NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2015

SPORTS AND EXERCISE SCIENCE PAPER 1

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 ***Any 3 of the following:***
Men's sport is generally stronger, faster and so more exciting.
Their results are quicker, distances thrown or jumped further/higher.
More men watch TV.
More men participate in sport
Historically sport was 'for men'
Lack of opportunities for women (3)

1.2 1.2.1 ***Any 1 of the following:***
Lead to increased participation
Better health
National identity
Females try to prove their abilities (1)

1.2.2 ***Any 1 of the following:***
Women aren't as good as men
Sport is for men
Males and females can't compete on equal footing
Women sport is only aired when no other sport is available
Less acceptance of females (1)

QUESTION 2

2.1 2.1.1 ***Any 3 of the following:***
Crowding
Crime
Traffic
Poor air quality
Lack of parks & sport facilities
Finances
Age
Environment
Lack of time
Discrimination
Obesity
Disability
Diseases
Lack of motivation (3)

2.1.2 Learners must relate their answers to the factors listed in 2.1.1
One mark per explanation per factor.
For example:
Crowding – not enough space to train in an overcrowded facility
Crime – people are afraid to exercise in parks at night
Pollution – people do not want to run where they are breathing in smog or exhaust fumes (3)

2.2 Learners must provide a solution to their answer provided in 2.1.1
Allocate 1 mark per solution.
For example:
Crowding – build more facilities
Crime – exercise/run in groups for safety. Choose a well-lit area to exercise in.
Pollution – government could impose stricter fuel emission rules. (3)

2.3 ***Allocate 1 mark per solution***.
For example:
Education Department insists that all schools offer physical education lessons.
Government builds more stadiums and facilities
Increases in tax on tobacco and alcohol
Reduce salt and other unhealthy components in food by law
Stricter environmental controls on pollution (2)

2.4 ***Learners to provide 2 solutions. Allocate 1 mark per solution.***
For example:
Increase the number of PE lessons
Have compulsory extramural sport
Introduce competitions at school – inter class or inter grade (2)

2.5 2.5.1 ***Any 2 of the following: 1 mark per strategy***
Provide activities for the parents, reduce fees for juniors, allow free/reduced cost round for parents, running clinics in schools, provide vouchers for young people to play, club-sponsored school competitions and 'bring a friend' days
Increase advertising
Prizes (2)

2.5.2 ***Any 3 of the following: 1 mark per suggestion***
Provide specialist training for coaches
Facilities for adaptation of sports should be available
Use of lighter, smaller, different coloured balls
Short-handled racquets
Lower nets
Smaller playing areas
Increase in team numbers
Promote positive images for disabled sportsmen and women
Provide equal access to competitions
Unemployment amongst disabled people tends to be high. Where this is the case financial support should be provided
Promote sport that encourages both disabled and able bodied sportsmen to participate alongside each other.
Increase number of coaches and volunteers so players get individual attention
Introduce rehab centre
Make rules more user-friendly (3)

QUESTION 3

3.1 3.1.1 ***1 mark for naming the energy system. 1 mark for reason.***
ATP/PC; Anaerobic energy system/phosphagen system/Alactic system
All the energy is coming from supplies immediately available in the muscles,
100% intensity.
The ATP-CP system is for immediate activity. (2)

3.1.2 ATP/PC/Anaerobic energy system/phosphagen system/Alactic system
Single maximum effort
All the energy is coming from supplies immediately available in the muscles, 100% intensity
The ATP-CP system is for immediate activity. 0-15 seconds (2)

3.1.3 Aerobic energy system/Oxidative system
The Aerobic system is for long term activity. Longer than 3 minutes (2)

3.1.4 Lactic acid system/Glycolytic system or ATP
The runner will be sprinting hard at 100% and will rely on the lactic, anaerobic system. (2)

3.1.5 (i) ATP/PC/Anaerobic energy system/phosphagen system/Alactic system
Initially, the incline is steep and intensity is high. 80 – 100% effort (2)

(ii) Lactic acid system/Glycolytic system
By the time the jogger reaches the top of the hill, the ATP/PC will have run out and the lactic acid system will come into play. 80-100% intensity. (2)

