Examiners' Report/
Lead Examiner Feedback
Summer 2017

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

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June 2017
Publications Code 31813H_1706_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, at Distinction, Merit, Pass and Near 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://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Unit 1: Sport and Exercise Physiology

Grade	Unclassified	Level 3			
		N	P	M	D
Boundary Mark	0	13	27	41	55

Introduction

This was the first series of the new specification, and as such, the first time that this unit has been externally assessed via an examination rather than centre based internal assessment. Centres and learners should be congratulated on their preparation for this radical change to the assessment format. Overall learners appeared well prepared and well versed on many of the specification topics covered in this assessment.

The question paper followed the format identified in the sample assessment material. 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. Each question was marked out of 20 marks, 10 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 half 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, Q4bi/ii/c. There are very few instances within the paper were only recall of knowledge is required, therefore raising the demand on the learner.

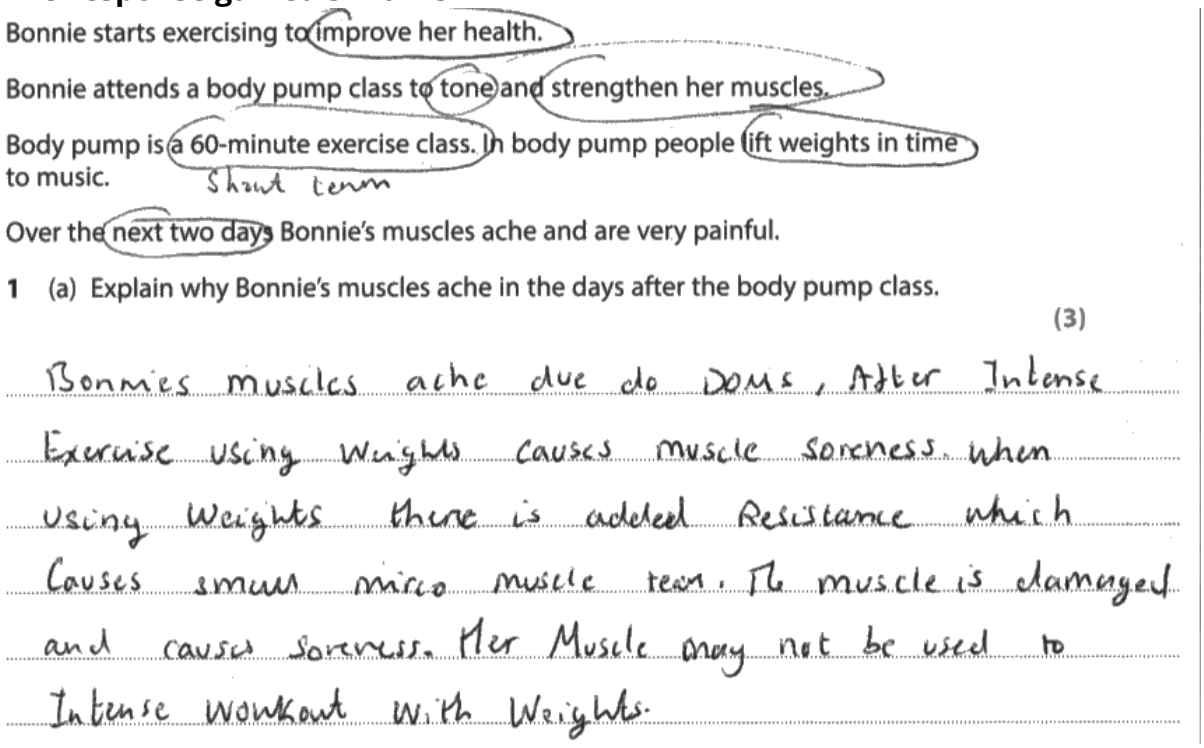
Individual Questions

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)

The majority of learners gained at least one mark for this question, with many achieving two marks for identification of DOMS and then some explanation that this was caused by micro tears to the muscle fibres. In order to gain access to all three marks learners needed to identify that the performer would be experiencing DOMS, caused by micro tears to the muscle fibres as a result of exercising more than normal. Therefore, learners had to use the information in the scenario and apply their knowledge to gain all three marks.

This response gained 3 marks



Bonnie starts exercising to improve her health.

Bonnie attends a body pump class to tone and strengthen her muscles.

Body pump is a 60-minute exercise class. In body pump people lift weights in time to music. Short term

Over the next two days Bonnie's muscles ache and are very painful.

1 (a) Explain why Bonnie's muscles ache in the days after the body pump class.

(3)

Bonnies muscles ache due do DOMS, After Intense Exercise using Weights causes muscle soreness. when using Weights there is added Resistance which Causes small micro muscle tear. The muscle is damaged and causes soreness. Her Muscle may not be used to Intense Workout With Weights.

The three key elements are provided in the response: DOMS; micro tears and in the final sentence the statement that 'the muscle may not be used to the intense workout'.

This response gained 0 marks

1 (a) Explain why Bonnie's muscles ache in the days after the body pump class.

(3)

Bonnie's muscles ache in the days after the body pump classes as his body has not got rid of all of the lactic acid that has built up in his body. This is why it is essential to do a cool down exercise after you do exercise.

Popular incorrect responses focused on lactic acid formation which is not the cause of DOMS. One other common error was to describe muscle tear rather than micro tears.

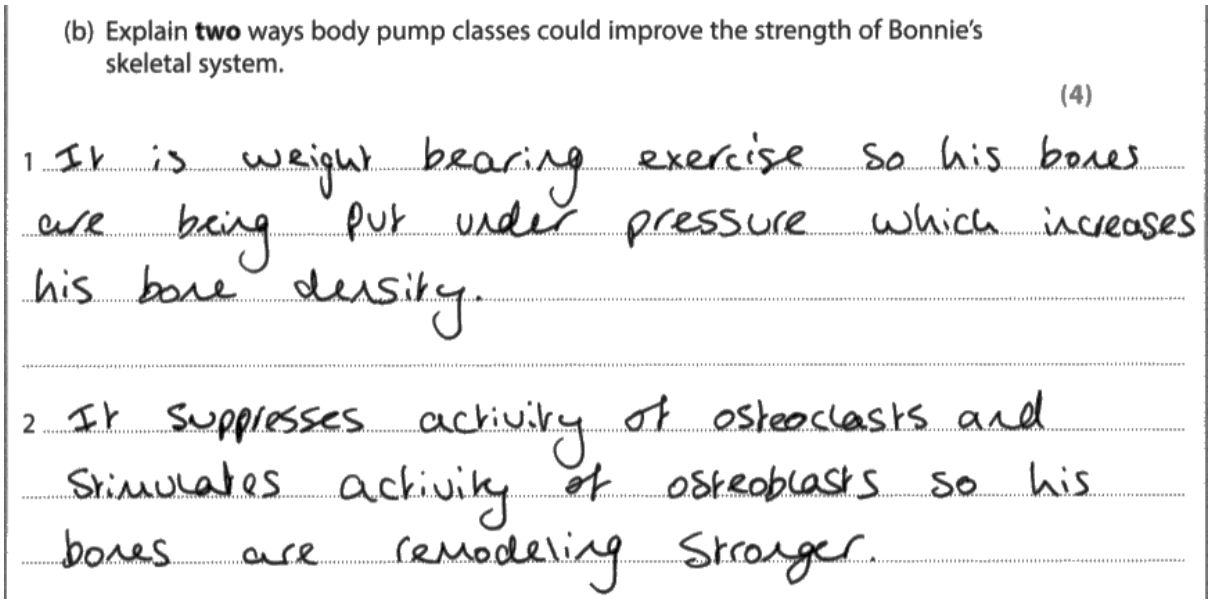
Q1(b)

To gain maximum marks for this question learners were required to explain two different ways the class could improve the strength of the performer's skeletal system. 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.

