Examiners' Report
Lead Examiner Feedback

June 2022

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

Awarding BTEC qualifications in 2022

Ofqual has set out their plans for awarding qualifications in 2022 and intend to return to a normal, pre-pandemic, approach to grading standards over by 2023. They have confirmed that 2022 will be a transition year, to reflect that we are in a pandemic recovery period and students' education has been disrupted.

Our guiding principle and approach to awarding BTEC qualification results in 2022 will be to ensure parity in relation to the approach being taken for GCSE and A level learners. BTEC courses have a different structure and design to academic qualifications - BTECs are modular qualifications (with

assessments taking place throughout the course) compared to GCSEs and A levels which are linear (assessed and awarded at the same time at the end of the year), and therefore our approach needs to be different.

In 2022 we will return to the usual method of calculating BTEC qualification results, however adaptations including, U-TAGs and reduced internal assessment, are in place to provide a comprehensive package of support for students.

The basis of our awarding approach to BTECs this year is to ensure it is as fair as possible for all learners. We will use a range of evidence to set grade boundaries for the external units. Part of this evidence will be to closely monitor learner performance in all assessments that contribute to learners' final qualification grade, to ensure parity with A level and GCSEs.

Further information can be found on our website and via our Social Media channels.

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 to 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 knowledge and understanding tested, is applied to the situation in context and expansion marks are awarded accordingly.
Nevertheless, performance continues to get better series by series, with the mean mark increasing by 1.3 and the highest paper total was 80/80.

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 & b

The majority of candidates performed as anticipated on this question, with many identifying the correct answers. It is important that technical terminology is used and phonetic spelling was credited. Common errors were identifying bones of the leg for 1a and identifying the wrong joint for 1b.

This response gained 3 marks for 1a and 1 mark for 1b

Answer ALL questions. Write your answers in the spaces provided.

1 (a) Name the **three** bones that form the elbow joint.

(3)

1 Humerus

2 Radius

3 Ulna

(b) State the **type** of synovial joint that allows the head to rotate.

(1)

Pivot

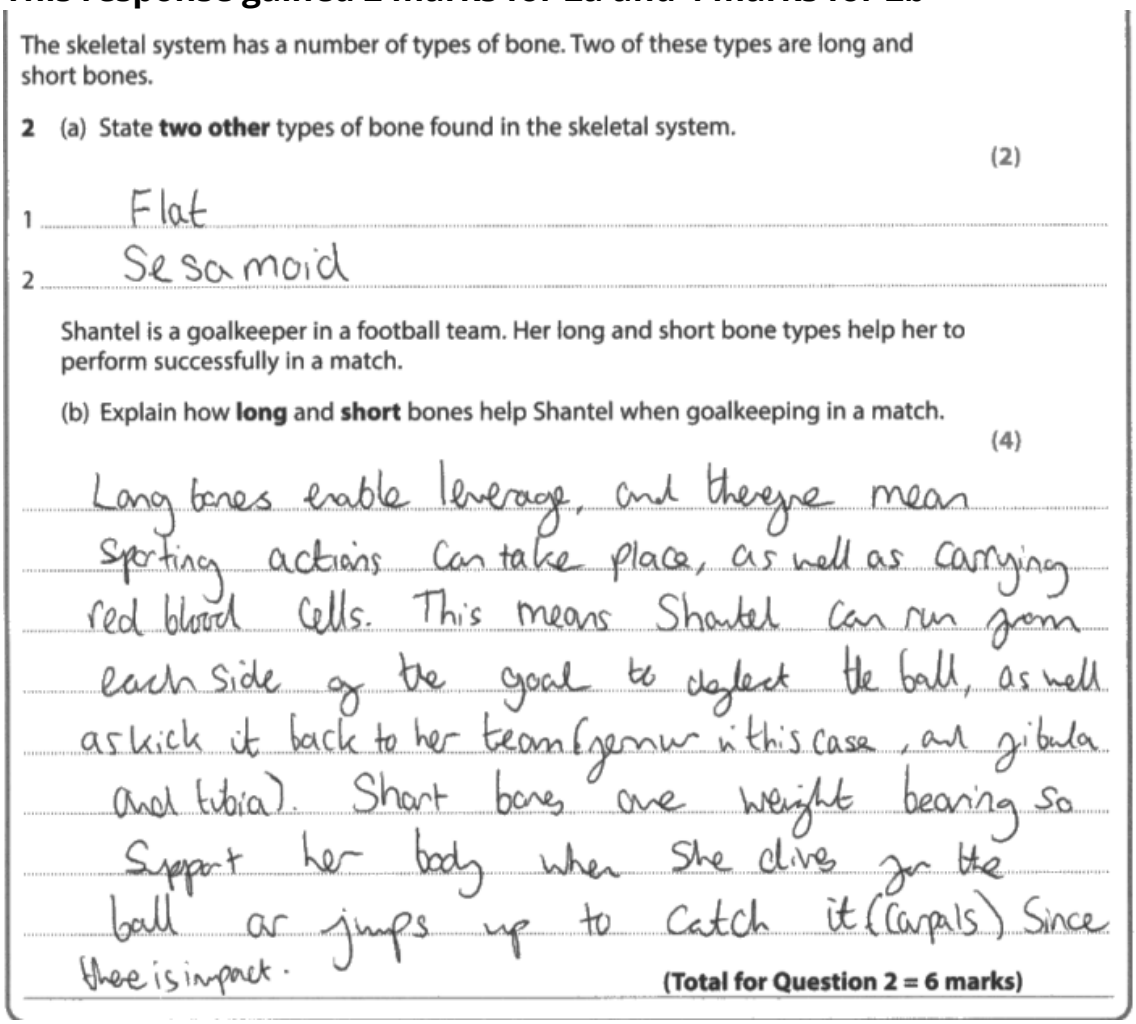
(Total for Question 1 = 4 marks)

Q2a & 2b

For 2a candidates were required to identify two additional bone types found in the skeleton other than long and short bones. Q2a was answered very well with the vast majority of learners accessing both marks.

Q2b then took the knowledge of the long and short bones and applied it to how they could be beneficial to a goalkeeper. Candidates were awarded credit for identifying their role and a further two marks for linked justification of how it could support football 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 goal, which is too vague.

This response gained 2 marks for 2a and 4 marks for 2b



The skeletal system has a number of types of bone. Two of these types are long and short bones.

2 (a) State **two other** types of bone found in the skeletal system.

(2)

1 Flat

2 Sesamoid

Shantel is a goalkeeper in a football team. Her long and short bone types help her to perform successfully in a match.

(b) Explain how **long** and **short** bones help Shantel when goalkeeping in a match.

(4)

Long bones enable leverage, and therefore mean sporting actions can take place, as well as carrying red blood cells. This means Shantel can run from each side of the goal to deflect the ball, as well as kick it back to her team (femur in this case, and fibula and tibia). Short bones are weight bearing so support her body when she dives for the ball or jumps up to catch it (carpals) since there is impact.

(Total for Question 2 = 6 marks)

This response gained 2 marks

Shantel is a goalkeeper in a football team. Her long and short bone types help her to perform successfully in a match.

(b) Explain how **long** and **short** bones help Shantel when goalkeeping in a match.

