NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2012

SPORT AND EXERCISE SCIENCE: PAPER I

EXAMINATION NUMBER

Time: 2 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 20 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 that can be 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.

QUESTION 1

Athletes are predisposed to metabolise energy from foods to enable optimum performance.

Assume the following:

- Athlete A is a gymnast completing a 3½ minute floor routine.
- Athlete B is a soccer mid-fielder playing in a 90 minute match.
- Athlete C is an ultra-distance runner covering 200 km.
- Athlete D is a track sprinter.
- Athlete E is an 800 m swimmer.

1.1 Rank the **FIVE** athletes (from highest to lowest) according to the estimated amount of oxygen consumed while participating in the given event.

_____

_____

_____

_____

_____ (5)

1.2 Identify which athlete requires fats as a food fuel for the production of ATP. Briefly motivate your response.

_____

_____ (2)

1.3 Name the energy systems which Athlete E will use during the following stages of the race:

1.3.1 First 10 m _____

1.3.2 Between 200 m and 400 m _____

1.3.3 Final 10 m _____ (3)

1.4 Significant muscle glycogen depletion will be experienced by Athlete B unless this athlete maintains an optimal carbohydrate intake. Various factors influence the recovery rate of muscle glycogen. Identify **FOUR** factors that **inhibit** the recovery rate of glycogen.

_____

_____

_____

_____ (4)

1.5 Athletes: A – E respond differently to the physiological demands and energy cost of exercise. Each depends on metabolic pathways which optimise their performance. Associate the optimum training duration and intensity which will activate the most efficient energy production system for each athlete.

Athlete A: _____

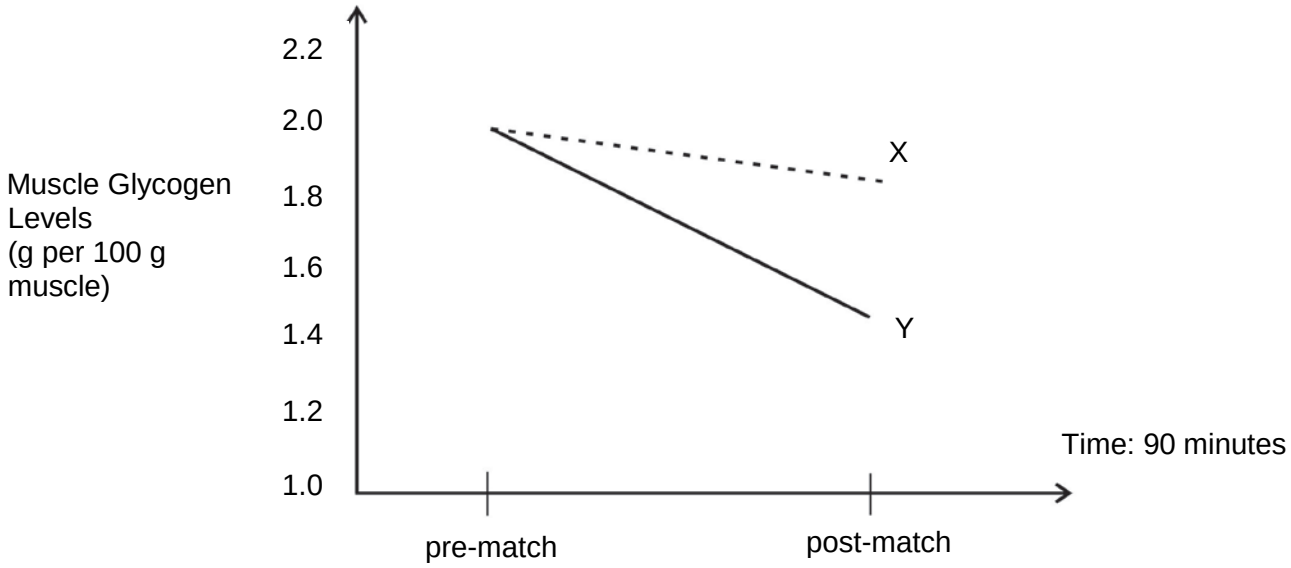
Athlete B: _____

Athlete C: _____

Athlete D: _____

Athlete E: _____ (5)

1.6 The graph below shows the rate of glycogen depletion of **TWO** soccer players. One player is a goalkeeper and the other is a mid-field player.



Which line (**X** or **Y**) represents the soccer mid-fielder? Motivate your response.

_____

_____

_____ (2)

1.7 What specific food supplements should be ingested by Athlete Y to efficiently replenish muscle glycogen stores?

_____

_____

_____ (2)

[23]

QUESTION 2

Female swimming performances have improved dramatically in recent times.
The current World Record for 100 m freestyle (female) is 52,07 seconds. The Olympic qualifying time for the 100 m freestyle has decreased from 1:22.2 to 54 seconds.

2.1 Identify an anatomical **OR** mechanical factor that could have contributed to the improved performance time of 100 m female Olympic swimmers. (All 8 finalists finishing in 53 – 53.88 seconds in London 2012.)

