Please paste the barcoded label here	TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2023

SPORT AND EXERCISE SCIENCE

EXAMINATION NUMBER

Time: 3 hours 200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 30 pages. Please check that your question paper is complete.
2. **Answer all questions on the question paper** and hand it in at the end of the examination. Remember to write your examination number in the space provided above.
3. Read the questions carefully.
4. Use the total marks awarded for each question as an indication of the detail required.
5. It is in your own interest to write legibly and to present your work neatly.
6. TWO blank pages (pages 29–30) are included at the end of the question paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.

FOR MARKERS' USE ONLY

Question	1	2	3	4	5	6	**Total**
Marks	37	62	17	47	17	20	**200**
Obtained							

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QUESTION 1

1.1 Match a description in column B to the term in column A. Write only the letter of your chosen description in the table below.

COLUMN A		COLUMN B	
1.1.1	Oxygen debt	A	When the body's consumption of Oxygen exceeds its intake
1.1.2	Oxygen deficit	B	A thick protein filament
1.1.3	Myosin	C	The percentage of the blood volume consisting of red blood cells
1.1.4	Actin	D	The amount of Oxygen required to remove the Lactic Acid, and replace the body's reserves of Oxygen
1.1.5	Paralympic Games	E	Runs from the front to the back of your body
1.1.6	Special Olympics	F	This is the organised division of training into a number of specific blocks, periods or phases
1.1.7	Transverse rotation	G	Include athletes with a wide range of physical disabilities
1.1.8	Anteroposterior rotation	H	A thin protein filament
1.1.9	Periodisation	I	Runs from side to side of the body
1.1.10	Haematocrit	J	For athletes with any disability that results in problems with growth and development

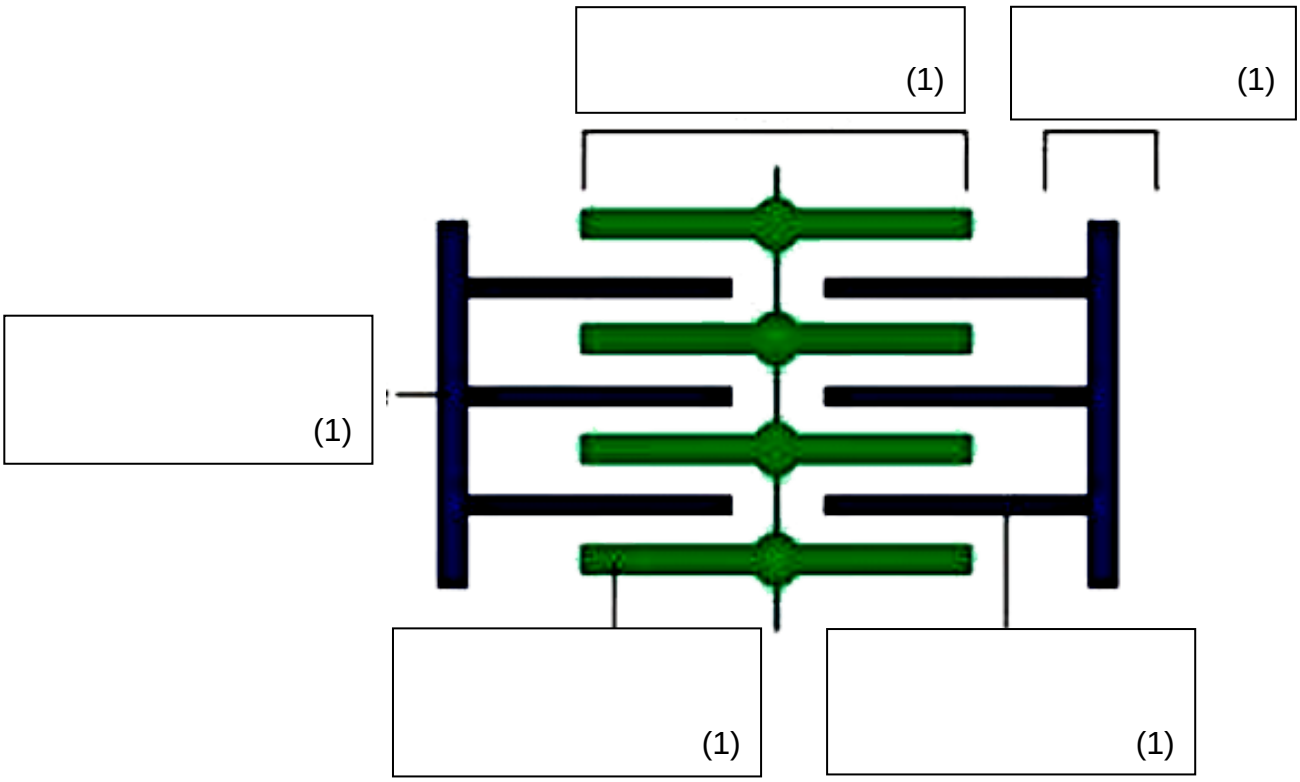
ANSWERS:

