



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2018

SPORT AND EXERCISE SCIENCE

MARKING GUIDELINES

Time: 3 hours

300 marks

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.

SECTION A**QUESTION 1**

| | |
|------|-------------------------------|
| 1.1 | F |
| 1.2 | J |
| 1.3 | I |
| 1.4 | K |
| 1.5 | H |
| 1.6 | A |
| 1.7 | B give 3 marks for any answer |
| 1.8 | C |
| 1.9 | E |
| 1.10 | G |
| 1.11 | L or B |
| 1.12 | D |

(12 × 3)
[36]

QUESTION 2

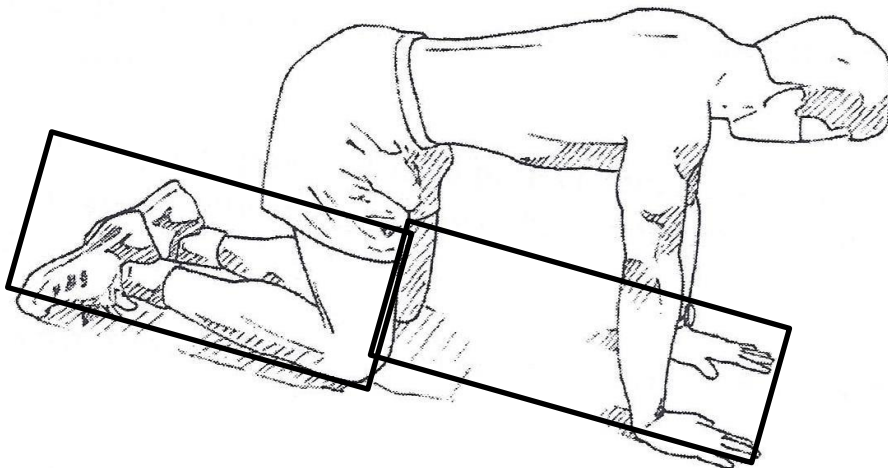
| | |
|-----------------|------------|
| Picture A – 3rd | (2) |
| Picture B – 1st | (2) |
| Picture C – 1st | (2) |
| Picture D – 2nd | (2) |
| | [8] |

QUESTION 3

Outline and shade in the base of support in each of the following pictures.

PICTURE A

Allocate one mark for shading in the area from ballet shoe to his foot.
 Allocate one mark for shading in the area from his front foot to his knee.
 Allocate one mark for shading in the area from his knee to foot.

(3)

Allocate one mark for shading between both hands, including the hands up to the knees.
 Allocate one mark for shading from the knees to the toes.

(2)
[5]

QUESTION 4

- 4.1 B (2)
- 4.2 C (2)
- 4.3 A (2)
- [6]**

QUESTION 5

- 5.1 (a) C (2)
- (b) A (2)
- (c) B (2)
- 5.2 Aerobic energy system (2)
- 5.3 Allocate one mark for any one of the following:
- CO₂; H₂O; sweat; heat (1)
- 5.4 Maximum OR high intensity OR 100% (1)
- 5.5 Allocate one mark for any two of the following:
- glycogen; fats; proteins; free fatty acids/FFA; triglycerides (2)
- 5.6 Performance drops or declines; fatigue; provides energy (1)
- 5.7 None (1)
- 5.8 Allocate two marks per answer:

| | ENERGY SYSTEMS | | |
|----------------------|-----------------------|---------------------------|-----------------------|
| | ATP/PC system | Lactic acid system | Aerobic system |
| 400 m sprint | | ✓ | |
| Arm wrestling | | ✓ | |
| Basketball jump shot | ✓ | | |
| Race walking | | | ✓ |
| Volleyball spike | ✓ | | |

(10)
[24]

| |
|-----------------|
| 79 marks |
|-----------------|

SECTION B**QUESTION 6**

6.1 Allocate two marks per factor:

| Economic | Cultural/Societal | Environmental |
|---|---|--|
| Factor 1: Poor, so eat cheap, unhealthy food (Accept any reasonable response.) Healthy food is expensive Stress eating due to financial burden = 1 (2) | Factor 1: Cultural traditions (Accept any reasonable response.) Cultural foods high in carbs & fats Being overweight is seen as a positive (2) | Factor 1: Air pollution (Accept any reasonable response.) Lack of suppliers of healthy foods (2) |
| Factor 2: Not enough money to pay for sport (Accept any reasonable response.) Lack of finances for proper healthcare = 1 (2) | Factor 2: Religious reasons (Accept any reasonable response.) (2) | Factor 2: Gangs or violence (Accept any reasonable response.) (2) |

