NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2019

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.

QUESTION 1

1.1

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

1.2

1.2.1	Glycogen
1.2.2	Lactic Acid
1.2.3	ATP
1.2.4	ATPase
1.2.5	Aerobic
1.2.6	Threshold
1.2.7	Aerobic/Oxidative

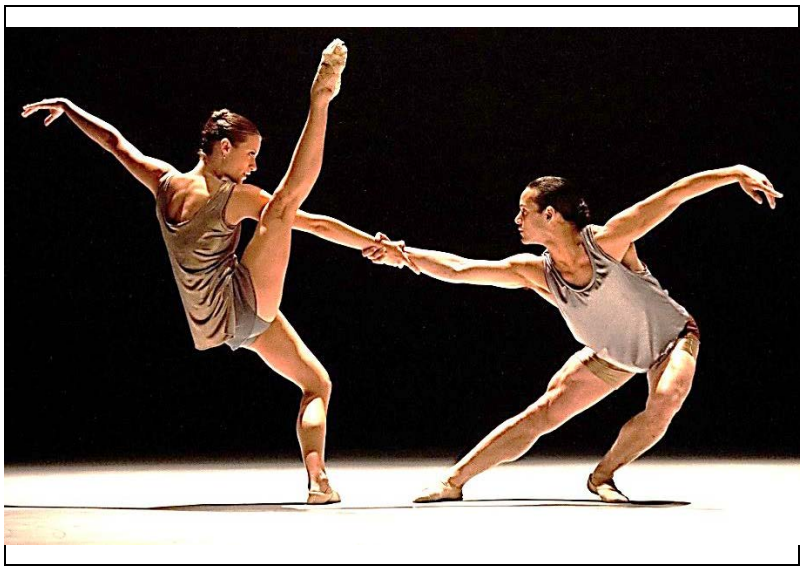
1.3 Picture A: frontal

Picture B: sagittal

Picture C: transverse

1.4

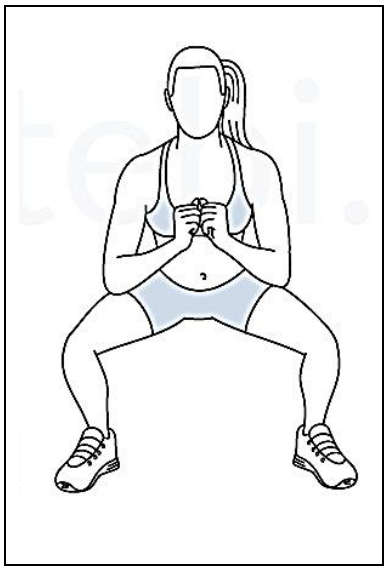
Picture A



[Source: <https://www.google.co.za/=dance+balance&oq?> (Accessed 5/2/19)]

Allocate 1 mark for each foot.
Allocate 1 mark for the space between the two dancers
Allocate 1 mark between the two feet of the dancer on the right

Picture B



Allocate 1 mark for each foot
Allocate 1 mark for the space between the two feet

Picture C

[Source: <https://www.google.co.za/wheelchair+basketball> (Accessed 5/2/19)]

Allocate 1 mark for the space between the 2 main wheels
Allocate 1 mark for including the space between the small wheels

1.5 1.5.1 B

The centre of gravity/ line of gravity falls within the middle of the base of support.

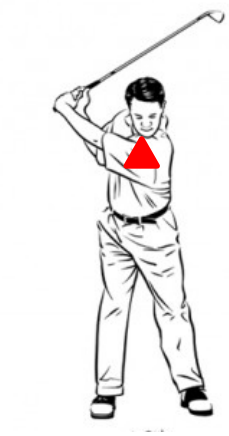
1.5.2 C

The centre of gravity is totally outside the base of support.