When answering 'explain' questions it is also important that points are developed rather simply presenting a number of unrelated (but relevant) points. For example, reference to increased calcium, osteoblast activity, increased mineral uptake and collagen to strengthen tendons would gain a maximum of two marks as the points are all independent, whereas reference to weight bearing activity leading to collagen formation to strengthen tendons and an increase in calcium to increase bone density would gain four marks.

Popular correct responses made reference to the class being weight bearing, or that exercise increases bone density due to increased osteoblast activity. Where learners failed to gain maximum marks tended to be due to repeating points or explaining short term responses to exercise, for example increased production of synovial fluid.

This response gained 4 marks



(b) Explain **two** ways body pump classes could improve the strength of Bonnie's skeletal system.

(4)

1 It is weight bearing exercise so his bones are being put under pressure which increases his bone density.

2 It suppresses activity of osteoclasts and stimulates activity of osteoblasts so his bones are remodeling stronger.

In reason 1, marks were gained for identification of the class being weight bearing and the expansion of this point that this would result in increased bone density.

In reason 2, marks were gained for identification of the stimulation of osteoblast activity leading to bone remodelling, the initial reference to suppressing osteoclast activity was ignored.

This response gained 2 marks

(b) Explain **two** ways body pump classes could improve the strength of Bonnie's skeletal system.

(4)

1 For The weights will cause osteoblasts (put on) and osteoclasts (take away) v to ~~add~~ ~~and~~ remove then add new layers of the bone matrix making them stronger and more dense.

2 The class will also allow the bones to be remodelled to make them stronger as they will be able to take higher weights.

As with the previous example, marks were gained in reason 1 for the description of bone remodelling leading to increased bone density. No further credit was given as the response in reason 2 repeats that already stated, i.e. bone remodelling.

Q1(c)

This question asked learners to explain how the nervous system made it possible for the performer to lift different size weights. The majority of learners correctly linked this to the recruitment of different size or number of motor units. Some learners focused on muscle spindles and their role and gained credit for this. Credit was not given for reference to Golgi tendons as they prevent the muscle from contracting rather than allow additional weight to be lifted.

Once again, as an explain question, learners needed to develop their response, ideally having identified the role of motor units to then explain how a greater number would allow a heavier weight to be lifted, and recruitment of a smaller number for a lighter weight.

Where credit was not gained this was often due to reference to recruitment of muscle fibres rather than motor units.

This response gained 3 marks

During the body pump session Bonnie varies the weight that she lifts.

(c) Explain **one** way the nervous system makes it possible for Bonnie to vary the weight she can lift.

(3)

One way the nervous system makes it possible for Bonnie to vary the weight she can lift is through motor units. Dependent on the weight she lifts the nervous system will recruit more or less motor units. If the weight is heavy then it will recruit more motor units than if the weight is less.

This response provides a good explanation, reference is made to varying the number of motor units and then how this will vary depending on whether the weight is heavier or lighter.

This response gained 2 marks

During the body pump session Bonnie varies the weight that she lifts.

(c) Explain **one** way the nervous system makes it possible for Bonnie to vary the weight she can lift.

(3)

One way is through the use of muscle spindles and golgi tendon organs. They detect muscle Stretch and send this message to the brain So the body can tell the muscle how forcefully it needs to contract. The proprioceptors are essentially giving the brain information about the weight the muscle is lifting.

In this example the learner gains credit for identification of the muscle spindles and their role in feeding back information. To have gained maximum marks this could have been linked to providing information to increase the number of motor units recruited to lift the heavier weight.

Q1(d)
This was the first of four extended questions on the paper.

Learners were asked to analyse how the chemoreceptors and baroreceptors help maintain appropriate blood oxygen levels during the session. As with other parts of the question the scenario was added to, providing the learners with more information they could use when applying their knowledge.

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 just one of the receptors without contextualisation of the response. Level 2 responses tended to demonstrate knowledge of the role of both receptors, but again, often failed to contextualise the answer. To achieve level 3 learners' responses required accurate knowledge of the role of both receptors and to express this knowledge within the question context. For example, analysing the difference in blood pH during the high intensity parts of the session compared to the less intense parts.

Most learners demonstrated some knowledge of the role of chemoreceptors, although the role of baroreceptors appeared less well known. Relatively few learners applied their knowledge to the question scenario, i.e. analysed the impact of the varying intensity of the session on the chemoreceptors and baroreceptors and blood oxygen levels.

This response was placed at level 3: and gained 8 marks

There is an excellent account of the role of the chemoreceptors and there is some attempt to link this to the question context, had this quality been replicated for baroreceptors this response would have gained maximum marks.

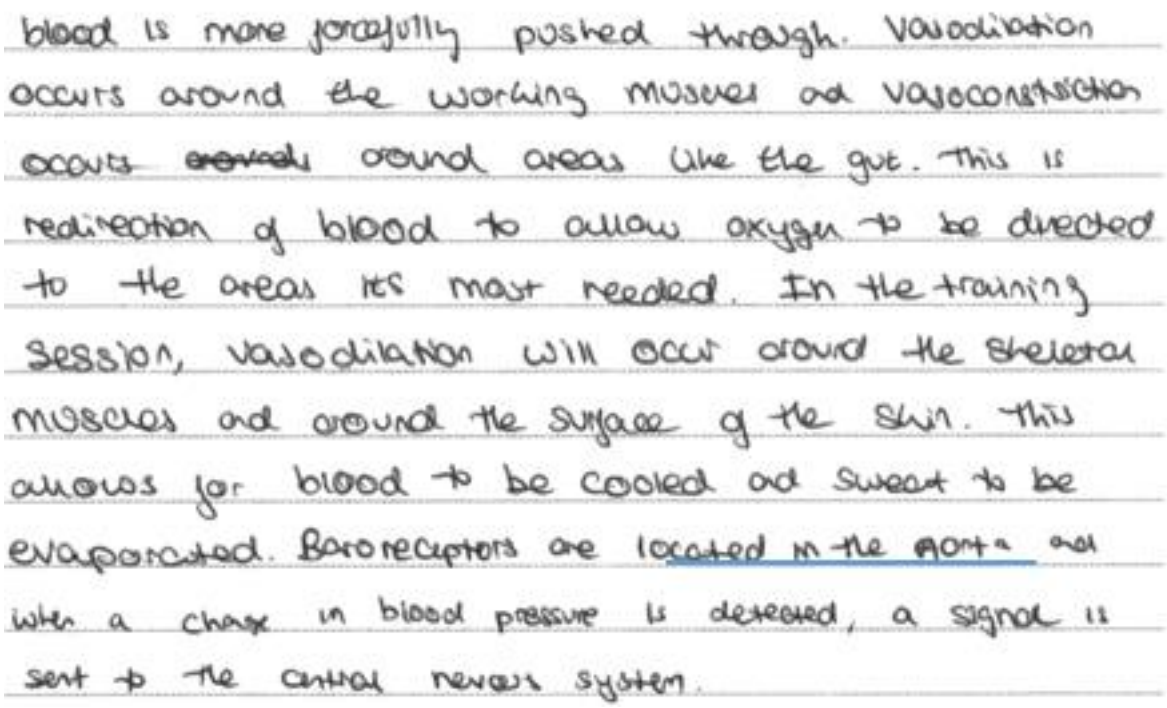
The key points from the relevant content are underlined.