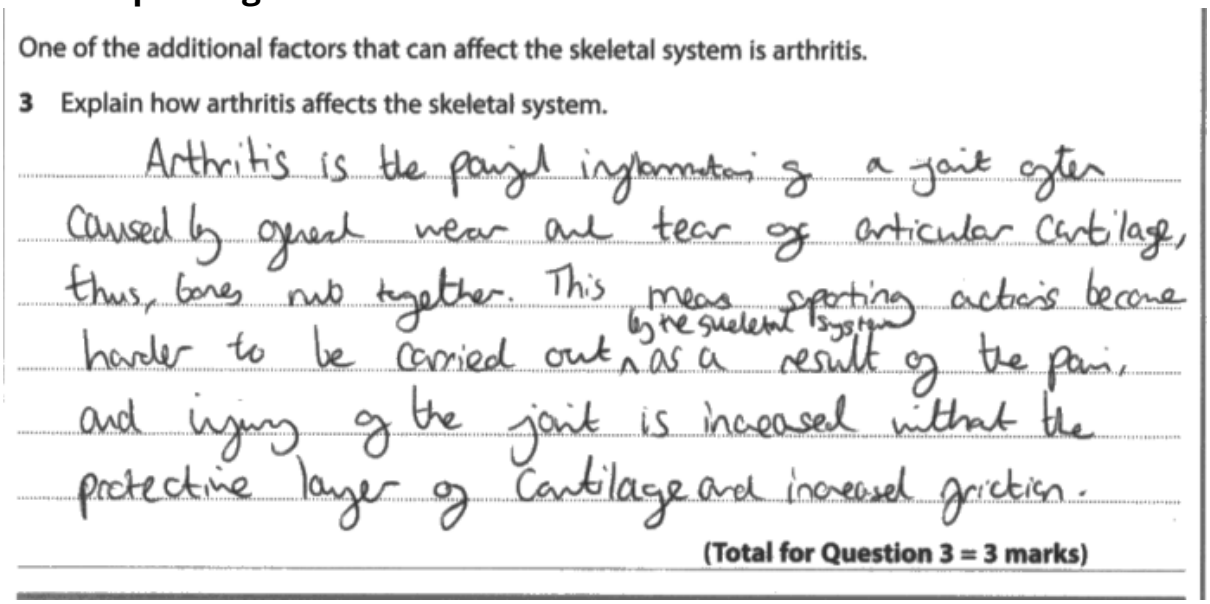
(4)

Shantel's long bones acts as levers, this will help her to reach for the ball by extending, and her short bones help her stability when diving to save the ball.

Q3

Candidates were required to explain how arthritis affects the skeletal system. The majority of candidates accessed the final marking point around friction and pain, with fewer accessing the points available for inflammation and breakdown of cartilage. Common errors were answering the question as if it was about osteoporosis.

This response gained 1 mark



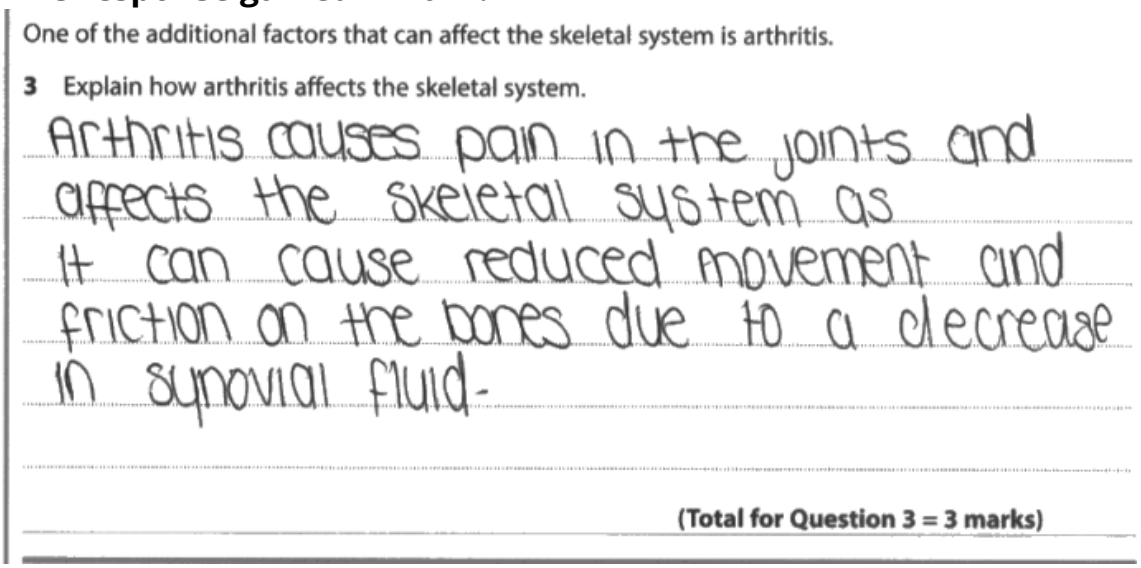
One of the additional factors that can affect the skeletal system is arthritis.

3 Explain how arthritis affects the skeletal system.

Arthritis is the painful inflammation of a joint often caused by general wear and tear of articular cartilage, thus, bones rub together. This means sporting actions become harder to be carried out by the skeletal system as a result of the pain, and injury of the joint is increased without the protective layer of cartilage and increased friction.

(Total for Question 3 = 3 marks)

This response gained 1 mark.



One of the additional factors that can affect the skeletal system is arthritis.

3 Explain how arthritis affects the skeletal system.

Arthritis causes pain in the joints and affects the skeletal system as it can cause reduced movement and friction on the bones due to a decrease in synovial fluid.

(Total for Question 3 = 3 marks)

Q4 & Q5

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

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 'lats' would receive no credit for Q4.

Common errors seen on Q5 were identifying joint movements, flexion, extension, rather than the contractions.

This response gained 4 marks for Q4 and 3 marks for Q5

4 Identify the muscles labelled **A–C** in **Figure 1**.

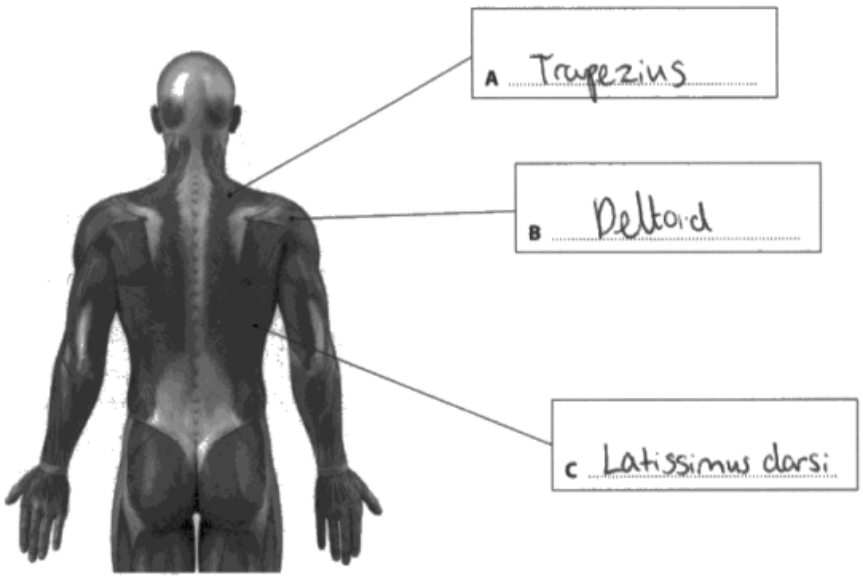


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Figure 1

(Total for Question 4 = 3 marks)

5 State **three** types of muscle contraction.

1 Isometric

2 Isotonic eccentric

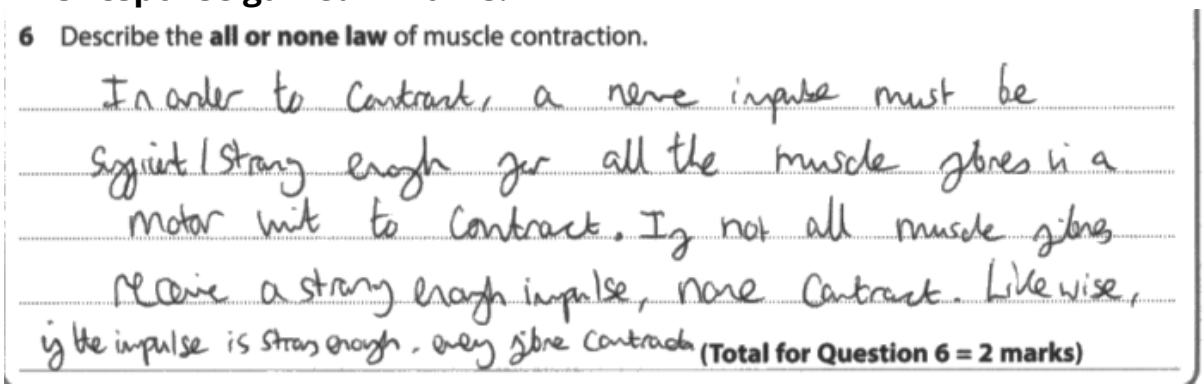
3 Isotonic Concentric

(Total for Question 5 = 3 marks)

Q6

Question 6 did not perform as anticipated. The question required candidates to describe the all or none law, although this was only a 2-mark question it was apparent that this knowledge was not evident in a significant number of responses, although it is a clear specification point. The majority of responses seen either paid no reference to question set or outlined what the law was. Those who did attempt were too vague with their responses and stated 'the muscle' as opposed to the 'muscle fibres'.

