NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2014

SPORT AND EXERCISE SCIENCE: PAPER II

MARKING GUIDELINES

Time: 2 hours 150 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.

QUESTION 1

1.1 To rub the surface of the ball is to artificially change the surface and therefore the flight of the ball. All cricketers know the rules and yet he still rubbed the ball on the zip. He was breaking the rules. (2)

1.2 Making one part of the ball rougher will affect the flight of the ball.
Cricket balls travel at high velocity and a rough surface will be affected by air resistance.
It will cause the ball to not travel in a straight line – it will curve.
Daniel Bernoulli developed the Bernoulli principle → an increase in velocity causes a decrease in pressure, so where the flow is fast, the pressure is low and vice versa. If applied to the aerofoil – the low pressure above and the high pressure below it = lift force. (4)

1.3 Competitive stress becomes negative, leading to anxiety, when an athlete perceives what is being asked of him to be beyond his capabilities. Anxiety is often linked to a fear of failure.

An athlete's perception of his abilities may be based on:
- a previous performance,
- his beliefs regarding the opposition or
- the perceived importance of the competition.

His perception can also vary greatly from event to event, depending on his perceived state of physical and mental preparation in each case.

Motivation is the internal mechanism and external stimuli which arouses and directs our behaviour. It's a drive to fulfil a need. Intrinsic motivation is greatest when the person feels competent.
Extrinsic – A person looks for materialistic/tangible rewards (e.g. trophy, money, prize) BUT it could also be intangible, e.g. a pat on the back, publicity, praise, social status.

The development of flow has been linked to the following:
- Positive thinking and confidence
- Being relaxed, controlling anxiety
- Physical readiness – well trained and well prepared
- Perfect environment and good atmosphere
- Shared sense of purpose, good interaction between team mates
- Feel good and in control

By focusing on these things when preparing, elite athletes increase the probability that the flow experience will occur.
Coaches will be most effective combining both extrinsic and intrinsic rewards.
- Positive self-talk
- Concentration
- Visualisation/mental rehearsal

Mental preparation will differ according to individual needs but aims to get individuals to an optimal state of arousal for their activity.

ANSWERS MAY VARY – ACCEPT FEASIBLE ANSWERS (10)
[16]

QUESTION 2

(The inverted U theory predicts that as arousal rises so does the standard of performance, until the athlete reaches the optimal point. After this point is reached the person will become over-aroused and performance will drop. Arousal is a level of excitement. When it is high the person tends to behave in an intense, excitable way.
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.
So it's important that a coach assess the appropriate levels of arousal for each task in order to ensure that the optimum level is achieved.)

2.1 A young player will have a different level of arousal compared to an older, elite athlete. What might be easy for an elite athlete will involve a lot of information processing for the younger player.

Younger players are considered beginners and are in the cognitive or associative stages – they need to concentrate.
This aroused state is often associated with emotional states of fear, anger, tension, worry, apprehension and anxiety.
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.
A beginner will pay attention to things related to the main task, e.g. how to hit a ball rather than on more advanced tasks like where to hit the ball. Their ability to focus their attention is severely hampered if arousal levels increase.
Perceptual narrowing will continue and this will cause the athlete to miss important cues and this will have a negative effect on performance.
The coach will need to keep the player calm and confident because being a beginner there will be intense anxiety. (4)

2.2 An athlete with confidence tends to seek challenges – they could set the heights too high, they could sit out some heights and then not be able to clear them.
Extroverts perform better at a high level of arousal.
The coach will need to get the jumper psyched up BUT still be able focus when needed. (4)

2.3 The precision of dart throwing and aiming at a small target makes it a fairly complex skill and generally need a low arousal level. If the activity needs lots of accuracy then the effects of arousal will be more noticeable.
There will be added pressure with the TV crews present so the player will need to focus even more and block out the TV crews. (4)
[12]

