Examiners' Report/
Lead Examiner Feedback

June 2018

BTEC Level 3 National in Sport
Unit 1: Anatomy and Physiology
(31524H)

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Grade Boundaries

What is a grade boundary?
A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade (Distinction, Merit, Pass and Near Pass). The grade awarded for each unit contributes proportionately to the overall qualification grade and each unit should always be viewed in the context of its impact on the whole qualification.

Setting grade boundaries
When we set grade boundaries, we look at the performance of every learner who took the assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark should be for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

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Each test we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each test, because then it would not take into account that a test might be slightly easier or more difficult than any other.

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Unit 1: Anatomy and Physiology

Grade	Unclassified	Near Pass	Pass	Merit	Distinction
Boundary Mark	0	11	22	38	54

Introduction

This was the third series of the new specification, and the second time that this unit has been assessed under the new rubrics. Centres and candidates should be congratulated on their preparation for this change to the assessment format. Overall, candidates performed better than the January series and it was obvious that they prepared for many of the specification topics covered in this assessment, to which they need congratulating for.

The question paper followed the format identified in the sample assessment materials. The paper was split into six sections. Each section was based on a sport or exercise scenario and required candidates to demonstrate knowledge and understanding of a range of specification topics and apply this knowledge to the specific question scenario. Each section is weighted in accordance to the specification design.

As in January the extended response questions were marked using a 'levels based' approach to assessment where the overall quality of the response was considered rather than the specific number of facts stated from the indicative content, although this obviously had a bearing on the quality of the response. The remainder of the questions on the paper were assessed using a traditional points-based approach, where a mark was given for each appropriate point. More detail can be found below in the individual question section of the report.

Introduction to the Overall Performance of the Unit

This report has been written to help you understand how candidates have performed overall in the exam. For each question there is a brief analysis of candidate responses. You will also find examples of candidate responses to the questions that have been well answered. These should help to provide additional guidance. We hope this will help you to prepare your candidates for future examination series.

Candidate performance varied throughout the paper. Whilst the extended response questions still provided the greatest challenge, most candidates gained some marks for these questions. The style of the assessment is challenging due to the depth and breadth of knowledge required to fully address the demands of the paper. The extended writing questions account for just over 30% of the paper, each question demanding depth of knowledge, but across the paper this also requires breadth as each of these questions examines different areas of the specification.

The assessment is also challenging due to the need to apply knowledge not only in the extended answer questions but also the 'points-based' questions.

It was clear that some candidates did not make full use of the stimulus material provided in the question, but this is getting better series by series. To reiterate with explain command verb questions there is an expectation that knowledge and understanding tested is applied to the situation in context and expansion marks are awarded accordingly.

As always the emphasis in this paper is on candidate's application of their knowledge to a variety of practical sports related situations. The higher marks, particularly in levelled response questions (Sections C-F), will always focus on the ability to demonstrate application rather than the ability to recall theory. It will be important for candidates to have the opportunity to practice this in their preparation for the assessment. Candidates that were able to access higher marks for these questions were able to apply their knowledge and understanding to the stimulus and provide realistic and appropriate responses.

As this is a vocational sports related subject, the external assessment seeks to put the candidates in applied sporting related situations and asks them to respond to these: this method of questioning will continue in the future. It is therefore essential that centre's stress to candidates the need to read the stimulus information carefully before they answer questions, and be prepared to use this information within their responses, this also applies when graphical or statistical data is supplied.

Where candidates are unable to apply the stimulus in their answer it will significantly restrict the number of marks candidates can receive. Generic responses will only gain limited credit.

Where the stimulus material uses a particular sport, it is not necessary for

candidates to have an in-depth knowledge of this type of sport in order to answer the questions well, however, an awareness of the basic requirements of sports are expected which will have been covered in core curriculum PE lessons throughout KS3 and KS4.

Individual Questions

The following section considers each question on the paper, providing examples of popular candidate responses and a brief commentary of why the responses gained the marks they did. This section should be considered with the live external assessment and corresponding mark scheme.

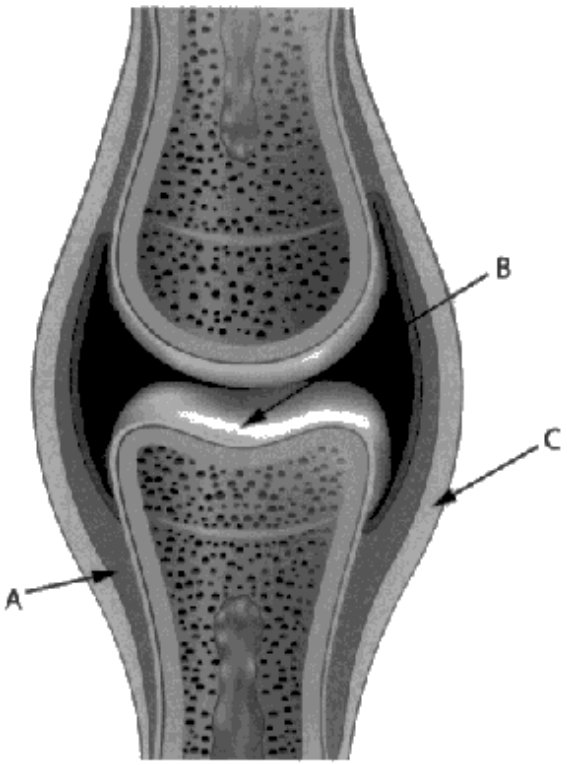
Q1(a)
The majority of candidates did not perform as anticipated on this question, with many identifying the cartilage as the bone. Available marks for identification of the joint capsule, (articular/hyaline) cartilage and ligament as correct answers. It is important that technical terminology is used and phonetic spelling was credited. Common errors were cartilage being labelled as synovial fluid.

This response gained 2 marks

Figure 1 shows a synovial joint.

1 (a) Name the components of the synovial joint labelled A–C in **Figure 1**.

(3)



(Source: © Tefi/Shutterstock)

Figure 1

A Articular cartilage Bursa

B Articular cartilage Bursa Articular cartilage

C Ligament

Q1(b)
Candidates were required to give three functions of synovial fluid (A.3). Many identified to 'provide lubrication and 'prevent friction. Significantly less candidates correctly identified act as a shock absorber and nourishes the cartilage. Common errors made were helps movement, to be awarded this point it needs to indicate an increase to the range of movement.

This response gained 3 marks

(b) Synovial fluid is a thick liquid found in synovial joints.

Give **three** functions of synovial fluid.

(3)

It allows a wider range of movement at the joint by lubricating it. It protects the bones from rubbing against each other. It provides minerals to the bones in the joint.

