NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2023

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 E

1.1.2 B

1.1.3 D

1.1.4 F

1.1.5 A

1.1.6 C

1.2 1.2.1 Picture B

1.2.2 Picture A

1.3 **Picture A**

Allocate:
1 mark for each foot.
1 mark for the space between the feet.
1 mark for the right hand.
1 mark for the area between her hand and both feet (sort of triangular shape).

Picture B

Allocate:
1 mark for each foot.
1 mark for the space between the feet.
1 mark for the area from the feet to the ball.
1 mark for the area under the ball.

1.4 1.4.1 Dumbbell/weight

1.4.2 Biceps
Deltoid
(If they provide 'arms' as an answer then no mark is allocated.)

1.4.3 3rd (L-E-F)

1.4.4

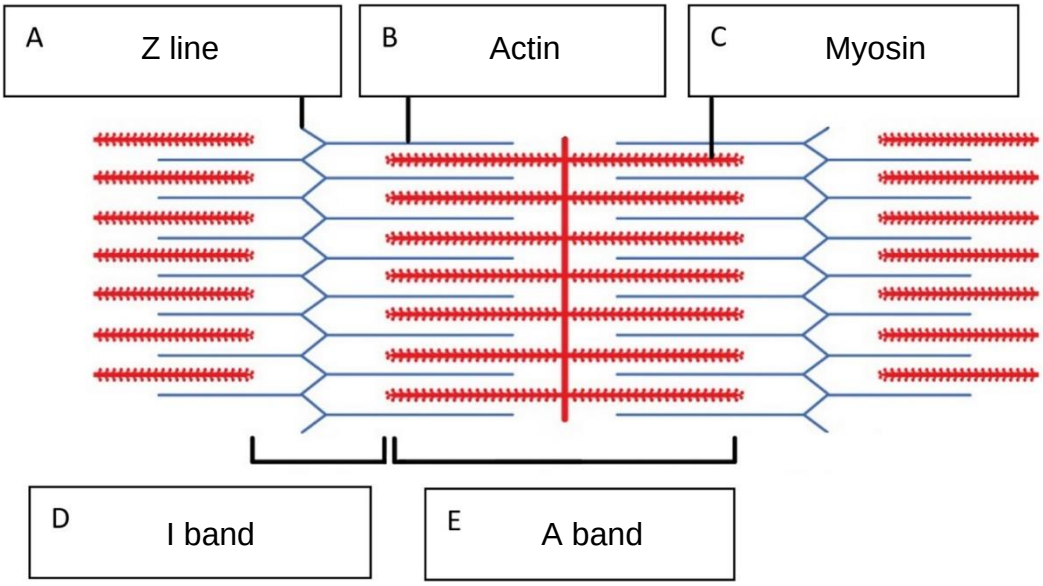
1.4.5 ball

1.4.6 rectus abdominis, transverse abdominis
(If they provide 'abdominal muscles as an answer then no mark is allocated.)

1.4.7 1st (E-F-L)

1.4.8

1.5



1.6 1.6.1 ATP/PC

1.6.2 Lactic Acid

1.6.3 Aerobic

1.6.4 Aerobic

1.6.5 Carbohydrates stored as glycogen in muscles

1.6.6 400 m sprint

QUESTION 2

2.1 10 years

2.2
- Running
- Swimming
- Cycling

2.3 Australia

2.4 Accept any 3 of the following:
- After the Games are over and the hype is over the athletes feel a sense of loss.
- After preparing for years there is suddenly no reason to train anymore.
- Athletes have gone from being heroes to being a nobody.
- Sponsors desert them.
- They suddenly have too much free time on their hands, so they feel lost.
- Realise that they have no purpose.

Accept feasible.

2.5 Allocate 1 mark per reason:
- Sponsors provide lots of money in the build up to the Games in the hope of getting exposure for their brand.
- After the Games are over, people lose interest and there is less exposure.
- The next Olympics are 4 years away. The athlete might not qualify again and money would be wasted.

