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BTEC

Mark Scheme (Results)

Summer 2017

BTEC Level 3 National in Sport and Exercise Science
Unit 1: Sport and Exercise Physiology

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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 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

Question Number	Answer	Mark
1 (a)	Award **one** mark for identifying DOMS and up to **two** additional mark for explaining the cause of this. Credit to a total of **three** marks. Bonnie is suffering from DOMS/delayed onset of muscle soreness (1) as she is overloading her muscles (1) causing micro-tears to her muscle fibres (1) Do not accept reference to lactic acid/lactate. **Accept other appropriate responses**	(3)

Question Number	Answer	Mark
1 (b)	Award **one** mark for identifying how body pump could increase strength of the skeletal system and **one** additional mark for explaining how this is achieved. Credit to a total of **two** marks per correct answer. Body pump is a form of strength training that will increase bone density (1) through the retention/increase of calcium (1). Body pump stresses the skeletal system (1) encouraging bone remodelling / collagen formation to strengthen ligaments/tendons (1) Body pump will stimulate increased osteoblast activity to develop new bone (1) increasing bone density and therefore strength (1). **Accept other appropriate responses.**	(4)

Question Number	Answer	Mark
1 (c)	Award **one** mark for identifying how a person is able to lift weights of varying amounts and up to **two** additional marks for explaining how this occurs. Credit to a maximum of **three** marks. Bonnie's nervous system will vary the number/size/type of the motor units (1), when she needs to lift a heavier weight a larger number/size/type of motor units will be recruited (1) for a lighter weight, smaller/ fewer motor units will be stimulated (1). Bonnie's muscle spindles will detect any change in the length of the muscle (1) when she lifts a heavier weight information is sent to the central nervous system (1) so that more/larger motor units can be recruited to lift the weight (1). **Accept other appropriate responses.**	(3)

Question number	Indicative content
1 (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. **Chemoreceptors** • located in the aorta and carotid arteries • detect changes in acidity/pH levels of the blood • caused by increased carbon dioxide levels compared to oxygen levels • messages are sent to the respiratory control centre to increase breathing rate. **Baroreceptors** • located in the blood vessels supplying the heart and linking the heart and lungs • detect changes in blood pressure • due to changes in intensity of session • if blood pressure is too high they signal the sympathetic nervous system **Role in maintaining appropriate oxygen levels** • both receptors feedback information to the respiratory control centre/medulla oblongata • the respiratory centre acts on this information to regulate breathing rate • for example, an increase in acidity in the blood indicates intense exercise and the need for more oxygen to remove the waste products • if more oxygen is required deeper/quicker breathing to increase movement of air into and out of the lungs • to allow greater oxygen transfer and then transport to the muscles.

Level	Mark	Descriptor (Analyse)
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. • Generic statements may be presented, rather than linked factors/components being identified and explored in the context of the question. Limited attempt to address the question. • Response is likely to lack clarity, organisation and the required technical language.
Level 2	4–7	• Demonstrates mostly accurate knowledge and understanding. • Provides references to relevant information in relation to the context in the question. • Learners will identify linked factors/components with development in the form of mostly accurate and relevant factual material in the context of the question. The accuracy in the detail on the factors identified is likely to vary. • The response may contain parts which lack clarity or organisation. There is evidence of correct technical language being used.
Level 3	8-10	• Demonstrates accurate knowledge and understanding. • Provides sustained references to relevant information in relation to the question context. • A contextualised analysis is developed using mostly coherent chains of reasoning leading to a range of factors/components being present. Learners will demonstrate understanding of linkages and relationships. • Response demonstrates good organisation, clarity and use of technical language.

Question Number	Answer	Mark
2 (a)	Award **one** mark for stating the meaning of the term thermoregulation • the process the body uses to maintain its core temperature • process to keep core temperature at 37° C regardless of external temperatures • way to maintain body temperature at 37° C regardless of level of activity **Accept other appropriate responses.**	(1)

Question Number	Answer	Mark
2 (b)	Award **one** mark for each stated response to excessive heat. Credit to a total of **2** marks. • hyperthermia • dehydration • sweating **Accept other appropriate responses.**	(2)