1.1.1	
1.1.2	
1.1.3	
1.1.4	
1.1.5	
1.1.6	
1.1.7	
1.1.8	
1.1.9	
1.1.10	

(10)

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1.2 Label the diagram of a sarcomere below



[Source: <https://www.meritnation.com/describe-the-structure-of-a-sarcomere/biology/Accessed 2/6/22>]

1.3 Outline AND shade in the Base of Support in the following picture.



[Source: <https://www.google.com/female+contemporary+dance Accessed 17/8/22>]

(6)

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1.4 Complete the following table by selecting which of the three energy systems is **mostly** used to provide energy for each sporting activity. Tick the appropriate column to indicate your answer.

	ENERGY SYSTEMS		
	ATP/PC System	**Lactic Acid System**	**Aerobic System**
400 m sprint			
Arm wrestling			
Basketball jump shot			
Race walking			
Volleyball spike			

(5)

1.5 Provide definitions AND provide explicit / clear sporting examples of the following terms:

1.5.1 Form drag:

Definition:

_____

_____

_____

(2)

Example:

_____

_____

_____

(2)

1.5.2 Tapering

Definition:

_____

_____

_____

(2)

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Example:

(1)

1.5.3 Group dynamics

Definition:

(3)

Example:

(1)
[37]

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QUESTION 2

Examine the sources below and use them to answer the questions that follow.

SOURCE A

Sacrifice in pursuit of glory

Brad Binder's road to motorcycle racing glory was not paved in gold. It's a story of family sacrifice in pursuit of racing glory, long lonely months apart and staggering sums of money. An astonishing win for Binder in his rookie year, on Sunday in the 3rd round of the 2020 MotoGP calendar in the Czech Republic, had racing fans in elation, and for good reason. His win was the first ever by any South African in MotoGP.

The ranks upon ranks of Italian and Spanish riders who can be found in abundance in all classes of the world's premier motorcycle racing series are there due to a combination of factors. They race in nationally approved racing programmes from a young age. Motorcycle racing is recognised and given the place it deserves – right alongside football.

Some crucial points:

- The bike's minimum weight is 160 kg.
- The bikes often top 300 km/hr with an average speed of 200 – 250 km/hr.
- The men who blast around tracks on these machines are finely tuned athletes with training regimens and diets that would not look out of place in the diaries of Olympians.
- The smallest mistake, the tiniest change in body position, the smallest twist of the throttle could make the difference between a rider moving from 1st to 10th on the timing sheets.
- A race typically lasts approximately 45 minutes.
- Riders can lose 6 litres of sweat when racing.
- When cornering, the motorbike can lean 61 degrees.

