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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2024

SPORT AND EXERCISE SCIENCE

EXAMINATION NUMBER

Time: 3 hours 200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 32 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. One blank page (page 32) is included at the end of the question paper. If you run out of space for a question, use this page. Clearly indicate the number of your answer should you use this extra space.

FOR MARKER'S USE ONLY

Question	1	2	3	4	5	6	7	**Total**
Marks	33	24	26	60	23	14	20	**200**
Obtained								

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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 table below.

COLUMN A		COLUMN B	
1.1.1	Surface drag	A	Are sensory nerves/receptors found in the muscles.
1.1.2	Form drag	B	Red blood cells.
1.1.3	Proprioception	C	The range of motion present when a body segment is passively moved.
1.1.4	Muscle spindles	D	This depends on the cross-sectional area of the body exposed to the fluid.
1.1.5	Reciprocal inhibition	E	The ability to sense stimuli arising within the body regarding position, motion, and equilibrium.
1.1.6	Erythrocytes	F	Is played within the rules and spirit of the game.
1.1.7	Static flexibility	G	The main motive is to harm an opponent and cause injury.
1.1.8	Hostile aggression	H	When muscles on one side of a joint relax.
1.1.9	Dynamic flexibility	I	The range of motion achieved by actively moving a body part using muscular contraction.
1.1.10	Channelled aggression	J	This depends mainly on the surface moving through the fluid.

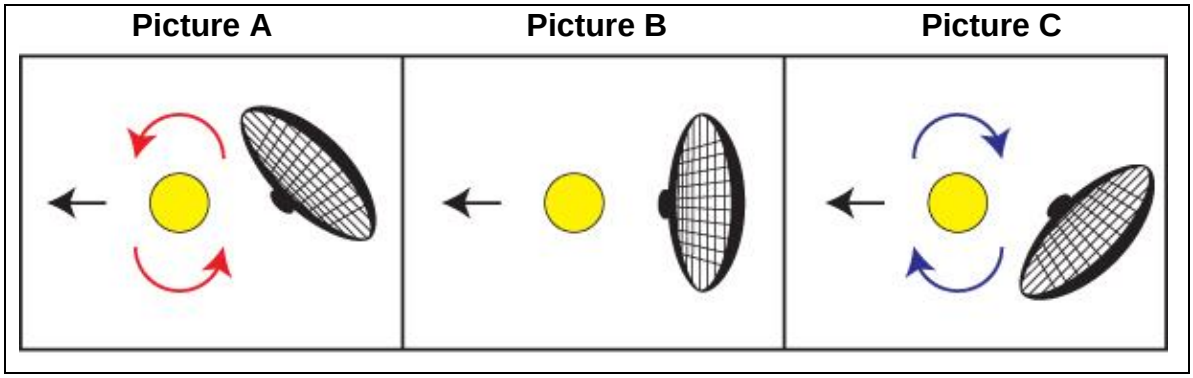
ANSWERS:

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 Examine the pictures below of a tennis ball being hit and answer the questions that follow.



1.2.1 State which picture depicts back spin.

_____

(1)

1.2.2 State which picture depicts top spin.

_____

(1)

1.2.3 State which picture is hit with no spin.

_____

(1)

1.2.4 Describe the impact that back spin would have on the tennis ball's flight.

_____

_____

_____

_____

(2)

1.2.5 Describe the impact that top spin would have on the tennis ball's flight.

_____

_____

_____

_____

(2)

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1.2.6 Describe the impact that back spin would have on the tennis ball when hitting the ground.

(1)

1.2.7 Describe the impact that top spin would have on the tennis ball when hitting the ground.

(1)

1.2.8 Explain what occurs with the airflow around the tennis ball when it is hit with top spin.

(6)

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1.2.9 Why is tennis played on a clay surface considered to be a slow game?

(2)

1.3 The following pairs of pictures have had their Base of Support shaded in. For each pair select which picture is correctly shaded. Place a tick in the box of the correct picture.