When analysing the role of the baroreceptors many learners focused on their role in regulating blood flow rather than blood oxygen levels.

(d) Analyse how Bonnie's chemoreceptors and baroreceptors maintain appropriate blood oxygen levels during the body pump session.

(10)

Chemoreceptors detect change in PH in the blood and baroreceptors detect change in pressure. When exercise begins the body accumulates more CO_2 and lactic acid which lowers the PH of the blood making it more acidic. Chemoreceptors detect this change and send signals to the medulla oblongata. In response, the medulla oblongata sends impulses in the form of phrenic nerves to increase respiratory muscle contraction. This increases breath rate allowing for more O_2 to be inhaled to oxidise the lactate and to remove waste products (eg carbon dioxide). During the workout, the intensities vary so at low intensities EPOC will ~~occur~~ occur (oxygen dept) to allow for more oxygen uptake. At these lower intensities lactate can be removed and oxidised and CO_2 can be exhaled. At high intensities lactate accumulates in the blood. Lactate buffering can aid slowing this down. Baroreceptors detect the change in blood pressure. They are responsible for vasodilation and vasoconstriction of blood vessels. When low blood pressure is detected, baroreceptors send signals to the CNS to vaso constrict these areas which means the


blood is more forcefully pushed through. Vasodilation occurs around the working muscles and vasoconstriction occurs ~~around~~ around areas like the gut. This is redirection of blood to allow oxygen to be directed to the areas its most needed. In the training session, vasodilation will occur around the skeletal muscles and around the surface of the skin. This allows for blood to be cooled and sweat to be evaporated. Baroreceptors are located in the aorta and when a change in blood pressure is detected, a signal is sent to the central nervous system.

This is a borderline level 2/3 response as knowledge is mostly accurate, and there are sustained references to relevant information, (certainly in relation to the chemoreceptors). The response demonstrates understanding of the linkages between factors and their relationship in ensuring blood oxygen levels are maintained.

This response was placed at level 1: and gained 3 marks

In contrast to the previous example this response contains isolated elements of knowledge and understanding with little reference to the question context (other than the initial statement).

(d) Analyse how Bonnie's chemoreceptors and baroreceptors maintain appropriate blood oxygen levels during the body pump session.

(10)

When Bonnie's is exercising ~~her oxygen levels will~~ there will be a carbon dioxide created. her chemoreceptors will dectect this increase of acidity in her blood. which means that the chemoreceptors will tell the respiratory muscles to breath more, this will then help to keep the appropriate oxygen levels. lactate acid is also accumulated in the muscles and to get rid of this the body will need more oxygen to help. Baroreceptors ~~deet~~ detect the change in blood pressure. while we exercise blood is redistributed around the body. when we exercise more blood is transported to the working muscles and less to things like your liver, brain etc. this is done by ~~vasoatri~~ vasoconstriction and vasodilating. The blood vessels (gets smaller) around the working muscles vasodilate this used to let more blood in this helps to let more oxgenated blood in to the muscles and carbon dioxide out. This helps the muscles not to get a build up of ~~lactate~~ lactic acid. vasoriction is where your blood vessels contrict and get smaller.

Q2(a)

This question asked learners to state the meaning of the term thermoregulation. To gain credit learners needed to state that this meant maintaining the body at 37^{o} C or maintaining **core** temperature.

A high percentage of learners provided one or both of these points in their responses thus gained the available mark.

This response gained 1 mark

To perform well in the marathon Jenna's body maintained an appropriate body temperature through thermoregulation.

2 (a) State the meaning of the term thermoregulation.

(1)

Maintaing the core body temperture at 37°C

Where learners did not gain the mark, this was often due to vague responses linked to adjusting body temperature, or how the body varied its temperature.

This response gained 0 marks

To perform well in the marathon Jenna's body maintained an appropriate body temperature through thermoregulation.

2 (a) State the meaning of the term thermoregulation.

(1)

Thermoregulation is the way in which heat is controlled throughout the body.

Q2(b)
This question asked learners to give two responses of the body to excessive heat during exercise.

Common correct responses were sweating and dehydration. The majority of learners gained at least one mark for this question.

This response gained 2 marks

(b) Give **two** responses of the body to excessive heat during exercise.

(2)

1 Dehydration

2 heat loss (sweating)

Some learners identified vasodilation as a response but neglected to state of what, therefore credit was not given. Those learners stating vasodilation of blood vessels did gain credit.

This response gained 1 mark

(b) Give **two** responses of the body to excessive heat during exercise.

(2)

1 Sweating

2 vasodiolation

Another common incorrect response was a method of heat loss, such as convection or evaporation, rather than the body response during exercise.

This response gained 1 mark

(b) Give **two** responses of the body to excessive heat during exercise.

(2)

1 Sweating

2 Convection

Q2(c)

Learners were required to explain one reason why the runner in the polar bear costume would find it more difficult to maintain their body temperature.

The majority of learners gained two marks for this question, with the full range of marks being achieved. As this was an 'explain' question it was important that learners focused on one method of heat loss and looked at this in more detail rather than simply looking at a variety of methods. The three methods of heat loss prevented by the costume were evaporation, radiation and convection. Any one of these methods could have been used as the focus in the learner's response.

This response gained 3 marks

(c) Explain **one** reason why it will be harder for Jenna to maintain an appropriate body temperature compared to the other fun runners in **Figure 1**.

(3)

As she is running dressed as a polar bear it will make her sweat even more, it will make her even warmer and it will not let her body do evaporisation as she has all of those clothes touching her skin.

The learner makes reference to sweating, thus is focusing on evaporation as a method of heat loss. Credit is given for the extended explanation that heat cannot be lost by sweat being evaporated as the costume is covering the skin.

This response gained 2 marks

(c) Explain **one** reason why it will be harder for Jenna to maintain an appropriate body temperature compared to the other fun runners in **Figure 1**.

(3)

Because Jenna is wearing a full body suit all the excessive heat her body produces is trapped in these with her, there's no escape for it. Due to the exercise her body is already warming up, the heat insulation from the polar bear suit would make it difficult to maintain a temperature.

In this example response the learner has correctly identified that the costume is trapping heat generated by the body during exercise. However, no reference is made to the costume preventing heat loss through radiation.