[The Witness August 12, 2020]

SOURCE B



[Source: <https://www.motogp/results/free-practice Accessed 8/6/22>]

SOURCE C

Tyre warmers



[Source: <https://www.motogp+tyre+warmers Accessed 8/6/22>]

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SOURCE D



[Source: <https://www./brad-binder-racing-bikes Accessed 8/6/22>]

SOURCE E

Leg dangle



[Source: <https://www.motogp+leg+dangle Accessed 8/6/22>]

2.1 List TWO reasons for the fans being elated at Brad Binder's win.

(2)

2.2 Explain what is meant by the term 'in his rookie year'.

(1)

2.3 Suggest which food groups a MotoGP athlete would need to consume and why.

(8)

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2.4 Would a MotoGP rider need to ‘carbo-load' before a race? Provide a reason for your answer.

(3)

2.5 Describe the process of 'carbo-loading'.

(7)

2.6 Provide a hydration strategy for Brad Binder.

(5)

2.7 2.7.1 Name the technique used by the MotoGP riders when they ride in formation as shown in source D.

(1)

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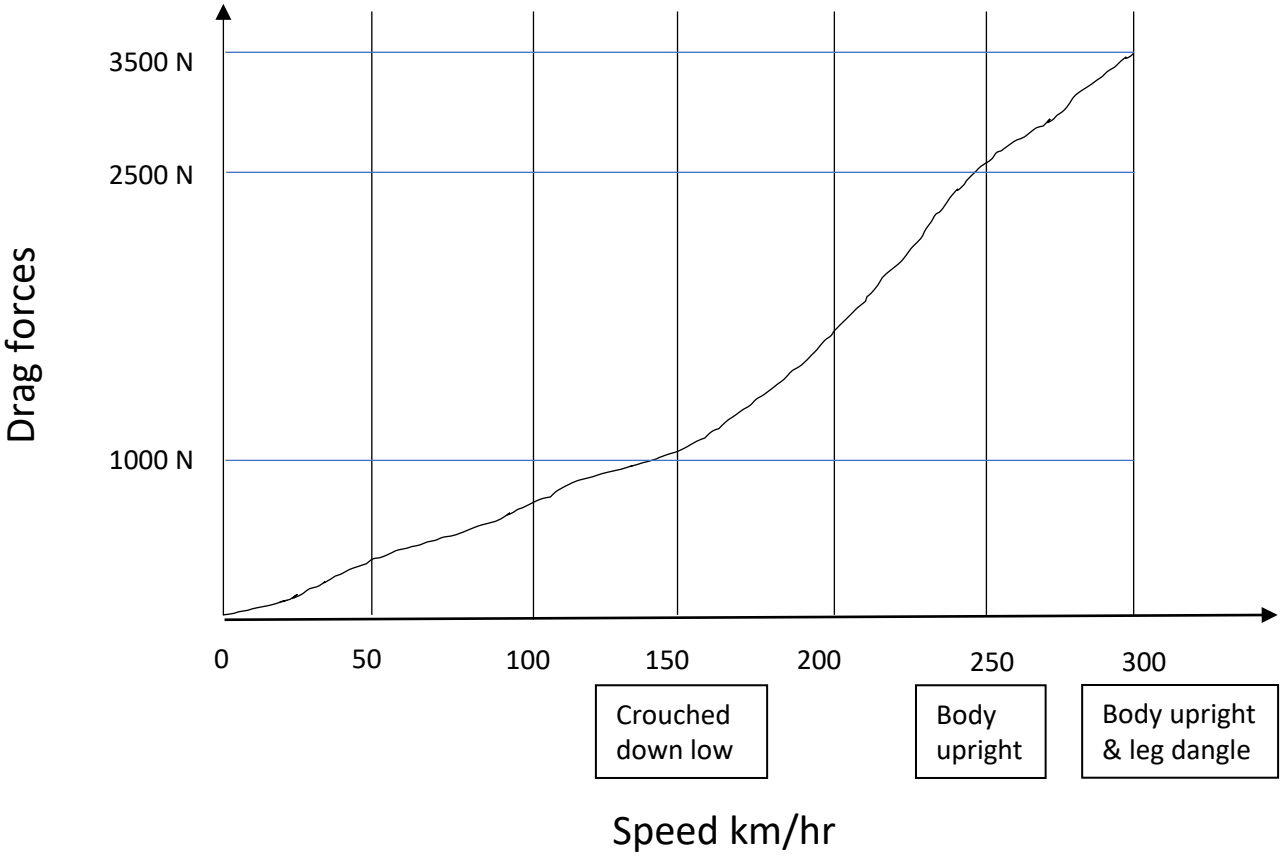
2.7.2 Provide THREE reasons for the riders using this technique.

