BTEC

Pearson BTEC Level 3 National in Sport and Exercise Science

Unit 2: Functional Anatomy

Sample Assessment Materials (SAMs)

For use with Extended Certificate, Foundation Diploma and Extended Diploma in Sport and Exercise Science

First teaching from September 2016 **Issue 3**

Pearson

BTEC

Pearson BTEC Level 3 Nationals

Write your name here

Surname	Forename

Learner Registration Number

Centre Number

Level 3

Sport and Exercise Science

Unit 2: Functional Anatomy

Extended Certificate, Foundation Diploma, Diploma, Extended Diploma

Sample Assessment Materials for first teaching September 2016 onwards

Time: 1 hour 30 minutes

You do not need any other materials.

Total marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – there may be more space than you need.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in grey boxes.
  – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Paper reference
XXXX/XX
S50444A

1/1/1/1/1/1

S 5 0 4 4 4 A 0 1 1 3

Turn over ▶

PEARSON

1 State the location and function of the Sino Atrial Node (SAN).

.....

.....

.....

Total for Question 1 = 2 marks

2 Give the meaning of the following anatomical terms

(a) Anterior

1 mark

.....

.....

.....

(b) Peripheral

1 mark

.....

.....

.....

Total for Question 2 = 2 marks

3 Describe the function of white blood cells.

Total for Question 3 = 2 marks

4 Explain the function of visceral pleura when breathing.

Total for Question 4 = 4 marks

5 Describe the process of bone remodelling.

Total for Question 5 = 3 marks

6 Describe the process of gaseous exchange in the lungs.

Total for Question 6 = 5 marks

The table below shows an athlete's tidal volume as they take part in a game of hockey.

Tidal volume before taking part in hockey	Tidal volume after 40 minutes of playing hockey
500ml	650ml

7 Explain why the athlete's tidal volume has changed after 40 minutes of playing hockey.

Total for Question 7 = 4 marks

Ben is a high jump athlete and Harry is a 1500m runner. They will recruit different skeletal muscle fibre types to complete their sports.

8 Explain why different muscle fibre types would be recruited when taking part in the high jump and 1500m.

Total for Question 8 = 4 marks

9 Describe how the cardiovascular system helps the body to thermoregulate in hot environments.

Total for Question 9 = 4 marks

Figure 1 shows a basketball player taking a shot.

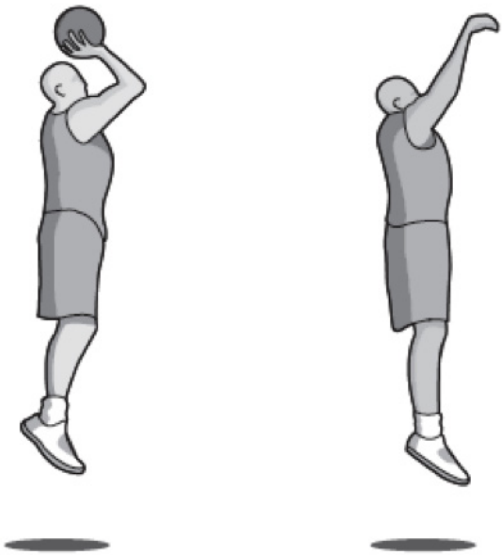

Figure 1

10 Analyse the role of the muscles operating at the shoulder and elbow that allow the basketball player to complete the action shown.

8 marks

Total for Question 10 = 8 marks

Figure 2 shows an athlete using a rowing machine as part of his training session.

(Source: www.gettyimages.co.uk)

Figure 2

11 Analyse how the axial and appendicular skeleton allows the ranges of movement necessary at the shoulder, trunk and wrist for the athlete to adopt the position shown compared to the anatomical standing position.

8 marks

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Total for Question 11 = 8 marks

Figure 3 shows an athlete performing a long jump.

