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**TOTAL
MARKS**

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NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2021

SPORT AND EXERCISE SCIENCE

EXAMINATION NUMBER

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Time: 3 hours

200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 28 pages. Please check that your question paper is complete.
2. **All the questions must be answered on the question paper.**
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 27 and 28) are included at the end of the question paper. If you run out of space for a question, use these pages. Clearly indicate the question number of your answer should you use this extra space.

FOR MARKER'S USE ONLY

Question	1	2	3	4	5	6	7	8	Total
Marks	35	28	30	30	13	34	10	20	200
Obtained									

QUESTION 1

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

COLUMN A	COLUMN B
1.1.1 Dynamic muscle action	A Contains the myosin filaments
1.1.2 The sarcomere	B Is a proprioceptor
1.1.3 The I band	C Visible shortening or lengthening of a muscle
1.1.4 Static muscle action	D Contains thin actin filaments
1.1.5 The A band	E Contains both actin and myosin filaments
1.1.6 The H zone	F No visible shortening or lengthening of a muscle
1.1.7 The Golgi tendon organ	G The area between the two Z lines

ANSWERS:

1.1.1	
1.1.2	
1.1.3	
1.1.4	
1.1.5	
1.1.6	
1.1.7	

(7)

1.2 Choose the most correct option to each of the following questions. Write only the letter of your choice in the answer grid below.

1.2.1 Which option would an active female choose in order to lose weight?

- A Eat 2000 calories per day and burn 2500 calories per day while exercising.
- B Eat 2000 calories per day and burn 2000 calories per day while exercising.
- C Eat 2000 calories per day and burn 1500 calories per day while exercising.
- D Eat 2000 calories per meal and burn 2000 calories per day while exercising.

(1)

1.2.2 Which of the following best describes 'carbo-loading'?

- A A high GI diet, followed by a 2–4 day reduction in exercise.
- B A 2–4 day reduction in exercise load, followed by reduction in carbohydrates.
- C A balanced diet high in carbohydrates, followed by a 2–4 day reduction in exercise.
- D Carbohydrate depletion, then a 2–4 day reduction in exercise, followed by an increase in carbohydrates.

(1)

1.2.3 When should athletes consume more high glycaemic index foods?

- A During performance.
- B Immediately post-performance.
- C Up to 2 hours pre-performance.
- D During the 2 days of 'carbo-loading'.

(1)

ANSWERS

1.2.1	1.2.2	1.2.3

1.3 Complete the following table on the predominant energy systems.

	ATP/PC system	Lactic Acid system	Aerobic system
Source of fuel	<ul style="list-style-type: none"> <p>(1)</p>	<ul style="list-style-type: none"> <p>(2)</p>	<ul style="list-style-type: none"> Carbohydrates <p>(2)</p>
Duration	<ul style="list-style-type: none"> 0 – 10 seconds 	With high intensity exercise – <ul style="list-style-type: none"> With maximal exercise – <ul style="list-style-type: none"> <p>(2)</p>	<ul style="list-style-type: none"> <p>(1)</p>
Byproducts	<ul style="list-style-type: none"> <p>(1)</p>	<ul style="list-style-type: none"> <p>(1)</p>	<ul style="list-style-type: none"> water <p>(1)</p>

1.4 Outline **AND** shade in the Base of Support in each of the following pictures.

Picture A



[<<https://thehealthsite.com>> Accessed 21/1/21]

(3)

Picture B



[<<https://sprint start>> Accessed 22/1/21]

(5)

Picture C



[<<https://www.mlive.com/volleyball>_Accessed 22/1/21]

(3)

1.5 Circle the correct phrases to complete the sentences on fluid forces.

1.5.1 The more mass a projectile has

- (a) the more weight it has.
- (b) the more resistance it encounters. (1)

1.5.2 The faster a projectile travels

- (a) the more force gravity exerts on it.
- (b) the more drag it is exposed to. (1)

1.5.3 To reduce fluid resistance of a projectile

- (a) reduce the front area.
- (b) reduce the smoothness of its surface.
- (c) increase its buoyancy. (1)

[35]

QUESTION 2

In the table below, information regarding two different athletes and the sport in which they participate is provided. Use this information to assist in answering the questions that follow.