QUESTION 3

3.1 The recorded time of a 100 m sprinter is the sum of 2 parts:

- The reaction time to the starter's gun
- The subsequent running time over the 100 m

Bolt could have incredibly fast reaction times and is usually the 1st person out of the blocks.
His strength allows him to exert large forces onto the starting blocks.
His training and conditioning.
ACCEPT FEASIBLE ANSWERS (3)

3.2 (Physical well-being includes – healthy body weight, sleep, disease and illness
Mental well-being includes – enjoyment, stress and anxiety, confidence and self-esteem, thinking processes)
Yes
High levels of motor skills and performance will not necessarily mean that an athlete has increased levels of health related fitness components. An athlete may be skilled but their lifestyle will influence their state of well-being, e.g. smoking, drinking alcohol and eating too much fast food or junk food will impact negatively on their health and well-being. This might not have an immediate effect on motor performance but will over time.
Excessive alcohol and junk food will ultimately lead to weight gain and this will also affect the quality of sleep. (4)

3.3 Pupils could use alternate words:

S – Specific.
Specific goals are more effective than 'do your best' goals, e.g. 'want to improve my time by 0,2 seconds'.
M – Measurable/motivational
Goals should be evaluated and measured
A – Agreed/accepted/accountable/action oriented
Must be agreed or accepted by coach and athlete
T – Time bound/timed/time based
Can be short, intermediate or long duration. There should be a time limit on when the goal must be achieved by.
R – Relevant/realistic
Should be challenging but attainable
E – Exciting/ethical
Prevents possibility of boredom. When a goal is challenging it becomes exciting
R – Recorded.
Progress should be written down and logged
LEARNERS TO EXPAND ON EACH (14)

3.4 3.4.1 Knowledge of results/performance provides the athlete with much more specific information about what they are doing well or what their weaknesses are. This information could come as a result of digital devices or from the coaches' observations. The athlete is able to improve his/her technique with the data provided. Developing an understanding will help the athlete to 'self-check' and correct techniques and this will result in improved consistency of skill execution.

Feedback is communication to a person or a team of people regarding the affect their behaviour is having on another person, the organisation, their own performance, or the team. Feedback allows you to judge if you are 'on the right track' or not. (4)

3.4.2 PUPILS NEED TO MAKE REFERENCE TO HIGH JUMP and THE NOVICE ASPECT

In sport it is vitally important to receive feedback as it enables you to improve on your performance. Feedback can be given during competition and/or at training.

Positive feedback

Affirming comments about past behaviour – a jump that has just been correctly executed. These are things that went well and need to be repeated. Athletes need to know if a movement is correct as it provides the reference point for future execution of the movement. Positive feedback is essential in motivating athletes. Positive feedback involves telling someone about good performance. Make this feedback timely, specific, and frequent → a beginner will need this feedback to be made after each jump whether practicing or competing. The information needs to be exact and specific and it needs to be given often.

Negative feedback

Also called 'corrective comments' about past behaviour. These are things that didn't go well. This is used to inform the athlete as to what was incorrect about the movement e.g your heels knocked the crossbar off because you didn't extend your legs quick enough. It should include info on the action/s required by the athlete to achieve the correct movement.

General feedback

This is feedback that doesn't go into great detail, e.g. 'you are jumping much better'. It doesn't really help an athlete improve on technique or performance but might make them feel a little more positive.

Specific feedback

This is the type of feedback that most athletes prefer. It is detailed and specific to their actual performance, e.g. 'you need to stretch your right arm over the crossbar sooner when taking off'. This type of feedback gives the athlete the type of information they need in order to improve.

Extrinsic feedback
Extrinsic feedback is the information that a jumper receives from an outside source. This information may come from a coach, a teammate, heights achieved during a competition or a videotape/DVD.

One of the difficult aspects of coaching is being able to tailor feedback to the individual needs of the athlete. Younger jumpers with little or no experience will rely more on the extrinsic feedback from a coach. If you ask a beginner how a jump felt, they will look at you with a blank stare and reply, 'I don't know.'