Q2
Candidates were required to identify two postural deviations from the specification (A.1) and then describe what they are. Many identified to 'kyphosis and scoliosis' and were awarded the 2 marks. Significantly less candidates correctly described both of these deviations, with many answers being to generic. Common errors made were 'curve of the spine' without any reference to sideways, for the case of scoliosis and therefore did not achieve any marks.

This response gained 4 marks.

Michael is a high jumper. He has recently experienced severe pain and his doctor has diagnosed postural deviations.

2 Complete the table by:

(a) giving **two** types of postural deviation in Column A.

(2)

(b) giving **one** characteristic of each type of postural deviation in Column B.

(2)

	Column A	**Column B**
	Type of postural deviation	**Characteristic of postural deviation**
1	Scoliosis	Abnormal curvature of the spine to the right or left
2	Kyphosis	Abnormal overcurvature of the spine. 'Hunchback'.

This response gained 3 marks.

Michael is a high jumper. He has recently experienced severe pain and his doctor has diagnosed postural deviations.

2 Complete the table by:

(a) giving **two** types of postural deviation in Column A.

(2)

(b) giving **one** characteristic of each type of postural deviation in Column B.

(2)

	Column A	**Column B**
	Type of postural deviation	**Characteristic of postural deviation**
1	kyphosis	'hunch back' shaped appearance of the back.
2	Scoliosis	~~curvature~~ curviture of the spine ~~low~~

Q3 (a) & (b)
The majority of candidates gained both available marks for this question by correctly identifying a flat bone and it's function. It is important that technical terminology is used and phonetic spelling is credited. Common errors were the skull being used rather than the cranium in some cases and candidates will not gain any credit for this. It is important that centre's delivery the bones that are found in the specification (A.1) and use those terms only.

This response gained 2 marks.

3 (a) Give an example of a flat bone.

(1)

Sternum

(b) State the function of a flat bone.

(1)

To protect a vital organ e.g sternum protects heart

(Total for Question 3 = 2 marks)

This response gained 1 mark

3 (a) Give an example of a flat bone.

(1)

Pelvis

(b) State the function of a flat bone.

(1)

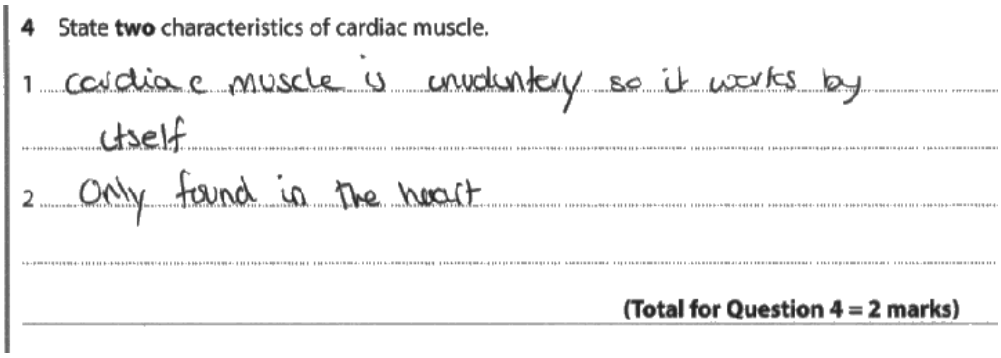
to provide Support

(Total for Question 3 = 2 marks)

Q4 The majority of candidates gained the at least one of the two marks

available for this question, with many achieving the mark for identification of 'involuntary'. Common errors were replacing a characteristic with a function 'it allows blood to be pumped around the body'.

This response gained 2 marks

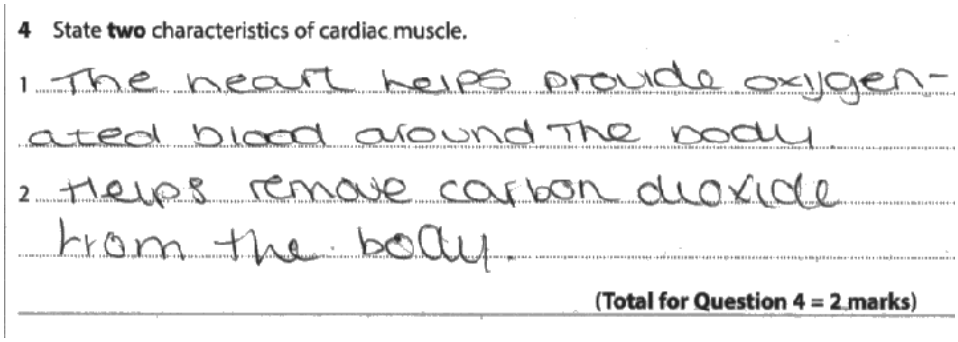

4 State **two** characteristics of cardiac muscle.

1 cardiac muscle is unvolentery so it works by itself

2 Only found in the heart

(Total for Question 4 = 2 marks)

This response gained 0 marks


4 State **two** characteristics of cardiac muscle.

1 The heart helps provide oxygen-ated blood around the body

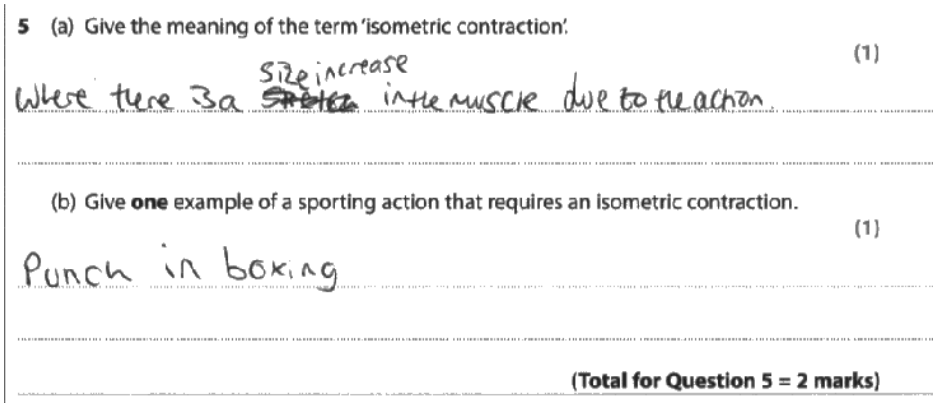
2 Helps remove carbon dioxide from the body.

(Total for Question 4 = 2 marks)

Q5 (a) & (b)

Candidates were required to describe an isometric contraction. Correct responses identified that it is a contraction where no movement takes place in the muscle, this was followed by an example from sport that uses an isometric contraction. Common errors made were 'lengthens the muscle' which is an eccentric contraction, therefore, incorrect knowledge and therefore did not achieve any marks.