Accept feasible.

2.6 Accept any of the following:
- The adventure of it.
- The unexpected.
- It's different.

2.7 Accept any 3 of the following points – 2 marks per fact (one for the sprinter and 1 for the triathlete). There MUST be a comparison – if not learner can only get 3 marks.

- Triathletes should eat approximately 8–12 g/kg of body weight of carbohydrates while sprinters eat 5–7 g/kg of body weight.
- Triathletes need more protein than sprinters.
- Triathletes should eat 2 g/kg of protein while sprinters eat 1–1,8 g/kg of body weight.
- Triathletes should carbo-load before an event whilst sprinters do not need to.
- Triathletes' daily calorie intake should comprise 20–35% fats while a sprinter needs 25%.
- Sprinters need to consume sufficient carbohydrate to fuel training needs, however carbohydrate requirements do not reach the level of endurance-type athletes like triathletes.
- Both types of athletes need carbohydrates, proteins and fats – it's the quantities that differ.

- Endurance athletes (triathletes) need a lot more carbohydrates than track athletes in order to meet the energy requirements for high intensity and to delay fatigue.
- An endurance athlete will get most of their daily energy intake requirements from carbohydrates whereas a track athlete will eat less carbohydrates.
- Endurance athletes need energy to sustain them for long periods of time whereas a track athlete needs the instant burst of energy.
- A track athlete needs less fat while an endurance athlete needs more fat.
- Triathletes need to eat more carbohydrates than sprinters.

Accept feasible.

2.8 By eating a diet high in fat and low in carbohydrates, the body accesses stored fat when energy is needed.
The body relies less on glucose for fuel.

2.9 Allocate 1 mark per fact.
- There will be an immediate/sharp/quick rise in blood glucose levels.
- This gives the athlete a spurt of energy.
- Followed by a sharp drop in energy.

2.10 Accept any 2 of the following:
- Fatigue especially towards the end of the week or at the end of the event.
- Increased incidence of injury.
- Inability to keep up with the training program.
- Sudden drastic drop in energy levels during competition and/or aching muscles.
- Headache.

2.11 **Stage 3: Learn to train**
Allocate 1 mark per bullet until 5 marks achieved.

- Boys are 9–12 years old and girls 8–11years old.
- This is an important stage because children learn coordination and fine motor control.
- At this stage they are developmentally ready to learn general sport skills.
- Children, by this stage, have developed a preference for 1 sport but they still need to be involved in a wide range of activities to ensure full athletic development. They should be playing at least 2 sports but ideally the focus should be on playing at least 3 sports in different seasons.
- The emphasis should remain on general sport skills that suit many activities rather than excessive single-sport training and competition.
- Although competition is important, learning to compete and athletic development is the focus and not winning. Competition should not be about results.
- 70% of the time should be spent practicing & 30% competing.
- At this stage the nervous system is well developed, and the athlete is capable of performing refined technical skills.
- Younger athletes in this stage are now able to control their bodies better and should concentrate on correct technique.

- Spend time on flexibility and work on endurance by playing games and doing relays.
- In this stage, coaches should encourage children to play all positions and do many events, e.g. long jump, sprinting, shotput.
- This takes them out of their comfort zone which improves their decision-making skills.
- In team sports, strategies revolve around basic defence and attack with the emphasis being on proper spacing and understanding team play.

Stage 5: Train to compete
Allocate 1 mark per bullet until 5 marks achieved.

- This phase is appropriate for boys aged 16–18 and girls aged 15–17 years old.
- 60% of the time is spent is competition.
- 40% of the time is spent on skills & fitness.
- The emphasis moves to a repetitive sequence of 'prepare to compete – compete – recover – review – modify'.
- Athletes at this stage have serious commitment to achieve a goal.
- This time is for even more developing of the skills needed with help from sports science and sports medicine.
- The time frame of this stage varies from athlete to athlete.

