Examiners' Report
Lead Examiner Feedback

January 2023

Pearson BTEC Nationals
In Sport (31524H)
Unit 1: Anatomy & Physiology

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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, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external 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 is 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.

Variations in external assessments

Each external assessment 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 assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:
http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Introduction

Centres and candidates should be congratulated on their preparation for this assessment format, in some very challenging times. Overall, candidates performed slightly better than previous 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 and previous series. 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.

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 and it is encouraging to see that more candidates are accessing top mark boundaries. 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. To reiterate, with explain command verb questions, there is an expectation that the knowledge and understanding tested is applied to the situation in context and expansion marks are awarded accordingly. Nevertheless, performance continues to be by in large in line with previous series, with the mean mark dropping by -0.14 with the highest paper total seen being 75/80.

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 centres 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.

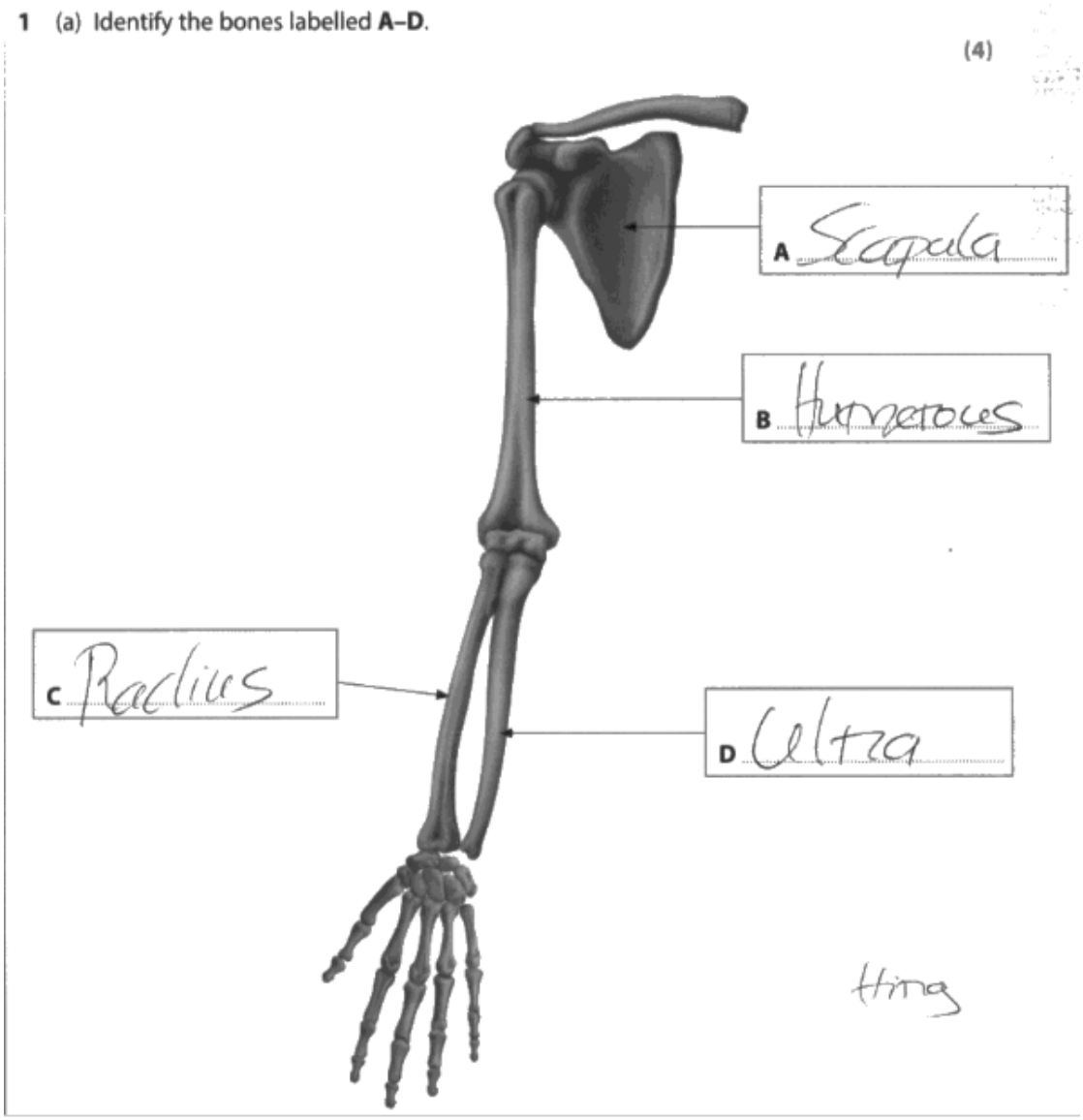
Individual Questions

The following section considers each question on the paper, providing examples of popular candidate responses. This section should be considered with the live external assessment and corresponding mark scheme.

Q1a

The majority of candidates performed as anticipated on this question, with many identifying the correct answers from the labelled diagram. It is important that technical terminology is used and phonetic spelling was credited. Common errors were identifying the ulna and radius the wrong way around

This response gained 4 marks



Q1b

For 1b candidates were required to identify the type of joint found at the hip. Q1b was answered very well with the vast majority of learners accessing the mark, nevertheless a number of candidates left this response blank, so the assumption can be made that they missed the question. I urge centres to remind candidates to check the entirety of the question paper, to ensure that they have answered all the questions.

This response gained 1 mark

(b) State the type of synovial joint that is found at the shoulder.

(1)

Ball and Socket Joint

Q2a

Q2a then took the knowledge of the long and short bones and applied it to how they could be beneficial to a rugby player. Candidates were awarded credit for identifying their role and a further two marks for linked justification of how it could support rugby performance. Common errors made were stating that the long bone allows movement, which achieved the mark, but then followed it with the link to performance as moving in the game, which is too vague. For flat bones it was that identifying that they protect organs and then providing an example, such as, the ribs protect the lungs, but without applying it to rugby performance.

This response gained 4 marks

Warren is a rugby player. He uses different bone types to perform successfully in a match.
Two of these bone types are flat bones and long bones.

2 (a) Explain why flat bones **and** long bones help Warren when playing a match.

(4)

Flat bones help warren by keeping his vital organs protected when he takes contact from a tackle. For example his ribs protect his lungs when someone tackles into his chest. Long bones help warren by helping him move. The main function of a long bone is movement. ~~this~~ For example his Femur tibia and fibia help warren dodge passed defenders without being tackled. Another function is red blood cell production from the long bones. This helps Warren have more oxygen in his working muscles so he can play at a higher intensity for longer.

This response gained 2 marks

Warren is a rugby player. He uses different bone types to perform successfully in a match. Two of these bone types are flat bones and long bones.

2 (a) Explain why flat bones **and** long bones help Warren when playing a match.

(4)

Flat bones help protect vital organs for example in football if Warren ~~is~~ is a goalie and the ball is hit at her chest her sternum will protect her heart from impact.

long bones act as weight bearage and allow for movement eg if lauren was a Goalie when diving to get the ball she would push off her femur to ~~push~~ herself foward

Q2b

This response required candidates to state one type of bone other than flat or long bone. On the whole candidates performed well on this question, with the vast majority accessing the available mark.

This response gained 1 mark

(b) State **one** type of bone other than flat and long bones.

(1)

~~flat~~ irregular

This response gained 1 mark

(b) State **one** type of bone other than flat and long bones.