1.3.1

Picture A



☐

Picture B



☐

[Source: captionsgram.com Accessed 9/7/23]

(1)

1.3.2

Picture A



☐

Picture B



☐

[Source: <https://www.google.com/forward+lunge+on+a+pad> Accessed 14/3/22]

(1)

1.4 Examine picture A below and answer the questions that follow.

Picture A (Tricep – kickbacks)

STEP 1



STEP 2



[Source: <bio4me.co.za Accessed 9/7/23>]

1.4.1 State what the load is.

_____

(1)

1.4.2 What predominant muscle is providing the effort?

_____

(1)

1.4.3 What class / order of lever is occurring in this exercise?

_____

(1)

1.4.4 Place the fulcrum on the picture below.

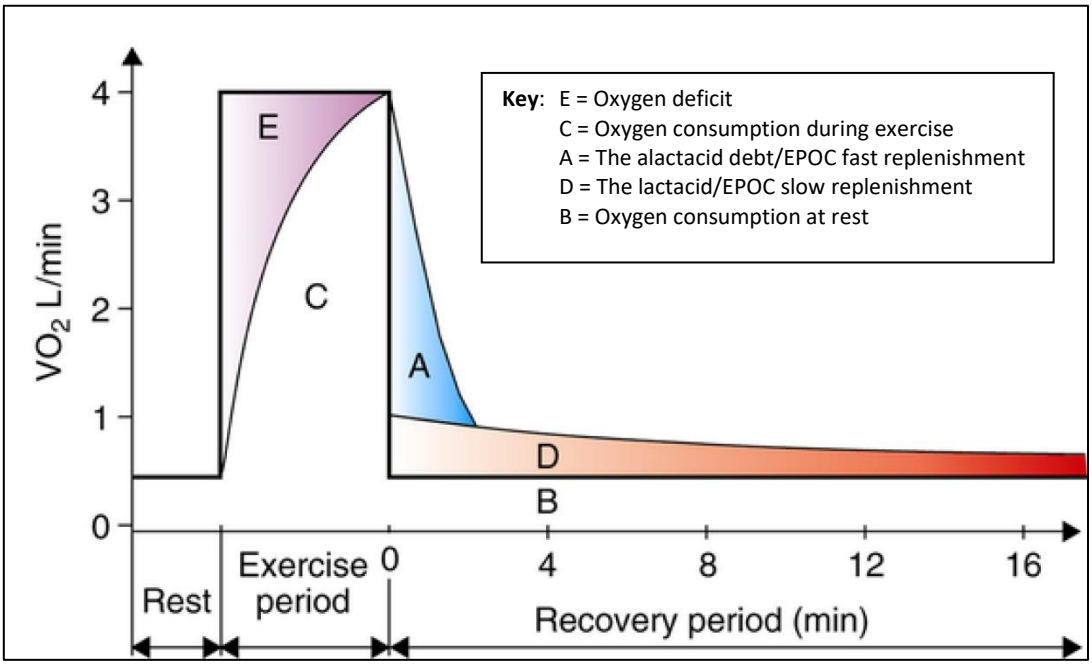


(1)
[33]

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QUESTION 2

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



[Source: <https://www.google.com/q=epoc>, Accessed 9/7/23]

2.1 Explain what is meant by the following terms:

2.1.1 Oxygen deficit

_____

_____

_____

(2)

2.1.2 EPOC

_____

_____

_____

(2)

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2.2 Briefly explain the main differences between alactacid debt and lactacid debt.

(5)

2.3 What does VO_2L/min, indicated on the Y axis, mean?

(4)

2.4 Interpret the data depicted in the graph. Refer to each time period.

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(6)

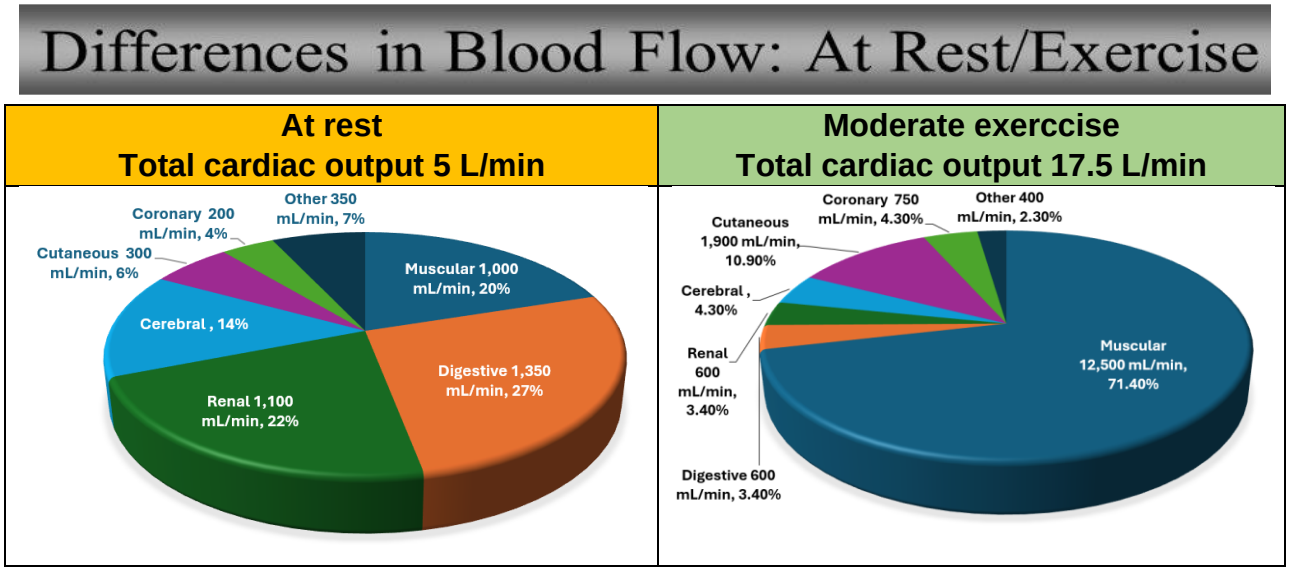
2.5 List 5 tasks that the body needs to perform after strenuous exercise in order to return to homeostasis.