Q2(d)

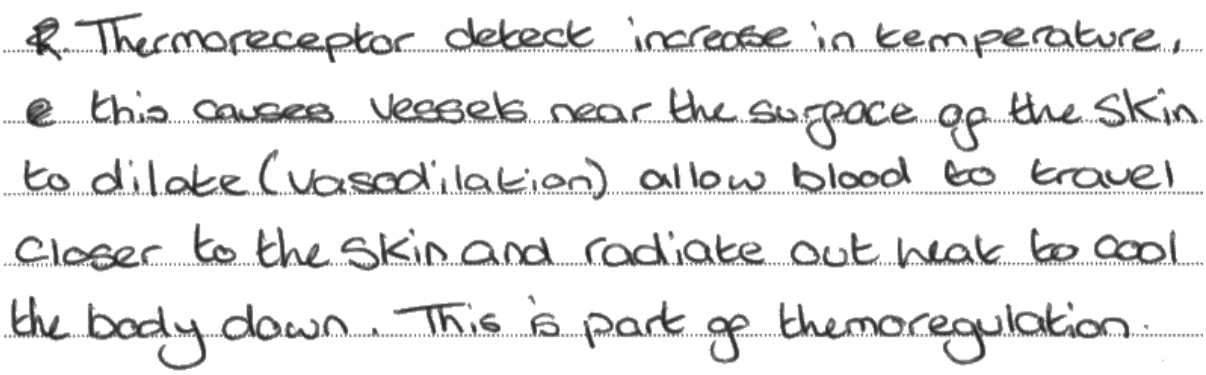
This question asked learners to describe how the cardiovascular system helps the fun runners maintain an appropriate body temperature. As the command word is 'describe' there was no need for learners to justify any part of their response, instead an account of how the cardiovascular system helps reduce heat was all that was required.

Many learners accessed marks for this question. Vasodilation increasing blood flow to the skin were popular correct responses. Some learners made reference to thermoreceptors triggering vasodilation and the impact this had on the internal diameter of the blood vessel. Learners would be well advised to be clear in their response that it is the internal diameter of the blood vessel that increases in size rather than the blood vessel getting larger, and that it is increased blood flow to the skin rather than the blood vessels moving to the surface of the skin.

This response gained 4 marks

(d) Describe how the cardiovascular system helps the fun runners in **Figure 1** to maintain an appropriate body temperature.

(4)



This learner describes how thermoreceptors detect the increase in temperature, causing vasodilation of blood vessels, increasing blood flow to the surface of the skin so that heat can be lost through radiation.

This response gained 1 mark

(d) Describe how the cardiovascular system helps the fun runners in **Figure 1** to maintain an appropriate body temperature.

(4)

Cardiovascular system maintains body temperature in two ways - vasoconstriction and vasodilation
Vasoconstriction - the blood vessels becomes smaller therefore and blood pressure increases, therefore body temperature increases
Vasodilation - the blood vessels ~~too~~ becomes wider and bigger therefore blood pressure and temperature decreases, and thats how body helps to maintain good temperature for fun runners

A mark was gained for correct identification of vasodilation as a way in which the cardiovascular system could help maintain an appropriate body temperature. Given the question context, i.e. during exercise, the issue for the runners would be an increase in body temperature rather than being too cold. This meant responses relating to maintaining heat or preventing heat loss were considered non-credit worthy.

Learners should ensure, when describing the process of vasodilation, that they are clear that the blood vessels do not move closer to the skin's surface, but that there is increased blood flow to the skin (due to vasodilation).

Q2(e)

This extended response question focused on aerobic training adaptations on the muscular and respiratory systems and the impact of these adaptations on a marathon runner's performance.

Like all of the extended response questions, the quality of learner responses varied. Some learners were clearly very knowledgeable about both body systems and were able to apply this knowledge to provide an assessment of the impact of these adaptations on marathon performance. Other learners were unable to address the question fully due to confusion between the respiratory and cardiovascular systems, or a focus on anaerobic training effects on the muscular system rather than aerobic.

Level 1 responses tended to focus on just one of the body systems without contextualisation of the response. Level 2 responses tended to demonstrate knowledge of both systems, but again, often failed to contextualise the answer. To achieve level 3 learners' responses required accurate knowledge of both systems and to express this knowledge within the question context. For example, through

identification of a range of adaptations to both systems, stating the effect of these adaptations and then providing an assessment of the impact of the adaptations, such as an increase in the runner's ability to work harder/at a faster pace for longer.

Most learners demonstrated some knowledge of adaptations to the muscular system, although often these also included reference to adaptations due to strength training, for example, muscle hypertrophy. Correct, often cited adaptations included increased muscular endurance and capillarisation. Many learners were able to expand on this, making reference to myoglobin / glycogen stores / type IIa fibres. However very often development of these points in terms of their impact on performance were lacking.

Knowledge of the respiratory system varied, whilst most learners correctly identified an increase in lung volume or tidal volume as an adaptation others focused on the cardiovascular system instead.

This response was placed at level 3: and gained 10 marks

Within each paragraph is an adaptation of either the respiratory or muscular system. Rather than simply listing each adaptation the learner develops their response, explaining the effect of this adaptation and often the impact of this to the runner. Consider the first paragraph, the circles around the work highlight key points. Adaptations include increased tidal volume and minute volume. These adaptations mean that greater oxygen intake providing increased oxygen for oxygen transport resulting in the runner being able to work at higher intensities for longer periods of time.

The response continues in this way, each adaptation is developed in a logical and well balanced way hence the placement of the response at level 3, achieving maximum marks.

(e) Assess the impact of regular aerobic training on the muscular and respiratory systems to improve the runners' marathon performance.

MUSCULAR ENDURANCE

(10)

Training on a regular basis aerobically improves both the muscular and respiratory systems and makes them more efficient. The respiratory system adapts by increasing tidal volume. This allows for more oxygen uptake and for more CO_2 to be removed. As the runner trains more, minute volume will increase to allow for more oxygen rich breaths, leading to more red blood cells carrying more oxygen to the working muscles enabling them to work for longer periods of time at higher intensities. Hypertrophy will occur of the respiratory muscles allowing for more forceful contractions. The sternoclastnoid is able to lift the upper half of the chest to increase the chest cavity allowing for more air to be inhaled. The internal and external intercostal muscles become stronger allowing for greater contractions and this aids performance because the runner is able to supply the muscles with more O_2. Increased capillarisation leads to an increase in diffusion rates around the alveoli and skeletal muscles, thereby allowing more O_2 to be respired in the cells. Increasing gaseus exchage rates.

The muscular system adapts to the new demands and allows the marathon runners ability to contract muscle

for longe, this enhaces muscle endurace that aids peformace Hypertrophy occus of the muscles allowing them to grow in size and therefore become stronger. The numbe and size of the mitochondria within the cells increases to allow for more respiration to occur helping the athlete respire for longer periods of time without excessive fatigue Myoglobin stores within the cells increase to allow the body to work at highe intensities because oxygen is readily available for aerobic training. These stores increase with training. Muscle strength increases allowing the muscles to exert a large force. This occus before hypertrophy, so athlets notice they can lift heavier weights before they aesthetically look any stronger. There are increased numbes of oxidative enzymes and increased haemoglobin. this aids peformace as haemoglobin can carry more O_2.