Question Number	Answer	Mark
2 (c)	Award **one** mark for identifying why it is harder to maintain body temperature and up to **two** additional marks for further details of why this occurs. Credit to a maximum of **three** marks. The fun runners lose heat more easily than Jenna as more of their body is in contact with the air (1) so heat can be transferred from the body to the air through convection (1) whereas Jenna is encased in the polar bear suit so is unable to lose heat in this way (1) Jenna will generate additional heat due to the clothing acting as an insulator (1) in addition to generating heat due to exercise (1). So will lose less heat via evaporation than the other fun runners / but this will need to be from her clothes rather than her skin (1) **Accept other appropriate responses.**	(3)

Question Number	Answer	Mark
2 (d)	Award **one** mark for identifying how appropriate body temperature is maintained and up to **three** additional marks for describing this process. Credit to a maximum of **four** marks. The CV system helps through redistributing blood flow (1) increasing blood flow to the skin (1) this is due to vasodilation of the blood vessels (1) so that heat can be lost through radiation/convection/evaporation (1) **Accept other appropriate responses.**	(4)

Question number	Indicative content
2 (e)	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 my cover some/all of the indicative content but should be rewarded for other relevant answers. **Muscular adaptations to aerobic training:** • A runner's muscular endurance in their legs will increase from the long bouts of continuous training • there will be an increased number of mitochondria in a runner's muscle cells so more places for aerobic respiration to take place • A runner's myoglobin stores in their leg muscles will also increase so that oxygen is more readily available to the muscle • A runner's muscles will increase their ability to store glycogen and triglyceride's providing further fuel sources for exercise • A runner's muscles will experience capillarisation, improving the blood flow through them, providing more opportunity for gaseous exchange to take place. **Respiratory adaptations to aerobic training:** • A runner's respiratory muscles will increase in strength due to the additional stress the body was placed under during training, contributing to an increased vital capacity to increase the volume of air moving into and out of their lungs • Training will result in increased lung volumes/vital capacity/tidal volume/minute volume will all increase allowing them to move a greater volume of air into and out of their lungs. • capillarisation around the alveoli will increase the efficiency of gaseous exchange at the lungs • so the runner will be able to better utilise the increased oxygen coming into the body (through increased lung volumes) increasing oxygen uptake **Marathon performance:** • By using continuous training, a runner is making sure that the adaptations from the training are relevant to the marathon run so the adaptations their body makes to the training will be relevant to the marathon. • Adaptations to the runner's muscular system increase their muscular endurance so they can continue to maintain race pace/medium intensity running for longer in the marathon before feeling the effects of fatigue. • Increasing mitochondria in the muscle increases the amount of energy that can be supplied aerobically, each mitochondria contributing to an increase in energy production. • With increased myoglobin more oxygen can be stored in the muscle, this is readily available for aerobic respiration to break down the increased stores of glycogen and triglycerides increasing energy available. • The increase in lung volumes/vital capacity/tidal volume/minute volume will allow them to move a greater volume of air into and out of their lungs. • Capillarisation at the alveoli and in the muscle ensures that there is a good supply of oxygen to the muscle for aerobic respiration to continue

	• so the runner will be able to sustain aerobic energy production for longer so they can maintain the required pace over the 26 miles of the marathon • A runner's increased ability to utilise oxygen breathed into the body will also mean that more oxygen is available to break down lactic acid • this delays OBLA/lactate threshold so that they can continue to run at a higher pace for longer • delay of OBLA/lactate threshold is a result of the runner's increased VO_2 max • these adaptations mean that the runner not only completes the marathon, but also does so in a good time. **Accept other appropriate responses.**

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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	4–7	• Demonstrates 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	8–10	• Demonstrates 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 stated physiological effect of overtraining. Credit to a total of **3** marks. • imbalances in the endocrine system • excess adrenaline production • excess cortisol production • insufficient rest time to repair muscular and skeletal tissues. Accept other appropriate responses.	(3)

Question Number	Answer	Mark
3 (b)	Award **one** mark for identifying reason why overtraining will result in drop in fitness and **one** additional mark for justifying/rationalising the reason. Credit to a total of **two** marks per correct answer. Enzo may be susceptible to minor illnesses that will prevent him from attending fitness sessions (1) because his immune system will be supressed (1) Enzo will be more susceptible to injury and therefore not able to train / resulting in reversibility (1) as he is not leaving adequate time for his body to repair after each session (1) For pre-stand - might need to place (1) after highlighted text or oblique with next marking point. **Accept other appropriate responses.**	(4)