Keeping extrinsic feedback simple means giving athletes the type of feedback that is most relevant at a particular moment. In other words, quality is more important than quantity. That way you will direct athletes' attention to the most important information without overloading them.

The best feedback is sincerely and honestly provided to help. Successful feedback describes actions or behaviour that the individual can do something about.

Check to make sure the other person understood what you communicated by using a feedback loop, such as asking a question or observing changed behaviour. (6)

3.5 Ringelmann effect:

- A coach needs to ensure that he/she does not have an unnecessary large number of players sitting on the bench – don't have too many reserves.
- A netball squad consisting of possibly 10 players as opposed to 15 players will work more efficiently. There will be less co-ordination problems.
- Hockey squad shouldn't have more than approx. 16 players for the same reason above.

Social Loafing:

- This often happens when an individual or group of individuals feel that the other team mates are not trying hard enough or putting in less effort.
- A coach also needs to guard against 'causing' social loafing. This occurs when a player feels that their performance is never watched or appreciated by the coach.
- Any player with low self-esteem will develop a strategy of social loafing to protect their ego.
- Also a player that has experienced a negative situation (e.g. being ridiculed) will also develop a strategy of social loafing. (6)

[37]

QUESTION 4

Table 1

NEWTON'S LAWS	
Define Newton's 1st Law	(Law of Inertia) An object will resist change in their state of motion (rest or moving). 'a body continues at a state of rest or uniform velocity unless acted upon by an external force'. (2)
How is Newton's 1st Law applied in physical activity?	A large rugby player will be slower to start moving but more difficult to stop at full speed. ACCEPT FEASIBLE EXAMPLES (2)
Define 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'. The greater the force applied, the larger its acceleration will be in the direction of the applied force. (2)
How is Newton's 2nd Law applied in physical activity?	A ball hit with great force will fly faster and further than a ball hit with less force. ACCEPT FEASIBLE EXAMPLES (2)
Define Newton's 3rd Law	'for every action there is an equal and opposite reaction.' (2)
How is Newton's 3rd Law applied in physical activity?	A person running – his/her foot/leg will apply a force to the ground. The ground applies an equal and opposite reaction force to the foot. ACCEPT FEASIBLE EXAMPLES (2)

Table 2

STABILITY	
Define 'Static Balance'	Static balance means the object is balancing without movement or with very little movement. (2)
How is the principle of balance applied in physical activity?	An athlete will stand with a lower stance with a wide base of support when expecting to be tackled in rugby or thrown in judo. This allows them to keep their balance while dealing with external forces. ACCEPT FEASIBLE EXAMPLES (2)

Table 3

FORCE SUMMATION	
Define 'range of motion.'	To get maximum force on an object, all segments must use their greatest range of motion. This increases the amount of force produced. This will also increase the speed that the limbs move at. (2)
How is range of motion applied in physical activity?	When throwing a javelin, the upper body and the arms swivel and rotate. The arm is stretched to its fullest before the javelin is thrown. ACCEPT FEASIBLE EXAMPLES (2)
Explain the principle 'co-ordination continuum.'	In order to get the highest amount of force, each body segment must follow the previous segment in the correct order. Each segment must reach peak force before the next segment comes into play. This will allow for maximum force between body parts. (2)
How is the co-ordination continuum principle applied in physical activity?	When spiking a ball in volleyball or taking a jump shot in basketball, the force starts in the lower limbs and gets transferred progressively through the body until it reaches the upper limbs. The motion must be fluid and well timed. ACCEPT FEASIBLE EXAMPLES (2)