(Total for Question 2 = 20 marks)

This response was placed at level 2: and gained 5 marks
This example response is placed at level 2 as it not only provides an account of some of the adaptations to both the muscular and respiratory system, it also expands on these adaptations, linking them to their effect. With inclusion of further adaptations and linked effects this response would have gained further credit.

Learners were not credited with 'effects' without first identifying the 'cause' of the effect, for example, reference to delaying OBLA would not be credited unless it was clear why this was the case, i.e. the adaptation that made this possible.

(e) Assess the impact of regular aerobic training on the muscular and respiratory systems to improve the runners' marathon performance.

(10)

Aerobic training on the muscular system means that it is able to increase in muscular endurance. This is due to another increase in capilirisation meaning blood is more easily and quickly flowed to the working muscle. Meaning that oxgyen is going to be carried to the muscles at a faster pace. As the muscles are now able to work for a longer period of time, the aerobic training would also increase muscular strength. Due to being able to last longer, the muscle will develop more stronger

as well especially with more blood oxygen levels in the working muscles. Aerobic training will also delay OBLA in the working muscles quicker.
Aerobic training on the respiratory system means that there will be an increase in Vital Capacity. This meaning that more air is able to be passed in and out of the lungs.
Also aerobic training would improve the respiratory muscles. Meaning that the external intercostal muscles would contract, and the internal intercostal muscles would relax whilst inspiring.

Another impact on his respiratory system is that his tidal Volume would increase as well.

Q3(a)

To answer this question, learners needed to state three physiological effects of overtraining. As this was a 'state' question no explanation or expansion was required, just a list of three different effects from those stated in the specification.

Popular correct responses stated insufficient rest time for repair of muscles (as stated in the specification) and imbalances in the endocrine system. Credit was also given for responses that stated poor sleep patterns or depression of the immune system.

This response gained 3 marks

3 (a) State **three** physiological effects of overtraining. **(3)**

1 ~~more~~ Sleep deprevation Causing drowsyness

2 Embalanced endocrine System (increased Cortisol Causing Stress)

3 Suppressed immune system so Consuming food is harder (decreased glycogen Store).

This response gained 0 marks

Many learners did not gain credit for this question as answers tended to be the consequence of the physiological effects, for example injury or tiredness.

3 (a) State **three** physiological effects of overtraining.

(3)

1 Muscle ~~fad~~ ~~fradness~~ firedness

2 ~~DOMS~~ [illegible] ~~Firedness~~ More likly for injury to happen.

3 Drop in performance

This response gained 0 marks
Due to the focus on the psychological impacts of overtraining rather than the physiological effects.

3 (a) State **three** physiological effects of overtraining.

(3)

1 confidence will lower

2 depression

3 lack of motivation.

Q3(b)
To gain full marks for this question learners needed to identify two reasons why overtraining would result in a drop of fitness and then expand on this to rationalise each stated reason. Lack of rest or recovery proved a very accessible mark. Many responses made reference to injury but very few of these were specific to overtraining, i.e. Overuse injuries so were not credited.

This response gained 3 marks

For reason 1 the learner identifies the lack of recovery time for the muscles thus gains one mark for this part of the response. To gain the second mark reference would have been needed to lack of energy (due to lack of recovery time) due to lower energy stores. Alternatively, the learner could have linked the lack of time for muscle repair to overuse injury.
For reason 2 the learner gains both marks, they identify a reason why overtraining will result in a drop in fitness and justified this: 'increased cortisol production increasing stress resulting in poor sleep leading to a drop in energy'.

(b) Explain **two** reasons why overtraining will result in a drop in Enzo's fitness.

(4)

1 By over training Enzo isn't giving his muscles a lot of recovery time so they can grow and repair. This will cause them to fatigue faster and he is also more likely to get injured putting him out of training

2 due to increased cortisol and adrenaline production he is likely to become stressed and therefore ~~miss~~ have poor rests or sleeps which will impact his energy leading to a decreased performance and fitness levels.

This response gained 1 mark

For reason 1 the learner makes reference to fatigue but this is not credited as that would be an expected response to any training session. There needed to be greater emphasis on the level of fatigue, for example, constant tiredness or extreme fatigue. For reason 2 the learner gains credit for linking overtraining to lack of motivation to train.

(b) Explain **two** reasons why overtraining will result in a drop in Enzo's fitness.

(4)

1 One reason is that Enzo will not performance as well because he is physical and mentally fatigued therefore not show proper improvements.

2 Another reason is that he will not enjoy training anymore and become demotived which could lead to injury as movements aren't being performed correctly.

Q3(c)
To fully address this question, learners needed to explain how lactate accumulation causes muscle fatigue. This proved to be one of the most challenging question on the paper for learners, with the majority of responses being scored at 0 marks for this question.

Those that did achieve a mark for this question tended to do so for correctly identifying that lactate causes an increase in acidity. Attempts to provide further explanation often centred on a lack of oxygen or a build-up of lactic acid. Further credit was only gained if the reason why lactate accumulation caused fatigue was given, for example, the increased acidity inhibits enzyme action reducing the breakdown of glucose.

This response gained 3 marks
The learner correctly identifies that lactate accumulation will increase acidity of the tissue which will impact negatively on enzymes reducing their ability to support energy production, hence leading to muscle fatigue.

(c) Explain how lactate accumulation causes muscle fatigue.

(3)

Lactate accumulation increases the acidity / lowers the pH of the muscle tissue. This will prevent respiratory enzymes from functioning correctly causing less ATP to be produced via respiration for muscle contractions. A lactate build up is also ~~painful~~ painful and may cause the athlete to avoid continuing with the exercise.

This response gained 2 marks
The learner identifies the increase in acidity and goes on to explain that this increase in acidity levels makes it difficult to make energy. Had the learner stated why it was more difficult, e.g. due to inhibited enzyme action full credit would have been given.

During Enzo's fitness sessions he experiences muscle fatigue due to lactate accumulation.

(c) Explain how lactate accumulation causes muscle fatigue.

(3)

When lactate builds up in muscles it increase the acidity in the muscles. This makes it hard for the muscles to make energy & contract properly. high acidity levels will also cause soreness and pain forcing the muscles to stop contracting or freeze up causing fatigue and cramps

This response gained 1 mark

Credit was given here for reference to the increase in acidity as a result of lactate accumulation. The reference to insufficient oxygen explains why lactate accumulates, but not why this in turn leads to fatigue.

During Enzo's fitness sessions he experiences muscle fatigue due to lactate accumulation.

(c) Explain how lactate accumulation causes muscle fatigue.

(3)

a ~~build~~ build of lactic acid causes fatigue as the is an increased intensity causing an increase in acidity, and an insufficient amount of oxygen getting to the muscles.

Q3(d)

The third extended response question required depth of knowledge of adaptations of the cardiovascular system to aerobic training and the effect of these on cardiovascular fitness.

Level 1 responses tended to focus on adaptations to the cardiovascular system, or the effects of unstated adaptations. For example, one adaptation is cardiac hypertrophy, the effect of this is an increased stroke volume and drop in resting heart rate. These effects would often be stated without first stating the adaptation that lead to these effects.