1.6 1.6.1 Allocate 1 mark for fulcrum

Load: Golf club

A



[Source: <https://www.google.co.za. golf+swing> (Accessed 7/2/19)]

Effort: Accept any of the following: (1 mark)
Arm muscles (they cannot just say 'arm')
deltoid
Biceps and triceps

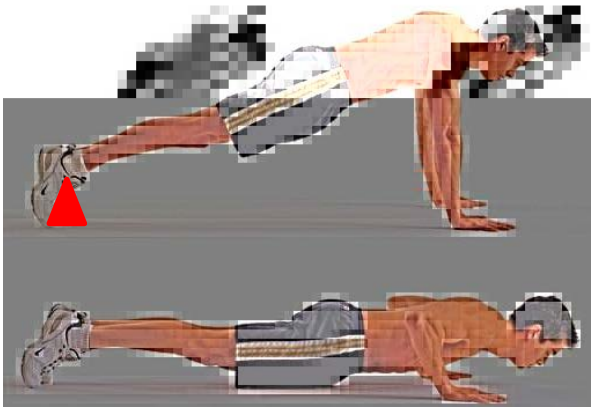
B

[Source: <https://www.google.co.za/cricket+fast+bowlers> (Accessed 7/2/19)]

Allocate 1 mark for fulcrum
Load: Cricket ball (1 mark)

Effort: Accept any of the following: (1 mark)
- Arm muscles
- Deltoid
- Biceps and triceps

C



[Source: <https://www.google.co.za/search push+up> (Accessed 7/2/19)]

Allocate 1 mark for fulcrum
Load: the body (1 mark)

Effort: Accept any of the following: (1 mark)
- Arm muscles
- Deltoid
- Biceps
- Triceps

1.6.2 Picture A: 3rd class (L-E-F)

Picture B: 3rd class (L-E-F)

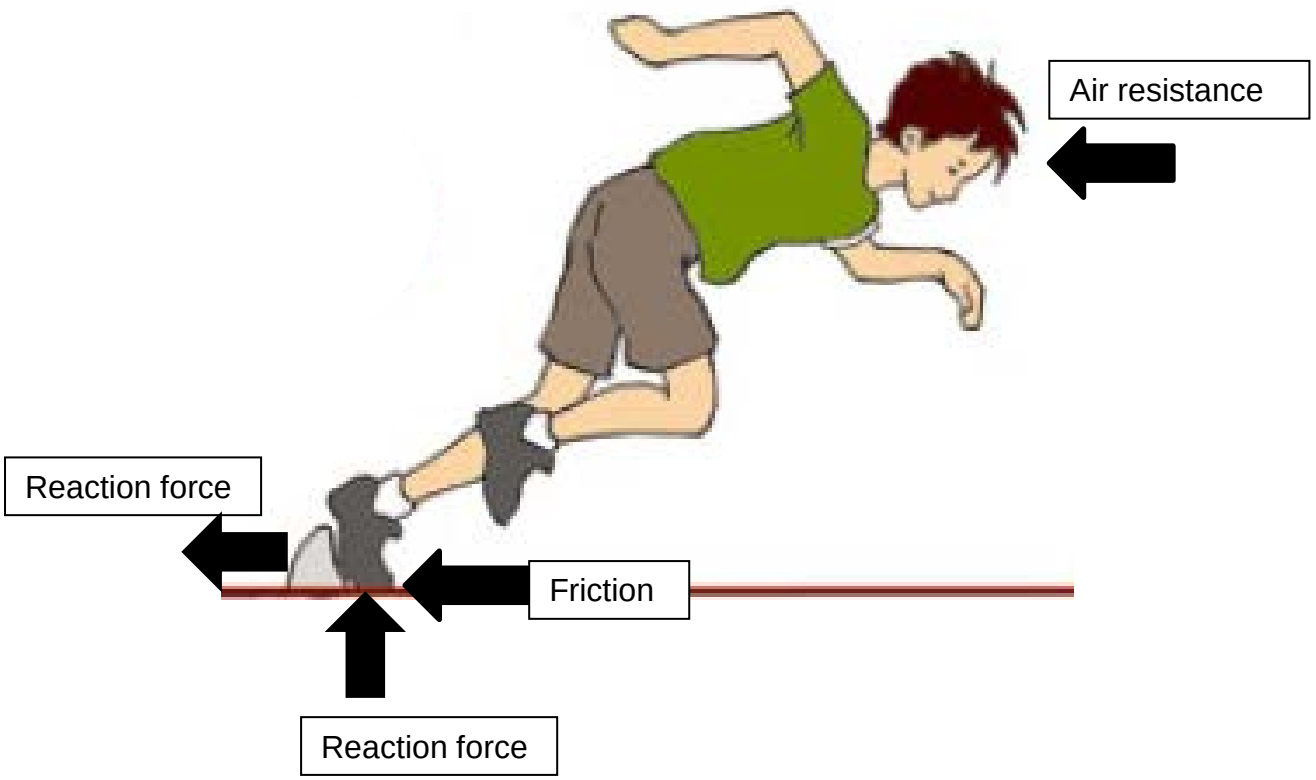
Picture C: 2nd class (F-L-E)

