NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2011

SPORT AND EXERCISE SCIENCE: PAPER I

MARKING GUIDELINES

Time: 2 hours 150 marks

These marking guidelines were used as the basis for the official IEB marking session. They were prepared for use by examiners and sub-examiners, all of whom were required to attend a rigorous standardisation meeting to ensure that the guidelines were consistently and fairly interpreted and applied in the marking of candidates' scripts.

At standardisation meetings, decisions are taken regarding the allocation of marks in the interests of fairness to all candidates in the context of an entirely summative assessment.

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, and different interpretations of the application thereof. Hence, the specific mark allocations have been omitted.

QUESTION 1

1.1 A = Phospho-creatine system/Alactic or ATP-PC system/Anaerobic CP system
B = Anaerobic lactic acid system/Lactic acid system/Glycolytic system
C = Aerobic system (3)

1.2

A	B	C
Phospho-creatine system/Alactic or ATP-PC system/Anaerobic CP system	Anaerobic lactic acid system/Lactic acid system/Glycolytic system	Aerobic system
This is used for high intensity activities that last up to 30 seconds. Energy is supplied through the consumption of creatine phosphate. There are no by-products and it keeps going until all the stored energy is used up. This is when performance will suffer. This pathway replenishes after 2 or 3 minutes. (Golf swing;100 m; Powerlifting)	This is used for activities short in duration and highly intensive. The activity normally lasts for 30 – 90 seconds. Energy is supplied through the consumption of carbohydrates. This causes lactic acid to build up and this will affect performance negatively. At this point the athlete will either ease up or allow the aerobic system to continue fuelling the activity or they may completely just stop. (400 m)	Energy is supplied to the body through the use of oxygen. The oxygen combines with lactic acid to produce water. This means that there is no effect on the athlete's performance.

(12)

1.3 1.3.1 B (1)

1.3.2 Substitution
Timeout
Jump balls
Free shots
Injury (4)

1.3.3 The rest is not great enough for full recovery but is enough to prevent fatigue. Some stores will be available for energy production. Lactic acid production will be reduced. (3)

[23]

QUESTION 2

These 2 influences may be hard to separate. Someone might be physically strong because of their natural body type or it could be because they have been exercising hard. Both camps are right, within the context of their own arguments and experiences.
A person's ability is dependent on their genetics as well as their environment.
A person could be strong because they are born a mesomorph or because they are involved in a lot of physical activity.

Natural Talent
A person's genes are inherited and are passed down from generation to generation. These genes give a person their primary physical and mental characteristics. A child that grows up being physically active is more likely to have better movement patterns and coordination.

GENETICS
Examples of athletes, but any other appropriate athlete is fine:
American Reggie Miller was born with genes that would make him a good basketball player since he was born with potential to grow tall. Miller grew to be 6' 6". His older sister also became one of the greatest basketball players of her time. Therefore, it could be said that the Millers were born to play basketball.
Another example of a great athlete that was supposedly 'genetically' made is Lance Armstrong. He was born with an unbelievable lung capacity, a heart larger than normal and slow lactic acid build up. Believers in this theory say that he was a 'born' cyclist, because he was born with the ideal genetic makeup to become a pro cyclist.
Prof Tim Noakes visited Kenya, where he attended the Nairobi marathon. A woman in one of the rural villages was annoyed to be woken up every morning by her sqwarking chickens. She then discovered that the chickens were being frightened by a group of runners out for their morning training run. She asked them what they were doing and was told they were training for a marathon where there was good prizemoney. She started training and 3 months later became the champion. She clearly had natural talent.
Speed is the result of genetically determined factors meeting training effects. If you take a random sample of children from West Africa and another from a western European country, on average, the West Africans will be faster in a sprint race. That's natural ability, physiologically determined, though the exact genes and physiological characteristics that go into this performance remain inconclusively unknown.
Somatotype

ENVIRONMENT
Kenyan runners are the top distance runners in the world. This could be as a result of the fact that they live and train at high altitude. It could also be that no transport is provided to school and as a result they run to school every day. Their diet could also play a role in their success.
Role models: females have fewer sporting role models than males do. This could affect initial participation.
Finances
Access to facilities, training, coaches
Nutrition

MENTAL STATE
An athlete who is mentally strong is better able to set realistic goals, deal with disappointments, deal with injuries, etc.
Positive attitude
Ability to focus, visualise, mental rehearsal

Performance is the result of a cluster of physiological, psychological and environmental traits that are currently too complex for us to analyse. Hard work and training is one of them, and when one looks at the very top level of performers, the difference made by hard work becomes the tiny difference between victory and defeat.