2.12 No mark allocation for stating yes or no.
However, allocate 2 marks for reason as long as it pertains to the yes or no response.

No – he was overtrained in primary school.

Yes – with triathlon training he first concentrated on swimming, then cycling and then running.
He spent 10 years preparing for the Olympics.

2.13

Number of Newton's Law	Action	Description of Newton's Law
1st	B	C
2nd	C	A
3rd	A	B

QUESTION 3

PERIODISATION PLANNING FOR AN ELITE NETBALL TEAM

Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Competitions												
Periodisation	Pre-season				In-Season				Finals		Post-season	
Macrocycles	Basic conditioning		Specific conditioning		Unloading				Peaking		Transition	
Speed	Developing running speed				Maintain running speed						Maintain low level speed	
Endurance	Develop aerobic capacity				Maintain aerobic capacity						Maintain low level	
Flexibility	Develop flexibility				Maintain flexibility						Maintain flexibility	
Agility	Develop agility				Maintain agility						Maintain agility	
Skill	Improve specific skills				Continue to develop skills under pressure and game play situations						Improve basic skills	
Psychology	Establish goal setting				Stimulate strategies to achieve goal				Increase motivation		Decide on next goal	
% training time: Conditioning Skill Tactical	50 30 20	40 30 30	30 40 30	20 40 40	20 40 40	20 40 40	20 30 50	30 20 50	20 20 60		No training 	60 40 0	70 30 0
Training load	100% 80% 60%											

(Table adapted by examiner)

3.1 Allocate 1 mark per response:

- To ensure athletes progress/improve/get better.
- To ensure athlete peaks at the right time/peak for major competition.

3.2

- Pre-season
- Competition/in-season
- Off season/transition/post season

3.3 If no reference is made to netball, then learner can only receive a maximum of 2 marks. Allocate 1 mark per bullet:

- As it is pre-season/'starting from scratch' the players will not have worked on any of the various fitness components.
- The players need flexibility in order to reach for an intercept pass and stretch legs when leaping so time needs to be spent on that component.
- In netball agility is needed because the players are required to change direction so quickly, so agility is an important fitness component to develop.
- Netball is a fast game and the players need to work on their speed.
- To avoid injury coaches will gradually develop their fitness levels, hence the use of the word 'develop'.

3.4 Accept any of the following:
- Ability to jump high.
- Able to change direction quickly with balance and control.
- Accurate shooting.
- Ability to pass/throw a ball accurately.

Accept feasible.

3.5 Accept any 4 feasible points for example:
- Athletes need to learn how to cope with pressure from an opponent in a match/game situation.
- Otherwise, they will make careless errors.
- To cope with a worst-case scenario and develop a strategy to help.
- To learn to focus on what they can control.
- Can identify their strengths.
- Can alleviate a feeling of being un-prepared.
- To maximise performance.
- Mistakes in training allow learning opportunities.

3.6 3.6.1 Learner responses must relate to netball. Accept any one feasible response, e.g.
- To shoot x-number of goals per game.
- To attend every training session.
- To run x km per day.

3.6.2 Accept any feasible strategy, e.g.
- Practice shooting 50 goals every day.
- Ask the coach to take a register on attendance.
- Have a logbook to monitor runs.

3.7

	Pre-season			In-Season				Finals		Post-season		
% Training time:										No training		
Conditioning	50	40	30	20	20	20	20	30	20		60	70
Skill	30	30	40	40	40	40	30	20	20		40	30
Tactical	20	30	30	40	40	40	50	50	60		0	0

4 marks are allocated per phase – 2 for interpreting data and 2 marks for stating why the data is as is.
Answers must refer to all 3 phases of the year – pre-season, in competition and off-season.
If learner only refers to 1 phase, then they cannot get more than 4 marks.