- 6.2 (a) Economic:
 Poor, so eat cheap, unhealthy food that tends to make a person gain weight.
 No time – have to take on two jobs to bring more money in so there is no time to exercise.
 Not enough money to pay for sport so cannot join a club or buy equipment.
 (Accept any reasonable response.) (2)
- (b) Cultural/Societal:
 Rural traditions – black girls often have to use free time to look after the elderly or children – no time to exercise.
 Religious reasons – Muslim girls cannot expose their bodies so often not allowed to play sport where you need to wear sports attire.
 (Accept any reasonable response.) (2)
- (c) Environmental:
 Air pollution might prevent someone from exercising/jogging outside.
 Living in a city centre – no parks to run in, no sports clubs.
 Schools not offering sport so children not getting physically active.
 Gangs or violence prevents children going outside to play.
 (Accept any reasonable response.) (2)

- 6.3 Allocate one mark per correct response.
 Possible answers:
 Educate parents on the importance of healthy eating.
 Stop school tuck shops from selling junk food.
 Increase sugar tax even more.
 Make sport compulsory at all schools.

(Accept any reasonable response.)

(4)

- 6.4 Allocate one mark per appropriate exercise.
The answer **MUST** be an exercise performed while seated.
The pupils can either list; name or describe the exercises.
Suggested answers:
Calf raisers
Bicep curls
Tricep curls
Lift thigh off the chair while seated
Side bends
Shoulder rolls
Neck roll
(Accept any reasonable response.)

(4)
[26]

QUESTION 7

- 7.1 Picture A – Allocate two marks for what causes the difference and allocate two marks for the reason.

What – Bread would give a ✓ sharper and more rapid rise in blood glucose.
There is a ✓ rapid drop in energy.
The carbs in the bread would provide enough ✓ fuel to the body for about ✓ one hour.

Why – White bread is a ✓ high-GI food (it has a GI value of 70–80).
Gets ✓ absorbed more easily.

Picture B – Allocate two marks for what causes the difference and allocate two marks for the reason.

What – Lentils – there is no spike in blood glucose but rather a more ✓ gradual rise.
This ✓ plateaus off.
Thereafter the ✓ drop is gradual.

Why – Lentils are ✓ a low-GI food.
Lentils would give a smaller, steady stream of ✓ fuel for approximately ✓ two hours.

(The body would be able to secrete less insulin to deal with the carbs from the lentils than it would to deal with the carbs that are dumped in the bloodstream by the bread. Physiologically speaking lower GI carbs (slow-release carbs) are less taxing on the body because they release their glucose into the bloodstream at a slower rate.)

(8)

- 7.2 Athletes, depending on their sport, ✓ can select food types that will ✓ benefit them most.

OR

If they are involved in a sport that requires a ✓ quick burst of energy and the event is over quickly then they would ✓ benefit from a high GI food.

OR

If they are involved in a sport that needs energy for a ✓ long period, then they will eat a ✓ low-GI food.

(2)

Low GI before an event

- 7.3 The Glycaemic Index is a ✓ numerical measure/scale of the ✓ rate (how fast and to what extent) at which a ✓ carbohydrate-rich food affects ✓ blood glucose levels after it has been eaten.

OR

Glycaemic Index is the ✓ ranking of ✓ carbohydrates on a ✓ scale of 0–100 according to the extent they ✓ raise blood sugar levels after consumption of a food that contains carbohydrates.

