Examiners' Report/
Lead Examiner Feedback

January 2018

BTEC Level 3 Nationals in Sport and Exercise Science
Unit 1: Sport and Exercise Physiology (31813H)

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January 2018
Publications Code 31813H_1801_ER

Grade Boundaries

What is a grade boundary?

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

Setting grade boundaries

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

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

Variations in external assessments

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

Grade boundaries for this, and all other papers, are on the website via this link: qualifications.pearson.com/gradeboundaries

Unit 1: Sport and Exercise Physiology (31813)

Grade	Unclassified	Near Pass	Pass	Merit	Distinction
Boundary Mark	0	15	25	35	46

Introduction

This was the second test series of the new specification. Centres and learners should be congratulated on their preparation for this assessment. Overall learners appeared well prepared and well versed on many of the specification topics covered in this assessment.

The question paper followed the general format identified in the sample assessment material and the summer 2017 series. The main difference being the reduction in marks available for the extended responses, reduced from 10 marks to 8. As previously, the paper was split into four questions. Each question was based on a sport or exercise scenario and required learners to demonstrate knowledge and understanding of a range of specification topics and apply this knowledge to the specific question scenario. Three questions were marked out of 18 marks, and one out of 16 marks, 8 marks being gained for the final part of each question where an extended response was required.

Each of 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, 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 point's 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

Learner performance varied throughout the paper. Whilst the extended response questions were challenging most learners gained some marks for these questions. The style of the assessment is challenging due to the depth and breadth of knowledge required to fully address the demands of the paper. The extended writing questions account for 45% 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, for example, Q3a. There are limited instances within each question were only recall of knowledge is required, therefore raising the demand on the learner.

Individual Questions

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

Q1(a)

This question was split into two parts. The first part of the question tested recall of knowledge. Learners were provided with one method of controlling breathing rate and had to identify the 'other' mechanism. The correct response was through neural control. Whilst many learners correctly identified this mechanism not all responses were correct. Incorrect responses often linked to another body systems or were general such as the example below.

This response gained 0 marks

1 (a) Breathing rate is controlled by two mechanisms. One of these mechanisms is chemical.

(i) State the other mechanism that controls breathing rate.

(1)

Biological

This response gained 1 mark

1 (a) Breathing rate is controlled by two mechanisms. One of these mechanisms is chemical.

(i) State the other mechanism that controls breathing rate.

(1)

neural

The second part of the question was more demanding as it required a description of the chemical control of breathing rate, however this was still recall of factual information. This question was answered well, the majority of learners gained at two marks for this question, with many achieving three marks for the identification of increased levels of carbon dioxide as the trigger to increased breathing rate and the impact on blood acidity levels which was detected by the chemoreceptors. As this question required a description no justification or explanation was required in the response.

This response gained 3 marks

(ii) Describe how Beth's breathing rate is controlled by chemical mechanisms so she receives the oxygen required during her fitness class.

(3)

As Beth continues to exercise, Carbon dioxide will build-up in her muscles and move into the bloodstream. This will make the pH of the blood decrease as it becomes more acidic. Chemoreceptors in the arteries will detect this change and signal to the medulla oblongata in the brain to increase breathing rate. This will ensure more oxygen is breathed in making the blood neutral again and providing the muscles with the energy they need to continue exercising.

The three key elements are provided in the response: the increase in carbon dioxide; the drop in pH in the blood and on the fourth line the statement that 'Chemoreceptors in the arteries will detect this change'.

This response gained 1 mark

(ii) Describe how Beth's breathing rate is controlled by chemical mechanisms so she receives the oxygen required during her fitness class.

(3)

Her blood carries oxygen. A faster breathing rate means oxygen is taken in quicker and delivered to working muscles. Chemoreceptors in the blood can detect and decrease in oxygen and will send signals to the medulla oblongata in the brain. These tell the brain to speed up breathing as a way to taken in oxygen faster and remove CO_2.

The focus of the response is on oxygen rather than rising levels of carbon dioxide. However a mark is gained for knowledge that the role of the chemoreceptors is to 'detect' chemical change in the blood.

Popular incorrect responses focused on lactic acid or oxygen, or failed to reference the increase in carbon dioxide levels or that it was the pH of the blood that altered.

Q1(b)

To gain maximum marks for this question learners were required to explain why minute volume changes at the start of exercise.

When answering 'explain' questions it is important that points are developed rather simply presenting a number of unrelated (but relevant) points. For example, reference to increased breathing rate, increased depth of breathing, increase in minute volume would gain a maximum of one mark as the points are all independent, none explains the other whereas reference to increased breathing rate so that more oxygen can be taken in would gain both marks as there is a reason given for the increased breathing rate which explains why there is a change in minute ventilation.

This proved to be a very accessible question with most learners achieving both available marks.

This response gained 2 marks

(b) Explain why minute volume (VE) changes when Beth begins to exercise.

(2)

When Beth begins to exercise her minute volume will increase. This is because her breathing rate will increase meaning there will be more breathes in a minute due to there being more demand on the body as more oxygen needs to be carried around the body.

The first statement gains a mark for 'minute volume will increase', ie, the change referenced in the question has been identified. This is then explained towards the end of the response 'more oxygen needs to be carried around the body'.

This response gained 1 mark

(b) Explain why minute volume (VE) changes when Beth begins to exercise.

(2)

Minute volume changes when Beth starts to exercise because she will be working harder. When Beth works harder she will take in more air and breaths ~~to~~ so that she is able to breathe. Minute volume is the amount of air inhaled and exhaled (passing through the lungs) within a minute.

No marks are gained for the first statement, however the learner does attempt to explain this 'she will take in more air and breaths'. A mark was gained for increased breathing rate.

Q1(c)

This question asked learners to describe one other way that adrenaline helps during exercise. This question was made more difficult for learners as the most accessible response 'increase in heart rate' was stated in the question therefore to gain a mark learners had to think of another advantage. This made this a challenging question for learners, with most scoring 0 marks.

Many learners stated that adrenaline causes an increase in heart rate, no marks were gained for this as it had already been stated in the question. Learners needed to describe vasodilation or vasoconstriction of blood vessels, or the relaxing of the bronchioles or the impact of adrenaline on metabolism and therefore energy production.

Popular incorrect responses repeated reference to increased heart rate or talked in general terms about fight or flight.

This response gained 2 marks

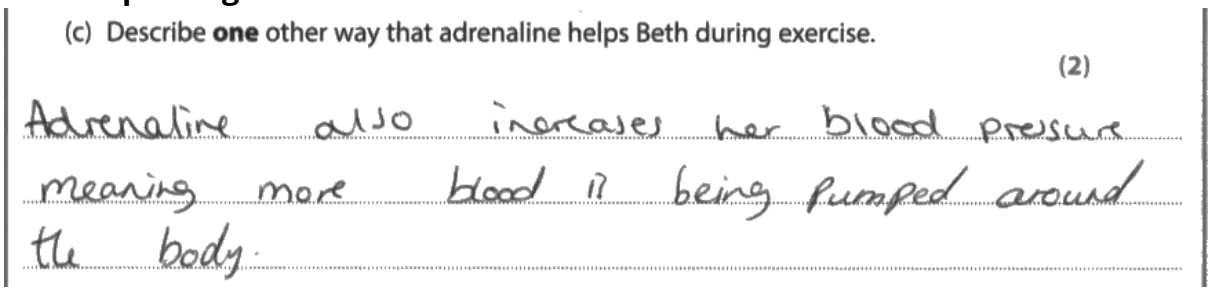
(c) Describe **one** other way that adrenaline helps Beth during exercise.

(2)

Beth's pupils dilate as a result of adrenaline, this allows more light in, improving your vision. This allows Beth to see everything more clearly ~~and~~ which could lead to her performing better.

Whilst not the expected response this is an accurate and relevant example and is credited on the mark scheme under the phrase 'Accept other appropriate responses'. One mark is given for identifying the physiological effect of dilating the pupil and for the description of how this effect helps during exercise.

This response gained 1 mark


(c) Describe **one** other way that adrenaline helps Beth during exercise.

(2)

Adrenaline also increases her blood pressure meaning more blood is being pumped around the body.

One mark was gained for effect of adrenaline, ie, increased blood pressure (1) but as the benefit of this was not explained no further mark was gained.

Q1(d)

This was the first of four extended questions on the paper.

Learners were asked to evaluate which one, of two fitness classes, should be chosen to maintain adaptations to the cardiovascular and skeletal systems.

Responses to extended answer questions are marked using levels based mark schemes; the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2, 3; the higher the level the greater the quality of the response.

