



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**2017**

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**Sports Science and the  
Active Leisure Industry**

Unit A2 2

The Application of Science  
to Sports Performance

**[A2LB1]**

**THURSDAY 15 JUNE, AFTERNOON**

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**MARK  
SCHEME**

## Foreword

### Introduction

Mark Schemes are published to assist teachers and students in the preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

### The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16- to 18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

**1 (a)** Some examples of suitable points to be explained by the candidate:

- A period of time during which there is no change in performance – a levelling off.
- A learning plateau is when forward progress seems to have stopped while engaged in learning a new skill, or improving an existing skill.
- A coach could provide positive feedback and visual guidance.
- The use of extrinsic rewards and plenty of encouragement to keep the athlete engaged.
- Using various methods of teaching skills, breaking the skill down, use of whole–part–whole method.
- Use of visualisation/mental imagery to keep the athlete focused and on task.
- Varied sessions, training programme to incorporate appropriate rest and recovery – avoid mental/physical fatigue.
- Explain to the performer that the learning plateau is a normal part of the learning process.
- The coach makes sure to plan appropriate goals to ensure continued progress.
- Ensure the learner is physically ready for the next step.
- Avoid fatigue and boredom by breaking the practice session into shorter or distributed time periods.
- Selection of appropriate input/cues – selective attention.

Award [1] mark for the key definition and up to [3] marks for the full explanation.

All other valid points will be given credit.

(AO1, AO2)

[4]

**(b)** Some examples of suitable points to be identified by the candidate:

- (i)** Intrinsic Motivation – comes from within the performer. A desire to perform well and succeed.
- Primary motivation.
  - It derives from a pride, pleasure and satisfaction in completing a task or a determination to achieve personal goals.
  - It could be a desire to overcome a problem or task, development of skills and habits to improve.
  - Repeated goal setting in order to progress and maintain motivation.
  - Rehearsal of successful habits until they are perfected.
- (ii)** Extrinsic Motivation – comes from a source outside of the performer
- Secondary motivation.
  - Tangible rewards – physical rewards, for example medals, trophies and money.
  - Intangible rewards – which could come from other people, when receiving praise, recognition from the coach, the public, parents and peers.
  - Removal of external rewards may diminish individual's motivation to take part.

Award [1] mark for key phrase, [2] marks for a basic identification and up to [4] marks for a full identification.

All other valid points will be given credit.

(2 × [2])

(AO1)

[4]

(c) Any **two** from the effects of positive transfer and any **two** from the effects of negative transfer:

(i) Effects of positive transfer:

- Learning situations need to allow for positive transfer, variability of practice recreating the conditions experienced in a real game.
- Clear and concise demonstrations must be used where the learner will be able to transfer elements of the demonstration to aid performance.
- The learner must be made aware of the transferable elements of a previously learned skill.
- The closer the practice is to the replication of the game situation, the greater the chance of positive transfer.
- Simplify the task during the initial learning and transfer it later into the real situation.

(ii) Limiting the effects of negative transfer:

- The performer must be helped to understand the requirements of the task before beginning practice.
- The environment in which the skill is learned and practised must match that experienced in the applied situation.
- The learner's attention must be drawn towards motor programmes that transfer positively to the skill being currently performed and drawn away from movements causing negative transfer.
- Avoid confusion between new and old skill by correct cue selection.

Award up to [2] marks for each phase identified and up to [2] marks for a full description of what a coach can do.

All other valid points will be given credit.

(2 × [2])

AO1

[4]

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2 (a) Some examples of suitable points to be described by the candidate:

Open–Closed Continuum – based on how much the performance of the skill is affected by factors outside of the performer, the environment.

- Open skill: skill affected by the environment or performed in a dynamic changing situation or environment e.g. required for actions of other players, ball flight, acquiring and using external information, high level of decision making.
  - For example, skills involved in invasion games, striking and fielding games.
  - Any activity where the performer has to attend to a changing environment, decide upon a course of action and be prepared to change it as the skill action is carried out.
  - Typically externally paced.
- Closed skill: skill performed in a stable, unchanging environment, where the environment has little or no impact on the performance of the skill. For example, in athletics, shot put or in gymnastics, vaulting, where there is no need to pay attention to the actions of others.
  - The actions are habitual, require little or no decision making.
  - Typically self-paced.

