NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY/JUNE 2021

SPORT AND EXERCISE SCIENCE

MARKING GUIDELINES

Time: 3 hours 200 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.

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QUESTION 1

1.1

1.1.1	G
1.1.2	J
1.1.3	D
1.1.4	H
1.1.5	A
1.1.6	C
1.1.7	E
1.1.8	F
1.1.9	B
1.1.10	I

1.2 1.2.1 **The sagittal plane** divides the body vertically into left and right halves.
OR
The frontal plane **splits the body vertically into front and back halves of equal mass**.

1.2.2 Static flexibility is the ROM present when a body segment is **passively moved**.
OR
Dynamic flexibility is the ROM present when a body segment is actively moved.

1.2.3 Topspin causes a tennis ball to **dip during the flight**.
OR
Side spin causes a tennis ball to swerve left or right.

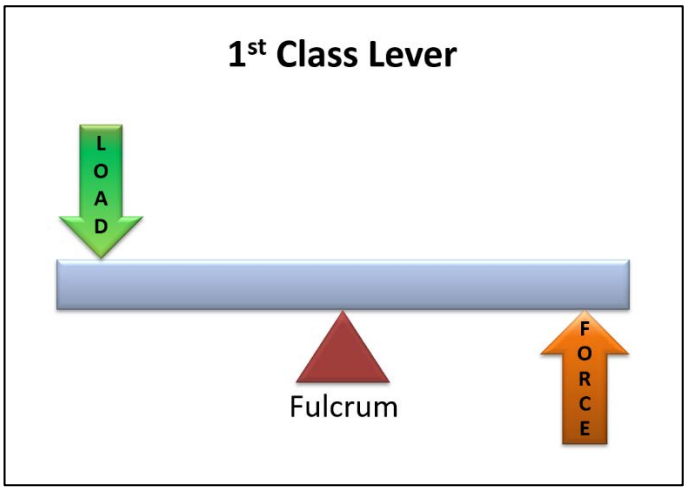
1.2.4 **Visual reaction time** is the speed with which your brain interprets and reacts to your opponent's action.
OR
Depth perception **enables you to quickly and accurately judge the distance between yourself and other objects.**

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QUESTION 2

2.1 1st class

2.2

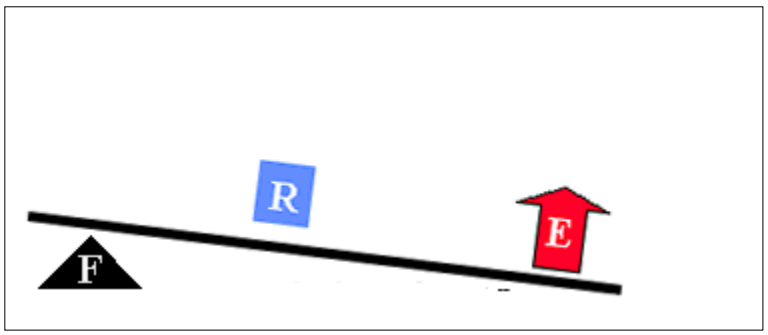


Allocate 1 mark for including a fulcrum.
Allocate 1 mark for fulcrum in the middle.
Allocate 1 mark for naming effort and another mark for placing it on one side (either side).
Allocate 1 mark for naming load/resistance and another mark for placing it on one side (either side).

2.3 2.3.1 Weightlifting (short limbs/levers so easier to lift).
Artistic gym (easier for rotations).
table tennis, shot put, slap shot in hockey.
Accept feasible.

2.3.2 Swimming; tennis, volleyball
Accept feasible.

2.4 2nd



Allocate 1 mark for including a fulcrum.
Allocate 1 mark for fulcrum at one end (either end).
Allocate 1 mark for naming effort and another mark for placing it on the opposite side to the fulcrum side (either side).
Allocate 1 mark for naming load/resistance and another mark for placing it in the middle.

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QUESTION 3

3.1 Sport in boys' schools is emphasised, so more boys are physically active. Rugby is especially encouraged, and this sport requires high fitness levels and intense training.
Girls become body conscious and often won't wear revealing clothing required for sport so instead they don't participate at all.
Accept feasible.

