



NATIONAL SENIOR CERTIFICATE EXAMINATION  
NOVEMBER 2016

## **SPORT AND EXERCISE SCIENCE**

### **MARKING GUIDELINES**

Time: 3 hours

300 marks

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**These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.**

**The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.**

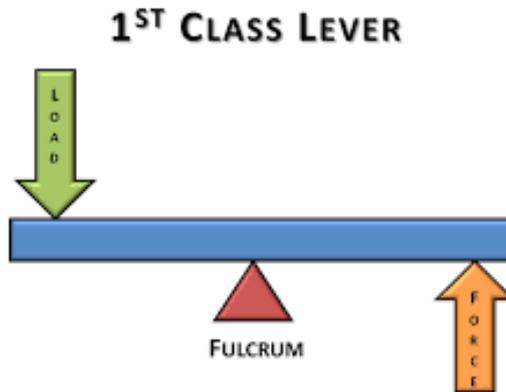
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**SECTION A**

**QUESTION 1**

1.1 Allocate 1 mark for either First class lever OR First order. (1)

1.2



Allocate 1 mark each for the 3 labels – names must be written in full

Labels – resistance/load; fulcrum; effort/force

Allocate 1 mark each for the labels being in the correct places

Learners do not need to provide the direction of load and force as indicated in the diagram above. (6)

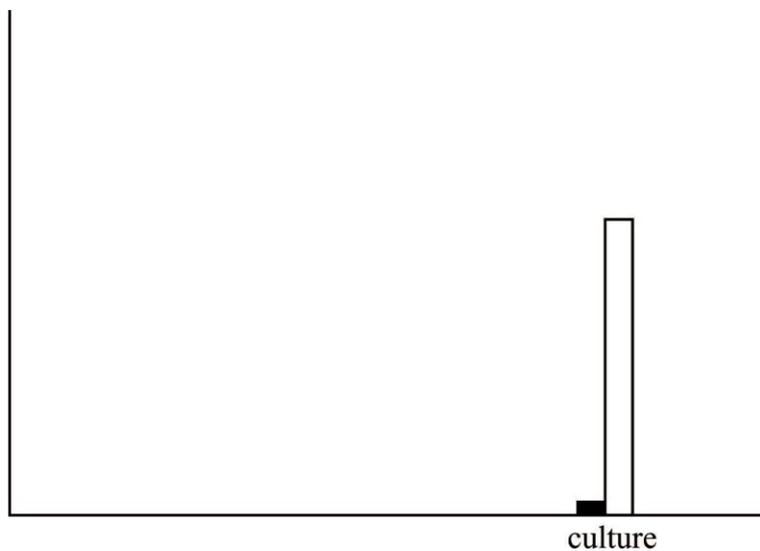
1.3

Action	Correct letter
1 <sup>st</sup> movement	C
2 <sup>nd</sup> movement	A
3 <sup>rd</sup> movement	F
4 <sup>th</sup> movement	B
5 <sup>th</sup> movement	G or D
6 <sup>th</sup> movement	D or G
7 <sup>th</sup> movement	H or E
Last movement	E or H

(16)  
[23]

**QUESTION 2**

- 2.1 Friends (1)
- 2.2 Family (1)
- 2.3 Allocate 2 marks for 1 explanation, e.g. children are more likely to want to play sport if it is sunny rather than raining. (2)
- 2.4 Allocate 2 marks for 1 explanation  
Safety is an issue and more so for females. If the facilities are nearby, then females will be more inclined to get to them. (2)
- 2.5 2.5.1 Pupils need to actually draw in a column onto the graph on the question paper. Pupils' column to look roughly like this:



Allocate 1 mark for indicating that the female column is considerably higher than the male column.

Allocate 1 mark for the male column being very small or even non-existent AS DEPICTED ON GRAPH ABOVE. Accepted a male column that was approximate height of that depicted in the 'closer facilities'. (2)

- 2.5.2 Allocate 2 marks for explaining the impact of culture on participation for females.

For example:

Some cultures, e.g. Muslims will not allow females to play sport. The extreme Muslims allow no sport whatsoever whereas other Muslims allow certain sports as long as the female body is covered.

**OR**

They could also mention African upbringing where females have to tend the family, gather water, cook the food and therefore have little time for sport.

Accept feasible responses.

Allocate 2 marks for male participation.

Their column will be small so they could say that males are generally not restricted by their culture apart from possibly tending the herds in rural areas.