Gross–Fine Continuum – the level of precision or fine control that the performer uses when performing the skill.

- Gross Skill: a strong powerful movement requiring the use of the major muscle groups. Major body movement involving large muscle groups. Associated with strength, power and endurance; often fundamental motor patterns, e.g. kicking, throwing a ball, shot put, long jump.
- Fine Skill: small, precise movement showing high levels of accuracy and co-ordination, using small muscle groups. Intricate, fine movements using small muscle groups, requiring good hand–eye coordination, for example a badminton net drop shot.

Discrete–Serial–Continuous Continuum – whether it is possible to determine the movement has a definite beginning or end.

- Discrete skill: a movement with a clear beginning and end. A single specific skill, often short, brief. To repeat the performer must start from the beginning. For example, basketball free throw, tennis serve.
- Serial Skill: series of specific movements (often discrete) chained together in a sequence. The first movement in the series triggers the next. For example, a gymnastics routine, triple jump.
- Continuous Skill: no clear beginning and end, one end blends into the start phase of the next cycle. Movement is ongoing, the pattern is continuously repeated. End of one cycle leads to the beginning of the next. For example, running, swimming, cycling.

Externally Paced–Self-Paced Continuum – how much control the performer has over the rate and the timing of the action.

- Externally Paced skill: e.g. a skill that is initiated by something other than the performer. The rate of movement is controlled or influenced by external factors, e.g. opponents, receiving a tennis serve. The initiation of the movement is controlled by external factors, for example, hockey defender reacting to an attacker.
- Self-Paced skill: the performer decides when the movement will begin and the pace at which the movement is performed. The rate of movement is controlled by the performer, for example, speed of rotation in a gymnastics somersault or when the initiation of the movement is controlled by the performer, e.g. the start of a dive.

Award up to [1] mark for each classification identified and up to [2] marks for a full description.

All other valid points will be given credit.

(3 × [3])

(AO1, AO2)

[9]

(b) Some examples of suitable points examined by the candidate:

- (i) • Gross Motor Ability: also known as physical proficiency abilities, usually involve movement and are related to physical fitness. A potential physical movement/underpins physical skills/innate/genetic/natural/enduring/stable.
- Strength, speed, flexibility.
  - Dynamic strength, exerting muscular force repeated over a period of time, e.g. press-ups.
  - Static strength, the maximum strength that can be exerted against an object, e.g. lifting max weight.
  - Explosive strength, energy used effectively for a short burst of muscular effort, e.g. vertical jump. Stamina, the capacity to sustain maximum effort involving the cardiovascular system, e.g. marathon.
  - Extent flexibility – flexing or stretching the trunk and back muscles, e.g. high jump. Gross body co-ordination, the organisation of the actions of several parts of the body while the body is moving.
  - Gross body equilibrium, being able to maintain balance using the internal senses, e.g. balance on one leg.
  - Trunk strength, the strength of the abdominal muscles.
- (ii) • Psychomotor Ability: relates to processing information or decision making/initiate movement (rather than actual movements) innate/genetic/natural/putting decisions into action.
- Reaction time, co-ordination, manual dexterity, hand–arm steadiness, hand–eye co-ordination.
  - Multi-limb co-ordination, being able to organise the movement of several limbs at the same time, e.g. throwing a tennis ball and catching with the other hand.
  - Response orientation, choosing quickly the position in which an action should be made, e.g. the batter needs to decide on what shot to play when someone is bowling.
  - Reaction time, being able to respond quickly to a stimulus, e.g. sprint start.
  - Speed of movement, being able to make gross rapid movements.
  - Finger dexterity, being able to work with tiny objects using the fingers, e.g. spin bowling in cricket.
  - Manual dexterity, being able to make accurate arm/hand movements involving objects at speed, e.g. a gaelic football player sprinting, then receiving a pass.
  - Rate control, being able to change speed and direction of responses accurately, e.g. throwing a ball at a moving target in dodgeball, tracking the target in clay pigeon shooting.
  - Aiming, being able to aim accurately at a small object, e.g. throwing a cricket ball at the wicket.