For this question level 1 responses tended to focus on the adaptations that may occur as a result of one of the exercise classes. The focus was often on the couch to 5km class and the adaptations to the cardiovascular system. Level 2 responses tended to demonstrate knowledge of the adaptations to both systems and could make some links to the question scenario, for example, identifying running as weight bearing and therefore able to cause adaptations to the skeletal system as well as the cardiovascular system. To achieve level 3 learners' responses required accurate knowledge of the adaptations to both systems, the reasons for the adaptations, ie, how the particular training class caused the adaptation and an evaluation of which class would therefore be best.

Most learners demonstrated some knowledge of the adaptations to the body systems thus gained some marks for this question. Relatively few learners applied their knowledge to the question scenario, ie, linking the type of training to the adaptations. A very small number of learners presented information about both activity classes, without this it was not possible to evaluate which class was the best.

This response was placed at level 3: and gained 7 marks

Adaptations to both body systems have been identified: cardiac hypertrophy; increased stroke volume and increased bone strength. There is an attempt to expand on the training adaptations, but in the case of the cardiovascular system this is just in relation to the impact of one adaptation on another rather than how the class brings about the adaptations. However, there is a well developed account of how the running class brings about increased bone density: running is weight bearing (link) therefore activates osteoclasts to destroy old bone which activates osteoblasts (explanation of adaptation) to make stronger bone (adaptation)
There is also an attempt at evaluation, necessary to achieve level 3. Eg, 'resistance training doesn't have such a big impact on cardiovascular system as it is anaerobic therefore they should focus on cardiovascular training as this benefits both systems'. For this response to have achieved maximum marks a further explanation of how training adaptations occurred was needed eg, why the running class produces the identified training adaptations to the cardiovascular system.

(d) Evaluate which one of the fitness classes Beth should choose to maintain adaptations to her cardiovascular and skeletal systems.

(8)

Training causes adaptations in her cardiovascular systeam and skeletal system. Aerobic trauning will ~~a~~ cause ~~these~~ cardiac hypertrophy in her cardiovascular system. Cardiac hypertrophy is when the heart muscle gets stronger and more powerful. As the heart is stronger, stroke volume, which is the amount of blood pumped out of the heart, will increase as more ~~the~~ blood can be ejected at a time. This also means that Beths heart rate will decrease as it doesn't need to ~~pump~~ beat as many times to keep up with the demand as stroke volume has increased. Cardiac output = stroke volume x heart rate. So aerobic training

will allow Beth to work more efficiently and mean she can train for longer. Aerobic training also causes adaptations in the skeletal system - This is because when we ~~exercise~~ do a weight bearing exercise such as running, it activates the osteoclasts which destroy old bone, which then activates the osteoblasts to make new, stronger bone, so it makes her bones stronger.

Resistance training won't have as big as an effect on her cardiovascular system as weights are predominently lyted anaerobically. So she won't require oxygen. Weight lifting will trigger more calcium and phosphagen to be released which makes bones stronger. But it won't cause many adaptions to the cardiovascular system. Therefore Beth should carry on with the 5km run as this will cause more adaptations to occur and help her to maintain her fitness levels.

Resistance training is more beneficial for adaptations ~~to~~ to the muscular system.

This is a level 1 response. The adaptations are focused solely on the cardiovascular system. Whilst there is reference to osteoblast activity this is very vague, ie, 'maintain osteoblast production'. The short term responses to exercise are included, ie, synovial fluid production thus are irrelevant to this specific question.

(d) Evaluate which one of the fitness classes Beth should choose to maintain adaptations to her cardiovascular and skeletal systems.

rate ↓ (8) More oxygenated

Beth should continue to take part in the from couch to 5 km ~~training~~ training class for adaptions to her cardiovascular system and skeletal system. Firstly, ~~this~~ this is due to cardiovascular training to be more endurance (aerobic) training. If she maintains this a long term adaption of the heart it will help her heart walls thicken. This will mean her heart can pump harder getting more oxygenated blood out to working muscles. Linking to this, her resting rate will the decrease as the heart will have a higher Stroke volume and cardiac output than it did before. Secondly, her skeletal System will also need to be maintained so the amount of osteoblasts being produced is still high. If this is kept high here bones will recover to injury quicker. Also Synovial fluid will increase lubricating the joint- allowing it to be stronger and more pressure to be applied reducing the risk of her sustaining another injury. Therefore, Beth should maintain the 5km couch run.

Q2(a)

This question asked learners to explain why an increase in synovial fluid production was an advantage when throwing the javelin. To gain credit learners needed to identify an advantage, eg, lubrication of the joint and then expand on this to explain how this helped the thrower, for example, by increasing the range of movement at the joint allowing for a better javelin technique or throw.

The majority of learners identified that the additional fluid increased lubrication at the joint, some linked this to reduced friction and therefore a reduced risk of injury, this approach was also credited.

This response gained 3 marks

2 (a) Explain why an increase in synovial fluid production is an advantage to Ola when she is throwing the javelin.

(3)

This is an advantage because it will lubricate her joints and allow them to flex, extend, and rotate to a higher degree. This will allow Ola to create a bigger throwing angle and therefore, throw the javelin further than the other competitors.

Reference is made to the additional fluid lubricating the joint and the explanation that this allows movement to a 'higher degree' which in turn gives a better 'throwing angle' to throw the javelin further. This is a well-developed and explained response.

This response gained 0 marks

2 (a) Explain why an increase in synovial fluid production is an advantage to Ola when she is throwing the javelin.

(3)

An increase in Synovial fluids means bones and joints are more flexible, and therefore more Range of Movement. Which is needed in Javelin.

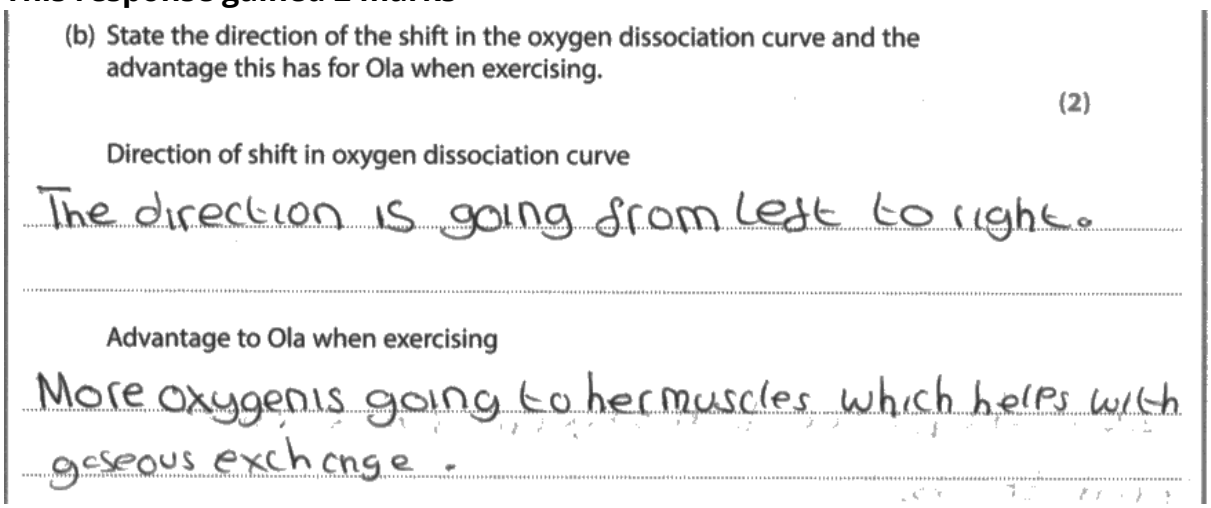
No marks were gained for increased flexibility, as this relates to the component of fitness which is not increased. However, a mark was gained for 'therefore more range of movement'. The reference to 'needed in Javelin' was too vague for further credit, it needed to be clear how this was used/why it was needed.

Q2(b)

This question was split into two parts, the first asked learners to identify the direction of the shift of the oxygen dissociation curve due to an increase in temperature. The correct response was 'to the right', which was often stated, however, so were other directions such as up, down and to the left.

In the second part of the question learners needed to state the advantage of this shift.

This response gained 2 marks



(b) State the direction of the shift in the oxygen dissociation curve and the advantage this has for Ola when exercising.

