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Mark Scheme (Results)

January 2019

BTEC Level 3 National in Sport and Exercise Science

Unit 1: Sport and Exercise Physiology (31813H)

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BTEC Next Generation Mark Scheme

Sport and Exercise Physiology Unit 1 Series 1901

Question Number	Answer	Mark
1 (a) (i)	Award **one** mark for the correct identification of a response of the skeletal system to exercise. • Increased synovial fluid (production) • Reduction in viscosity of the synovial fluid Accept other appropriate responses.	(1)

Question Number	Answer	Mark
1 (a) (ii)	Award **one** mark for each correct identification of the role of the bone cell. Credit to a maximum of **three** marks. **Osteoblasts** • build new bone (1) **Osteoclasts** • destroy/clear away/reabsorbs (old) bone (1) **Osteocytes** • become trapped in the bone matrix • control bone resorption and formation (1) • maintain strength of bone • direct osteoclasts to areas of bone needing remodelling Accept other appropriate responses.	(3)

Question Number	Answer	Mark
1 (b) (i)	Award **one** mark for each correct identification of a reason why blood flow increases. Credit to a maximum of **two** marks. • Increased oxygen delivery for exercise (1) • Increased removal of carbon dioxide/reduce CO_2/removal of waste products (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
1 (b) (ii)	Award **one** mark for correct identification of how blood flow is increased and **one** additional mark for a linked descriptive point. Credit to a maximum of **two** marks. • Vasodilation (1) increasing the diameter of the lumen/blood vessel (which increases blood flow to the working muscles) (1) • Vasodilation of blood vessels to muscles • vasoconstriction of blood vessels to inactive areas/digestive system (1) • Increased heart rate/increased stroke volume (1) <u>which</u> increases cardiac output (1) Accept other appropriate responses.	(2)

Question number	Indicative content
1 (c)	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. **Knowledge and understanding (respiratory system/nervous system)** • (Need) more O_2 during exercise • BR/depth of breathing will increase during exercise • During exercise CO_2 levels increase • During exercise blood acidity increases/pH decreases • The respiratory system expels CO_2/intakes O_2 • Increased rate/depth of breathing will increase gas exchange • Nervous system uses receptors to monitor body systems • Nervous system sends messages to control breathing rate/increase or decrease breathing rate • Breathing control is automatic/involuntary • The medulla (oblongata) controls breathing rate **Linked factors to controlling breathing rate through:** **Chemical control** • Respiratory centre (RCC) controls breathing rate/depth by the percent CO_2 in blood • Increased CO_2 (carbonic acid) increases blood acidity/lowers blood pH • Chemoreceptors detect high concentrations of CO_2/ low pp O_2/change in pH • Chemoreceptors send signals to increase/decrease BR based on CO_2 levels/pH levels **Neural control** • The respiratory control centre (RCC) is in the brainstem/medulla/pons • (The RCC) sends messages to the respiratory muscles telling them when to contract • (The RCC) sends messages to diaphragm/intercostal muscles via the phrenic nerves • The medulla directs the spinal cord to maintain breathing **Application to question context of different intensities** • During high intensity messages sent from CNS to speed up breathing rate due to increased demand for oxygen • During exercise increased CO_2 as more is produced by the body in energy production to meet the increased demands of exercise • Maintain elevated breathing rate during less intense sections to help with recovery after the intense part of the session • Breathing rate slowly decreases as levels of CO_2 in the blood drop as less is produced during the less intense parts of the session Accept other appropriate responses.

Level	Mark	Descriptor (Analyse)
Level 0	0	No rewardable material.
Level 1	1–3	• 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	• 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	• 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.