(5)
[24]

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QUESTION 3

Examine the information provided below and then answer the questions that follow.



[Figure adapted from: Saladin, Anatomy & Physiology, McGraw Hill, 2007]

3.1 State the amount of blood flow to the renal organs

3.1.1 while at rest.

_____

(1)

3.1.2 while exercising.

_____

(1)

3.2 What impact could the cerebral percentage blood flow have on the athlete's overall performance?

_____

_____

_____

_____

_____

_____

(3)

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3.3 What percentage of blood is found in the muscles when exercising?

(1)

3.4 During exercise blood flow to digestive organs decreases. What precautions should a long distance athlete take as a result of this?

(2)

3.5 Why does the total cardiac output of an athlete increase during moderate exercise?

(5)

3.6 Use the pie graphs provided on page 10 to explain vasodilation and vasoconstriction as part of the 'vascular shunt'.

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(6)

3.7 Explain the role of pre-capillary sphincters in blood redistribution when exercising.

(7)
[26]

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QUESTION 4

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

Football analysis: The effect of altitude on the 2010 World Cup by Professor Ross Tucker

The effect of altitude on physiological performance

Elite sport competition seldom takes place at high altitude. When the soccer World Cup took place in South Africa, matches were played in Gauteng at high altitude venues. Many people felt it would impact on players, and I predicted a number of changes in matches caused by altitude. The overall summary is that players would cover less distance and also sprint less. The impact of altitude would be to slow the game down.

Every match at the World Cup was being tracked using cameras and all kinds of statistics and technical analysis were produced. How far players ran, how many passes they attempted and completed, tackles made and missed, number of sprints attempted, and so forth.

Altitude – less sprinting, less high intensity distance

The table below is a summary of the data on distances run and sprints attempted during the Round 1 matches. There were 29 altitude matches and 19 sea-level matches, meaning that there are values for 38 teams at sea-level and 58 at altitude (Nelspruit is regarded as sea-level, being at 600 m).

The distances covered by teams in matches were looked at for TOTAL DISTANCE, DISTANCE AT LOW INTENSITY (walking and very slow jogging – the average speed in this zone was 4.5 km/h, which is walking pace), and DISTANCE AT HIGH INTENSITY. The average speed in this zone was 16 km/hour, but in some matches, where more high intensity running was done, it got up above 20 km/hour.

Altitude	Distance (m)	Low intensity (m)	High intensity (m)	Sprints
High	102,872	61,948	25,106	949
Low	106,840	62,095	27,856	1,059
Diff (%)	–3.9%	–0.2%	–11.0%	–11.5%

[Source: <https://sportsscientists.com/2010/07/football-analysis-altitude-and-goal-scoring/>, Accessed 5/7/2010]

4.1 What did the writer of the article predict would happen when matches were played at high altitude?

(3)

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4.2 According to the source, what average speed is considered to be high-intensity running?

(1)

4.3 Compare the high-altitude data with the low-altitude data in the table provided.

(6)

4.4 Why is there a difference between low-altitude performance and high-altitude performance in football?

(2)

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4.5 State the impact of high altitude on the soccer ball's movement. Provide a reason for your answer.

(3)

4.6 Describe the physiological adaptations that the body goes through when exposed to high altitude for a long period of time.