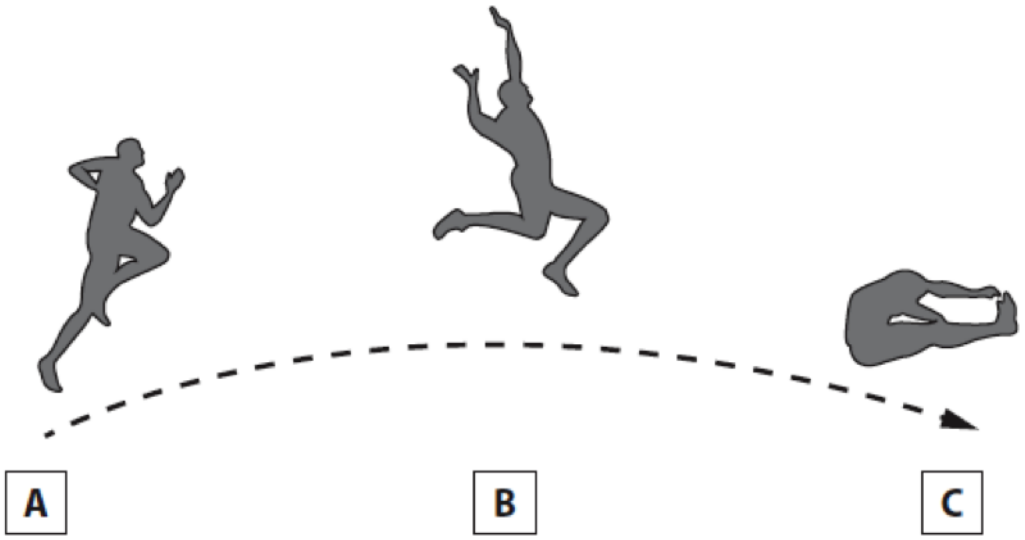

Figure 3

12 Analyse the required movements at the hip, knee and ankle to achieve the position shown at C during the follow through phase of a long jump.

14 marks

Total for Question 12 = 14 marks

END OF EXAM

TOTAL FOR PAPER = 60 MARKS

Unit 2: Functional Anatomy – sample mark scheme

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Learners must be rewarded for what they have shown they can do, rather than be penalised for omissions.
- Examiners should mark according to the mark scheme, not according to their perception of where the grade boundaries may lie.
- All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks, if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, the mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed-out work should be marked unless the candidate has replaced it with an alternative response.

Specific marking guidance for levels-based mark schemes*

Levels-based mark schemes (LBMS) have been designed to assess the learner's work holistically. They consist of two parts: indicative content and level-based descriptors. Indicative content reflects specific content-related points that a learner might make. Levels-based descriptors articulate the skills that a learner is likely to demonstrate in relation to the assessment outcomes being targeted by the question. Different rows in the levels represent the progression of these skills.

When using a levels-based mark scheme, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the assessment focus/objective and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band depending on how they have evidenced each of the descriptor bullet points.

Question number	Answer	Mark
1	Award **1** mark for the identification of the location of the SAN and a further mark for its function. • (Located in the) upper wall of right atrium (1). • Acts as pacemaker to regulate heart beat (1). Accept any other appropriate answer.	**(2)**

Question number	Answer	Mark
2 a)	Award **1** mark for stating the meaning of the anatomical term anterior. Front (of body) (1). Accept any other appropriate responses.	**(1)**
2 b)	Award **1** mark for stating the meaning of the anatomical term peripheral. At the surface (of the body) (1). Accept any other appropriate responses.	**(1)**

Question number	Answer	Mark
3	Answers should contain 2 linked points, which in combination, provides a description of the function of white blood cells. The key function of white blood cells is to protect the body from infectious agents (1), by identifying/destroying/removing damaged/harmful cells (1). Accept any other appropriate answer.	**(2)**

Question number	Answer	Mark
4	Award **1** mark for the identification of the function of visceral pleura and up to **3** marks for an explanation of the function of visceral pleura. The visceral pleura allows the lungs to move freely during breathing (1) by providing a smooth, slippery surface (1). This is possible, as the pleura attaches to the lungs completely covering them (1), preventing friction between the lungs and other organs (1). Accept any other appropriate answer.	**(4)**

Question number	Answer	Mark
5	Answers should contain 3 linked points, which in combination, provides a logical description of the process of bone remodelling. • Bone remodelling is a process of mature bone being removed and new bone being formed (ossification) (1). • Osteoclasts, break down damaged/mature bone (1). • While osteoblasts are bone forming cells, which lay down new bone tissue (1). Accept any other appropriate answer.	**(3)**