(1)

short

Q3

Candidates were required to explain how regular participation in physical activity can reduce the likelihood of osteoporosis occurring. The majority of candidates accessed the first and last marking points around increasing bone density and reducing the risk of fractures. Fewer candidates accessed the points available for greater uptake of minerals and osteoblast and osteoclast activity. Common errors were answering the question as if it was about arthritis.

This response gained 3 marks

Zara is a badminton player. During a game she regularly runs, jumps and changes direction.

3 Explain why regular participation in weight-bearing activities helps to reduce the likelihood of osteoporosis.

Osteoporosis is the weakening of bones due to a lack of minerals and vitamin D. One way to prevent or stall osteoporosis is by doing physical activity frequently. This will increase the bone density over time and will therefore make the bones stronger.

This response gained 1 mark.

Zara is a badminton player. During a game she regularly runs, jumps and changes direction.

3 Explain why regular participation in weight-bearing activities helps to reduce the likelihood of osteoporosis.

Osteoporosis is when the bone weakens and cannot be repaired by osteoblasts. If Zara is completing weight bearing activities then her bones are being used regularly, this allows the bone to strengthen through regular osisication. Osification is when osteoclasts break down bone, the osteoblasts rebuild the bone to make it stronger than before with the use of Collagen.

Q4 & Q5

Were both recall questions and candidates performed as anticipated on this question, with the spread of marks clearly outlining the candidate's knowledge and understanding of muscle locations and types of muscle fibres.

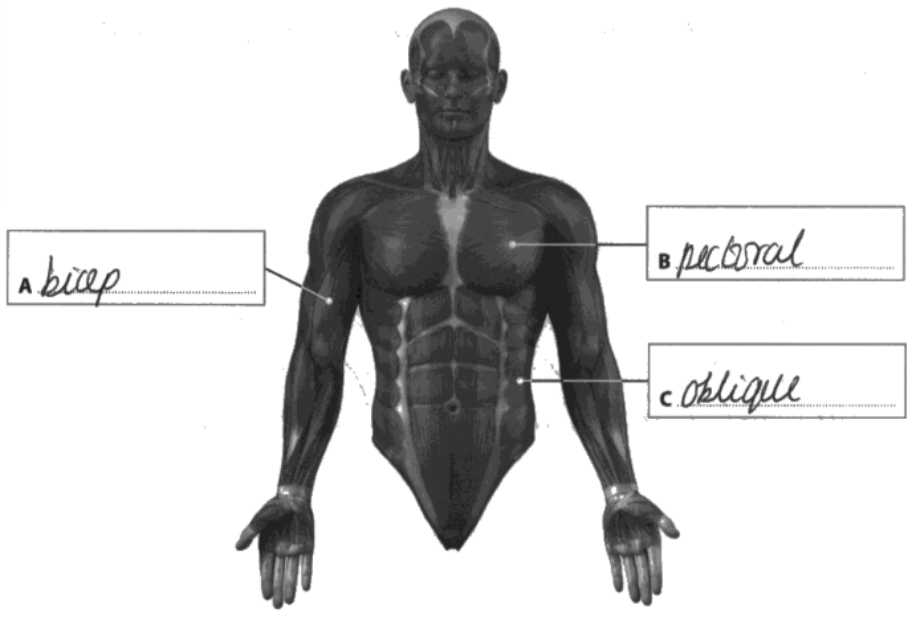
It is important that technical terminology is used and phonetic spelling was credited. However, the shortening of muscle names is not credited to give consistency with other series, therefore the 'pecs' would receive no credit for Q4.

Common errors seen on Q5 were identifying cardiac, skin, smooth muscle types, rather than skeletal muscle fibres.

This response gained 3 marks

Figure 2 shows the muscles in the upper body.

4 Identify the muscles labelled **A–C**.



This response gained 3 marks

5 State **three** types of skeletal muscle fibre.

1 type 1 slow twitch muscle fibres

2 type IIa , fast twitch muscle fibres

3 type IIx , fast twitch muscle fibres

This response gained 0 marks

5 State **three** types of skeletal muscle fibre.

1 tissue
2 fat
3 ~~blah~~ skin

Q6

The question required candidates to describe using a sporting example the role of an agonist muscle.
The majority of responses accessed at least one mark, with the most common example given as the bicep curl. Common errors were mixing up the role of the agonist with the role of the antagonist

This response gained 2 marks.

6 Describe, using an example of a sporting action, the role of an agonist muscle.

The agonist muscle contracts isometrically, concentrically or eccentrically to make movement. A sporting example is doing a ~~bicep curl to the bicep~~ when kicking a football the quadriceps extension of the leg causes the ~~hamstrings~~ to contract.

This response gained 1 mark

6 Describe, using an example of a sporting action, the role of an agonist muscle.

In ~~egg~~ when bicep curling your bicep will be the agonist because it is allowing you to do the motion

Q7a

The majority of candidates performed as anticipated on this question, with a nice spread of marks, many could identify that increased muscle temperature resulted in increased muscle pliability and then made clear links to increasing stride length or reducing the risk of injury.

This response gained 2 marks

Sundeep is a 400 m runner.

As part of his training regime he participates in two track sessions per week. One response that occurs during a training session is that his muscles increase in temperature.

7 (a) Explain how increased muscle temperature will affect Sundeep when running.

(2)

Heat is a waste product from the breakdown of food ⇒ energy. Warm muscles increase muscle pliability, so Sundeep will avoid pulling a muscle

This response gained 1 mark

Sundeep is a 400 m runner.

As part of his training regime he participates in two track sessions per week. One response that occurs during a training session is that his muscles increase in temperature.

7 (a) Explain how increased muscle temperature will affect Sundeep when running.

(2)

An increase in temperature will mean an increase in pliability for Sundeep when running. This means that Sundeeps muscles will become more flexable.

Q7b

The majority of candidates performed as anticipated on this question, with a nice spread of marks, many could identify the impact on performance in the context of the question, through working at a higher intensity for long, and delaying fatigue. However, much fewer articulated that it is more efficient in reducing the build-up of waste products. To reiterate, with explain command verb questions, there is an expectation that knowledge and understanding that is tested is applied to the situation in context and expansion marks are awarded accordingly. Common errors when applying to performance was to run further.

This response gained 3 marks.

Over a period of time, Sundeep's muscular system has adapted to the training programme, causing an increased tolerance to lactate.

(b) Explain the impact an increase in tolerance to lactate has on Sundeep's 400 m running performance.

(3)

An increase tolerance means that more oxygen is getting to the muscle to get rid of waste products like lactid acid. This means that Sundeep can run at a high intensity, & fatiqueing alot slower.

This response gained 1 mark.

Over a period of time, Sundeep's muscular system has adapted to the training programme, causing an increased tolerance to lactate.

(b) Explain the impact an increase in tolerance to lactate has on Sundeep's 400 m running performance.

(3)

An increase in tolerance to lactate will positively effect Sundeeps performance as it means that his muscles do not fatigue as quickly.