3.2 Allocate 1 mark per factor provided.
Allocate 1 mark for the solution.

Accept any 3 of the following:
Age – have leagues that cater for all ages; adapt equipment and field size.
Gender – ensure that there is equality.
A person's ability – ensure that training caters for all levels as well as having matches for all levels.
Wealth/cost – lower club fees; offer specials; discounts.
Environment – ensure areas where exercise/sport takes place is safe and secure.
Pollution – keep facilities clean.
Culture – respect all cultures and cater for them, e.g. Muslim women need to exercise privately.
Accept feasible.

3.3 Accept any 2 of the following facts:
- Lack of energy and weakness.
- Slowed thinking, poor memory.
- Dizziness, fainting, and headaches.
- An athlete with an eating disorder can expect to be more prone to injury, and to have a shorter sports career that is troubled by inconsistent performances.
- Athletes with eating disorders can be at a higher risk for medical complications such as electrolyte imbalances and cardiac arrhythmias.

QUESTION 4

4.1 It is a numerical measure of the rate at which a carb-rich food affects blood glucose levels.

4.2 Knowing what the GI value is of different foods means that the athlete knows which foods should be eaten before competing and which should be avoided. They can plan their diet better.

4.3 4.3.1 One of the side effects is shaking. An archer needs to aim at a small target and shaking will cause them to be less accurate and performance will decline.
OR
Fatigue means they might struggle to lift the bow and hold it steady while aiming = decline in performance.
OR
Fatigue = no energy = poor performance

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4.3.2 One side-affect is irritability. Hockey and netball are team sports. Athletes need to work together to succeed. Irritation will negatively impact on this and the ultimate performance.
OR
Another side effect is shaking. A shooter or GA in netball needs to aim at a ring and shaking will cause them to be less accurate and performance will decline.
Accept feasible.

4.4 Complete the table below on the glycaemic index.

	Glycaemic index value	**Speed of release**	**When should it be eaten?**	**Example of food type/s**
High-GI foods	4.4.1 70 and above	4.4.2 fast release quick	**After exercise that lasts 1 hour. During or after exercise lasting more than 1 hour.**	4.4.3 Sports drinks, white bread, corn flakes; potato; soft drinks; chips. 4.4.4 Biscuits, muffin
Medium-GI foods	4.4.5 56–69	**Medium release**	4.4.6 **After** exercise that lasts for 1 hour. 4.4.7 **During** and **after** exercise that lasts longer than 1 hour.	**Pita bread**
Low-GI foods	**55 or less**	4.4.8 Slow release	4.4.9 When you are inactive and **before** exercising.	4.4.10 Any fruit Wholewheat Pronutro; porridge, beans; cereal bar; milk; pasta; carrots

4.5 4.5.1 Accept any 5 of the following:
The athlete is mainly eating high GI foods at mealtimes that are resulting in a spike of blood sugar after eating them. Lunch and dinner especially are very high GI foods whereas the 2 snacks are probably intermediate/medium GI foods as the spike is considerably lower.
Breakfast has slightly lower high GI foods consumed.

4.5.2 They will have a burst of energy, which should last for the duration of their event, which is to their advantage. Their performance should improve. However, if they have to race a second time, they might have a problem unless they eat another high GI food.

4.5.3 The athlete will start off with a sprint and burst of energy but will later feel the effect of low blood sugar and will fatigue. They will lack energy and performance will drop off.

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QUESTION 5

5.1 Saliva with sweet residue – MUST mention the sweet.

5.2 Players are not allowed to apply anything to the ball except saliva or smooth cloth. It would alter the surface characteristics of the ball.
Breaking the rules.

5.3 Accept feasible.
Yes, as by applying sticky saliva he was intending it to affect the flight of the ball.
OR
No, he was applying saliva and happened to have a sweet in his mouth.

5.4 If they shine both sides of the ball then the ball will travel in a straight line.
This won't benefit the bowler at all.
Shining one side causes spin.

5.5 No, he was caught cheating before when he used a zip. So this is his second offence.
Yes, he did it by mistake, forgetting that he had a sweet in his mouth.
Accept feasible.

5.6 Allocate one mark to any three of the following facts:
Coincidental timing is the ability to match a motor action when an object (e.g. ball) arrives.
A batsman must time his/her strike to connect with the ball just at the moment that it arrives.
This means that he/she must be able to estimate the velocity (speed and direction) of the ball.
Being able to match the arrival of an object (e.g. a bowled ball) with a motor act (swinging the cricket bat) relies on accurately estimating the object's incoming velocity.