Award [1] mark for key phrase, up to [2] marks for full description.

All other valid points will be given credit.

(2 × [2])

(AO2)

[4]

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**3 (a)** Some examples of suitable responses included by the candidate:

- Associative stage of learning, the athlete understands the fundamentals of the skill and is in the process of refining the skill.
- Movement patterns are now more fluent and integrated. Performance improves greatly.
- Simple aspects of the skill is becoming well learned, motor programmes begin to be formed, and must be reinforced.
- More trial and error, learning from the mistakes/error detection and correction, more consistent or effective.
- Better able to deal with more information and more complex information.
- Feedback should be specific, focusing on knowledge of performance.

Award [1] mark for key phrase and up to [2] marks for the identification of the characteristics of the associative stage of learning.

All other valid points will be given credit.

(3 × [1])

(AO1)

[3]

**(b)** Some examples of suitable points to be explained by the candidate:

- Performance in the final stage is skilled, consistent and aesthetically pleasing, the highest level of proficiency. To get to this stage it often takes years of training, the goal for the coach is to get the athletes to perform almost automatically.
- Motor programmes are well learned and stored in the long-term memory, therefore reaction time is shorter. This is where athletes are capable of attending to and processing other information, for example, the position of defensive players, game strategy, or the form and style of movement.
- Performers judge their own performance and make changes without external feedback from a coach. The coach must remind the athletes to stay focused during competition.
- To remain in this phase constant practice is required to keep reinforcing the motor programmes. It is important for the coach to continue to keep the athlete engaged and highly motivated, varying training sessions, reviewing targets and goals.
- At this stage the athlete will make few errors and can generally detect and correct those errors. It is important for the coach to be aware of the athletes who may focus on the outcome of a competition and the thought of losing, a coach can help an athlete redirect their thoughts, for example, using positive self-talk or imagery.

Award [1] mark for key phrase and up to [3] marks for full explanation

All other valid points will be given credit.

(4 × [1])

(AO2)

[4]

**(c) The quality of written communication is assessed in this question.****Indicative content**

Advantages of command style:

- Instructions and objectives are clear, athletes will be learning a task and are asked to practise it using precise movements.
- Control and discipline are maintained. Going at this slower, controlled pace, athletes are not rushed to perform. Waiting for the signal from the coach, all athletes move together.
- Large groups can be catered for easily.

- Allows the coach to more adequately monitor key safety issues and is therefore useful when addressing higher risk activities, for example, javelin, shot put, adventure activities.
- Has potential to achieve accuracy and precision in performance and is therefore useful when a predetermined model must be adhered to.
- Information can be given quickly if time is limited. Greater likelihood of tasks being completed on time.
- Coach makes all the decisions, performers not distracted by decision making process.

Disadvantages of command style:

- Possible lack of understanding, as the coach could have a large group and is limited to the amount of individual feedback that can be given.
- Little social interaction with the coach or other learners, this may decrease self-esteem and motivation.
- Little allowance for individual creativity and responsibility. Individuals could be held back, as some may be able to perform the task or learn the task quickly and are ready to move on.
- Demotivation as learner becomes disengaged. The coach's time is used giving group signals and occasional group feedback. Some students may become idle as they have completed the task quicker than others and risk the chance of becoming bored.
- No student input into the session and therefore may fail to foster 'deeper learning'.
- Limited individual feedback is given. As the coach is focused on the group, this style does not lend itself to providing feedback to individual athletes.

All other valid points will be given credit.

