



*Rewarding Learning*

**ADVANCED**  
**General Certificate of Education**  
**2024**

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**Sports Science and the  
Active Leisure Industry**

Unit A2 2

The Application of Science  
to Sports Performance

**[AAL21]**

**TUESDAY 11 JUNE, MORNING**

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**MARK  
SCHEME**

## **General Marking Instructions**

### ***Introduction***

Mark schemes are intended to ensure that the GCE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses.

### ***Assessment objectives***

Below are the assessment objectives for GCE Sports Science and the Active Leisure Industry.

Candidates must:

- demonstrate knowledge and understanding of sports science and the active leisure industry (AO1);
- apply knowledge, understanding and skills through different contexts appropriate to sports science and the active leisure industry (AO2); and
- analyse and evaluate evidence to make reasoned and valid judgements about sports science and the active leisure industry (AO3).

### ***Quality of candidates' responses***

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17-year-old or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

### ***Flexibility in marking***

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

### ***Positive marking***

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 17-year-old or 18-year-old GCE candidate.

### ***Awarding zero marks***

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

### ***Types of mark schemes***

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

### **Levels of response**

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for 'best fit' bearing in mind that weakness in one area may be compensated by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement.

### **Quality of written communication**

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response. An example follows:

Level 1: Quality of written communication is basic.

Level 2: Quality of written communication is good.

Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, an example is provided below. Examiners should refer to the specific guidance given within the mark scheme for each question:

**Band 1 (Basic):** The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material will lack clarity and coherence. There is little use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

**Band 2 (Good):** The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

**Band 3 (Excellent):** The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

- 1 (a) Some examples of suitable points to be identified and described by the candidate:

Isometric contraction:

- Muscle contraction occurs but stays the same length.
- There is generally no visible movement resulting from this contraction.
- Examples may include a tennis grip or crucifix in gymnastics.

Isotonic concentric contraction:

- The muscle shortens as it contracts.
- Examples may include contraction of the biceps brachii to cause flexion of the elbow during biceps curl or contraction of the gastrocnemius during plantar flexion in a ballet pirouette.

Isotonic eccentric contraction:

- This involves the muscle lengthening while it contracts.
- Eccentric contraction is associated with controlling or slowing down a movement.
- Examples may include the eccentric contraction of the biceps brachii during the downward phase of the biceps curl to control the movement.

Isokinetic contraction:

- The muscle changes length during this contraction but the contraction produce movements at constant speed.
- Examples may include the breaststroke in swimming, where the water provides a constant, even resistance to the movement of adduction of the arms or use of an isokinetic dynamometer for rehabilitation after injury.

Award [1] for the identification and [1] for the description.

All other valid points will be given credit.

(AO1) (AO2) (2 × [2])

[4]

- (b) Some examples of suitable points to be described by the candidate:

(i) Slow twitch fibres/Type 1 structural characteristics:

- Red in colour
- Small fibre diameter
- Small number of fibres per motor unit (10–180)
- High capillary density
- High myoglobin content
- High mitochondrial density
- High triglyceride stores
- Low phosphocreatine content
- Utilised by endurance based athletes, e.g. triathletes/marathon runners

Award [1] mark for a structural characteristic and [1] mark for a sporting activity.

All other valid points will be given credit.

(2 × [1])

(AO2)

[2]

(ii) Fast twitch glycolytic/Type 11b fibres structural characteristics:

- White in colour
- Large fibre diameter

- Large number of fibres per motor unit (300–800)
- Low capillary density
- Low myoglobin content
- Low mitochondrial density
- Low triglyceride stores
- High phosphocreatine content
- Utilised by powerful athletes, e.g. sprinters/weight lifters

Award [1] mark for a structural characteristic and [1] mark for a sporting activity.

All other valid points will be given credit.

