



NATIONAL SENIOR CERTIFICATE EXAMINATION  
NOVEMBER 2020

**SPORT AND EXERCISE SCIENCE**  
**MARKING GUIDELINES**

Time: 3 hours

200 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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**QUESTION 1**

1.1

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

1.2 1.2.1 Weight loss

1.2.2 Weight balanced / constant / maintained/no weight lost or gained

1.2.3 Weight gain

1.3 1.3.1 A joint

1.3.2 A tendon

1.3.3 An antagonist

1.3.4 Minute ventilation

1.3.5 Hypertrophy

1.3.6 Stroke volume

1.4 Picture A: Transverse/horizontal/axialPicture B: Frontal/coronal

1.5 Outline **AND** shade in the base of support in each of the following pictures.

**Picture A**



[Source: <<https://mcardlesport.co.uk>> (Accessed 25/2/20)]

Only allocate marks if they are accurate

Allocate 1 mark for each foot = 2

Allocate 1 mark for the space between the feet

Allocate 1 mark for the place where the hockey stick is in contact with the AstroTurf

Allocate 1 mark for the space between the front foot and hockey stick

**Picture B**



[Source: <<https://www.mercurynews.com/>> (Accessed 25/2/20)]

Only allocate marks if they are accurate

Allocate 1 mark for left hand

Allocate 1 mark for right foot

Allocate 1 mark for left shin

Allocate 1 mark for space between hand and front foot

Allocate 1 mark for space between right leg and left shin

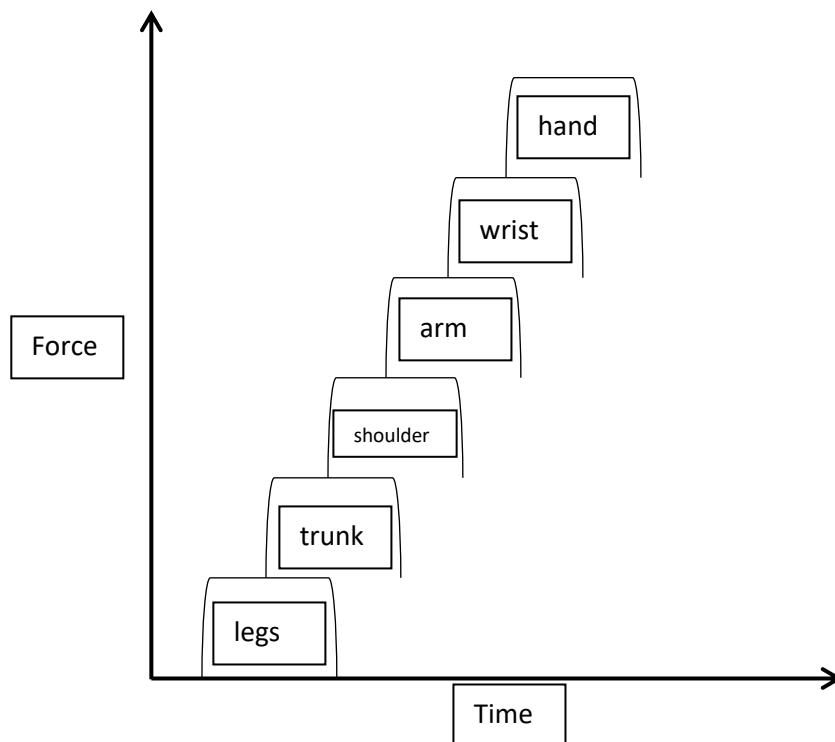
**QUESTION 2**

- 2.1    2.1.1    3
- 2.1.2    biathlon (e.g. run, swim) or duathlon (e.g. run, cycle, run)
- 2.1.3    Aerobic / oxidative
- 2.1.4    Allocate 1 mark for either answer:  
It produces more ATP than any other system.  
It produces ATP at a slower rate and is less suitable for intense exercise.  
The event is long duration
- 2.1.5    Accept any one of the following:  
The aerobic system uses carbohydrates, fats and proteins to resynthesise ATP.  
To replenish the body's carbohydrate levels.  
To provide energy quickly.  
They work by immediately raising your blood sugar level.  