Level 2 responses tended to state adaptations and the effect, whilst level 3 responses also linked the adaptation and its effect to improvement in cardiovascular fitness. For example, the adaptation of increasing the number of red blood cells, resulting in increased haemoglobin content would lead to increased cardiovascular fitness due to an increased ability to transport oxygen.

This response was placed at level 3: and gained 9 marks

The learner identifies several adaptations and expands on each, linking the adaptation to its effect, for example, cardiac hypertrophy leading to increased stroke volume and cardiac output and a reduced resting heart rate resulting in improved oxygen transport.

This approach is replicated in relation to the increase in red blood cells and then capillarisation. To gain maximum marks a little more impact on cardiovascular fitness could have been provided, for example all of these adaptations leading to increased VO_2 max or greater oxygen uptake. However, this was still an excellent response.

(d) Analyse how adaptations to Enzo's cardiovascular system will improve his cardiovascular fitness.

(10)

An adaption of the cardiovascular system includes Cardiac cycle changes which includes ~~the~~ Cardiac hypertrophy of the left ventricle Meaning that the heart will become more powerful in pumping oxygenated blood around the body at a quicker rate. Stroke volume (the amount of blood pumped out the heart per beat) will increase drastically as the heart is stronger. it will be able to pump more blood in one beat and also Cardiac output would increase which is the amount of blood pumped out the heart per minute along with a decreased resting heart rate. This suggests that the heart has become ~~of~~ more efficient at pumping more blood in less amount of time (low resting heart rate) which will benefit Enzo's CV fitness as he is able to get more oxygen to his muscles during exercise at a quicker rate. The Sinoatrial node / parasympathetic nervous system also adapt and become more efficient at firing less impulses this causes the lowered resting heart rate to be achieved as the parasympathetic system and acetylcholine will become more effective.

Blood Components would adapt for example an increased amount of red blood cells will be achieved through long term exercise. More red blood cells means that there is more haemoglobin in the blood stream. An increase in haemoglobin would suggest more oxyhaemoglobin association

which means more oxygen can be transported to desired working muscles to increase the rate of energy production and aerobic glycolysis. Blood diffusion would also increase as a result of capillarisation which is the increase in the amount of blood vessels i.e. capillaries around the muscle site. The more that there will be more connecting ~~extracellular~~ networks for oxygen to diffuse across the semi permeable membrane of the capillaries into the muscle for usage, CO_2 diffusion across from muscle to blood vessel would also increase, this will help buffer the accumulation of lactic products that cause fatigue and prevents ~~the~~ Cardiovascular work; less CO_2 would mean the CV system would be able to continously remove it at ease which allows the body to continue exercising at an optimal level.

(Total for Question 3 = 20 marks)

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

The learner identifies several adaptations to the cardiovascular system: cardiac hypertrophy; increased red blood cells; increase in capillary density. In each case they try to extend the point by explaining the effect of this adaptation. Whilst the phrasing is not totally accurate they have demonstrated mostly accurate knowledge and understanding through the attempt to link cardiac hypertrophy to increased stroke volume and a drop in resting heart rate. There is also an attempt to link red blood cells, haemoglobin, increased oxygen and performance although again there are some inaccuracies/omissions, however sufficient evidence for the response to be placed at the middle of level 2.

(d) Analyse how adaptations to Enzo's cardiovascular system will improve his cardiovascular fitness.

(10)

ENZO's ~~for~~ will have Cardia hyper ~~hardly~~.
trophy. This is because the Stroke volume has
increased meaning more blood can be pumped
around the body quicker. This will also have
a massive effect ~~on his resting heart rate~~
due to bradycardia which is a decrease in
resting Heart rate. Enzo will also have adapted
by an increase in Red blood cells. This means
he will be able to run further because of
the increase of oxygen passed through the muscles.
Caused by haemoglobin.

Enzo will also have an increase in capilarisation.
~~This is because~~ around the alveoli. This is
because their is more oxygen that can be
used. therefore meaning enzo will have
Sufficient oxygen when he runs.

This response was placed at level 1: and gained 2 marks

The first paragraph relates to the respiratory system and therefore is irrelevant content for this question. The learner then states that the heart will increase in size becoming stronger. Whilst this statement lacks the required technical language (cardiac hypertrophy) the learner can gain some credit for this level of knowledge at level 1, similarly for the link between this and increased stroke volume.

(d) Analyse how adaptations to Enzo's cardiovascular system will improve his cardiovascular fitness.

(10)

The pulmonary system will become more efficient allowing the lungs to take in more oxygen and utilize it better they will develop.

The heart will get bigger and stronger and more efficient it can take in more oxygen and be more dense. The stroke volume will increase means more blood can be pumped with every ventricle beat they body will become more efficient lactic acid accumulation with take longer kick in.

Q4(a)

This question required learners to 'state' two responses of the skeletal system during a game of basketball.

Many learners were able to gain at least 1 mark for this question, correctly identifying an increase in synovial fluid or a reduction in its viscosity. Where learners failed to gain credit tended to be when they misinterpreted the question, stating long term adaptations rather than short term or immediate responses to an exercise session.

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

Kai plays basketball. When he plays basketball his body systems respond to the increase in physical activity.

4 (a) State **two** responses of the skeletal system during a game of basketball.

(2)

1 Synovial fluid increase

2 Stimulates osteoclasts (ossification process)

This response gained 2 marks
This learner also gained two marks, this time for correctly stating reduction in viscosity of synovial fluid and an increased range of movement at the joints.

Kai plays basketball. When he plays basketball his body systems respond to the increase in physical activity.

4 (a) State **two** responses of the skeletal system during a game of basketball.

(2)

1 Synovial fluid get warm so it becomes less viscous

2 Increased range of movement in joints

This response gained 0 marks
No credit was given for increased mobility or free range of movement as the learner did not state where the increased range of movement was, i.e. at the joint.

Kai plays basketball. When he plays basketball his body systems respond to the increase in physical activity.

4 (a) State **two** responses of the skeletal system during a game of basketball.

(2)

1 Increased Mobility

2 Free range of Movment

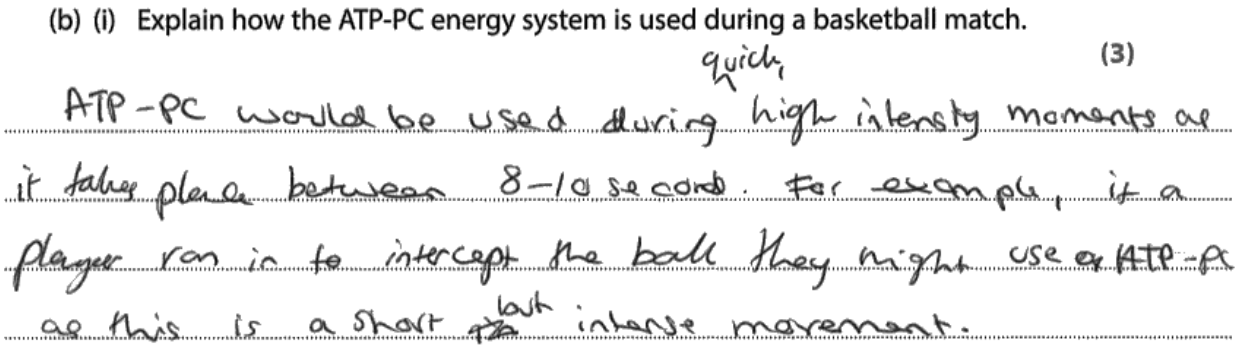
Q4(b)(i)

This question assessed the learners' knowledge and understanding of the ATP-PC system, specifically its use in sporting activity.