This response gained 0 marks


5 (a) Give the meaning of the term 'isometric contraction'.

(1)

Where there is a size increase in the muscle due to the action.

(b) Give **one** example of a sporting action that requires an isometric contraction.

(1)

Punch in boxing

(Total for Question 5 = 2 marks)

This response gained 2 marks

5 (a) Give the meaning of the term 'isometric contraction'.

(1)

Where the muscle doesn't lengthen or shorten (no movement).

(b) Give **one** example of a sporting action that requires an isometric contraction.

(1)

A gymnast holding a position e.g hand stand, head stand.

(Total for Question 5 = 2 marks)

Q6 (ai)

The majority of candidates gained the mark for stating that the mitochondria produces energy as the correct answer.
Common errors were confusing the mitochondria with haemoglobin.

This response gained 1 mark

Jane is an 800m runner. One of the adaptations of her training is an increase in the size and number of her mitochondria.

6 (a) (i) State the function of mitochondria.

(1)

To produce energy

This response gained 0 marks

Jane is an 800m runner. One of the adaptations of her training is an increase in the size and number of her mitochondria.

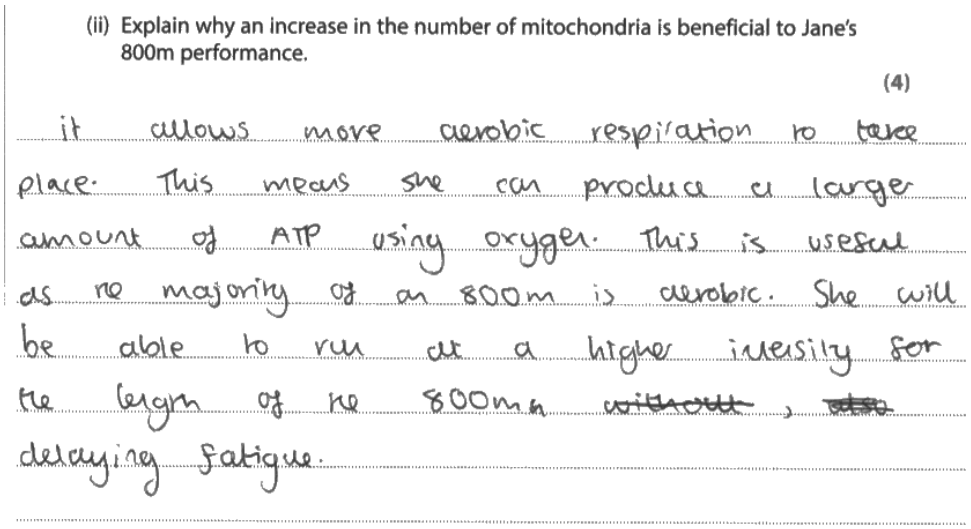
6 (a) (i) State the function of mitochondria.

(1)

mitochondria Contains Oxygen In the muscle Cell Walls

Q6 (aii)
Candidates were required to explain why an increase in mitochondria would benefit performance in the 800m. The majority of candidates correctly identified the one of the linked expansions, most often around performance but very few labelled correctly the reduced anaerobic energy production and therefore less lactic acid is produced. Also very few state that more mitochondria would allow more energy to be produced aerobically. Common errors made encompassed a lack of knowledge of what the mitochondria are and confusion with haemoglobin.

This response gained 3 marks.

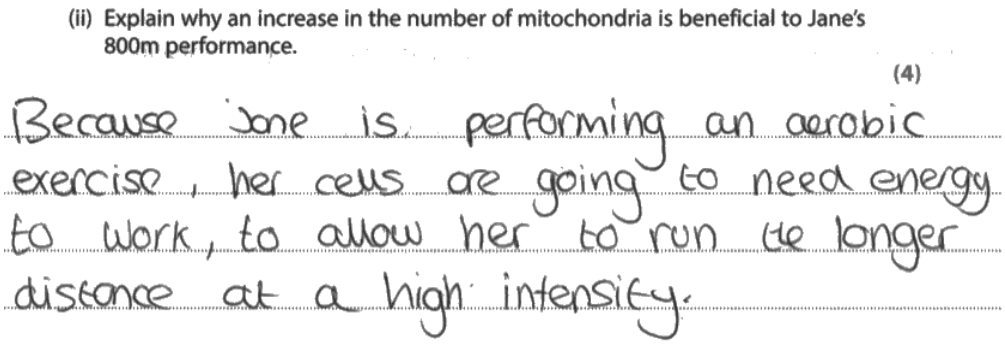


(ii) Explain why an increase in the number of mitochondria is beneficial to Jane's 800m performance.

(4)

it allows more aerobic respiration to take place. This means she can produce a larger amount of ATP using oxygen. This is useful as the majority of an 800m is aerobic. She will be able to run at a higher intesity for the length of the 800m, ~~without~~, ~~also~~ delaying fatigue.

This response gained 1 mark.



(ii) Explain why an increase in the number of mitochondria is beneficial to Jane's 800m performance.

(4)

Because Jane is performing an aerobic exercise, her cells are going to need energy to work, to allow her to run the longer distance at a high intensity.

Q6(b)

Candidates found this question difficult and were required to explain why type IIa fibres are suited to competing in exercise (800m race), other than resisting fatigue (B.5). The candidates could articulate what it does but lacked detail and clarity desired by the mark scheme, many repeated the question and brought in withstanding fatigue. Many talked about a sprint finish and therefore discussing type IIx fibres and not the type IIa as in the question.

This response gained 2 marks

One reason Type IIa muscle fibres are important to an 800m runner's performance is that they are more resistant to fatigue than Type IIx muscle fibres.

(b) Explain one **other** reason that Type IIa muscle fibres are important to an 800m runner's performance.

(3)

Type IIa muscle fibres are fast twitch, this means they allow fast and powerful movement, this mean that the runner can run faster for longer as they are also more resistant to fatigue.

Q7

The majority of candidates gained at least 2 marks for this question, with many achieving 3 marks for identification of the epiglottis, trachea and bronchioles as correct answers. It is important that technical terminology is used and phonetic spelling was credited.

