar flexion) and the antagonist. (3 marks)

(ii) During a prolonged Dance routine the predominant muscle fibre type would be slow oxidative (Type I). Give two structural and two functional characteristics of this fibre type. (4 marks)

**MAY 2004**

1 a) (i) Apply your anatomical and physiological knowledge to complete the joint analysis table for a Football player kicking a ball. (6 marks)

<table>
<thead>
<tr>
<th>Joint</th>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Movement Type</th>
<th>Agonist</th>
<th>Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee</td>
<td></td>
<td></td>
<td></td>
<td>Rectus Femoris</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ball and Socket</td>
<td>Femur and Pelvic girdle</td>
<td></td>
<td>Iliopsoas</td>
<td>Gluteus Maximus</td>
</tr>
</tbody>
</table>

12
(ii) Identify the type of contraction occurring in the agonist (rectus femoris) of the knee joint. Name an exercise that could be used to strengthen the muscle. (2 marks)

**JANUARY 2005**

1 a) (i) Identify the type of joint, articulating bones, agonist and antagonist during extension of the elbow joint during the execution phase of a netball shot. (4 marks)

(ii) Name the type of contraction occurring at the agonist and give one exercise that could be used to improve the strength in that muscle. (2 marks)

(iii) How would a warm up benefit the strength of muscle contractions when performing the strengthening exercise? (3 marks)

**MAY 2005**

1 a) (i) Apply your knowledge to complete the following movement analysis table about a Tuck Jump. (3 marks)

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Movement Occurring</th>
<th>Agonist</th>
<th>Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td></td>
<td>Flexion</td>
<td>Iliopsoas</td>
<td></td>
</tr>
</tbody>
</table>

(ii) Identify two structures of the hip joint and describe the role of each structure during physical performance. (4 marks)

**JANUARY 2006**

1 a) (i) Complete the following joint analysis of a Tennis player when completing a serve (execution phase). (6 marks)

**Shoulder Joint During Extension**
Type of Joint
Articulating Bones
Agonist
Type of Contraction at agonist

**Wrist Joint During Flexion**
Agonist
Antagonist
(ii) Tennis players need to develop strength in their leg muscles. Identify one exercise which would develop strength in each of the following muscles.  

Gastrocnemius  
Rectus Femoris

1  c) During sub-maximal (aerobic) exercise the predominant muscle fibre type would be slow oxidative (type 1). Give one structural and one functional characteristic of this fibre type.  

MAY 2006

1  a) (i) Complete the joint analysis of an athlete during the take off phase of the long jump.  

Knee Joint During Extension
Type of Joint  
Articulating Bones  
Agonist

Ankle Joint During Plantar Flexion
Type of Joint  
Agonist

(ii) The long jumper would use fast glycolytic fibre type (IIb) during the take off phase. Identify two reasons why this fibre type would be used.  

1  b) Complete the table below, giving an exercise which could be used to strengthen each of the muscles.  

<table>
<thead>
<tr>
<th>MUSCLE</th>
<th>EXERCISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pectoralis Major</td>
<td>1.</td>
</tr>
<tr>
<td>Rectus Abdominus</td>
<td>2.</td>
</tr>
<tr>
<td>Bicep Brachii</td>
<td>3.</td>
</tr>
</tbody>
</table>

JANUARY 2007

1  a) (i) Complete the following joint analysis table for the hip joint when preparing to kick a Football.  

<table>
<thead>
<tr>
<th>Joint</th>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Movement Occurring</th>
<th>Agonist</th>
<th>Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Iliopsoas</td>
</tr>
</tbody>
</table>
(ii) Identify the type of contraction occurring at the agonist and give one exercise that could be used to strengthen the agonist muscle. (2 Marks)

(iii) Identify ways in which a warm up can help improve the strength of contraction during the exercise identified in (ii) above. (3 Marks)

MAY 2007

1 a) (i) Complete the following movement analysis for the elbow joint during the flexion phase of the pull up. (4 Marks)

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Agonist Muscle</th>
<th>Antagonist Muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Knee (Trailing)</td>
<td>Femur and Tibia</td>
<td>Rectus Femoris</td>
<td></td>
</tr>
<tr>
<td>Left Ankle (Trailing)</td>
<td>Hinge</td>
<td>Dorsi Flexion</td>
<td>Tibialis Anterior</td>
</tr>
</tbody>
</table>

b) (i) Complete the following movement analysis of the spine during the extension phase of a back raise exercise. (2 Marks)

<table>
<thead>
<tr>
<th>Agonist</th>
<th>Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) Identify an exercise for each of the following muscles which could be included in a strength training programme. (2 Marks)

Biceps Femoris: .................................................................
Gastrocnemius: .................................................................

(iii) The muscle fibre type that would be used during a maximal strength contraction is fast glycolytic (type IIb). Give one structural and one functional characteristic of this muscle fibre type. (2 Marks)

JANUARY 2008

1 a) (i) Complete the joint analysis table below for the athlete’s left (trailing leg) during a 110m hurdles race. (5 Marks)

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Movement</th>
<th>Agonist</th>
<th>Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Knee (Trailing)</td>
<td>Femur and Tibia</td>
<td>Dorsi Flexion</td>
<td>Tibialis Anterior</td>
<td>Rectus Femoris</td>
</tr>
<tr>
<td>Left Ankle (Trailing)</td>
<td>Hinge</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(ii) Give **one** exercise that could be used to strengthen the rectus femoris and **one** exercise to strengthen the tibialis anterior.  

(2 Marks)

(iii) Identify **two** structures of a synovial joint and describe the role of **one** of these structures during physical performance.  

(3 Marks)

**MAY 2008**

1 a) (i) Complete the following joint analysis table below for a right-handed shot putter.  

(4 Marks)

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Joint Type</th>
<th>Articulating Bones</th>
<th>Movement</th>
<th>Agonist</th>
<th>Antagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Shoulder</td>
<td></td>
<td></td>
<td>Abduction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) What type of contraction is occurring in the shoulder muscles to hold the “crucifix” position on the rings in Gymnastics.  

(1 Mark)

(iii) What movement is occurring in the ankle joint of the Gymnast performing the “crucifix”?  

(1 Mark)