Question Number	Answer	Mark
2 (a) (i)	Award **one** mark for correct identification of an aerobic adaptation and **one** mark for a related explanation. Credit to a maximum of **two** marks. Increased number/size of mitochondria (1) therefore increased energy production (1) Increased myoglobin stores (1) therefore more resistant to fatigue/work for longer with tiring (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
2 (a) (ii)	Award **one** mark for correct identification of an anaerobic adaptation and **one** mark for a related explanation. Credit to a maximum of **two** marks. Increased muscle strength (1) due to hypertrophy/increased muscle size (1) Increased hypertrophy (1) due to increased muscle <u>fibre</u> size (1) Increased tolerance to lactic acid (1) due to increased buffering capacity (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
2 (b) (i)	Award **one** mark for correct identification of the muscle fibre type and **one** mark for a related explanation of muscle fibre type. Credit to a maximum of **two** marks. **Long distance running** • Type I/slow twitch muscle fibres (1) as they have a very high resistance to fatigue (1) • Type I/slow twitch muscle fibres (1) as they can utilise oxygen (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
2 (b) (ii)	Award **one** mark for correct identification of the muscle fibre type and **one** mark for a related explanation of muscle fibre type. Credit to a maximum of **two** marks. **Single maximum weight lift** • Type IIx muscle fibres (1) as they produce high force (1) • Type IIx muscle fibres (1) as they break down ATP very quickly (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
2 (b) (iii)	Award **one** mark for correct identification of the muscle fibre type and **one** mark for a related explanation of muscle fibre type. Credit to a maximum of **two** marks. **Repeated 30-second stair climb** • Type IIa muscle fibres (1) as they produce medium to high force (1) • Type IIa muscle fibres (1) as they have medium resistance to fatigue (1) Accept other appropriate responses.	(2)

Question number	Indicative content
2 (c)	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. **Cardiovascular system adaptations to high altitude** • Increase in red blood cell (RBC) production • Increase in haemoglobin concentration • Increased capillarisation **Explained adaptation and impact** • More RBCs/greater concentration of haemoglobin, therefore more oxygen can be carried in the blood • Capillarisation means the rate of diffusion is increased/improved transfer of oxygen and carbon dioxide • Therefore, capillarisation allows increased a-vO_2 diff/greater oxygen uptake (at the muscle) **Assessment of impact of adaptations on future football performance** • Training adaptations will be lost after 21 days at sea level (so only effective for a limited period) • Initially will have an increased VO_2 max at sea level so will be able to sustain a higher level of performance throughout a game • Will have impact on aerobic aspects of game rather than anaerobic, although recovery from anaerobic exercise will be quicker Accept other appropriate responses.

Level	Mark	Descriptor (Assess)
Level 0	0	No rewardable material.
Level 1	1–3	• 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	• 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	• 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)	Award **one** mark for each correct identification of ATP yield. Credit to a maximum of **two** marks. **Lactate system** 2 (ATP) (1) **Aerobic system** 34 (ATP) (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
3 (b) (i)	Award **one** mark for correct identification of the recovery process and up to **two** additional marks for each linked descriptive point. Credit to a maximum of **three** marks. • Oxygen is used (1) to break down the accumulated lactic acid/lactate (1) into carbon dioxide and water (1) • Lactate is removed by buffering (1) by hydrogen carbonate ion (1) absorbing the lactate/forming carbonic acid (1) Accept other appropriate responses.	(3)

Question Number	Answer	Mark
3 (b) (ii)	Award **one** mark for correct identification of the recovery process and up to **two** additional marks for each linked descriptive point. Credit to a maximum of **three** marks. • Re-association of oxygen (1) with myoglobin in the muscle (1) ready for use by mitochondria (1) • Repletion of <u>glycogen</u> stores (1) within the muscle (1) through the use of oxygen/diet (1) Accept other appropriate responses.	(3)

Question Number	Answer	Mark
3 (c)	Award **one** mark for correct identification of a type of thermogenesis and **one** mark for a related explanation. Credit to a maximum of **two** marks. Shivering (thermogenesis) (1) where skeletal muscles rapidly contract and relax to generate heat (1) Non-shivering (thermogenesis) (1) an increase in the release of hormones/maintains metabolic rate (1) Accept other appropriate responses.	(2)