3.2

Event	**Predominant energy system**
100-m sprint	ATP/PC
Long Jump	ATP/PC
800 m	Anaerobic lactic
Javelin	ATP/PC
3 000 m	Aerobic / Oxidative

(5)

3.3 ***1 mark for each energy system. 1 mark for stating when that energy system is used.***
For example:
Start of race, during the first 10 seconds, the ATP/PC system is used.
After this, the lactic acid system kicks in. Glycolysis
Once the athlete runs at a steady pace, the aerobic energy system is used.
Should the athlete give a final burst at the end, the athlete will move back into the lactic acid system. (6)

3.4 ***The learner needs to comment that the training programme needs to match the activity by training the appropriate energy system.***
Allocate 3 marks for explanation.
Allocate 2 marks for examples.
If no examples are provided, the learner only receives marks for the explanation.
For example: When planning a training programme the coach will know which energy system is the predominant one needed for the athlete's event. They can then work that particular energy system more than the others. They would still need to work all three systems because all 3 come into play at some stage when exercising … but they can focus more on the main one.

The Alactic Energy System
To develop this energy system, sessions of 4 to 8 seconds of high intensity work at near peak velocity are required e.g.
- 3 × 10 × 30 metres with recovery of 30 seconds/repetition and 3 minutes/set.
- 15 × 60 metres with 60 seconds recovery
- 20 × 20 metres shuttle runs with 45 seconds recovery

Influence of the recovery time
The length of recovery between repetitions is important in the recovery of power output through the resynthesis of CP. E.g. 6 second sprints with recovery intervals from 15 to 180 seconds results in an 81% recovery in peak power output (PPO) with a 1 minute recovery and a 92% recovery of PPO in 3 minutes

The Lactate Energy System
Sessions to develop this energy system:
- 5 to 8 × 300 metres fast – 45 seconds recovery – until pace significantly slows
- 150 metre intervals at 400 metre pace – 20 seconds recovery – until pace significantly slows
- 8 × 300 metres – 3 minutes recovery (lactate recovery training)

Distances of 300 – 600m may be used by coaches to do high lactate work. High quality lactate work can shock the body and the central nervous system. Thus, loads (Total Distance and Volume) and intensities must be progressively sequenced. For example, sequencing workouts to prevent injuries may be achieved by planning each day of the week of an entire year. Each workout is a single unit of preparation designed to produce a desired result and each session is more demanding than the previous.

Anaerobic Capacity and Anaerobic Power
Anaerobic Capacity refers to the body's ability to regenerate ATP using the glycolytic system and Anaerobic Power refers to the body's ability to regenerate ATP using the phosphagen system. These energy systems can be developed with appropriate interval training sessions.
Points that must be followed in the training sessions: 1) the speed component of anaerobic metabolism should be trained when no fatigue is present, 2) most athletes require 24 – 36 hours of rest with low intensity work before doing maximum speed work again, 3) work sets of around 3-4 repetitions with 2-3 minutes recovery between repetitions, and 8-10 minutes recovery between sets is recommended for maximum results to occur, 4) the time period necessary for the proper resynthesis of ATP and CP recovery rates for CP resynthesis and 5) four (4) sets, involving 600m (ie. 4 × 4 × 65 m) in total distance in a practice session is sufficient to stimulate this system.

To challenge the Anaerobic Phosphagen Energy System high intensity workouts of 4 to 7 seconds are necessary. For example, 30 – 50m of maximal sprinting or 3 – 5 repetition-sets of weightlifting.

The Aerobic Energy System
This energy system can be developed with various intensity (Tempo) runs.

The types of Tempo runs are:
- *Continuous Tempo* – long slow runs at 50 – 70% of maximum heart rate. This places demands on muscle and liver glycogen.
- *Extensive Tempo* – continuous runs at 60 - 80% of maximum heart rate. This places demands on the system to cope with lactate production. Running at this level assists the removal and turnover of lactate and the body's ability to tolerate greater levels of lactate
- *Intensive Tempo* – continuous runs at 80 to 90% of maximum heart rate. Lactate levels become high as these runs boarder on speed endurance and special endurance. Intensive tempo training provides the base for the development of anaerobic energy systems

Sessions to develop this energy system:
- 4 to 6 × 2 to 5 minute runs – 2 to 5 minutes recovery
- 20 × 200m – 30 seconds recovery
- 10 × 400m – 60 to 90 seconds recovery
- 5 to 10 kilometre runs (5)

QUESTION 4

4.1 Learners must clearly state 2 advantages and 2 disadvantages that they relate to netball.
Allocate 2 marks for the 2 advantages.
Allocate 2 marks for the 2 disadvantages.
For example:
Advantages:
Fat is an energy source needed to provide sustained energy for an entire match without feeling fatigued.
Fat provides a slow release of energy for the low intensity, aerobic work required during a match.