(2 × [1])

(AO2)

[2]

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

Skeletal adaptations:

- A high intensity sprint based training programme load will place stress on bone stimulating the growth of new bone tissue (osteoblasts) and calcium deposits.
- Weight bearing exercise will help increase and maintain bone density, strengthening bone.
- Achieving and maintaining peak bone mass requires progressive intense loading of the spine and hip through exercises such as squats and lunges.
- Reduce risk of osteoporosis in the future.
- The effects of exercise on tissue such as hyaline cartilage leads to thickening of cartilage.
- Tendons connecting muscle to bone become stronger improving joint stability.
- Ligaments connecting bone to bone become stronger improving joint stability.
- Increased capacity to absorb and expel synovial fluid, improving lubrication in synovial joints.
- Reduced friction within the joint, improving joint mobility and flexibility.

Award [1] mark for the explanation of each skeletal adaptation.

All other valid points will be given credit.

(2 × [1])

(AO2)

Muscular adaptations:

- Muscle hypertrophy.
- Fast twitch muscle fibres type 11a and type 11b increase in size.
- Increased strength of muscle and force production.
- Muscles retain more elasticity improving flexibility.
- Improved calcium release enhancing muscular ability to contract efficiently.
- Increased buffering capacity prevents muscle fatigue despite lactic acid accumulation/offset OBLA.
- Increase levels of phosphocreatine.
- Increase recruitment of fast twitch fibres.

Award [1] mark for the explanation of each muscular adaptation.

All other valid points will be given credit.

(2 × [1])

(AO2)

[4]

12

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

## Intrinsic Motivation:

- Intrinsic motivation comes from within the performer.
- Athletes participate in sport for internal reasons, e.g. joy and satisfaction.
- Intrinsically motivated athletes tend to focus on skill development and growth.
- It derives from pride, pleasure and satisfaction in completing task or a determination to achieve personal goals.
- Coaches can make training sessions fun and enjoyable to encourage an intrinsic love for the sport.
- Coaches can vary training to stimulate the participant and create an exciting training environment.

## Extrinsic Motivation:

- Extrinsic motivation comes from a source outside of the performer.
- Coaches can create opportunities for the public, parents or peers to give praise or recognition.
- A coach can aim to extrinsically motivate a performer by giving tangible rewards such as trophies, medals and certificates.
- A coach can aim to extrinsically motivate a performer by giving intangible rewards such as praise, recognition and approval of effort.

Award [1] mark for definition and up to [2] marks for the full explanation.

All other valid points will be given credit.

(2 × [3])

(AO1, AO2)

[6]

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

- Occurs when the knowledge and performance of one skill will help the learning of a new skill.
- Tends to occur when the skill has a similar shape or form, e.g. overarm throwing technique for javelin and shoulder pass in Netball.
- There must be similarity in the structure of the skill components.
- Positive transfer can be enhanced if these similar elements are shown to learners.

**(ii)** Bilateral transfer:

- Occurs when learning and performance is transferred from one side of the body to the other.
- Will enhance performance as it makes performers more versatile, e.g. a soccer player learns to strike with their right and their left foot.

**(iii)** Retroactive transfer:

- Occurs when a newly learned skill influences a previously learned skill.
- This can be positive as skills overlap in many sports, e.g. jump to catch in Gaelic Football enhances rebound skills in Basketball.

Award [1] mark for the explanation and [1] mark for the correct sporting example.

All other valid points will be given credit.

(3 × [2])

(AO1, AO2)

[6]

AVAILABLE  
MARKS

12

3 (a) Some examples of suitable points to be identified by the candidate:

- Cognitive
- Perceptual
- Motor
- Psychomotor

Award [1] mark for each type of skill identified.

All other valid points will be given credit.

(3 × [1])

(AO1)

[3]

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

Definition: A plateau is when the performance stops improving and performance levels out.

Strategies:

- Coaching should be of a high standard and focus on technical development to target improvements in performance.
- A coach could provide positive feedback and correct errors.
- Provision of extrinsic rewards and plenty of encouragement to keep the athlete engaged.
- Use a range of teaching/coaching methods, e.g. breaking the skill down into parts or use of the whole-part-whole method.
- Incorporate visualisation or mental imagery into performance to keep the athlete focused and on task. This can be provided through a demonstration.
- Incorporate appropriate rest and recovery to avoid mental or physical fatigue.
- Explain to the performer that the learning plateau is a normal part of the learning process.
- Set achievable goals to motivate the performer and ensure continued progress.
- Ensure the learner is physically ready for the next step.
- Introduce difficult skills gradually to ensure mastery of skill.
- Competition schedule should be monitored to ensure time for learning and progress to take place.

