Neap

Trial Examination 2020

VCE Physical Education Units 3&4

Written Examination

Suggested Solutions

SECTION A – MULTIPLE-CHOICE QUESTIONS

1	A	B	**C**	D
2	A	B	**C**	D
3	A	**B**	C	D
4	**A**	B	C	D
5	A	B	C	**D**
6	**A**	B	C	D
7	A	B	C	**D**
8	A	B	C	**D**
9	A	B	**C**	D
10	A	**B**	C	D
11	**A**	B	C	D
12	A	B	C	**D**
13	A	**B**	C	D
14	A	B	**C**	D
15	A	B	C	**D**

Question 1 C

Of the four molecules, triglycerides produce the most amount of energy per molecule. Stored ATP and CP, glycogen and blood glucose, while able to produce energy more quickly, provides less ATP per molecule than triglycerides.

Question 2 C

A decreased reaction time would benefit the 100 m sprinter at the start of the race. Note that a decreased reaction time would be an improvement, while an increased reaction time would not.

Question 3 B

During the autonomous (advanced) stage of learning, skills will be performed automatically. During the autonomous stage, there will be slow or no improvement, a lot of focus on strategies and a low level of variability in performance (meaning that performance will be consistent).

Question 4 A

The athlete has run 800 m (distance covered), but as they began and ended at the same point, their displacement is 0 m.

Question 5 D

All three statements about high-intensity interval training are correct; it does result in aerobic-based chronic adaptations, it does involve periods of high-intensity work followed by periods of reduced intensity recovery and it also can be a more efficient aerobic training method than continuous training. HIIT is an aerobic training method that intersperses periods of work with reduced intensity recovery, often on a spin bike, and can potentially achieve aerobic chronic adaptations more quickly than continuous training.

Question 6 A

When throwing the shot put, Melanie would primarily use the ATP-CP system. A passive recovery is then most effective to replenish her PC stores before the next throw.

Question 7 D

Physiological, psychological and sociocultural data should all be recorded in a training diary. Emotional data is the only type of data mentioned that would not be necessary to record. Emotional data could fall under the category of psychological data, as this includes motivation levels, but psychological data covers more than just emotional data.

Question 8 D

Blocked practice involves performing the same skill repetitively, while massed practice involves longer, less frequent sessions. This is best represented in the examples given by **D**.

Question 9 C

A lower centre of gravity will result in greater stability, reducing James' chances of being knocked over in a tackle. Bringing his feet together to reduce his base of support would increase his chances of being knocked over when tackled, as would having a lower body mass. Reduced friction between James and the ground would decrease stability.

Question 10 B

During the upward stage of a sit-up, the axis is at the hips, the force is applied in the abdominal muscles and the head/upper body is the resistance. Therefore, this is a third-class lever system.

Question 11 A

Direct coaches will run the training session with high levels of control, with athletes having little input. The athletes may still receive plentiful feedback, but they would not be included in designing the training sessions.

Question 12 D

The athlete spends 30 minutes either standing still or walking (classified as rest) and 60 minutes running or sprinting (classified as work), giving a work-to-rest (W : R) ratio of 2 : 1.

Question 13 B

The four principles of qualitative movement analysis are preparation, observation, evaluation and error correction. While it is important that methods used in a qualitative movement analysis are reliable and valid, they are not principles themselves.

Question 14 C

Muscular endurance should be trained through a lot of repetitions at a low weight, as in **C**. **A** would train muscular hypertrophy, **B** would train muscular strength, and **D** would train muscular power.