(4)

[14]

QUESTION 8

8.1

| | Zone A | Zone B | Zone C |
|--------------------------|---|--|--|
| Name two mental states | Allocate one mark for any two of the following mental states: apathy lack of focus low arousal bored disinterested unmotivated (Accept any reasonable response.) (2) | Allocate one mark for any two of the following mental states: confident at ease in the zone / psyched up alert focused (2) | Allocate one mark for any two of the following mental states: anxious scared stressed over-excited panic-stricken over-aroused anger unfocused (2) |
| Name two physical states | Allocate one mark for any two of the following physical states: poor performance lethargic / sluggish laid-back inattentive (Accept any reasonable response.) Low heart rate inaccurate (2) | Allocate one mark for any two of the following physical states: perfect performance optimal performance well co-ordinated high energy warm muscles body temp up (2) | Allocate one mark for any two of the following physical states: impaired performance poor performance bad judgement violence aggression high heart rate fidget/hyperactive (2) |

- 8.2 Accept any eight of the following
 Personality type ✓ – extroverts need ✓ higher levels. Introverts ✓ lower.

Type of task ✓ – ✓ complex tasks need higher arousal. Fine skills need ✓ lower arousal.

Gross ✓ tasks need higher levels.

Simple ✓ tasks need lower levels.

Athlete ✓ experience/skill level – ✓ experienced athletes need higher.

✓ Beginner needs lower

Different sports need different arousal levels (8)

8.3 Allocate two marks to any two of the following techniques:

Biofeedback

Progressive muscle relaxation

Breathing control

Listen to music

Imagery

Goalsetting

Visualisation

Train constantly on a specific task until athlete no longer feels anxious

(4)

8.4 Allocate two marks to any one strategy.

Make them listen to loud music

Psych them up verbally / pep talk

Get aggressive with them

(Accept any reasonable response.)

(2)

8.5 Allocate two marks to any one strategy.

Calm them down

Listen to calm, soothing music

Get them to focus

(Accept any reasonable response.)

(2)

Remove player from field so can calm down

8.6 C

(1)

[29]

QUESTION 9

- 9.1 At the Olympics he only races ✓ once a day and that race lasts 10 seconds whereas when training he trains for ✓ several hours at a time. (2)
- 9.2 An athlete will ✓ increase their intake of ✓ carbohydrates several days ✓ before a major competition.
- OR
- The aim of this is to ✓ increase ✓ glycogen stores in the muscle fibres ready for a ✓ long-duration activity like a marathon or triathlon. (3)
Eat LOTS of carbs
Large amounts of energy
- 9.3 Athletes cannot exercise at a high intensity without glycogen. Carbo-loading can provide enough ✓ energy for about ✓ 2 hours / long of low intensity exercise like an endurance event. This will help the athlete ✓ perform better and for longer before they start to ✓ feel tired / fatigue (4)
Maintain energy
- 9.4 Pasta, potato, bread, pancakes, waffles, bagels, granola bars, oatmeal, cereals, rice, higher-sugar fruits like bananas and raisins, flavoured yoghurts. (2)
(Accept any reasonable response.)
- 9.5 Protein allows ✓ muscles to recover, ✓ repair and develop / get stronger after sprint and resistance drills that cause minute ✓ damage to the muscle fibres. Provides energy (3)
- 9.6 Fast twitch OR type 2. (2)
- 9.7 (a) Allocate one mark per advantage: (1)
tall or 1,95 m height (1)
long legs (1)
powerful arms (1)
- (b) Allocate two marks: (2)
Tall/long legs – long legs are long levers OR he takes fewer strides compared to rivals, therefore using less energy.
Powerful arms – to drive his body forward OR to keep him balanced while using strong leg movement.
- 9.8 Allocate one mark per factor. (4)
Accept any 4 of the following:
The stroke volume increases.
The amount of blood ejected per beat increases.
Increase in the strength of each contraction.
Lower heart rate when training.
Maximal cardiac output increases.
Cardiac muscle has lower demands for oxygen.
Makes training "easier".

9.9 (a) The ✓ maximum amount / volume of ✓ oxygen, in millilitres, a person can use in ✓ one minute ✓ per kilogram of body weight. (4)

(b) The ✓ higher the VO_2max , the greater the ✓ endurance capacity of the athlete.

OR

The ✓ higher the VO_2max , the ✓ longer an athlete can perform at higher intensities.

OR

The ✓ higher the VO_2max , the more chance the athlete has of ✓ delaying OBLA.

(Responses could also be opposite of above, e.g. a low VO_2max the less endurance capacity.)