It is more convenient to eat a gel while exercising.  
Help to delay muscular fatigue.  
Enhance performance.  
Sustain energy levels
- 2.2    2.2.1    Allocate 1 mark for stating that the lactic acid system has come into play.  
Allocate 1 mark for stating lactic acid build-up.  
lactate  
The gradient means she is working harder. The aerobic system is no longer sufficient when going uphill. The lactic acid system comes into play. (A by-product is the build-up of lactic acid which causes soreness.)
- 2.2.2    To shift their centre of mass forward and make it easier to pedal.  
Greater forward momentum
- 2.2.3    (a)    D
- (b)    280–300 W
- (c)    20%–21% slope
- 2.3    Jill was predominantly using the lactic acid system. This system produces CO<sub>2</sub> in the blood and it needed to be expelled. If Jill doesn't reduce the CO<sub>2</sub> build-up it would force her to stop. The best way to get rid of CO<sub>2</sub> is to take deep breaths.  
Greater demand for oxygen for muscles

**QUESTION 3**

- 3.1 Allocate 6 marks for any of the following facts.  
Allocate 2 marks for reference to pictures.  
All body parts must move in sequence for maximum force.  
Need a stable base to start movement.  
Spiking starts with larger muscles in the legs (quads; hamstrings).  
Trunk extension follows, allowing abdominal muscles to flex and generate force.  
Force transferred to upper body.  
Shoulder and arm muscles come into play.  
Just before the hand applies force on the ball, the wrist flexes.  
All combined forces of all muscles applied to ball.  
Timing determines the control, size and direction of the force applied to the ball.  
Start with larger muscles (legs; torso) followed by smaller muscles in wrist and hand.  
Body parts must move in correct order.

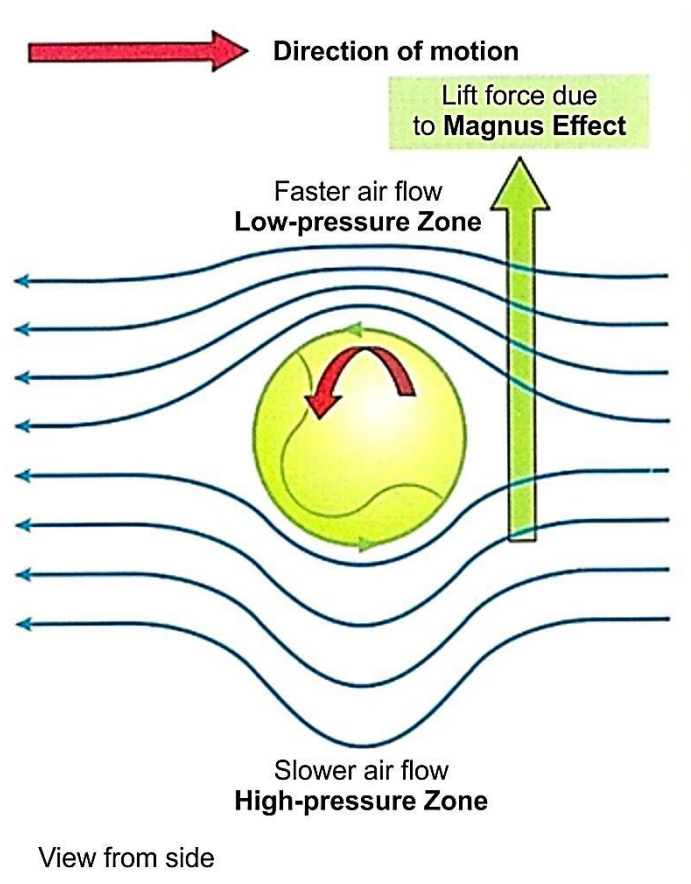
3.2



- Allocate 1 mark for each axis being correctly labelled  
Allocate 1 mark for each body part in the correct order  
Allocate 1 mark for each segment being accurately placed