- Respiration/ Pulmonary ventilation:

(2)

- Cardiac output:

(2)

- Blood volume:

(2)

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4.7 In the build up to the soccer World Cup, the coaches will carefully plan and divide the year into a number of training blocks.

4.7.1 What is the term for the planning and organisation of training into a number of blocks?

_____

(1)

4.7.2 What is the main purpose of this planning?

_____

_____

(2)

4.7.3 List the 3 phases of this planning.

_____

_____

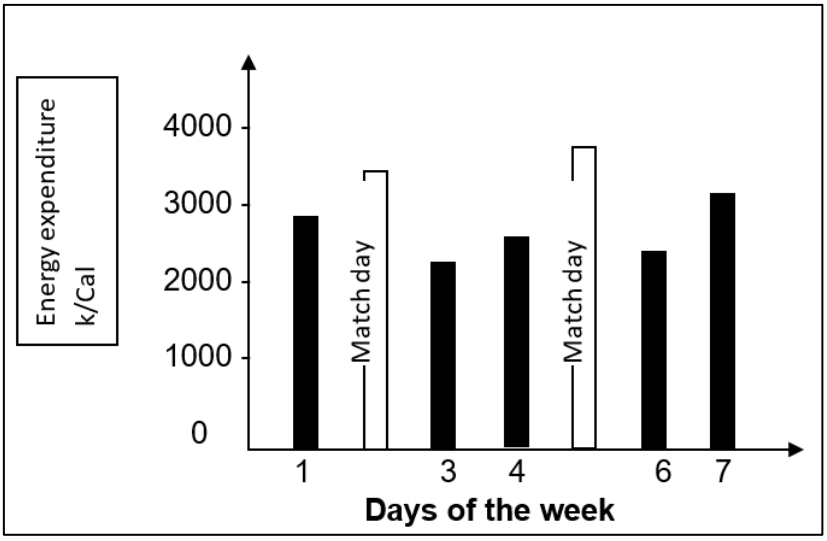
_____

_____

(3)

4.8 Examine the graph provided below and use it to answer the questions that follow.

Energy expenditure over a week by 6 professional soccer players



[Source: <www.mysportsscience.com. Accessed 12/7/23>]

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4.8.1 On what day/s do the players have the highest energy expenditure?

(2)

4.8.2 State why the players would have a higher energy expenditure on those days.

(1)

4.8.3 Explain why the players have the lowest energy expenditure on days 3 and 6.

(3)

4.8.4 What is meant by the term 'carbo-load'?

(3)

4.8.5 State 4 effects on the body if not enough carbohydrates are consumed prior to and during athletic performance.

-
-

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- _____

_____

- _____

_____

(4)

4.8.6 Why should carbohydrates be eaten immediately after exercise?

_____

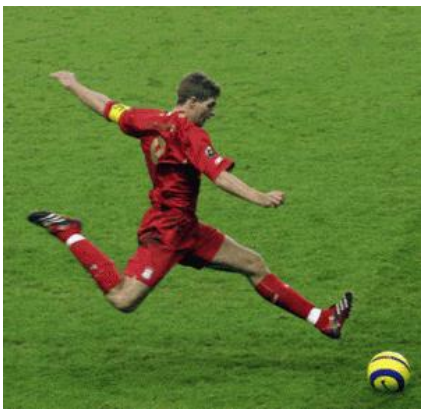
_____

_____

_____

(3)

4.9 Examine the picture below which shows Steven Gerrard kicking a soccer ball. Use it to answer the questions that follow.



4.9.1 With direct reference to the action in the picture, explain the function of the Golgi tendon.

_____

_____

_____

_____

_____

(5)

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4.9.2 Explain the function of the muscle spindles in Gerrard's legs.

(8)