Many learners were aware that this energy system is used for high intensity actions and were often able to give a relevant example to demonstrate when it would be used in a game thus gained a minimum of two marks for this question. Many learners identified an appropriate time frame for the duration of this system (6 – 10 seconds) although on occasion the stated duration far exceeded the 2 – 15 second range allowed for in the mark scheme.

This response gained 3 marks

This response gained marks for identifying the intensity of the action that required the use of the ATP-PC system, an example of its use in basketball and for knowledge of the limited duration of this system.

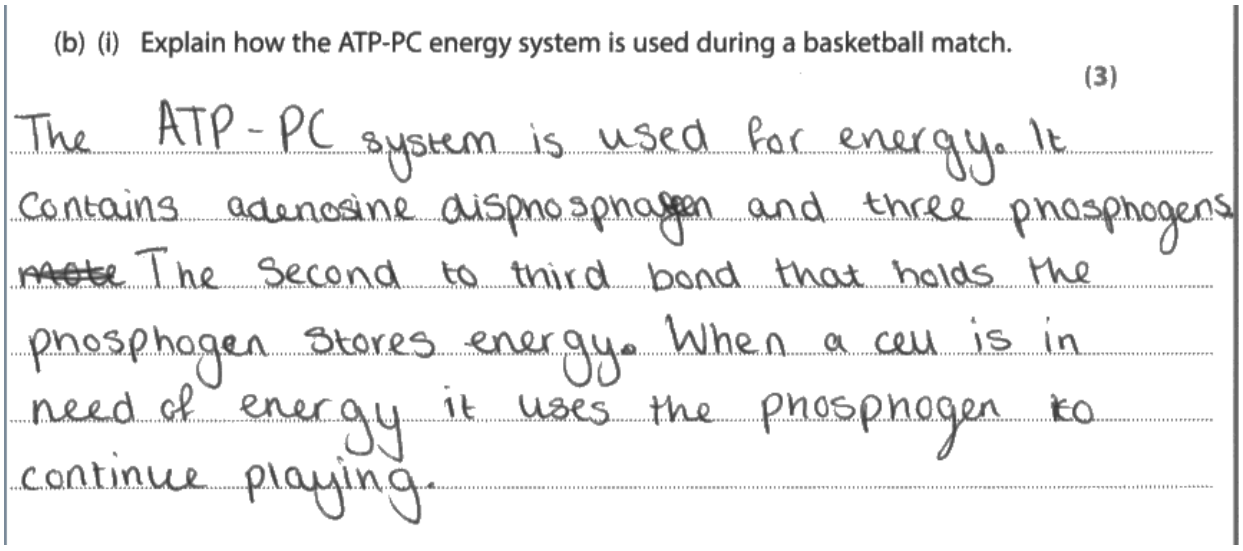


(b) (i) Explain how the ATP-PC energy system is used during a basketball match. (3)

ATP-PC would be used during quick high intensity moments as it takes place between 8–10 second. For example, if a player ran in to intercept the ball they might use ~~ATP-PC~~ as this is a short ~~fast~~ last intense movement.

This response gained 0 marks

Some learners misinterpreted the question, attempting to explain the process of energy release within the ATP-PC system rather than how the system was used within the game.



(b) (i) Explain how the ATP-PC energy system is used during a basketball match. (3)

The ATP-PC system is used for energy. It contains adenosine disphosphagen and three phosphogens ~~meter~~ The second to third bond that holds the phosphogen stores energy. When a cell is in need of energy it uses the phosphogen to continue playing.

Q4(b)(ii)

This energy system (lactate) appeared to be less well-known than the ATP-PC system, or at least appeared harder for learners to explain, thus learner marks were lower for this question. Part of the difficulty may have been due to the clarity required in the response to differentiate the use of this energy system compared to the ATP-PC system. For example, learners were not credited if they simply stated this system was used for high intensity exercise, they had to state that it was for medium to high intensity, similarly the example use in the game needed to demonstrate the longer duration of this energy system compared to the ATP-PC system.

Popular correct responses were that the lactate system produces lactic acid as a by-product and that the system lasts up to 3 minutes.

This response gained 2 marks

The learner has described a situation when this system would be used, taking care to state that it lasts longer than 10 seconds (to direct us to the lactate system rather than ATP-PC) when the player has been in attach and then has to come back and defend, this is sufficient to demonstrate the idea of extended medium to high intensity exercise. The learner also correctly identifies that lactic acid will build up.

(b) (ii) Explain how the lactate energy system is used during a basketball match.

(3)

The lactic acid system would occour when their player has dribbled past opponents and then has to defend. This would be longer than 10 seconds as it all happens at once. Therefore lactic acid builds up until he starts to recover.

This response gained 1 mark

The learner correctly identifies that this energy system is used for high to medium intensity work. However, they incorrectly state the duration of the system as lasting for 'a few minutes', this is too vague to credit.

ATP (b) (ii) Explain how the lactate energy system is used during a basketball match.

(3)

The lactate energy system, like the PC is working anaerobically (without oxygen) as it is quick and lactate system has a high to medium intensity it has a slower fatigue rate however and produces 2 ATP. The lactate energy system lasts for a few minutes and takes about 30 minutes to replenish.

Q4(c)

This question proved challenging. Learners were told that during the game there were two-minute intervals between each of the periods of play within the game. They were then asked to explain how the ATP-PC system recovers between periods. Learners could have approached this question in one of two ways, the first could have been to focus on the time available for recovery, the second on the use of oxygen during the recovery period to regenerate ATP for energy for PC resynthesis.

This response gained 2 marks

The learner gains both available marks for their knowledge that it takes three minutes for the system to fully replenish meaning that the two minute breaks in play will be insufficient time for it to fully replenish.

(c) Explain how the ATP-PC system recovers between periods.

(2)

ATP-PC replenishe ~~with~~ quite quickly - 50% in 30 seconds and 100% in 3 minutes. so by having a 2 minute break, this ATP-PC system is almost replenished fully.

This response gained 0 marks

This learner has explained how PC is used to regenerate ATP rather than explain how PC is resynthesised therefore does not gain marks for this response.

Kai's basketball match is split into four periods.

There is a two-minute break between each period.

(c) Explain how the ATP-PC system recovers between periods.

(2)

The PC bond splits down breaks releasing a Phosphate. So that it can bond with ADP to become replenished ATP

Q4(d)

This question was the most accessible of the extended answer questions for learners. This was possibly due to the wide variety of features that learners could have referred to in relation to each muscle fibre type. Most learners were able to gain some credit for understanding when, during a game of basketball, each fibre type might be used. Where learners had difficulty tended to be due to confusion over type IIa and type IIx, with a minority of learners simply classifying the fibres as either fast twitch or slow twitch. Some learners, focused on energy systems rather than muscle fibre types, discussing the characteristics of the energy systems rather than the muscle fibres.

Learners who identified muscle fibre types as type IIb were credited, even though type IIx is used within the specification.