Disadvantages:
Eating too much fat could cause obesity, which will slow the player down on court.
Too much fat can cause diseases like diabetes and high blood pressure, which will negatively affect performance.
Fatigue quicker (4)

4.2 Food intake containing the correct quantity of all the nutrients needed for energy balance (2)

4.3 4.3.1 Allocate 1 mark for stating the effect.
Blood glucose will increase. This causes an insulin surge increasing reliance on muscle glycogen
Increases in fluid loss into gut increasing dehydration.
Leads to decreased performance due to difficulty in mobilising glycogen
He will initially feel a 'sugar high' but then will feel a loss of energy and will feel fatigues.
The immediate result is a sharp, quick rise in blood glucose levels (2)

4.3.2 It means eating or drinking enough carbs on a daily basis – not only 2-3 days before an event – to maximise glycogen storage so that sufficient glucose is available for the demand.

4.3.3 Accept either
Barry will perform better OR
Barry will be able to perform for longer before starting to feel tired. (1)

4.3.4 Learners must refer to carbohydrates and not to general diet.
Allocate 2 marks for referring to eating carbs **before** an event with an example.
Allocate 2 marks for what the athlete must eat the day before the event.
Allocate 2 marks for pre-event meal.

2-3 days before an event
Eat a high-carb diet made up of bread, potatoes & pasta. The glycogen stored in the liver & muscles then becomes optimal.

It is NB to drink more water than normal when carbo-loading.

Ideas:
Eat low GI cereals, bread, fruit & fruit juices for breakfast.
Use low fat or fat free milk or yoghurt.
Keep fat content low
Eat high carb snacks
Substitute pasta (macaroni, spaghetti) for some of the meat/fish/chicken
Eat more potato, especially baby potatoes with skin

If Barry is still exercising 2-3 days before competition (i.e. not resting), then he must make sure that his carb choice before exercise is low GI and the carbs eaten after exercise are intermediate or high GI --- if exercise lasts 1 hour or longer.

Day before an event
Eat balanced meals & snacks containing low GI foods e.g. starches, fruit, veg, legumes. Also eat small or moderate amounts of lean protein (tuna, skinless chicken) and fat.
Don't skip meals or skip your snacks as your muscles don't have enough carbs for the event yet.
Eat a predominantly carb meal on the night before the event (pizza, pasta) instead of steak.
Drink fluid.

Pre-event
Barry needs to consume carbs 2-3 hours before an event and then again 1 hour before. These carbs should be low GI carbs. (6)

QUESTION 5

5.1 ***Any 2 of the following:***
Decreased
- Blood volume
- Muscle mass/strength
- Reaction time
- Slower protein synthesis
- Recovery rates
- Basal Metabolic rates
- Cardiac output OR stroke volume
- Increased body fat levels/decreased power to weight ratio
- VO2 max
- Flexibility
- Anaerobic threshold
- Lung capacity/ventilation

Increased cholesterol levels
Weaker joints, bones (2)

5.2 ***Any 2 of the following:***
Decreased body fat/weight
Systolic blood pressure drops
Cholesterol levels lower
Arterial wall elasticity increases
A high-level answer might be:
Physical activity over a long period lowers systolic blood pressure reducing pressure on arterial walls and strain on the heart. (2)

5.3 ***Any 3 of the following:***
Social activity will increase
Self-esteem/sense of achievement
More productive lifestyle
Stress may be reduced
Skill development increases
Decreased health care costs
Inclusivity (3)