This response gained 3 marks

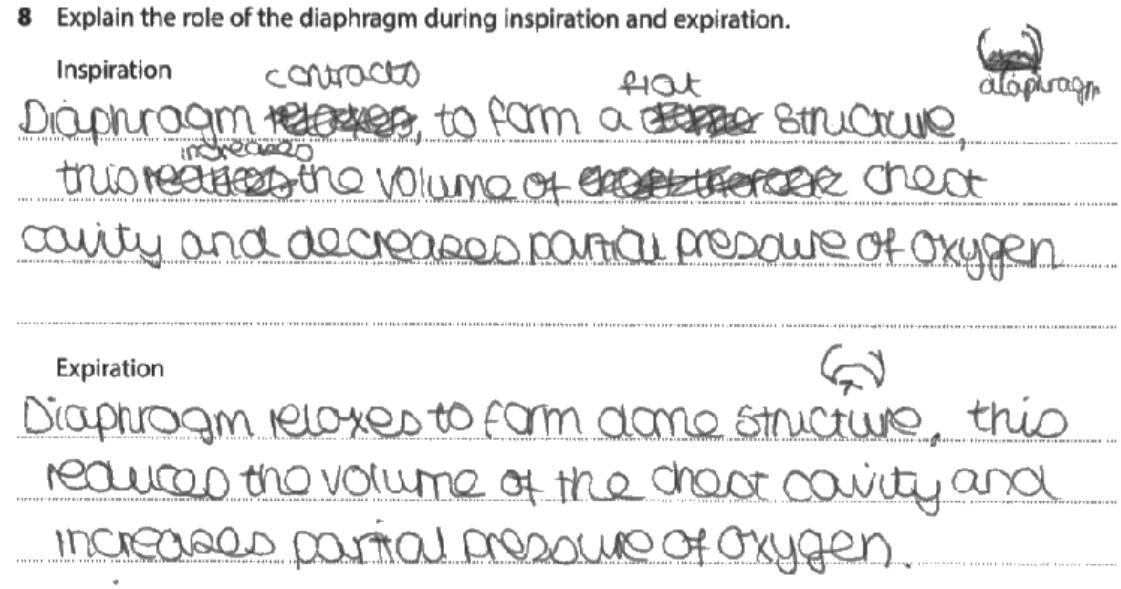
7 Name the structures, A–C, described in **Table 1**.

Structure	Description
A epiglottis	A flap of cartilage at the base of the tongue, which prevents food from entering the windpipe.
B trachea	Large single tube strengthened by rings of cartilage.
C bronchioles	Tiny airways that carry oxygen to the alveoli.

Q8

Candidates were required to explain the role of the diaphragm, during inspiration and expiration. The majority of candidates correctly identified it contracts and relaxes in both phases of the mechanisms of breathing. Also very few stated one of the linked expansions, mostly often around thoracic cavity increasing/decreasing in size. Common errors made included contraction and relaxation in the wrong place and the link between flattening and contracting and doming and relaxing

This response gained 4 marks



8 Explain the role of the diaphragm during inspiration and expiration.

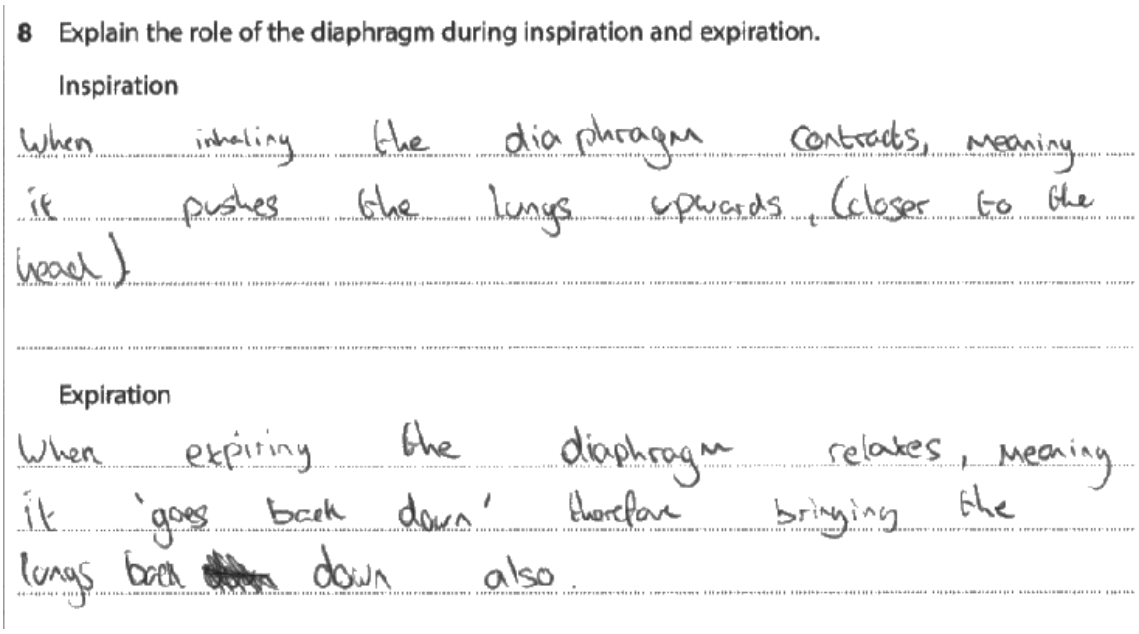
Inspiration

Diaphragm contracts to form a flat structure, this increases the volume of thorax chest cavity and decreases partial pressure of oxygen

Expiration

Diaphragm relaxes to form dome structure, this reduces the volume of the chest cavity and increases partial pressure of oxygen.

This response was awarded 2 marks



8 Explain the role of the diaphragm during inspiration and expiration.

Inspiration

When inhaling the diaphragm contracts, meaning it pushes the lungs upwards, (closer to the head)

Expiration

When expiring the diaphragm relaxes, meaning it 'goes back down' therefore bringing the lungs back down also.

Q9(a)

This was a recall question for stating the meaning of the term tidal volume. Common errors were included forced breathing and it is the volume of oxygen rather than air.

This response was awarded 1 mark.

9 (a) State the meaning of the term 'tidal volume'.

(1)

tidal volume is the volume of air breathed in and out with one breath

This response was awarded 0 marks.

9 (a) State the meaning of the term 'tidal volume'.

(1)

the amount of oxygen taken in, in one breath.

Q9(b)

This was a recall question and continuation from the previous question for stating the other respiratory response other than increased tidal volume. Common errors were included increased heart rate, although this is correct it is not a respiratory response (C.5).

This response was awarded 1 mark.

Increased tidal volume is one immediate response of the respiratory system to exercise.

(b) State **one other** response of the respiratory system when starting sport or exercise

Increased breathing rate

This response was awarded 0 marks.

Increased tidal volume is one immediate response of the respiratory system to exercise.