(2)

Direction of shift in oxygen dissociation curve

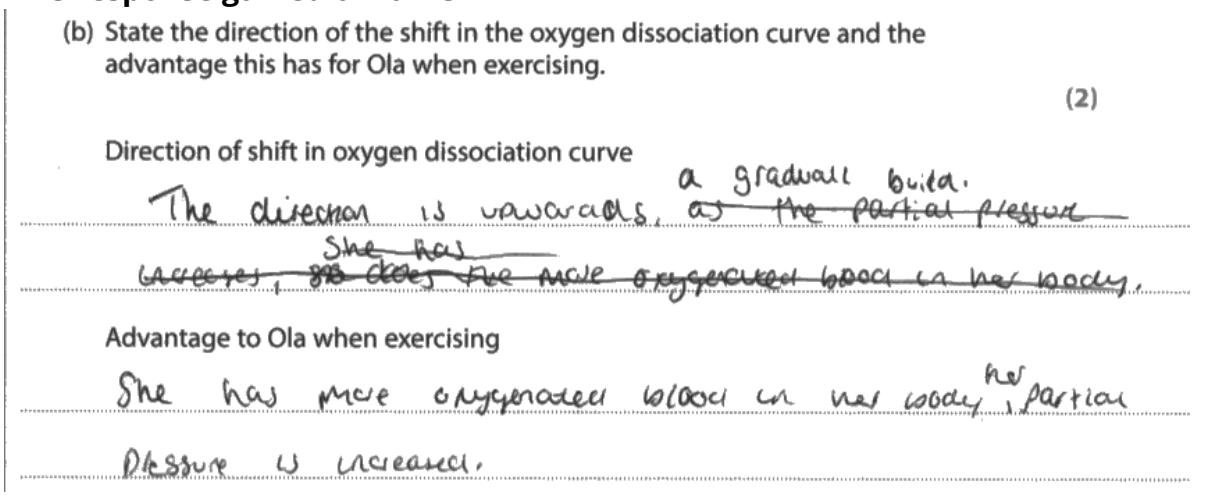
The direction is going from left to right.

Advantage to Ola when exercising

More oxygen is going to her muscles which helps with gaseous exchange.

Both elements correct, the shift of the curve is to the right and this is an advantage as 'more oxygen is going to her muscles'.

This response gained 0 marks



(b) State the direction of the shift in the oxygen dissociation curve and the advantage this has for Ola when exercising.

(2)

Direction of shift in oxygen dissociation curve

The direction is upwards, a gradual build. ~~as the partial pressure increases, so does the more oxygenated blood in her body.~~ She has

Advantage to Ola when exercising

She has more oxygenated blood in her body, her partial pressure is increased.

Although reference is made to more oxygenated blood the advantage is that this is released to the muscles. Without reference to muscles no mark was gained.

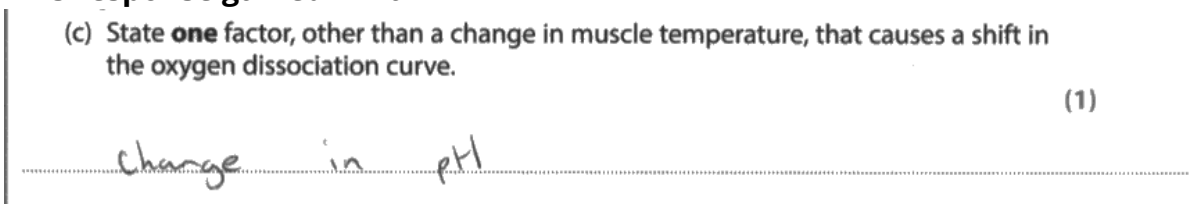
Q2(c)

This part of the question linked to 2(b). Learners had to state, other than a change in muscle temperature, a factor that caused a shift in the oxygen dissociation curve.

There were several acceptable responses, for example, carbon dioxide, lactate or blood pH therefore this was quite an accessible question.

Oxygen was a popular incorrect response, as was exercise.

This response gained 1 mark

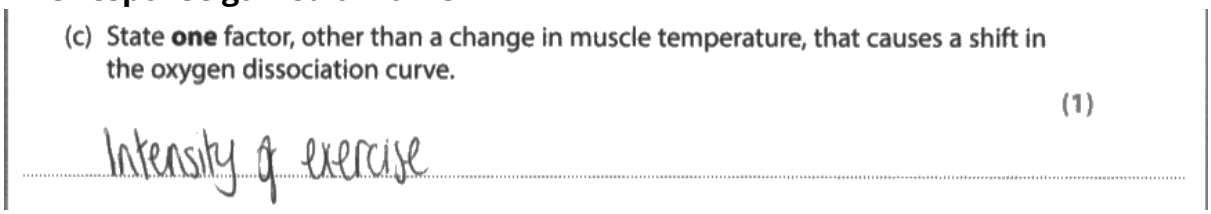

(c) State **one** factor, other than a change in muscle temperature, that causes a shift in the oxygen dissociation curve.

(1)

change in pH

The learner correctly identifies a change in pH as a factor causing the shift in the oxygen dissociation curve.

This response gained 0 marks


(c) State **one** factor, other than a change in muscle temperature, that causes a shift in the oxygen dissociation curve.

(1)

Intensity of exercise

In this example response the learner incorrectly identifies intensity of exercise. This was considered too vague for a mark to be gained. The learner would need to go a bit further and consider what happens as intensity of exercise increases, eg, increased carbon dioxide.

Q2(d)

This question was split into two parts. Learners were presented with some data showing an athlete's a-vO_2 diff at rest and during training.

The first part of the question asked learners to say what the term a-vO_2 diff meant. To gain the mark learners needed to make reference to oxygen levels, arteries and veins, without one of these elements no mark would be gained. Many learners gained the available mark, although where they did not this tended to be because reference was only made to oxygen levels in arteries (ie, no reference to veins) or to the term meaning oxygen levels during rest and exercise.

This response gained 1 mark

Table 1 shows Ola's arteriovenous oxygen difference (a-vO_2 diff) at rest and during a training session.

	ml per 100ml
At rest	4
During a training session	15

Table 1

(d) (i) State the meaning of the term arteriovenous oxygen difference (a-vO_2 diff).

(1)

The difference in the amount of oxygen between the viens and arteries

The learner's response contains all the required elements, ie, the difference in oxygen levels between arteries and veins.

This response gained 0 marks

(d) (i) State the meaning of the term arteriovenous oxygen difference (a-vO_2 diff).

(1)

It is the rate at which oxygen can be extracted from the body

Although the learner has made reference to oxygen this is not in relation to the difference in levels between the different types of blood vessels therefore no mark is gained.

The second part of the question asked learners to explain the change in a-vO_2 diff between rest and exercise. The first marking point for this question was very accessible as learners could use the information presented in the table and identify the difference in values, ie, that there was an increase. The additional two marks for explaining the difference gave better differentiation between learners.

This response gained 3 marks

(ii) Explain, using the data in **Table 1**, the change in Ola's a-vO_2 diff between rest and exercise.

(3)

During exercise a-vO_2 diff increases as there is a higher demand for oxygen in the working muscles, the arteries will have more Oxygen dissociation, so there is less oxygen in the veins when they go back to the heart. So the oxygen content in the ~~veins and~~ arteries increases and decreases in the Veins which causes the difference to increase.

All required elements were stated, that a-vO_2 diff increases, du to an increased demand for oxygen meaning the arteries will receive more oxygen so less left in the blood in the veins.

This response gained 2 marks

(ii) Explain, using the data in **Table 1**, the change in Ola's a-vO_2 diff between rest and exercise.

(3)

At rest it is low due to her body not needing the oxygen. This dramatically increases during training as more oxygen needs to go to the working muscles to prevent fatigue. Meaning she can carry on for longer.

The missing element in this response is the concluding point, ie, that as there is a greater oxygen demand more oxygen is extracted from the arteries leaving less in the veins.

Q2(e)

This extended response question focused on energy systems and their recovery. Learners were provided with information in a table about the events within the heptathlon and their order over 2 days of competition.

The heptathlon takes place over two days. Ola competes in four events on day 1 and three events on day 2. The events are shown in **Table 2**.

Day 1	Day 2
100m hurdles	Long jump
High jump	Javelin throw
Shot put	800m
200m sprint	

Table 2

(e) Assess the effect on Ola's energy systems of competing on day 1 **and** the impact of this on her performance in day 2 of the competition.

(8)

Like all of the extended response questions, the quality of learner responses varied. Some learners were clearly very knowledgeable about energy systems and were able to apply this knowledge so could provide appropriate links and explanations of these links between the energy systems and the events shown in the table. Generally, learners were not able to access level 3 as they failed to 'assess' the effect of use of the energy systems on day one on energy supplies for performance in day 2.

Level 1 responses tended to make links between energy systems and the events in the table, eg, shot put using energy from the ATP-PC system. Level 2 responses extended this further, explaining why the energy system was used for that particular event, therefore linking a characteristic of the energy system with the demands of the activity. Some learners at this level also discussed recovery times of the energy systems and made an attempt to assess the impact of this on performance in day 2. To achieve level 3 learners' responses required accurate knowledge of energy, the ability to apply this knowledge to the question context and then make an informed judgement as to whether this would impact performance on day 2.

It is important to note that there was some lee-way when determining the predominant energy source for the stated activity as learners would not be penalised for a lack of athletics knowledge. Therefore, it was acceptable for learners to link the 800m with the aerobic or lactate system, similarly the 100m hurdles with the ATP-PC system or the lactate system.