This response gained 2 marks.

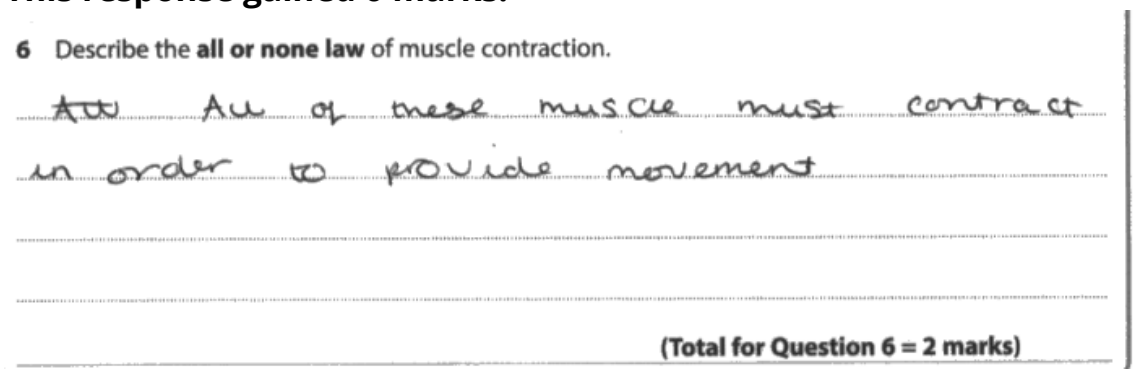


6 Describe the **all or none law** of muscle contraction.

In order to Contract, a nerve impulse must be
Sufficient / Strong enough for all the muscle fibres in a
motor unit to Contract. If not all muscle fibres
receive a strong enough impulse, none Contract. Likewise,
if the impulse is strong enough, every fibre contracts

(Total for Question 6 = 2 marks)

This response gained 0 marks.



6 Describe the **all or none law** of muscle contraction.

~~All~~ All of these muscle must contract
in order to provide movement

(Total for Question 6 = 2 marks)

Q7a

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

This response gained 2 marks

Tristan is a long-distance runner. One response that occurs during a training run is that his muscles become more pliable.

7 (a) Explain why increased muscle pliability will benefit Tristan when running.

(2)

Increased muscle pliability as a result of increased body temperature means the range of ~~movement~~ movement increases, so Tristan will be able to take longer strides on his run to complete it in a quicker ~~time~~ time. The threat of injury is also reduced (e.g strains) so he can maintain fitness.

This response gained 1 mark

Tristan is a long-distance runner. One response that occurs during a training run is that his muscles become more pliable.

7 (a) Explain why increased muscle pliability will benefit Tristan when running.

(2)

Increased pliability will help with movement leading to an increase in flexibility. This will help Tristan run with ease as he won't find it uncomfortable when using his running technique

Q7b

The majority of candidates performed as anticipated on this question, with a nice spread of marks, many could identify that myoglobin was linked to more oxygen being transported to the working muscle, but fewer could effectively expand on this point, to create more energy and then the impact on performance in the context of the question. 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 long period of time Tristan's muscular system has adapted to the training programme, causing an increase in myoglobin stores.

(b) Explain the impact of an increase in myoglobin stores on Tristan's performance in a 10,000 m race.

(3)

Myoglobin is a type of haemoglobin that carries oxygen from the muscles to the mitochondria. An increased amount of it means more oxygen can be carried to the mitochondria, thus increasing the rate of aerobic respiration (and energy production). This means Tristan will have sufficient energy to maintain intensity in his race, and reduce the onset of fatigue. So he can complete the run in a quicker time.

(Total for Question 7 = 5 marks)

This response gained 1 mark.

Over a long period of time Tristan's muscular system has adapted to the training programme, causing an increase in myoglobin stores.

(b) Explain the impact of an increase in myoglobin stores on Tristan's performance in a 10,000 m race.

(3)

the impact of an increase in myoglobin stores will lead to Tristan having more energy when running 10,000 m race. This happens because the myoglobin cells store carbohydrates leading to energy being released for a longer period of time leading to a better race result.

Q8

On the whole candidates performed well on this question, with the spread of marks clearly outlining their knowledge and understanding of the effects of altitude on sporting performance.

Many provided logical responses from the conditions at altitude and the impact of a lack of oxygen would have on the body.

This response gained 4 marks

Alex is an endurance athlete who is starting altitude training.

8 Explain the negative effects on Alex's respiratory system when starting training at altitude.

Since he has not become accustomed to it, the lower concentration of oxygen in the atmosphere means his lungs have to work harder to meet the demands, so as a result he breathes faster and deeper, increasing workload on the lungs. The lack of oxygen can also cause hypoxia, which results in dizziness, and sickness, whilst worsening aerobic performance. Fatigue will set in sooner as waste products cannot be removed as quickly, meaning he will have to slow down or stop more frequently (lactic acid and carbon dioxide are examples of waste products), again decreasing performance.

(Total for Question 8 = 4 marks)

This response gained 2 marks.

Alex is an endurance athlete who is starting altitude training.

8 Explain the negative effects on Alex's respiratory system when starting training at altitude.

one effect will be feeling sick. This is because there is less oxygen present at higher altitude so ~~lactic acid~~ there is more Co^2. Present. leading to you having Max lactic acid which creates a sicky feeling

Q9

The majority of candidates found this question challenging to access the full marks, a significant number correctly identified that a person would struggle breathing.

Significantly fewer identified why they would struggle to breathe; due to the airways being constricted. Common errors were providing information about using an inhaler, which was irrelevant in the context of the question.

This response gained 2 marks.

Asthma is a condition that affects the respiratory system.

9 Describe the condition asthma.

Asthma is ~~an inflammation~~ where the band of muscles surrounding the airway are constricted or tightened, allowing less air to enter the lungs, and as a result reduce sporting performance. It can also result in wheezing or coughing if demand is too high. Normal airways have glee growing muscles for expansion.

(Total for Question 9 = 2 marks)

This response gained 1 mark.

Asthma is a condition that affects the respiratory system.