(b) State **one other** response of the respiratory system when starting sport or exercise

(1)

Increased rate of gaseous exchange

Q10

This was the first extended response question of the paper and focused on the immediate and long term effects of altitude training on an individual's respiratory system. Responses for the question required focus on the immediate effects and the difficulty experience and the long term benefits of being at altitude and the indicative content was written accordingly, to encompass this knowledge and application.

Like all of the extended response questions, the quality of candidates' responses varied. Some candidates were clearly very knowledgeable about altitude and the effects both immediate and long term. Other candidates were unable to address the question fully due to confusion between the cardiovascular system and respiratory system.

Level 1 responses tended to focus on one area or provided a list with no development of the points within the indicative content. At level 3 candidates' responses provided accurate knowledge of altitude process, analysed both immediate and long term effects, used technical terminology with clear development of the point and referenced to long distance cycling.

Overall this was a challenging question and it was obvious from a number of responses that this knowledge was lacking, although a clear specification point. A number discussed the impacts on the cardiovascular system, when it was in the respiratory section.

This response was placed at Level 3 and given 6 marks. The answer clearly assesses a number of points from the indicative content, focusing on both immediate and long term effects and reference to cycling performance, with appropriate development in reference to the question.

Cameron is a long distance cyclist.

10 Discuss the immediate **and** long-term effects of altitude training on Cameron's respiratory system.

(6)

When Cameron first starts cycling in a high altitude he may experience hypoxia. This is due to the decrease in partial pressure of oxygen in the air. Because of the decreased particle pressure of oxygen, ~~he will~~ his breathing rate + depth will increase to try and cope with the low amount of oxygen. Also, there will be a lower amount of oxygen in the ~~lung~~ alveoli, reducing the concentration gradient of oxygen between the capillaries and alveoli. This means that there may be a decrease in the ~~amount of go~~ speed of gas exchange. Due to the low amount of oxygen available in the alveoli, there will be a lower amount that will be able to bind with the haemoglobin and get transported to the muscles ~~for~~ to be used in aerobic respiration. This may result in muscle fatigue if the oxygen demands aren't met. He may also experience altitude sickness due to the low partial pressure of oxygen in the air. This could mean he is unable to train and may be characterised by shortness of breath, dizziness and nausea. He could also hyperventilate due to the increased rate of breathing. Although the immediate effects are mainly negative, the long-term effects are more positive. As a result of his body trying to cope with the low partial pressure of oxygen, his lungs will increase in size. This means that when he returns to a normal altitude, his vital capacity and total lung volume will increase, enabling him to increase the amount of oxygen he breathes in and is therefore available for aerobic respiration. His red blood cell count will also increase ~~as~~ as a way to increase the amount of oxygen available in the muscles at a high altitude. This means that when he returns to normal altitude, he will be able to transport oxygen to the ~~lungs~~ muscles more efficiency so he can produce more ATP aerobically. This means he will be able to cycle at a higher intensity for longer / delaying fatigue.

(Total for Question 10 = 6 marks)

This response was placed at Level 1 and given 2 marks. The answer assesses some points from the indicative content, focused on immediate experiences 'harder to breathe' due to 'less oxygen' and generates more credit. For the long term effects, cardiovascular responses were discussed and although correct, were not required within this section.

Cameron is a long distance cyclist.

10 Discuss the immediate **and** long-term effects of altitude training on Cameron's respiratory system.

(6)

When training at a high altitude an immediate affect would be an increase in breathing rate. The reason for this, is because the higher up that you go, the less oxygen there is, so it will be harder to breathe. Another immediate effect would be that there is an increase in blood cell production. As our breathing rate increases, so will our blood cell production. This is because we need as much blood and oxygen as we can to get to the working muscles.

A long term effect would be a decrease in resting heart rate and also working heart rate, this is because the altitude training will make the heart bigger and stronger, therefore less blood will be needed. This leads to a decrease in breathing rate because you will need less oxygen due to the decrease in heart rate.

Q11

This was a recall question for describing the flow of oxygenated blood through the heart. A number of responses were incorrect. Common errors were, that it was carried along the right side of the heart and some candidates also got the ordering incorrect and therefore marks could not be awarded.

This response gained 4 marks.

One of the functions of the cardiovascular system is to deliver oxygen to the working muscles.

11 Describe, in the correct order, the flow of **oxygenated blood** through the heart.

oxygenated blood enters the heart through the pulmonary veins vena cava. It becomes oxygenated and flows through the left atrium to the left ventricle through the bicuspid valve. It then goes up the aorta which redistributes this oxygenated blood around the body to muscles and the brain.

Q12

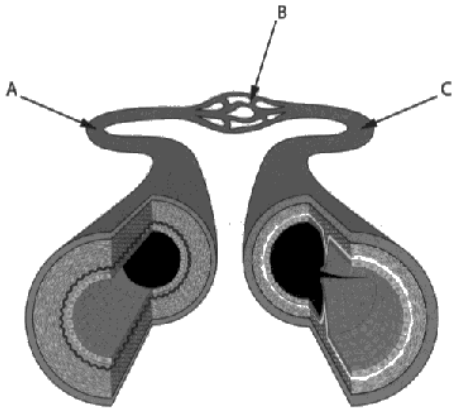
The majority of candidates gained at least 2 marks for this question, with many achieving 3 marks for identification of the arteries/arterioles, capillaries and venules/veins as correct answers. It is important that technical terminology is used and phonetic spelling was credited. Common mistakes were labelling arteries as veins and veins as arteries.

This response gained 3 marks

Figure 2 shows the various types of blood vessel.

12 Name the blood vessels labelled A–C in **Figure 2**.

(3)



(Source: © Blamb/Shutterstock)