Question number	Answer	Mark
6	Answers should contain 5 linked points, which in combination, provides a logical description of the process of gaseous exchange in the lungs. • Gaseous exchange is the process of oxygen moving from the lungs into the blood, and carbon dioxide moving from the blood into the lungs (1). • In the lungs, oxygen diffuses from a high concentration to a lower concentration in the blood stream (1). • In the blood, carbon dioxide diffuses from a high concentration to a lower concentration in the lungs (1). • This process occurs within the alveoli in the lungs and the capillaries (1). • Both walls of these structures are semi-permeable to allow for the gases to pass across them (1). Accept any other appropriate answer.	**(5)**

Question number	Answer	Mark
7	Award **1** mark for identifying the reason for change to tidal volume, and up to **3** additional marks for justifying/rationalising why there is this increase in tidal volume. Credit to a total of **4** marks. Tidal volume increases, as there is a greater demand for oxygen due to exercise (1). Therefore the amount of air in one breath increases from the resting value (1), to make sure there is sufficient oxygen to enable the muscles to repeatedly contract (1). Tidal volume also increases, as the body needs to remove carbon dioxide, which is produced as a waste product (1). Accept any other appropriate answer	**(4)**

Question Number	Indicative content	Mark
8	Award **one** mark for each identification of muscle fibre type for each sport and **one** additional mark for justifying/rationalising why this muscle fibre type is required to be successful in the stated sport. Credit to a total of **four** marks The athletes will need to recruit different muscle fibre types to match the demands of the different activities (1) therefore as the high jumper requires explosive/forceful muscle contractions to lift over the high jump bar (1) they would recruit fast twitch muscle fibres (1) compared to the 1500m runner who will require slow twitch muscle fibres to allow for sustained muscle contraction over the length of the race (1) Accept any other appropriate answer.	**(4)**

Question number	Answer	Mark
9	Answers should contain 4 linked points, which in combination, provides a logical description of the process of heat loss via the cardiovascular system. • The arterioles vasodilate (1). • This makes the superficial arterioles at the skin surface open (1). • This brings blood closer to the skin surface (1). • This then allows heat loss from the blood to the air, through sweat evaporating (1). Accept any other appropriate answer.	**(4)**

<table>
<tr><th>Question number</th><th>Indicative content</th><th>Mark</th></tr>
<tr><td>10</td><td>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content (table and text) and level descriptors below. The indicative content that follows is not prescriptive, additional information demonstrating knowledge of the muscular system to ensure efficient execution of the move can be provided to show a deeper understanding of the interrelationships within the system to bring about fluid movement. Answers may cover some/all of the indicative content but should be rewarded for other relevant answers.

<table>
<tr><td>Joint</td><td>Joint movement</td><td>Muscles at A</td><td>Muscles at B</td></tr>
<tr><td rowspan="2">Shoulder</td><td rowspan="2">Flexion</td><td>Agonist – Anterior deltoid</td><td>Agonist – Anterior deltoid</td></tr>
<tr><td>Antagonist – Latissimus dorsi</td><td>Antagonist – Latissimus dorsi</td></tr>
<tr><td rowspan="2">Elbow</td><td rowspan="2">Flexion to Extension</td><td>Agonist – biceps</td><td>Agonist – triceps</td></tr>
<tr><td>Antagonist – triceps</td><td>Antagonist – biceps</td></tr>
</table>

Working muscles at joints

• Shoulder: Anterior deltoid, latissimus dorsi
• Elbow: triceps, biceps

Type of muscle contraction

• Concentric muscle action due to movement throughout

At A (preparation phase):

• The agonist muscles are the anterior deltoid and the biceps.
• The antagonist muscles are the latissimus dorsi and triceps they stay relaxed to allow the anterior deltoid and biceps to contract.
• During the preparation phase concentric contractions in the anterior deltoid and the biceps produce flexion at the shoulder and flexion at the elbow.
• These concentric contractions allow the basketball player to correctly align the basketball to the target so they can produce an accurate shot

At B (execution phase):

• The agonist muscles are the anterior deltoid and the triceps.
• Although there is movement at the shoulder, the shoulder remains flexed due to the continued forward movement of the arm during the action.
• The antagonist muscles are the latissimus dorsi and biceps they stay relaxed to allow the anterior deltoid and triceps to contract.
• During the follow through phase concentric contractions in the anterior deltoid and the triceps produce flexion at the shoulder and extension at the elbow.
• These concentric contractions allow the basketball player to complete the follow through ensuring the ball follows the correct line to the</td><td>(8)</td></tr>
</table>

	basket **Additional muscle action supporting movement:** Other muscles will act as synergists and fixators to stabilise the shoulder joint throughout the movement, increasing functionality of the movement, maximising the force generated.	