Pre-season:
Accept any 2 feasible points for example:

- **Interpretation:** 50% of their training is devoted to conditioning **Why?** The athletes are unfit and untrained.
- **Interpretation:** 30% of time is spent on skills **Why?** They haven't thrown a ball around for a period of time or done foot-work either.
- **Interpretation:** 20% of the time is spent on tactics **Why?** At the start of the season the focus is more on training hence small percentage of time but the players still need to start planning strategies.
- **Interpretation:** Only 20% is spent on tactics initially **Why?** because the main focus is on getting fit and getting the skills improved.

In-season:
Accept any 2 feasible points for example:

- **Interpretation:** 20% of the training time is spent on conditioning **Why?** At this point in the season the players are fit so less time is needed on conditioning.
- **Interpretation:** 20% of the training time is spent on conditioning **Why?** Although fit, the players still need to maintain their fitness levels.
- **Interpretation:** More time (40%) is now spent on skill **Why?** The players need the various skills to be exceptional during match time.
- **Interpretation:** More time than before (40%) is spent on tactics **Why?** because tactics are needed during matches.

Post-season
Accept any 2 feasible points for example:

- **Interpretation:** The players are given an immediate break of 1½ months **Why?** to rest and recover.
- **Interpretation:** The players are given an immediate break of 1½ months **Why?** Without recovery time, injuries could occur.
- **Interpretation:** They now spend a great deal of time (60–70%) getting their conditioning up **Why?** They were given a rest.
- **Interpretation:** They spend 40% of the time on skill **Why?** They need to maintain.
- **Interpretation:** No time spent on tactics **Why?** There are no matches for 5 months.

3.8 Hip
Shoulder

Reasons:

- When leaping and jumping to catch the ball or intercept they need a large range of motion in the hip joint.

- The arms are stretching and reaching for the ball and the shoulder joint plays a pivotal role in this.

3.9 Allocate 1 mark for any of the following reasons and 1 mark for expanding on the reason:
Accept any 3 feasible points for example:

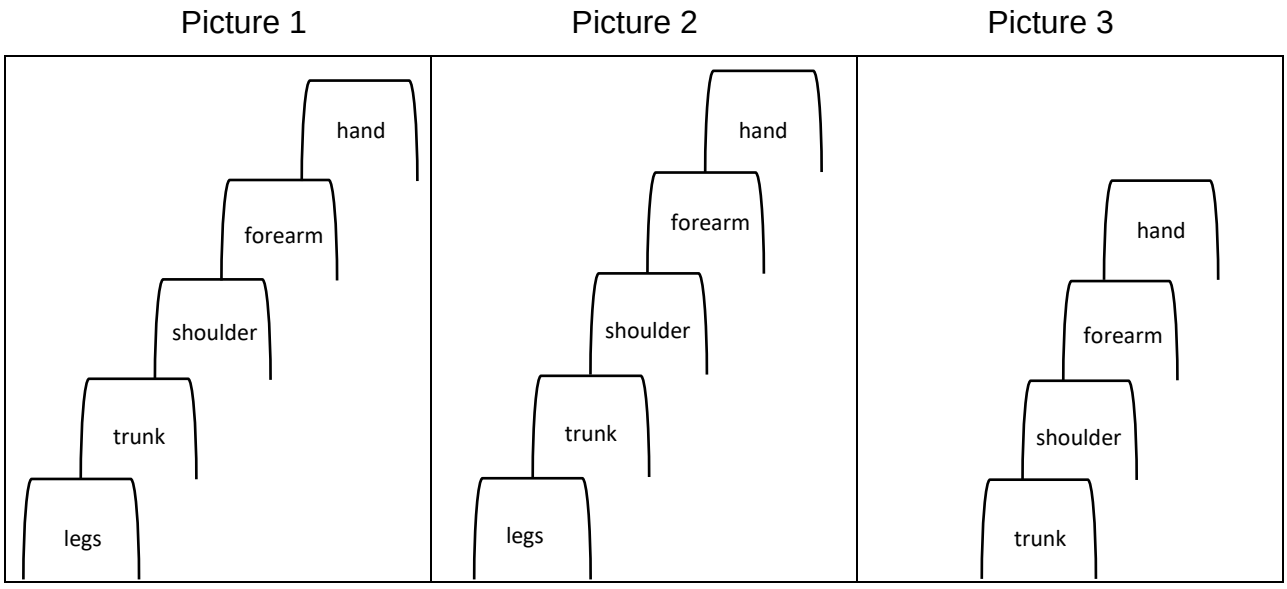
- **Reason:** Athletes are unfit.
  Expansion: If training load starts off at too intense, players could get injured.
- **Reason:** To prevent overload.
  Expansion: Overloading muscles causes tears in muscle fibre and injury results.
- **Reason:** To progressively increase the stresses.
  Expansion: This allows the muscles to adapt.