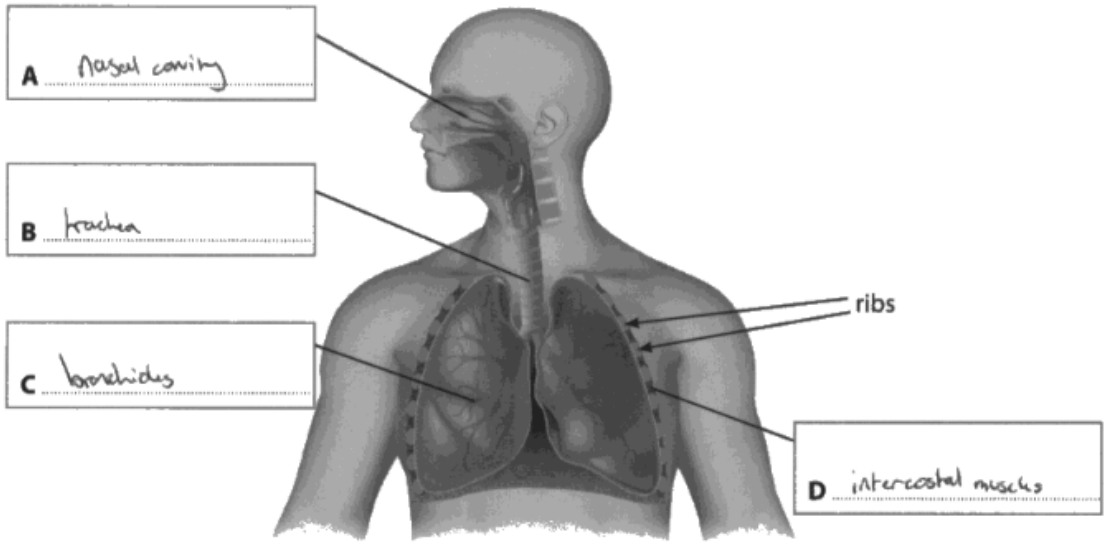
Q8

The majority of candidates performed as anticipated on this question, with many identifying the correct answers from the labelled diagram. It is important that technical terminology is used and phonetic spelling was credited. Common errors were identifying the bronchioles as the bronchus.

This response gained 4 marks

Figure 3 shows the structure of the respiratory system.

8 Identify the respiratory structures labelled **A–D**.



Q9a

The majority of candidates found this question challenging to access the full marks, a significant number correctly identified the responses but linked both expansions to oxygen and therefore only achieving 3/4 available marks.

To be awarded the expansion marks the candidates had to correctly identify the responses.

Common errors were providing information about increasing the diffusion rate of oxygen and carbon dioxide, which is an adaptation rather than a response.

This response gained 4 marks.

Ethan is a 1500 m swimmer.

9 (a) Explain **two** immediate respiratory responses for Ethan when he starts swimming in a 1500 m race.

(4)

When Ethan starts swimming his tidal volume will increase so that he can get more oxygen in his body to reduce the chance of fatigue. Secondly his breathing rate will increase to get more oxygen in per minute as well as getting more CO_2 out of his body.

This response gained 2 mark.

Ethan is a 1500 m swimmer.

9 (a) Explain **two** immediate respiratory responses for Ethan when he starts swimming in a 1500 m race.

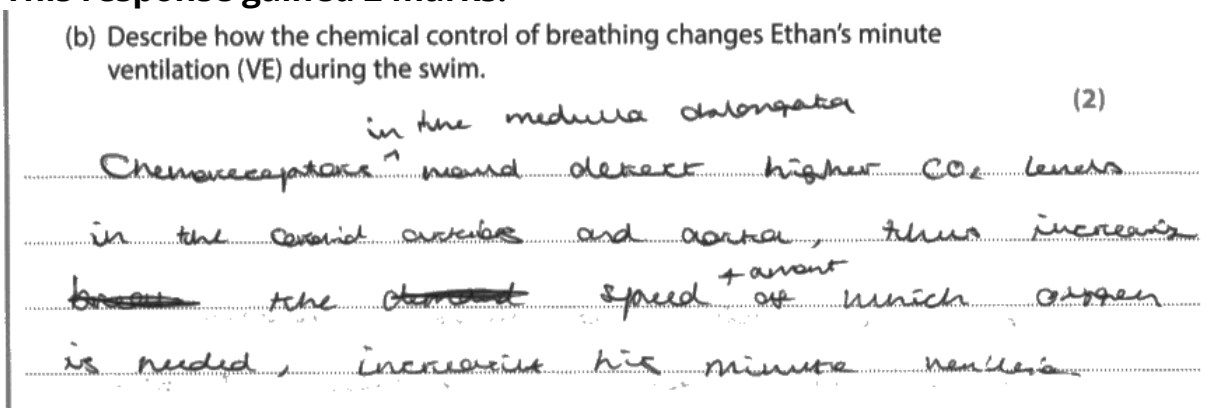
(4)

One response is increased breathing rate. This allows more oxygen to enter the body and reach the working muscles, giving him more energy to complete the race faster. Another response is diffusion rate increases. This allows more waste CO_2 to leave the lungs and the body, meaning ethan can respire more efficiently to swim for longer without feeling fatigued.

Q9b

This question acted as a good differentiator, for how chemical control of breathing changes minute ventilation.
It was clear from the spread of marks that some candidates found this question challenging and this area of knowledge for some was missing.
Those who did display knowledge of chemical control generally accessed all marking points.
Common errors were not fully identifying the role of a chemoreceptor and stating that they detect chemical change, rather than increased levels of carbon dioxide/low levels of oxygen. Some candidates also confused the expansion and did not comment on the effect on minute ventilation and used breathing rate instead.

This response gained 2 marks.

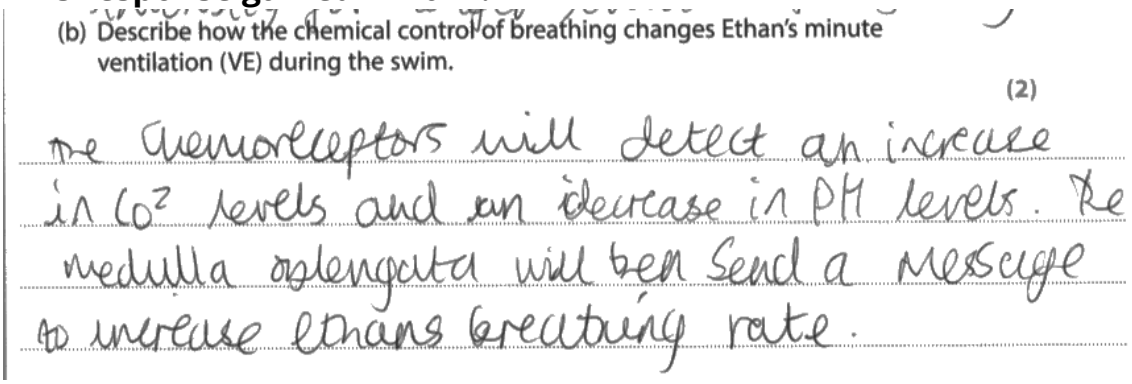


(b) Describe how the chemical control of breathing changes Ethan's minute ventilation (VE) during the swim.

(2)

in the medulla oblongata
Chemoreceptors ↑ would detect higher CO_2 levels
in the carotid arteries and aorta, thus increasing
~~breath~~ the ~~increased~~ speed + amount of which oxygen
is needed, increasing his minute ventilation

This response gained 1 mark.



(b) Describe how the chemical control of breathing changes Ethan's minute ventilation (VE) during the swim.