- 3.3 Allocate 1 mark to any 3 of the following facts:  
Being tall means they have long limbs and therefore longer levers.  
Long levers allow greater force to be exerted on the ball.  
When serving, a tall player is making contact with the ball at a higher point at the service line – the ball will drop quicker and be more difficult for the opponents to reach.  
When blocking at the net, they can be more effective.  
Can cover more ground.  
The arm situated with the ball is the lever. The longer the lever (the longer the individual's limb) the greater the mass. Additionally, the ball is positioned further away from the body, thus this will increase the velocity within the hand.  
This assists tossing the ball in front of the athlete's body and generating the optimal height of the toss. The hand throws the ball up into the air allowing the ball to accelerate vertically. The force applied to the ball during the toss increases the velocity of the ball; thus, momentum of the object is increased and the impulse–momentum relationship is present.  
Accept feasible.  
Don't have to use as much effort to jump to reach height
- 3.4 Jump as high as possible.  
Use a straight arm to contact the ball at its highest point – long lever.
- 3.5 Quicker reaction time will mean the player can get to the ball faster and performance will be better.
- 3.6 If the player can predict where the ball will go then their response is prepared. Movement time response will already be decided and organised by the brain = quicker reaction and better performance.  
Prepare in advance
- 3.7 Accept any 6 of the following factors:  
A topspin serve – hit towards the top of the ball in a downward and outward motion.  
The top of the ball spins into the oncoming air.  
The front of the ball moves downwards.  
The boundary layer of air draws the air down along the front of the ball.  
More air gets pulled under the ball than goes above it.  
Where there is more air, the air moves faster.  
Higher velocity on the lower side of the ball. I.e. air speed at top is less  
Lower velocity on top. I.e. air speed at bottom is greater  
Contact is made with the ball at a point just below its centre, the ball is quickly and sharply forced downwards.

3.8



Allocate 1 mark for correct rotation as indicated in diagram

Allocate 1 mark for air pressure above the ball = low

Allocate 1 mark for air pressure below the ball = high

Allocate 1 mark for velocity above the ball = high

Allocate 1 mark for velocity below the ball = low



3.9

**Name:** Performing  
**Description:** Group members use one another's strengths. They function as a united team.

Name: Norming

Description: Rules

accepted

Tolerant

Consensus

Roles are clear

Decisions made

through discussion

Name: Storming

Description: Conflict

can weaken group

Decisions difficult

Power struggle

Leader advises

Name: Forming

Description: Group

comes together

Excitement

Leader guides

Individuals unclear

on role

**QUESTION 4**

4.1 Allocate 1 mark for any 5 of the following facts:

Kayak

Narrower, less frontal surface area in contact with water and air

Lighter (carbon fibre). Needs less force to move

Pointed nose – bow cuts through water with less drag; less air resistance

Carbon fibre is smooth and strong – less drag from air and water

Paddler sits lower/inside boat – less frontal drag

If they use the word 'streamline' then need more of an explanation. No mark for just saying 'it's streamlined'

4.2 Picture B's paddler sits low in the boat whereas the person in Picture D is exposed.

Picture B has less frontal resistance to air whereas picture D has greater frontal air resistance.

Rowing boat

Made of wood – heavy and absorbs water – causes more drag

Large frontal area creating resistance

Rower sits higher – more frontal resistance

D = larger surface area

Accept mention of impact of clothing

They must compare otherwise max  $\frac{3}{4}$  marks awarded

4.3 1<sup>st</sup> class / order

4.4 The water

4.5

Picture D Rowing boat



[Source: <<https://www.google.co.za/people+in+rowing+boat>> (Accessed 25/2/20)]

Allocate 1 mark for the fulcrum being drawn on either side of the boat.

4.6 Accept any of the following:

- arm muscles
- biceps and triceps
- deltoids

4.7 Allocate 2 marks for the definition or explanation of the law.

Newton's first 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 unbalanced force.

Application of law:

Allocate 2 marks for applying the law to rowing.

If the rower doesn't apply force through the oar into the water, the boat will remain at rest or won't move.

OR: The boat will keep moving in a straight line unless another boat pushes against it.

Accept feasible.

Newton's third law:

Allocate 2 marks for the definition or explanation of the 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 forces 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.

Application of law:

Allocate 2 marks for applying the law to rowing.

The pull on the oar in the water is the action, the reaction is the boat moving.