### Level 1 ([1]–[3])

#### Overall impression: Basic

- Basic knowledge and understanding of the advantages and disadvantages of command style. The candidate may provide a few relevant advantages and disadvantages, with limited explanation.
- Demonstrates a basic ability to discuss the advantages and disadvantages of command style used by a coach. The candidate may list basic examples related to this coaching style.
- Quality of written communication is basic. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

### Level 2 ([4]–[6])

#### Overall impression: Good

- Good knowledge and understanding of the advantages and disadvantages of command style. The candidate may provide some advantages and disadvantages, with some explanation given.
- Demonstrates a good ability to discuss the advantages and disadvantages of command style used by a coach. The candidate will provide some relevant examples related to this coaching style.
- Quality of written communication is good. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is appropriate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning evident.

**Level 3 ([7]–[8])**

**Overall impression: Excellent**

- Excellent knowledge and understanding of the advantages and disadvantages of command style. The candidate will provide fully developed explanations of the advantages and disadvantages.
- Demonstrates an excellent ability to discuss the advantages and disadvantages of command style used by a coach. The candidate will provide detailed examples related to this coaching style to an excellent level and elaborate with thorough explanation.
- Quality of written communication is excellent. The candidate successfully selects and uses an appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is an extensive and accurate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are of a high standard and ensure that the meaning is clear.

[0] is awarded for a response not worthy of credit (AO3)

[8]

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MARKS

4 (a) Some examples of suitable points to be addressed by the candidate:

- Condylloid : radius, ulna, carpal bones

Movement: flexion, extension, abduction, adduction

Sporting Example: basketball players dribbling the ball, bowling in cricket where bowlers can put a spin on the ball by adjusting their wrist.

- Hinge (elbow): humerus, radius, ulna

Movement: flexion, extension.

Sporting Example: Flexion – flexing the knee when the knee is lifted upwards when running. Bicep curls, flexion occurs at the upward phase of the movement.

Extension – the position of the knee on the lead leg of a hurdler as they take off to jump the hurdle. Bicep curl, extension occurs on the downward phase of the movement.

- Hinge (knee): femur, tibia.

Movement: flexion, extension.

Sporting example: Flexion – in football the preparatory phase as the leg is bent backwards.

Extension – in football, the kicking phase, there is a powerful extension.

- Ball and Socket (Shoulder): Humerus, scapula.

Movement: flexion, extension, abduction, adduction, rotation.

Sporting Example: Cricket, when a player is bowling they rotate using their shoulder, it extends and flexes.

Arm raises – when performing an arm raise laterally, the ball and socket joint is being used. The arms are brought away from the midline of the body, abduction and when the arms are brought back towards the midline of the body, the movement occurring is adduction.

- Pivot: Atlas and Axis – First two vertebrae.

Allows rotation – turning the head in relation to shoulders.

Allows athlete to turn head to assist sighting in sports such as archery, shooting and cricket. Also to turn to take in visual cues in most sports – position of opponents, teammates, obstacles.

- Gliding: Clavicle and scapula – shoulder girdle.

Allow – elevations of shoulder – bracing shoulders in rugby tackle.

– abduction and adduction of arms/shoulders.

– rotation of shoulders

This would be evident in sports involving catching skills.

Award [1] mark for each type of joint identified (3 × [1])

And up to [3] marks for an description of the bones and movement at each joint (3 × [3])

All other valid points will be given credit.

(AO1, AO2)

[12]

- (b) (i)
- Synovial fluid fills the cavities at synovial joints, this reduces the friction at the joint, enabling the articulating bones to move freely.
  - Synovial fluid is a fluid that fills the joint capsule and nourishes and lubricates the articular cartilage, as well as shock absorption, rids joints of waste debris.
  - Fluid found inside synovial joints and bursae which lubricates the joint and helps maintain joint stability.

Award [1] mark for structure and [1] mark for function.