(2)

The Chemoreceptors will detect an increase
in CO^2 levels and an decrease in PH levels. The
medulla oblongata will then send a message
to increase Ethans breathing rate.

Q9c

This was the first extended response question of the paper and candidates had to analyse the gas exchange process that enables swimming performance to be sustained throughout. Responses for the question required focus on the gas exchange process at both the lungs and the tissue/muscle (specification topic C2) and the impact that would cause. The impact in this sense was not linked towards performance, but such things as a steeper diffusion gradient, more O_2 to be used. 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 the gas exchange process. Other candidates were unable to address the question fully and only highlighted the process at the lungs and not the tissue and/or impact as required.

Level 1 responses tended to focus on the process at the lungs, with some errors and links to performance were generalist, such as swim for longer.
At level 3 candidates' responses provided accurate knowledge of the process at the lungs and tissue, they linked in the impacts correctly. At this level candidates used technical terminology with clear development of the point and linked to performance.

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.
Some candidates also discussed the impacts on the cardiovascular system when it was in the respiratory section and thus generated no credit.

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 gas exchange process with appropriate development in reference to the question.

(c) Analyse the gaseous exchange process that makes sure that Ethan sustains his performance throughout his swim.

(6)

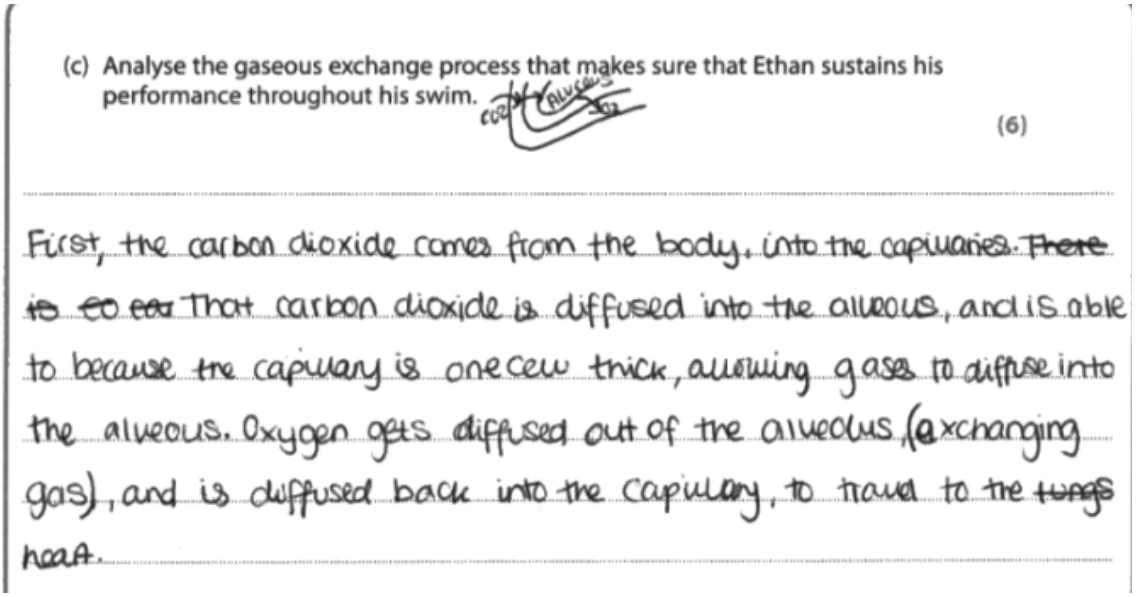
this is seen within the alveoli and the capillaries in the blood where there is a difference in concentration being 100 mmHg of oxygen in the alveoli and 40 mmHg in the capillaries the difference in partial pressure sets up a diffusion gradient in which the O_2 moves from a high pressure in alveoli and low in capillaries, this similarly occurs with CO_2 being 45 mmHg in the capillaries and 40 mmHg in the alveoli and so diffusing into the alveoli to be breathed out. Oxygen is then carried through the capillaries by binding to hemoglobin forming oxyhemoglobin travelling to the muscles where gaseous exchange takes place again. ~~co in~~ O_2 in the capillaries is higher at 105 mmHg than the muscle cells at 40mmHg this ~~yes~~ difference in partial pressure sets up a diffusion ...

→ on spare

(Total for Question 9 = 12 marks) Q09_Total

Q9c gradient in which oxygen moves from a high pressure in the capillaries to a low pressure in the muscle cells where it binds with myoglobin to form oxymyoglobin this will help ethan to sustain his performance as he will have a constant supply of oxygen in the muscles that can be broken down in the mitochondria for energy preventing him from fatiguing additionally CO_2 is higher in the muscle cells at ~~10 kPa~~ 4.5 - 6.0 mmHg and 40 mmHg in the capillaries which so diffuses into the capillaries through a diffusion gradient this will also help him to sustain performance as he will not tire as quick due to preventing a build up of waste, in the muscles and lactic acid

This response was placed at Level 1 and given 2 marks.
The answer includes a correct identification of the gas exchange process, CO_2 removed from the body and diffused into the alveoli and O_2 is diffused out of the alveolus into the capillary.



(c) Analyse the gaseous exchange process that makes sure that Ethan sustains his performance throughout his swim. (6)

First, the carbon dioxide comes from the body, into the capillaries. ~~There is so so~~ That carbon dioxide is diffused into the alveous, and is able to because the capillary is one cell thick, allowing gases to diffuse into the alveous. Oxygen gets diffused out of the alveolus (exchanging gas), and is diffused back into the capillary, to travel to the ~~lungs~~ heart.

Q10

Was a recall question and candidates performed as anticipated on this question, with the spread of marks clearly outlining the candidate's knowledge and understanding of the structure of cardiac cycle.
It is important that technical terminology is used and phonetic spelling was credited.

This response gained 2 marks.

Figure 4 is an incomplete flow diagram of the structures in the heart that control the cardiac cycle.

10 Identify the **two** structures needed to complete the flow diagram in **Figure 4**.

A Sino Atrial node (SAN)

↓

Atrioventricular node (AVN)

↓

B Bundle of His

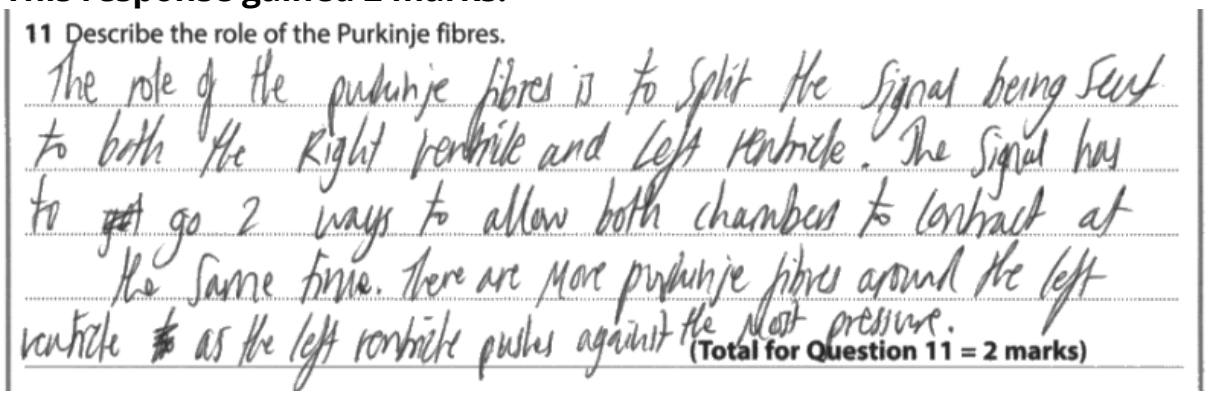
↓

Purkinje fibres

Q11

The candidates found this question challenging, with many providing generic responses although this is a clear specification point (D3 – nervous control of the cardiac cycle). It was evident that this knowledge and understanding was missing from a number of responses. Common errors were saying that it contracts the heart which is too vague, it needed to be contracts the ventricles to access the second mark point.