Athlete A	Athlete B
Elite individual athlete	Elite team sport athlete
Target sport	Interacts with teammates and opposition
Needs intense focus and concentration	Performs under high pressure from opponents
Maintains a low heart rate and controlled breathing	High levels of physical exertion
Spectators are kept quiet	Loud spectators and music played over loudspeakers

2.1 Provide an example of

2.1.1 a 'target sport'

(1)

2.1.2 a 'team sport'

(1)

2.2 Provide three examples that show what is meant by "performs under high pressure from opponents".

(3)

2.3 For each athlete, provide psychological strategies that could be used to manage their anxiety and enhance their motivation.

[illegible]

 $(5 \times 2 = 10)$

- 2.4 The table below shows the cardiovascular responses of two 20-year-old males during a full body exercise session. Both men are the same weight and height. One is sedentary and untrained while the other is an elite endurance athlete. Use the information in the table to answer the questions that follow.

	Intensity	Sedentary male	Trained male
Heart rate (bpm)	<ul style="list-style-type: none"> • At rest • At sub-max • At max 	78 110 197	50 80 195
Stroke volume (ml/beat)	<ul style="list-style-type: none"> • At rest • At sub-max • At max 	60 85 120	90 112 190
Cardiac output (ℓ/min)	<ul style="list-style-type: none"> • At rest • At sub-max • At max 	4,6 9,4 19,7	4,5 9,0 32,2

- 2.4.1 How many millilitres (mℓ) of blood is pumped out of the trained athlete's heart with each contraction while at rest?

_____ (1)

- 2.4.2 Explain why the untrained man's stroke volume is lower than the trained athlete's stroke volume at rest.

 _____ (2)

- 2.4.3 Explain why the trained athlete's cardiac output at maximum intensity is 32,2 litre/minute (ℓ/min) compared to the untrained man's cardiac output of 19,7 ℓ/min.

 _____ (2)

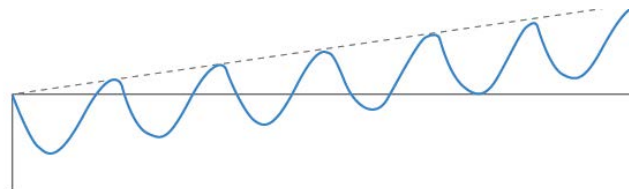
- 2.5 The graphs below show the effect of training on the body's adaptive response. Examine the data and answer the questions that follow.

Body's response to training

Picture A



Picture B



- 2.5.1 State which graph depicts the following:

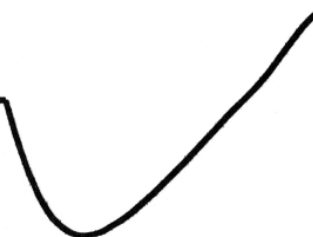
Optimal training

Under-training or incorrect overload

(2)

- 2.5.2 Complete the graph below to show what will happen if **another 2** overloaded training sessions occur with insufficient rest.

Fitness before
Training session



(5)

- 2.5.3 Provide the correct term for what you have shown in Question 2.5.2 above.

(1)
[28]

QUESTION 3

Examine the sources A – C adapted from 'Alone. The search for Brett Archibald'... provided in this question and use them to answer the questions posed.

3.1 Source A

In his book *Alive*, Brett Archibald describes his experiences after falling off a yacht out at sea. He was left to fend for himself at sea for 28 hours and 30 minutes. He survived a shark attack, interest from a barracuda, numerous stings from jellyfish, an attack by 2 seagulls and small fish eating his skin. The ordeal was brutal.

Brett's ordeal, having to pit all of his strength and ingenuity against the forces of nature for more than 28 hours, is something very few people could have survived. So says Professor Tim Noakes. "If you put 1000 people in the sea in those circumstances, 999 would die", Noakes says.

The ocean's temperature – at 28°C – was critical, says Noakes. It meant that Brett was able to keep swimming for longer than would have been possible in even marginally colder water. When we're submerged in water, body heat is rapidly lost and our body temperature drops. In 28°C water, this would be expected to happen after 10 to 15 hours. While Brett was certainly losing body heat, this was limited to some degree by his body shutting off the blood flow to his skin and diverting it to his heart and brain.