(AO1)

[2]

(ii) **The quality of written communication is assessed in this question.**

### Indicative Content

Positive:

- Increases the bone mass – exercise varies the line of stress and stimulates an increase in the amount of calcium deposited in the bone.
- The type of training an athlete does will affect the changes in the muscle fibres. Strength training will encourage an increase in both muscle size, hypertrophy and strength.
- Reduces the risk of osteoporosis.
- Increase in the size and density of the mitochondria within the muscles. Increase in myoglobin with the muscle cell.
- Increases strength of the connective tissue, tendons and ligaments.
- Increases joint stability because of strong ligaments, tendons, healthy cartilage and good muscle tone.
- Greater flexibility at a joint occurs because of the increased muscle elasticity and as a result of responses with the joint.
- Good posture and alignment where stabilising muscles are strong. This helps the joints of the body to cope with external forces as they are mechanically efficient.
- Increases production of synovial fluid, aiding friction-free movement.
- Good core stability supports the lumbar spine and reduces the likelihood of lower back problems.
- Increases the tolerance of the muscles to lactic acid.

Negative Impact:

- Joint dislocation occurs when the articulating bones are forced from their normal position and the joint ceases to function properly.
- Osteoarthritis is when the articular cartilage is damaged and in some cases eventually wears away. This exposes the bone tissue and can lead to the formation of bone spurs. The joint becomes swollen, painful and movement is limited.
- Joint sprain is an injury that stretches or tears a ligament. A ligament is strong connective tissue that joins one bone to another and provides stability. Constant wear and tear from physical activity can cause stretching of the ligament and reduced joint stability.
- Growth plate injuries can result in abnormal growth of bone tissue or completely stop the bone growth.
- Overuse injury from sustained impact, e.g. tennis elbow, shin splints.
- Stress fracture resulting from repeated application of stress.

All other valid points will be given credit.

**Level 1 ([1]–[4])****Overall impression: Basic**

- Basic knowledge and understanding of the positive and negative effects of regular physical activity on the musculoskeletal system. The candidate may provide basic examples.
- Demonstrates a basic ability to discuss the positive and negative effects of regular physical activity on the musculoskeletal system. Candidate will give basic explanations of the positive and negative effects.
- Quality of written communication is basic. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

**Level 2 ([5]–[7])****Overall impression: Good**

- Good knowledge and understanding of the positive and negative effects of regular physical activity on the musculoskeletal system. The candidate may provide some examples.
- Demonstrates a good ability to discuss the positive and negative effects of regular physical activity on the musculoskeletal system. Candidate will provide some examples and explanations of these positive and negative effects of regular physical activity.
- Quality of written communication is good. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is appropriate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning evident.

**Level 3 ([8]–[10])****Overall impression: Excellent**

- Excellent knowledge and understanding of the positive and negative benefits of regular physical activity on the musculoskeletal system. The candidate will provide fully developed examples and show excellent understanding of each one.
- Demonstrates an excellent ability to discuss the positive and negative benefits of regular physical activity on the musculoskeletal system. Candidate will provide thorough explanation of these positive and negative benefits to an excellent level and elaborate with thorough explanation.
- Quality of written communication is excellent. The candidate successfully selects and uses an appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is an extensive and accurate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are of a high standard and ensure that the meaning is clear.

[0] is awarded for a response not worthy of credit  
(AO3)

[10]

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5 (a) Some examples of suitable points to be explained by the candidate:

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Legal:

- Hypoxic tents – the amount of oxygen in the atmosphere inside a hypoxic tent can be manipulated and controlled. Athletes can live or in some cases train in hypoxic tents to stimulate the effects of living or training at high altitude.
  - The tents facilitate the LLTH (Live Low, Train High) method allowing athletes the opportunity to experience this type of training without having to leave home. Hypoxic tents are economically more attractive than annual altitude training camps.
- Altitude Training – at altitude, atmospheric pressure and the partial pressure of oxygen are lower than at sea level. There is a lower pressure gradient between the air in the lungs and the atmosphere and a reduced rate of gaseous exchange.
  - As less oxygen arrives at the mitochondria, therefore, at altitude an athlete will find it harder to work and train aerobically. Training in this environment, at high altitude, enables the body to become better able to function with less oxygen.