Learners should be aware that ATP instantly available in the muscle is not an energy 'system'.

This response was placed at level 3: and gained 7 marks

The learner is clearly knowledgeable about the different energy systems. They apply their knowledge to the question scenario and provide some assessment of the impact of using energy on day 1 on performance in day 2. 'The fact that glycogen stores take 24-48 hours to be fully replaced would have a negative impact on day 2'.

(e) Assess the effect on Ola's energy systems of competing on day 1 **and** the impact of this on her performance in day 2 of the competition.

(8)

When Ola competes during day one, she will deplete her anaerobic energy stores such as her PC phosphocreatine stores, her ATP adenosintriphosphate stores and her glycogen stores. Depleting her energy stores would take time to recover. Ola's PC stores would be replaced in around 3 minutes if she gets sufficient rest between the activities. Ola's ATP stores would also be replaced in around 3 minutes or 50% replaced in 30 seconds. Ola's ATP stores and PC stores would be needed for energy production via the ATP-PC system for day 1 during the High jump and the shot put. Ola's glycogen stores, however would take anywhere from 24 hours to 48 hours to be replaced fully. Ola would use stored glycogen as a fuel during day 1 in the 100m ~~hurdles~~ hurdles and the 200m sprint by utilising the anaerobic glycolytic system. The fact that glycogen stores take 24-48 hours to be fully replaced would have a negative impact on day 2 of Ola's heptharon during her

event. This is because there will be less glycogen available for energy production causing fatigue at an earlier stage during her event. This means that Ola will have less energy for day 2 and will feel fatigued, resulting in immobile/affected results. She will not be able to perform as well as she did in day 1, even more so if she does not get a sufficient amount of rest in between the two days of her hepthathlon.

This response was placed at level 1

Knowledge focuses on the ATP-PC system, as does the attempt to apply knowledge to the question context. The response lacks detail and development thus is placed at level 1 due to isolated elements of knowledge, in particular in relation to the ATP-PC system.

(e) Assess the effect on Ola's energy systems of competing on day 1 **and** the impact of this on her performance in day 2 of the competition.

(8)

During day 1 she will start off by using her ATP-PC stores due the first event being a high intensity workout. With ATP-PC lasting between 3-9 seconds this will meaning will be able to go through her event without going into the lactate cycle (anaerobic cycle). High jump is a high intense exercise as you have to have power and speed. Due to this being a short event she will be able to get through by using ATP PC however due to the event taking place for more than 10 seconds it will start the aerobic cycle due to re-charging oxygen. Shot put is a high power event meaning she will use all of her ATP-PC stores when throwing the shot put. 200m will

use all of her ATP-PC stores in the first half of the race and due to this it will move into the lactate cycle due to not having enough oxygen this will lead to ATP-PC being produced however it will also lead to a build up of lactic acid in the body and because of this on the second day there will be an ~~onset of blood~~ OBLA onset of blood lactate accumulation. Meaning therefore she will not be able to perform at higher intensities because her body is still recovering and getting rid of the lactate in her muscles. This could lead to her fatiguing and therefore not performing as well in the 800m meaning a lower performance could cause her to not do as well in their event.

Q3(a)

To answer this question, learners needed to explain why VO_2 max would be tested. Marks were gained for identifying what VO_2max is a measure of, eg, aerobic fitness and then for how a knowledge of this would be useful. Ie, because it would provide a measure of the ability to uptake oxygen, the greater this ability the more likely they were to be able to endure long matches.

This was not an accessible question, when marks were achieved this tended to be for identifying the link between VO_2max and aerobic fitness.

Marks were not awarded for general points about the value of fitness testing, knowledge needed to be applied to the question context for marks to be gained. Learners should be advised not to confuse oxygen intake with oxygen uptake. Oxygen uptake, the use of oxygen, was the required reference for this question.

This response gained 3 marks

Marks were gained for recognition that this is a test of cardiovascular fitness, and that with an increased VO_2max if games go beyond 2.5 hours the higher VO_2max will prevent a drop in performance because of the greater oxygen uptake 'increased gaseous exchange at alveoli AND capillaries'

On average his matches last 2 hours 30 minutes. If a match lasts much longer than this, Amit's performance deteriorates rapidly. As a result, Amit takes part in a fitness test to assess his VO_2 max.

3 (a) Explain why Amit tests his VO_2 max.

(3)

He wants to assess his cardiovascular fitness. If games lasts longer than 2hours 30, Amit will need better cardiovascular fitness and an increased VO_2 max to prevent a drop in performance. An increased VO_2 max would aid Amit as it would increase the rate of gaseous exchange at the alveoli and capillaries, ~~maintaining~~ maintaining a sufficient oxygen supply even during longer exercise durations.

This response gained 2 marks

The missing element in this response was the application of knowledge, why it is important for the tennis player to know his oxygen uptake.

On average his matches last 2 hours 30 minutes. If a match lasts much longer than this, Amit's performance deteriorates rapidly. As a result, Amit takes part in a fitness test to assess his VO_2 max.

3 (a) Explain why Amit tests his VO_2 max.

(3)

This is because VO_2 max is a aerobic endurance test and tests to ~~the~~ ~~how~~ see what the maximum amount of oxygen the body can utilise is. Therefore this would help him see how fit he is and to see if he can work on his muscular and aerobic endurance.

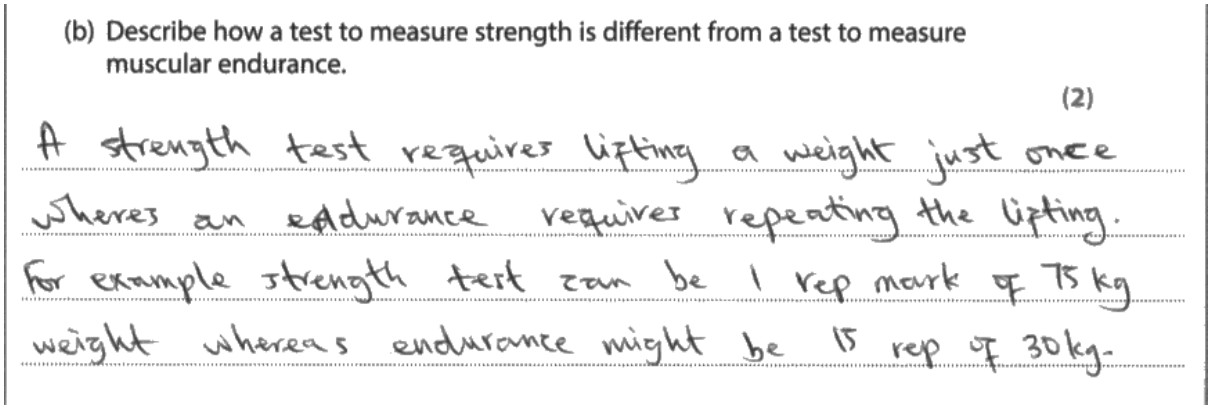
Q3(b)

To gain both marks for this question learners needed to describe how a test to measure muscular strength is different from a test to measure muscular endurance. To do this, learners needed to talk about the duration and intensity of each test (to show the differences). Many learners achieved one mark for this question.

Generally, learners were able to describe a strength test but were often incomplete in their description of a test to measure muscular endurance, often only referencing the duration of the test.

This response gained 2 marks

The first statement would only gain one mark for the comparison of the duration of each test. However the response continues to give the intensity as well thus gains both marks.



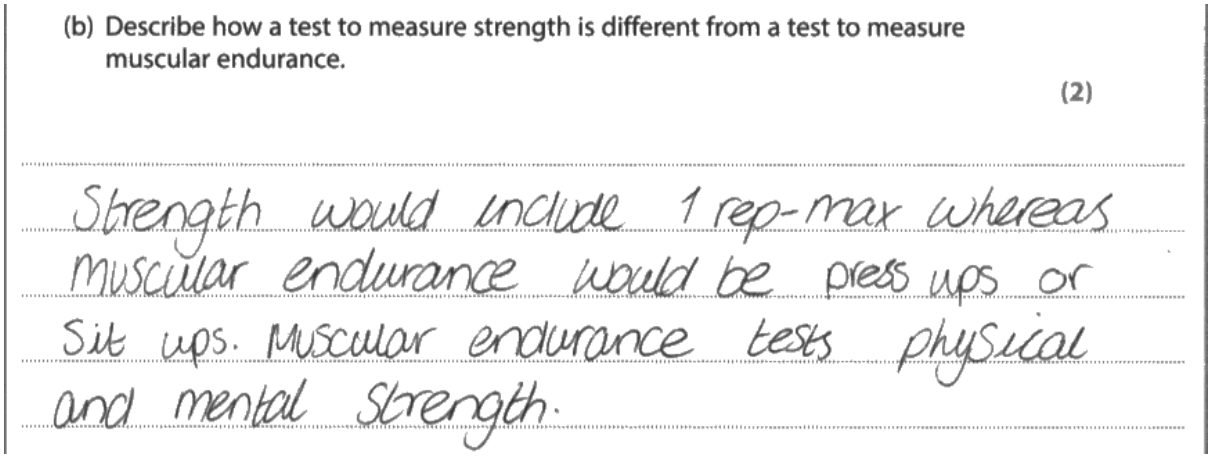
(b) Describe how a test to measure strength is different from a test to measure muscular endurance.