Question Number	Answer	Mark
3 (c)	Award **one** mark for identifying what happens when lactate accumulates and up to **two** additional marks for explaining how this results in fatigue. Credit to a maximum of **three** marks. Accumulation of lactate causes an increase in the acidity of blood plasma (1) which inhibits enzyme action (1) reducing the ability to break down glucose resulting in muscle fatigue (1). The release of hydrogen ions (1) increases the acidity of the blood plasma (1) which inhibits enzyme action (1). **Accept other appropriate responses.**	(3)

Question number	Indicative content
3 (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. **Cardiovascular system adaptations** • cardiac hypertrophy causing a drop in resting heart rate • and an increase in resting stroke volume • an increase in blood plasma volume • an increase in number of red blood cells and therefore an increase in haemoglobin content • an increase in capillary density • increased diffusion rate **Impact on Enzo's CV fitness** • the increase in haemoglobin content due to increased number of red blood cells leads to improved oxygen transport • therefore, there will be more oxygen available for aerobic energy production • the increase in capillary density around the alveoli allows for greater gaseous exchange as blood has more contact time with oxygen in the lungs • the increase in capillary density in the skeletal muscle allows for greater gaseous exchange so more oxygen can be offloaded to the muscle • therefore, more oxygen can be supplied to sustain energy production so training intensity can be maintained for longer • increased removal of waste products over a sustained period of time • this helps to increase VO_2 max., • and can also cause an increase in a-VO_2 diff (increase in oxygen consumption by the muscle) • an increased VO_2 max means a greater aerobic endurance • therefore, the exercise classes will appear easier.

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Question Number	Answer	Mark
4 (a)	Award **one** mark for each stated response of the skeletal system to exercise/game of basketball. Credit to a total of **2** marks. • increase in osteoclast activity • increase in amount of synovial fluid • reduction in viscosity of synovial fluid. **Accept other appropriate responses.**	(2)

Question Number	Answer	Mark
4 (b)i	Award **one** mark for identifying when the ATP-PC energy system is used as an energy system, **one** mark for how this is applied to basketball and **one** mark for expansion of system. Up to a maximum of 3 marks. The ATP-PC system provides energy for high intensity exercise (1) such as jumping up high to perform a layup shot/rebounding (1) this is possible as ATP is quickly rebuilt by PC to provide the required energy (1). **Accept other appropriate responses.**	(6) (new MS 16/12/16; revised 21/12/16)
4 (b) ii	Award **one** mark for identifying when the lactate energy system is used as an energy system, **one** mark for how this is applied to basketball and **one** mark for expansion of system. Up to a maximum of 3 marks. The lactate system provides energy for moderate to high intensity exercise (1) such as sprinting whilst dribbling the ball down the court/fast break (1) as the energy system does not require oxygen so resynthesises ATP at a quick rate (1).	(new MS 16/12/16, revised 21/12/16)

Question Number	Answer	Mark
4 (c)	Award **one** mark for identifying need for additional oxygen and **one** additional mark for explaining how this is used in recovery of the ATP-PC system. Credit to a total of **two** marks. Aerobic energy system/oxygen will be used to regenerate ATP (1) this ATP is then broken down to release energy for PC resynthesis (1) In the two minute breaks there will not be enough time to fully replenish the ATP-PC system (1) as three minutes is required to fully resynthesise ATP-PC (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. **Type I** • recruited for low intensity, long duration endurance work • as they have a slower contraction time but are slow to fatigue due to their characteristics • for example, a greater number of capillaries than the other fibre types so better oxygen delivery **Type IIa** • recruited when greater force required, can be used in combination with slow twitch for moderate intensity work for longer duration • with appropriate training can develop endurance properties so become more resistant to fatigue than Type IIx **Type IIx** • Recruited when maximal force/high intensity required • but as the fibre fatigues quickly they can only be used for a short period of time • this is due to the build up of lactate **Importance in the game** • Without the slow twitch fibres the players would not be able to endure 40 minutes of play and the quality of play would drop in the later stages of each quarter • slow twitch fibres are always recruited at the start of exercise regardless of intensity • without Type IIa the players would not be able to endure high intensity runs when game play is end to end in quick succession • without Type IIx the players would not be able to execute explosive powerful actions required to jump to intercept passes, shoot or rebound before opponents get the ball • also these fibre types will be recruited even in low intensity activity if the performer is becoming fatigued • therefore, each fibre type will be recruited for a specific purpose within the game and therefore are all valuable to basketball performance as all contribute to the force produced for the required movement.

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