9 Describe the condition asthma.

Asthma is a condition that in the lungs there is not enough dampness causing a harder breathing for people with this condition

Q10a

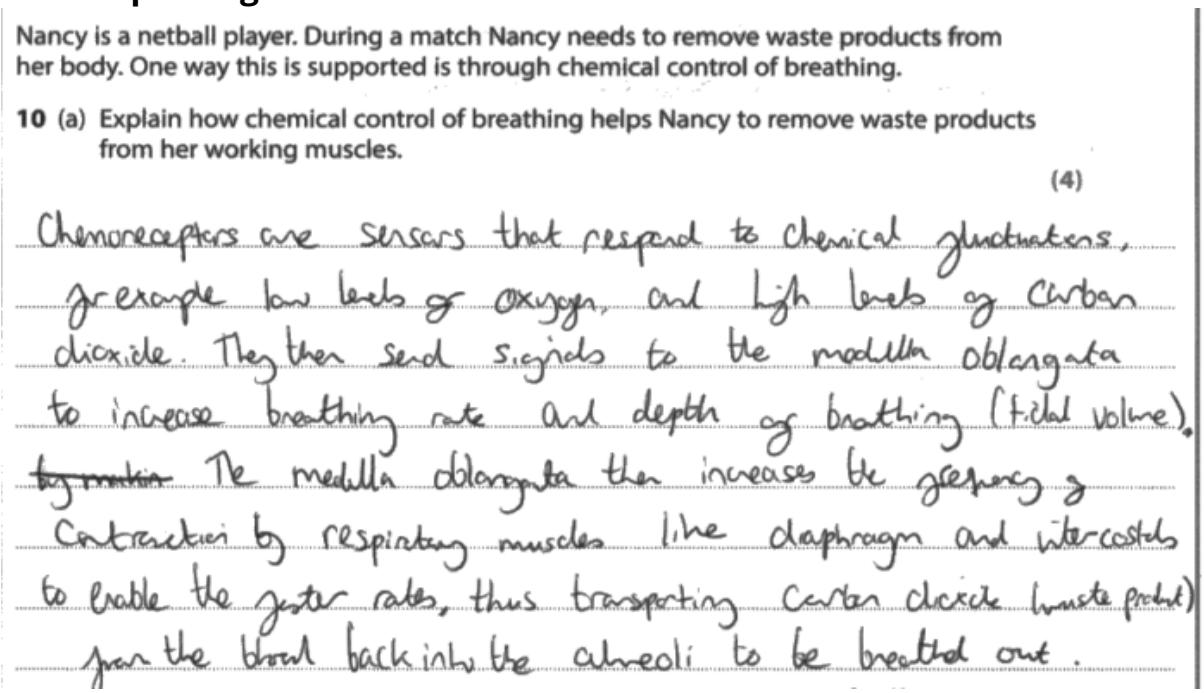
This question acted as a good differentiator, for how chemical control of breathing helps remove waste products.

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 was bringing oxygen into the answer and the cardiovascular system, which is irrelevant when the question is based around waste products and the respiratory system.

This response gained 4 mark.



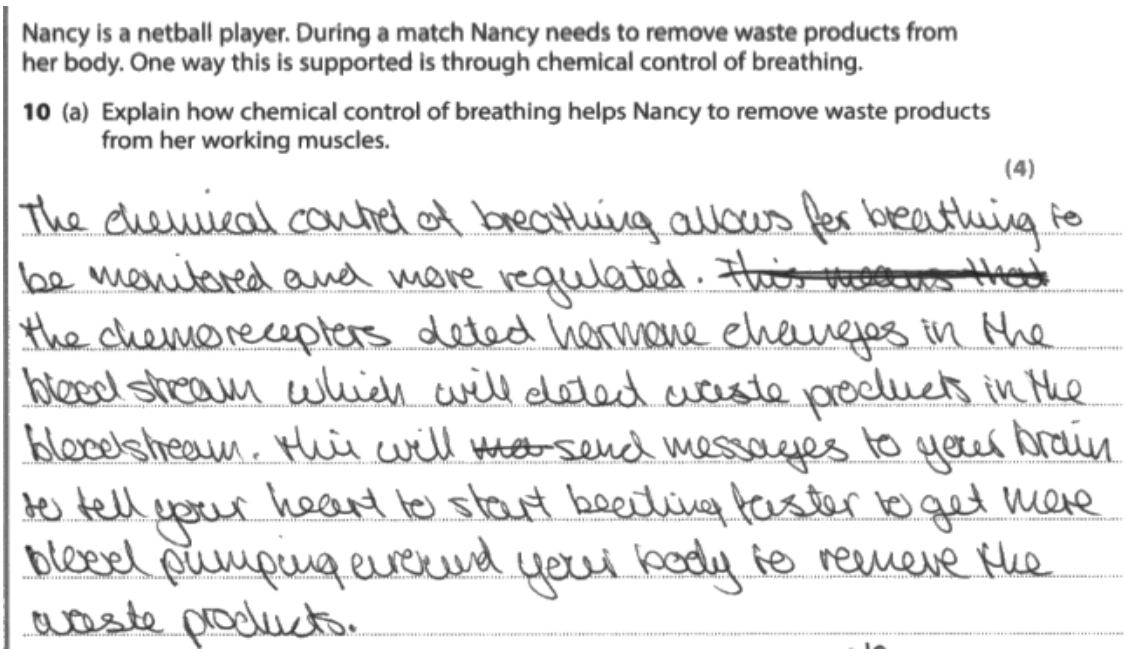
Nancy is a netball player. During a match Nancy needs to remove waste products from her body. One way this is supported is through chemical control of breathing.

10 (a) Explain how chemical control of breathing helps Nancy to remove waste products from her working muscles.

(4)

Chemoreceptors are sensors that respond to chemical fluctuations, for example low levels of oxygen, and high levels of carbon dioxide. They then send signals to the medulla oblongata to increase breathing rate and depth of breathing (tidal volume). ~~by motion~~ The medulla oblongata then increases the frequency of contraction by respiratory muscles like diaphragm and intercostals to enable the faster rates, thus transporting carbon dioxide (waste product) from the blood back into the alveoli to be breathed out.

This response gained 2 marks.



Nancy is a netball player. During a match Nancy needs to remove waste products from her body. One way this is supported is through chemical control of breathing.

10 (a) Explain how chemical control of breathing helps Nancy to remove waste products from her working muscles.

(4)

The chemical control of breathing allows for breathing to be monitored and more regulated. ~~This means that~~ the chemoreceptors detect hormone changes in the blood stream which will detect waste products in the bloodstream. This will ~~then~~ send messages to your brain to tell your heart to start beating faster to get more blood pumping around your body to remove the waste products.