Figure 2

A Arteries / Arteriole

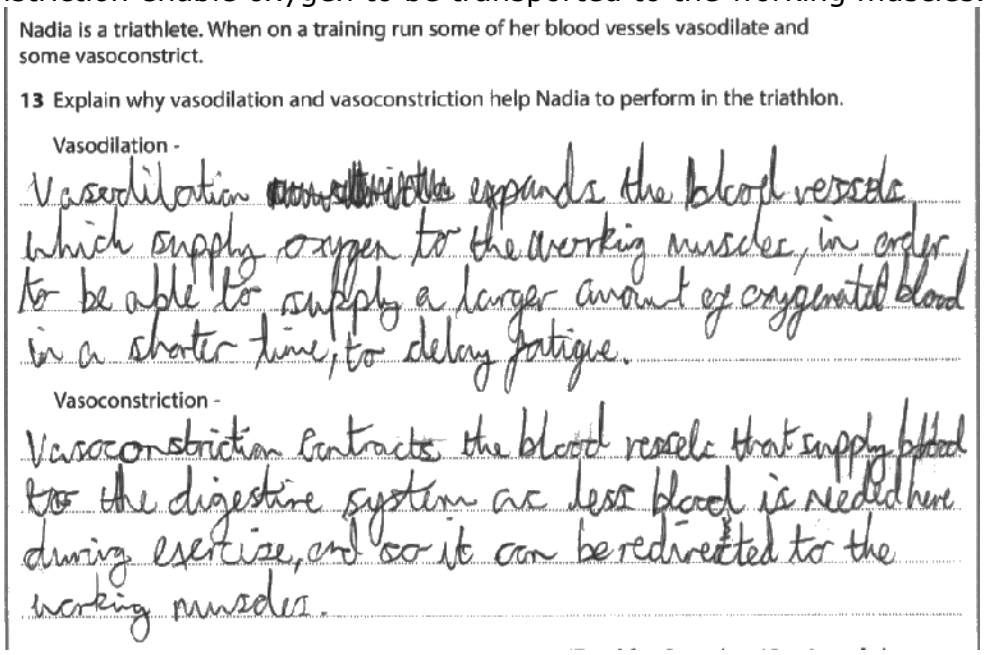
B capillaries

C vein / venule

Q13

This question required candidates to explain why vasoconstriction and vasodilation would help performance within a triathlon. Credit was awarded for linking oxygen to working muscles without appropriate linked expansion or control of body temperature with appropriate linked expansion, but not mixing the two within the same response. Common errors made were using the same expansion point for part vasoconstriction and vasodilation and therefore although correct this expansion point can only be awarded once. This is the same for any other question within this paper and subsequent examination series.

This response gained 4 marks for correctly explaining how vasodilation and vasoconstriction enable oxygen to be transported to the working muscles.



Nadia is a triathlete. When on a training run some of her blood vessels vasodilate and some vasoconstrict.

13 Explain why vasodilation and vasoconstriction help Nadia to perform in the triathlon.

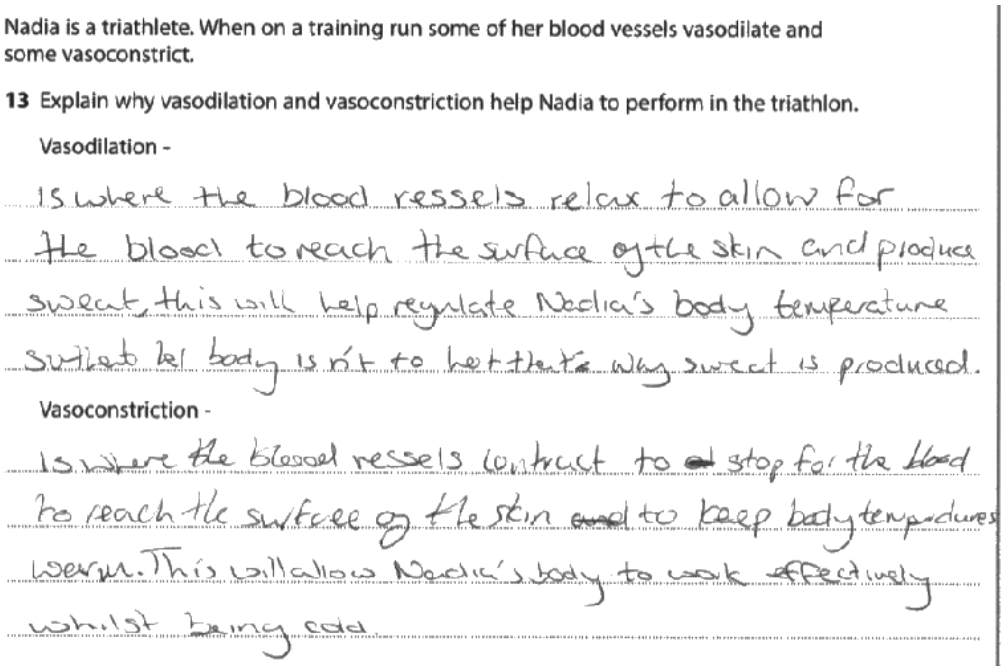
Vasodilation -

Vasodilation expands the blood vessels which supply oxygen to the working muscles, in order to be able to supply a larger amount of oxygenated blood in a shorter time, to delay fatigue.

Vasoconstriction -

Vasoconstriction contracts the blood vessels that supply blood to the digestive system as less blood is needed here during exercise, and so it can be redirected to the working muscles.

This response gained 4 marks for correctly explaining how vasodilation and vasoconstriction control body temperature.



Nadia is a triathlete. When on a training run some of her blood vessels vasodilate and some vasoconstrict.

13 Explain why vasodilation and vasoconstriction help Nadia to perform in the triathlon.

Vasodilation -

Is where the blood vessels relax to allow for the blood to reach the surface of the skin and produce sweat, this will help regulate Nadia's body temperature so that her body is not too hot that is why sweat is produced.

Vasoconstriction -

Is where the blood vessels contract to stop for the blood to reach the surface of the skin and to keep body temperatures warm. This will allow Nadia's body to work effectively whilst being cold

Q14

Candidates were required to explain the changes to cardiac output due to exercise intensity. Many correctly identified that it would increase due to an increase in heart rate and stroke volume. Common errors made were not stating what would happen to cardiac output.

This response gained 3 marks

Figure 3 shows Nadia's heart rate and stroke volume during the running training session.

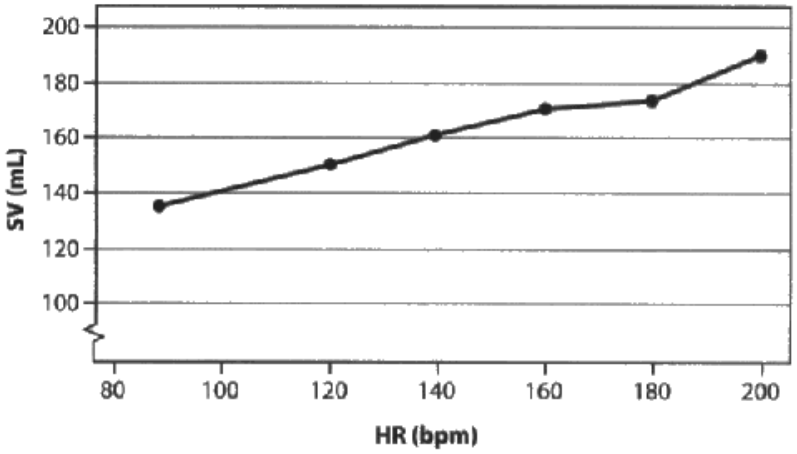


Figure 3

14 Explain the effects of exercise intensity on cardiac output.

(3)

The more intense the exercise is the higher the heart rate she will have. This will cause stroke volume to increase as there will be an increased demand for blood around her body. This will therefore increase her cardiac output.