Table 4

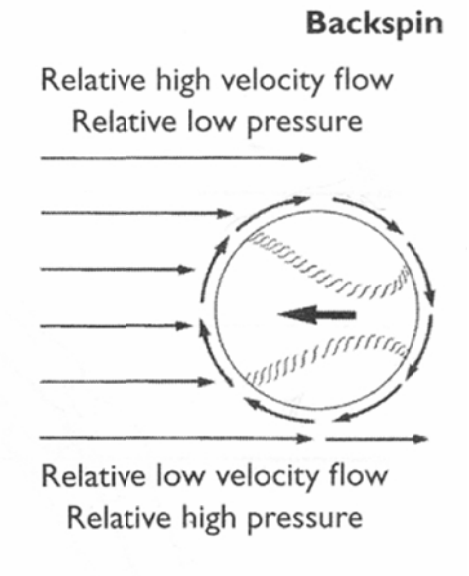
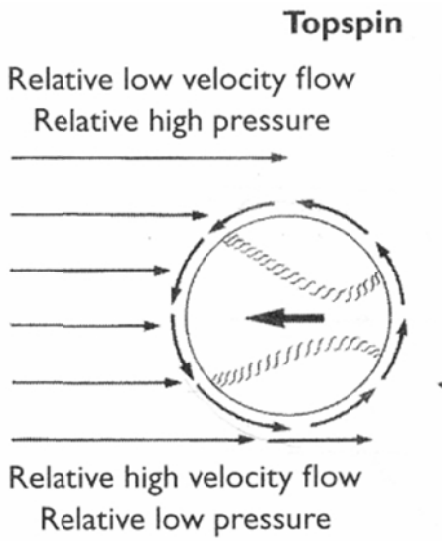
PROJECTILE MOTION	
Explain the optimal projection principle.	Height, speed and angle of release will have a huge impact on the object's flight path and the distance it covers. Angle of release → for any given speed of release, the optimum angle of release is always 45 degrees. This assumes that there is no air resistance. In sport though, the angle of release is usually lower, around 35 – 45 degrees. (3)
Provide examples of how the principle of optimal projection is applied in physical activity?	A ball thrown will have to have its flight path adjusted depending on whether it needs to be thrown far or close. E.g. In cricket or softball – the flight path from a player standing on the boundary will be different from that of a player standing near the pitch. ACCEPT FEASIBLE EXAMPLES (2)
Illustrate the physics of ball spin when a force is applied by a tennis racquet to a tennis ball.  	Spin occurs when a force is applied away from and not through the object's centre of mass. This causes the object to curve in the air.  (4)
Is the outcome illustrated above sidespin, topspin or backspin?	Topspin and backspin or side spin (depending on illustration) in tennis is caused when the ball is hit either above or below the centre of mass. ACCEPT FEASIBLE EXAMPLES (1)

Table 5

FORCE	
Define 'Momentum.'	This is the amount of motion found in a moving object. This is the quantity of motion and is 'mass on the move.' The amount of momentum possessed by a body depends on its mass and its velocity. If the mass or velocity increases then the momentum will increase and vice versa. Momentum = mass x velocity Mo = mv (2)
How is the Principle of Momentum applied in physical activity?	Momentum plays an important role in contact sports. The result of the impact will depend on the momentum of each of the colliding bodies just before they crash into each other. A player with more speed who weighs more, will be harder to stop than a smaller player. ACCEPT FEASIBLE EXAMPLES (3)

[39]

QUESTION 5

5.1 **Diagram 1 – skier**

Learners to relate the answer to a skier

Force is a push or pull that alters or tries to alter the state of motion of a body.

A force can:

- make a still object or body move – the skier will apply force onto the ski/snow to start moving.
- make a moving object change direction – using poles to change direction to zigzag in and out of slalom poles, or to avoid obstacles or to zigzag down a slope.
- make a moving object accelerate or decelerate – depending on the amount of force initially applied, the skier will accelerate quickly at the start. Depending on the amount of force exerted on the side of the ski, the skier will slow down or stop abruptly.

The extent to how effective the force is depends on:

- where the force is applied.
- the size of the force.
- the direction of the force.

