

Mark Scheme

January 2018

**Pearson BTEC Level 3 - Sport and Exercise
Physiology**

Unit 1: Sport and Exercise Physiology (31813H)



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1. General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- All marks on the mark scheme should be used appropriately.
- All marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if a candidate's response is not worthy of credit according to the mark scheme.
- Where some judgment is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt about applying the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed-out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Phonetic spelling should be accepted.

Specific marking guidance

The marking grids have been designed to assess learner work holistically. Rows in the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band, depending on how they have evidenced each of the descriptor bullet points.

BTEC Next Generation Mark Scheme

Sport and Exercise Physiology Unit 1 31813H

Question Number	Answer	Mark
1 (ai)	Award one mark for identifying the mechanism Neural (1)	(1)

Question Number	Answer	Mark
1 (aii)	Award one mark for identifying the initiator of the chemical control mechanism for breathing rate and up to two additional marks for describing the process. Credit to a maximum of three marks. When levels of carbon dioxide/CO ₂ <u>increase</u> (1) the pH of the <u>blood</u> decreases/ <u>blood</u> acidity increases/changes (1) which is detected by the chemoreceptors (to increase breathing rate) (1). (Breathing rate will increase) when chemoreceptors detect (1) change in <u>blood</u> acidity/pH (1) due to <u>increased</u> CO ₂ levels (1) Accept other appropriate responses.	(3)

Question Number	Answer	Mark
1 (b)	<p>Award one mark for identifying a reason why minute volume changes and up to one additional mark for expansion that links exercise to an increase in a component of minute volume. Credit to a maximum of two marks.</p> <p>We need to breath more/take deeper breaths/increase minute volume (1) so that increased oxygen can be taken in to meet the demands of exercise (1)</p> <p>Breathing rate increases due to exercise/exercise increases minute volume (1) so that more oxygen can be taken in/CO₂ exhaled to meet the demands of exercise (1)</p> <p>Minute volume/VE = frequency x tidal volume/is the product of frequency and tidal volume (1) so when we increase breathing during exercise minute volume increases (1)</p> <p>Accept other appropriate responses.</p>	(2)

Question Number	Answer	Mark
1 (c)	<p data-bbox="485 320 1123 472">Award one mark for physiological effect and one additional mark for impact of this that would help during exercise. Credit to a total of two marks.</p> <ul data-bbox="533 555 1155 920" style="list-style-type: none"><li data-bbox="533 555 1129 707">• vasodilation of blood vessels to active muscles/redistributing blood flow (1) to increase oxygen delivery to the working muscles<li data-bbox="533 719 1129 831">• vasoconstriction of blood vessels to the digestive system (1) to increase blood flow to working muscles (1)<li data-bbox="533 842 1155 920">• relaxing the bronchioles (1) to increase air flow for greater diffusion of oxygen (1) <p data-bbox="485 994 991 1032">Accept other appropriate responses.</p>	(2)

Question number	Indicative content
1 (d)	<p>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some/all of the indicative content but should be rewarded for other relevant answers.</p> <p>Knowledge and understanding (adaptations to cardiovascular/skeletal system)</p> <ul style="list-style-type: none"> • Aerobic training results in cardiac hypertrophy/increased thickness of left ventricle wall. • Aerobic training will increase stroke volume/reduce resting heart rate/bradycardia. • Aerobic training will increase capillarisation. • Resistance training will increase strength of the skeleton. • Resistance training will stimulate bone remodelling. • Resistance training will increase the collagen content of cartilage. <p>Application to question context (explanation of adaptation due to training type)</p> <ul style="list-style-type: none"> • When Beth trains she will be placing her body under greater stress so it adapts to cope with the increased stress, for example as she runs further the heart works harder and undergoes cardiac hypertrophy. • When she runs Beth is taking part in weight-bearing exercise, the impact of the exercise stimulates osteoclasts to destroy old bone, which signals osteoblast activity to generate new bone growth making the bone stronger. • The resistance training sessions will increase Beth's bone strength, so her skeleton can take a greater impact/withstand greater forces, so she is less likely to get injured. • The resistance sessions will increase collagen content in tendons/ligaments/cartilage, the collagen will make these tissues stronger, so that Beth can continue to work harder in the fitness sessions. <p>Applied logical chains of reasoning/judgement</p> <ul style="list-style-type: none"> • Due to the increased strength from the resistance training sessions, Beth's bones will be able to take a greater impact, reducing the risk of injury/osteoporosis in the future. • Whilst the resistance training will result in stronger, denser bones due to the additional resistance the skeleton experiences, long distance running, as a weight-bearing activity, will also increase bone density, therefore Beth could just focus on aerobic training if she was just interested in bone, rather than muscle, strength.