(2)

A strength test requires lifting a weight just once wheres an ~~e~~Adurance requires repeating the lifting. For example strength test can be 1 rep mark of 75 kg weight whereas endurance might be 15 rep of 30kg.

This response gained 1 mark

One mark was gained for reference to the 1 rep-max as a test of strength. '1 rep' indicates duration and 'max' the intensity.



(b) Describe how a test to measure strength is different from a test to measure muscular endurance.

(2)

Strength would include 1 rep-max whereas Muscular endurance would be press ups or Sit ups. Muscular endurance tests physical and mental strength.

Q3(c)

This was a very accessible question with most learners achieving a minimum of two marks.

Learners were given information about the duration of some fitness tests and asked to identify the main energy system in use during each test.

Amit has to work for a different length of time in each fitness test.

The time spent working in each fitness test is shown in **Table 3**.

Fitness test	Time spent working in fitness test before resting
VO_2 max.	7 minutes
Strength	1 second
Muscular endurance	1 minute

Table 3

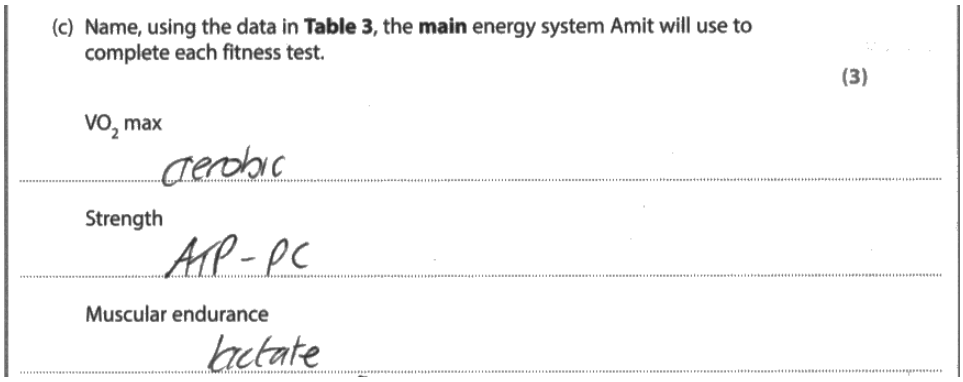
(c) Name, using the data in **Table 3**, the **main** energy system Amit will use to complete each fitness test.

(3)

Occasionally learners referenced ATP rather than ATP-PC system, or anaerobic glycolysis which was too vague (in relation to energy systems) for a mark to be gained.

This response gained 3 marks

The learner correctly applied their knowledge giving the three energy systems used for each test.


(c) Name, using the data in **Table 3**, the **main** energy system Amit will use to complete each fitness test.

(3)

VO_2 max

aerobic

Strength

ATP-PC

Muscular endurance

lactate

This response gained 2 marks

Although the ATP-PC system is anaerobic this was too vague for the mark to be gained as it does not differentiate between the ATP-PC system and the lactate system.

(c) Name, using the data in **Table 3**, the **main** energy system Amit will use to complete each fitness test.

(3)

VO_2 max

aerobic

Strength

anaerobic

Muscular endurance

Lactate

Q3(d)

This was also a very accessible question with most learners achieving a minimum of one mark.

Learners were asked to name the two gases referenced in the respiratory exchange ratio (RER). Even if learners were unfamiliar with the RER they would be familiar with the gases required, therefore would be likely to state oxygen and carbon dioxide and therefore gain the available marks.

This was not the case for all learners, some of whom left this question blank, whilst others made reference to hydrogen or nitrogen.

This response gained 2 marks

The learner correctly named both of the required gases.

(d) Name the **two** gases referenced in the respiratory exchange ratio (RER).

(2)

(i) Oxygen

(ii) CO_2

This response gained 1 mark

The learner correctly identified oxygen.

(d) Name the **two** gases referenced in the respiratory exchange ratio (RER).

(2)

(i) Oxygen

(ii) Nitrogen

Q3(d)

The third extended response question followed a similar format to question 2(e). Learners were given a table of data to use within their response. The information in the table was provided to ensure those with a limited knowledge of tennis would still have full access to this question.

A coach analyses Amit's match performance and records the data in **Table 4**.

Aces served	19
Average speed of first serves	95 mph
Length of match	2 hours 35 minutes

Table 4

(e) Assess the importance of recruiting different muscle fibre types during Amit's tennis match.

Learners had to assess the importance of the different muscle fibre types to a tennis player during a long match. Learners needed to use their knowledge of the characteristics of the different muscle fibres and apply this to their use within a game of tennis. Having done this, learners then needed to asses whether one fibre type was more important or equally important.

As with the other extended response questions few learners achieved level 3 as they did not assess, ie, make a judgement, the relative importance of the muscle fibres during the game.

Level 1 responses either correctly linked the fibre type to an aspect of the game or demonstrated knowledge of the different muscle fibre types, describing their characteristics. Level 2 responses comprised both of these elements and as mentioned above those that achieved level 3 did so as they included a valid assessment based on points made within the response.

Learners who identified muscle fibre types as type IIb were credited this series, even though type IIx is used within the specification. Learners should use type IIx for future series.

This response was placed at level 3: and gained 7 marks

The characteristics of each fibre type are used to justify their specific use in the match. This demonstrates knowledge, understanding and the ability to apply knowledge to different scenarios. Had the response stopped at this point it would have been placed at the top of level 2. However, towards the end of the response there is an attempt to justify the importance of having the varied muscle fibre types. This justification is based on the content already provided in the response therefore this pushes the response into the top marking band.

(e) Assess the importance of recruiting different muscle fibre types during Amit's tennis match.

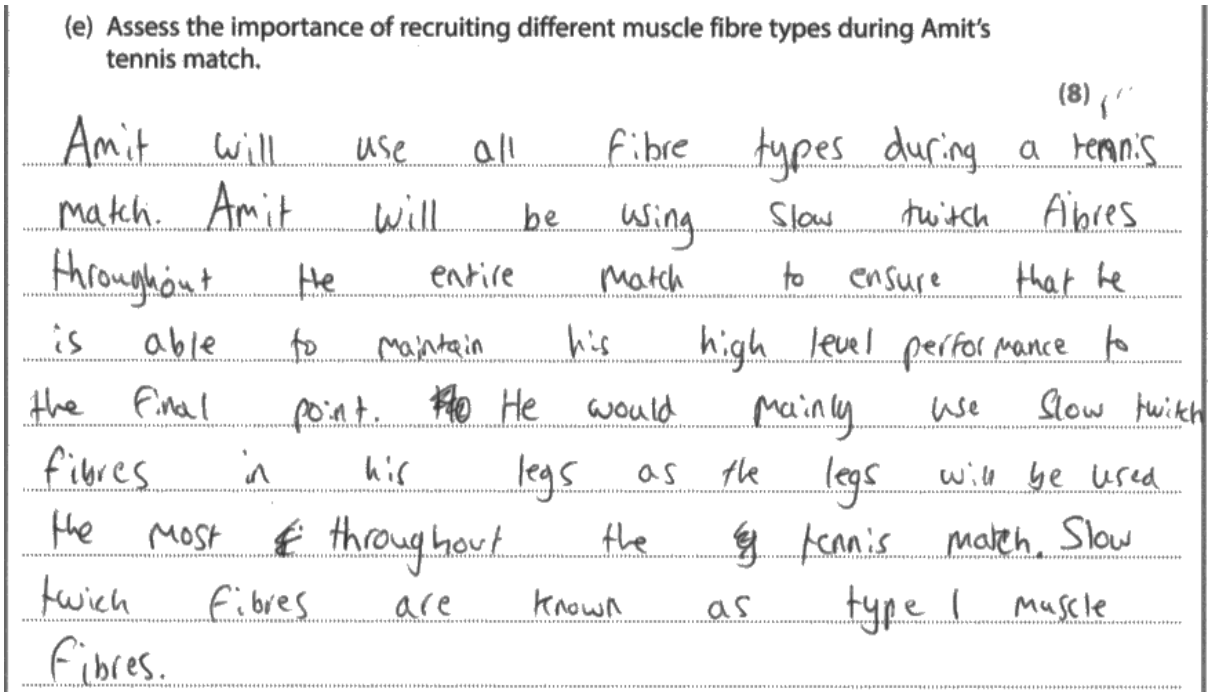
(8)

During Amits tennis match he will recruit different muscle Types. As the match lasts 2 hours 35 minutes, he will be recruiting Type 1 muscle fibres in order for him to last the full match, as Type 1 fibres work for long durations at a low intensity. During a rally with his opposition or during his Second Serve he will recruit Type 2a muscle fibres. These fibres work at a moderate/high intensity for a medium duration, he will recruit Type 2a as he requires more Power than in Type 1, but for a Shorter duration. His average speed of his first serve is 95mph, to do this requires explosive Power, So Amit will therefore recruit Type 2x muscle fibres. Type 2x works at a high intensity for a Short duration, So it will supply explosive Power to Amits Shot Power in order to Score Aces. The different muscle fibres are very important because Amits match has a range of fitness requirements such as muscular endurance,

Strength and Power. Therefore by recruiting different muscle fibres Amit can work for longer durations whilst also having bursts of Power throughout the game. Such as lasting 2 hours 35 minutes and serving at 95mph.