3.10 Progressive overload

3.11 Learners must refer to both time periods
Accept any 6 of the following facts:

- Between February and March the athletes training load is at 100%.
- This is because they have gradually increased their training and are physically able to train at maximum effort.
- They need to work at a high intensity to get fit.
- They need to get match fit to enable them to play a full match without too much fatigue.
- April to August is their competition period.
- During the competition phase of the season the players are involved in highly energetic matches every week.
- If they maintained their training load at 100% they would be fatigued when playing a match.
- However, they do not want to become unfit so reduce the load to 80%.

3.12



3.12.1
- Force summation is the combination of forces produced by different body parts **OR**
- Force summation is achieved by adding the forces of each body segment together – these produce a larger force than if only 1 body part was used.
- The more body parts involved in completing a movement, the greater the force that can potentially be generated & then transferred to the striking implement like a racket or bat.

3.12.2 Picture 2

3.12.3 Allocate 1 mark per fact:
- Picture 2 demonstrates the various body parts/segments are activated in the correct order.
- The body parts are engaged at the correct time because each arch is placed directly in the middle of the previous arch (indicating correct timing).
- Each successive body segment commences movement at exactly the right time, starting with bigger muscles in the legs and trunk and ending with smaller muscles in the hands.

3.12.4 Allocate 2 marks per picture.

Picture 1:

- the player has the correct order of body parts BUT the shoulder, forearm and hand are engaging too late.
- This will cause an uncoordinated movement.
- If a body segment starts too late (in relation to the previous segment) there will be less force transferred.

Picture 3:

- the player has not used 1 important body segment, i.e. the legs.
- All the body parts after the trunk movement are engaging too early.
- If a segment starts accelerating too soon (in relation to the previous segment) there will be less force transferred.

3.13 Accept any 3 of the following facts:

- The heart adapts by becoming bigger.
- The heart becomes stronger.
- The cardiac muscle that surrounds the heart hypertrophies.
- The heart develops thicker, stronger walls.
- The area that changes the most is the left ventricle.
- The heart pumps slower.
- More blood is pumped around the body per minute.
- More capillaries develop in the muscles and around the heart.

3.14 Allocate 1 mark per fact:

- More capillaries allow for more efficient gaseous exchange of oxygen and carbon dioxide.
- When exercising the player needs more oxygen delivered to the working muscles.
- The player needs the CO_2 removed as fast as possible.

QUESTION 4

4.1 Allocate 1 mark for each fact.
- It levels the playing fields and racing is fair.
- Tactics and skill is what decides the winner.

Accept feasible.

4.2 Accept any 3 of the following:
- There are 6 races over a weekend which means that spectators get value for money.
- The best skippers in the world are racing.
- On-board cameras deliver point-of-view racing onto big screens.
- On-board microphones give race fans the sensation they are on the race boat, as they listen in on the winning tactical calls.

4.3 Accept any 4 of the following:
- Sailors wear safety harnesses.
- They carry spare air in case they are trapped underwater.
- They wear vests.
- They wear helmets.
- They have communication radios so that they can hear the skipper.