The answer needs to show evidence of discussion with a decision as to whether the comment is valid or not.

The following rubric will be used to assess the learners:

	5	4 – 3	2 – 1
Content: Knowledge thoroughness	Significant instances of information that shows insight and understanding.	Some instances of information show understanding.	Very little evidence of understanding.
	4 – 5	2 – 3	0 – 1
Logical reasoning provided for supporting or refuting the statement.	Insightful and logical reasoning provided.	Some logical reasoning provided.	Little or no logical reasoning provided.
	3	2	1
Areas of relative contribution included	More than the 3 provided suggestions discussed.	3 provided suggestions discussed.	Only 1 or 2 provided suggestions discussed.
	2	1	0
Examples of elite athletes provided	Appropriate examples used for all suggestions.	Few examples used.	No examples used.

[15]

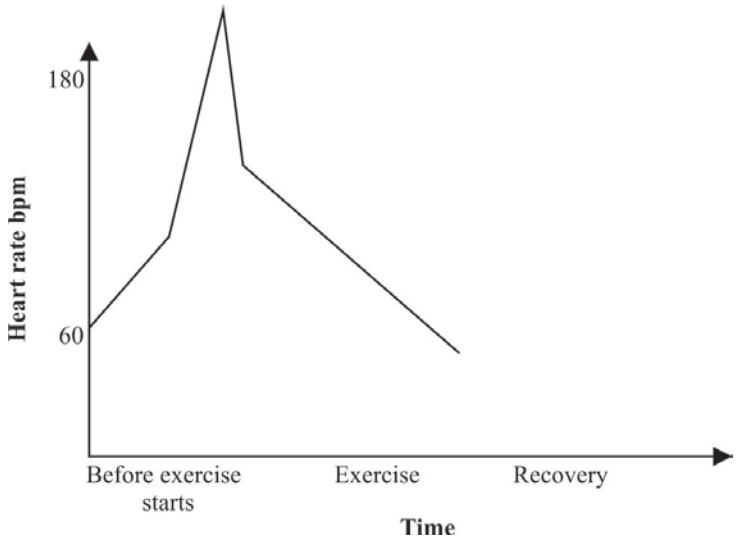
QUESTION 3

3.1 This graph shows the heart rate of an athlete. Before exercise starts the heart is beating at approx 70 b/m. The heart rate increases as the athlete exercises until it reaches a plateau at about 80 b/m. After exercise the heartbeat slows down again, until the heart is beating slower than originally. This athlete wasn't doing very strenuous exercise as the heart beat only increased slightly. (3)

3.2 Low intensity/sub-maximal exercise. (1)

3.3 The athlete's working pulse rate has only increased to 80 beats per minute. The athlete's resting heart rate is 60 bpm. Once exercise starts the heart rate increases rapidly until it reaches a steady rate. This rate stays constant during exercise. Once the activity is completed the heart rate drops rapidly to below 60. The quicker your heart rate returns to normal, the fitter you are. (4)

3.4



As gun goes there will be a rapid increase, then the increase slows.
At the end, there is a rapid decrease, then a slower decrease. (5)
[13]

QUESTION 4

Food and Hydration
On the day of competition, they should eat a meal high in carbohydrates 3 – 4 hours before competing to keep blood glucose levels high throughout the tournament.
The ideal time for replenishing an athlete's carbohydrate stores is 30 – 60 minutes after an event. When competing over several days, and when competing in several matches in one day, this becomes extremely important. Ideally drink about 600 ml per kilogram of body weight lost during the match. It is also important to drink the correct fluid, as the athlete is not only losing water, but is also losing important minerals.
Having enough of the right fuels in the body for competition plays a big part in how the game is played. The athlete may need to top up the glycogen stores by consuming small quantities of carbohydrates by eating snacks like dried fruit or drinking a carbohydrate drink.

Stretching
It is important to stretch after games, as this will decrease the soreness or stiffness felt in muscles. Performing static stretching that focuses on the prime movers.