A skier will balance if their centre of mass is directly above their base – i.e. the ski; the force of gravity will act directly down so that the weight is fully on the base. As soon as the centre of mass moves away from its stable position above the base, gravity will act more on the one side that the other. The object will turn and fall: it has become unstable. If the skier leans over too much, they will become unstable and fall over. They are effectively balancing and placing downward force on a very small surface area when zigzagging. They will transfer their body weight from ski to ski and from side in order to weave down the slope.

A low centre of mass is an advantage as it makes a person more stable. That is one reason why skiers bend their knees.

A person's centre of gravity shifts with every movement they make.
When skiers start learning they will often have their skis considerably further apart than hip width. This gives them a bit more static/low speed balance as they have a wider stance, but it does make turning more difficult and slower, because they have to move their body further to move their weight from ski to ski. This is a trade off between balance and ease of turning, and is not ideal, but it does not matter too much in the early learning stages. What is important however is not to have the skis too far apart, as this can cause problems.

When leaning over in turns, we keep the body more upright that the legs to keep a more adaptable stance, and transfer the weight more efficiently.

A downhill skier wants to minimise the friction force because it acts opposite to their direction of movement and will slow them down. That is why they spend lots of time putting wax on the bottom of their skis so that it decreases the friction between the ski and the snow.

Weight transference and force application need to be correctly timed otherwise the skier will tumble. (3)

Diagram 2 – rugby scrum

Learners to relate the answer to a rugby scrum

Force is a push or pull that alters or tries to alter the state of motion of a body

A force can:
- make a still object or body move – depending on the amount of force applied as the ball is thrown into the scrum, will affect how much movement follows.
- make a moving object change direction.

The extent to how effective the force is depends on:
- where the force is applied if the force is not direct, the scrum will swing.
- the size of the force – the greater the force, the further the scrum will move.
- the direction of the force – if the force is direct, straight on, the scrum will be most effective.

A team scrumming will be most balance if its centre of mass is directly above its base; the force of gravity will act directly down so that the weight is fully on the base as soon as the centre of mass moves away from its stable position above the base, gravity will act more on one side that the other. The scrum will turn and fall: it has become unstable.

Weight transfer
Both teams stand upright when binding. They then lean forward before they engage with force. At the moment that they should fall on their faces, they are held in place by their opponent. And their weight is transferred forwards and their centre of gravity is very far forward – hence the collapse of scrums. (3)

Diagram 3 – skeleton racing

Learners to relate the answer to skeleton racing

Force is a push or pull that alters or tries to alter the state of motion of a body.

A force can:
- make a still object or body move – the racer will push off the ice and run pushing the skeleton sled in front, the amount of force will impact on the speed.
- make a moving object change direction – to steer, the athlete presses their foot into the ice with some force.
- make a moving object accelerate or decelerate.

The extent to how effective the force is depends on:
- where the force is applied.
- the size of the force.
- the direction of the force.

After sprinting 50 m, the slider must quickly board the sled without losing any of the momentum that has built up.

The sled will be most balanced if the athlete's centre of mass is directly above its base; the force of gravity will act directly down so that the weight is fully on the base. As soon as the centre of mass moves away from its stable position above the base, gravity will act more on one side than the other. The sled will turn and fall: it has become unstable. The slider steers by slightly shifting his or her body weight to the left or right. At the end of the run, the slider slows the skeleton to a stop by dragging his or her feet along the icy track. You steer by shifting your weight slightly, or by tapping a toe or toes on the ice. Dragging your toes slows you down if you think you are going too fast and might crash. (3)

5.2 Internal force – caused by muscle contraction
External force – a force that results from outside the body (2)

5.3 Internal force – bicep curl – the biceps brachii contracts causing flexion of the elbow.
ACCEPT FEASIBLE EXAMPLE (1)

External force – air resistance, drag, friction, weight, reaction, gravity
ACCEPT FEASIBLE EXAMPLES (1)

