1.5 Energy Systems: ATP-PC, Lactic Acid and Aerobic: 10-minute Pack

AQA 8582 · Calculators not allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Which term describes exercise that can be sustained because the body is able to supply working muscles with enough oxygen to produce energy?

- ☐ A) Anaerobic exercise
- ☐ B) Aerobic exercise
- ☐ C) Isometric exercise
- ☐ D) Ballistic exercise

(Total for Question 1 is 1 mark)

2 Explain why a build-up of lactic acid in a muscle causes muscle fatigue during high-intensity exercise.

(Total for Question 2 is 2 marks)

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3 After a hard 400 m race, a runner continues to breathe heavily and their heart rate stays elevated for several minutes as they recover.

(a) State the term used for the extra oxygen the body consumes during recovery from exercise, above what it would consume at rest. **(1)**

(b) State one reason why this extra oxygen is needed during recovery. **(1)**

(Total for Question 3 is 2 marks)

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4 A rugby union match lasts 80 minutes and involves a constantly changing mix of walking, jogging, sprinting and maximal-effort tackling or scrummaging.

Explain how a rugby player uses all three energy systems at different points during a match, and evaluate why relying on any single system throughout the whole 80 minutes would not be possible.

(Total for Question 4 is 6 marks)

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Mark scheme · 1.5 Energy Systems: ATP-PC, Lactic Acid and Aerobic: 10-minute Pack

Question 1

B (aerobic exercise) **B1**

Answer: B (aerobic exercise)

Question 2

lactic acid builds up in the muscle when it is produced faster than the body can remove/break it down, oe **B1**

this build-up interferes with muscle contraction, causing a burning sensation, reduced force production and eventual fatigue, forcing the performer to slow down or stop, oe **B1**

Answer: Lactic acid builds up in the muscle when it is produced faster than the body can remove it; this build-up interferes with muscle contraction, causing a burning sensation, reduced force production and eventual fatigue, forcing the performer to slow down or stop.

Question 3

(a) oxygen debt (excess post-exercise oxygen consumption, EPOC) **B1**

(a) Answer: Oxygen debt (EPOC).

(b) any one of: to help break down/remove the lactic acid that built up during the race / to replenish the muscle's stores of ATP and phosphocreatine (PC) / to restore the levels of oxygen stored in the muscle (myoglobin) **B1**

(b) Answer: For example, to help break down the lactic acid that built up during the race.

Question 4

Level 3 A detailed and coherent answer that correctly explains when each of the three energy systems is used during a rugby match, with accurate durations and by-products, and clearly evaluates why no single system could fuel the whole 80 minutes. **5-6**

Level 2 At least two energy systems are correctly linked to appropriate match actions, with some evaluation of why a single system would not be sufficient, but development or accuracy may be limited. **3-4**

Level 1 One or two relevant points about energy systems in rugby are made, with little explanation or evaluation. **1-2**

Level 0 No relevant content. **0**

Indicative content:

- The ATP-PC system fuels very short, maximal actions such as a sprint to the try line, a tackle or a scrum drive, which last up to around 10 seconds and use stored ATP and phosphocreatine.
- The lactic acid system fuels harder, sustained bursts of running lasting from around 10 seconds up to a few minutes, such as a prolonged phase of open play, producing lactic acid which contributes to fatigue if not allowed to clear.
- The aerobic system fuels the lower-intensity periods of jogging, walking and standing that make up most of the 80 minutes, using oxygen to break down carbohydrates and fats, and also contributes to recovery between higher-intensity bursts.
- The ATP-PC system alone could not fuel the match because its phosphocreatine stores are used up within about 10 seconds and take time to be replenished, so it can only cover the very shortest actions.
- The lactic acid system alone could not fuel the match because the lactic acid it produces builds up and causes fatigue if relied on continuously for more than a few minutes, and its fuel (glycogen) would also be exhausted well before 80 minutes.
- The aerobic system alone could not fuel the sprints and tackles because it releases energy too slowly to meet the sudden, very high energy demand of a maximal, explosive action.
- A balanced evaluation might conclude that a rugby match's constantly changing intensity means the body must switch rapidly between all three systems, using each for the type of action it is suited to, rather than any one system being able to fuel the whole game alone.

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