Massage
Massage is widely known as an effective tool for recovery. If the team has a budget that allows for a masseur to be part of the management team, then they will assist the athletes greatly by massaging their muscles between matches and at the end of the day. However, many teams don't have the budget for a massage therapist – in which case the athletes could use a foam or polystyrene roller or a slightly flat netball or soccer ball. Roll specific muscles over the roller or soccer ball for effectiveness. This will increase blood flow, relax the nerves and loosen muscle.

Hot/Cold contrast baths
The hot-cold contrast baths can also advance recovery. To perform hot-cold contrast baths, simply sit in hot water for about 2 minutes 30 seconds then about 45 seconds in the cold water. Repeat this a few times for maximum benefits.
Alternatively rub ice on the muscles or simply sit in an ice bath, without using heat first.

Sleep
Athletes must sleep to recover otherwise their performance will be negatively affected. One of the biggest mistakes you can make as a coach or parent is to think that the harder and more frequent athletes exercise the better athlete they will be. Proper rest and recovery between intense games is the key to preventing injury.

Mental preparation
To help overcome a feeling of fatigue or even a sense of failure if the results have not been good, the coach and captain needs to continually motivate the athlete. The coach should have taught the athletes, prior to competition, on how to focus, visualise, etc.

Physical preparation
The coach would have prepared the athletes physically – cardiovascular endurance being one of the main areas to be worked on. Possibly by doing interval work, Fartlek, etc. Could bring in FITTER.

The following rubric will be used to assess the learners:

	4 – 5	3	2	1
Content knowledge	Complete and thorough knowledge and excellent suggestions provided.	Covers the most important elements of knowledge.	Little evidence of knowledge.	Vague and insufficient knowledge.
	4 – 5	2 – 3	0 – 1	
Understanding of the nature of Sports Festivals	Full and complete understanding of festivals.	Incomplete understanding of festivals	Little understanding.	
Recovery strategy provided	Effective strategy provided.	Inappropriate strategy provided.	No strategy provided.	

[15]

QUESTION 5

5.1 Water balance needs to be maintained especially in athletes, as it carries nutrients to and removes waste products from the cells. It also helps control body temperature. When an athlete starts exercising one of the by-products of the aerobic energy system is water. In other words, the production of water increases. Water loss through sweat also increases. Basically the body sweats more water than it produces = dehydration. At the same time important electrolytes are lost and this results in an increased heart rate.
Dehydration of as little as 2% of an athlete's body weight will have a negative effect on the athlete's performance: the circulatory system efficiency decreases resulting in blood pressure dropping. This means less blood gets to the muscles.
Body temperature rises as well.
Referring to the graph – when the athlete is perfectly hydrated, the athlete can perform at his or her maximum.
As the % of dehydration increases, so you see performance deteriorate, until at 5% dehydration the athlete is far below an average performance. (7)

5.2 Any 4 of these:-
Thirst; loss of appetite; dry skin; dry mouth; fatigue/weakness; chills; headache; nausea; muscle cramps; skin flushing; dark urine; tingling of limbs; increased heart rate; increased respiration. (4)
[11]

QUESTION 6

All people, including athletes need to eat healthy food. No single food provides all the nutrients that the body needs so it is important to eat a variety of foods. All food groups should be consumed – bread/cereals/potatoes; fruit/vegetables; milk/dairy; meat/fish; fats and sugars. Athletes need a considerable amount of energy. Most of this will come from glycogen stored in the muscles. But as this store is limited, the athletes need to eat extra carbohydrates. This will get converted into glycogen.

For a sport involving weight categories – weight is crucial and the diet must be precise.
Endurance athletes will increase the carbs eaten by carbo loading.
Gymnasts need to remain small and light – they must avoid very fatty foods. They need strength and energy so must eat carbs, proteins.
Hockey/soccer players don't need to be very light or heavy but they need lots of energy to keep going. Body weight isn't a major concern but they still need to keep an eye on their weight as it will slow them down.
Weightlifters need a lot of body weight and might even have to increase their weight. Quantities would be large and be mainly carbs and fats. Because they need strength, they need to consume proteins.

Off Season
Although this is off season, the athlete will still be training so will need to be eating extra carbohydrates as this is where the main source of energy comes from. Other energy sources are fats and proteins.
Vitamins and minerals are also important. During exercise, the body uses more energy and so the need for some of the B group vitamins increases slightly. Minerals are necessary for the efficient working of the body.