This response was placed at level 1

In the first paragraph the learner makes a link between slow twitch muscle fibres and their use throughout the match but no explanation is given, linking a characteristic or feature of the fibre type to this use, eg, very resistance to fatigue so can be used throughout the game at low intensity. The response does not differentiate between fast twitch fibre types therefore fails to gain any further credit.



(e) Assess the importance of recruiting different muscle fibre types during Amit's tennis match.

(8)

Amit will use all fibre types during a tennis match. Amit will be using Slow twitch fibres throughout the entire match to ensure that he is able to maintain his high level performance to the final point. He would mainly use Slow twitch fibres in his legs as the legs will be used the most throughout the tennis match. Slow twitch fibres are known as type 1 muscle fibres.

Amit will also use type 2a and 2x muscle fibres. These are fast twitch fibres Amit will use fast twich fibres when he is serving as well as changing direction quickly. fast twitch fibres are used for short duration explosive movements. Amit will mainly need fast twich fibres in his arm for powerful serves.

Amit will need a higher ratio of fast twitch fibres then slow twich fibres to ensure he is able to meet the demand of the fast paced tennis match.

Q4(a)
This question required learners to 'state' two negative effects of extreme cold on the body.

Many learners were able to gain at least 1 mark for this question, correctly identifying frostbite or hypothermia as negative effects.

The list of possible correct responses was long, although most popular correct responses were hypothermia and frostbite. Occasionally learners would incorrectly confuse hypothermia with hyperthermia, therefore not gaining the mark. Incorrect responses tended to relate methods of maintaining heat, for example shivering or wearing additional clothing.

This response gained 2 marks
A mark was gained for each part of the response.

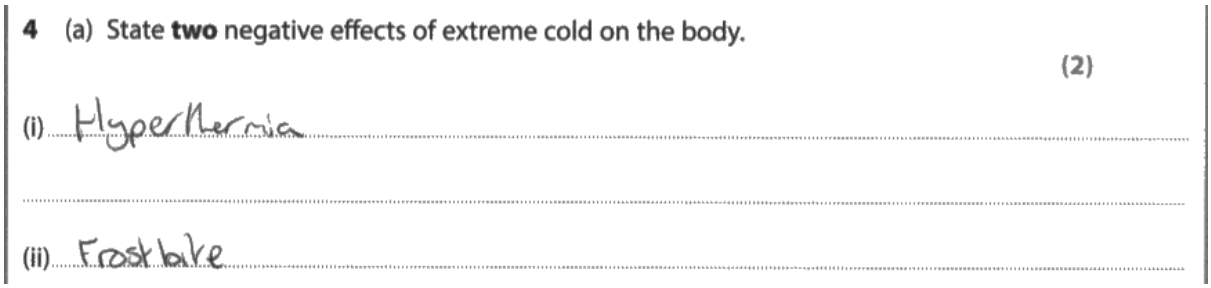
4 (a) State **two** negative effects of extreme cold on the body.

(2)

(i) Frostbite

(ii) hypothermia

This response gained 1 mark
One mark was gained for frostbite but no mark was gained in (i).


4 (a) State **two** negative effects of extreme cold on the body.

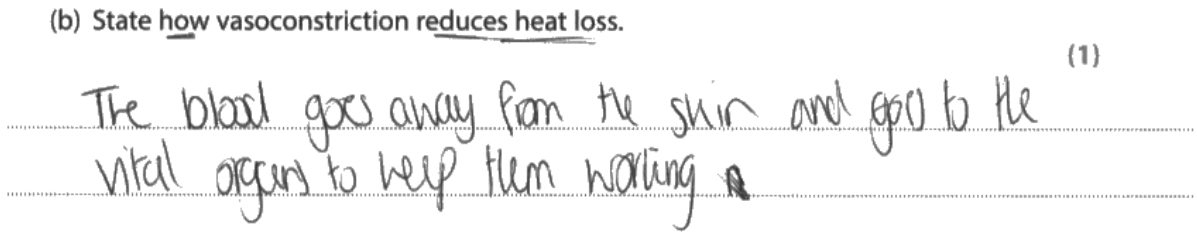
(2)

(i) Hyperthermia

(ii) Frostbite

Q4(b)
This question asked learners to state how vasoconstriction reduces heat loss. The question was allocated one mark. As the command word is 'State' an explanation is not required. Learners needed to indicate that blood moved away from the skin to gain the mark. Where learners made reference to blood vessels near the skin moving away from the skin no mark was gained as this is not accurate.

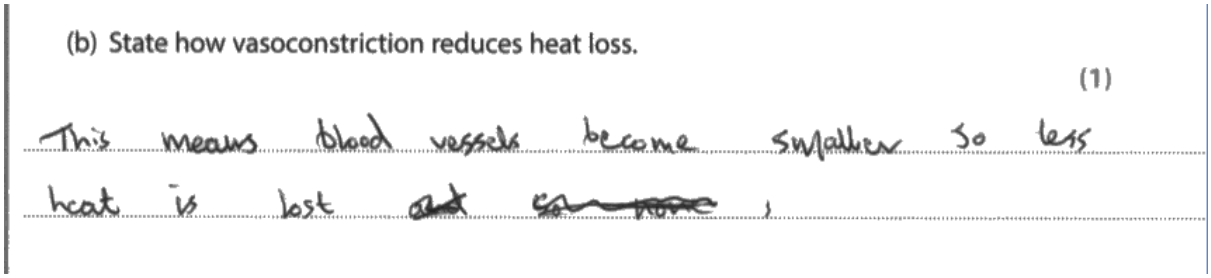
This response gained 1 mark
This response gained the available mark for the reference to blood moving away from the skin.


(b) State how vasoconstriction reduces heat loss.

(1)

The blood goes away from the skin and goes to the vital organs to help them working

This response gained 0 marks
This response did not gain a mark as the implication is that the size of the blood vessel reduces rather than the internal diameter. Greater accuracy was required for the mark to be gained.


(b) State how vasoconstriction reduces heat loss.

(1)

This means blood vessels become smaller so less heat is lost ~~and~~ ~~so more~~ ,

Q4(c)

To gain maximum marks for this question learners were required to explain two **other** methods 'Jenny's body' could use to reduce heat loss. It is important to note that the question relates to 'Jenny's body' rather than a general question about reducing heat loss. Therefore, learners that focused responses on external factors such as layering or avoiding getting wet did not gain credit.