Q10b

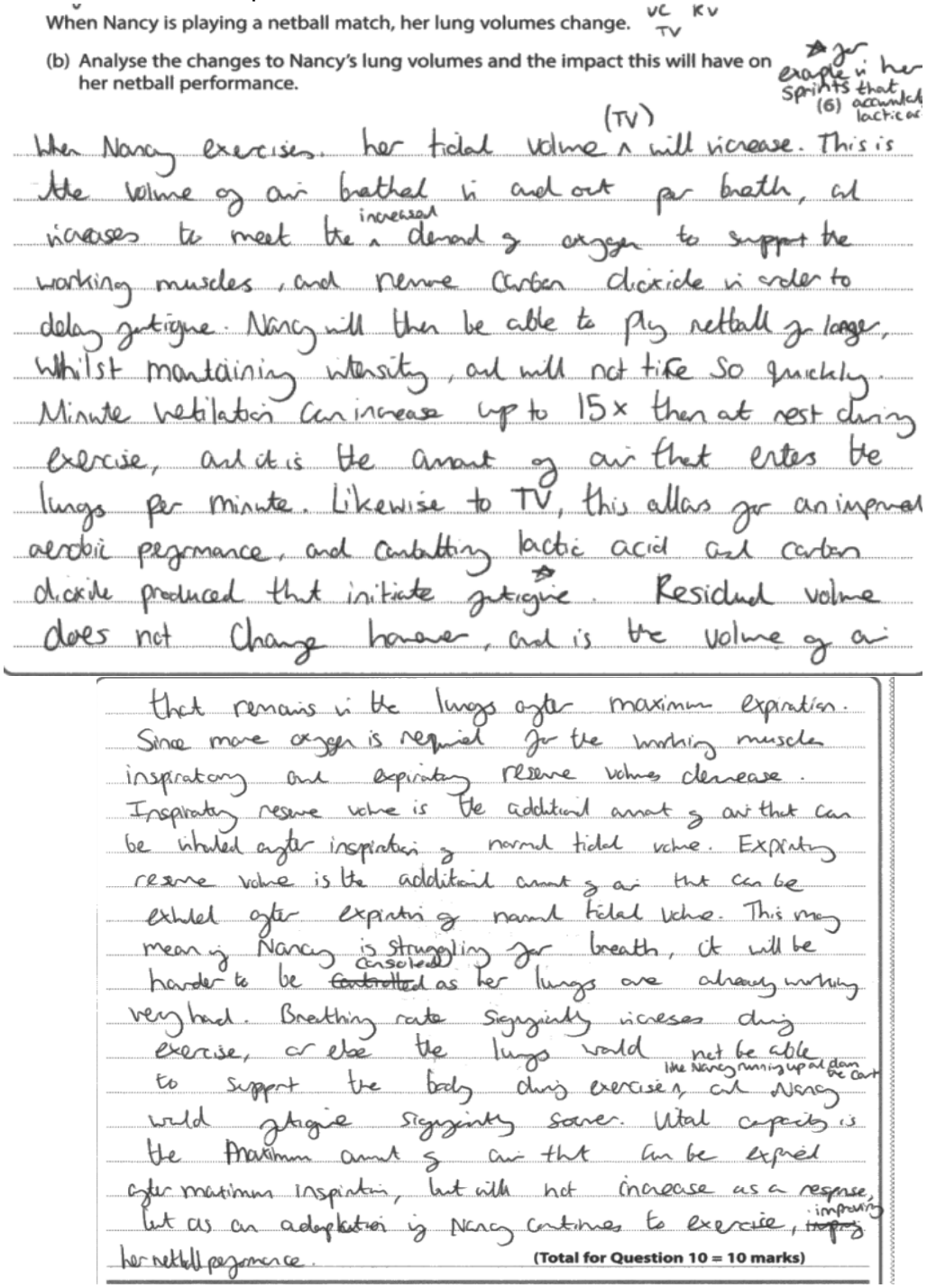
This was the first extended response question of the paper and candidates had to analyse the changes in lung volumes and the impact it will have on performance. Responses for the question required focus on the changes in different lung volumes (specification topic C3). The candidates needed to articulate whether it would increase/decrease or stay the same and the impact this would have on performance. 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 change in lung volumes. Other candidates were unable to address the question fully and only highlighted the lung volume goes up and down and not changes as required.

Level 1 responses tended to focus on the lung volume going up and down and links to performance were generalistic.
At level 3 candidates' responses provided accurate knowledge of the effects on performance of the changes in the specific lung volumes, used technical terminology with clear development of the point and linked to netball 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 changes with appropriate development in reference to the question.



When Nancy is playing a netball match, her lung volumes change. VC KV TV

(b) Analyse the changes to Nancy's lung volumes and the impact this will have on her netball performance. (6)

for example in her sprints that accumulated lactic ac

When Nancy exercises, her tidal volume (TV) ^ will increase. This is the volume of air breathed in and out per breath, and increases to meet the ^ increased demand of oxygen to support the working muscles, and remove Carbon dioxide in order to delay fatigue. Nancy will then be able to play netball for longer, whilst maintaining intensity, and will not tire so quickly. Minute ventilation can increase up to 15x than at rest during exercise, and it is the amount of air that enters the lungs per minute. Likewise to TV, this allows for an improved aerobic performance, and combatting lactic acid and carbon dioxide produced that initiate fatigue. Residual volume does not change however, and is the volume of air that remains in the lungs after maximum expiration. Since more oxygen is required for the working muscles inspiratory and expiratory reserve volume decrease. Inspiratory reserve volume is the additional amount of air that can be inhaled after inspiration of normal tidal volume. Expiratory reserve volume is the additional amount of air that can be exhaled after expiration of normal tidal volume. This may mean if Nancy is struggling for breath, it will be harder to be ~~controlled~~ assisted as her lungs are already working very hard. Breathing rate significantly increases during exercise, or else the lungs would not be able to support the body during exercise, as Nancy like Nancy running up and down the court would fatigue significantly sooner. Vital capacity is the maximum amount of air that can be expired after maximum inspiration, but will not increase as a response, but as an adaptation if Nancy continues to exercise, improving her netball performance.

(Total for Question 10 = 10 marks)

This response was placed at Level 2 and given 3 marks. The answer includes tidal volume and a nice expansion to getting more air in**.** There is a good connection to the impact on performance. However, some on the content is incorrect (IRV/VC will increase)

When Nancy is playing a netball match, her lung volumes change.

(b) Analyse the changes to Nancy's lung volumes and the impact this will have on her netball performance.

(6)

During the netball match, Nancy's tidal volume will increase. This can increase from 6L to 60L. This means she will be breathing more air in each breath, so more oxygen will be entering the body. The increase in oxygen will impact her performance as she is less likely to fatigue leading to a more consistent performance instead of it deteriorating. Another change to her lung volumes are that her inspiratory reserve volume will increase and her vital capacity will increase so she can breathe more air in for more oxygen. This will help her last the whole netball match as she will have more energy.

Q11

Was a recall question and candidates performed as anticipated on this question, with the spread of marks clearly outlining the candidates knowledge and understanding of the structure of the heart.

It is important that technical terminology is used and phonetic spelling was credited.

Common errors seen on were identifying left as right and vice versa.

Figure 2 shows the heart.

VC PA L, PV A

11 Identify the structures of the heart labelled **A–D**.

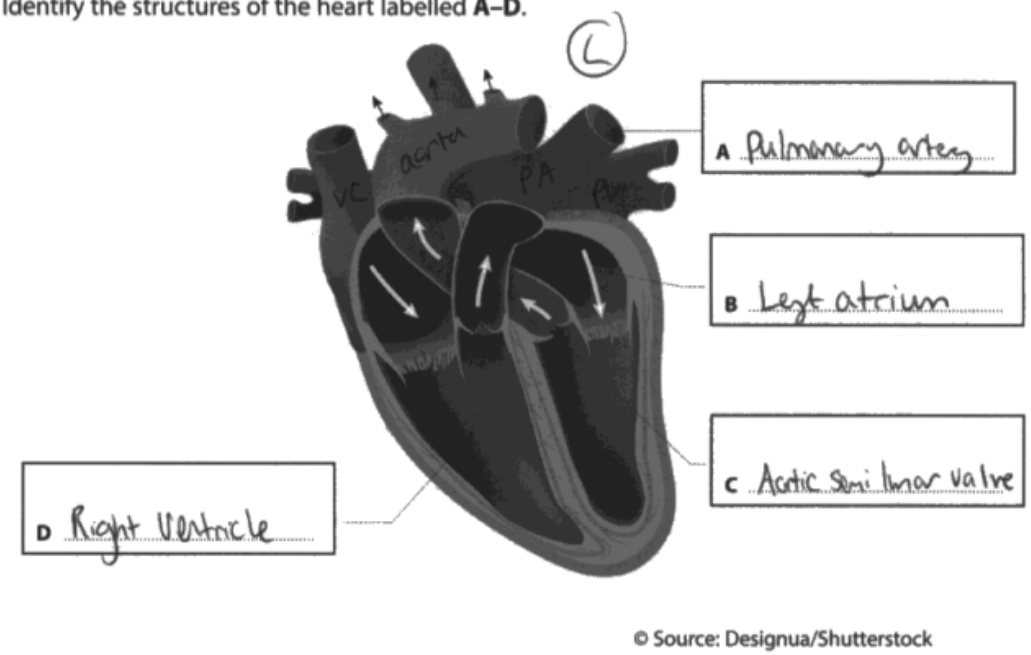


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Figure 2

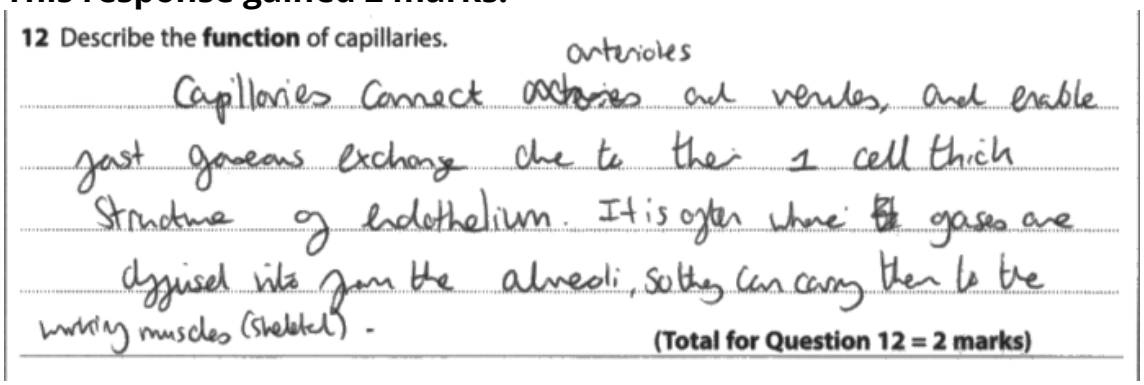
(Total for Question 11 = 4 marks)

