



Mark Scheme (Results)

January 2022

Pearson BTEC Nationals
In Sport and Exercise Science (31813H)
Unit 1: Sport and Exercise Physiology

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January 2022

Publications Code 31813H _2201_MS

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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 judgement 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 Series 2201

Qu Num	Answer	Mark
1 (a) (i)	<p>Award one mark for the identification of the term.</p> <ul style="list-style-type: none"> Hypothermia (1) NB Must be clear it is 'o' and not 'er', i.e. hypothermia not hyperthermia. <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
1 (a) (ii)	<p>Award one mark for the identification of the term.</p> <ul style="list-style-type: none"> Frostbite <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
1 (b)	<p>Award one mark for identification of an increase in metabolic rate and one mark for a related explanation. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> By increasing metabolic rate/metabolic heat production (1) And any one of the following (1) <ul style="list-style-type: none"> by increasing metabolism of brown fat/fatty acid through increased release of adrenaline through increased sympathetic nervous system activity <u>Catabolic</u> reactions in the body (1) release heat energy (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
1 (c) (i)	<p>Award one mark for identification of the reason for greater heat loss and one mark for a related explanation. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> • (Increased amount of) <u>air/wind</u> movement across the <u>skin</u> (1) therefore (greater) transfer of heat from the body/skin to the cooler air (1) • Through convection (1) as there will be an increased amount of <u>air</u> movement across the <u>skin</u> (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
1 (c) (ii)	<p>Award one mark for identification of the method of heat loss and one additional mark for a linked descriptive point. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> • Conduction (1) • Heat loss due to contact with the water (1) <p>Accept other appropriate responses.</p>	(2)

Indicative content - Evaluate	
Q1d	<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>Adaptations:</p> <ul style="list-style-type: none"> • Hypertrophy • Hyperplasia • Increased size/number of mitochondria • Increased myoglobin stores • Capillarisation • Increased glycogen/triglyceride stores • Muscle tone <p>Use of aerobic training linked to rowing performance</p> <ul style="list-style-type: none"> • Aerobic training will increase the myoglobin content in muscles, 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 they can complete the race without needing to reduce pace towards the end of the race • The muscles will also adapt by increasing their stores of glycogen/triglycerides therefore providing more immediate energy to the muscle so that the rowers can continue to use the muscles for longer • Capillarisation will increase blood flow, increasing diffusion rate/oxygen delivery/CO₂ removal to delay fatigue/delay OBLA <p>Use of strength training linked to rowing performance</p> <ul style="list-style-type: none"> • Hypertrophy/hyperplasia means more force can be exerted when rowing to propel the boat through the water at a faster speed • Muscle tone so better posture in boat therefore better technique to improve performance • Increase stimulation of <u>motor units</u> so more recruited so more force can be generated <p>Evaluation of best method</p> <p>Accept reasoned justification for either method, e.g.</p> <ul style="list-style-type: none"> • Although muscular strength is important to produce more powerful strokes, as it is a long-distance race the aerobic adaptations to the muscular system will mean that the rowers can continue to maintain their pace, delaying fatigue, improving their overall time. • Without strength adaptations low force on water so less distance travelled with each stroke so slower time • Could have a mixture of methods to improve strength endurance <p>Accept other appropriate responses.</p>

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.