QUESTION 6

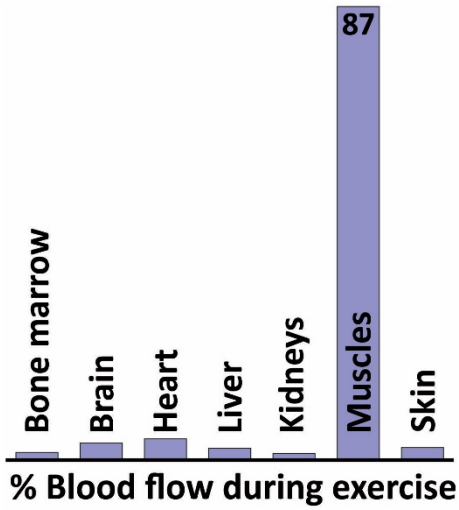
6.1 Accept any of the following:
Extra weight – not wanted when trying to be as fast as possible.
Mud clumps on tyres could cause discomfort to the rider.
Mud clumps could cause the bike to not travel in a straight line.
Causes friction – reducing speed.
Accept feasible.

6.2 6.2.1 Allocate 1 mark for any two of the following facts.
To create a smaller surface area for the air to 'hit'.
Less air resistance.
So can go faster.
Reduce cross sectional area.
Reduces drag.

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6.2.2 Allocate 1 mark to any 2 of the following facts:
Drafting gives an advantage because it reduces drag.
The leader partially shelters the follower.
The leader protects the others from increased pressure from the air.
Depending on the size of the pocket of reduced pressure behind the leader, a force like a suction can help propel the follower forward.

6.3 6.3.1



Allocate 2 marks for muscles having the most blood.
Allocate 1 mark each for less blood going to 2 organs.

6.3.2 Accept any 10 of the following facts:

Taking Blood from the Organs – The vascular shunt. The vascular shunt involves 2 mechanisms:

1. Vasodilation → the arterioles supplying the skeletal muscles increases the blood flow to them. The increase in the internal diameter of blood vessels that is caused by relaxation of smooth muscle within the wall of the vessels, causing an increase in blood flow. **OR** The blood vessels widen and so get 'bigger', which means more blood can now flow.
2. Vasoconstriction → the arterioles supplying the other organs (e.g. kidneys, liver) reduces blood flow to these organs. The blood vessels constrict/narrow and this reduces blood flow. Opening of the pre-capillary sphincters in the capillaries supplying skeletal muscles & closing the pre-capillary sphincters in the capillaries supplying the other organs. This increases the flow of blood to the skeletal muscles & decreases flow to other organs.
   Because the rest of the body gets the message to constrict the blood vessels and the muscles dilate their blood vessels, blood flow from nonessential organs (for example, stomach, intestines and kidney) is diverted to working muscle. This helps increase the delivery of oxygenated blood to working muscles even more. The overall effect is to increase the % of the cardiac output going to the muscles.

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6.4 6.4.1 Accept any 2 of the following facts:
At higher altitudes, the body compensates for the decrease in oxygen by increasing its production of erythrocytes (red blood cells), which transport oxygen through the body. **OR**
Increased production in red blood cells begins in the kidneys, through the production of the hormone erythropoietin (EPO).

6.4.2
- "live high/train high," where the cyclist both lives and trains at altitude.
- "live high/train low," where the cyclist lives at altitude but trains at sea level.

6.4.3 Allocate 1 mark per fact. Accept any 2 of the following:
Hydrate well.
Drink cold fluids.
Open race vest to allow air flow.
Place ice on nape of neck.
Pour ice water on head.
Pour ice water down back of vest.
Breathable fabric.

6.5 If there is no glycogen in the muscles, then they cannot contract.
Cramp

QUESTION 7

7.1 When an athlete is well hydrated their performance is at 100%. As dehydration percentage increases performance drops linearly. Once the athlete experiences a 5% drop in hydration, their maximum performance declines to below 70%.

7.2 Allocate 1 mark for any of the following 4 facts:
- Electrolytes include minerals like sodium, potassium, and calcium and they are lost through perspiration.
- The combined effect of electrolytic and fluid loss causes muscle cramps.
- The cardiovascular system is compromised.
- The body can't produce cooling perspiration resulting in elevated body temperature.
- Impaired muscle function.
- Loss of coordination.
- Loss of motor control.