If the rower pulls with great force then the boat will move faster. Accept feasible.

4.8 Allocate 4 marks for the law and 1 mark for referring to the canoeist.

The all-or-none law states that the strength of a response of a muscle fibre does not depend upon the strength of the stimulus.

OR

There will either be a full response (ALL) or there will be no response at all (NONE). Either the single fibre does not respond or it responds to the utmost of its ability.

OR

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 canoeist, when pulling the paddle blade through the water, is engaging all his/her arm muscles.

**QUESTION 5**

- 5.1 2 minutes 50 seconds / 2:50
- 5.2 Kenya is found at high altitude so Kenyans naturally produce more red blood cells which transport oxygen to muscles.  
High above sea level
- 5.3 No, they concluded that there was a 10% likelihood that the two-hour mark would fall in May of 2032, and just a 5% chance it would happen by 2024.
- 5.4 Accept any 2 of the following:  
He had over 40 pacemakers.  
He had a car leading him.  
He wore shoes not recognised.  
Hydration was handed to him, as opposed to the runner going to a seconding table to collect.  
Standard competition rules for pacing not followed  
Standard competition rules for hydration not followed
- 5.5 They lower the air resistance experienced by the runner making it easier for him/her.  
They set the pace that the runner needs in order to win or break a record.
- 5.6 For the run they used a reversed V shape whereas in the Tour de France they use a triangle formation.
- 5.7 85%
- 5.8 A laser shone on the road to assist with pace setting.  
Electric cars don't produce exhaust fumes that would affect breathing.
- 5.9 The carbon fibre plates assist runner by enabling them to use less oxygen.  
Foam in sole absorbs energy and transfers it back into the foot making the running easier.
- 5.10 Accept either of the following:  
  - Shin splints
  - Stress fracture
  - Calf strain
  - Tendonitis in achilles
- 5.11 Carbohydrates
- 5.12 To give him a **constant** supply.  
Replenish carbohydrates lost throughout race
- 5.13 The actual date of the run wasn't confirmed.
- 5.14 The fat-burning process isn't as efficient.  
Fat is often in short supply in the bodies of elite athletes.

**5.15 The answer MUST refer to Kipchoge**

Allocate 3 marks for each:

drag,  
resistance,  
drafting,  
friction

- **Drag**

Allocate 1 mark for any 3 of the following facts:

- Drag causes resistance in the air.
- Drag acts in the opposite direction of the movement of the object.
- Surface drag – This type of drag depends mainly on the surface of the object moving through the air, e.g. rough surface (e.g. loose-fitting clothing) or smooth surface (e.g. tight-fitting clothing). If Kipchoge wore very loose-fitting or baggy clothing, it would create lots of resistance/drag to slow him down.
- Form drag – This type of drag depends on the cross-sectional area of the body exposed to the air, e.g. a larger runner causes more drag than a thinner runner. Kipchoge is an ectomorph – lean and thin. Wiry muscles.

- **Drafting**

Allocate 1 mark for any 3 of the following facts:

- This involves following closely behind another athlete in sports that use speed and where the athlete tries to conserve energy.
- Drafting gives an advantage because it reduces drag – the leader partially shelters the follower from increased air pressure. Kipchoge has his pacemakers in a specific formation in front of him to allow some drafting.
- Depending on the size of the pocket of reduced pressure behind the runners in front, a force like a suction can help propel Kipchoge forward.

- **Friction**

Allocate 1 mark for any 3 of the following facts:

- Friction between shoes and ground allows runners to run and not slip.
- Kipchoge ran with special shoes that had special soles allowing traction on the tar.
- Friction provides the force to accelerate, stop or change direction when needed.
- Surface characteristics – To increase friction, one or more of the surfaces need to be rough and that's why athletes wear shoes with rough soles so they can increase friction with the ground.
- This helps 'stick' to the surface and this creates a large friction force and stops the feet from slipping.
- This maximises forward acceleration.