[Source: Brett Archibald. 2016. *Alone. The search for Brett Archibald*. Burnet Media]

3.1.1 Exactly how long was Brett Archibald left in the sea?

_____ (1)

3.1.2 List three factors mentioned in the source that resulted in Brett's time at sea being referred to as 'brutal'.

_____ (3)

3.1.3 What accounts for Brett rapidly losing heat when he was in the water?

_____ (2)

3.1.4 What is the scientific term used when the human body temperature drops too low?

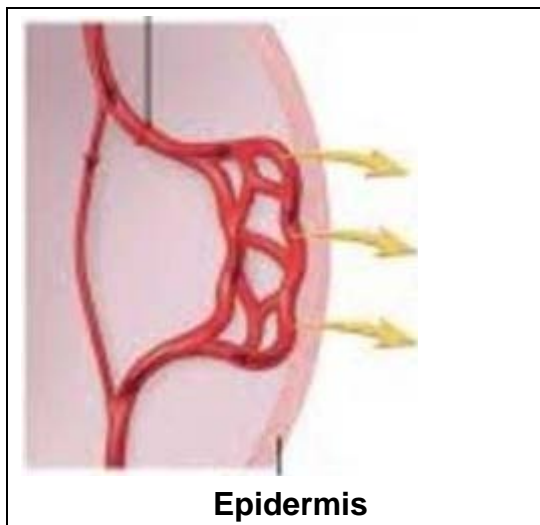
_____ (1)

- 3.1.5 Brett's body reacted to the loss of body heat by controlling his blood flow. This is known as the vascular shunt. Explain what occurs physiologically during a vascular shunt.

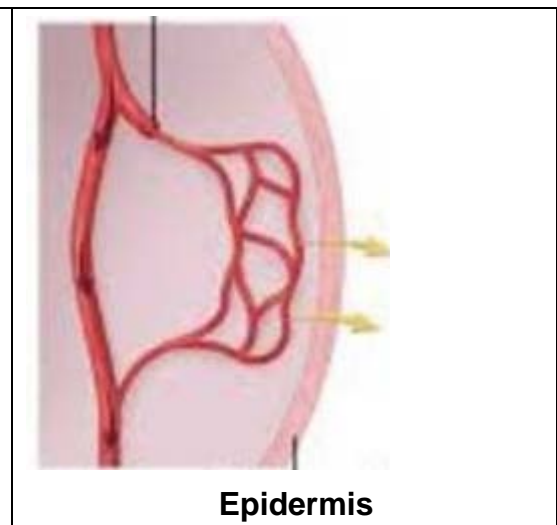
(6)

- 3.1.6 State which picture depicts vasoconstriction, and which depicts vasodilation.

Picture A



Picture B



[<<https://www.researchgate.net/>> Accessed 26/1/21]

(2)

3.2 Source B

Although Brett had no food in his system, no fuel to burn for energy, his brain was metabolising his body's glucose reserves in order to keep going. "If there aren't enough carbohydrates in the digestive system," Noakes explains, "the liver generates glucose from protein or fat."

[Source: Brett Archibald. 2016. *Alone. The search for Brett Archibald*. Burnet Media]

3.2.1 In what form does the body store glucose?

_____ (1)

3.2.2 State three negative side effects that Brett could experience from a lack of carbohydrates in his body.

_____ (3)

3.3 Source C

Physical aptitude aside, the key for endurance of any kind is mental strength, Noakes concludes. Getting one's mind around a goal requires a different kind of coaching and seeing the outcome is important. "Brett's case shows just how powerful the mind can be. He had to decide whether to survive or not. Whenever negative thoughts sneaked up, his mind would simply not let them flow."

[Source: Brett Archibald. 2016. *Alone. The search for Brett Archibald*. Burnet Media]

3.3.1 According to Professor Noakes what, apart from physical ability, enabled Brett to survive this ordeal?

_____ (1)

3.3.2 Name four physiological reactions to Brett's increased mental stress.

_____ (4)

3.3.3 Select two of the physiological reactions named in Question 3.3.2 and discuss how they could have affected Brett's performance.

(6)
[30]

QUESTION 4

Below are the daily schedules of two high school learners. Examine the data and answer the questions that follow.

Kiara's daily schedule		Megan's daily schedule	
12 – 6:30 am	Sleep	12 – 5 am	Sleep
7:00	Breakfast, get ready for school	5:30	5km jog, then shower
7:30	Walk to school	6:30	Breakfast, get ready for school
7:45	Time with class teacher	7:00	Cycle to school
8:00	Lessons start	7:45	Time with class teacher
10:00	Morning tea	8:00	Lessons start
10:15	Lessons resume	10:00	Morning tea
12:15	Lunch, 10 min game of soccer	10:15	Lessons resume
13:00	Lessons resume	12:15	Lunch, 30 min game of basketball
14:30	Walk home	13:00	Lessons resume
14:45	Play computer games	14:30	Water polo practice
16:00	Watch TV	16:00	Cycle home
18:00	Supper	17:00	Play touch rugby with friends in garden
18:30	Homework	18:00	Recreational swim in home pool
20:00	Shower	18:30	Shower and supper
20:30	Watch TV	19:00	Homework
23:00	Sleep	21:30	Sleep

4.1 What types of physical activities does Kiara do everyday?

(2)

4.2 How long, approximately, does Kiara spend exercising every day? Show your calculation.

(2)

- 4.3 Suggest three ways in which Kiara could increase the amount of physical activity she does everyday.