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QUESTION 8

8.1 Allocate 1 mark for any 2 of the following facts:

- Winning isn't the only reason for competing.
- Athletes should have intrinsic reasons for competing too.
- If the athlete did his/her best, then they needn't feel disappointed.
- If the athlete has trained correctly, then there should be no regrets.
- It is also an experience to be able to compete against the best in the world and compare yourself to them.

Accept feasible.

8.2 Allocate 1 mark for any 4 of the following:

- Talk to the athlete and praise him/her for the dedication in preparing for the event.
- Explain that it is a steppingstone towards achieving a medal in the future.
- Experience was one of the main reasons for competing so that the athlete is not overawed at the next Olympics when they will be physically, mentally and emotionally better prepared for this level of competition.
- Give the athlete some time off and then resume training, remembering to refer back to the Olympics and the experiences gained.
- Set new goals – SMARTER goals.
- Educate the athlete's family on how to deal with him/her.
- Ensure that the athlete gets a chance to talk about the event and his/her feelings.

Accept feasible.

8.3 Allocate 2 marks each:
An athlete may wonder if he is good enough, strong enough, fast enough, experienced enough or smart enough.
Been ill.
Previously lost to that opponent.
Uncertainty of the outcome.
Spectators.
Expectation of success.

QUESTION 9

9.1 A tennis match can last for hours which means that the players need to be cardiovascularly/aerobically fit. This is achieved by running or cycling.
The player also needs power and strength in his arms and quads hence the weight training.
Depending on the type of weight training, it could also involve explosive power needed for quick acceleration and reactions.

9.2 Melbourne gets extremely hot and dry so training in Abu Dhabi where the temperatures are extreme will help his body adapt better and quicker in Australia.

This will help him psychologically as he knows that he has done everything possible to prepare for the tournament.

9.3 Agility or Speed

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9.4 ATP/PC system.
Is anaerobic so energy can be produced very quickly, e.g. sprint out to hit a ball that has landed in an unexpected spot or any other example from the game requiring high-intensity work.
No by-products.

Lactic acid system.
Is anaerobic so energy can be produced quickly, e.g. runs to hit the ball at the net and then quickly have to sprint to take up a defensive position or any other example from the game.
By-product is lactic acid, not so good as accumulation causes temporary reduction in body's ability to produce ATP causing fatigue.
2 ATP produced.
Fuel used is carbohydrate (stored in the body as glycogen).
Glycogen is broken down into glucose then pyruvic acid then lactic acid; process producing ATP.

9.5 **Positive Impact:**
Allocate 1 mark for any of the following:
- An increase in muscular tension. This means there is an increase in blood flow to the muscles allowing him to move quicker on court.
- Tachycardia i.e. rapid heartbeat – this has the purpose of pumping more blood to his muscles.

Negative Impact:
Allocate 1 mark for any of the following:
- Hyperventilation – this could make him dizzy and could affect vision.
- An increase in sensitivity to pain which will make him more aware of blisters or other aches and pains.

9.6

Laminar flow	Turbulent flow
The smooth flow of air around an object or person.	The flow of air where the motion of particles varies
The air flows in parallel layers	Irregular fluctuations
All the air moves in distinct and separate layers around the object	The flow of air where the motion of particles varies
This decreases the amount of resistance.	This increases air resistance

Accept any 3 of the following bullets:
Allocate 2 marks per bullet on condition that both laminar AND turbulent flow are compared accurately.
- With laminar air flow the air around the ball flows in a smooth manner whereas with turbulent air flow the motion of the air particles is inconsistent.
- With laminar air flow the air moves in distinct and clearly defined separate layers around the tennis ball while with turbulent flow the air flow varies.
- With laminar air flow the air flows in parallel layers with no disruption between layers whereas with turbulent flow there are irregular fluctuations of the air and layers get mixed up.
- Laminar flow – the air movement is predictable as opposed to turbulent air flow where the air movement is unpredictable/chaotic.
- Laminar flow causes a decrease in resistance while turbulent flow increases air resistance.

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QUESTION 10

10.1 **Newton's 2nd law** (Law of Acceleration) = 'when a force acts on an object, the rate of 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 is dependent on 2 variables. The net force acting on the object and the mass of the object. The acceleration of an object depends directly on the net force acting on the object and inversely on the mass of the object.