OR

✓Low VO_2max ✓ prevents athlete from high-intensity training

OR

✓ Low VO_2max means ✓ OBLA will impact earlier. (2)

9.10 A = reaction time / time it takes to react (2)

B = movement time /move (react & move = 1) (2)

C = response time (whole race & reaction = 1) (2)

9.11 Periodisation involves breaking the season into 3 ✓ phases/periods/specific blocks – ✓ preseason; ✓ in season/competition season
✓ postseason/transition season/off season.

OR

Pupils could answer using format below:

| | | | | | | | | | | | |
|------------|-----|------|--------------|-----|-----|-----|-----|-----|-----|-------------|------|
| July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June |
| ✓Preseason | | | ✓Peak season | | | | | | | ✓Off season | |

✓The year is called a macro-cycle.

✓Meso-cycles are shorter – could last 4–16 weeks.

Length and number of meso-cycles depend on the activity and individual.

✓Micro-cycles are units of training – could last 1 week or could be an individual training session. (7)

9.12 Accept any three of the following responses:

Each phase has specific goals and needs.

Periodisation allows the coach to monitor training volume and intensity.

It allows adjustment if necessary.

By dividing the year into phases it allows for suitable periods of high-volume and/or high-intensity training as well as providing time when the intensity and/or volume can be decreased to allow recovery time.

It also allows the coach to determine when to peak and when to taper.

Periodisation allows time periods to be set that allow the athlete to adapt.

Allows time periods to focus on skills or fitness needs and can be planned.

Periodisation should prevent overtraining or even undertraining. (3)

Prevent boredom

Focus on certain aspects

[47]

QUESTION 10

10.1 Allocate one mark to any four of the following facts.

Alternating actin and myosin filaments found in the ✓ A band of the muscle fibre have the ✓ ability to attach to and slide past one another. ✓ This causes a muscle to shorten, lengthen or hold – called the ✓ sliding filament theory.

The actin filaments are attached to the ✓ Z-lines and when a muscle contracts, the two Z-lines get pulled closer together and this ✓ shortens the sarcomere.

(4)

10.2 Allocate four marks to Golgi tendon explanation

Allocate four marks to muscle spindle explanation

BUT candidates must refer to the picture or a weightlifter.

If the facts are correct but no reference is made to the picture or weightlifting they can score a maximum of 6/8, i.e. two marks for Golgi and two marks for muscle spindle.

E.g. when you lift weights, the Golgi tendon organ is the sense organ that tells you how much tension the muscle is exerting. If there is too much force and risk of injury, the Golgi tendon "prevents" this.

Golgi tendon

Accept any four of the following facts. One mark per fact.

- The Golgi tendon organ senses tension.
- The Golgi gives feedback to the central nervous system (CNS) about the amount of force a muscle is producing.
- The tension is from a tendon.
- If too much tension is exerted, Golgi inhibits the muscle.
- If there is too much force, the CNS sends an impulse to the muscle to stop contracting.
- Reduces the amount of force.
- If too much tension is exerted, Golgi activates a reflex arc.
- This is to prevent injury.

Muscle spindle

Accept any 4 of the following facts. One mark per fact.

- Muscle spindles detect change in muscle length.
- Muscle spindles detect change in the velocity/speed of the lengthening.
- When muscle fibres contract, ends of the muscle spindle come close together, stimulating the sensory/afferent nerves which then pass on electrical impulses to the CNS.
- The nervous system notes the change in joint angles and can stop the muscle from lengthening too fast and too much.
- A reflex arc signals to your spinal column telling you not to stretch any further.
- Prevents injury.

(2 × 4 = 8)

10.3 Allocate three marks for defining or explaining the law.

Allocate two marks for referring to the diagram.

Explanation:

The law states that when a muscle fibre contracts, it contracts completely.

✓ There is no such thing as a partially contracted muscle fibre. Muscle fibres are ✓ unable to vary the intensity of their contraction ✓ relative to the load against which they are acting. The more muscle fibres that are recruited by the central nervous system, the stronger the force generated by the muscular contraction.