1.6.3 Picture A: Speed

Picture B: Speed

Picture C: Force

1.7



Arrows must point in correct direction

QUESTION 2

2.1 Picture A: Backswing:

Backswing – kicking leg bends creating a short lever to swing forward at speed. Lever magnifies movement. Greater distance between joint and effort = more power.

Picture B: Connecting with the ball:

Kick – kicking leg straightens creating a long lever. The ball is kicked with more speed. Longer lever = greater speed/velocity and force on the ball.

Picture C: Follow through:

Follow through – this improves accuracy and allows leg to slow down safely.

2.2.1 More females (95%) approve of females playing rugby compared to 85% of males approving OR
More males at 15% disapprove of females playing rugby compared to the 5% of females disapproving.

2.2.2 Allocate 1 mark per reason.
More females approving – This is to be expected as females should be supporting other females competing in all sports and not only the sports traditionally considered feminine sports.
Accept feasible
OR
More males disapproving – Males tend to think that females are too delicate to participate in rugged activities. Dangerous for females
Accept feasible

QUESTION 3

3.1 Allocate 1 mark per fact from those listed below:
Start using large muscles and then move onto smaller muscles
The girl is using most of her body parts to create a large force.
In picture A she has her throwing arm raised and behind her. This allows more force as she is using her shoulder and back muscles too.
In picture B the hips have been used to create more force.
In picture B the back leg has rotated slightly to add to the force.
The torso has been used too.
Each body part used in a movement tends to accelerate – in picture A and B the throwing arm is serving as a "whip".
By bending the elbow and then straightening the arm creates greater force.
In picture C transference of body weight from back leg to front leg also transfers force.
In picture C she is following through which allows for more power and accuracy.
They can't just describe what they are seeing in the pictures
Force summation allows maximum forces to be produced by the muscles and then transferred into physical movements - by adding the forces of each body segment together.
The more body parts involved in completing a movement, the greater the force that can potentially be generated and then transferred to the released ball.

3.2 Allocate 1 mark for referring to upper body usage:
Start with throwing arm further back.
OR
Use the Latissimus dorsi/deltoids.

Allocate 1 mark for referring to lower body usage:
Start by pushing down on feet to use gastrocnemius then quadriceps and hips.