Illegal:

- Blood doping – blood doping is an artificial way of increasing the number of red blood cells in the body. This can significantly increase VO<sub>2</sub> max. It is carried out by blood transfusion, using either the athlete's blood or matched blood from another person. The benefits are increased energy delivery and delayed fatigue for aerobic performance.
- EPO (Erythropoietin) – EPO is a hormone that stimulates the production of red blood cells in bone marrow. It is a blood protein produced in the kidneys during periods of hypoxia, where there is an insufficient supply of oxygen in the respiring muscles. EPO can increase red blood cell volume from 45% to 65%. Athletes will use EPO as it builds and mends muscle and increases oxygen transportation.

Award [1] mark for key phrase, [2] marks for explanation and up to [4] marks for full explanation.

(2 × [4])

All other valid points will be given credit.

(AO2)

[8]

**(b) The quality of written communication is assessed in this question.**

**Indicative Content:**

Structural:

- With exercise the heart becomes stronger and bigger, cardiac hypertrophy.
- Increase in red blood cells – red blood cell volume and haemoglobin content is higher in the trained athlete, which facilitates the transport of oxygen around the body.
- The arteries retain or increase their elasticity, increased thickness of the ventricular myocardium.
- Body parts where oxygen is required may experience growth of new capillaries. Increased vascularisation.

Functional:

- Increase in stroke volume, increased volume of blood ejected from the left ventricle per beat/more oxygenated blood and nutrients supplied to working muscles.

- Increase in venous return/increased amount of blood returning to heart in veins/facilitated by skeletal muscle pump/increased strength in muscles causes venous return to increase.
- Vasodilation and vasoconstriction ensure that blood is directed to areas that need it (muscles, lungs, heart) and away from inactive organs.
- Increase in cardiac output, increase volume of blood ejected from left ventricle per minute/lower resting heart rate/more oxygenated blood and nutrients supplied to working muscles.
- Increase in ventilation rate, increases occur as a result of both an increase in frequency of ventilation and an increase in the depth of ventilation.
- Increase in rates of diffusion, moving from an area of high pressure to one of low pressure.
- Increase in blood pressure, therefore increasing flow rate and the speed of delivery of oxygen and nutrients to the working muscles.
- Vascular shunting occurs where blood is diverted to skeletal muscle tissue where it is needed.
- Increase strength of ventricular contraction.
- Increase in end diastolic volume and decrease in end systolic volume. Greater diastolic filling of the ventricle so more blood available to be ejected from the left ventricle to the body or from the right ventricle to the lungs.
- Increased lactate threshold.
- Increase in red blood cell and haemoglobin levels. This is higher in trained athletes, which facilitates the transport of oxygen around the body.

### **Level 1 ([1]–[4])**

#### **Overall impression: Basic**

- Basic knowledge and understanding of the effects of exercise on an endurance athlete's cardiovascular system; may be structural and functional. The candidate may provide basic examples.
- Demonstrates a basic ability to discuss the effects of exercise on an endurance athlete's cardiovascular system; may be structural and functional. The candidate will provide basic examples but does not discuss the effects in detail.
- Quality of written communication is basic. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

### **Level 2 ([5]–[8])**

#### **Overall impression: Good**

- Good knowledge and understanding of the effects of exercise on an endurance athlete's cardiovascular system; may be structural and functional, using specific examples.
- Demonstrates a good ability to discuss the effects of exercise on an endurance athlete's cardiovascular system; may be structural and functional. The candidate will provide some examples and does discuss some effects of exercise related to an endurance athlete's cardiovascular system.
- Quality of written communication is good. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is appropriate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning evident.

**Level 3 ([9]–[12])****Overall impression: Excellent**

- Excellent knowledge and understanding of the effects of exercise on an endurance athlete's cardiovascular system; may be structural and functional. The candidate will provide fully developed examples and shows excellent understanding of the effects of exercise on the cardiovascular system of an endurance athlete.
- Demonstrates an excellent ability to discuss the effects of exercise on an endurance athlete's cardiovascular system; may be structural and functional. The candidate will provide thorough explanation and will use a variety of relevant examples.
- Quality of written communication is excellent. The candidate successfully selects and uses an appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is an extensive and accurate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are of a high standard and ensure that the meaning is clear.