Qu Num	Answer	Mark
2 (a)	<p>Award one mark for the identification of the height required to be considered high altitude.</p> <ul style="list-style-type: none"> • 2400m (1) <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
2 (b)	<p>Award one mark for identification of the difference in partial pressure and one mark for a related explanation. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> • There is a decrease in ppO₂ at altitude (1) due to the drop in atmospheric pressure (1) • There are fewer molecules of O₂ at high altitude than at sea level (1) due to lower air/barometric pressure/therefore lower ppO₂ at altitude (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
2 (c) (i)	<p>Award one mark for the identification of a symptom of altitude sickness.</p> <ul style="list-style-type: none"> • Nausea/feeling sick/vomiting (1) • Headaches (1) • Dizzy/light-headed (1) • Tiredness (1) • Loss of appetite (1) • Shortness of breath (1) <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
2 (c) (ii)	<p>Award one mark for the identification of another initial response of the body to high altitude.</p> <ul style="list-style-type: none"> • Hypoxia (1) • Increased breathing rate (1) • Increased heart rate (1) • Reduced VO₂ max (1) <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
2 (c) (iii)	<p>Award one mark for the identification of the specialised chambers.</p> <ul style="list-style-type: none"> • Hypoxic chamber (1) • Hypobaric chamber (1) • Altitude chamber (1) <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
2 (d) (i)	<p>Award one mark for identification of advantage of adaptation and one mark for a related explanation. Credit to a maximum of two marks.</p> <p>(i) Increased red blood cell production:</p> <ul style="list-style-type: none"> • More haemoglobin (1) therefore carries more oxygen/allow aerobic respiration for longer (1) <p>Accept other appropriate responses.</p>	(2)
2 (d) (ii)	<p>Award one mark for identification of advantage of adaptation and one mark for a related explanation. Credit to a maximum of two marks.</p> <p>(ii) Increased number of mitochondria:</p> <ul style="list-style-type: none"> • Site of aerobic respiration/ATP synthesis (1) so increased energy available for exercise (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Indicative content - ASSESS
2 (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>Cardiovascular system responses to starting exercise:</p> <ul style="list-style-type: none"> • Increase in SV/cardiac output/cardiac cycle • Starling's Law/ increased venous return • Increased blood pressure • Redistribution of blood flow/vasodilation • Changes in blood pH • Increased diffusion rate • Greater difference in a-VO₂ diff <p>Link between response and starting exercise:</p> <ul style="list-style-type: none"> • Increase in HR/SV/Cardiac output increasing oxygen delivery to the muscles • Increased blood flow so increased transport of nutrients to muscles • Starling's Law/increased venous return/ results in increased ejection fraction/greater emptying of the ventricles/increased SV • Increased blood pressure due to the increased rate of blood flow/inc HR • Redistribution of blood flow from inactive areas/digestive system to working muscles/active areas • Changes in blood pH due to increased CO₂ production due to exercise • Increased diffusion rate allowing greater oxygen uptake/CO₂ removal to the muscles • Greater difference in a-VO₂ diff indicating better extraction of oxygen by muscles <p>Importance in relation to running a marathon:</p> <ul style="list-style-type: none"> • All responses lead to increased oxygen delivery to the working muscles, with increased oxygen available Wendy will be able to sustain aerobic energy production for longer, critical if she is to maintain her energy throughout the marathon • Also important is that the responses increase the removal of waste products such as CO₂/lactate from the muscle into the blood to be transported out of the body. This is important as it delays fatigue • The more oxygen available the more lactic acid can be broken down delaying OBLA/lactate threshold so she can work at a higher intensity for longer <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.

Qu Num	Answer	Mark
3 (a)	<p>Award one mark for each identification of a change in breathing that increases minute volume. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> • Increased breathing rate (1) • Increased depth of breathing (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
3 (b)	<p>Award one mark for each identification of a respiratory muscle. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> • Diaphragm (1) • Internal intercostal (1) • External intercostal (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
3 (c)	<p>Award one mark for identification of advantage and up to two additional marks for each related explanation. Credit to a maximum of three marks</p> <ul style="list-style-type: none"> • Helps to maintain core temperature (1) as sweat will evaporate off his skin (1) cooling the cyclist/preventing the effects of overheating (1) <p>Accept other appropriate responses.</p>	(3)

Qu Num	Answer	Mark
3 (d)	<p>Award one mark for identification of why they will take on water and up to two additional marks for each related explanation. Credit to a maximum of three marks.</p> <ul style="list-style-type: none"> • Prevent dehydration (1) as a large volume of water is lost when sweating (1) reducing oxygen transport to the muscles/reduction in blood (plasma) volume (1) • To replace fluid (1) lost through (additional) sweating (1) to avoid dehydration (1) <p>Accept other appropriate responses.</p>	(3)

Qu Num	Indicative content - Evaluate
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>General points in relation to energy system recovery – time or what happens:</p> <ul style="list-style-type: none"> • ATP-PC system can recover in 2 - 3 minutes • Lactate system can take 1 - 2 hours to recover (accept 20m – 2h) • Aerobic system can take 24 - 48 hours to recover (accept 2hr – 48h) <p>Expansion - recovery of the energy system</p> <ul style="list-style-type: none"> • The ATP-PC system uses oxygen during recovery to combine with ADP to resynthesise ATP. • ATP-PC system achieves 50% recovery after 30 seconds • Lactate system requires oxygen to break down lactate during recovery • Lactate is broken down into pyruvate during recovery • The aerobic system needs to replenish muscle glycogen • The aerobic system needs time to re-saturate myoglobin stores <p>Application - energy system to the event:</p> <ul style="list-style-type: none"> • ATP-PC used for high intensity aspects of race, e.g., overtaking/quick start • Lactate system is used for higher intensity parts of the race, e.g., uphill sections • Aerobic system is the main energy system used throughout the race <p>Evaluation of whether enough time to recover: Accept reasoned justification for either e.g.</p> <ul style="list-style-type: none"> • No there is not enough time for recovery as although two of Bryon’s energy systems will have recovered, he may not have replaced enough glycogen so he will rely more heavily on fat stores, which will make him slower • Yes, 24 hours is enough time to recover as the lactate and ATP-PC system will have recovered and muscle glycogen can be restored in 24 hours if he has an appropriate diet, so he will also be able to use his aerobic system effectively <p>Accept other appropriate responses.</p>

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.