(3)

2.8 Explain the reasoning behind the use of tyre warmers as depicted in source C.

(3)

2.9 Use the graph below to explain how a MotoGP rider would experience various amounts of form drag while racing.



(8)

2.10 Traction is the resistance between the tyre and the road, as seen in source B. Briefly explain the impact of traction/friction on the control of the bike when a MotoGP rider goes around a corner.

(3)

2.11 Name TWO 'enemies' of traction for a motorcycle rider.

(2)

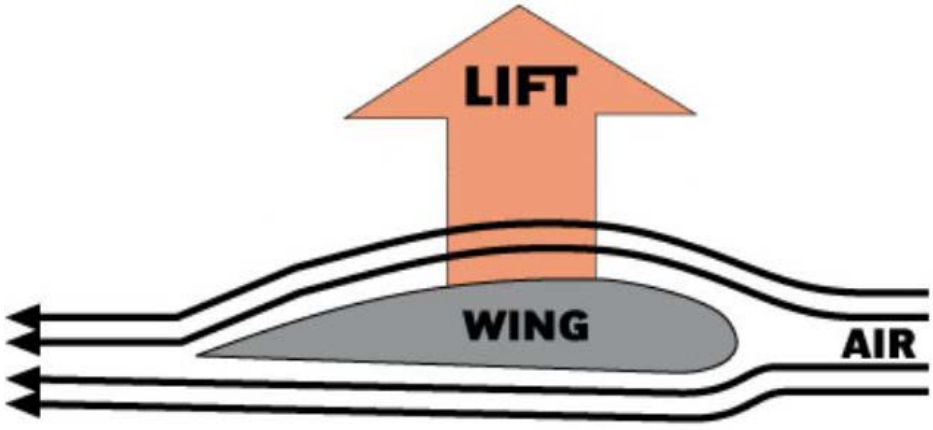
2.12 Explain why the rider is using the leg dangle technique seen in source E.

(3)

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2.13 Label the diagram below depicting the Bernoulli Principle.
Place the following labels on the diagram:

- High pressure
- Low pressure
- High speed air movement
- Low speed air movement



[Source: <https://www.google.com/bernoulli+principle Accessed 8/6/22>]
(4)

2.14 Source A refers to the Italians and Spanish starting the sport at a young age. This is called LTAD.

2.14.1 What does the abbreviation LTAD stand for?

_____
(1)

2.14.2 Use a sport of your choice to compare the 'Learn to Train' with the 'Train to Compete' concepts.

Sport: _____

_____

_____

_____

_____

_____

(8)
[62]

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QUESTION 3

Read the source below and use it to answer the questions that follow.

Two extreme athletes find themselves in hospital sharing the same ward. Gary is a cross-country snow skier while Barry competes in endurance running in deserts. The nurse informs them of their core body temperature when they were admitted – Gary's was 34° C while Barry's was 41°C. Both men were critical when admitted.

3.1 What medical condition was Gary suffering from?

_____

(1)

3.2 What medical condition was Barry suffering from?

_____

(1)

3.3 Explain what occurred, physiologically, in their bodies when suffering from their conditions.

3.3.1 Gary's body:

_____

_____

_____

_____

_____

(3)

3.3.2 Barry's body:

_____

_____

_____

_____

_____

(3)

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3.4 Describe the physiological responses and adaptations that Gary experiences when training at high altitude.

(3 × 3 = 9)
[17]

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QUESTION 4

Examine the source below and use it to answer the questions that follow.

Sports Psychology has been frequently ignored until recent significant data suggested a relationship between mental skills and athletic performance. Athletes frequently emphasize the significance of psychological state during important decisions and actions in sports. The American professional golfer Arnold Palmer, for example, stated that the game of golf is 90% psychological. Mental readiness plays a significant role since it represents the athlete's ability to comprehend personal mental well-being under stressful conditions.