Award [1] mark for definition and up to [4] marks for explanation of two strategies.

All other valid points will be given credit.

(1 × [5])

(AO1, AO3)

[5]



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

AVAILABLE  
MARKS

**Indicative Content:**

Command style

- This is a didactic style where the teacher makes all the decisions.
- Instructions and objectives are clear.
- Control and discipline are maintained.
- Suitable for high risk sports where there are safety concerns and higher risk of injury.
- Information can be given quickly if time is limited.
- Large groups can be catered for easily.
- No decision making or input from the learner.
- Possible lack of understanding.
- Limited social interaction with teachers or other learners.
- Limited individual feedback is given.
- Suitable for beginners/those at cognitive stage of learning.

Reciprocal style

- Performers work in pairs and take turns observing and giving feedback to each other based on established performance criteria.
- Encourages active involvement and interaction of performers.
- Develops communication and decision making skills.
- Coach has less control than command styles.
- Relies on learner's standard of knowledge and ability to communicate.
- This style can be more time consuming to plan and manage effectively.
- Promotes listening skills.
- Suitable for those at associative/autonomous stage of learning.

Guided discovery style

- Coach uses questions and tasks to gradually direct participants towards a predetermined learning target.
- It is an open-ended approach, encouraging creativity while developing the cognitive and performance element of the learner.
- Performers draw on their acquired knowledge.
- Encourages creativity and decision making skills.
- Development of the learner's responsibility for their own learning.
- Increased motivation and self-confidence.
- Suitable for those at associative/autonomous stage of learning.

Other teaching styles accepted: Problem solving, Practice, Self-check, Inclusion, Divergent, Individual, Learner initiated, Self-teach.

All other valid points will be given credit.

**Level 1 ([1]–[3])**

**Overall impression: Basic**

- Basic knowledge and understanding of the different teaching styles a coach could adopt to engage participants in sport. The candidate may provide basic examples.
- Demonstrates a basic ability to discuss the different teaching styles a coach could adopt to engage performers in sport. Candidates will provide basic explanations of the advantages and disadvantages.
- Quality of written communication is basic. The candidates make 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 different teaching styles a coach could adopt to engage performers in sport. The candidates will give some relevant examples.
- Demonstrates a good ability to discuss the different teaching styles a coach could adopt to engage performers in sport. Candidates will provide some explanations of the teaching styles a coach could adopt.
- 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 different teaching styles a coach could adapt to engage participants in sport. The candidate will provide fully developed examples and show excellent understanding of each one.
- Demonstrates an excellent ability to discuss the different teaching styles a coach could adopt to engage participants in sport. Candidates will be able to discuss 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.

(AO1, AO3)

[8]

16

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

(i) Plantar flexion

- The action of pointing the toes, increasing the angle between the tibia and tarsals.
- Sporting example: Punt kicking phase in Gaelic Football, Ballerina pirouette/Irish dancer pointing toe.
- Synovial joint: Hinge.
- Agonist/prime mover: Gastrocnemius.

(ii) Flexion of the elbow

- Decreasing the angle between the bones of the elbow joint (ulna, radius & Humerus).
- Sporting example: Bicep Curl, tennis forehand execution, prepare to throw in javelin.
- Synovial joint: Hinge.
- Agonist/prime mover: biceps brachii.

(iii) Abduction of the shoulder

- The action of the arm movement away from the midline of the body, raising your arm out from the side of your body.
- Sporting example: Star jump/jumping jack, preparing to shoot in Netball, cartwheel.
- Synovial joint: Ball and socket.
- Agonist/prime mover: Deltoid.

Award [1] mark for definition of movement pattern.

Award [1] mark for sporting example.

Award [1] mark for agonist/prime mover.

Award [1] mark for synovial joint.

(3 × [4])

(AO1, AO2)

[12]

(b) (i) Some examples of suitable points to be defined and outlined by the candidate:

Definition:

- Decreased resting heart rate/RHR below 60 bpm.

Structural adaptation:

- Cardiac muscle hypertrophy.
- Increased vascularisation.
- Increase in size of atria and ventricles (left ventricle 15%–20%).