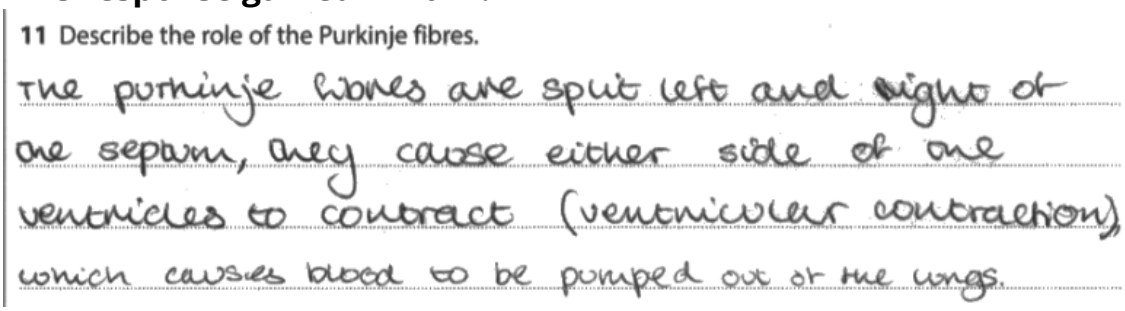
This response gained 2 marks.


11 Describe the role of the Purkinje fibres.

The role of the purkinje fibres is to split the signal being sent to both the Right ventricle and Left ventricle. The signal has to ~~get~~ go 2 ways to allow both chambers to contract at the same time. There are more purkinje fibres around the left ventricle as the left ventricle pushes against the ~~most~~ pressure.

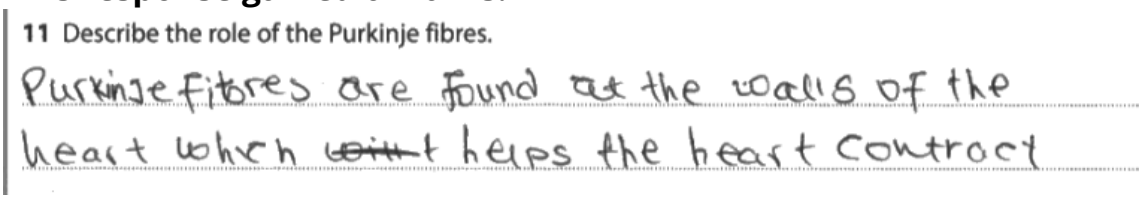
(Total for Question 11 = 2 marks)

This response gained 1 mark.


11 Describe the role of the Purkinje fibres.

The purkinje fibres are split left and right of the septum, they cause either side of the ventricles to contract (ventricular contraction) which causes blood to be pumped out of the lungs.

This response gained 0 marks.

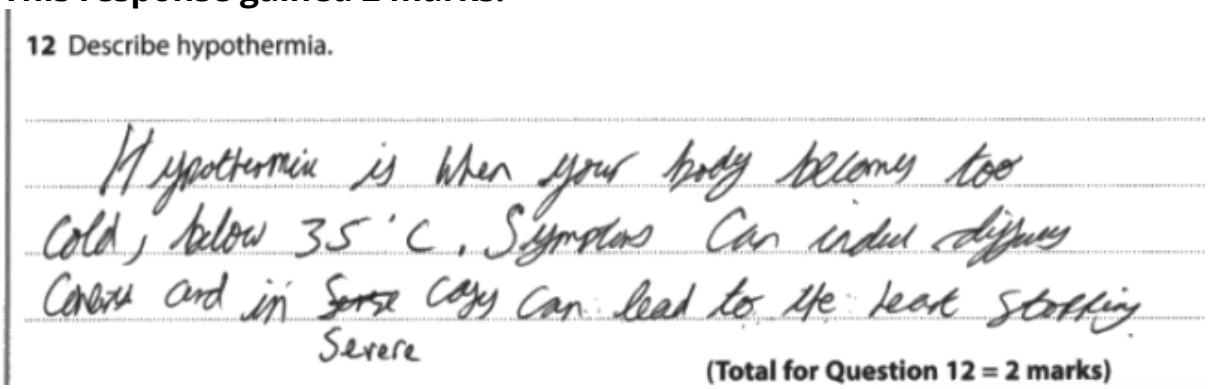

11 Describe the role of the Purkinje fibres.

Purkinje fibres are found at the walls of the heart when ~~they~~ it helps the heart contract

Q12

This question acted as a good differentiator that required the candidates to describe hypothermia.
It was clear from the spread of marks that some candidates found this question challenging especially the description (body temperature below 35°). Those who did display knowledge of hypothermia generally accessed both marking points.
Common errors were confusing hypothermia with hyperthermia.

This response gained 2 marks.

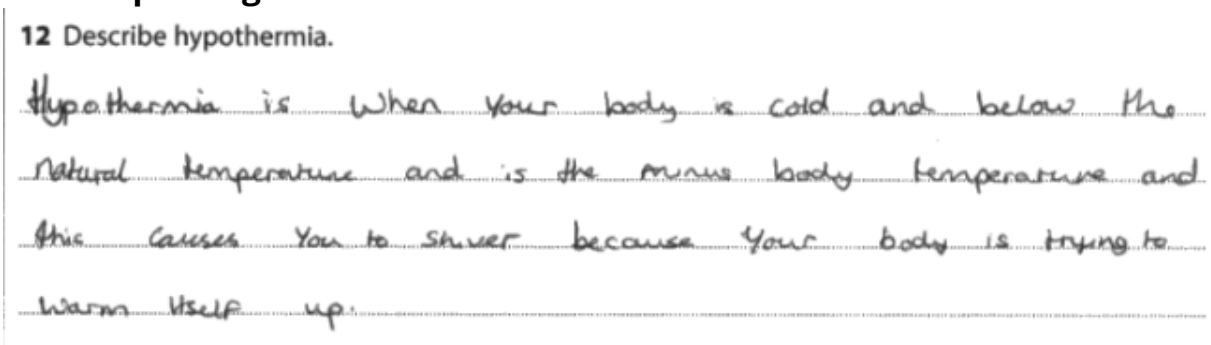


12 Describe hypothermia.

Hypothermia is when your body becomes too cold, below 35 °C. Symptoms can induce diffuse cancer and in ~~Serse~~ Severe cases can lead to the heart stopping.

(Total for Question 12 = 2 marks)

This response gained 1 mark.



12 Describe hypothermia.

Hypothermia is when your body is cold and below the natural temperature and is the minus body temperature and this causes you to shiver because your body is trying to warm itself up.

Q13a

The majority of candidates performed as anticipated on this question, with a nice spread of marks, many could identify that increased heart rate before exercise is due to an anticipatory rise, but fewer linked this to increased release of adrenalin or the impact more blood and O_2 to the working muscle.