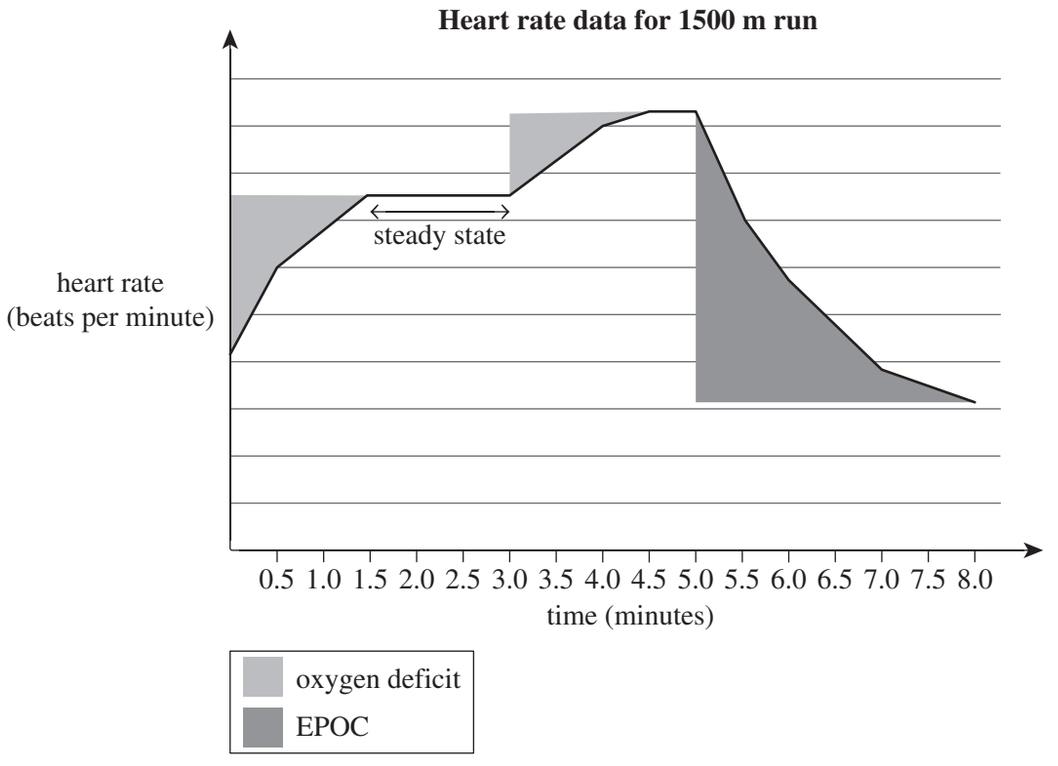
Question 15 D

While the vertical velocity of the projectile will change, the vertical acceleration, which is caused by gravity, will remain constant.

SECTION B

Question 1 (10 marks)

a.



3 marks
1 mark for each correctly labelled state.

b. *For example, any two of:*

- ATP stores are replenished at the muscle.
- PC stores are replenished at the muscle.
- Fatigue-causing by-products such as H^+ ions are removed from the muscle.
- Core body temperature decreases to pre-exercise levels.
- Heart rate decreases to resting levels.
- Breathing rate decreases to resting levels.
- The conversion of lactate to glucose takes place in the liver.

2 marks
1 mark for each correct physiological change.

c. The acute response shown in the graph is an increased venous return. This increases during exercise due to the following mechanisms:

Any two of:

- vasoconstriction: The veins, which carry blood back towards the heart, constrict, increasing pressure and therefore forcing the blood more forcefully back towards the heart.
- respiratory pump: This occurs when the diaphragm expands and increases pressure on nearby veins, forcing the blood more forcefully back towards the heart.
- muscle pump: This occurs when muscles contract and increase pressure on nearby veins, forcing the blood more forcefully back towards the heart.

5 marks

1 mark for identifying increased venous return.
1 mark for each physiological mechanism identified (two required).
1 mark for each physiological mechanism explained (two required).