Increase stride length
Add a run up
Increase range of motion

QUESTION 4

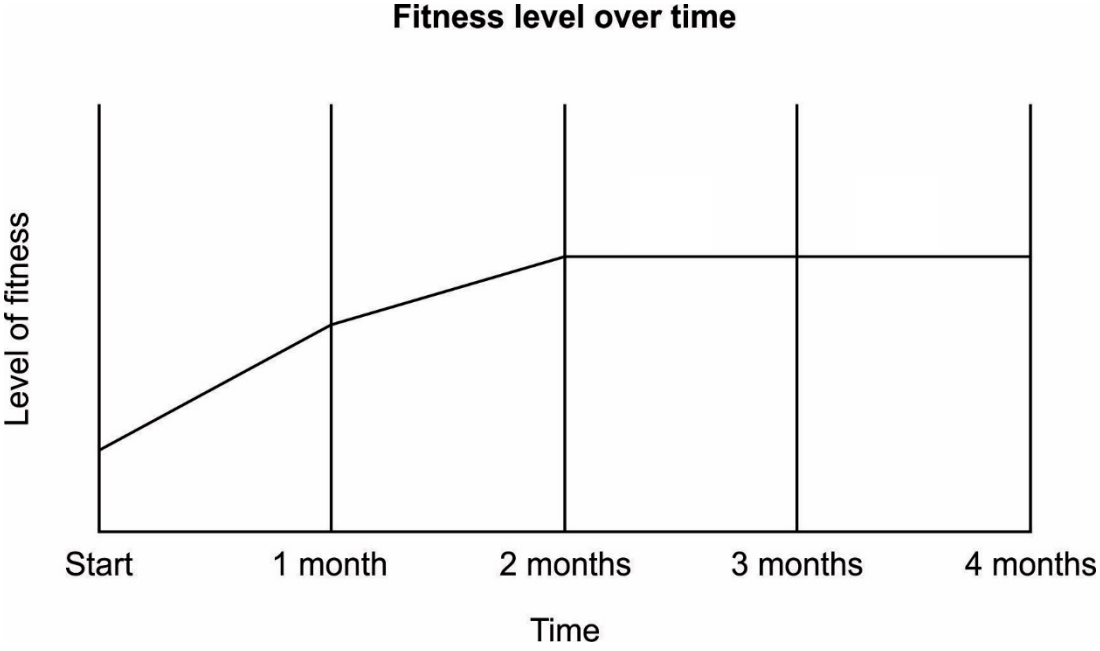
4.1 4.1.1 70 – 73

4.1.2 Accept 3.4–4 minutes

4.1.3 Accept any of the following:
Allocate 2 marks per response
The session wasn't challenging the player enough in a cardiovascular way.
The athlete is very fit and the training session was keeping the player at MHR.
There was no rest period to allow the heart rate to drop and then rise again.
Training intensity stayed constant

4.1.4 The heart rate would drop rapidly but would still be slightly elevated above the RHR.
HR would decrease

4.2 4.2.1



4.2.2 Accept any feasible reason, e.g.:
Not enough progressive overload applied to training.
Training too easy.
The athlete has become stale and unmotivated.

Don't allocate a mark for saying 'plateau' because that is a descriptor and not a reason

4.3 Allocate 1 mark to each difference in diet.
Allocate 1 mark to each appropriate reason.

Elite squash players would eat a high carbohydrate diet.
Reason – A match can last as long as 2 hours or more. And they often need to play more than 1 match in a day or on consecutive days which means they need to replenish muscle glycogen stores.

Elite squash players would eat a high protein diet.
Reason – Protein repairs and builds muscle
Eat fats for slow release of energy
Accept facts relating to hydration

4.4 Muscle spindles detect change in muscle length as well as the velocity of the lengthening.
Prevents injury
Senses stretch
Senses speed of stretch
Important for coordinated movement

4.5 When muscle fibres contract, ends of the muscle spindle come close together, stimulating the sensory / afferent nerves which then pass on electrical impulses to the CNS.
The spindle sends a reflex arc signal to stop further stretching and injury.
Information processed by brain
Activate motor neurons via stretch reflex to resist stretch
Motor/efferent nerve sends impulse to muscle and spindles adjust tension
Change in length of muscle
Accept appropriate reference to myosin and actin

QUESTION 5

5.1 Melbourne

5.2 Rod Laver

5.3 Hyperthermia

5.4 "We are, at the end of the day, an outdoor event."
Being a tournament that is played outdoors means that the players have to cope with the conditions.