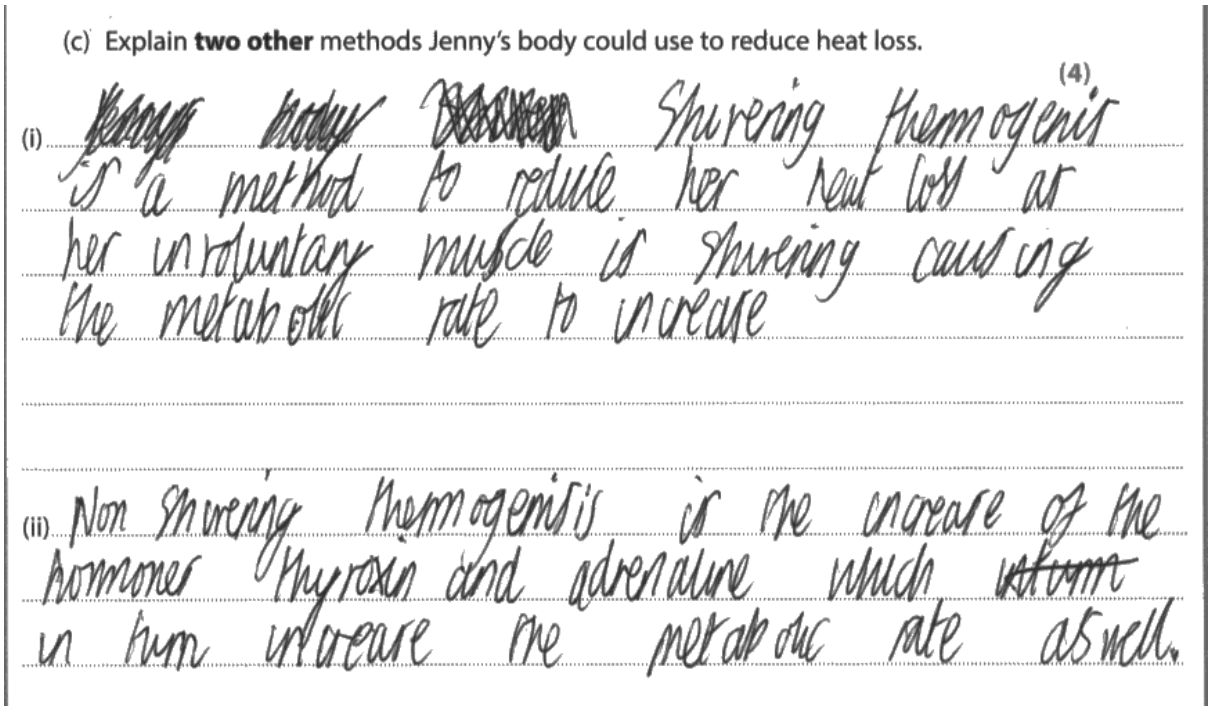
It is important when providing two responses to a question to ensure that the responses are sufficiently different to access all available marks, as marks will only be given once for a repeated point.

As an 'explain' question points needed to be expanded on in each part of the question, ie, it would have been insufficient to simply state four other methods of reducing heat loss, a method of heat loss needed to be identified and then expanded on so it was clear how this reduced heat loss.

Most learners accessed some marks for this question, correctly identifying shivering. Marks were also gained for the body response due to the erector pilli contracting to raise body hair.

This response gained 4 marks

In part (i) two marks were gained for identification of shivering thermogenesis and then the explanation that this reduces heat loss due to increasing the metabolic rate
In part (ii) two marks were gained for identification of non-shivering thermogenesis and then the explanation this reduces heat loss due to the increase in the release of hormones. Had the learner not made specific reference to hormones this response would have gained three rather than four marks due to the repeated point about the metabolic rate.



(c) Explain **two other** methods Jenny's body could use to reduce heat loss.

(4)

(i) Shivering thermogenis is a method to reduce her heat loss as her involuntary muscle is shivering causing the metabolic rate to increase

(ii) Non shivering thermogenisis is the increase of the hormones thyroxin and adrenaline which in turn increase the metabolic rate as well.

This response gained 4 marks

This response also gains four marks but in slightly different way to the previous example.

Two marks are gained in part (i) for hair standing on end and the explanation that this means a layer of air is trapped to reduce heat loss. In part (ii) one mark is gained for the method of shivering and the second for the explanation that this reduces heat loss by the muscle movements generating heat.

(c) Explain **two other** methods Jenny's body could use to reduce heat loss.

(4)

(i) Hairs stand up to trap a layer of air between them and the skin.

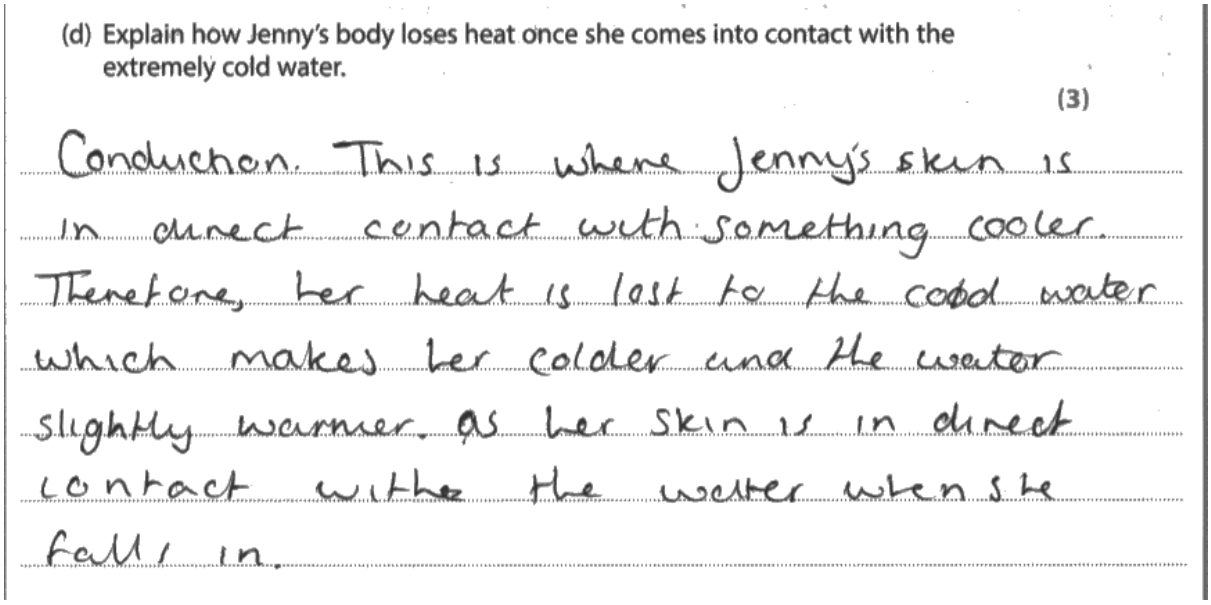
(ii) Shivering. Shivering helps us warm up because it keep contracting the muscles generating heat.

Q4(d)

This question asked learners to explain how 'Jenny's body' loses heat once it comes into contact with the extremely cold water. It is very important that learners read questions carefully and gather any information they are given about the question. In this case a key element of the question is the phrase 'into contact with'. As the question is focusing on the point of contact the method of heat loss that should be referred to is conduction. If this method of heat loss was not stated in the response no marks were gained, as the question asks for an explanation of this method.

This response gained 3 marks

All required key elements are present. The method of heat loss is correctly identified as conduction and this is then explained, reference is made to her skin being in direct contact with something colder, resulting in heat transference from the warmer object to the colder one.



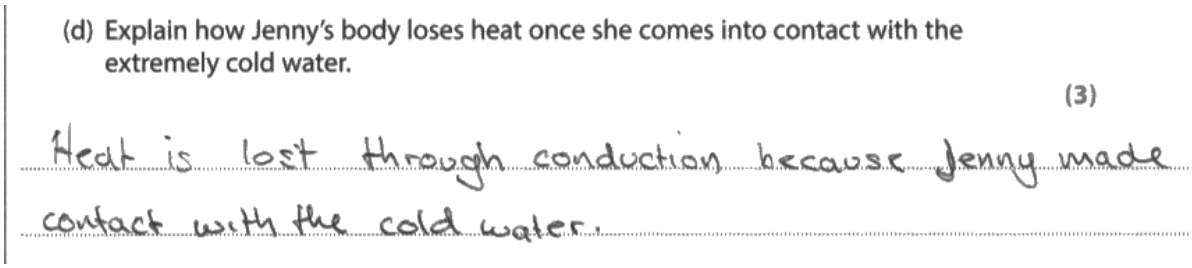
(d) Explain how Jenny's body loses heat once she comes into contact with the extremely cold water.

(3)

Conduction. This is where Jenny's skin is in direct contact with something cooler. Therefore, her heat is lost to the cold water which makes her colder and the water slightly warmer. as her skin is in direct contact with the water when she fall in.

This response gained 1 mark

The mark is gained for identification of conduction. A second mark is not gained as the learner has not expanded on the information given in the question, ie, there is no reference to her skin or body touching the water.



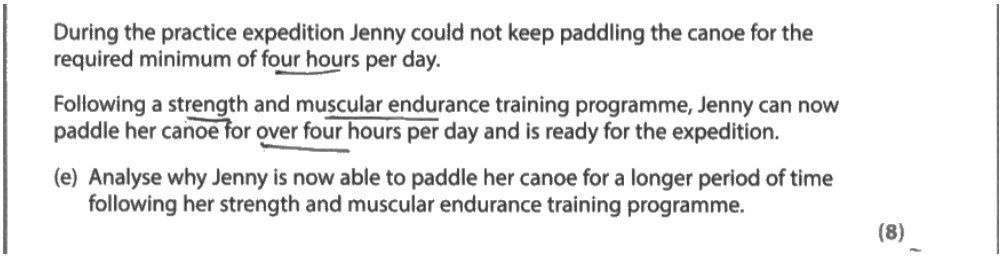
(d) Explain how Jenny's body loses heat once she comes into contact with the extremely cold water.

(3)

Heat is lost through conduction because Jenny made contact with the cold water.