5.4 ***Any 2 of the following:***
Learner must provide 2 reasons that are both substantiated
Allocate 1 mark for each reason
Allocate 1 mark for each substantiation
For example:
Genetic predisposition – these athletes have the gene that enables them to run great distances with minimum stress
Somatotype – they are ectomorphs with longer limbs and little body fat
Other possible reasons could be:
Diet
Living and training at altitude
Muscle fibre composition (slow twitch)
Motivated to achieve economic success
High haemoglobin
Extensive walking and running at an early age (4)

5.5 During exercise, the rhythmic pump of your muscles facilitates venous return by forcing blood through the one-way valves that lead to the heart. Increased lung activity creates a change in thoracic pressure that draws blood toward your heart. Regular exercise improves venous return by increasing total blood volume, increasing end diastolic volume, and increasing the size and contractile strength of the heart muscle.
Muscle action compresses veins. Veins have one way valves to prevent back flow. Blood gets pushed to the heart.
Pocket Valves: located within the veins prevent the backflow of blood and help it towards the heart
Muscle Pump: Many veins are situated between skeletal muscles, which when they contract and relax, squeeze on the veins and help push the blood back towards the heart.
Smooth Muscle: The wall of each vein contains smooth muscle which contracts to help push the blood back towards the heart
Respiratory Pump: The respiratory pump helps return blood in the thoracic cavity and abdomen back to the heart. Whilst exercising we breathe faster and deeper which rapidly changes the pressure within the thorax between high and low to help to squeeze the blood in the area back to the heart.
Gravity: Veins in the upper body are aided by gravity in order to return blood to the heart (4)

5.6 Increased metabolic activity and increased lactic acid result from exercise. This is detected by chemoreceptors. The message is sent to vasomotor control centre/ medulla. Adrenaline/noradrenaline is produced.
Vasoconstriction to organs
Vasodilation to muscles
Heart rate increases and blood transfers quicker (6)

5.7 ***Any 3 of the following:***
The coach will then know to include active recovery or cool down to reduce muscle soreness.
Build up training intensity gradually
Aerobic training increases capillarisation within muscles which allows oxygenated blood to reach lactic acid in muscle cells.
A fitter person won't suffer as much. (3)

5.8 The athlete will gulp in air to pay off the oxygen debt
He/she will have to stop all- out effort (2)

5.9 Learner must interpret the 3 phases of the graph
Allocate 2 marks per phase.
For example:
Initially (125 – 200W) both athletes produce equal amounts of blood lactate.
Once the work rate increases from 250W, there is a difference between the trained and untrained athlete. OR The untrained athlete builds up LA much sooner than the trained athlete, which negatively impacts on the untrained athlete.
The trained athlete can train at a more intense work rate – 400 W compared to the untrained athlete – 350 W because the lactic acid build-up in the untrained athlete forces him/her to stop or slow down. (6)

QUESTION 6

6.1 ***Any TWO of the following:***
Dynamic strength
Explosive strength
Cardiovascular endurance (stamina)
Flexibility
Speed
Agility
Power
Coordination
Muscular endurance
Balance
Reaction time (2)

6.2 Learner must explain why the 2 components will improve **football** performance.
Allocate 1 mark per explanation.
For example:
Explosive strength – allows player to execute quick bursts of speed when dodging opponents.
Flexibility – allows the player to lift their legs high enough when intercepting a ball without causing injury.
Power – allows the player to kick the ball with force when shooting at goal. (2)

6.3 Warm up increases muscle temperature. This, in turn, improves extensibility and elasticity of muscle fibres. Muscle viscosity decreases. (2)

6.4 Answer must refer to football.
Allocate 2 marks per phase – 1mark for naming the phase and 1 mark for explanation.
For examples:
Preparation phase/preseason
General fitness work will be developed to build up endurance needed in a football match.
Competition phase/during the season/in season
Specific skills needed for football will be worked on.
Transition phase/off season
General fitness training will be done to maintain fitness levels and allow the body to recover.
Active rest (6)

6.5 ***Any 3 of the following:***
Provides qualitative or quantitative details of whether the programme is effective/working
It substantiates specific fitness/skill progress
It ensures that overload/progressions that are applied are appropriate
Provides evidence to compare progress/targets/improvements
Enables changes/adaptations to be made to the programme to ensure further challenges and progress
Promotes motivation and challenge
Prevent injury (3)

6.6 ***Any 1 reason for each factor***
Factor 1 – Excessive dieting
Diets can result in feeling fatigued.
If a person battles to maintain the eating plan, they could feel like a failure and worthless.
Excluding certain food groups could result in the body losing proper function
Eating disorders

Factor 2 – Overtraining
Training too hard results in the body being pushed beyond what it can cope with. This can cause stress, fatigue, tiredness and even injury.