Award [1] for the key definition and [1] for the outline of adaptation.

All other valid points will be given credit.

(2 × [1])

(AO1)

[2]

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

**Indicative content:**

Cardiovascular responses:

- Heart rate increases (bts/min) from a resting value of 40–60 bts/min.
- Heart rate can increase prior to the onset of exercise as a result of anticipatory rise caused by the release of adrenaline.

- Increase in stroke volume (volume of blood ejected in each ventricular contraction) from a resting value of 50–100 mls.
- Increase in cardiac output/Q ( $Q = HR \times SV$ ) from 5–6 L/min at rest.
- Vascular shunt mechanism occurs with the automatic opening up of blood vessels (arterioles) to active muscle tissue and the constriction of blood vessels to non-active tissues (kidneys, liver) in response to an increase in exercise.
- Vascular shunting aids performance by increasing blood flow to working muscles. Oxygen facilitates energy production and the performer can work for longer.
- Increase in blood pressure improving the flow of oxygen and nutrients to the working muscles.
- Cardiovascular responses allow oxygenated blood to be delivered to the working muscles at a quicker rate.
- Increase in venous return.

#### Respiratory responses:

- Breathing rate (frequency of breaths per minute) increases from resting value of 12–16 breaths per minute.
- Tidal volume (amount of air breathed in with each normal breath) increases from a resting value of 500 mls as the performer responds to the demand of increased oxygen needed during exercise.
- Minute ventilation ( $VE = TV \times f$ ), the total amount of air moving in and out of the lungs in one minute. It increases from resting value of approx 6 L/min at rest.
- The muscles which facilitate breathing such as the diaphragm or intercostals muscles work harder to increase expansion of the thoracic cavity during inhalation.
- Gaseous exchange in the lungs is known as external respiration. Oxygen and carbon dioxide exchange between the alveoli in the lungs and the blood capillaries that surround the alveoli. Gaseous exchange increases in the lungs during exercise.
- Gaseous exchange occurs between areas of high partial pressure and low partial pressure. The difference between these pressures creates a diffusion gradient.
- The partial pressure of oxygen is higher in the alveolar air compared to the partial pressure in the blood capillaries therefore oxygen diffuses into blood capillaries at a faster rate than at rest.
- The partial pressure of carbon dioxide is higher in the blood capillaries than in the alveoli.
- Gaseous exchange in the muscles is known as internal respiration. Oxygen and carbon dioxide exchange between the muscle and the blood. Gaseous exchange increases in the muscles during exercise.
- Oxygen is carried in the haemoglobin of the blood. There is a high partial pressure of oxygen in the blood and this diffuses across to the capillaries surrounding the muscle. Oxygen binds with myoglobin in the muscle.
- As a waste product of exercise there is a high partial pressure of carbon dioxide in the muscle. It diffuses across into the blood which has a lower partial pressure of carbon dioxide.

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

- Basic knowledge and understanding of the cardiovascular and respiratory responses experienced by an endurance athlete. The candidate may provide basic examples.
- Demonstrates a basic ability to examine the effects of exercise on an endurance athlete's cardiovascular and respiratory system. The candidate will provide basic examples but does not discuss the responses 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]–[7])****Overall impression: Good**

- Good knowledge and understanding of the cardiovascular and respiratory responses experienced by an endurance athlete.
- Demonstrates a good ability to examine the effects of exercise on an endurance athlete's cardiovascular and respiratory systems. The candidate will provide some examples and does discuss some cardiovascular and respiratory 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 an appropriate use of specialised 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 effects of the cardiovascular and respiratory responses experienced by an endurance athlete. The candidate will provide fully developed examples and shows excellent understanding of the cardiovascular and respiratory responses.
- Demonstrates an excellent ability to discuss the effects of exercise on an endurance athlete's cardiovascular and respiratory systems. 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.

(AO1, AO3)

[10]

24

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

(i) Advantages of altitude training:

- To compensate for the decrease in oxygen, the athlete's body produces erythropoietin/EPO naturally. EPO triggers the production of more red blood cells.
- There is an increased concentration of haemoglobin and myoglobin therefore the body is more efficient at carrying oxygen.
- Increased mitochondria and capillarisation increases the efficiency of the aerobic energy system.
- Enhanced oxygen transport to overcome oxygen debt.
- Increased tolerance to lactic acid/delayed OBLA.
- Altitude training will increase  $VO_2$  max.
- Altitude training will improve aerobic endurance and reduce impact of fatigue on performance.