5.5 Allocate 1 mark per factor:
temperature, humidity and wind speed.

5.6 Federer played his matches later in the day when it was cooler.
Played at night
Federer had played in previous Australian opens with extreme heat
Mentally tougher

5.7 Allocate one mark per strategy
Train in hot and humid conditions
Train at the heat of the day
Spend time in a sauna – exercising
Arrive earlier to acclimatise
Accept feasible

5.8 Allocate 1 mark per strategy.
Accept any one of the following:
- Drink lots of fluids
- Wear appropriate clothing / loose clothing
- Wear light coloured clothing
- Wear fabric that draws sweat away from the skin
- Wear ice vests in the change room before tournament starts
- Ice towel
- Acclimatise by playing or training in hot conditions
- Carbohydrate load as this increase fluid storage
- Males could shave their hair short/ females tie hair up

5.9 Allocate 1 mark per strategy
Accept any one of the following:
- Drink lots of fluids
- Use an ice towel between sets
- Change playing strategy to conserve energy
- Insist on an umbrella at the changeover
- Place towel over head at changeover if no umbrella for shade
- Cooling stations

Accept feasible

5.10 Accept any 4 of the following facts:
This theory says that as the athlete's somatic arousal increases the athlete performs better (as depicted by A) but the athlete's performance will only continue improving if the cognitive arousal is kept low.
If the cognitive arousal gets too high then the athlete "goes over the edge" (as seen at point B) and performance will drop and the athlete experiences a catastrophe.
Once this has happened, the athlete will not return to the original arousal levels (A) but will need to psych themselves up again and start at point C.
If no reference made to graph then can only get 3 marks

5.11 Accept any 4 of the following
Being tall means that he has longer limbs, i.e. levers.
The longer the lever the greater the velocity (speed) and force that can be imparted on an object, e.g. a tennis ball can be hit harder when the elbow joint is fully extended rather than flexed.
The use of the racquet lengthens the lever even more.
When serving or hitting a smash, Federer is able to hit the ball at an acute angle making it harder for his opponent to reach the ball.
Arm and racquet speed gets transferred to the ball resulting in a harder force.
Can take bigger strides and cover more area

QUESTION 6

6.1 6.1.1 The higher the release, the more downward direction that the ball will travel but still clear the net.
The higher the release when hit, the smaller the angle of release and the shorter the distance the ball travels.
Harder for opponent
Lower release – travel further

6.1.2 Accept any two of the following:
This makes it harder for the opponent to reach and return the ball.
Lose points
Opponent needs to assess what shot to return with

6.2
- Racquet movement:
  Racquet moves down and under the ball

- Ball flight in the air:
  Accept any 2 of the following points:
  Gains lift and rises
  Slow

- Ball flight on landing:
  Ball has less bounce, doesn't travel far

6.3 6.3.1 When we exercise there is an increase in heart rate and stroke volume to meet demands, cardiac output (the volume of blood pumped out of the heart in one minute) automatically increases.
Venous return

6.3.2 To increase blood flow to the muscles the pre-capillary sphincters in the capillaries leading to muscles open.
The pre-capillary sphincters leading to non-essential organs will close.
This restricts blood flow to the organs.

QUESTION 7

7.1 Allocate 1 mark per activity:
Swim
Walk
Jog
Exercise using own body weight

7.2 Allocate 1 mark per explanation
They are individual sports, not team sports
Little equipment needed
Inexpensive
Uses bodyweight

7.3 Swimming

7.4 Allocate 1 mark per reason for any three of the following:
SA is a hot country.
SA has a long coast line
Many public swimming pools
Many homes have pools
More age groups can participate.
Older people can swim without fear of injury
Little strain on joints/ non-weight-bearing
Don't need specialised equipment
Cost effective
Weight loss
Can be done alone

Accept feasible

7.5 Tennis

7.6 Allocate 2 marks to any of the following:
Have to join a club
Expensive equipment – tennis racket and shoes
Need an opponent
Accept feasible

7.7 Allocate 1 mark per activity and 1 mark for the explanation
Possible activities:
Bowls; yoga; walking; swimming; golf
Gardening
Chess; darts; juksei
Accept feasible