Question 2 (6 marks)

a. Anaerobic training is most likely to cause the changes shown in the table. 1 mark

This can be seen in the data, as the average diameter of fast twitch muscles fibres increased from 43.6 μm to 54.7 μm, the amount of phosphocreatine stored at the muscle increased from 8.9 to 11.2 seconds worth and the thickness of the left ventricle wall increased from 51 mm to 78 mm. All these changes are anaerobic chronic adaptations. 1 mark

However, oxidative enzyme concentration stayed relatively similar (2.3 to 2.4%) and blood volume showed no change, indicating aerobic training was not consistently performed. 1 mark

b. An increase in the average diameter of fast twitch muscles will increase the overall cross-sectional area of the muscle. 1 mark

A larger cross-sectional area is directly related to increased muscular strength and related improvements in muscular power. 1 mark

This will improve the performance of the high jumper as they will be able to generate more force (and therefore more height) when they push off explosively to jump due to the increase in size of the fast twitch muscle fibres. 1 mark

Note: An additional reasonable response is that larger muscle fibres allow for more storage of ATP and PC.

Question 3 (15 marks)

a. The diver's moment of inertia is equal to mass × radius^2. 1 mark

As the diver moves into the tuck position, they are decreasing their radius, therefore decreasing their moment of inertia. 1 mark

Angular momentum must always remain constant while an athlete is in the air. Therefore, the angular momentum of the diver will not change. 1 mark

Angular momentum is equal to angular velocity × moment of inertia. Therefore, as angular momentum is remaining constant, and moment of inertia is decreasing, 1 mark
the diver's angular velocity must increase when they move into the tuck position. 1 mark

b. Mitcham's dive would best be classed as a serial motor skill. 1 mark

This is because it is made up of several discrete motor skills, each of which have a clear beginning and end (such as a somersault), performed immediately after each other. 1 mark

c. *For example, any two of:*

- flexibility: A large range of motion is required at the hip joints for plaform divers, particularly in order to perform the movement shown in the image.
- balance: Platform divers need a high level of balance to effectively balance on the edge of the springboard and allow themselves the best possible take-off into the dive, allowing them to achieve difficult positions such as the one shown in the image.
- coordination: A high level of bodily coordination is required for platform divers to smoothly move between different positions, such as that shown in the image, and to enter the water with the body in the correct position.
- muscular power: Platform divers need to have high levels of muscular power in their leg muscles, allowing them to explosively push off the springboard and attain maximum height on their dive, therefore giving them more time in the air.
- body composition: It is important for platform divers to have a reasonably low level of fat mass in order to reduce their body size and therefore enter the water more effectively, without causing a large splash. A lower level of fat mass is also likely to improve their flexibility and ability to easily move between different positions whilst in the air, such as the position shown in the image above.

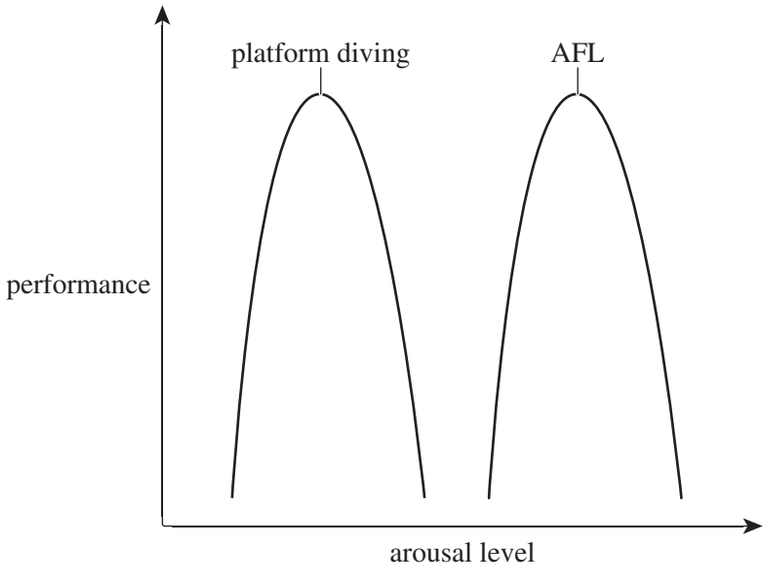
4 marks

1 mark for each fitness component identified (two required).
1 mark for each explanation of the fitness component identified (two required).

d. The optimal arousal levels for a platform diver would be lower than those of an Australian-rules football (AFL) player. 1 mark

This is because divers need to be focused internally and perform more precise movements, whereas football players are more likely to be required to perform large, aggressive movements towards an opposition player or to gain possession of the ball. 1 mark

e.