In order to gauge stimulus intensity, the nervous system relies on the rate at which a neuron fires and how many neurons fire at any given time. A neuron firing at a faster rate indicates a stronger intensity stimulus. Numerous neurons firing simultaneously or in rapid succession would also indicate a stronger stimulus.

Reference to diagram:

The athlete in the diagram is lifting a very heavy weight – this means that lots of neurons are firing rapidly which results in most, if not all, of her muscles engaging to lift the weight.

(5)
[17]

QUESTION 11

11.1 Allocate two marks for any one of the following:

glycogen stores
stored carbohydrates found in muscles and the liver
glucose from eating carbohydrates
ATP/PC

(2)

11.2 Lactic acid system/Glycolytic.

(2)

11.3 Deep breathing or gasping for air.

(1)

11.4 Allocate one mark per fact. Accept any four of the following:

lactic acid debt

- This process is responsible for removing lactic acid/get rid of.
- Recovery can take up to one hour depending on intensity of exercise.
- The energy needed to convert lactic acid back to pyruvic acid is made available aerobically because of the elevated rate of respiration during recovery (heavy breathing).
- Exercise during recovery should be submaximal and will help flush the lactic acid out.

(4)
[9]

QUESTION 12

- 12.1 (a) Allocate one mark to any 4 of the following:
 graphite tennis rackets
 roof that closes
 speed of service recorded
 electronic scoreboards
 fabric of clothing
 umpires use computers
 (Accept any reasonable response.)
 Reaction time machine (4)
- (b) Graphite tennis rackets – stronger, ball bounces off strings more accurately.
 Roof that closes – can play in all weather, player income will not be affected.
 Speed of service recorded – more interesting for spectators; players can improve further in training.
 Electronic scoreboards – quick, updated instantly.
 Fabric of clothing – lighter, cooler, keeps sweat away from skin.
 Umpires use computers – no errors, quicker.
 (Accept any reasonable response.) (4 × 2 = 8)
- 12.2 Allocate two marks to any one of the following facts.
 The opponent needs to have faster reflexes; quicker reaction times.
 Be more agile; fast on his/her feet; able to change direction quickly.
 Have less time to think and make decisions.
 Tire quicker.
 (Accept any reasonable response.)
 More pressure (2)
- 12.3 Allocate one mark to any five of the following facts.
 Motor unit size – a ✓ single motor unit will be ✓ responsible for stimulating a ✓ few muscle fibres within a muscle. The ✓ number of fibres affected depends on the ✓ precision of the movement.
 When a gross movement is needed, ✓ more motor units get recruited.
 A ✓ motor neuron stimulates the fibres.
 CNS (5)
- 12.4 Allocate six marks to any of the following points.
 The graph starts off as a linear graph.
 It starts to plateau at 10 and 11 responses.
 Reaction time is dependent on the number of responses or options that the player has.
 When a player only has one way of responding, his time is incredibly quick at just under 200 milliseconds.
 When a player has many possible responses or options then his reaction time is slower and is only at 640 milliseconds.
 More choices = slower response time.
 Fewer choices = quicker response time. (6)
- 12.5 Allocate one mark for topspin.
 The ball dips, so does not travel far.
 Allocate one mark for backspin.

Ball travels further/longer horizontal flight

After bounce:

Top = travels further

Back = dips

(2)

12.6 Allocate one mark to any five of the following facts.

- The movements are not co-ordinated.
- To be effective, force needs to be transferred efficiently through the body between body segments.
- This athlete is not transferring power correctly.
- The movement of the hip is taking place too late.
- The trunk movement is taking place too early.
- The shoulder movement is taking place too early.

(Accept similar terminology.)

(No marks for – *The arm and hand movement is perfect as the question asked for **incorrect** movements.*)

(5)

[32]

QUESTION 13

Newton's first law:

Allocate two marks for the definition or explanation of the law.

1st law – A body continues at a state of rest or uniform velocity unless acted upon by an external force.

OR An object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.

OR

An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an external force.

(2)

Application of law:

Allocate two marks for applying the law to soccer.

Application – If the player does not apply force through the foot to kick the ball, the ball will remain at rest on the ground. (Accept any reasonable response.)

(2)

Newton's second law:

Allocate two marks for the definition or explanation of the law.