To reiterate, with explain command verb questions, there is an expectation that knowledge and understanding that is tested, is applied to the situation in context and expansion marks are awarded accordingly.

Common errors when applying this to performance during the game, when the question was about before the game.

This response gained 4 marks.

Ashley is a tennis player and is preparing for a match. Her heart rate starts to increase just before the match. anticipatory rise, increaseHR, BR, cardiac output, redirect blood

13 (a) Explain why Ashley's heart rate increases just before the match and the impact of this increase on her performance.

(4)

Anticipatary rise increases her heart rate as the hormone of adrenaline is released which redirects blood to allow an increased heart rate. Her heart rate will continue to increase during exercise until she meets her max heart rate and there it will plateau. An increased heart rate also increases blood pressure during exercise and Cardiac output. An increased HR will allow for more blood to be pumped per minute, meaning more O2 oxigenated blood will go to working muscles to delay fatigue and it also brings back deoxygenated blood and CO^2 for a faster gaseous exchange, capillirasation will occur.

This response gained 1 mark.

Ashley is a tennis player and is preparing for a match. Her heart rate starts to increase just before the match.

13 (a) Explain why Ashley's heart rate increases just before the match and the impact of this increase on her performance.

(4)

Ashley may be experiencing pre-match/adreniline nerves which will increase her heart rate. The impact this will have is that she will reach her maximum intensity quicker due to the adreniline and increased heart rate. This also means that there is more blood being pumped around to her muscles.

Q13b

This response required candidates to name the blood vessel that returns blood back to the heart. On the whole candidates performed well on this question, with the vast majority accessing the available mark. Common mistakes were identifying the pulmonary vein or artery.

This response gained 1 mark.

(b) Name the blood vessel that returns blood back to Ashley's right atrium.

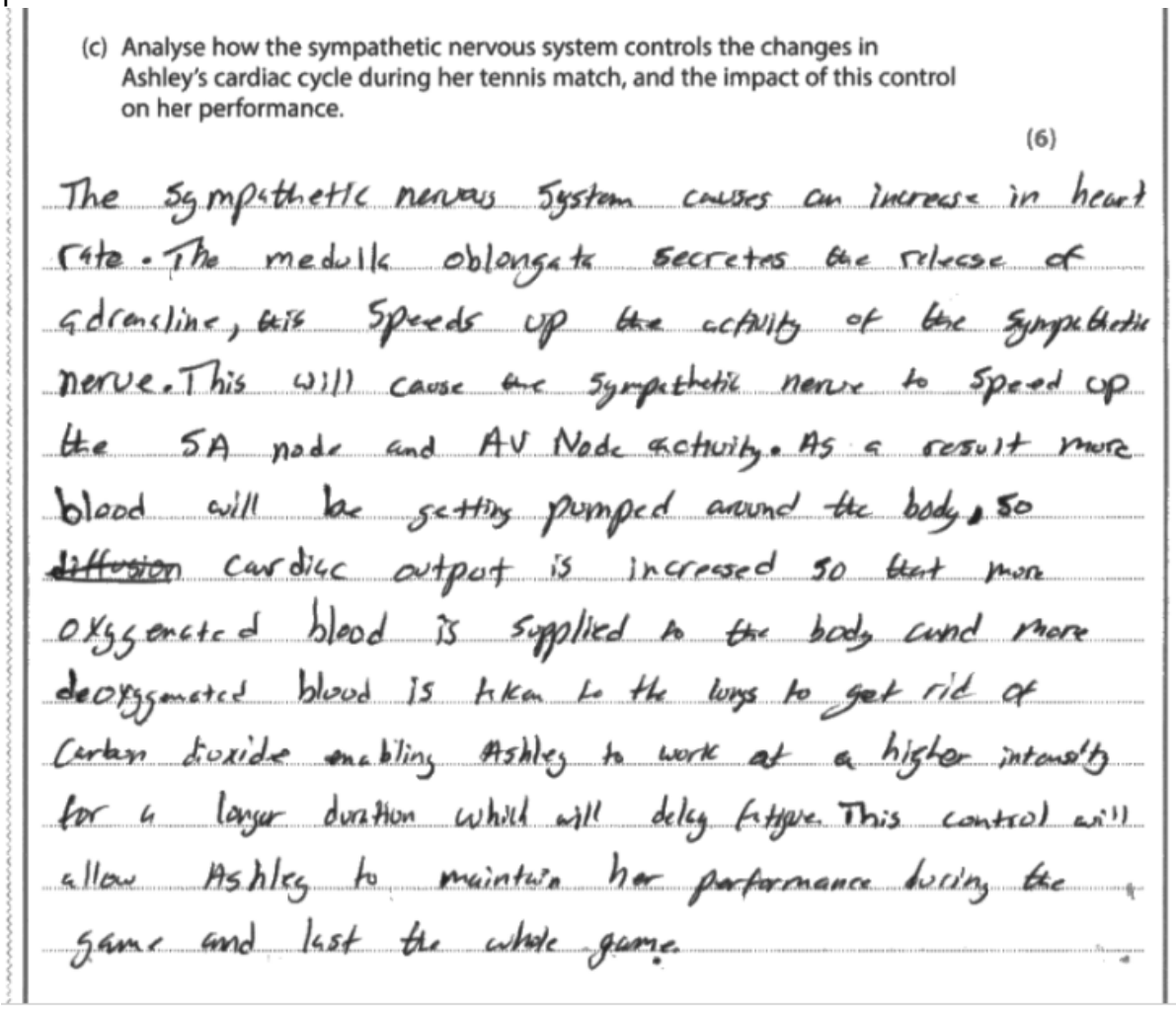
Vena cava

Q13c

This was the second extended response question of the paper and focused on how the sympathetic nervous system controls the changes within the cardiac cycle, the 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 how the sympathetic nervous system controls the changes within the cardiac cycle, but some candidates struggled to express this beyond transferring it speeds up heart rate, many described the cardiac cycle with no reference to it happening quicker or with more force.

This response was placed at Level 3 and given 5 marks.
The answer clearly assesses a number of points from the indicative content, focusing on how the sympathetic nervous system controls the changes in the cardiac cycle. with effective use of technical terminology and appropriate development in reference to the effects on performance.