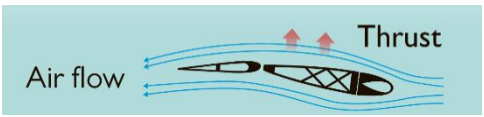
4.4 4.4.1 Accept any 3 of the following:
- Reduction in muscle & liver glycogen and blood glucose.
- The body suffers from depleted energy sources.
- Decrease in power coming from the muscle over time.
- Athlete needs longer recovery time after training and competition.
- The athlete suffers from recurring injuries.
- Low immune system.
- Tight shoulders and neck.
- Low self-esteem and loss of confidence.
- Irritable and snappy.
- Angry and aggressive.
- Loss of interest.

4.4.2 Allocate 1 mark for any 3 of the following facts:
- Reduction in muscle & liver glycogen and blood glucose – if there is no glycogen in the muscles, then they cannot contract.
- The body suffers from depleted energy sources – can no longer function properly.
- Decrease in power coming from the muscle over time – for sailing at this speed the athletes need to be quick and strong.
- Athlete needs longer recovery time after training and competition – no ideal when racing is every weekend.
- The athlete suffers from recurring injuries – prevent competition at a high level.
- Low immune system – the athlete may be more susceptible to catch common colds.

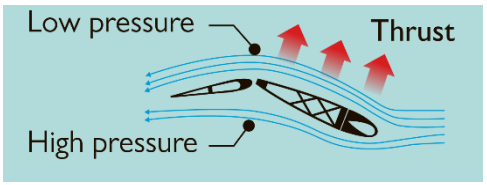
- Tight shoulders and neck – that can lead to a tight torso, tight jaw, tightness in the arms and hands and eventually tightness into the legs and ankles which will hamper movement.
- Low self-esteem and loss of confidence – won't be at peak performance level.
- Irritable and snappy – this is a team sport so will impact on team spirit.
- Angry and aggressive – ditto.
- Loss of interest – coach and trainers will need to motivate.

4.5

Picture A



Picture B



Allocate 1 mark per fact:

- In Picture A, the sail has been kept almost straight and isn't catching much wind.
- The air flow on 1 side of the sail (bottom of the picture) is slightly slower than on the other side.
- Slow airflow means more air pressure and this causes thrust.
- In Picture B the sail has been curved to catch more wind causing more pressure and therefore more thrust and
- the boat moves faster through the water.

4.6

- Water flow above the foil is less/less pressure.
- Water flow under the foil is greater.
- The higher pressure under the foil pushes the foil up and out of the water, creating lift.

4.7 Accept any 2 of the following:

- It is unstable.
- Can nosedive.
- Has a smaller base of support.

4.8 Allocate 1 mark for a possible cause. Allocate 1 mark for the impact on the boat.

- A collision with another boat or floating item in the water will result in a scratched hull.
- This will cause a rough surface moving through the water.
- The rough surface would slow the boat down.