Award [2] marks for the full description of each advantage.

All other valid points will be given credit.

(2 × [2])

(AO2)

[4]

(ii) Disadvantages of altitude training:

- Atmospheric pressure decreases as altitude increases. This has significant implications for athletes because a fall in partial pressure on arrival at high altitude leads to a shortage of oxygen (hypoxia). Every breath taken at high altitude delivers less of what working muscles require.
- Athletes may experience altitude sickness, dizziness, headaches and nausea.
- It takes time to acclimatise and breathing rate may increase on arrival at altitude causing hyperventilation.
- Detraining is possible, where the decreased availability of oxygen makes training harder, it may be difficult to train at the same intensity, which could lead to loss of fitness level.
- Altitude training is an expensive method of training for some athletes.
- Benefits may be lost quicker than anticipated when the athlete returns back to sea level.
- Athlete may experience loneliness/feeling of isolation during training which may impact motivation.

Award [2] marks for the full description of each disadvantage.

All other valid points will be given credit.

(2 × [2])

(AO2)

[4]

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

**Indicative Content:**

- Athletes may feel under pressure from coaches to produce a certain standard of performance and may resort to performance enhancing drugs to achieve this.
- Athletes put pressure on themselves to win at all costs.
- Athletes may feel financial pressure from sponsors and the media to achieve success to fulfil contracts and to gain financial reward.
- Pressure from the government/state exists to ensure dominance during competition. Russia operated a state sponsored doping programme

from 2011–2015 affecting athletes competing in London 2012 – Sochi 2014 Winter Olympics.

- An investigation by WADA stated that Russia's sports ministry directed, controlled and oversaw manipulation of urine samples provided by its athletes. In 2019 Russia was banned by WADA from the world's top sporting events for four years. This ban was reduced to two years by the Court of arbitration for sport.
  - Sports performers take illegal performance enhancing drugs in an attempt to gain advantage over other competitors or players.
  - Some drugs are against the law and others against sporting regulations but many elite athletes can be attracted because it is presumed most top performers are taking them.
  - Athletes want financial rewards and fame that comes with success and performance enhancing drugs may enable them to achieve this success.
  - Many athletes take performance enhancing drugs to increase power and strength, e.g. anabolic steroids.
  - Performance enhancing drugs will enable the athlete to train for longer and recover quicker, e.g. EPO.
  - Some may experience fear from 'not making it'. The huge increase in rewards for winning means that the temptation to take drugs has become greater for some athletes.
  - Performance enhancing drugs are easily accessible and testing is not always accurate. As advances in technology progress at a rapid speed, many new substances may not be easily detectable.
  - Not all athletes have the same access to performance enhancing drugs, it is important for the authorities to continue to fight the battle against drug cheats, this will ensure a level playing field for all performers as many athletes are successful without the use of drugs.
  - Performance enhancing drugs may prolong/extend an athlete's career.
- All other valid points will be given credit.

### **Level 1 ([1]–[4])**

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

- Basic knowledge and understanding of the reasons athletes feel under pressure to take drugs. The candidate may provide basic examples.
- Demonstrates a basic ability to assess the pressures athletes are under to take performance enhancing drugs. The candidate may provide basic explanations but does not examine 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 reasons athletes feel under pressure to take drugs. The candidate will give some relevant examples.
- Demonstrates a good ability to assess the pressures athletes are under to take performance enhancing drugs. The candidate will provide some explanations.
- 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 reasons athletes feel under pressure to take drugs. The candidate will provide fully developed examples and shows excellent understanding.
- Demonstrates an excellent ability to assess the pressures athletes are under to take performance enhancing drugs. 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.

(AO1, AO3)

[12]

#### (c) The quality of written communication is assessed in this question.

#### Indicative Content:

##### Positive:

- Use of technology gives performers a competitive edge helping athletes to refine techniques, reduce injury, improve fitness and perform better.