2 marks

1 mark for two labelled inverted U-shapes of roughly similar height.
1 mark for diving arousal level being lower than football.
Note: The inverted U-shapes may be partially overlapping.

Question 4 (9 marks)

a. The triathlete would use the aerobic energy system predominantly during the triathlon, which lasts for 2 hours and 30 minutes, and would have small contributions from the anaerobic glycolysis system and the ATP-CP system. The anaerobic systems would increase their contributions during periods of increased intensity (such as a final sprint), and at the very start of the triathlon. 1 mark

This is shown in the data, as the triathlete has a relatively low blood lactate concentration (2.2 mmol/L), meaning their anaerobic glycolysis system had a minor contribution. Also, their average heart rate is 72% of their maximum heart rate, which is within the aerobic zone of 70–85% maximum heart rate. 1 mark

The primary source of fatigue for the triathlete is likely to be glycogen depletion, as they only have 14% of their glycogen stores remaining after the event. This would mean they have to use triglycerides more predominantly, and therefore reduce their intensity. 1 mark

In contrast, the netballer would have had a greater contribution from their anaerobic energy systems, although as the match went for 45 minutes the aerobic energy system is likely still dominant for much of the time. 1 mark

Their average heart rate of 87% maximum heart rate indicates a high contribution from the anaerobic energy systems. Their blood lactate contribution of 6.4 mmol/L also indicates this. 1 mark

Therefore, the primary source of fatigue for the netballer is likely to be the build-up of metabolic by-products such as H+ ions, which would slow down enzyme activity in the muscle. 1 mark

b. *For example, any one of:*

- increased motor unit recruitment/activation
- increased enzyme activity
- increased ATP production/resynthesis
- decreased energy substrate levels
- increased production of by-products
- increased temperature

1 mark

For example (increased motor unit recruitment/activation):

During both the triathlon and the netball game, the athletes would experience increased motor unit recruitment and activation. Motor units are how muscle contractions are controlled by the brain – the more motor units are recruited, the greater the contraction force will be. 1 mark

This will improve the performance of both athletes as a greater contraction force will allow them to make more powerful movements, including running, cycling and jumping, which are needed during their respective sports. 1 mark

Note: While there are other acute responses, the response chosen must link to increased performance to be awarded full marks.

Question 5 (19 marks)

a. Learners in group 1, who have just begun playing tennis, are likely to be in the cognitive stage of learning. 1 mark

Learners in subsequent groups are more likely to be in the associative or autonomous stages of learning. 1 mark

Therefore, players in group 1 are less likely to have improved their skills and are therefore less likely to be motivated to continue. Players in later groups are more likely to have developed their skills and therefore more likely to want to continue participating in the sessions. This will lead to group 1 have the highest dropout rate. 1 mark

b. Plyometric training involves a forceful rapid eccentric contraction of the muscle immediately before 1 mark
a forceful rapid concentric contraction of the muscle. 1 mark

c. *For example, any two of:*

- box jumps: jumping onto a box and then stepping off
- skipping: jumping over a rope
- squat jumps: squatting down and jumping vertically into the air
- power skipping: pushing vertically off one leg whilst bringing the other leg up towards the chest in a skipping motion
- long jumps: jumping as far as possible from a standing start
- alternate leg bounds: bounding from one leg to another over a set distance
- hurdles: jumping over hurdles from a standing start

2 marks

Note: Both the exercise and a description must be given to be awarded the mark.