Explanation:
Low impact activities for weaker joints
Accept feasible

7.8 Allocate 3 marks for explanation and 1 mark for appropriate example.
The *Ringelmann effect* is the tendency for individual members of a group to become increasingly less productive as the size of their group increases, e.g. any team sport where there are too many reserves.
Accept feasible

QUESTION 8

8.1 Allocate 1 mark to any 6 of the following facts.

- When the race starts, the body will use the ATP/PC system
- Can use phosphagen name
- The ATP/PC system only lasts a few seconds so the anaerobic lactic acid system will then kick in
- Can use glycolytic name
- The LA system causes a build-up of lactic acid
- Lactic acid negatively affects performance
- After about 1 minute the aerobic system will take over
- Can use the oxidative name
- The cyclist will stay in the aerobic system for the duration of the race
- Unless they suddenly sprint away or need to cycle up a steep hill
- In this case the cyclist will move into the lactic acid system again
- Once they reach the top of the hill or stop sprinting they will return to the aerobic system

8.2 8.2.1 Altitude training is the practice by some endurance athletes of training for several weeks at high altitude, preferably over 2,400 metres (8,000 ft.) above sea level. Body adapts

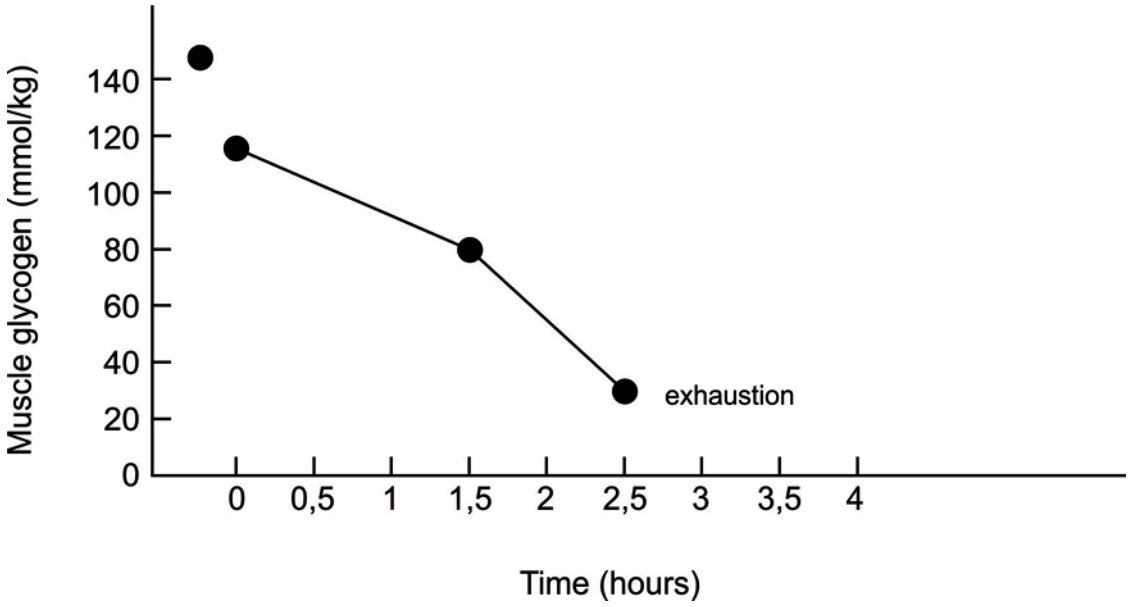
OR

Altitude training develops the ability of an athlete to use oxygen better, which makes the athlete more effective in sea level competitions.