(4)

**QUESTION 3**

- 3.1 D
- 3.2 E
- 3.3 B
- 3.4 I
- 3.5 H
- 3.6 C
- 3.7 F
- 3.8 G
- 3.9 A

**[18]****QUESTION 4**

Allocate 2 marks per answer.

- 4.1 Positive stress is called eustress  
Accept 'arousal' or 'motivation' for 1 mark only (2)
  - 4.2 Negative stress is called distress  
Accept 'anxiety' for 1 mark only (2)
  - 4.3 Golgi tendon (2)
  - 4.4 Sagittal plane (2)
  - 4.5 Frontal plane OR Coronal plane (2)
  - 4.6 Transverse plane (2)
  - 4.7 Hypothermia (2)
- [14]**

**QUESTION 5**

Allocate 2 marks per answer. 1 mark for correct underlining and 1 mark for the correction.

- 5.1 Underline the words 'lactic acid'.  
Accept any one of these:  
ATP/PC system; ATP – CP system; Alactic system; ATP – PCr system (2)
  - 5.2 Underline the word 'addition'.  
Replace with 'accumulation' (2)
  - 5.3 Underline the number '18'  
Replace with 38 (2)
- [6]**

**QUESTION 6****Predominant Energy Systems**

<b>Activity</b>	<b>Predominant energy system used</b>	<b>Approximate duration</b>
6.1 Running a marathon	Aerobic/Oxidative (1)	3+ minutes (1) Accept any time that is longer than 3 minutes
6.2 A gymnastic vault	ATP/PC (1)	3–10 seconds or less than 10 seconds Accept any time that falls within that mentioned above (1)
6.3 Swimming a 100m individual medley	Lactic acid system or Glycolytic Do not accept 'anaerobic'	15 seconds – 3 minutes Accept any time that falls within that mentioned above (1)

**[6]****QUESTION 7**

Allocate 2 marks per projectile.

The shuttlecock (A) is least symmetric so air resistance is great, which results in a shorter distance travelled.

The shot put (B) is heavy so is thrown at less velocity so won't travel far. It follows a parabolic shape. Angle of release is higher than A

The more symmetric the object, the less effect that air resistance would have on it so a tennis ball (C) is the most symmetric and light so it flies further.

OR A spinning tennis ball will have Magnus effect causing it to soar at the start of the flight.

**[6]**

<b>85 marks</b>
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**SECTION B****QUESTION 8**

- 8.1 8.1.1 By shining one side of the ball, they are creating a smooth side and then the other side of the ball gets "rougher" OR This will affect the flight of the ball in the air and maybe the ball will hit the stumps OR to create reverse swing. To decrease drag (2)
- 8.1.2 Any 2 of the following:  
Air turbulence makes the ball swerve/swing if one side of the ball is smooth. The ball moves sideways. The ball swings towards the rough side of the ball.  
Smooth side – air flows faster.  
Smooth side causes laminar effect (2)
- 8.1.3 The batsman has to deal with unexpected movement of the ball, which makes it harder to hit OR could bowl the batsman out. (2)
- 8.1.4 A bouncer can be used to:
- intimidate a batsman
  - to get the batsman to mishit it and get caught out
  - confuse batsman
  - less predictable (2)
- 8.2 8.2.1 Award 1 mark for stating each (of 2) visual skill and award 1 mark for describing the skill.  
Eye tracking – players need to be able to follow the ball without moving the head a lot. It keeps them better balanced and able to react to a situation more quickly.  
Dynamic visual acuity – a cricketer needs to clearly see the ball while it is moving fast  
Visual concentration – our eyes normally react to movement happening in our field of vision – this could include spectators at a cricket match. Visual concentration is the ability to block out distractions and focus on the ball.  
Eye-hand-body coordination – this is how the player's hands, feet and body respond to what they see.  
Visual reaction time – this is the speed at which the batsman's brain interprets and reacts.  
Depth perception. (4)
- 8.2.2 Award 2 marks for each explanation on why basketball players need that visual skill = 4  
Award 1 mark for each exercise (can name the exercise or describe it) = 2 (6)
- 8.3 Award 2 marks for the description of the exercise.  
Award 2 marks for appropriate reason for the choice of the exercise. It MUST relate to the sport the learner has selected. (4)