4.9.3 Explain what DOMS (Delayed Onset Muscle Soreness) is by referring to Gerrard's leg muscles.

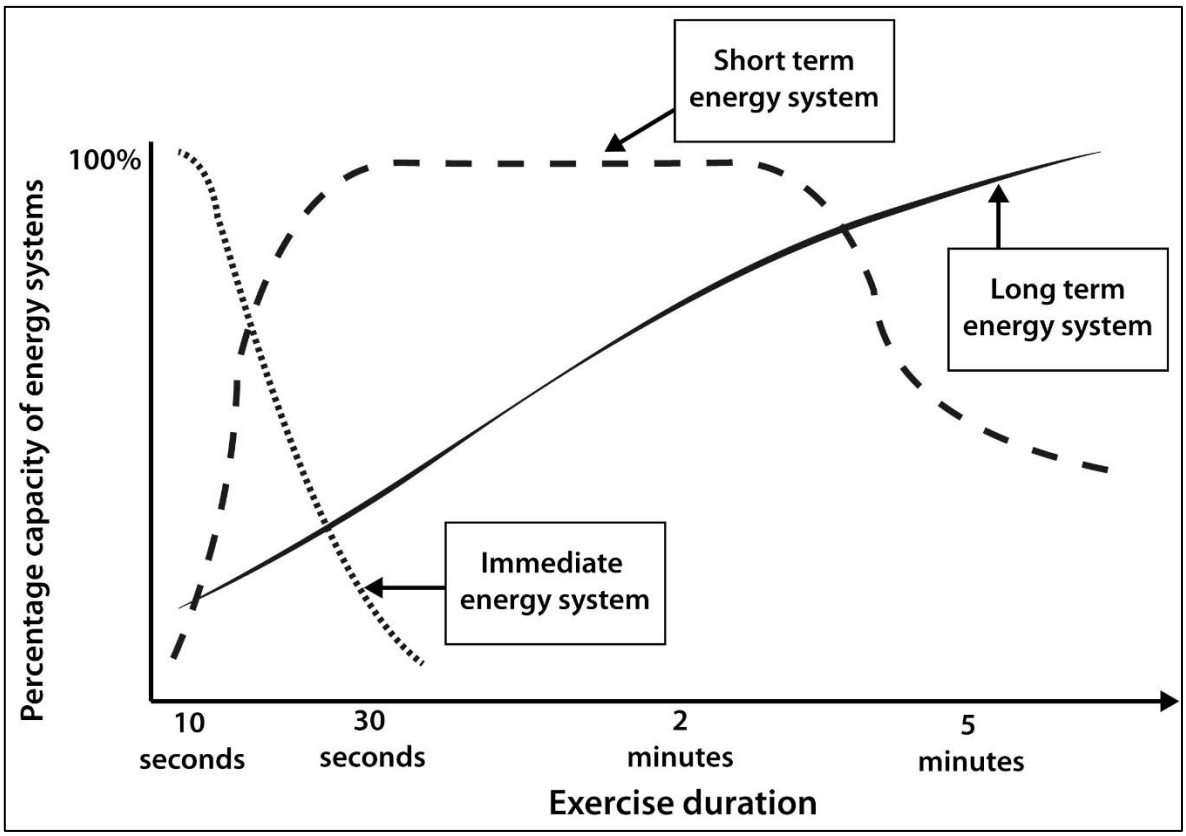
(4)

[60]

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QUESTION 5

Study the graph below and use it to answer the questions that follow.



5.1 Provide an alternate name for each of the following energy systems:

5.1.1 Immediate energy system:

_____

(1)

5.1.2 Short term energy system:

_____

(1)

5.1.3 Long term energy system:

_____

(1)

5.2 What is the dominant energy system at 5 minutes?

_____

(2)

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5.3 What is the dominant energy system at 1 minute?

(2)

5.4 What is the dominant energy system at 10 seconds?

(2)

5.5 Name two factors that could affect the energy systems being used when exercising. Explain why these factors would have an impact.

Factor 1:

(1)

Explanation:

(3)

Factor 2:

(1)

Explanation:

(3)

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5.6 Explain how interval training is efficient in improving adaptations in the energy systems for both 100 m sprinters and speed-endurance runners.

(6)
[23]

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QUESTION 6

Explain each of Newton's Laws and how they could be applied to the sport of hockey.

- Newton's First Law:

  Explanation:

  _____

  _____

  _____

  (3)

  Application:

  _____

  _____

  _____

  _____

  _____

  (2)

- Newton's Second Law:

  Explanation:

  _____

  _____

  _____

  (2)

  Application:

  _____

  _____

  _____

  _____

  _____

  (3)

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- Newton's Third Law:

  Explanation:

  _____

  _____

  _____

  _____

  (2)

  Application:

  _____

  _____

  _____

  _____

  _____

  _____

  (2)
  [14]

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QUESTION 7

Examine the information provided in the sources that follow, as well as the rubric. Use it to write an essay of 1–1½ pages on the following topic:

The importance of nutrition and rest in athletes.

To answer this question you are expected to:
- Integrate your own relevant sport science knowledge.
- Use real-life examples where applicable.
- Make use of the rubric to shape your response.