2nd law – When a force acts on an object, the change of momentum experienced by the object is proportional to the size of the force and takes place in the direction in which the force acts.

OR

The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

(2)

Application of law:

Allocate two marks for applying the law to soccer.

Application – When the boot/foot makes contact with the ball, it causes the ball to accelerate in the direction it was kicked. The amount of acceleration depends on the amount of force exerted on it. The ball will continue to move forward until acted

upon by an external force, either gravity or the contact with the opponent's foot (or goalkeeper's hands). (Accept any reasonable response.). (2)

Newton's third law:

Allocate two marks for the definition or explanation of the law.

3rd law – For every action there is an equal and opposite reaction.

OR

In every interaction, there is a pair of forces acting on the two interacting objects. The size of the force on the first object equals the size of the force on the second object. The direction of the force on the first object is opposite to the direction of the force on the second object. (2)

Application of law:

Allocate two marks for applying the law to soccer.

Application – The foot hitting the ball is the action, the reaction is the ball pushing on the foot. (Accept any reasonable response.) (2)

[12]

QUESTION 14

Movement A:

Kicking leg up:

Allocate one mark to any three of the following facts:

Raising the leg moves the centre of gravity outside the base of support.

By raising the arms the centre of gravity is also raised.

Small base of support on one foot.

Because of the small base of support, the gymnast is relatively unstable.

(Maximum of two marks can be awarded if provided words are not used.)

Line of gravity

(3)

Movement B:

Steps forwards and places hands on floor.

Allocate one mark to any three of the following facts:

Body rotates.

Rear leg swings up = angular momentum.

Remaining foot on mat pushes off – action force.

A reaction force from the floor results where an action force was applied.

(Maximum of two marks can be awarded if provided words are not used.)

Unstable

(3)

Movement C:

Body vertical.

Allocate one mark to any three of the following facts:

Gymnast balances on hands. The line of gravity falls within the base of support.

The gymnast may spread fingers out a bit (splay) to increase the size of base of support slightly. Base of support is small so gymnast is unstable.

Centre of gravity is high so the stability is low.

(Maximum of two marks can be awarded if provided words are not used.)

(3)

[9]

QUESTION 15

Allocate two marks per factor viz. height, weight and speed.

Height:

Allocate two marks for any two facts:

Being tall means that they have longer levers.

The longer the lever the greater the velocity (speed) and force that can be imparted on an object.

Longer levers create greater speed and force at the end of the lever arm which is an advantage when throwing.

(2)

Weight:

Allocate two marks for any two facts:

Shot putters are mesomorphs and are muscular. The fact that they weigh 100 kg indicates that they have a lot of muscle mass which in turn means that they can exert a big amount of force onto the shot putt.

(2)

Speed:

Allocate two marks for any two facts:

Indicates that the athlete has explosive power.

Indicates a high percentage of fast twitch muscle fibre.

Greater velocity

(2)

[6]

QUESTION 16

Carefully read sources A, B and C as well as the rubric. Use them to answer the following question.

Write an essay of 250–300 words in which you argue that **early specialisation in sport is detrimental to an athlete**.

To answer this question you are expected to:

- Present an in-depth argument that convincingly supports this statement.
- Examine the source material carefully and use the information in the sources to best develop your argument.
- Integrate your own relevant sport science knowledge into your argument.
- Use real-life examples to support your argument.

ESSAY RUBRIC

| | 1 mark | 2 marks | 3 marks | 4 marks | Possible mark (20) |
|--|---|---|---|--|--------------------|
| Statement | Vague. Disagree with statement in essay. | Clear statement made. | | | 2 |
| Use of knowledge from sources | Reference made to one source only. | Reference made to two sources. | Several and appropriate references made to all sources. | Source detail fully utilised 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 statement | Writing consists of facts with little linkage or reasoning. | Reasoning correct but hard to follow. Some linkage evident. | Supports the statement. Reasoning is clear. Minor errors in flow. Linkage is sometimes missed. | Strongly supports the statement. 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 beyond the sources given to support argument AND integrated into the argument. | Many facts beyond the sources given to support argument. | Many facts beyond the sources given to support argument AND integrated into the argument. | 8 |

[20]

| |
|------------------|
| 221 marks |
|------------------|

Total: 300 marks