- 8.4 Accept any 5 facts from the following:  
 The myosin and actin filaments run next to each other but at rest aren't attached.  
 The sarcomere is the area between the 2 Z lines. Z line moves closer together.  
 Sarcomere shortens  
 The I band contains only the thin actin filaments.  
 The H zone contains the myosin filaments.  
 The A band contains both actin & myosin filaments.  
 More advanced might say:  
 Ca<sup>++</sup> is released which releases Ach (acetylcholine)  
 Ach bonds to sarcolemma and opens Na<sup>+</sup> channels.  
 Calcium binds to Troponin and moves Tropomyosin out of the way. This exposes the actin.  
 When calcium is present the blocked site of actin clears.  
 Thin actin filaments slide over thick myosin filaments.  
 Myosin head attached to actin.  
 Myosin head pivots pulling the actin filament – power stroke.  
 The cross bridges detaches when a new ATP binds with the myosin.  
 Cocking of myosin head occurs when ATP – ADP +P.  
 The sarcomere shortens. (5)
- 8.5 8.5.1 Allocate 1 mark each for appropriate example.  
 A few possible responses:  
 Improved equipment has improved safety.  
 Third umpire has allowed batsmen who were not "out" to ask for a referral.  
 Improved stadiums with better facilities, e.g. lighting.  
 The game has evolved allowing for more exciting forms of the game and more revenue for the players.  
 Accept feasible answers. (2)
- 8.5.2 Allocate 1 mark each for appropriate example.  
 A few possible responses:  
 Big screens at venues to watch replays.  
 Electronic scoreboard for instant scores.  
 Improved seating, catering at stadiums.  
 Lighting that allows games to continue for longer.  
 Accept feasible answers. (2)
- 8.5.3 Allocate 2 marks for an appropriate example.  
 A few possible responses:  
 More matches are taking place, which leads to overuse injury and exhaustion.  
 Have to wait for 3rd umpire decision.  
 Constantly need to upgrade equipment. Expensive.  
 Protective gear can be restricting. (2)
- 8.5.4 Allocate 2 marks for an appropriate example.  
 A few possible responses:  
 Matches tend to be much noisier now with fireworks, dancing girls and music.  
 The delay caused by the third umpire slows the game down. (2)

8.5.5 Allocate 2 marks for an answer.

Possible responses:

Equipment advancements mean that equipment has become more expensive.  
This means that poorer athletes and poor countries can't afford it and start the competition on "the back foot".

True ability not compared

(2)

[37]

## QUESTION 9

Accept feasible answers.

For example:

Hazard:

Spectators walking in the road or crossing the road

Solution:

- Have marshals or traffic police along the route
- OR

- Put fencing along the route

Hazard:

Traffic

Solution:

- Apply to municipality (or similar) for permission to close the route.

[20]

## QUESTION 10

10.1 Allocate 1 mark per factor.

For example:

Playing at altitude.

It's an Olympic qualifier so players will feel pressure.

Unknown environment/venue.

3 days of continuous activity.

Members of opposite sex watching – need to impress.

Large amounts of visual and audio stimuli

Accept feasible responses.

(3)

10.2 Allocate 2 marks per strategy listed from the possibilities below.

Ensure that players are well rested beforehand.

Diet is important.

Carbo-loading.

Ensure that they hydrate before, during and after each match.

Warm up and cool down properly.

Could use ice baths or ice vests after each match.

Altitude training.

Prepare the players for the anxiety and stress. Use a sports psychologist.

Ensure fitness levels are high through correct training.

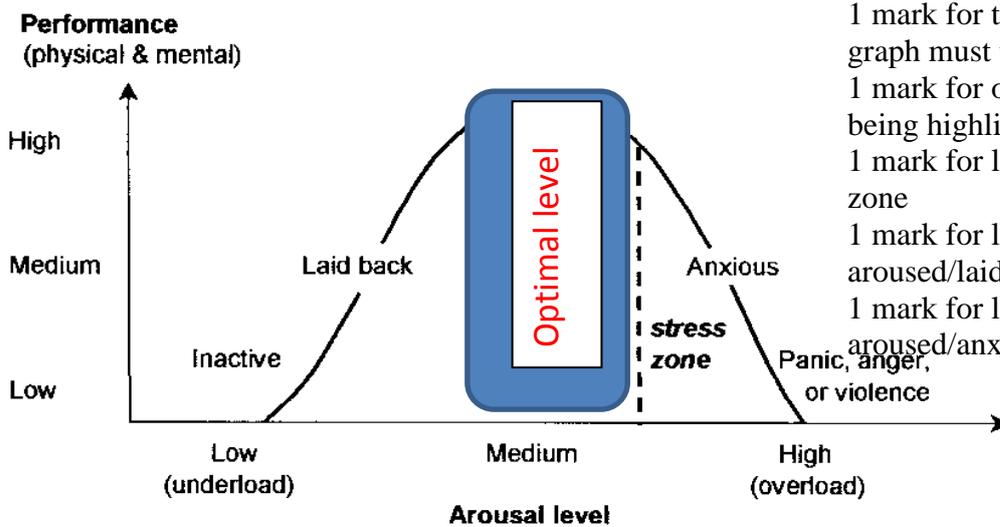
Have team-building activities.