	<ul style="list-style-type: none"> • Resistance training will do little in comparison to the aerobic training to develop Beth's cardiovascular system, therefore if Beth has to reduce training she should focus on the aerobic training as this still benefits both systems. • Whilst resistance training has many acute effects on the cardiovascular system it has limited chronic effects/causes limited adaptations therefore Beth should focus on her running class. <p>Accept other appropriate responses.</p>
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Level	Mark	Descriptor (Evaluate)
Level 0	0	No rewardable material.
Level 1	1-3	<ul style="list-style-type: none"> • Demonstrates isolated elements of knowledge and understanding. • Few of the points made will be relevant to the context in the question. • Limited evaluation which contains generic assertions leading to a conclusion that is superficial or unsupported.
Level 2	4-6	<ul style="list-style-type: none"> • Demonstrates some accurate knowledge and understanding. • Some of the points made will be relevant to the context in question, but the link will not always be clear. • Displays a partially developed evaluation which considers some different aspects leading to a conclusion which considers some different competing points, although not always in detail.
Level 3	7-8	<ul style="list-style-type: none"> • Demonstrates mostly accurate knowledge and understanding. • Most of the points made will be relevant to the context in question, and there will be clear links. • Displays a developed evaluation and logical evaluation which clearly considers different aspects leading to a conclusion which considers different competing points in detail.

Question Number	Answer	Mark
2 (a)	<p>Award one mark for identifying the advantage and up to two additional marks for explaining how this advantage is brought about. Credit to a maximum of three marks.</p> <p>The increase in production of synovial fluid lubricates the joints (1) increasing the range of movement at the joint (1) so she can achieve a better throwing technique (1)</p> <p>Accept other appropriate responses.</p>	(3)

Question Number	Answer	Mark
2 (b)	<p>Award one mark for each statement. Credit to a total of two marks.</p> <ul style="list-style-type: none"> • The oxygen dissociation curve shifts to the right (1) • The advantage is that oxygen is released more readily to the muscle/more oxygen to the muscles (1) <p>Accept other appropriate responses.</p>	(2)

Question Number	Answer	Mark
2 (c)	<p>Award one mark for stating a factor that results in a shift in the oxygen dissociation curve.</p> <ul style="list-style-type: none"> • (Changes in) carbon dioxide/CO₂ (levels) • (Changes in) hydrogen ion concentration/ pH/ acidity/lactic acid/lactate <p>Accept other appropriate responses.</p>	(1)

Question Number	Answer	Mark
2 (d) (i)	<p>Award one mark for stating the meaning of the term arteriovenous oxygen difference (a-vO₂ diff).</p> <p>Arteriovenous oxygen difference (a-vO₂ diff) is the difference in oxygen content in arteries compared to veins (1)</p> <p>Accept other appropriate responses.</p>	(1)

Question Number	Answer	Mark
2 (d) (ii)	<p>Award one mark for identifying the difference in a-vO₂ diff and up to two additional marks for explaining why there is a difference. Credit to a maximum of three marks.</p> <p>a-VO₂ diff increases from 4ml per 100ml at rest to 15ml per 100ml during the exercise session/by 11ml per 100ml/during exercise (1) this is because during exercise there is a higher demand for oxygen (1) therefore a greater amount is extracted from the arteries/greater oxygen uptake before the blood arrives at the veins (1).</p> <p>Accept other appropriate responses.</p>	(3)