10.2 The bigger athlete has a heavier weight so he needs to exert more force to move it.

The smaller athlete has a light weight so less force is needed to move the weight.

10.3 Allocate 1 mark each to any of the following 6 facts:

As the dumbbell is raised, the myosin filaments attach to the actin filaments.

Alternating actin and myosin filaments have the ability to attach to and slide past one another.

These filaments slide in and out between each other to form muscle contraction, hence called the sliding filament theory.

The A band contains both actin and myosin filaments. This is where contraction takes place between the myosin and actin.

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QUESTION 11

	0 mark	1 mark	2 marks	3 marks	4 marks	Possible mark (20)
Use of sources.	No reference to sources.	Reference made to some sources only.	Source detail used to nearly full potential to support the discussion and impact on performance.			2
Content relevance × 2.	Little or no content relevance.	Significant important information missing AND facts not related closely to the topic AND some serious factual errors.	Some vital information missing OR many irrelevant facts OR errors affecting the quality of the essay.	Slightly flawed in some facts missing OR facts mostly relevant to topic OR few errors.	Sufficient facts provided. All information is relevant and accurate.	8
Real-life examples × 2.	No examples provided.	Inappropriate or weak examples provided.	Two real life examples provided.	More than two real-life examples provided.	Examples used to full potential to support the discussion and impact on performance.	8
Quality of discussion.	Question not answered. Missed the point.	Reasoning correct but hard to follow. Some linkage evident.	Reasoning is very clear and succinct. Flow is logical. Compelling with regular linkage.			2

Points to look for:

There is a close link between motivation and arousal. Arousal is linked to the state that drives a person to learn or perform. Arousal is a general mixture of the physiological and psychological levels of activity that a performer experiences.

Arousal is not to be seen as good or bad but rather represents the level of energy or effort that a person applies to any sporting or learning situation.

When the body is placed under physical or mental stress, it produces levels of arousal which affect the information processing and then performance. If the activity needs lots of decision making quickly and accurately then the effects of arousal will be more noticeable. If the body is placed under stress, physically or mentally, then arousal levels are increased, and we are motivated to behave in a way that will reduce these levels to the optimum (perfect) level of arousal.

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Physiological reactions to increased arousal levels:

- Heart rate
- Blood pressure
- Skin responses
- Biomechanical indicators like adrenaline and epinephrine

An athlete preparing for a big physical race needs to be in a highly alert state/ arousal. The body must make sure that it can meet all the physiological demands – muscles need blood sugars, oxygen, etc. Sport involving high-intensity exercise like soccer or netball, are associated with a highly aroused state.

Lots of adrenaline, increased heart rate, increased breathing rate. This aroused state is often associated with emotional states of fear, anger, tension, worry, apprehension and anxiety.

Levels of arousal can affect levels of perception, attention and movement control. A performer needs to have appropriate levels of arousal in order to promote effective concentration, attention and decision-making levels to produce optimum performance. Coaches know that as being 'psyched up'. The intensity of arousal levels is often an important factor in competition. If arousal gets too high, the athlete can become anxious. If it is too low, they may become bored and demotivated. Both states can have a negative effect on performance.

Research shows that motor skills (skills that are physical and need muscle control, e.g. dribbling) generally need an above-average level of arousal. If the skills or activity use mainly gross movements (use large muscles, e.g. walk, kick, run) and simple skills (e.g. swimming) using strength, endurance and speed and little decision making then higher levels of arousal will be more effective. Activities involving very fine, accurate muscle actions or complex tasks needing higher levels of perception, decision making, concentration and attention, will be more effective if the arousal level is lower.

Both groups' HR increase as they get into their jump gear.

As the jumpers climb into the aircraft their pulse rates increase rapidly.

The experienced jumpers more so as they are excited, and adrenaline is being pumped around the body.

The novice jumpers' HR increase rapidly as the plane warms up – this is due to nerves.

Their HR continues to increase until there is a massive spike just before exiting the plane.

The experienced jumpers' HR increases until they are airborne. Then it stabilises. Before exiting the plane, their HR has dropped. This indicates that experienced jumpers get more excited when getting into jump gear than when actually jumping.

Performance is said to improve up to a certain point of arousal; if arousal continues to increase beyond the optimal state, the performance will begin to decline.

Total: 200 marks

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