Fartlek training.

Goal setting.

(8)

10.3 Allocate 5 marks. Response must refer to:



- 1 mark for the curve but graph must touch the x axis
- 1 mark for optimal zone being highlighted/indicated
- 1 mark for label of optimal zone
- 1 mark for labelling under-aroused/laid-back
- 1 mark for labelling over-aroused/anxious

(5)

10.4 Allocate 2 marks per adaptation.

Possible answers:

- Increased alveoli, which means more surface area for diffusion.
- Increased elasticity of the lungs, alveoli and pleura, which improves lung efficiency.
- Increased longevity of the respiratory system – longer life with less disease.
- Increased efficiency of respiratory muscles, which reduces fatigue.
- Increase in strength, power & endurance of respiratory muscles, which leads to improved performance and increased lung efficiency.
- Tidal Volume can increase so amount breathed in and out with each breath increases.
- Respiratory frequency decreases at rest.
- Maximal VE increases from 120 ℓ/min in an untrained person to 150 ℓ/min after training.
- Increase in pulmonary diffusion during maximal activity – athlete can perform longer.
- Improved VO<sub>2</sub> so athlete can utilise oxygen more effectively.

The overall effect is that there are improvements in VO<sub>2</sub> max and lactate threshold increase = better performance.

(8)

10.5 Accept any 3 of the following. Allocate 2 marks per response.

Trained athlete will have:

- Decreased RHR
- Hypertrophy
- Increased stroke volume
- More capillaries develop around the heart
- Bradycardia
- Heart is under less stress
- Increased cardiac output (Q)

Learners can refer to the ability of the trained athlete OR the inability of the untrained athlete

(6)

10.6 Allocate 1 mark per suggestion:

Possible responses could be:

Have team building exercises/training camp.

Motivate players through positive reinforcement.

Ensure communication channels are open between players and coach.

Allow for relaxation time.

(3)

10.7 Allocate 1 mark per factor:

Possible suggestions could include:

- Avoid training when tired.
- Increases in training should be matched with increases in resting.
- Stop training immediately if you feel pain.
- Introduce new activities very gradually.
- Allow lots of time for warming up and cooling down.
- Monitor daily for signs of fatigue and check pulse rate.
- Many injuries are caused by weak muscles, which simply are not ready to handle the specific demands of the sport.
- Screen muscle imbalances.
- Muscle stiffness is thought to be related to muscle injury risk, so it is important to reduce muscle stiffness as part of a warm-up.
- Different exercises targeting different muscles. Don't focus on 1 area for prolonged periods
- Quality of equipment

(5)

10.8 Allocate 1 mark for stating that a hockey stick is an effective lever.

Allocate 2 marks for evidence of effectiveness.

Any 2 of the following:

Longer levers create greater speed and force at the end of the lever arm, which is an advantage when hitting. There is greater acceleration & range of movement. Longer levers (within reason) generate the greatest velocity at the end.

Learners may also state that if a hockey stick is too long (as in a child using an adult stick) then it is actually ineffective.

(3)

10.9 Allocate 2 marks for how to adjust stick.

Allocate 2 marks for the reasoning.

E.g., a long lever is harder to control, so the stick could be **shortened**. This could ideally be achieved by **cutting** the stick shorter or by **adjusting the child's grip** on the stick – the child will hold the stick lower down.

Can make reference to giving the child a lighter stick for more control

(4)

[45]

**QUESTION 11**

11.1 A rugby prop needs to be fairly aggressive and physical and therefore needs high levels of arousal.

Accept feasible examples of psyching up:

- listen to loud music
- get together with other players and "push and shove" and scream
- head butting

(2)

11.2 An archer needs to be calm.

- Listen to calm music
- Visualisation
- Close eyes

Accept feasible answers.