This response was placed at level 3: and gained 10 marks

This response gives detail of all three fibre types, their characteristics and features and links these to their use in the game. For example, the assessment of slow twitch fibres being highly resistant to fatigue, allowing aerobic work at a low intensity to allow time for lactate to be oxidised (hence highly resistant to fatigue).

(d) Assess the importance of the different muscle fibre types in a game of basketball.

(10)

Basketball is a sport that predominantly uses the anaerobic system. (Type 2a and Type 2b fibres). The energy systems work as a continuum so there is not one energy system that is specifically used for one sport. Figure 1 shows Kai using explosive power to jump and score, this shows him using type 2b muscle fibres that contract fast for explosive power but fatigue quickly. These muscle fibres work without O_2, working anaerobically. They are fast twitch and white in colour due to the lack of myoglobin in them. In a game of basketball, all three muscle fibre types are important because the game lasts for 40 minutes so all energy systems ~~are~~ are used. When sprinting up the court and doing skills, Kai uses his lactate system which is Type 2a muscle fibres, these contract with intermediate force and are fast twitch fibres. They work anaerobically and

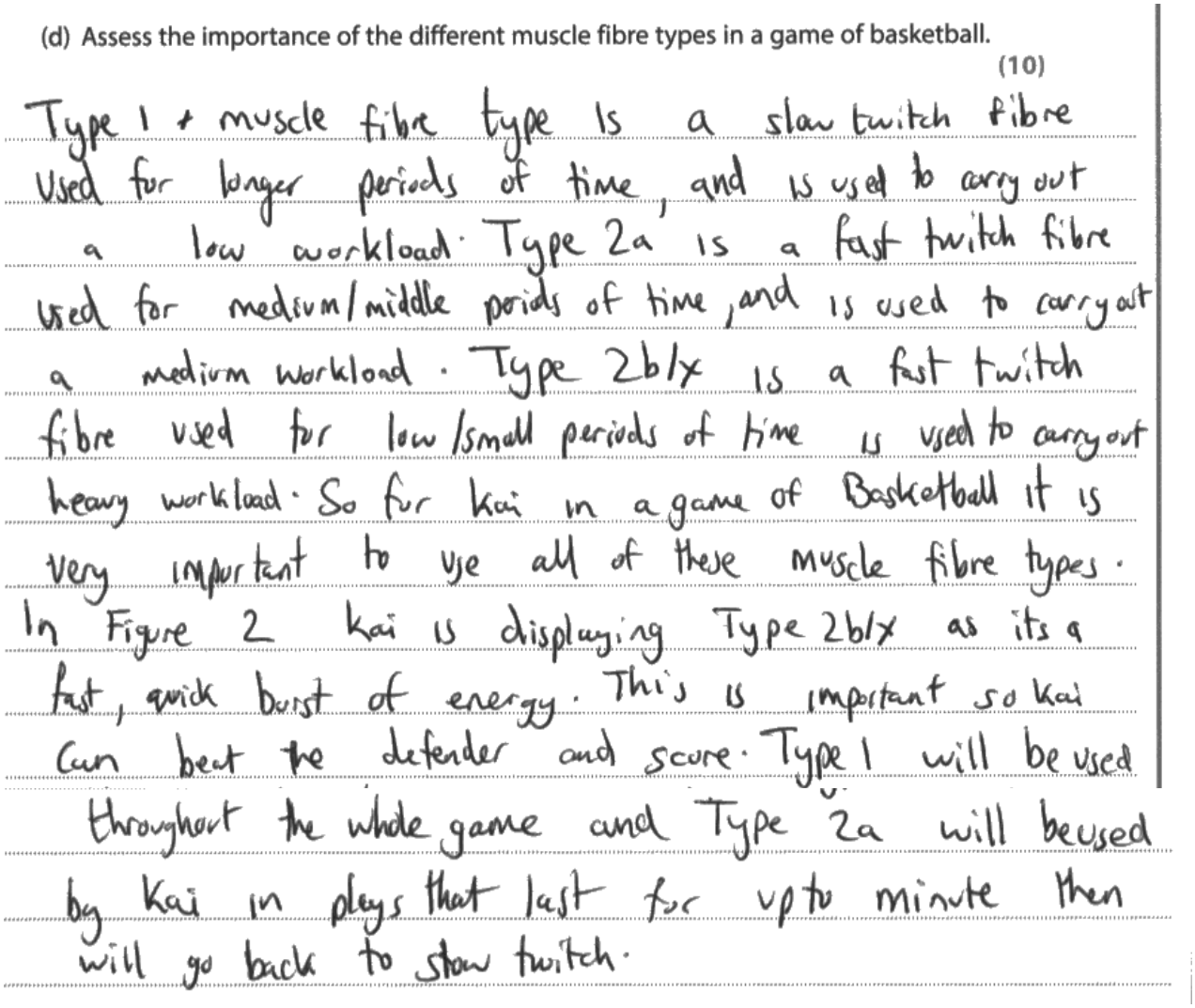
are pink in colour as there is some myoglobin present. They are important because they allow Kai to work at a high intensity throughout the game. These types of fibres are not highly resistant, Type 1 fibres are highly resistant to fatigue, they are important in a game of basketball because they allow Kai to work aerobically and while working at a lower intensity, oxygen can oxidise the lactate that will have accumulated in the blood.

Kai will use all three muscle fibres at different intervals and intensities during the basketball game. They are recruited depending on the duration and intensity of the activity. All three will be used throughout the game

This response was placed at level 2: and gained 5 marks.

The learner has attempted to differentiate between the fibre types. Initially they discuss the 'workload' associated with each fibre type and their expected duration. Although not the expected technical language, as no reference is made to intensity the intent here is clear and therefore can be considered. The learner also gives examples of when each fire type would be used in a game with varied success. For example, type 1 'will be used throughout the game' is a little too vague, reference to the intensity or how it is used would have been more helpful.

Inclusion of more features/characteristics of each type; clearer examples to link to these features/characteristics and the use of technical language would be required for further credit within the level and to move into level 3.



(d) Assess the importance of the different muscle fibre types in a game of basketball.

(10)

Type 1 + muscle fibre type is a slow twitch fibre used for longer periods of time, and is used to carry out a low workload. Type 2a is a fast twitch fibre used for medium/middle perids of time, and is used to carry out a medium workload. Type 2b/x is a fast twitch fibre used for low/small periods of time is used to carry out heavy workload. So for kai in a game of Basketball it is very important to use all of these muscle fibre types. In Figure 2 kai is displaying Type 2b/x as its a fast, quick burst of energy. This is important so kai can beat the defender and score. Type 1 will be used throughout the whole game and Type 2a will be used by kai in plays that last for up to minute then will go back to slow twitch.

It is key for kai to change between fibre types as he will be able to adapt his game and try to score or defend at different speeds using Type 1 to help recover and he can use fast bursts of energy from Type 2a and 2b/x

Summary

Based on their performance on this paper, learners should:

- Use appropriate technical language throughout your responses, ie, do not abbreviate terms, eg, state osteoblasts in full rather than simply stating 'blasts'
- 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 about terminology used in the specification as these words will be repeated in the exam paper, eg, responses and 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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