Q12

The majority of candidates achieved 1 mark; for allows for gas exchange/diffusion to take place. Significantly fewer identified the mark for identifying that capillaries connect arteries/arterioles with veins/venules.

Common errors were giving structural characteristics, semi permeable, 1 cell thick rather than functions.

This response gained 2 marks.

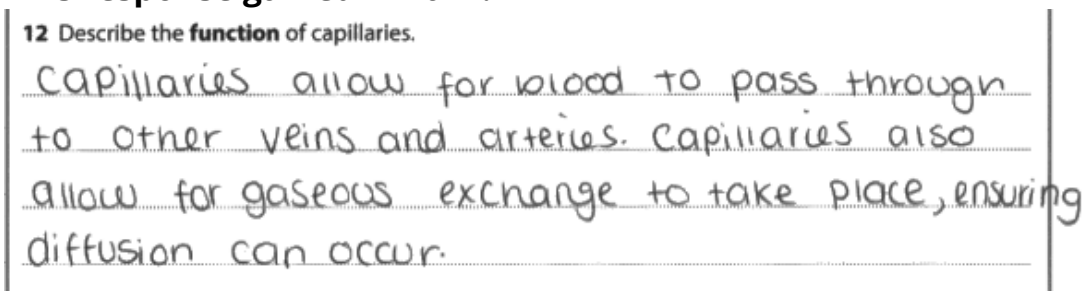


12 Describe the **function** of capillaries.

Capillaries connect arterioles and venules, and enable fast gaseous exchange due to their 1 cell thick structure of endothelium. It is often where gases are dyfused into from the alveoli, so they can carry them to the working muscles (skeletal).

(Total for Question 12 = 2 marks)

This response gained 1 mark.



12 Describe the **function** of capillaries.

Capillaries allow for blood to pass through to other veins and arteries. Capillaries also allow for gaseous exchange to take place, ensuring diffusion can occur.

Q13a

This question acted as a good differentiator, for how an increased exercising stroke volume has an impact on performance.
It was clear from the spread of marks that some candidates found this question challenging especially the impact on performance. Those who did display knowledge of the role generally accessed all marking points.
Common errors was confusing stroke volume with cardiac output and being too general regarding performance impacts, with responses such as 'play a better game' or 'not fatigue', when the mark scheme was looking for 'play at a higher intensity for a longer duration, and 'delay the onset of fatigue'.

This response gained 4 marks.

Robin is a badminton player. Over time Robin's cardiovascular system has adapted. One of these adaptations is an increase in exercising stroke volume.

13 (a) Explain how an increase in exercising stroke volume has an impact on Robin's badminton performance.

(4)

Stroke volume is the amount/volume of blood pumped out by the left ventricle per contraction. If this is increased it means the heart does not have to work as hard or become stronger, as it can beat less (reduced heart rate), and happens as a result of hypertrophy. This means Robin's working muscles will receive more oxygenated blood at a faster rate to sustain intensity, for example when running up and down the court to hit the shuttlecock. Furthermore, waste products like lactic acid and carbon dioxide can be removed, delaying the onset of fatigue for him when he completes explosive movements like jumps, thus improving his performance since he can play at a higher intensity for a longer time and not slow down or stop.

This response gained 2 marks.

Robin is a badminton player. Over time Robin's cardiovascular system has adapted. One of these adaptations is an increase in exercising stroke volume.

13 (a) Explain how an increase in exercising stroke volume has an impact on Robin's badminton performance.

(4)

An increase in stroke volume will impact Robyns performance as more oxygenated blood is getting to the working muscles, this will increase muscle temperature, more O^2 is getting to the heart and lungs allowing Robyn not to fatigue and get shortness of breath. The impacts this will have on her performance is that can remain doing high intensity for longer duration as she will not fatigue.

Q13b

The majority of candidates performed as anticipated on this question, with many identifying the correct answer. Common errors was stating it was white blood cells.

(b) State the component of blood that carries most of Robin's oxygen during the badminton match.

(1)

Red blood cells

Q13c

This was the second extended response question of the paper and focused functions of the cardiovascular system and the impact that would have on badminton performance, 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 functions of the cardiovascular system, but some candidates struggled to express this beyond transferring oxygen to working muscles.

Level 1 responses generally only included that the function to transport oxygen and provided limited application to performance.
At level 3 candidates charted accurately the three functions of the cardiovascular system and how that impacted on performance.

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 three functions of the cardiovascular system and the impact on performance, with effective use of technical terminology and appropriate development in reference to the effects on performance.

Two functions of the cardiovascular system are to fight infection and clot blood.

(c) Analyse the **three other** functions of the cardiovascular system and how they impact on Robin's badminton performance. Deliver O_2 Remove waste products Thermoregulate (6)

One other function is delivering oxygen and nutrients. These are needed at the working muscles to sustain high intensity activity for a longer duration, so improving performance as a result since muscles can work harder to win the match. Removal of waste

products is another function, and is crucial to delay fatigue. Becoming fatigued in his match could mean the opponent scores more points against him and he loses, as he cannot present it by ~~having~~ having enough energy to whack the shuttlecock back to the other side. Lactic acid is taken from the tissues, to the kidneys and liver where it is taken down, and carbon dioxide back to the alveoli where it is breathed out (waste products). Thermoregulation enables Robin's temperature to stay at a moderate level, and since muscle contracting produce heat as a by-product, ensures he does not overheat. This is via vasoconstriction and vasodilation. Blood vessels around his skin and skeletal muscles in this case will dilate, decreasing the resistance to blood flow, enabling more blood to flow towards the skin. Heat is then lost here often by radiation, preventing Robin from overheating as it decreases his body temperature, so he can continue to perform well without risk of having to slow down or stop.

* without sufficient oxygen, muscular contractions cannot be made at as the same high intensity, like hitting the shuttlecock.

(Total for Question 13 = 11 marks)

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 expanded upon delivering oxygen to the working muscle and the impact on performance.

Two functions of the cardiovascular system are to fight infection and clot blood.

(c) Analyse the **three other** functions of the cardiovascular system and how they impact on Robin's badminton performance.