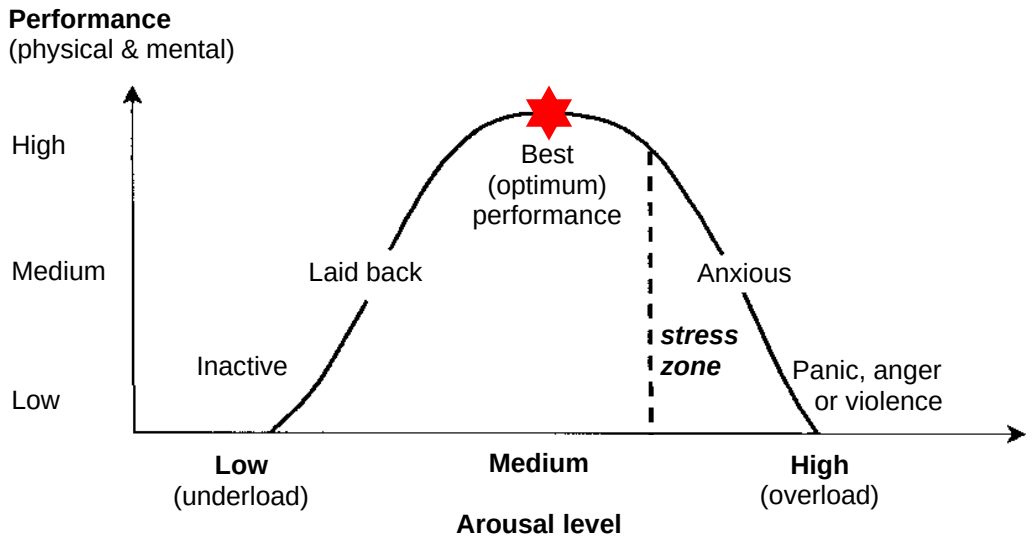
QUESTION 5

5.1 He was the 1st World Series diver to receive perfect marks.

5.2 27 m

5.3 They travel at 80 km/hr and would get injured otherwise.

5.4



Allocate 1 mark for each of the following:

- 'performance' on the *y*-axis
- 'stress/anxiety' on the *x*-axis
- the shape of the graph
- for indicating where 'low stress' or 'laid back' is (learners can use other adjectives)
- for indicating where 'anxious' or 'panic' is (learners can use other adjectives)
- indicating 'optimal/perfect' arousal

5.5 See diagram above for star.

QUESTION 6

Examine the information provided in sources A, B and C on pages 33 and 34. Use it to write an essay of 1–1½ pages on the following topic:

> An athlete competing year-round at an elite, competitive level will experience strain not only to their body but also to their mind. Modern sports are extremely competitive and performance levels are constantly improving and reaching higher levels. As a result, elite athletes are often susceptible to sport burnout.

Discuss the various factors and conditions that can lead to sport burnout and the impact of burnout on the mind and body. Also explore how athletes and their coaches can identify, monitor and manage burnout.

To answer this question, you are expected to:

- Examine the source material carefully and use the information in the sources to best develop your essay.
- Integrate your own relevant sport science knowledge.
- Use real-life examples where applicable.
- Make use of the rubric to shape your response.

Source A

Gymnastics star retires to focus on happiness

British gymnast Ellie Downie has decided to retire at 23. Protecting her mental health: Ellie Downie has faced hard times in the last few years.

It is a huge moment for the young gymnast. At just 23 years old, British star Ellie Downie has announced she is hanging up her leotard. She is still only young, but Downie has already had a long career. She started gymnastics when she was three. At 15, she won a bronze medal in the European Championships. Next, she went to the 2016 Olympic Games. But now, she has decided to quit. 'After a really tough last few years I've made the decision to prioritise my mental health and happiness,' she said.

[*The Day* 25/1/23]

Source B

Nadal 'mentally destroyed'

Rafael Nadal says he is 'mentally destroyed' after his Australian Open title defence came to an end in the second round. The Spaniard struggled with a left hip problem as he fell to a 6-4 6-3 7-5 defeat by American Mackenzie McDonald. The 36-year-old said he was carrying the injury before the match, but the pain had been 'nothing like today'. 'I really hope that it doesn't put me out of the court for a long time,' Nadal said. 'It's not only the recovery. It's all the amount of work that you need to put together to come back at a decent level.

Speaking at his post-match news conference, the 22-time Grand Slam champion said he felt he 'cannot move' after his earliest exit at a Grand Slam since the 2016 Australian Open, when he was eliminated in the first round. '[I] just can't say that I am not destroyed mentally at this time, because I will be lying,' he said.