5.4 5.4.1 Action force – arm muscles pulling back on the bow and arrow
bowstring pushing on the arrow (4)

Reaction force – force of the bow and bowstring pulling against the fingers
arrow pushing back on the string. This reaction force will also be felt by the archer as the recoil. (4)

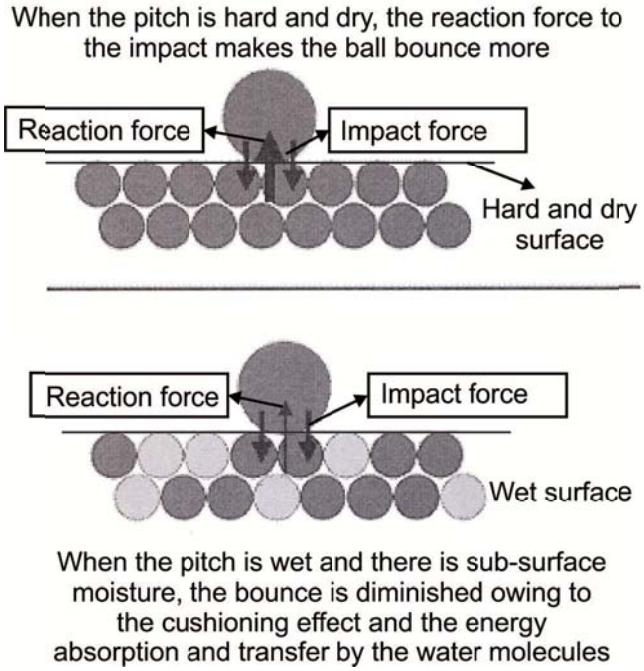
5.4.2 Action force – as the gymnast approaches the springboard they will push hard against the ground to jump onto the springboard OR the gymnast will jump hard onto the springboard. (2)

Reaction force – the force of the gymnast added to the springs in the springboard will push the gymnast into the air with a great deal of velocity and force. This force is larger than the gravitational force so the gymnast is lifted. (2)

5.4.3 (a) Clay: the ball will slow down after bouncing – rough surface = greater friction. The balls bounce relatively high and more slowly.

Grass: Wimbledon grass is cut extremely short. Very little friction. Ball bounces fast and true. Unless the grass is wet.

Acrylic/Hard court: the ball will skid across the surface.
Hard courts are also considered as 'fast' surfaces, where fast, low bounces.



(3)

(b) Clay: The player slides and stops very slowly.

Grass: immediate stop, can be slippery when wet.

Acrylic/hard court: player slides before stopping but will stop quicker than when on a clay surface. (3)

[31]

QUESTION 6

6.1 People have become more sedentary.
More and more fast food outlets
Schools offering less sport/no PE lessons
Adults drive everywhere
From age 20 most adults are working and have less time for sport and recreation
ACCEPT FEASIBLE EXAMPLES (4)

6.2 Consult a doctor before exercising
Never exercise alone
Always wear a bracelet that identifies your condition
If you inject insulin, inject it into a muscle that won't be exercised
Type 1 diabetic, should eat 15 – 30 g of carbs during each 30 minutes of intense exercise
Eat carbohydrate snack after exercise. (3)
[7]

QUESTION 7

7.1 7.1.1 Ball B (furthest from the hinge) will accelerate faster and travel further than ball A. (2)

7.1.2 This occurs because the contact time of ball B against the door will be longer than ball A. Ball B has a longer lever. (2)

7.2 7.2.1 A long lever can be more difficult to control and can be less accurate when hitting a ball.
The hitter could lose balance too. (2)

7.2.2 A long lever can be more difficult to control and can be less accurate.
A long lever (the leg) travels further and can be seen for longer – the opponent therefore has more time to avoid the kick. It also means that the kicker is off balance and open for a counter punch. (2)
[8]

Total: 150 marks