Factor 3 – Using performance enhancing drugs
Drugs can be addictive, overdose
There are many side effects viz. irritability, sleep problems, vomiting, nausea, mental problems, loss of co-ordination, heart attack

Factor 4 – Using supplements
A person could overdose on a certain nutrient
This could result in stress on the internal organs e.g. liver and kidneys
They could give a person a false sense of security if they use a supplement instead of eating healthy food (4)

6.7 6.7.1 ***Any 2 of the following:***
Heredity/genes
Training
Age (VO_2max decreases about 1% per year. The age that it starts decreasing depends on the training.)
Sex (females have about 20-25% less than men. This is mainly because women are smaller – smaller lungs, smaller heart)
Tennis player is female – smaller lungs, smaller lung volume
The long distance runner is genetically predisposed to the sport
VO_{2max} depends on body mass as well as fitness level so comparisons can't be made between individuals of different body mass (2)

6.7.2 Their body can transport and use oxygen efficiently which will enable them to continue running for longer before feeling fatigue. (1)

QUESTION 7

7.1 ***Any 4 of the following:***
Allow more flexibility to miss training if the pupil has too much homework.
Be fair to all – equal court time
Show an interest in the players – equal interest
It isn't just about winning
Don't shout
Discourage spectators from screaming insults – sportsmanship
Employ qualified coaches
ACCEPT FEASIBLE SUGGESTIONS relating to the data provided (4)

7.2 ***Any 1 of the following:***
Strategic plan
- Provide rackets for pupils to use at each training session
- Approach a sports shop/company to see if they will donate equipment OR give discount
- Approach a local tennis club to see if they will allow free membership for school children
- Ask for donations of old equipment from the community

ACCEPT FEASIBLE RESPONSES (3)

7.3 ***Any 3 of the following:***
Communication involves:
- Talking loudly, clearly, slowly
- Remove distractions
- Listening to others
- Watching body language
- Asking questions
- Thinking clearly to emphasise NB/important points
- Knowing how much information to give
- Being positive & encouraging (3)

7.4 ***Any 2 of the following:***

A free shot at the goals in basketball
Shoot further from the post
Limit time to shoot
Provide a good opponent
Use the weaker hand
ACCEPT OTHER FEASIBLE ANSWERS
Introduce noise factor (2)

Dribbling a soccer ball.
Limit time
Provide a good opponent
Use the weaker foot
Play on an uneven surface
ACCEPT OTHER FEASIBLE ANSWERS
Introduce noise factor (2)

Swimming freestyle.
Limit time
Reduce breathing
Provide resistance / attach a light weight
ACCEPT OTHER FEASIBLE ANSWERS (2)

QUESTION 8

8.1 ***Any 2 of the following:***
Mexico City is found at 2 240 m – high altitude where the air is thinner, reduced atmospheric pressure.
Competing at altitude benefits explosive sports that are anaerobic e.g. long jump.
He could have included altitude training in his preparation. (2)

8.2 Thinner air will hinder aerobic performance as there is less oxygen available.
Marathon runners need considerable oxygen to compete. With less oxygen available they will be gasping for breath and will struggle. (4)

8.3 ***Allocate 2 marks per phase.***
Before exercise, anticipatory rise occurs where there is a slight increase in ventilation. This is caused by adrenaline.
Once an athlete starts exercising, there is a rapid increase in ventilation. With sub-maximal exercise, it will eventually plateau – steady state.
At this point, the energy demands of the muscles are being met by the oxygen that is available. The body is also able to expel CO_2 effectively.
With maximal effort – ventilation increases until exercise is finished. If the exercise is intense, the amount of oxygen is not sufficient to meet the demands and the athlete will be forced to stop or slow down.
After exercise, during recovery, ventilation initially drops rapidly and then tapers off to a slower decrease. The more intense the exercise, the longer it takes to recover and the longer ventilation stays above the normal rate. This is mainly due to the removal of by-products like lactic acid. (6)

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