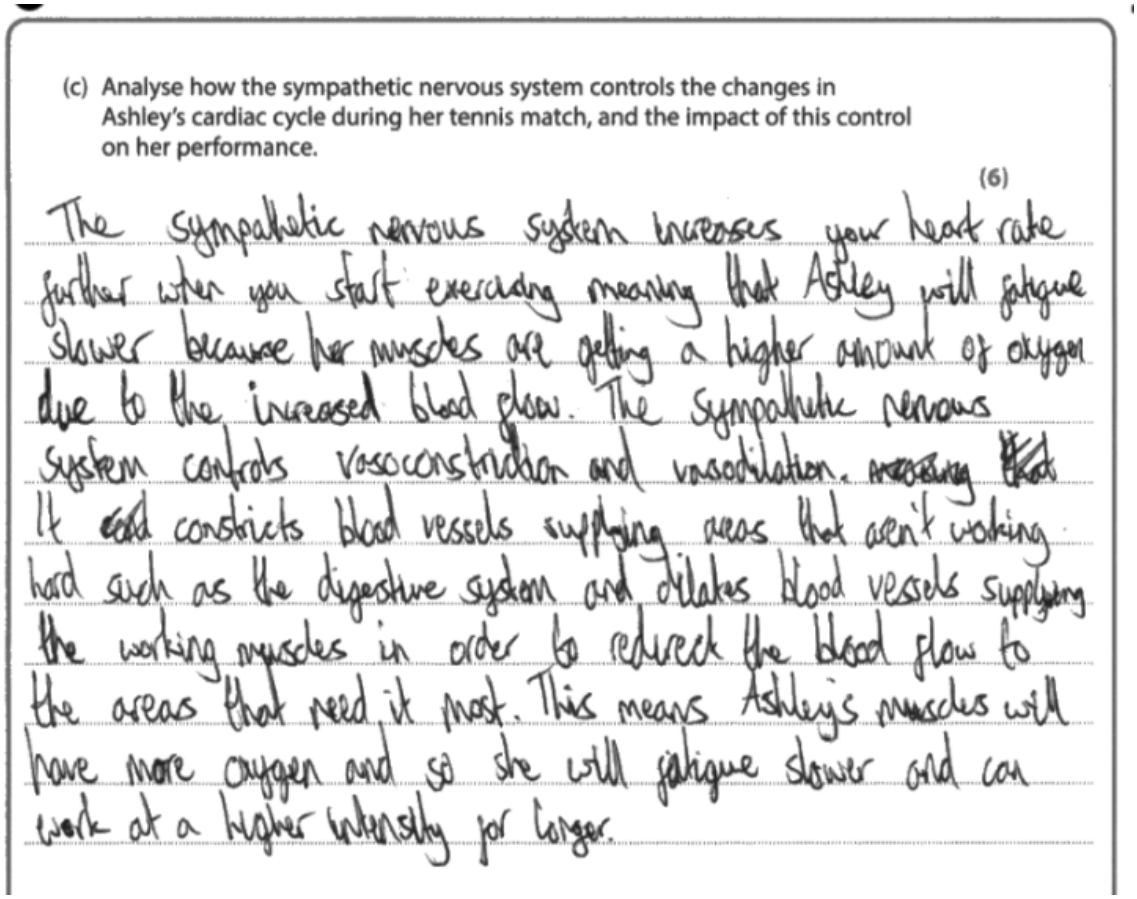


(c) Analyse how the sympathetic nervous system controls the changes in Ashley's cardiac cycle during her tennis match, and the impact of this control on her performance.

(6)

The Sympathetic nervous System causes an increase in heart rate. The medulla oblongata secretes the release of adrenaline, this speeds up the activity of the Sympathetic nerve. This will cause the Sympathetic nerve to speed up the SA node and AV Node activity. As a result more blood will be getting pumped around the body, so ~~diffusion~~ cardiac output is increased so that more oxygenated blood is supplied to the body and more deoxygenated blood is taken to the lungs to get rid of Carbon dioxide enabling Ashley to work at a higher intensity for a longer duration which will delay fatigue. This control will allow Ashley to maintain her performance during the game and last the whole game.

This response was placed at Level 2 and given 3 marks.
The answer assesses some of the points from the indicative content. The response correctly identifies that the sympathetic nervous system increases heart rate, that the muscles get a 'higher level' of O_2, there is also reference to working at a higher intensity for longer and fatiguing slower. However, the section on the vascular shunt is irrelevant in the context of this question.



(c) Analyse how the sympathetic nervous system controls the changes in Ashley's cardiac cycle during her tennis match, and the impact of this control on her performance.

(6)

The sympathetic nervous system increases your heart rate further when you start exercising meaning that Ashley will fatigue slower because her muscles are getting a higher amount of oxygen due to the increased blood flow. The sympathetic nervous system controls vasoconstriction and vasodilation. meaning that it vasoconstricts blood vessels supplying areas that aren't working hard such as the digestive system and dilates blood vessels supplying the working muscles in order to redirect the blood flow to the areas that need it most. This means Ashley's muscles will have more oxygen and so she will fatigue slower and can work at a higher intensity for longer.

Q14

This was a challenging question on the role played by the ATP-PC system during a high jump many could identify it was for explosive movements and linked to time, but very few achieved the third mark for quick recovery time or immediate source of energy. Common errors were candidates describing through the process of the breakdown of ATP, which was irrelevant in the context of the question.

This response gained 3 marks.

Luke is a decathlete. He participates in a number of different events across two days. These events use all of his energy systems.

On day one, the high jump is one of these events.



(Source: © Shutterstock)

Figure 5

14 Explain why the ATP-PC energy system is used when participating in the high jump.

The ATP-PC energy system provides quick bursts of energy, during the high jump the small sprint and powerful jump are aided by the ATP-PC system. The ATP is broken down by ATP-ase into ADP, creatine kinase then breaks down the PC and the ~~remaining~~ leftover PC will create more ATP-PC. The ATP-PC system lasts for 8-10 seconds which provides Luke with the energy to allwately perform high jump.

(Total for Question 14 = 3 marks)

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This response gained 1 mark

Luke is a decathlete. He participates in a number of different events across two days. These events use all of his energy systems.

On day one, the high jump is one of these events.



(Source: © Shutterstock)

Figure 5

14 Explain why the ATP-PC energy system is used when participating in the high jump.

ATP-PC is an anerobic system. It allow contractions at ~~hog~~ super high-intensity. ~~It allo~~ When he jumps ATP is turned into ADP. PC is then used to turn ADP back into ATP

Q15

This question acted as a good differentiator, for how the lactate system provides energy for the 400m run.
It was clear from the spread of marks that some candidates found this question challenging and this area of knowledge for some was missing.
Those who did display knowledge of how the lactate system provides energy, through the breakdown of fuel accessed full marks.
Common errors were identifying carbohydrate is broken down rather than glycogen/glucose. As well other common mistakes were describing the race in terms of the lactate system linked to intensity and duration and therefore irrelevant in the context of this question.

This response gained 4 marks

On day one, the last event is the 400 m run.

15 Describe how the **lactate system** provides energy for the 400 m run.

glycogen is stored in the muscles and liver and it is a store of glucose. glycogen is broken down by the enzyme GP to produce glucose. another enzyme called PFK breaks down glucoge into pyruvate and 2 ATP. The 2 ATP ~~are~~ is the energy which is produced for the 400 m run. The pyruvate will be broken down further by the enzyme LDH into lactate, a waste product. The lactate system lasts up ~~up~~ to 6 between 60 and 90 seconds and 2 ATP molecules are produced per glycogen molecule, enough for Luke to complete his 400 m run anaerobically, without the need of oxygen.

(Total for Question 15 = 4 marks)

This response gained 2 marks

On day one, the last event is the 400 m run.

15 Describe how the **lactate system** provides energy for the 400 m run.

~~In~~ The lactate system ~~uses~~ ~~anaerobic~~ ~~glycolosis~~ is used at high-intensity but not as high as ATP/PC. Anerobic glycolosis is coverted into the Krebs cycle using ATPase. ~~RFIK~~ PFK ~~than~~ then converts the kreb cycle into Lactate that is used for energy. ~~2~~ This produces a total of 2 ATP

Q16

The final question of this section required the candidates to analyse the role of the energy systems in in relation to the 1500m run.

Like all of the extended response questions, the quality of candidate responses varied. Some candidates were clearly very knowledgeable about the energy systems (ATP-PC/Lactate/Aerobic) in relation to intensity, duration and could articulate where each system contributes to different elements within the race. Other candidates were unable to address the question fully and struggled to articulate what elements of the race draw in the different energy systems as well as their limitations.