Nadal was trailing by a set and a break when he pulled up with the injury, taking a medical timeout towards the end of the second set before continuing. He said he had considered stopping all the time because he was in pain and mentally exhausted. 'Just try your best until the end,' added Nadal. 'That's the philosophy of the sport. That's the essence of the sport by itself. I tried to follow that during all my tennis career.' This is the latest in a series of physical and emotional problems for Nadal, who admitted he had no feeling in his left foot during his victory at the French Open last year.

He said it was his love of the sport that keeps him going amid the injury setbacks. 'It's a very simple thing: I like what I do,' he said. 'I like playing tennis. I know it's not forever. I like to fight for the things that I have been fighting for almost half of my life or even more. When you do things that you like to do, at the end of the day, it's not a sacrifice'.

[Adapted from *The Day* 25/1/23]

Source C

Simone Biles: 'It's basically life or death'
Tuesday, 28 September 2021

Is fame a curse? In a painfully honest new interview, the record-breaking gymnast explains why her controversial decision to back out of four Olympic finals was the right one.

It was on the fifth day of the Olympic gymnastics at Tokyo that everything went wrong. Simone Biles was in the middle of a vault when she had an attack of 'the twisties' – a mental block which makes gymnasts unable to tell where they are in the air and lose control of their bodies. Worst of all, she had no idea how she was going to land. It was, she says, 'the craziest feeling ever'.

Although she completed her routine safely, she knew at once that she had to withdraw from the event. 'My perspective has never changed so quickly from wanting to be on a podium, to wanting to be able to go home, by myself, without any crutches,' she explains in an interview for New York magazine. 'It's so dangerous, it's basically life or death. It's a miracle I landed on my feet. If that was any other person, they would have gone out on a stretcher.'

Her decision to back out of four finals rocked the world of sport. Instead of the six gold medals she had been expected to win, she left Tokyo with one silver and one bronze. Her decision to focus on her mental health was widely applauded, though some critics accused her of simply buckling under pressure.

She compares her experience to suddenly going blind. 'One morning, you wake up, you can't see… but people tell you to go on and do your daily job as if you still have your eyesight. You'd be lost, wouldn't you?' Not that it happened entirely out of the blue. Because of the pandemic, nothing felt quite right when she arrived in Tokyo. Her family could not be there to cheer her on; nor could the large crowds she was used to. She felt increasingly nervous and, despite her coaches' help, unable to perform properly:

'I was not physically capable. Every avenue we tried, my body was like, "Simone, chill. Sit down. We're not doing it." And I've never experienced that.' As the most successful gymnast ever, she was under constant pressure to fulfil the expectations of her parents, her coaches, her fans and the media.

She is now spending time with her family and friends, and taking part in an exhibition tour, but not competing. Of her decision to withdraw at Tokyo, she says: 'Everybody asks, "If you could go back, would you?" No: I wouldn't change anything because everything happens for a reason. And I learned a lot about myself – courage, resilience. how to say no and speak up for yourself.'

[*The Day* 28/9/21]

ESSAY RUBRIC

	0 mark	1 mark	2 marks	3 marks	4 marks	Possible mark (20)
Use of sources	No reference to sources.	Only 1 source referred to. Poorly integrated.	Not all sources used but those used were integrated.	Full use of sources but not fully integrated or expanded on.	Full use of all sources integrated into discussion with understanding.	4
Content relevance	No content relevance.	Little content provided and not integrated into discussion.	Some content provided but not integrated into discussion.	Some of the content provided is relevant and integrated into the discussion.	All the content provided is relevant and integrated into the discussion.	4
Use of own knowledge **X2**	No own knowledge provided.	Some facts and information given beyond the sources.	Some own knowledge provided but not integrated into the discussion.	Response shows evidence of own knowledge integrated into discussion.	Response shows substantial use of own knowledge and is well integrated into discussion.	8
Quality of discussion	Missed the point.	Little linkage evident. Reasoning correct but hard to follow.	Some linkage evident. Reasoning correct.	Compelling with regular linkage.	Reasoning is very clear and succinct. Flow is logical.	4

Total: 200 marks