Question number	Indicative content
2 (e) Exp	<p>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some/all of the indicative content but should be rewarded for other relevant answers.</p> <p>ATP-PC system</p> <ul style="list-style-type: none"> • Used for power events because energy is available very quickly but only lasts a few seconds as there are limited PC stores available. • This makes it a good energy system for power activities such as high jump/shot. • The PC can be replenished in 2-4 minutes therefore will have minimal impact on day 2 as the stores should be replaced before the start of day 2. <p>Lactate system</p> <ul style="list-style-type: none"> • Used for power events of a slightly longer duration as energy is available quickly and can last for a few minutes. • This makes it a good energy system for activities such as the 200m • Glucose/glycogen is the energy source but this takes longer to replenish (2 – 48 hours), therefore, this can have an impact on day 2, especially in the 800m meaning they would not be able to perform as well in the 800m on day 2 due to muscle fatigue. <p>Aerobic system</p> <ul style="list-style-type: none"> • Used for endurance events or during recovery. • Therefore, it is not specifically used during any of the events in the heptathlon as they are all of relatively short duration. However, it is important to the athletes' recovery between events. • The additional oxygen from EPOC (slow component) allows glycogen stores to be replaced so the athlete can maintain performance on day 2 <p>Accept other appropriate responses.</p>

Level	Mark	Descriptor (Assess)
Level 0	0	No rewardable material.
Level 1	1-3	<ul style="list-style-type: none"> • Demonstrates isolated elements of knowledge and understanding. • Provides little or no reference to the context in the question. • A conclusion may be presented, but will be generic and the supporting evidence will be limited. Limited attempt to address the question. • Response is likely to lack clarity, organisation and the required technical language.
Level 2	4-6	<ul style="list-style-type: none"> • Demonstrates some accurate knowledge and understanding. • Line(s) of argument occasionally supported through the application of relevant references to context in question. • Judgement is made from a partially-developed discussion, although the discussion may be imbalanced or superficial in places. Learners will produce some statements with development in the form of mostly accurate and relevant factual material leading to an assessment being presented. • The response may contain parts which lack clarity or organisation. There is evidence of correct technical language being used.
Level 3	7 - 8	<ul style="list-style-type: none"> • Demonstrates mostly accurate knowledge and understanding. • Line(s) of argument supported throughout by sustained application of relevant references to context in the question. Might demonstrate the ability to integrate and synthesise relevant systems. • Arrives at a supported judgement from a well-developed and logical balanced discussion, containing logical chains of reasoning. Demonstrates an awareness of competing arguments using these to reach a valid assessment. • Response demonstrates good organisation, clarity and use of technical language.

Question Number	Answer	Mark
3 (a)	<p>Award one mark for identifying why he would test VO₂ max and up to two additional marks for expansion. Credit to a maximum of three marks.</p> <ul style="list-style-type: none"> • It measures oxygen uptake /how much oxygen he can utilise per minute (1) if this is low he will need to take part in aerobic training/work on aerobic fitness (1) to continue working aerobically even when matches go past 2 hours 30 minutes (1). • It is a measure of aerobic capacity (1) the greater his ability to uptake/use oxygen/aerobic fitness (1) the more able he is to maintain sufficient oxygen supply even if matches go on for a longer period of time (1). <p>Accept other appropriate responses.</p>	(3)

Question Number	Answer	Mark
3 (b)	<p>Award one mark for each statement of how the tests would differ. Credit to a total of two marks.</p> <p>A strength test would test the maximum amount that could be lifted once/1RM (1) but a test of muscular endurance would require less weight and more repetitions/15RM (1).</p> <p>Accept other appropriate responses.</p>	(2)

Question Number	Answer	Mark								
3 (c)	<p>Award one mark for each stated energy system. Credit to a total of three marks.</p> <table border="1"> <thead> <tr> <th>Test</th> <th>Energy system</th> </tr> </thead> <tbody> <tr> <td>VO₂ max.</td> <td>Aerobic</td> </tr> <tr> <td>Strength</td> <td>ATP-PC/CP system</td> </tr> <tr> <td>Muscular endurance</td> <td>Lactate system</td> </tr> </tbody> </table>	Test	Energy system	VO ₂ max.	Aerobic	Strength	ATP-PC/CP system	Muscular endurance	Lactate system	(3)
Test	Energy system									
VO ₂ max.	Aerobic									
Strength	ATP-PC/CP system									
Muscular endurance	Lactate system									