Level	Mark	Descriptor
Level 0	**0**	No rewardable material
1	**1-3**	Demonstrates isolated elements of Knowledge and Understanding Breaks the situation down into component parts and a few of the points made will be relevant to the context in the question Limited analysis which contains generic assertions rather than interrelationships or linkages
2	**4-6**	Demonstrates some accurate Knowledge and Understanding Breaks the situation down into component parts and some of the points made will be relevant to the context in the question Displays a partially developed analysis which considers some interrelationships or linkages but not always sustained
3	**7-8**	Demonstrates mostly accurate Knowledge and Understanding Breaks the situation down into component parts and most of the points made will be relevant to the context in the question Displays a developed and logical analysis which clearly considers interrelationships or linkages in a sustained manner

<table>
<tr><th>Question number</th><th>Indicative content</th><th>Mark</th></tr>
<tr><td>11</td><td>
Learners are expected to provide answers in line with the information in the tables for each phase of the movement.

Interrelationships at each phase are expected to be provided, with full written analysis of how the skeletal and muscular system are working together to perform the movements. Additional information demonstrating knowledge of the skeletal and muscular system can be provided, to show a deeper understanding of the interrelationships between the two systems.

Marks will be awarded in relation to the detail and depth of coverage for each phase of movement.

Range of movement permitted at the synovial joints due to shape of articulating bones and associated ligaments, can also be explored.
<table>
<tr><th>Joint/area of body</th><th>Type of joint</th><th>Bones</th><th>Joint movement</th><th>Plane of movement</th></tr>
<tr><td>Shoulder</td><td>Ball and socket</td><td>Scapula
Clavicle
Humerus</td><td>Extension</td><td>Sagittal</td></tr>
<tr><td>Trunk</td><td>Gliding</td><td>Vertebral column</td><td>Extension</td><td>Sagittal</td></tr>
<tr><td>Wrist</td><td>Condyloid</td><td>Radius
Ulna
Carpals</td><td>Pronation</td><td>Transverse</td></tr>
</table>
Additional factors responsible for movement

Joint shape determines range of motion, due to shape of articulating surfaces and arrangement of other structures supporting the joint, e.g. ligaments.

Shoulder

• Ball and socket joint.
• The joint is formed by the articulation of the scapula, clavicle and humerus.
• Although a great range of movement is possible at the shoulder due to the shape made by the articulating bones, to achieve the rowing position shown, the movement is an extension of the shoulder, as the arm has moved behind the anatomical position.

Trunk

• Made up of gliding joints.
• The joints are formed by the articulation of the vertebrae in the vertebral column.
• Unlike other synovial joints, there is limited movement at gliding joints in order to limit injury.
</td><td>(8)</td></tr>
</table>

	• Unlike the shoulder and wrist, the joints of the vertebral column form part of the axial skeleton. • Although limited movement at each joint due to the number forming the vertebra column, a larger range of movement can be seen, allowing the rower to move the trunk back. **Wrist** • Condyloid joint. • The joint is formed by the articulation of the radius, ulna, carpals. • As the ankle is a condyloid, joint movement is possible in more than one plane, however, in this case it is in the transverse plane. • In the picture, we can see the athlete's wrists are pronated in order to hold the 'handle' of the rowing machine.	

Level	Mark	Descriptor
Level 0	**0**	No rewardable material
1	**1-3**	Demonstrates isolated elements of Knowledge and Understanding Breaks the situation down into component parts and a few of the points made will be relevant to the context in the question Limited analysis which contains generic assertions rather than interrelationships or linkages
2	**4-6**	Demonstrates some accurate Knowledge and Understanding Breaks the situation down into component parts and some of the points made will be relevant to the context in the question Displays a partially developed analysis which considers some interrelationships or linkages but not always sustained
3	**7-8**	Demonstrates mostly accurate Knowledge and Understanding Breaks the situation down into component parts and most of the points made will be relevant to the context in the question Displays a developed and logical analysis which clearly considers interrelationships or linkages in a sustained manner

<table>
<tr><th>Question number</th><th>Indicative content</th><th>Mark</th></tr>
<tr><td>12</td><td>
Learners are expected to provide answers in line with the information in the table, for the stated phase of the movement.