Question number	Indicative content
3 (d) Expert	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. **Knowledge and understanding (Isolated elements of knowledge)** • Through thermoregulation the body maintains core temperature of 37°C • Convection (through air flow over the skin) • Conduction (through direct contact) • Radiation (the body radiates heat so needs covering) • Evaporation (of sweat from the surface of the skin) **Application to question context** **Heating pads** • The heating pads will heat the body through conduction. **Blankets** • By providing blankets the skin is not exposed to the cold air decreasing heat loss from the body via convection • Heat loss through radiation can be controlled by insulating the body with the blankets to trap the warm air between the body and the blanket reducing heat loss • Can act as a barrier between a cold surface (eg. seat) and therefore avoid heat loss through conduction **Warm seat cushions** • By providing warm seat cushions heat won't be lost through conduction (due to direct contact with the seat) **Evaporation** • The spectators should make sure they do not get too hot from the additional items to cause them to sweat and then lose heat through evaporation **Applied logical chains of reasoning/judgement (Assessment)** • Heat loss through evaporation is not a factor as the spectators are sedentary therefore unlikely to be sweating and losing heat as a result • A lot of body heat is lost through the head – hats could also have been supplied, if the head isn't covered there will still be a lot of heat lost • Spectators are sedentary therefore not generating heat so need to conserve heat therefore these additional measures should help the spectators stay warm • All of the measures will help, although the spectators could also use layering to trap a warm layer of air reducing heat loss • The most effective method will be the heating pads as they are a heat source, so generate additional heat for the spectators Accept other appropriate responses.

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Question Number	Answer	Mark
4 (a)	Award **one** mark for correct identification of the role and up to **two** additional marks for each related explanation. Credit to a maximum of **three** marks • Muscle spindles detect changes in the muscle length (1) when the muscle is being overstretched (1) they send a signal to reduce the stretch (1) • They provide information to the central nervous system (CNS) (1) if the muscle is being overstretched (1) a stretch reflex is activated (1) Accept other appropriate responses.	(3)

Question Number	Answer	Mark
4 (b) (i)	Award **one** mark for correct identification of the hormone responsible for anticipatory rise in heart rate. • Adrenaline (1) Accept other appropriate responses.	(1)

Question Number	Answer	Mark
4 (b) (ii)	Award **one** mark for correct identification the effect on cardiac output and **one** mark for a related expansion. Credit to a maximum of **two** marks. • Cardiac output increases (1) as cardiac output = SV x HR (1) • Cardiac output increases (1) as more blood will be leaving the heart <u>per minute</u> (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
4 (b) (iii)	Award **one** mark for correct identification of the effect on blood pressure and **one** mark for a related expansion. Credit to a maximum of **two** marks. • Increased blood pressure (1) due to increased blood flow/increased speed of blood flow/increased force through vessels (1) Accept other appropriate responses.	(2)

Question Number	Answer	Mark
4 (c)	Award **one** mark for correct identification of the effect on muscle temperature and **one** mark for a related expansion. Credit to a maximum of **two** marks. • Muscle temperature will increase (1) as muscle contraction generates heat/breakdown of ATP generates heat (1) Accept other appropriate responses.	(2)

Question number	Indicative content
4 (d)	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. **Knowledge of nutritional strategies** • Amount of protein to eat • Carbohydrate intake • Rehydration • Use of dietary supplements • Use of energy drinks (as alternative 'once' where appropriate) **Applied to question context** • High intensity exercise can cause micro tears in muscle • Routine will use muscle glycogen and blood glucose • Routine will deplete muscle stores of ATP and PC • Fluid will be lost in the form of sweat during the routine **Analysis** • As there are limited supplies of ATP/PC in the body she will need to find a way to resynthesis stores, this can be done between events through the aerobic system, which can utilise glycogen or fatty acids to generate the energy needed to resynthesise CP. • After exercise glycogen levels will need restoring by eating carbohydrate to have sufficient energy stores to compete again. • After exercise blood glucose levels will need restoring by eating carbohydrate/drinking a sports drink • Nikki should also consider her protein intake as her activity is intense and will break down muscle tissue, which will need protein to repair the muscle tissue/allow the muscle to adapt. • Protein intake should be spread throughout the day in small amounts so Nikki could consider dietary supplements to consume all of her protein requirements, e.g. a protein bar or shake. • Nikki must ensure she is hydrated for her performance, if not performance will be impaired due to poor circulation/poor temperature control/to lubricate joints. Accept other appropriate responses.

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Welsh Assembly Government

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