(6)

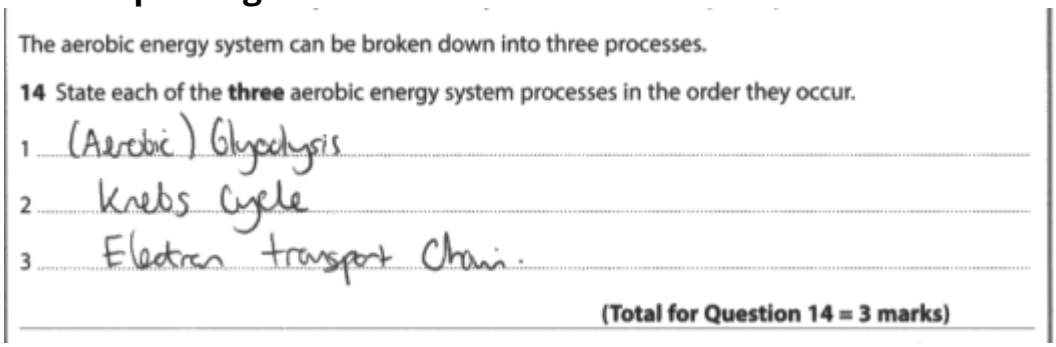
red blood cells carry oxygen through to the heart, which then delivers oxygen to the working muscles, this will have a positive impact on Robins badminton performance as he will have oxygen in his muscle meaning it is able to contract, have more power in his shots, Reduce risk of injury and Fatigue. Increase of blood supply will have an impact on Robins badminton performa

Plasma, allows more oxygen to flow through the body so this could benefit Robins badminton performance as he won't run out of breath quicky and he will be able to go at a high intensity level for a longer period of time.

Q14

This was a recall question for identifying in the correct order the three processes of the aerobic energy system. Common errors were candidates identifying the three energy systems, rather than the processes of the aerobic system.

This response gained 3 marks.



The aerobic energy system can be broken down into three processes.

14 State each of the **three** aerobic energy system processes in the order they occur.

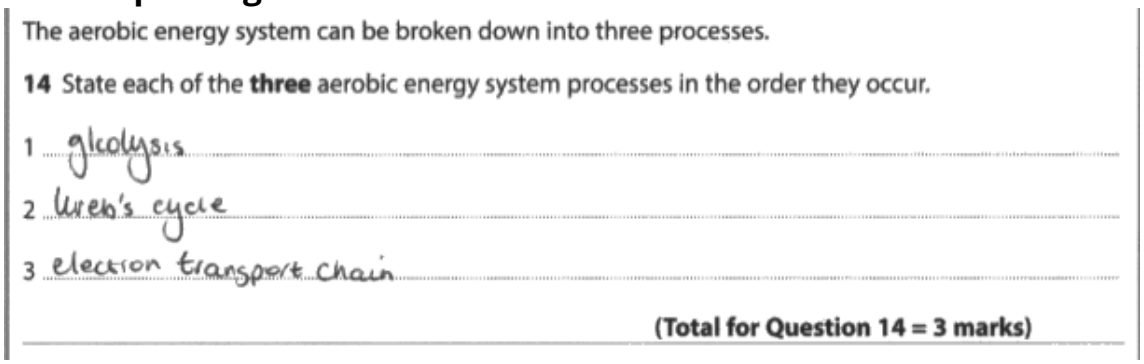
1 (Aerobic) Glycolysis

2 Krebs Cycle

3 Electron transport Chain.

(Total for Question 14 = 3 marks)

This response gained 2 marks.



The aerobic energy system can be broken down into three processes.

14 State each of the **three** aerobic energy system processes in the order they occur.

1 glcolysis

2 kreb's cycle

3 electron transport chain

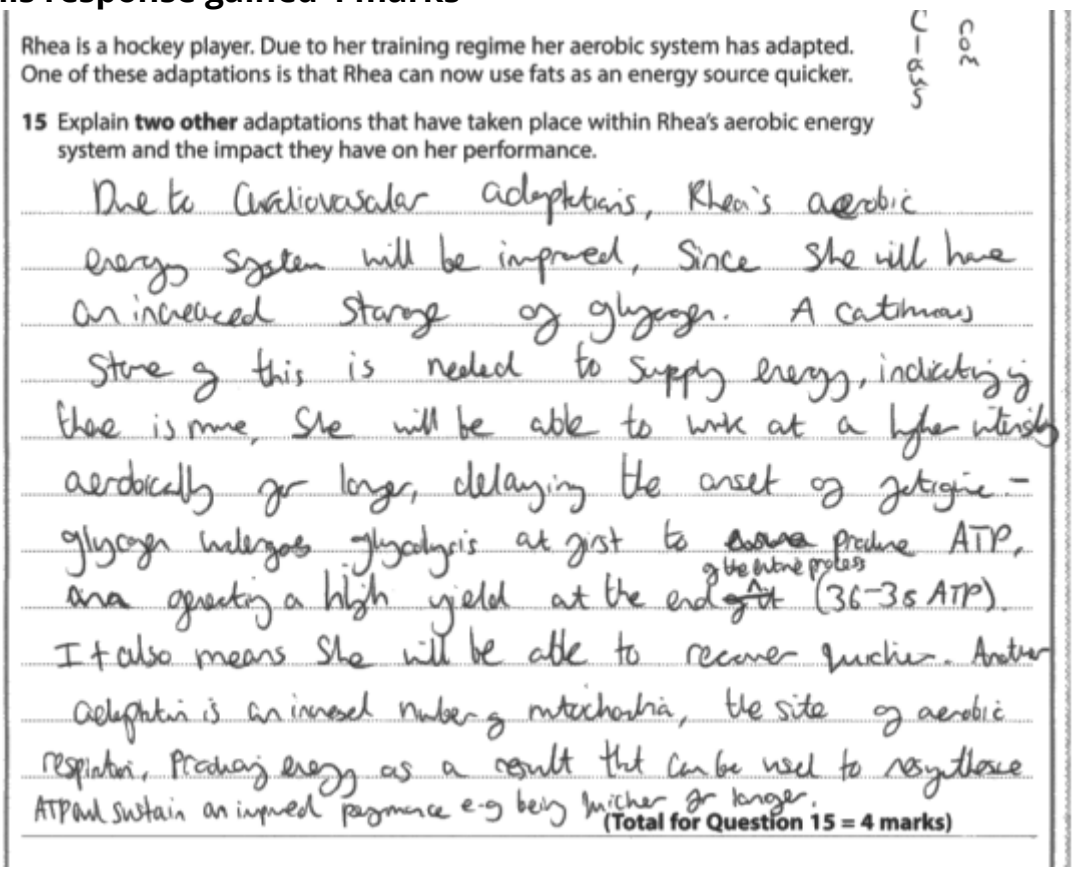
(Total for Question 14 = 3 marks)

Q15

Surprisingly, candidates found this question difficult and this was reflected in their scoring. Two marks were awarded for identification of the aerobic system adaptations (topic E5) and two marks for the linked expansion. Expansion marks were not awarded without the correct adaptation identified and thus affected candidates scoring.

Common errors made were bringing in cardiovascular and muscular adaptations, such as more myoglobin and therefore those candidates scored 0 marks.

This response gained 4 marks



Rhea is a hockey player. Due to her training regime her aerobic system has adapted. One of these adaptations is that Rhea can now use fats as an energy source quicker.

15 Explain **two other** adaptations that have taken place within Rhea's aerobic energy system and the impact they have on her performance.

Due to Cardiovascular adaptations, Rhea's aerobic energy system will be improved, since she will have an increased storage of glycogen. A continuous store of this is needed to supply energy, indicating if there is more, she will be able to work at a higher intensity aerobically for longer, delaying the onset of fatigue - glycogen undergoes glycolysis at first to ~~[illegible]~~ produce ATP, and generating a high yield at the end of the entire process ~~of it~~ (36-38 ATP). It also means she will be able to recover quicker. Another adaptation is an increased number of mitochondria, the site of aerobic respiration, producing energy as a result that can be used to resynthesise ATP and sustain an improved performance e.g being quicker for longer.

(Total for Question 15 = 4 marks)

This response gained 0 marks

Rhea is a hockey player. Due to her training regime her aerobic system has adapted. One of these adaptations is that Rhea can now use fats as an energy source quicker.

15 Explain **two other** adaptations that have taken place within Rhea's aerobic energy system and the impact they have on her performance.

There will be an increase in myoglobin stores so Rhea will have more enogy and will be able to delay the on set to fatigue.