Level 1 responses came from those candidates who focused on one system and not all, with limited or accurate links to performance.
Level 3 responses were those who assessed all energy systems in terms of intensity and time and linked this directly into performance as well as identifying why the ATP-PC and Lactate are not the predominant system.

This response was placed at Level 3 and given 5 marks.
The answer analyses the contributions of each of the energy systems and develops a number of points from the indicative content. Clear relation to performance is evident.

On day two, the last event is the 1500 m run. Luke completes the run in 4 minutes and 25 seconds.

16 Evaluate the contributions of each of the **three** energy systems throughout Luke's 1500 m run.

In the first 1000 M luke's aerobic system is important as it gives him the most ATP molecules and works with air so it doesn't fatigue his muscles aerobic system lasts for a long time so luke would be able to ~~continue~~ be supplied with energy and last the whole race. The lactate system would cover for the next 400M as luke would speed up to edge himself foward in the race, the lactate help him work without oxygen, so he will be able to work ever harder, lactate last for 3-2M giving him plenty of energy but on the other hand it can cause lactate acid to be produced which would fatigue the muscles, not allowing him to continue. His ATP-PC allows him to sprint the final 100 M without stopping, ATP last only for 3-10S but allows him to be explosive and work without oxygen. overall those vital in the race. The aerobic system is

(Total for Question 16 = 6 marks)

This response was placed at Level 1 and given 2 marks.
The answer generates credit through the aerobic system being used for the majority of the race, but this is not further developed. No credit given for the anaerobic system used for 'overtaking' because it is not linked to a system. The response also identifies that the lactate system wouldn't be used.

On day two, the last event is the 1500 m run. Luke completes the run in 4 minutes and 25 seconds.

16 Evaluate the contributions of each of the **three** energy systems throughout Luke's 1500 m run.

One energy system he will use is the Aerobic energy System and he will use this throughout most the race and it's contribution to his 1500m run is that this energy system will allow him to maintain his pace throughout the race supplying oxygen to his working muscles.

Another energy system that he will use throughout the race is the anaerobic system and this will contribute to his 1500m run because the anaerobic system will only be used for a short period of time and he would use this to be able to overtake his opponent and get ahead of them.

The final energy system that he would use during his run is the Lactate System but he wouldn't use this much as it would have a build up of lactic acid which you don't want as you can't live in acidic environment but he would use this system near the end of the race.

(Total for Question 16 = 6 marks)

Q17

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 adaptations work together. 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 getting the movements the wrong way around. A number of candidates also spent a proportion of their response describing Position A which is unnecessary in the context of this question.

High level responses displayed synoptic coverage from skeletal and muscular systems at the hip, knee and ankle, as well as making link to how these systems work collectively. High-level responses displayed coverage from both areas as well as clearly relating this to the movement taking place.

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 and how they work together to enable the movement (football shot) to take place. 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 the how the systems work together. Each system is visited and application to the movement and interrelationships are developed throughout.

Figure 6 shows Sammy in action during a game of football.

J= joint name/type
A=articulating bones
M=movement
A=agonist
C=contraction
A=antagonist

MACA



Position A Position B

Figure 6

17 Analyse how the muscular system and the skeletal system work together at the hip, knee and ankle joints to allow Sammy's right leg, shown shaded in **Figure 6**, to move from Position A to Position B to strike the football.

(8)

At the hip the joint is ball and socket. The articulating bones are the femur and pelvis. It goes from extension in the preparation phase to ~~exten~~ flexion in the execution and follow through stage. The agonist in this movement is the hip flexor. The contraction is concentric as it is a fast movement where the agonist contracts and shortens. The antagonist is the gluteals. The muscular and skeletal system work together to produce movement. When the muscle contracts it pulls a tendon which then pulls the bone it is attached to. This creates movements. Tendons attach muscle to bone. At the knee the joint is a ~~hinge~~ hinge joint. The articulating bones are the ~~femur~~

femur and tibia and fibula. The movement is flexion to extension. The agonist in this movement is the ~~quadric~~ quadricept. ~~The contract~~ as it contracts and shortens. The contraction type is concentric due to being a quick powerfull movement. The agonist contracts and shortens pulling the tendon ~~a~~ which pulls the bone to create movement. The antagonist in this action is the ~~ha~~ hamstring as it relaxes.

At the ankle the joint type is a complex hinge joint. The articulating bones are the tibia, fibula and tarsals. the agonist in this movement is the ~~tibialis anterior~~ gastrocnemeus. The contraction type is concentric as the agonist contracts and shortens. The antagonist is the tibialis anterior. At the end of the movement the ankle is: plantar-flexion.

~~Be~~ The muscular and skeletal system work ~~to~~ together to produce all movement. They work together using tendons which keep them attached

This response below was placed at Level 2 and given 4 marks. The answer identifies that hip and ankle joint correctly, the muscles and role is also correct at the hip, there is an incorrect role at the ankle and no contractions. There are, however, some inaccuracies at the hip and ankle. The knee has not been included at all in the response. How the systems work together has been included with a couple of examples given.

Figure 6 shows Sammy in action during a game of football.



Position A Position B

Figure 6

tendons muscle to bone.

17 Analyse how the muscular system and the skeletal system work together at the hip, knee and ankle joints to allow Sammy's right leg, shown shaded in **Figure 6**, to move from Position A to Position B to strike the football.

long bone lever age

The muscular system will use antagonist pairs to help create movement for a strike in football. As you can see in figure A the right leg is in a flexed position meaning the gluteous maximus is the agonist as it is contracted and the hip flexors are the agonist as its relaxed. The ball and socket joint at the hip will allow the movement of extention at the hip as you can see in position B. The antagonistic pairs have changed and now the hip flexors are the agonist, while the gluteus maximus is the antagonist. These muscles and the ball and socket

joint will help create the movement from flexion to extention at the hip to allow the movement of kicking the ball.

The skeletal System and muscular system will work together to create this movement as the long bones will help create leverage for the muscles to contract. for example the femur ~~tibias anterior with help~~ fibula will help the muscle, the ~~tibia~~ gastrocnemius, create a plantar flexion position which you can see in position ~~ex~~ A. The antagonistic pair, the gastrocnemius and the tibias anterior will also help create this movement. While in a plantar flexed position the gastrocnemius will be the agonist as it is contracted whilst the tibias anterior will be ~~retard~~ antagonist as its relaxed. The hinge joint in the ankle will allow the movement to change where the foot is not dorsi flexed. this means the antagonistic pairs have changed and now the ~~b~~ tibias anterior is now the agonist ~~and~~ as its contracted and the antagonist is the gastrocnemius as its relaxed. This will then create the movement of Dorsiflexion which you can see in position B to create spin needed when kicking the ball.

Tendons will also help provide movement as they attach bone to muscle allowing the bones to help contract the muscles, for example the patella above knee and the quads and tibias anterior to help create the movement of flexion and extention. **(Total for Question 17 = 8 marks)**

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).
- Only address the correct body system within this section, e.g.in Section A 'The Skeletal System' credit will only be awarded for responses from the specification of the skeletal 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 and not write general impacts, but relate this to performance.
- Check their paper carefully for any missed questions and attempt and read everything.
- Please click here for the specification and SAMS.

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