Qu Num	Answer	Mark
4 (a) (i)	<p>Award one mark for identification of term.</p> <ul style="list-style-type: none"> • Anticipatory rise <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
4 (a) (ii)	<p>Award one mark for identification of hormone.</p> <ul style="list-style-type: none"> • Adrenaline (1) <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
4 (b) (i)	<p>Award one mark for identification of reason for micro-tears.</p> <ul style="list-style-type: none"> • <u>Additional</u> stress placed on muscles when exercising • Overload of muscles <p>Accept other appropriate responses.</p>	(1)

Qu Num	Answer	Mark
4 (b) (ii)	<p>Award one mark for identification of an advantage and up to one additional mark for a related explanation. Credit to a maximum of two marks.</p> <ul style="list-style-type: none"> • Encourages protein synthesis/ stimulates more protein/uses protein/ (1) to grow stronger/more muscle mass/hypertrophy (1) • <u>Stimulates</u> the muscle to repair (1) to grow stronger/ bigger/more muscle mass/hypertrophy/more powerful (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
4 (c)	<p>Award one mark for identification of why muscle temperature increases and up to one additional mark for a related explanation. Credit to a maximum of two marks.</p> <p>Muscle contraction</p> <ul style="list-style-type: none"> Heat is a by-product of energy production (1) therefore increased heat as <u>more</u> energy needed/produced for exercise (1) Heat is produced when the muscles <u>contract</u> (1) therefore increased heat as muscles contracting <u>more</u> (1) <p>Accept other appropriate responses.</p>	(2)

Qu Num	Answer	Mark
4 (d)	<p>Award one mark for identification of why breathing rate is still elevated and up to two additional marks for each related explanation. Credit to a maximum of three marks.</p> <ul style="list-style-type: none"> He was working anaerobically (1) so is in oxygen debt (1) so needs as much oxygen as possible to recover (1) To supply <u>additional</u> oxygen (1) to remove lactate (1) that could not be removed during the race (1) Needs <u>additional</u> oxygen (1) to break down lactate (1) into CO₂ and water (1) <p>Accept other appropriate responses.</p>	(3)

Qu Num	Indicative content - Analyse
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>Muscle spindles:</p> <ul style="list-style-type: none"> • Sense organs • Detect length/stretch of the muscle • Detect speed of change of muscle length • Cause it to contract if overstretching <p>Golgi tendon organs:</p> <ul style="list-style-type: none"> • Sense organ/proprioceptor • Detect tension in muscle • Too much tension causes reflex arc to inhibit the muscle creating any more force <p>Motor units:</p> <ul style="list-style-type: none"> • Made up of a (motor) neuron and the muscle fibres it stimulates • Vary in size • Type I, IIa and IIx motor units <p>What happens when lifting weights:</p> <ul style="list-style-type: none"> • The muscle spindle monitors the speed the muscle is stretching at, and how far it stretches as the weight is lifted • The GTO registers the tension being exerted by the muscle as the weight is lifted • Adjusts the number of fibres recruited depending on the weight to be lifted <p>Relationship between factors and contribution:</p> <ul style="list-style-type: none"> • The muscle spindles protect Bill from injury. If the weight is too heavy for Bill causing the muscle to lengthen under the strain of the weight, this will be sensed by the muscle spindles so the CNS activates a stretch reflex. The quicker the change in length the faster the contraction to reduce the stretch. • If there is too much tension or force being generated, i.e., the weight is too heavy and the muscles are contracting too much to lift the weight the GTOs initiate a reflex arc, to prevent muscle injury. • Motor units provide the force to lift the weights. There will be an increased recruitment of motor units when Bill needs to lift a heavier weight and reduced recruitment (or recruitment of a different type) when Bill lifts a lighter weight. • The motor units provide the necessary variation in force to lift the weights, but the MS and GTOs allow Bill to continue to train injury free. <p>Accept other appropriate responses.</p>

Level	Mark	Descriptor (Analysis)
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 of the 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. <p>Displays a partially developed analysis which considers some interrelationships or linkages but not always sustained.</p>
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.



Llywodraeth Cynulliad Cymru
Welsh Assembly Government

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