Question Number	Answer	Mark
3 (d)	<p>Award one mark for each stated gas. Credit to a total of two marks.</p> <p>NB Any order</p> <ul style="list-style-type: none"> • Oxygen/O₂ (1) • carbon dioxide/CO₂ (1) <p>Accept other appropriate responses.</p>	(2)

Question number	Indicative content
3 (e)	<p>Answers will be credited according to the learner's demonstration of knowledge and understanding of the material using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some/all of the indicative content but should be rewarded for other relevant answers.</p> <p>Knowledge and understanding (slow/fast twitch muscle fibres, muscle fibre recruitment)</p> <ul style="list-style-type: none"> • Different muscle fibre types will be recruited depending on the intensity of the activity. • The greater the force required the more muscle fibres/motor units recruited. • Three different muscle fibre types (type I, type IIa, type IIx). • Slow twitch/type 1 fibres are recruited for low intensity/long duration aerobic work. • Fast twitch type IIa fibres can be trained to take on type 1 characteristics and therefore help with long duration aerobic work. • Fast twitch type IIx fibres are recruited when maximal force is required. <p>Application to question context</p> <ul style="list-style-type: none"> • As the intensity of the game of tennis changes, for example walking back to serve compared to serving, different muscle fibre types will be recruited. • Slow twitch/type I muscle fibres will be recruited to allow the performer to endure the length of the tennis match. • Fast twitch type IIa can be trained to take on characteristics of slow twitch fibres so they would be recruited along with the slow twitch fibres during a long game or match. • Fast twitch type IIx will be used to add power to the serve to generate fast, hard serves. <p>Applied logical chains of reasoning/judgement</p> <ul style="list-style-type: none"> • Without the use of slow twitch muscle fibres, the tennis player would be unable to sustain muscular contraction to keep running for the ball/hitting the ball throughout the 2 hour 35-minute match and therefore would have an increased risk of losing a rally if it extended beyond one or two strokes. • As type IIx allow powerful contractions the player will be able to deliver harder, faster first serves, putting increased pressure on his opponent making it more likely the player will win service/serve an ace. • Both fibre types have an important role to play in the tennis game. Without fast twitch fibres, although the player could last a long game, it is unlikely they would need to play one as rallies would be over

quickly as they would be unable to sprint for the ball or play winning shots.

- Both fibre types have an important role to play in the tennis game. Without slow twitch fibres, although the player may win service games through hitting powerful aces, they would not be able to maintain long rallies or general pace throughout the match.

Accept other appropriate responses.

Level	Mark	Descriptor (Assess)
Level 0	0	No rewardable material.
Level 1	1-3	<ul style="list-style-type: none"> • Demonstrates isolated elements of knowledge and understanding. • Provides little or no reference to the context in the question. • A conclusion may be presented, but will be generic and the supporting evidence will be limited. Limited attempt to address the question. • Response is likely to lack clarity, organisation and the required technical language.
Level 2	4-6	<ul style="list-style-type: none"> • Demonstrates some accurate knowledge and understanding. • Line(s) of argument occasionally supported through the application of relevant references to context in question. • Judgement is made from a partially-developed discussion, although the discussion may be imbalanced or superficial in places. Learners will produce some statements with development in the form of mostly accurate and relevant factual material leading to an assessment being presented. • The response may contain parts which lack clarity or organisation. There is evidence of correct technical language being used.
Level 3	7 - 8	<ul style="list-style-type: none"> • Demonstrates mostly accurate knowledge and understanding. • Line(s) of argument supported throughout by sustained application of relevant references to context in the question. Might demonstrate the ability to integrate and synthesise relevant systems. • Arrives at a supported judgement from a well-developed and logical balanced discussion, containing logical chains of reasoning. Demonstrates an awareness of competing arguments using these to reach a valid assessment. • Response demonstrates good organisation, clarity and use of technical language.