(3)

- 4.4 Would Megan be considered to be overtraining? Substantiate your answer.

(3)

- 4.5 Which learner would have a lower resting heart rate? Account for the lower resting heart rate.

(5)

4.6 Describe the physiological changes that have occurred in Megan's body as a result of all her exercise.

Make reference to the cardiovascular system; the respiratory system and the musculoskeletal system.

[illegible]

(15)
[30]

QUESTION 5

Draw a force summation graph showing force over time when performing a front foot drive or hit in cricket.

Place the following body parts on the graph in the correct order.

- trunk
- hips
- bat
- shoulder
- thigh
- wrist

**[13]**

QUESTION 6

- 6.1 Various forces will impact on a diver performing a forward somersault dive into a swimming pool.

Use the following terms to explain the actions that follow:

Centre of Gravity

Rotation

Air resistance

Water resistance

Action force

Reaction force

Momentum

- 6.1.1 Hurdle step and the take-off off the board:

(4)

- 6.1.2 Diver tucks into a somersault:

(4)

- 6.1.3 Diver kicks out of the somersault and enters the pool in a straight dive:

(4)

6.2 Explain and apply Newton's 1st and 2nd Laws to a springboard diver.

Newton's First Law:

(3)

Application of law:

(2)

Newton's Second Law:

(2)

Application of law:

(2)

6.3 Suggest **THREE** thought processes than an athlete would follow when visualising in preparation for a springboard diving competition.

(3)

6.4 Compare and account for the dietary requirements of a springboard diver and a rugby forward player.

[illegible]

[illegible]

(10)
[34]

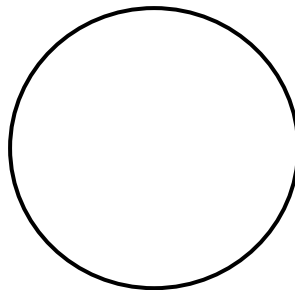
QUESTION 7

Use the diagrams below to indicate the effect of the following factors on a ball travelling through the air.

- Rotation of the ball
- Air pressure above the ball
- Air pressure below the ball
- Velocity above the ball
- Velocity below the ball

Top spin

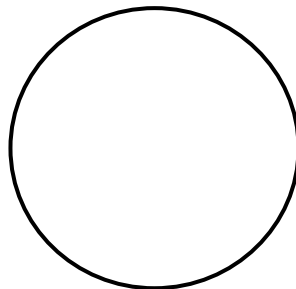
Direction the ball is travelling



(5)

Back spin

Direction the ball is travelling



(5)
[10]

QUESTION 8

Write an essay of 1–1½ pages on the following topic:

Discuss the various factors that influence whether or not people participate in sport.

To answer this question you are expected to:

- Make use of the rubric to shape your response.
- Integrate your own relevant sport science knowledge.
- Use real-life examples where applicable.

ESSAY RUBRIC

	0 marks	1 mark	2 marks	3 marks	4 marks	Possible mark (20)
Quality of content X 2	Little or no content relevance.	Significant important information missing AND Facts not related closely to the topic AND Some serious factual errors. No examples provided.	Some vital information missing OR Many irrelevant facts OR Errors affecting the quality of the essay. No examples provided or examples are not integrated into the discussion.	Sufficient facts provided. Most information is relevant, appropriate and accurate. Real-life examples integrated into the discussion.	Content is detailed. All information is relevant, appropriate and accurate. Real-life examples integrated into the discussion.	8
Use of own knowledge/ experience X 2	No own knowledge provided.	Very few facts and little information provided from own knowledge/ experience.	Includes some facts and information from own knowledge / experience but not integrated well into the discussion (add on).	Some facts and information from own knowledge / experience integrated into the discussion.	Many facts and much information from own knowledge / experience integrated into the discussion.	8
Quality of discussion	The discussion is meaningless.	Flawed in all respects.	Flawed in 2 respects.	Flawed in one respect.	Discussion is consistently focussed, clear and concise (not longwinded or rambling or repetitious). Flow is logical.	4

[illegible]

[illegible]

[20]

Total: 200 marks

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

[illegible]

[illegible]