Q16

The final question of this section required the candidates to analyse the role of the anaerobic energy systems in in relation to hockey performance.

Like all of the extended response questions, the quality of candidate responses varied. Some candidates were clearly very knowledgeable about the anaerobic energy systems (ATP-PC/Lactate) in relation to intensity, duration and could articulate where each system contributes to hockey performance. Other candidates were unable to address the question fully by writing everything they knew about the energy system in general rather than answering the specific question.

Level 1 responses came from those candidates who identified around time or intensity for one system and not both, with limited or accurate links to performance.
Level 3 responses were those who assessed both energy systems in terms of intensity and time and linked this directly into performance. They articulated using technical terminology

This response was placed at Level 3 and given 6 marks.
The answer analyses the contributions of each of the anaerobic energy systems and develops a number of points from the indicative content. Clear relation to performance is evident.

Rhea will also rely on her anaerobic energy systems during a hockey match.

16 Analyse the role of the **anaerobic** energy systems in making sure that Rhea is successful in the hockey match.

The anaerobic energy systems are the anaerobic glycolytic system, and ATP-PC. The anaerobic glycolytic system resynthesises 2 ATP and is used for activities beyond 6-10 seconds but under 2-3 minutes. It will be used for Rhea when she has to ~~sprint~~ sprint the length of the pitch, as it will provide energy faster than the aerobic system for example. However, it could be argued that due to the glycogen by-product of lactic acid (due to the ~~enzyme~~ effect of enzyme lactate dehydrogenase on pyruvic acid), Rhea's success may decrease since she will have to slow down or stop. This indicates that it is used for anaerobic activities that are slightly longer in duration, but since recovery time is also about 8 minutes, it is not always the reliable. The ATP-PC system on the other hand, uses its fast ~~coupled~~ coupled reaction in the sarcoplasm to create 1 ATP; though a lower yield than both other systems, energy is readily available for explosive, high intensity actions, and recovery only 2-3 minutes. It has no glycogen by-product so will be used for short tackles to obtain the ball and score a goal. ~~Although~~ increasing her success. Unfortunately, phosphocreatine stores (the gel) are limited, so it is difficult to rely on it for reasons other than explosive movements.

(Total for Question 16 = 6 marks)

Question Number	
16	Therefore, the role of the anaerobic energy ~~[illegible]~~ systems is still important to Rhea, as they enable swifter, high intensity movements that the aerobic system cannot (only sub-maximal activities) since the aerobic are cannot supply ~~[illegible]~~ energy fast enough, but it is still important for ~~[illegible]~~ enduring the entire match. Arguably, the fast movements like a tackle or a tactical spirit are what will lead Rhea to success. So all systems are required ~~[illegible]~~ to be predominant in different parts of the game, never in isolation

This response was placed at Level 2 and given 4 marks.
The answer generates credit through the attempt to link the ATP-PC and Lactate system to performance. Time is referenced for both systems, but intensity is missing.

16 Analyse the role of the **anaerobic** energy systems in making sure that Rhea is successful in the hockey match.

The anaerobic energy systems are the ATP-PC system and the lactate system. The ATP-PC will be used if Rhea has to sprint to beat an opponent to the hockey ball. This is because, for a short duration (less than 10seconds) the ATP-PC system gives off the most energy as the high energy bond between the last 2 phosphate molecules is broken down to release lots of energy.

The lactate system will be used when if Rhea joins in on a counter attack and has to sprint up the pitch. This is because it gives her a lot of energy and lasts up to two minutes. Although it doesn't give as much energy as the ATP-PC system, it is better in this instance because it lasts longer than 10seconds and gives off a good amount of energy.

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 respiratory and muscular systems 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 bringing in cardiovascular adaptations so irrelevant in the context of this question. Other errors were bringing in respiratory and muscular responses rather than adaptations.

High level responses displayed synoptic coverage from both areas 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.

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 systems adaptations visited and application to swimming performance and interrelationships are developed throughout.

Damian has been a competitive 800 m swimmer for 10 years. Over this time, both his respiratory **and** muscular systems have adapted.

17 Analyse how the adaptations to Damian's respiratory **and** muscular systems affect his swimming performance in the 800 m.

(8)

An 800m event requires endurance, but also strength to complete it in the fastest possible time. One adaptation of the muscular System is muscular hypertrophy. This is where the muscle becomes bigger, enabling more forceful Contractions, and increasing the number of mitochondria in a muscle too. An increased force of muscular Contraction allows Damian to whip through the water at speed, using his arms (biceps + triceps) and to drive through it, and increased push of the legs (quadriceps and hamstrings) at the wall of the pool to turn another length swiftly, improving his performance. Similarly, one of the respiratory adaptations is increased strength of respiratory muscles like the diaphragm and intercostals. This will allow a greater expansion of the Chest Cavity, thus increasing the Volume of air that can enter the lungs. The increased amount of air means that oxygen can reach the working muscles, like his arms and legs required in the swim, enabling Damian to swim at a higher intensity for longer during his 800m. Fatigue will be delayed too since Carbon dioxide can be removed

at a faster rate, again sustaining Damian's high intensity. Carbon dioxide is a waste product, as is lactic acid. And tolerance to lactic acid is another adaptation the muscular system. Endurance ~~training~~ training like Zoom creates capillary networks, allowing for more oxygen to reach the working muscles faster, and more efficiently removing lactic acid via oxidation. Lactic acid impedes muscle contractions, so its removal means Damian will not have to slow down or stop, so he can swim at a faster time or beat opponents. Capillaries are key in gaseous exchange, as they allow oxygen to diffuse from the alveoli into the blood, and carbon dioxide from the blood to the alveoli where it is breathed out. As a result of long term training, the rate of this ~~diffusion~~ of diffusion increases, maximising efficiency of the system so Damian will not tire as fast, and he may ~~even~~ have ~~taste~~ sufficient support from the high oxygen intake to increase his intensity in the last stretch of the swim. For sports like swimming, flexibility is key for joint movement that involves circumduction, so increased tendon strength of the muscular system is useful to both maximise range of movement to swim faster, and prevent injury so he can continue to train and see adaptations, improving performance further. ~~Furthermore~~, the increased ...

(Total for Question 17 = 8 marks)

17 ...glycogen stores and muscle (in muscles) mitochondria is key to energy production, as without this, lactic acid would prevail, and Usain Bolt would not have the sufficient stamina to complete the race to his full potential, especially as he has to work harder to soar through the water which provides resistance. An increased vital capacity is also necessary for the increased resistance (maximum amount of air that can be expired after maximum inspiration) in order to breathe out waste products faster (only minimal breaths are taken during

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Question Number

Swimming), and use the small capillaries for air to supply sufficient oxygen to all tissue being used.

This response below was placed at Level 3 and given 5 marks.
The answer identifies isolated elements of knowledge and understanding, to which some of this is well developed from the respiratory and muscular system adaptations. However, the information is not sustained across the adaptations and the links to performance is only evident in the respiratory system.

Damian has been a competitive 800 m swimmer for 10 years. Over this time, both his respiratory **and** muscular systems have adapted.

17 Analyse how the adaptations to Damian's respiratory **and** muscular systems affect his swimming performance in the 800 m.

(8)

An Adaptation to Damians respiratory system would be an increase in the strength of respiratory muscles. This means the strength of the diaphragm and the intercostal muscles have had an increase in strength. This is beneficial for damian because with these muscles stronger, during inhalation, the diaphragm can contract and pull flat quicker and further, and the external intercostals can move up and out further, creating much more room for the lungs to expand allowing for much more oxygen to be inhaled. ~~This~~ This benefits Damian as now more oxygen can go to muscles to prevent fatigue in his 800m swimming race, meaning he can swim faster for longer enhancing his chance of winning the swimming race. *

Damian having more strength and Power during his swimming race. SO when Damian is competing he has a higher chance of beating his competents and winning the race.

*This is linked with the aerobic energy system also.

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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