Training in environment with less oxygen (1 mark)

8.2.2 The body increases its production of erythrocytes / red blood cells.
Increased breathing
Capillary growth
Basal metabolic rate (BMR) increases
Increased cardiac volume
Decreased muscle fibre surface

8.3 8.3.1



8.3.2 Allocate 1 mark for either one of the facts below
Exhaustion will be delayed
Increased rate of glycogen depletion early in the race
Weight gain
More glycogen stored
Bloating / water retention
Don't accept 'feel less fatigue'

8.4 Allocate 3 marks to Sarah's responses

Allocate 3 marks to Jill's responses

Sarah:
Accept any 3 of the following facts:

- Sarah's body shows long term physiological adaptations to exercise while Jill's doesn't.
- Sarah's heart size has increased which allows it to pump out more blood at a slower rate.
- Sarah's heart rate during exercise can decrease.
- Red blood cell count has increased so blood delivers oxygen to cells quicker.
- VO_2 max increases slightly over time – more air and therefore more oxygen enters and exits lungs.
- With efficient aerobic system, carbohydrate stores are used up slower.
- Lactic acid production is delayed. Threshold pushed back.
- Being experienced Sarah will know the correct foods to eat before riding and she might have carbo-loaded.
- Sarah will use correct hydration before and during the ride pushing back fatigue.
- Mentally Sarah will be at ease and not nervous preventing muscle tension.

Accept feasible

Jill:

Accept any 3 of the following facts:

- Jill's body shows no long term physiological adaptations to exercise.
- Jill's heart size is "normal" so is smaller than Sarah's. Not enough blood is getting pumped out forcing Jill to stop when not enough oxygen is reaching her muscles.
- Cardiovascular system is not used to the high aerobic nature of the sport forcing her to go slow or rest.
- Carbohydrate stores are used up quickly.
- Lactic acid production occurs quickly; forcing Jill to rest.
- Probably didn't eat correct foods before riding causing fatigue.
- Incorrect or inadequate hydration before and during the ride resulting in fatigue.
- Fear of the unknown will make Jill nervous causing muscle tension.
- Jill's muscles cramp
- BP will increase
- Will experience fatigue

Accept feasible

8.5 Allocate 2 marks per demarcated spot.
One mark for mental state
One mark for physical state

X1
Mental state:
Little arousal
Not mentally prepared
Increasing attention

Physical state:
Laid back/not energised/sleepy
Poor performance

X2
Mental state:
Arousal is optimal
Psyched up
Focussed
Self-confident

Physical state:
Performance best/ideal
Heart rate increased
Blood pressure up
Biochemical indicators like adrenaline & epinephrine released

X3
Mental state:
Arousal: over aroused
Anxious / stressed
Psyched out /distracted
Panic/frustrated
Anger

Physical state:
Negative effect on performance
Tachycardia
Aggression

QUESTION 9

Provide effective strategies for coaches to use to ensure that players stay at peak physiological and psychological levels all season. Justify your strategies.

Included in the candidates' responses should be reference to the following:

All the sports referred to in the sources (rugby, cricket, tennis) have players competing too much. Too many matches in a season.

Both the duration of training sessions and their intensity are factors underlying fatigue. The relationship between workouts and a competitive schedule is important.

After all the work is done, athletes need a good strategy to recover from the stress of the workload – to cause adaptation and then come back ready for the next game or match. Recovery is just as important as the training. Adaptation to training occurs during the recovery. Recovery is the process the athlete goes through in order to return to a state of performance readiness.
Recovery involves:

- restoring nutrients and energy stores,
- reducing muscle soreness,
- returning to normal physiological function and
- removing psychological symptoms like irritability and the inability to concentrate.

Physiological problems that will occur as a result of too many matches:

- Fatigue
  Fatigue and the ability of the body to overcome its effects are also closely linked to:
  – diet and nutrition,
  – quality of sleep
  – scheduled recovery periods,
  – and external factors such as employment pressures, studies and injury.

- Overtraining
  Muscle pain and joint ache – Overtraining and too many competitions will lead to muscle tear and inflammation. This will lower strength and therefore the athlete's performance level
- Injuries. Under content relevance – to get to level 4 candidates should refer to specific injuries, e.g. cricket and tennis players often suffer from overuse shoulder injuries whereas rugby players often injure hamstrings and quadricep muscles, etc.