- **Air Resistance**

Allocate 1 mark for any 3 of the following facts:

- Air resistance is a frictional force between the surface of a person and the air moving in the opposite direction of travel.
- When running, the person sprints forwards and the air resistance acts backwards.
- It opposes acceleration by pushing, pulling or tugging on an athlete.
- The size of the resistance doesn't only depend on the speed of the body, it also depends on its shape – is the group running in a streamlined formation or not? Kipchoge and his team experimented with different formations until they found the one causing the least resistance and the most drafting.
- An athlete needs to reduce the cross-sectional area of their body to reduce air resistance or drag (make themselves 'smaller' or more streamlined).
- Surface characteristics – smooth or rough will also impact on resistance. Any lumps or bumps or roughness will increase air resistance or drag.
- Tight-fitting clothing. Even Kipchoge's arm warmers are tight fitting.

**QUESTION 6**

- 6.1 Players are returning after a break and so are relatively unfit.  
The coach needs to build up their fitness levels.
- 6.2 A coach can't get the players fit without working on skills otherwise performance will drop.  
Skill also get rusty after a break and they need to be worked on too.  
To see what skills need more work
- 6.3 The volume of both the conditioning and skills training has reduced considerably but not stopped altogether.  
This is to prevent the athletes from overtraining and suffering from fatigue / injury / burnout  
Although both conditioning and skills training are reduced, they haven't stopped altogether (they are being maintained at a lower volume); This is to prevent the player from going into 'shock' from high-volume exercise to no exercise.  
Prevent reversibility  
Rest and recovery  
Accept feasible.
- 6.4 Accept any 6 of the following facts:  
Weeks 5 to 8 are macrocycle 2 where the emphasis is on skills.  
There is still conditioning occurring at a low level but this volume remains constant for the 4 weeks.  
The skill training has increased considerably in volume.  
There is a gradual increase in volume from week 5 to 7.  
It peaks at week 7.  
Then the volume of skill training reduces to medium.  
At the same time that the volume has increased, the intensity has decreased and vice versa.
- 6.5 6.5.1 Shortens / thickens / overlaps  
6.5.2 Disappears / vanishes  
6.5.3 Stays the same length
- 6.6 Actin
- 6.7 Myosin

**QUESTION 7**

Examine the information provided in the sources below, as well as the rubric. Use it to write an essay of 1–1½ pages on the following topic:

Technology in sport: positive or negative?

Some possible answers:

**Positives**

- Safety. Clothing ensures fewer chances of injury, e.g. fire suits worn under overalls by Formula One drivers.  
Equipment adapted to ensure safety. Javelins have a weight inserted at the tip to make them drop as athletes were throwing too far and there were fears of hitting the runners on the track.
- Clothing. Designed for ease of movement – Lycra that 'gives'.  
Clothing that wicks sweat away from the body.  
To prevent injury – shoes specific to sports – track athletes with spikes.
- Improve performance.
- Spectators benefit – big screens at venues to watch replays.
- Accuracy – stopwatches; photo finish.
- Assists officials – watch replays; cricket bail lights up when contact between the bails and the stumps has been broken.
- Cheating made more difficult as drug tests are more advanced.
- Equipment designed to suit different ages, e.g. tennis rackets are shorter for children.
- Disabled athletes catered for.

**Negatives**

- Can slow the game down – wait for umpires to watch replays before making decisions.
- Expense – means tickets are more expensive.
- Times of matches are delayed to suit TV coverage.
- Equipment more expensive.



**ESSAY RUBRIC**

	<b>0 mark</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>	<b>4 marks</b>
Use of sources	No reference to sources.	Reference made to one source only	References made to 2 sources	References made to 3 sources	Source detail very close to full potential
Quality of content X 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.	Sufficient facts provided. Most information is relevant, appropriate and accurate	Many facts provided. All information is relevant, appropriate and accurate
Use of own knowledge/ experience	No own knowledge provided	A few facts and information provided from own knowledge/ experience	Includes some facts and information from own knowledge/ experience	Includes facts and information from own knowledge/ experience	Includes many facts and information from own knowledge/ experience
Quality of argument	Question not answered. Missed the point	Flawed in all respects	Flawed in 2 respects	Flawed in one respect	Decision clearly stated and supported by essay. Reasoning/logic very clear. Argument is not repetitive. Argument is succinct/not longwinded or rambling.

**Total: 200 marks**