A study was conducted on 235 Canadian Olympic athletes who participated in the 1984 Olympic Games. Individual interviews were carried out with 75 athletes and a questionnaire was completed by another 160 to assess their mental readiness for the Olympic Games and factors related to mental readiness. Common elements of success were identified, as well as factors that interfered with optimal performance at the Olympic Games. Significant links were found between Olympic performance and certain mental skills.

It has been determined that athletes participating at Olympic Games have more or less equal levels of training and physical preparedness. However, it is cognitive fitness and mental stability that enable and distinguish the outstanding sport-accomplishments. In the questionnaires athletes stressed that they have had the same training sessions polished to perfection for many years before they actually identified the pitfalls that prevented them from reaching the highest triumphs in sports performance. However, it was not until their mental skills were worked on that they became top Olympic performers and champions in the field.

In the meantime, nutritional psychologists described the correlation between increasing snacking habits — high-carb and low-fat dieting — and the rising records of anxiety, stress, aggression, tension, and depression cases. These five factors are identified as the most common to affect athletic performance.

The ketogenic diet is characterised as low carbohydrate, high fat, and moderate protein content. During endurance training such as triathlon, marathon, and cross-country cycling, fat oxidation is the most significant metabolic adaptation, because it provides cognitive and muscular strength. Athletes who get their energy from ketones perform with more efficiency for longer, while athletes whose carbo loading metabolised faster are left with energy for a shorter time period.

[Adapted: <https://www.athletes+vs+non+athletes Accessed 9/6/22>]

4.1 Provide a possible reason why 'Sports Psychology has been frequently ignored until recently.'

_____

_____

(2)

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4.2 Explain, using your own words, what is meant by the statement 'data suggested the existing positive correlation between mental skills and athletic performance'.

(2)

4.3 What, according to this study, is the difference between the Olympic champions and other Olympic athletes?

(3)

4.4 Name THREE mental strategies that a coach or sports psychologist could recommend to Olympic athletes to enable them to become Olympic champions.

(3)

4.5 List THREE factors identified in the research as having the most common negative effect on athletes.

(3)

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4.6 Explain how a ketogenic diet can be an advantage to endurance athletes.

(6)

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4.7 An athlete suffering from stress will undergo physiological changes. Some of these changes will affect their performance in a positive way and some will have a negative effect. Complete the table below.

Physiological change	**Is this change positive or negative?**	**Explain why this physiological change is positive or negative.**
(1)	(1)	(1)
(1)	(1)	(1)
(1)	(1)	(1)
(1)	(1)	(1)

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4.8 Use the Inverted-U Hypothesis to explain the process that an Olympic athlete will move through in order to reach optimal levels.

You may include a diagram to assist in your explanation – ensure that it is appropriately labelled.

(8)

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4.9 Explain the Catastrophe Theory.

(5)

4.10 What does the Catastrophe Theory Model suggest might happen to an Olympic athlete's arousal and subsequent performance?

(3)
[47]

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QUESTION 5

Read the sources below and use them to answer the questions that follow.

SOURCE A

Disabled athletes: do they have an advantage?

Oscar Pistorius is a double-amputee sprinter who set world records in the 100 m, 200 m and 400 m at the Paralympics in 2004. He then applied to compete at the able-bodied 2008 Olympics, but the IAAF had reservations about letting him. They said he had an unfair advantage, and they might have been right.

Pistorius runs with two curved prosthetic racing legs made of carbon fibre. According to the IAAF they provide less air resistance than human legs do, and they allow him to distribute energy differently.

[Huff post July 2007]

SOURCE B

World's fastest blade runner gets no competitive advantage from prostheses, study shows.

A study was conducted on various athletes with bilateral leg amputations. An expert in running prostheses biomechanics was enlisted to conduct the study.

On the treadmill and track, he measured acceleration out of the starting blocks, maximum speed along a straight line and around curves, velocity at aerobic capacity and sprint endurance (all-out effort). They took the results from all available data from elite bilateral amputees and compared them to the results from non-amputees.