Q15

This was the second extended response question of the paper and focused on the effects of cardiac hypertrophy on performance in the triathlon and indicative content was written according to encompass this knowledge and application. Like all of the extended response questions, the quality of candidate responses varied. Some candidates were clearly very knowledgeable about the cardiac hypertrophy and the effects, but some candidates struggled to express this in the context of the cardiovascular system.

Level 1 responses highlighted that hypertrophy is that the heart gets bigger and stronger, without much expansion towards the impact of this especially on performance and technical terminology was used sporadically. At level 3 candidates charted the impact of cardiac hypertrophy and the impact on performance, used technical terminology and discussed the impact of the on this on the triathlon.

This response was placed at Level 3 and given 6 marks. The answer clearly assesses a number of points from the indicative content, focusing on the effects of cardiac hypertrophy, with effective use of technical terminology, appropriate development in reference to the question was evident.

Nadia's cardiovascular system has adapted as a result of completing her triathlon training programme.

15 Analyse the effect of cardiac hypertrophy on Nadia's performance in the triathlon.

(6)

Cardiac hypertrophy is the heart as a muscle getting bigger. One way this will benefit her performance in the triathlon is it will increase cardiac output and stroke volume will increase, as more blood will leave the heart per minute and per beat, meaning the muscles will be supplied with an abundance of oxygenated blood. Another effect cardiac hypertrophy will have on her event is that, due to the heart getting bigger/ more efficient, her lactate threshold will increase. This will effect her triathlon performance as it means she can put off lactic acid for longer and work for a longer period of time without fatiguing. Another effect that cardiac hypertrophy will have is that there will be higher levels of blood in the body, this means there will be an abundance of oxygenated blood for the muscles which again means she can put off fatigue. She will also experience a lower working heart rate as the heart will be able to supply the same amount of blood as before but with less beats.

This response was placed at Level 1 and given 1 mark. The answer clearly identifies the heart becoming bigger and stronger, but the expansion to run for a longer time is too vague, this needs to be run for a higher intensity for longer.

Nadia's cardiovascular system has adapted as a result of completing her triathlon training programme.

15 Analyse the effect of cardiac hypertrophy on Nadia's performance in the triathlon.

(6)

Cardiac hypertrophy is the heart becoming bigger and stronger. This is due to Nadia and her training for the triathlon. Her heart needs to be able to work for a long amount of time as it needs to be able to pump blood around the body to the muscles. Due to her training her heart will adapt to this. Due to this Nadia will be able to run the race for a longer time.

The next section of the paper looked at the energy systems, as anticipated candidates found this section more difficult than other sections and this was reflected within their responses, although this was somewhat improved from the January.

Q16

Another recall question where the candidates were required to describe how ATP is broken down and resythesised. Many identified that the bond breaks off the ATP and energy is released, but very few identified that this occurs due to ATPase.

This response gained 4 marks

16 Describe how ATP is broken down for muscular contraction and then resynthesised.

ATP is broken down by an enzyme called ATpase, so adenosine triphosphate loses a phosphate molecule when energy is needed for a contraction to occur, becoming adenosine diphosphate. It is then resynthesised by using fuels such as fats or sugars, which gives ADP the phosphate molecule to resynthesise to ATP, ready to be used again.

This response gained 2 marks

16 Describe how ATP is broken down for muscular contraction and then resynthesised.

As energy is need one of the bonds holding a phosphate molecule will break which provides the body with energy for up to 3 seconds. After this for the body to recover the molecules have to resynthesise this is done with creatine phosphate. This will turn the ADP back to ATP as it has 3 molecules then it's able to provide energy again.

Q17

This question required the candidates to describe process of anaerobic glycolysis. This question proved to be a good differentiator evident through the spread of marks. It was evident that those candidates who understood the process scored highly with succient answers. Common errors were that, some candidates did not understand the anaerobic glycolysis and therefore, wrote everything that they knew about energy systems. With any process question, annotated diagrams will be accepted.

This response gained 3 marks

17 Describe the process of anaerobic glycolysis.

Firstly, glycogen is broken down into glucose by insulin. Then the glucose is converted into pyruvic acid. This conversion creates 2 ATP molecules which will allow for 30-90 seconds worth of energy to increase to intense exercise. Due to the lack of oxygen the pyruvic acid is converted into lactic acid which enters the bloodstream causing muscle fatigue.

This response gained 1 mark

17 Describe the process of anaerobic glycolysis.

This is the breakdown of glucose / glycogen that is stored in the liver and kidneys - the process breaks down glucose / glycogen without oxygen. If glucose is broken down it produces 2 ATP molecules and if glycogen is broken down it produces 3 ATP molecules. The process is Anaerobic so it all happens without oxygen.

Q18
The final question of this section required the candidates to evaluate the importance of the energy systems for a 100m sprinter.

Like all of the extended response questions, the quality of candidate responses varied. Some candidates were clearly very knowledgeable about the use of the all the energy systems in the 100m sprint and used the figure appropriately. Other candidates were unable to address the question fully and as with the entire section candidates were writing everything they knew about the energy system/s in general rather than answering the specific question.

Level 1 responses came from those candidates who identified what was available from the graph but could not further expand on the area. Common mistakes were saying that the lactate system would last for three minutes, with is irrelevant in the contexts of the question. Level 3 responses those who analysed the graph and articulated using technical terminology (intensity/duration/recovery) how the three systems are involved in powering the athlete through the race and recovery. Following this conclusions were drawn in terms of the effectiveness of each system.

This response was placed at Level 3 and given 5 marks. The answer clearly evaluates the three energy systems in relation to the 100m sprint. The systems characteristics are discussed and conclusions drawn to the relative importance of each system.

Joe is a 100m sprinter. Joe takes **11.50 seconds** to complete a race. **Figure 4** shows the contribution from each of the energy systems to sprinting.