- Onset of DOMs. When developing DOMs it begins with structural damage to muscle fibres (microtrauma) & the surrounding tissues. Microscopic damage to the muscle is normal and expected during an exercise. This damage causes inflammation as fluid and electrolytes move into the area. Muscle spasm can also occur and this causes more pain and prolongs the condition. DOM's causes a reduction in the force-generating ability of the affected muscles. The affected muscles are not able to exert as much force when the athlete is asked to apply maximal force in a 1-repitition max strength test.

- Central muscle weakness is an overall exhaustion of the whole body, while peripheral weakness is an exhaustion of individual muscles.
- Low immune system – Intense training actually increases levels of the body's stress hormone, which suppresses the immune system. The athlete may be more susceptible to catch common colds.

Psychological problems that will occur as a result of too many matches:
Anxiety before or during competitions can negatively affect your performance. The coordinated movement needed by athletic events becomes more difficult when your body is tense.
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 will be more noticeable.

- The athlete will experience depression and lack of motivation when suffering from fatigue.
- Low self-esteem and loss of confidence
- Angry and aggressive

Possible strategies
- Ensure rest days
- Periodisation. By planning and setting out the whole year, a coach will be able to see that there are too many competitions close together or that training is too intense close to competition. They can then re-plan the year.
- At elite level select competitions/tournaments that allow the player/s to have a break between them
  School fixtures are a bit harder to have control over but individual schools do have the "right" to choose not to play all matches on the fixture list. If a school isn't obsessed with winning then this is more likely to happen. At the annual fixture meeting heads of sport could discuss this topic.
- Provide rest within a training session
- Increases in training should be matched with increases in resting
- Athletes should avoid specialising in one sport too early. Child "superstars" are often injured or burned out prior to varsity. Children should be encouraged to try a variety of sports.
- Dealing with DOM's – The muscle will repair itself during rest and this will in turn promote growth in muscle size and strength.
- The recovery process involves both the removal of the by-products produced during exercise and allowing the fuels to be replenished.
- Coaches need to plan each training session, both with regard to work intensity and recovery intervals. This is often called the work-relief ratio.
- Ensure all athletes are screened. This identifies if a person is suitable for the activity or if they risk injuring themselves. It assesses a person's health, injury history, lifestyle and fitness before they start training.
- Ensure athletes are eating and drinking correctly. Athletes must drink proper amounts of fluids to replace sweat lost and to improve recovery.
- Injury surveillance will help keep performance up. The coach must identify potential causes of injury and devise strategies to deal with them. It's important when an injury occurs that essential information such as "when", "where", "how" and "what happened" is accurately recorded. This will allow patterns in occurrence of injuries as well as potential risk factors to be identified, which can provide information so changes can be made to reduce injuries in the future.
- Injury management. This is a process where an injury is identified, treated and then rehabilitated so it doesn't happen again.
- Ensure a correct balance between volume and intensity will enhance performance.
- All well-designed training programs use the principle of progressive overload.
- The coach faces the challenge of determining the optimal training stimulus for each athlete, recognising what works for 1 athlete might not work for another.
- Early identification and monitoring of susceptible athletes.

- Minimising known effects, such as sudden increases in training loads, inadequate dietary intake and too frequent competition.
- Individualising training.
- Periodising training.
- Programming recovery training and rest days into the training cycle.
- A training log is the best method to monitor progress. In addition to keeping track of distance and intensity, the athlete can record the resting morning heart rate, weight, general health, how the workout felt, and levels of muscular soreness and fatigue.
- Teach the athletes ways to cope with anxiety, e.g. visualisation, goal setting.

ESSAY RUBRIC

	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 very close to full potential used to support strategy and reasoning.			2
Content relevance X2	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
Effective strategies X2	No strategies provided.	Ineffective and unrealistic strategy/ies provided.	One effective strategy provided.	Several strategies provided – most are effective.	Several effective strategies provided.	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

Total: 200 marks