SOURCE A

The athlete's diet

An athlete's diet should be similar to that recommended for the general public, with energy intake divided into:
- 45 to 65% from carbohydrates
- 15 to 25% from protein
- 20 to 35% from fat

Athletes who exercise strenuously for more than 60 to 90 minutes every day may need to increase the amount of energy they consume, particularly from carbohydrate sources.

Guidelines for carbohydrate and protein based on grams intake per kilogram (g/kg) of body weight are also available.

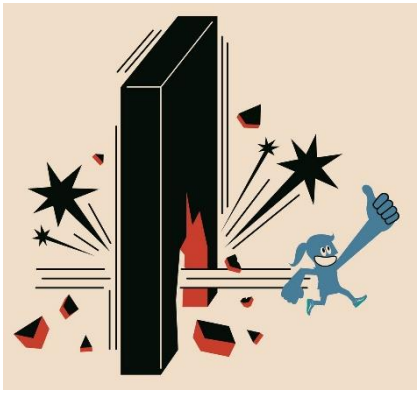
The current recommendations for fat intake are for most athletes to follow similar recommendations to those given for the general community, with the preference for fats coming from olive oils, avocado, nuts and seeds.

Athletes should also aim to minimise intake of high-fat foods such as biscuits, cakes, pastries, chips and fried foods.

[Source: <https://www.betterhealth.vic.gov.au/health/healthyliving/sporting-performance-and-food>]

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SOURCE B



What is 'hitting the wall' during a marathon and how can you avoid it?

If you fuel properly during your marathon, you needn't worry. Here's what you need to know.

By The Runner's World Editors *Updated: 20 April 2023*

What does it mean to 'hit the wall' during a marathon? Some refer to it as 'bonking', but whatever you call it, it's an awful experience. If you hit it, you feel like you've run face-first into a brick wall. Your legs simultaneously feel like they are made of jelly, yet also weigh eight tonnes each. Every step is an absolute triumph of will, and you start to seriously doubt that the race even **has** a finish line. It usually happens to runners around the 20 km mark, and is the result of insufficient fuelling.

Why do some runners 'hit the wall'?

Hitting the wall refers to the point in a race where your body simply runs out of energy. While you can produce energy via carbohydrates, fats and proteins, carbohydrate is the body's preferred fuel source during exercise. This is broken down into glucose and stored as glycogen in the liver and muscles. When your body runs out of glycogen, it has to utilise other fuel sources, such as fats and proteins, but you're not able to make energy as effectively.

There are some common telltale signs that you might be about to hit the wall – your legs may begin to feel heavy or you might begin to suddenly feel more fatigued. 'Is your vision delayed or slightly blurred? Are you becoming detached from your surroundings? Is your heart rate suddenly fluctuating (either really high or really low)? Are you experiencing muscle cramps? All these are signs that your glycogen stores are low, so it's important to slow down and take fuel on,' says Emily Kier, a leading nutritionist.

How can you avoid 'hitting the wall' during a marathon?

1. Get your race nutrition right
2. Fuel up the week before
3. Stay hydrated
4. Pace yourself

[Source: <https://www.runnersworld.com/uk/training/marathon/how-to-avoid-the-wall-and-cope-if-you-hit-it/>]

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SOURCE C

Rest and recovery are critical for an athlete's physiological and psychological well-being

Nobody questions the value of exercise training for optimal athletic performance and improvement.

But rest and recovery is an equally essential component of an exercise program because it gives the body time to repair, rebuild, and strengthen itself between workouts.

What is meant by rest and recovery and why is it important?
'There's not a one-size-fits-all answer about what it means for an athlete,' VanBaak said. 'The nuances are going to be a little bit different for everyone depending on their age, sport, and level of participation and development.'
But there's one general principle that applies to all athletes, she said. 'if you're participating in sports, you're breaking down your body. You're taxing yourself and pushing yourself beyond your current level of fitness.'
Exercise – especially intense exercise – creates tiny tears in the muscles. Over time, as muscles heal, they eventually grow bigger and stronger. It's important to remember that this process occurs during rest and recovery, not during the exercise session itself.
'In order to see gains in fitness, in order for the body to keep doing what you want it to do, you have to give it enough rest to repair itself,' VanBaak said. 'If you're an athlete, it means taking time out from your usual sport.'

[Source: <https://www.uchealth.org/today/rest-and-recovery-for-athletes-physiological-psychological-well-being>]

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ESSAY RUBRIC

	0 marks	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**

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ESSAY

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[20]

Total: 200 marks

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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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