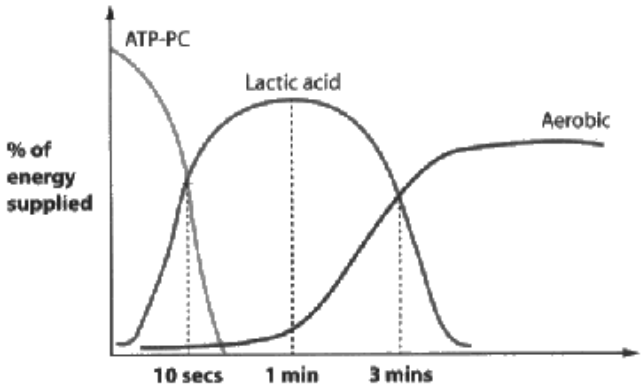


Figure 4

18 Assess the contribution of each energy system to Joe's 100m sprint.

(6)

The ATP-PC system would have been used for the majority of his 100m sprint as it is the most suitable. Whilst it doesn't produce large amounts of ATP (3), it is a quick reaction and lasts ~~between~~ up to 12 seconds meaning it produces quick anaerobic energy, which 100m is an anaerobic event.

~~Lactic~~ The lactate system isn't as important as its duration is normally 10-90 seconds, it could be used to produce a small amount of ~~energy~~ ATP anaerobically towards the end of the race if phosphocreatine stores run out.

The aerobic system is the least important energy system for a 100m sprint as it is quick, powerful and anaerobic whereas the aerobic system is slow, small force of contractions and aerobic. The aerobic system works from 90 seconds to fatigue making it useless in a 100m sprint (12 seconds). However, the aerobic system will be used after the race is finished to repay oxygen debt (EPOC) to remove any lactate from the working muscles.

Q19

The final question in the paper is a synoptic analysis. I urge centres to read the guidance under AO5 (page 20) of the specification to see the combinations between body systems. This question will always be a maximum of two systems. Candidates should look to synthesise their writing and make connections between the systems where possible demonstrating the inter-relationship.

Like all of the extended response questions, the quality of candidate responses varied. Some candidates were clearly very knowledgeable about how the skeletal and muscular systems work together to be able to generate the movement within the question. Some candidates were unable to address the question fully.

Low level responses demonstrated some knowledge and understanding of the indicative content and often lacked balance or coverage. Common errors were incorrect contractions and roles (agonist and antagonist). High level responses displayed synoptic coverage from both areas as well as making link to how these systems work collectively. Other errors were incorrect identification of the joint types and movements. Also, low-level responses brought in answers from cardiovascular and respiratory systems, which were not required within the question. High-level responses displayed coverage from both areas as well as making link to how these systems work collectively.

Level 1 responses tended to focus on isolated elements that make general assertions and did not reference the movement. Level 4 responses provided accurate knowledge of both the skeletal and muscular systems enable the movement. Like any levels of response based question, it is not 1 point equals 1 mark, the indicative content is extensive for candidates to demonstrate a breadth of knowledge and generate credit.

This response below was placed at Level 4 and given 8 marks. The answer clearly analyses how the systems work together to enable the movement to be carried out. Each system is visited and application to performance and interrelationships are developed throughout.

Figure 5 shows Joe in action during his race.

Figure 5

19 Analyse how the muscular system and the skeletal system work together to carry out the action of the leading leg which is shaded in **Figure 5**.

(8)

Firstly, the long bones such as the femur, tibia and fibula act as long bones which provide leverage for the movement above. At the hip is a ball and socket joint which allows flexion, extension and circumduction. At the knee is a hinge joint which allows flexion and extension. At the ankle, there is a hinge joint which allows dorsiflexion and plantar flexion. In the image above, the leg flexes at the hip to raise the femur upwards and forwards. Ligaments attach the bone to bone and in this case a ligament attaches the femur to the tibia/fibula. The hip flexors cause the flexing movement at the hip. The hip flexors are as the agonist muscle whilst the gluteals are relaxing as the by reciprocal inhibition.

Contagonist. The leg is flexed at the knee and this is caused by contraction of the hamstring concentrically. A tendon attaches the hamstrings (semimembranosus, semitendinosus, biceps femoris) to the fibula and/or tibia which pulls the fibula when contracting to cause flexion at the knee. The quadriceps (rectus femoris, vastus lateralis, vastus medialis, vastus intermedius) would be relaxed down concentrically slightly as the synergist to aid the flexion movement however it is still the antagonist as the hamstring is the primary mover as the agonist. The patella sits on the knee as a form of a sesamoid bone to which protects the soft tissue covered by reduces friction across the joint. The movement of the foot to point downwards is plantar flexion and this is caused by the concentric contraction of the gastrocnemius, which is the agonist and the tibialis anterior is the antagonist. As the gastrocnemius contracts concentrically the tendon attaching to the metatarsals for the gastrocnemius will be pulled on to plantar flex. The gliding joints within the metatarsals will have a slight movement as well to extend to point to plantar flex.

This response was placed at Level 2 and given 4 marks. Credit is gained correct movements and contractions but this is not consistant throughout the entire answer.

Figure 5 shows Joe in action during his race.

Figure 5

19 Analyse how the muscular system and the skeletal system work together to carry out the action of the leading leg which is shaded in **Figure 5**.

(8)

The antagonist muscles pairs would help carry out this movement as the quadriceps (agonist) and the hamstring ~~as~~ (agonist) would work with the patella at the knee which would act as a lever to prevent any unwanted contractions. This contraction is concentric and flexion is being done to shorten the hamstring. This would work with the femur, ~~and~~ tibia and fibula as when

the Muscle Contracts then bones must bend too And move to help the muscles. ALSO the Skeletal System allows attachment for muscle which would allow this movement to be performed. The hinge Joint at the knee is key in allowing this ~~bending~~ flexion action to be performed as it bends the Joint at the knee. Also, the plantar flexion ~~Mover~~ movement is being performed at the foot / this would work with the three bones in the foot (tarsals, metatarsals, phalanges) to perform this.

Summary

Based on their performance on this paper, candidates should:

- Use appropriate technical language throughout their responses,
- Tailor their response based on the command word in the question, e.g. for an explain question there will always be marks available for expansion points and relevance to the scenario.
- Be clear about terminology used in the specification as these words will be repeated in the exam paper, e.g. short-term responses (immediate, due to the exercise/sport), adaptations (long term). The same can be said for questions such as 9b – respiratory responses. This is taken directly from the specification C.5 and therefore they were the only one answer available for credit, due to the other response being in the stem of the question.
- Only address the correct body system within this section, e.g.in Section B 'The Muscular System' credit will only be awarded for responses from the specification of the muscular system. No marks will be available for reference to any other body system.
- I urge Centre's to read the guidance under AO5 (page 20) of the specification to see the combinations between body systems.
- Use the question scenario to demonstrate their ability to apply their knowledge.
- Check their paper carefully for any missed questions and attempt everything.
- Please click here for the specification and SAMS.