Q4(e)

The final extended answer question followed a similar format to the first question. Learners were told that a canoeist was following a strength and muscular endurance training programme. They were asked to analyse why the canoeist could paddle for longer following the strength and muscular endurance training programme.



During the practice expedition Jenny could not keep paddling the canoe for the required minimum of four hours per day.

Following a strength and muscular endurance training programme, Jenny can now paddle her canoe for over four hours per day and is ready for the expedition.

(e) Analyse why Jenny is now able to paddle her canoe for a longer period of time following her strength and muscular endurance training programme.

(8)

Most extended answer questions will have two or more components to consider, this allows learners to demonstrate higher level skills of analysis or evaluation. However, it does mean that the learner must be clear about the aspect of the question they are discussing. Ie, in this question there are two aspects to the training programme (muscular strength and muscular endurance). Learners gained marks for referencing adaptations that resulted from either aspect of the training programme but they needed to be clear which aspect caused the adaptation. Ie, they should not simply list training adaptations, instead they should make sure that each adaptation is linked to either strength training or muscular endurance training.

At level 1 learners tended to identify training adaptations, eg, muscular strength training leading to hypertrophy. At level 2 learners were able to apply this knowledge of adaptations to the question context, eg, with increased hypertrophy more force could be exerted against the water when paddling. To move into level 3 there needed to be analysis, eg, through applying increased force fewer strokes would be needed to cover the required distance helping the performer paddle for longer.

This response was placed at level 2: and gained 6 marks

This response provides a full analysis of the adaptations linked to strength training - the learner has stated that this produces muscle hypertrophy, the link to generating more force and then application to canoeing being able to paddle fewer strokes and reach a further distance. In addition, the learner has also discussed the impact of this which is increased strength to an increase in speed and resist fatigue. This aspect of the response is at level 3.

Muscular endurance however is only covered briefly in relation to working for a longer period of time with no further links to adaptions nor application.

Due to the quality of the analysis of the strength training the response was placed at the top of level 2 despite the lack of relevant content for muscular endurance.

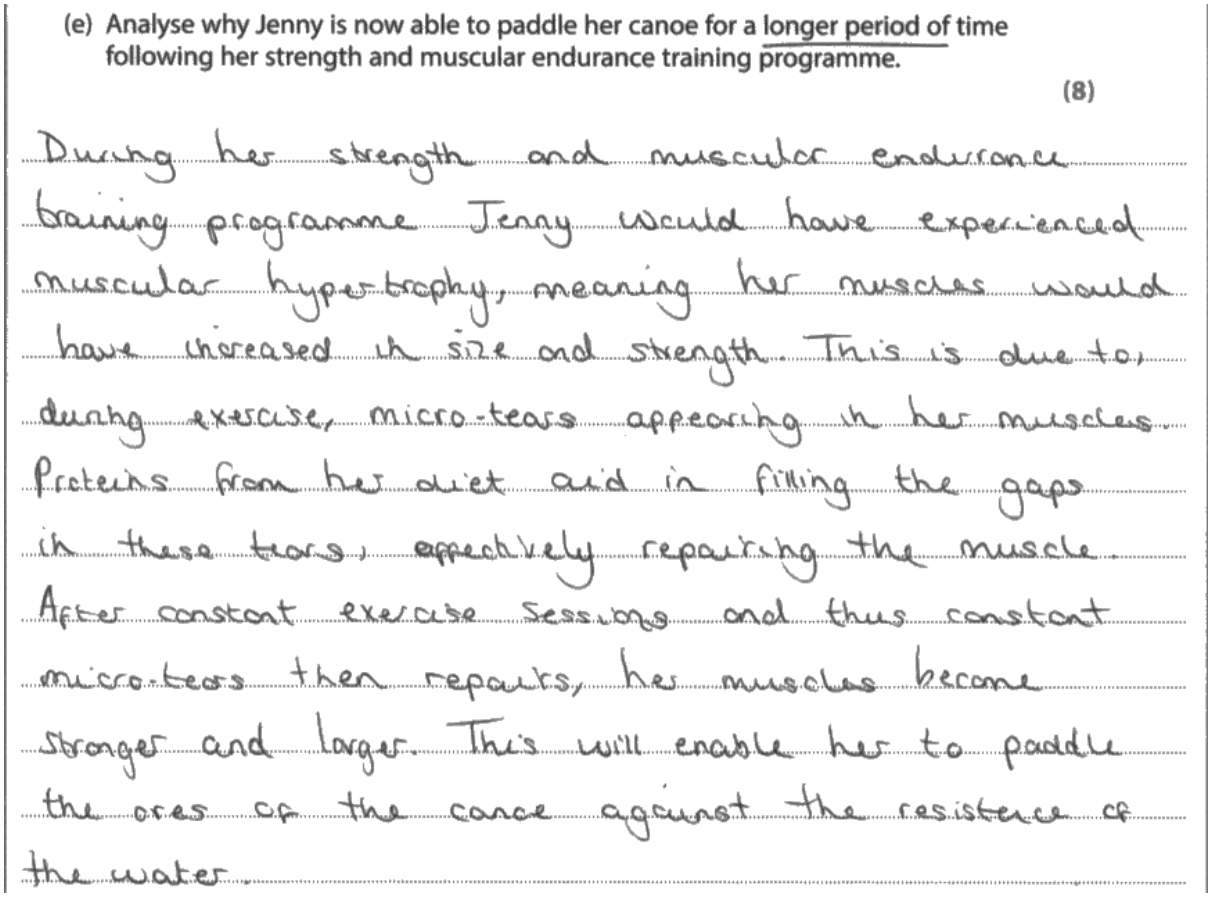
(e) Analyse why Jenny is now able to paddle her canoe for a longer period of time following her strength and muscular endurance training programme.

(8)

During her strength and muscular endurance training programe Jenny's muscle will have experienced hypertrophy This is when the muscles get biggjer and stronger and can generate more force. This would mean that each time she paddlled she would reach a further distance and would have to complete less strokes. Her muscles would have also experienced micro-tears. This is smalls tears in the muscle fibres which cause the muscles to rebuild and grow back stronger. As her muscles are stronger she will be able to generate more power and contract faster, this will mean she can paddle paster but also achieve a greater distance per row, so she will be more efficient in the way she rows, which will allow her to resist fatigue for longer and perform better during the expedition. Muscular endurance trainning allows her muscles to work for a longer period of time. The more she trains the more her muscles adapt and allow themselves to work for longer and utilise the oxygen supply. This will allow Jenny to use her muscles for longer and canoe for the 4 hours it will take her. Muscular endurance trainning also increases the elasticity of the muscles which means they can contract and relax more efficiently and work for longer.

This response was placed at level 2: and gained 4 marks

The learner has identified adaptations as a result of strength training (hypertrophy) and muscular endurance training (mitochondria/capillarisation). There is an attempt to link strength training to canoeing 'paddle the ores of the canoe against the resistance of the water' but this is vague, the learner should have discussed how strength training would have improved the ability to paddle against the resistance of the water. The learner has attempted to make a link between capillarisation and increased oxygen supplies allowing the canoeist to paddle for four hours. Thus the response includes adaptations which have been matched to the appropriate training type (muscular strength or muscular endurance) and demonstrated the ability to link this knowledge to the question context. This is sufficient evidence to place the response at level 2.



(e) Analyse why Jenny is now able to paddle her canoe for a longer period of time following her strength and muscular endurance training programme.

(8)

During her strength and muscular endurance training programme Jenny would have experienced muscular hypertrophy, meaning her muscles would have increased in size and strength. This is due to, during exercise, micro-tears appearing in her muscles. Proteins from her diet aid in filling the gaps in these tears, effectively repairing the muscle. After constant exercise sessions and thus constant micro-tears then repairs, her muscles become stronger and larger. This will enable her to paddle the ores of the canoe against the resistence of the water.

Also during the programme her muscular endurance would increase. After repeated exercise sessions an increase in muscular mitochondria occurs, meaning more ATP can be broken into energy during the canoeing. Also, increased capillarisation of her muscles, particularly her biceps and triceps, would happen. This increases the blood flow to her working muscles so that they have supplies of oxygen for the entirety of the 4 hours. Also,

Summary

Based on their performance on this paper, learners should:

- Use appropriate technical language throughout your responses, ie, do not abbreviate terms unless using a recognised technical abbreviation, eg, CO_2, O_2
- Tailor your response based on the command word in the question, eg, state does not require any expansion of a point but explain will.
- Use the number of marks gained and the space available as a guide to the depth of response required.
- Be clear, if an extended question asks about adaptations to different body systems make sure you are clear in your response which adaptations occur to which system.
- Be clear about terminology used in the specification as these words will be repeated in the exam paper, eg, responses, adaptations.
- Know the different body systems so you can focus on the correct one within a question.
- Use the question scenario to demonstrate your ability to apply your knowledge.

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