d. *For example, any three of:*

- Ensure an appropriate warm-up has been performed.
- Ensure appropriate footwear is worn.
- Ensure that the training is completed on a stable, even surface.
- Ensure that the players have an appropriate strength base before beginning plyometric training.
- Ensure that rest periods are taken between sets of exercises.
- Start with lower-intensity exercises and gradually increase the difficulty.
- Ensure that correct technique is used.
- Ensure an appropriate number of sessions of plyometrics training are undertaken if another training method is being used to improve muscular power (such as resistance training)

3 marks

e. Aerobic power is the maximum rate of energy production in the presence of oxygen. 1 mark

f. *For example, any two of:*

- cardiac output
- number and size of mitochondria
- concentration of oxidative enzymes
- age
- gender
- muscle fibre type

2 marks

g. *For example:*

An interval training session for a tennis player to improve their aerobic power could consist of a running work-period of two minutes, at approximately 75% maximum heart rate, followed by a rest period of one minute. This could then be repeated 10 times to form the session. 3 marks

1 mark for W : R ratio of 1 : 1 or higher.
1 mark for intensity within 70–85% maximum heart rate.
1 mark for session duration being at least 20 minutes.

h. *For example, any one of:*

- increase in stroke volume
- increase in left ventricle size
- increase in maximum cardiac output
- decrease in resting and submaximal heart rate
- increase in capillary density around the heart and muscles
- increase in blood volume and haemoglobin levels
- decrease in resting and submaximal blood pressure
- decrease in myocardium (heart muscle) oxygen consumption
- change in blood flow to muscles
- increase in removal of blood lactate
- increase in venous return
- increase in a-vO_2 difference

For example (increased stroke volume):

If the training session in **part g.** was consistently performed, the athlete would likely increase their stroke volume. 1 mark

An increased stroke volume means that more blood can be pumped out of the left ventricle of the heart with each beat. This will allow more blood to reach the working muscles when required and therefore the working muscles will be able to produce more ATP aerobically. 1 mark

As the aerobic system produces a greater amount of ATP than the anaerobic systems and causes less fatigue, this will improve the performance of the tennis player. 1 mark

Note: Students must explain a cardiovascular adaptation, not a muscular or respiratory adaptation.

Question 6 (16 marks)

a. The marathon runner's speed likely decreased as their glycogen stores became depleted. 1 mark

As a result, the runner would have been required to switch to triglycerides as their primary fuel source. 1 mark

As triglycerides take more oxygen to break down than glycogen, the rate of ATP resynthesis would have slowed, and the runner had to reduce their intensity. 1 mark

b. Due to the external temperature, Desisa was likely to have had a much higher body temperature during the marathon at the World Athletics Championship. 1 mark

As a result, his body would have attempted to cool itself by sending more blood to the skin to allow for greater sweating to occur. 1 mark

This would have resulted in Desisa's working muscles receiving less blood, and therefore less oxygen, reducing his aerobic ATP production and therefore reducing his running speed, resulting in a slower time. 1 mark

c. During the marathon, Desisa would likely have depleted his glycogen stores (at least partially). 1 mark

Therefore, consuming high-GI foods, which contain carbohydrates and raise blood sugar quickly, would help to replenish these stores. 1 mark

The body is much more responsive to fuel immediately after exercise due to the increased effect of insulin, and therefore it is important that Desisa consumes high-GI foods as soon as possible after the marathon. 1 mark

d. Newton's second law of motion states that net force = mass × acceleration. 1 mark

If Kipchoge must run up a hill, the force acting against him is greater due to gravity, and therefore he will have to apply a greater force to maintain a constant speed. 1 mark

To produce a greater force, he will need to rely more heavily on his anaerobic energy systems – the ATP-CP system and the anaerobic glycolysis system. 1 mark

These energy systems, while producing ATP at a faster rate than the aerobic energy system, also produce fatigue-causing by-products such as H^+ ions. Therefore, running up a hill will cause Kipchoge to feel fatigued. 1 mark