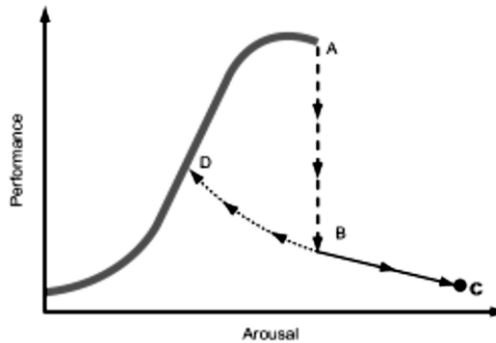
(2)

11.3 Allocate marks as indicated:

If performing well & then get over-aroused or distracted, their performance will drop.

Once they get their mind right, their performance will improve again but will build up gradually and won't necessarily return to where it was being distracted.

Recovery time can vary depending on the level of over-arousal and the performer/duration of the event.



(5)  
[9]

**QUESTION 12**

Allocate 4 marks for the ability to differentiate the different types of stability needed in different sports.

For example:

In a sport like rugby or judo where the purpose is to push your opponent over, then stability is vitally important and in both these cases the athlete will lower their C of G and broaden the base of support.

In gymnastics in certain movements (e.g. a handstand) the gymnast will want to be stable and will keep the line of gravity close to the centre of the base of support. When landing after performing a somersault, they will bend their knees (to lower the Cof G) and will land with their feet apart to widen the base of support to make them stable.

Allocate 4 marks for explaining the concept of stability and why stability is important OR for explaining what stability is.

For example:

Stability is defined as "the ability to hold or maintain a position in space."

There are 4 basic principles underlying stability:

The closer the line of gravity is to the centre of the base of support, the greater the probability of maintaining balance.

The broader the base of support, the greater the probability of maintaining balance.

The probability of maintaining balance is increased when the centre of gravity is lowered in relation to the base of support.

The further one body part move away from the line of gravity, the probability of maintaining balance decreases unless another body part moves to compensate for it.

**[8]**

**QUESTION 13**

13.1 Allocate 2 marks per answer.

13.1.1 Shot put – ATP/PC; phosphagen system; anaerobic alactic

13.1.2 aerobic system; oxidative

13.1.3 lactic acid system; glycogen (6)

13.2 Allocate 1 mark for saying that carbohydrates are needed.

Allocate 1 mark for mentioning carbo-loading OR providing an example of a carbohydrate. (2)

13.3 It is the level of exercise intensity above which lactate begins to accumulate in the blood.

Allocate 1 mark for the example and 2 marks for definition/explanation (3)

13.4 Allocate 1 mark for any of the following answers:

The athlete would slow down.

The athlete will stop.

Performance drops/declines.

Fatigue

Negative impact (1)

13.5 Allocate 2 marks for any ONE of the responses listed below:

- Perform workouts that elevate MHR to 93%–100%.
- short, high speed reps.
- ×3 minute intervals done at MHR with 3 minute rests.

Accept feasible responses. (2)

13.6 Allocate two marks for 1 answer.

Either Fast twitch OR type 2. (2)

13.7

	<b>Weightlifter</b>	<b>Decathlete</b>
13.7.1	X	
13.7.2	X	
13.7.3		X
13.7.4		X
13.7.5		X
13.7.6	X	
13.7.7	X	
13.7.8		X

(8)

13.8 Accept feasible responses. Allocate one mark per response. For example:

- The weightlifter needs to bulk up therefore needs to eat protein often. Also muscle tears will result from lifting.
- Decathlete needs sustained energy release – low GI.
- Decathlete needs to replace fluids lost while competing.

(2)

13.9 Three marks each for explaining and comparing the technique of each style.

For example:

The scissor technique is far from optimal – to clear the bar the athlete and their centre of gravity needs to pass OVER the bar. The centre of gravity probably goes close to 30 centimetres higher than the height of the bar. This is a very inefficient way to clear a high-jump bar.

Fosbury enables a high jumper to send their centre of gravity well below the bar even though their body curls over and around it. The more flexible you are, the more you can curve your body around the bar and the lower your centre of gravity will be.

The Fosbury Flop – centre of gravity is below the bar because the body passes over the crossbar in stages.

Scissor – entire body crosses the crossbar at the same time so centre of gravity is higher.