[0] is awarded for a response not worthy of credit

(AO3)

[12]

**(c) The quality of written communication is assessed in this question.****Indicative Content:**

- Muscle cell respiration increases – increased use of glycogen and oxygen and increased production of carbon dioxide.
- There is an increase in metabolic activity; as a result there is an increase demand for oxygen. There will be an increase in blood supply to muscles as the capillaries dilate to supply sufficient blood to the working muscles, supplying oxygen, nutrients and removing carbon dioxide.
- Metabolic changes occur within the muscles – PC/phosphocreatine ATP/Adenosine triphosphate and glycogen stores decrease as they are used as fuel to provide energy.
- Muscle damage – muscles can be damaged by injuries sustained during or as a result of exercise/training.
- Fatigue – muscle fatigue is a short-term decline in the ability of a muscle to generate force which can happen as a result of training or overexertion during exercise.
- Exercise places greater demand on the body. When an athlete is exercising, oxygen levels fall, carbon dioxide and lactate levels increase, body temperature increases, which can bring about muscle fatigue.
- Breathing rate/depth of breathing increases – the number of breaths per minute, which at rest is 12–16 breaths per minute, when exercising it increases to 60/70 breaths for an elite endurance athlete.
- Tidal volume increases as athletes try to respond to the demand of increased oxygen needed during exercise. This is controlled by the respiratory centre in the brain as a response to detecting changes in concentration of CO<sub>2</sub> and O<sub>2</sub>.
- The muscles which facilitate breathing work harder to increase the expansion of the thoracic cavity during inhalation, using the diaphragm and intercostals muscles.
- Heart rate increases, to transport the oxygenated blood to the muscles more quickly and return deoxygenated blood to the heart and lungs.
- During strenuous exercise the muscles involved in the breathing process can themselves utilise up to 10% of the total oxygen uptake.
- Gaseous exchange rate increases to deliver increased oxygen to the working muscles and remove carbon dioxide and lactic acid.
- Exercise results in an increase in minute ventilation (the volume of air breathed per minute). This rapid rise is due to nervous influences

generated from receptors located in the working muscles and joints. Both tidal volume and frequency of breath increase. After exercise ends minute ventilation returns to resting values.

- More carbon dioxide is removed to maintain concentration gradient and allow diffusion to occur – carbon dioxide and oxygen diffuse down a concentration gradient from high to low concentration.

All other valid points will be given credit.

### Level 1 ([1]–[5])

#### Overall impression: Basic

- Basic knowledge and understanding of the physiological responses of the muscular and respiratory system. The candidate may provide basic examples.
- Demonstrates a basic ability to discuss the physiological responses of the muscular and respiratory system. Candidate will provide basic comments relating to the athlete's physiological responses.
- Quality of written communication is basic. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

### Level 2 ([6]–[11])

#### Overall impression: Good

- Good knowledge and understanding of the physiological responses of the muscular and respiratory system. The candidate will give some relevant examples.
- Demonstrates a good ability to discuss the physiological responses of the muscular and respiratory system. The candidate will provide relevant comments relating to the athlete's physiological responses.
- Quality of written communication is good. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is appropriate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning evident.

### Level 3 ([12]–[16])

#### Overall impression: Excellent

- Excellent knowledge and understanding of the physiological responses of the muscular and respiratory system role. The candidate will provide fully developed examples and show excellent understanding of each one.
- Demonstrates an excellent ability to discuss the physiological responses of the muscular and respiratory system. The candidate will be able to discuss to an excellent level the physiological responses and elaborate with thorough explanation.
- Quality of written communication is excellent. The candidate successfully selects and uses an appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is an extensive and accurate use of specialist vocabulary. Presentation, spelling, punctuation and grammar are of a high standard and ensure that the meaning is clear.

[0] is awarded for a response not worthy of credit  
(AO2, AO3)

[16]

36

**Total**

**100**

AVAILABLE  
MARKS