##### Technology for data collection:

- Global Positioning Satellite (GPS) technology has enabled performers to be able to track their movements during training and competition. Data can be collected such as performer speed, distance covered and player acceleration. This data can be used to assess player fitness levels and identify areas for improvement.
- Video analysis can be utilised to provide a biomechanical analysis of a technical skill. Video footage combined with software can provide data on technique, movement efficiency and measurements of velocity.
- Timing technology such as speed gates and reaction timers off the starting blocks have enhanced the accuracy of timing.
- Heart rate monitors and FITBIT technology has enabled athletes to monitor training zones and lifestyle habits.

##### Technology for simulated conditions:

- The use of HAWKEYE has enabled players to challenge decisions in tennis and cricket.
- Simulated computer programmes can allow athletes to practice their sport virtually, e.g. golf and motor racing.
- Athletes can use technology to simulate climate to ensure that they are prepared for competition conditions, e.g. heat chamber or hypoxic tents.

##### Technology and Equipment:

- Equipment design has developed from a greater understanding of the



- biomechanics of sporting movement and advances in material science.
- New materials have contributed to advances in sport equipment. Lighter materials used in equipment have improved performance, e.g. carbon fibre bikes, graphite tennis racquets and golf clubs.
  - Aerodynamic design of equipment has aided performance, e.g. cycle helmets, Formula 1 cars, skis all attributing to faster times.
  - Technological improvements in equipment have made some sports safer. More robust landing mats used in pole vaulting, high jump and gymnastics. Headgear in boxing was adopted to provide protection from head injuries. Helmets in cycling are now lighter but designed to a higher safety specification.
  - Advances in technology have enabled Paralympic athletes to wear carbon fibre prosthetics specifically designed for their event.

#### Technology and Sports Clothing:

- Improvement in design and manufacturing of clothing for sport. Availability and variety of sports clothing offering a wide range to suit numerous sports.
- Clothing can now be designed to reduce friction (air, water). Tech swimsuits/running suits use a range of technologies to help cut down on drag and improve oxygen efficiency.
- Compression clothing encourages blood circulation and can also aid recovery after injury.
- Research into fabrics has created sports clothing that can be designed to be breathable, waterproof and can either prevent heat loss or prevent overheating.
- Footwear is constantly being developed to suit specific sports that are lighter and cushioned therefore reducing impact and adding support.

#### Negative:

- Use of sport science and the need to win could lead to the ethics of sport being ignored, e.g. use of performance enhancing drugs/cheating.
- Technology is expensive. Only elite level athletes may be able to afford technology creating a gulf between teams/participants within a sport.
- Delay in play can result if technology is being used to assist decision making, e.g. VAR.
- Skills may deteriorate, e.g. more advanced golf clubs take away the need for the golfer to strike the ball as accurately.
- Rules/regulation changes as a result of technological advances, e.g. LZR swim suits designs had to be banned because of the degree of assistance they were providing elite swimmers.
- Technology may prolong the duration of a game, e.g. referees/umpires which can take time to view video/computer aids cause breaks in game play.
- Technology can fail, e.g. Hawkeye had to be abandoned in GAA 2022 Championship due to errors.
- Technology cannot be a substitute for talent, e.g. the winner is not always the best athlete but the one with the better equipment.

All other valid points will be given credit.

### Level 1 ([1]–[5])

#### Overall impression: Basic

- Basic knowledge and understanding of the positive and negative impact of technology on the sports performer. The candidate may simply list basic examples.
- Demonstrates a basic ability to discuss the positive and negative impact of technology on the sports performer. Candidates give limited explanations of the impact.
- 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 positive and negative impact of technology on the sports performer. The candidate may include some relevant examples.
- Demonstrates a good ability to discuss the positive and negative impact of technology on the sports performer. The candidate will be able to discuss the impact and elaborate with appropriate explanation.
- 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 positive and negative impact of technology on the sports performer. The candidate will include fully developed examples and show excellent understanding of each one.
- Demonstrates an excellent ability to discuss the positive and negative impact of technology on the sports performer. The candidate will be able to discuss the impact 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.

(AO1, AO3)

[16]

**Total**

**AVAILABLE  
MARKS**

36

**100**