(6)

- 13.10 Learner to show an understanding of force summation.  
 Allocate 1 mark for using the word "force summation".  
 Allocate 3 marks for explaining the concept of force summation - different parts of the body act together to maximise the force. All body parts act simultaneously. The strongest and lowest body parts around the centre of gravity move first, followed by the weaker, lighter, and faster extremities.  
 Allocate 5 marks for stating exact sequence. This order must be exact.  
 Legs → hips → shoulder → elbow → wrist.  
 Release at optimal height. (9)
- 13.11 Oxygen Deficit  
 When we start exercising not enough O<sub>2</sub> is distributed to our tissues for all the energy production to be met aerobically. It takes time for the circulatory system to respond to the increase in demand for O<sub>2</sub> & the rate of aerobic respiration in the mitochondria also takes time to adjust.  
 Oxygen Debt.  
 This is the amount of oxygen needed by the muscles during recovery from exercise.  
 When exhausted, from sport, we gasp for breath (EPOC) to replace oxygen that was used up (oxygen debt). (6)

[47]

## QUESTION 14

- 14.1 Allocate 3 marks per law 1 mark for explanation or naming of the law. 2 marks for application to throw or example  
 For example:  
 Newton's first law of motion (Law of Inertia) states that a body continues in its state of rest or motion in a straight line, unless compelled to change that state by external forces exerted upon it.  
 E.g., when throwing a ball, the ball will continue in one direction until a force such as gravity/weight acts upon it, or until it is hit or deflected OR It will remain still until thrown or picked up.
- Newton's second law of motion (Law of Acceleration) states that the rate of momentum of a body (or the acceleration for a body of constant mass) is proportional to the force causing it and the change that takes place in the direction in which the force acts.  
 E.g., the ball will move at a speed in relation to how hard it is thrown/how much force is placed on it. OR The ball will move in the direction that it is thrown OR the more force that is applied, the further and faster the ball will go.
- Newton's third law of motion is that to every action there is an equal and opposite reaction.  
 E.g., the ball exerts force on the hand and vice versa – action force & reaction force. (9)

14.2 Allocate 1 mark for explaining linear motion in swimming.  
 Linear motion is movement in a straight line.  
 Allocate 1 mark for the example.  
 Diving in OR swimming across the pool.  
 Allocate 1 mark for explaining rotational motion in swimming.  
 Rotational movement caused when a body part or entire body makes a circular motion.  
 Allocate 1 mark for the example.  
 Tumble turn OR arm moving in a circular motion. (4)

14.3 Allocate 1 mark for explaining the effect of momentum.  
 An object with large momentum will have greater force.  
 Allocate 1 mark for explaining the effect of time of contact.  
 Longer contact time means the force will be smaller. (2)

14.4 When the foot strikes the ball, the foot moves around and to the side of the ball.  
 This causes the ball to spin in the opposite direction to the oncoming air. High pressure is created on the side of the ball. On the other side, the ball is turning in the same direction as the air flow and a low pressure results. An imbalance occurs and the ball moves sideways towards the low pressure area. This causes the ball to swerve. (6)

14.5 Allocate 2 marks per response. Possible responses:

<b>Sport</b>	<b>Method of increasing drag while training</b>
Swimming	Wear a drag, loose-fitting costume Wear hand paddles Accept feasible answers. (2)
Sprint canoeing	Loose-fitting clothing Put weight in the boat Place tennis balls under canoe (2)

14.6 Allocate 2 marks per response. Possible responses:

<b>Sport</b>	<b>Method of decreasing drag when racing</b>
Sprint cycling	Wear tight-fitting clothes Assume crouched tucked position Aerodynamic helmet, bike (2)
Sprint running	Tight-fitting clothing Correct technique with body aligned and streamlined (2)

[29]

**QUESTION 15**

**ESSAY RUBRIC**

	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>	<b>4 marks</b>	<b>Possible mark (20)</b>
Decision	Vague Change decision within essay	Clear decision made			2
Use of knowledge from sources	Reference made to one source only	Reference made to both sources	Several and appropriate references made to both sources	Source detail very close to full potential used to support argument	4
Content relevance	Repetition mostly avoided Some minor digression Supporting argument relevant	Repetition mostly avoided Some minor digression Supporting argument relevant Quality of source extracts accurate			2
Quality of argument supporting decision	Writing consists of facts with little linkage or reasoning	Reasoning correct but hard to follow Some linkage evident If no clear decision is reached, learner may NOT score higher than 2 marks in this category	Supports the position Reasoning is clear Minor errors in flow Linkage is sometimes missed	Strongly supports a clear position Reasoning is very clear and succinct Flow is logical Compelling with regular linkage Well integrated argument	4
Use of own knowledge × 2	Some facts given beyond the sources to support argument	Some facts given beyond the sources to support argument AND integrated into the argument	Many facts given beyond the sources to support argument	Many facts given beyond the sources to support argument AND integrated into the argument	8

[20]

**215 marks**

**Total: 300 marks**