Pre-Season
Training is increasing which means that more energy is required. The athlete will therefore need to up their carb and protein intake. After training, the body needs to be refuelled as soon as possible. This will resynthesise muscle and liver glycogen stores. A high carb meal should be eaten within 2 hours of training to start the refuelling process. Water and other appropriate fluids should also be consumed.

Competitive Season
Top athletes should adjust their diet for up to a week before competition. Timing is important.
Advise athletes not to eat immediately before their event but rather eat a light meal 2 hours before their event. This meal should include starches and no simple sugars.
During competition, especially if it is hot, fluids should be taken to prevent dehydration. The drinks should, ideally, contain glucose.
After exercise carbohydrates should be consumed to replace glycogen levels.

If training daily, carbohydrates should make up 60% of the total energy intake. It is better to eat 4 – 6 small meals a day. This keeps the glycogen stores topped up.

The following rubric will be used to assess the learners:

	4 – 5	3	2	1
Content knowledge	Complete and thorough knowledge.	Covers the most important elements of knowledge.	Little evidence of knowledge.	Vague and insufficient knowledge.
Provided information taken into account	All the recommendations provided were taken into account.	Most of the recommendations taken into account	Few recommendations taken into account.	No recommendations taken into account.
Proper understanding of the issue	Absolute understanding of the issue.	Incomplete understanding of the issue.	Little understanding.	No understanding.

[15]

QUESTION 7

7.1 Negatively (1)

7.2 Lack of oxygen (1)

7.3 Haemoglobin saturation with oxygen relies on the partial pressure of oxygen in the alveolar air.
At sea level, the partial pressure of oxygen breathed in, is sufficient to ensure that the haemoglobin in the blood is totally saturated.
At altitude there is less air pressure and so less pulmonary pressure. (3)

7.4 The haemoglobin isn't fully saturated so less oxygen is taken to the muscles. This results in the aerobic working capacity being reduced in the muscle tissues. (2)

7.5 – Increase in blood haemoglobin concentration. Red blood cells increase and so do the haemoglobin concentration. But the haemoglobin still doesn't have enough oxygen so although performance will improve it will never be as good as the performance at low altitude.

– Increased breathing rate. Because there is a decrease in the partial pressure of oxygen in the alveoli, the breathing rate increases. This takes several days.

– Cellular changes. The myoglobin in the cells increases after acclimatisation. The amount of mitochondria increases too. (8)

[15]

QUESTION 8

Multiple choice

8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	8.10
D	B	D	B	C	E	A	B	C	D

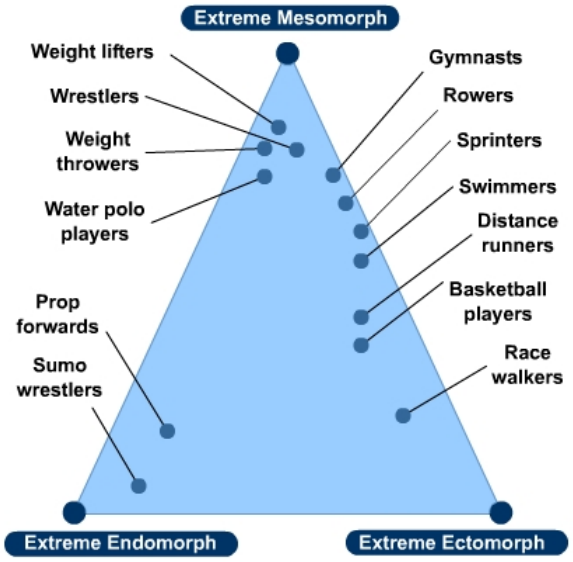
(10)

QUESTION 9

Components of fitness	Definition	Activity
9.1 Flexibility	(iii)	(b)
9.2 Aerobic Endurance	(iv)	(c)
9.3 Muscular Power	(ii)	(d)
9.4 Anaerobic Endurance	(v)	(e)
9.5 Muscular Endurance	(i)	(a)

(10)

QUESTION 10



(6)

QUESTION 11

11.1

Athlete	Time 1	Time 3	Time 6	Time 9	Time 10
Susan	6 seconds	8	12	18	24
Thabisile	6 seconds	6	8	10	12
Candice	6 seconds	6	6	8	10

(3 × 4 = 12)

11.2 Susan's times should increase dramatically. Drop in performance.
Thabisile's will increase, but more gradually. Drop in performance.
Candice's times will remain pretty constant and could even become quicker as her muscles warm up. Her performance will improve. (5)

[17]

Total: 150 marks