Question Number	Answer	Mark
4 (a)	<p>Award one mark for each stated effect of extreme cold on the body. Credit to a total of two marks.</p> <p>ANY ORDER</p> <ul style="list-style-type: none"> • Hypothermia/body temperature falls <u>below</u> <u>32°C</u>/reduced <u>core</u> temperature (1) • frostbite (1) • constriction of blood flow to extremities (1) • decreased cardiac output/bradycardia/drop in heart rate/heart failure (1) <p>Accept other appropriate responses.</p>	(2)

Question Number	Answer	Mark
4 (b)	<p>Award one mark for statement of how blood flow is altered by vasoconstriction.</p> <ul style="list-style-type: none"> • Decreased blood supply to the peripheral blood vessels/skin (1) • Blood moves away from the skin (1) <p>Accept other appropriate responses.</p>	(1)

Question Number	Answer	Mark
4 (c)	<p>Award one mark for identifying a way of reducing heat loss and one additional mark for explaining how this reduces heat loss. Credit to a total of two marks per correct answer.</p> <p>Shivering thermogenesis/shivering (1) where skeletal muscles rapidly contract and relax/small muscle movement to generate heat energy/increase metabolic rate (1)</p> <p>Non-shivering thermogenesis (1) an increase in the release of hormones/maintains metabolic rate (1)</p> <p>Accept other appropriate responses.</p>	(4)

Question Number	Answer	Mark
4 (d)	<p>Award one mark for identifying how heat is lost once in the water and up to two additional marks for explaining how this results in heat loss. Credit to a maximum of three marks.</p> <p>Heat is lost through conduction (1) through physical contact of Jenny's skin/body and the water (1) therefore the heat will move from Jenny who is warmer to the water which is colder (1).</p> <p>Accept other appropriate responses.</p>	(3)

Question number	Indicative content
4 (e)	<p>Answers will be credited according to the learner’s demonstration of knowledge and understanding of the material using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some/all of the indicative content but should be rewarded for other relevant answers.</p> <p>Knowledge and understanding (adaptations to muscular system, aerobic/anaerobic)</p> <ul style="list-style-type: none"> • Strength training increases muscle size/hypertrophy. • Through strength training greater force can be exerted. • Increased strength may be due to hyperplasia/increase in muscle fibres. • Muscular endurance training is aerobic. • Muscular endurance/aerobic training will increase myoglobin content in muscle. <p>Linked factors</p> <ul style="list-style-type: none"> • Increased muscle size/hypertrophy means more force can be exerted when paddling. • Increased strength may be due to hyperplasia/increase in muscle fibres rather than hypertrophy. • Muscular endurance training is aerobic and aerobic adaptations will mean the muscles can work for longer. • Muscular endurance/aerobic training will increase myoglobin content in muscle, increasing the store of oxygen in the muscle. <p>Application to question context</p> <ul style="list-style-type: none"> • Increased muscle size/hypertrophy means more force can be exerted when paddling so fewer strokes will be needed, allowing some recovery time within the activity so Jenny can work for longer. • Increased strength may be due to hyperplasia/increase in muscle fibres rather than hypertrophy. If there are more muscle fibres they can work collectively to generate more force, or contract whilst others are resting, again allowing some recovery within the activity so Jenny can paddle for longer. • Muscular endurance/aerobic training will increase the myoglobin content in muscle, increasing the store of oxygen in the muscle so that the muscle can work aerobically for longer, this means the muscles will not fatigue as quickly so Jenny can paddle for longer. • The muscles will also adapt by increasing their stores of glycogen/triglycerides therefore providing more immediate energy to the muscle so that Jenny can continue to use the muscles for longer. <p>Accept other appropriate responses</p>

Level	Mark	Descriptor (Analyse)
Level 0	0	No rewardable material.
Level 1	1-3	<ul style="list-style-type: none"> • Demonstrates isolated elements of knowledge and understanding. • Breaks the situation down into component parts and a few points made will be relevant to the context in the question. • Limited analysis which contains generic assertions rather than interrelationships or linkages.
Level 2	4-6	<ul style="list-style-type: none"> • Demonstrates some accurate knowledge and understanding. • Breaks the situation down into component parts and some of the points made will be relevant to the context in the question. • Displays a partially developed analysis which considers some interrelationships or linkages but not always sustained.
Level 3	7 - 8	<ul style="list-style-type: none"> • Demonstrates mostly accurate knowledge and understanding. • Breaks the situation down into component parts and most of the points made will be relevant to the context in the question. • Displays a developed and logical analysis which clearly considers interrelationships or linkages in a sustained manner.

Ofqual



Llywodraeth Cynulliad Cymru
Welsh Assembly Government



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