'We found that no athlete with prosthetic legs has ever performed better than an elite non-amputee athlete in lab-based experiments in any measure that relates to sprinting performance.'

Athletes using prosthetics were 40% slower out of the starting blocks, had 19% slower velocity at aerobic capacity and were 1–3% slower around curves compared to non-amputees.

[University of Colorado Boulder published 5 Jan 2022]

5.1 Source A states that the prosthetic legs 'provide less air resistance'. Why would a prosthetic leg have less air resistance?

_____

_____

_____

(2)

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5.2 Why do you think that an athlete with prosthetic legs is 40% slower out of the starting blocks?

(2)

5.3 Provide a possible reason why scientists test runners' speed 'around curves'.

(2)

5.4 Why is it that an athlete with prosthetic legs is 1–3% slower around curves?

(2)

5.5 List NINE ways in which a school would have to adjust should the school accept learners in wheelchairs.

(9)
[17]

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QUESTION 6

Read sources A, B and C as well as the rubric carefully. Use them to answer the following question.

'While it is very important to have individually talented athletes, it is also very important to foster teamwork in order to achieve success as a team.'

Write an essay of 1 to 1½ pages where you discuss the statement above.

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 into your essay.
- Use real-life examples where applicable.

You can plan your essay on page 28.

SOURCE A

Phil Jackson – Chicago Bulls

According to the famous coach of the Chicago Bulls, Phil Jackson, the strength of the entire team lies in the hands of each member. At the same time, the ultimate strength of individual members is the team itself. A team without teamwork will never be successful in the end. This is why most team coaches spend a good amount of time to foster teamwork within their team. Without teamwork, nothing can be achieved as a group.

SOURCE B

Jimmy Moody – 2007 and 2009 NCAA Fencing Champion

At a fencing event, team points are accrued based on each athlete's individual performance, in other words, each athlete's points are added together to get a team score. And like with most sports, when everyone focuses hard on their own contribution, great things can be achieved.

Olympic hopeful Jim Moody has witnessed this several times throughout his fencing career. During his time at Penn State University, Moody and his teammates helped their university win the team championship titles in 2007 and 2009.

'Every team starts as a group of individuals, then you start to lean on each other', Jimmy says. 'You motivate each other, pick up slack when someone is having an off day, congratulate others on a performance … then suddenly you all hold together to a higher standard because you are doing it for more than yourself. Now our opponents aren't just up against an individual, they have to contend with the whole team.'

[learn.truesport.org]

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SOURCE C

Worst teammates!

While great teamwork can inspire and unite us, teamwork failures occur too and can cause discontent, conflict, and of course, losing records.

In cricket and rugby, collisions often lead to dropped balls and even injuries. When the West Indies played a one-day cricket international against Pakistan, two players rushed to catch the ball and neither communicated to the other. The result? A shocking drop!

These collisions often occur when a person's ego gets in the way, or they fail to listen. These types of situations can be prevented by establishing strong communication among players during months of practice.

In basketball there is a perfect example where Russell Westbrooks would not pass the ball to a teammate that he had argued with. He would rather miss a shot than pass it! To make matters worse he failed to see Kobie Bryant who was also available to take a shot. This was clearly a teamwork failure.

[Examiner's story]

	0 mark	1 mark	2 marks	3 marks	4 marks	Possible mark (20)
Use of sources	No reference to sources	Reference made to one source only	Reference made to 2 sources	Source detail very close to full potential		3
Content relevance and use of own knowledge × 3	No content relevance or information provided	Some facts and information given beyond the sources BUT not integrated into discussion	Some facts and information given beyond the sources AND integrated into the discussion	Most information is relevant, appropriate and accurate	All information provided is relevant, appropriate and accurate	12
Real-life examples	No examples commented on	One real-life example provided	Two real-life examples provided	Three or more real-life examples provided		3
Quality of discussion	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

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[20]

Total: 200 marks

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PLANNING PAGE:

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ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.

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