A course with no uphill sections will therefore reduce the amount of force that he needs to produce to maintain his constant high speed. This will reduce Kipchoge's reliance on the anaerobic energy systems and therefore causing him less fatigue, allowing him to maintain a high level of performance. 1 mark

e. The laser is providing Kipchoge with augmented feedback. 1 mark

It is an external tool that is providing feedback to Kipchoge during his performance, allowing his performance to be improved. 1 mark

Question 7 (20 marks)

a. Ebony forgot to perform an activity analysis. 1 mark

This will affect the training program as she won't be able to make it specific to the fitness requirements of hockey. 1 mark

An activity analysis is important as it collects information on movement patterns, W : R ratios, and intensity and skill frequencies, which can be replicated in the training program to ensure that the most important fitness components and skill frequencies are being trained. 1 mark

b. *For example, any two of:*

- frequency: Ebony is training her aerobic power three times per week, which is an appropriate amount for improvements to occur.
- intensity: Ebony's training is primarily occurring in the aerobic training zone of 70–85% maximum heart rate, which is the correct intensity for improving aerobic power.
- time (duration): Ebony's continuous sessions are running for at least 30 minutes, which is appropriate. The overall training program runs for six weeks, which is appropriate to begin to see fitness improvements.
- variety: Ebony has included several different training methods, including continuous, fartlek and circuit training, to ensure that she remains motivated by the training program.
- progression (overload): Ebony has successfully overloaded most of her sessions in week 4, as she has increased either the duration or intensity of her sessions by no more than 10% (for example, 50-minute swim overloaded to a 55-minute swim).

4 marks

1 mark for each training principle identified (two required).
1 mark for each training principle identified explained with reference to Ebony's program (two required).

c. Warm-up: The purpose of the warm-up is to physically and mentally prepare Ebony for the upcoming training session by increasing arousal levels, increasing muscle and joint temperature and increasing heart and breathing rate. 1 mark

Cool-down: The purpose of the cool-down is to return the body to pre-exercise levels by removing waste products from muscles, gradually reducing heart and breathing rate, reducing delayed-onset muscle soreness and reducing venous pooling. 1 mark

d. Momentum is equal to mass × velocity. As the professional hockey player has a stick with a greater mass (620 g compared to 480 g) and swings her stick faster (12 m/s compared to 9 m/s), her stick will have a greater momentum. 1 mark

Therefore, the professional hockey player will cause a larger force to be imparted to the hockey ball when it is struck. 1 mark

This causes the hockey ball to have more momentum, and it will therefore have a greater velocity than when it is struck by Ebony (37 m/s compared to 21 m/s). 1 mark

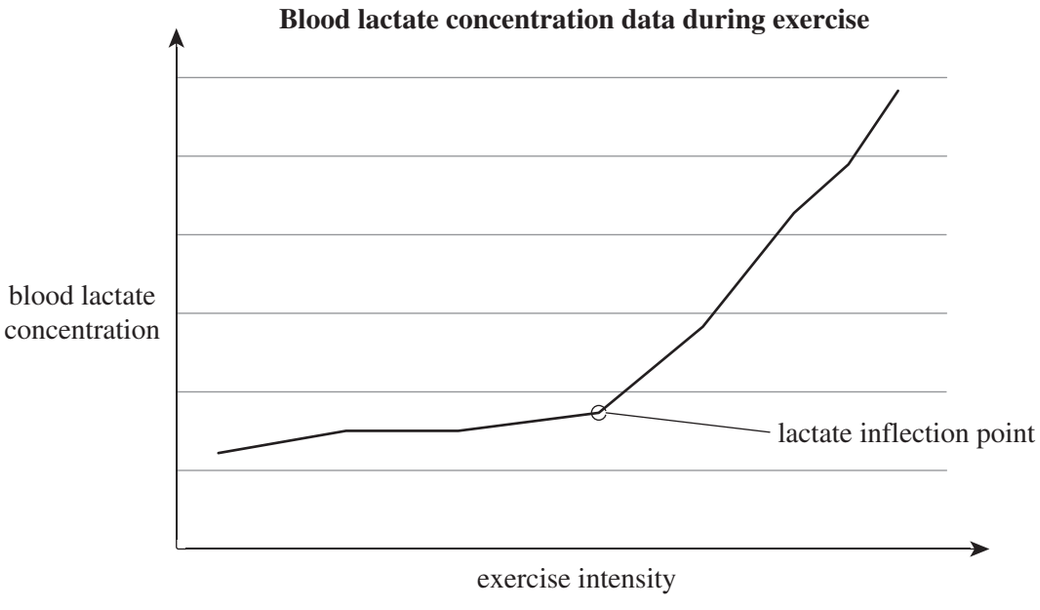
Note: Deduct one mark if no data is used in response.