Interrelationships in the phase are expected to be provided, with full written analysis of how the skeletal and muscular system are working together to perform the movement. Additional information demonstrating knowledge of the skeletal and muscular system can be provided, to show a deeper understanding of the interrelationships between the two systems.

Marks will be awarded in relation to the detail and depth of coverage of movement.

At C – Follow through phase
<table>
<tr><th>Joint</th><th>Type of joint</th><th>Bones</th><th>Plane of movement</th><th>Joint movement</th><th>Muscles</th><th>Muscle contraction</th></tr>
<tr><td>Hip</td><td>Ball and socket</td><td>Femur
Pelvis</td><td>Sagittal</td><td>Hip flexion</td><td>Agonist – hip flexors
Antagonist – gluteals</td><td>Concentric</td></tr>
<tr><td>Knee</td><td>Hinge</td><td>Femur
Fibula
Tibia</td><td>Sagittal</td><td>Knee extension</td><td>Agonist – quadriceps
Antagonist - hamstrings</td><td>Concentric</td></tr>
<tr><td>Ankle</td><td>Hinge</td><td>Tibia
Fibula
Tarsals</td><td>Sagittal</td><td>Dorsiflexion</td><td>Agonist – tibialis anterior
Antagonist – gastrocnemius</td><td>Concentric</td></tr>
</table>
All three joints are synovial joints, allowing a specific range of movement.

The muscles that work across each joint are connected to the bone via tendons.

The bones of each joint are held together securely by ligaments, to provide stability at the joint.

Hip

• Ball and socket joint.
• The joint is formed by the articulation of the femur and pelvis.
• Although a great range of movement is possible at the hip, due to the shape made by the articulating bones at position J, the movement is flexion of the hip to allow the leg shoot. This allows the long jumper to reach as far forward into the sand as possible, to maximise his score
• The muscles that bring about flexion at the hip, are the hip flexors. The hip flexors are the agonist muscle. In order for the hip flexors to contract, the antagonist, in this case the gluteals, must relax.
</td><td>(14)</td></tr>
</table>

	• As the hip flexors contract they shorten, pulling on the bone attached to the muscle's insertion point, in this case the femur, allowing the leg shoot. • As there is movement at the hip in the long jumper, the type of muscle contraction is concentric. **Knee** • Hinge joint. • The joint is formed by the articulation of the femur, fibula and tibia. • As the knee is a hinge joint, movement is only possible in one plane, the sagittal plane. • Flexion and extension occurs in the sagittal plane. In the picture, we can see the long jumper extends both his legs at the knee, in order to stretch them as far forward as possible. • The muscles that bring about extension at the knee are the quadriceps. The quadriceps are the agonist muscle. In order for the quadriceps to contract, the antagonist, in this case the hamstrings, must relax. • As the quadriceps contract, they shorten, pulling on the bone attached to the muscles insertion point, in this case the tibia, allowing the leg shoot. • As there is movement at the knee, in this phase of the long jump, the type of muscle contraction is concentric. **Ankle** • Hinge joint. • The joint is formed by the articulation of the tibia, fibula and tarsals. • As the ankle is a hinge joint, movement is only possible in one plane, the sagittal plane. • In the picture we can see the long jumper's ankles are dorsi-flexed. • The muscles that bring about dorsiflexion at the ankle is the tibialis anterior. The tibialis anterior is the agonist muscle. In order for the quadriceps to contract, the antagonist, in this case the gastrocnemius, must relax. • As the tibialis anterior contract, they shorten, pulling on the bone attached to the muscles insertion point, in this case the tarsals, allowing this movement at the ankle. • As there is movement at the ankle, in this phase of the long jump, the type of muscle contraction is concentric.	

Level	Mark	Descriptor
Level 0	**0**	No rewardable material
1	**1-5**	Demonstrates isolated elements of Knowledge and Understanding Breaks the situation down into component parts and a few of the points made will be relevant to the context in the question Limited analysis which contains generic assertions rather than interrelationships or linkages
2	**6-10**	Demonstrates some accurate Knowledge and Understanding Breaks the situation down into component parts and some of the points made will be relevant to the context in the question Displays a partially developed analysis which considers some interrelationships or linkages but not always sustained
3	**11-14**	Demonstrates mostly accurate Knowledge and Understanding Breaks the situation down into component parts and most of the points made will be relevant to the context in the question Displays a developed and logical analysis which clearly considers interrelationships or linkages in a sustained manner

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