e. The moment of inertia of a hockey stick is equal to mass × radius^2. By decreasing the mass and radius of a hockey stick, this will therefore decrease its moment of inertia. 1 mark

This results in the hockey stick requiring less force to swing, making it easier for junior players. 1 mark

f. The lactate inflection point is the last point where there is a balance of lactate entry into and removal from the blood. 1 mark

g.



1 mark

h. Ebony's coach is correct, as lactate inflection point (LIP) is best trained aerobically. 1 mark

LIP is best trained when an individual is working near the top end of their aerobic training zone, and therefore a long-interval session would be an appropriate method to train LIP. 1 mark

In contrast, lactate tolerance refers to the ability of an individual to continue working at a high intensity despite the build-up of fatigue-causing by-products, such as H^+ ions. 1 mark

Lactate tolerance is best trained anaerobically by targeting the anaerobic glycolysis system, such as through a medium-interval training session. 1 mark

Question 8 (10 marks)

For example:

During this basketball game, each energy system would be contributing to ATP production, with the contribution of each energy system changing depending on the intensity and duration of the situation. The ATP-CP system would increase its contribution during high-intensity movements such as sprints (18) and jumps (27), due to its ability to produce ATP at a rapid rate. The constant stoppages throughout the game would allow CP stores to be partially replenished, ready for the next high-intensity effort. During repeated high-intensity efforts, such as when a player must perform multiple sprints or jumps in a row, the ATP-CP system would deplete, and the anaerobic glycolysis system would become the dominant energy system. The aerobic system would be dominant during rest periods and when heart rate is below 85% of maximum heart rate, which occurs for a total of 76 minutes during this game. Due to the prolonged nature of a basketball game, lasting for approximately 85 minutes (including breaks), the aerobic energy system would be dominant for most of the match.

One important fitness component for the basketball player would be aerobic power, as they covered 8.9 kilometres during this game and spent the majority of the time (76 minutes) below 85% of maximum heart rate. To improve aerobic power, continuous training could be used, such as by performing a 30-minute run at 75% maximum heart rate three times per week.

One chronic adaptation that is likely to result from continuous training is a decrease in myocardium oxygen consumption. This results in the heart requiring less oxygen to operate during physical activity, meaning more oxygen is available to other working muscles, allowing more ATP to be produced aerobically. This will therefore increase the performance of the basketball player.

A second chronic adaptation that is likely to result from continuous training is an increase in pulmonary diffusion. This occurs because of an increased alveoli surface area and will allow more oxygen to move from the lungs into the bloodstream. These increased oxygen levels then allow more oxygen to be delivered to the working muscles, where it will allow more ATP to be produced aerobically, improving performance.

10 marks

1 mark for discussion of the role of the ATP-CP system.
1 mark for discussion of the role of the anaerobic glycolysis system.
1 mark for discussion of the role of the aerobic system.
1 mark for overall energy system interplay discussion, including use of data, and correct identification of the overall dominant energy system.
1 mark for identification of important fitness component and justification using the provided data.
1 mark for identification and discussion of a correct training method.
1 mark for identification and discussion of each chronic adaptation (two required).
1 mark for linking the chronic adaptation identified to improved performance (two required).