_____ (1)

2.2 Identify a physiological factor that could account for the improved times of these female 100 m swimmers.

_____

_____ (1)

2.3 Other than diet and training methods, identify and briefly explain **THREE** other factors that could have contributed to this remarkable improvement.

_____

_____

_____

_____

_____

_____ (3)

2.4 Historically, access to and participation in Aquatic Sports in South Africa (swimming, synchronised swimming, diving and waterpolo) has regrettably been limited, yet Chad le Clos, Cameron van der Burgh and Natalie du Toit confirm our world-class presence in Aquatic Sport.

2.4.1 Identify **TWO** reasons why access and participation in Aquatic Sports is limited in South Africa.

_____

_____ (2)

2.4.2 What may account for our Aquatic Sport Athletes' recent success?

_____ (1)

2.4.3 Name **ONE** factor that may significantly increase access to and participation in Aquatic Sports in South Africa.

_____ (1)
[9]

QUESTION 3

The table below represents the participation patterns of the same female in physical activity.

			Aged 8	**Aged 16**
Day/Week	**Influence**	**Hours/day**	**Activity Choice**	**Activity Choice**
Saturday		60 minutes	Cycling	No longer cycling
Tuesday		90 minutes	Basketball	Basketball
Thursday		90 minutes	Kick Boxing	No longer involved
Friday	L.O. Teacher	90 minutes	Physical Education	No longer attending P.E.

3.1 Identify the circumstances/factors that may have influenced the participation patterns of the 8-year old girl in her different activity choices.

_____

_____

_____ (3)

3.2 What circumstances/factors may account for her limited activity engagements at age 16?

_____

_____ (2)

3.3 What is the long-term health and wellness prediction for this individual, should this participation trend continue?

(2)

3.4 Identify **TWO** socio-political factors, at the **macro-level**, that could influence this trend positively.

(2)

3.5 For this particular individual, what could be done at the **micro-level** to increase her commitment to participate in sufficient, regular, quality activity?

(2)

3.6 In your opinion, would this individual be more likely to maintain her participation patterns in activity, had she been influenced by a significant other (such as an athlete role model)? Motivate your response.

(2)
[13]

QUESTION 4

The table below shows the predicted trend in expected World Record times in the 1 mile (1,6 km) track event.

	Year		
	2000	**2027**	**2042**
Males	3:41.96	3:33.28	3:29.83
Females	4:10.77	4:00.80	3:59.80

4.1 What trend do you notice in the actual and predicted performances for male and female athletes in this event?

(1)

4.2 Identify **THREE** physiological factors that could explain the differences between genders in this event.

(3)

4.3 What advances in training techniques, applied to both male and female athletes, may account for the predicted sub-4 minute times?

(3)

4.4 In your opinion, should gender be a reason to distinguish between middle distance athletes in future? Briefly motivate your response.

(2)
[9]

QUESTION 5

The following table shows three meals chosen by an athlete involved in a multi-day endurance event such as the *Tour de France*.

Meal A	**Meal B**	**Meal C**
Banana Wholewheat bread roll Water Low fat strawberry smoothie	Dried fruit Honey sandwich Watermelon Sports drink	Oatmeal porridge Steak and chips Fruit salad Coffee

5.1 Which one of these meals (**A, B** or **C**) should be eaten 1 – 2 hours before the race session on the day? Motivate your response.

_____

_____ (2)

5.2 Improve one of these meals which should be taken 3 hours before sleeping.

_____

_____

_____

_____ (4)

5.3 Describe how lactic acid is produced and accumulates in the blood during this taxing, multi-day endurance cycle challenge.

_____

_____

_____

_____

_____

_____ (5)

5.4 Approximately how long would it take to clear the accumulated metabolic waste in working muscles after completing such an event?

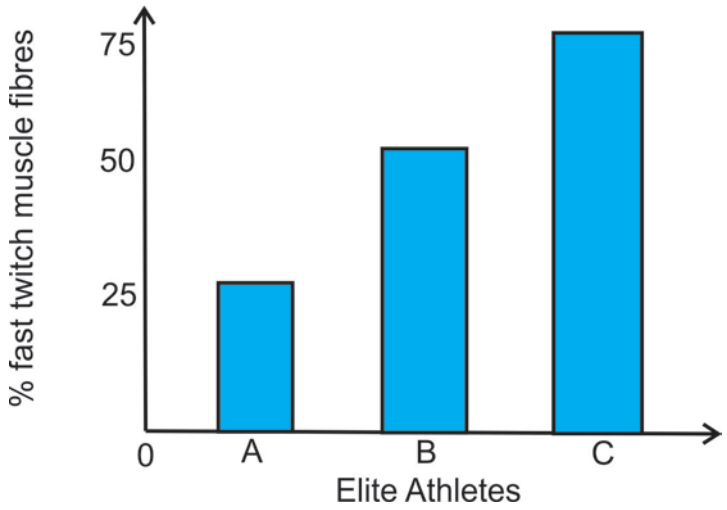
_____ (1)

5.5 Which muscle fibre type is most likely to benefit from training that is focused on improving lactic acid tolerance?

_____ (1)

5.6 The graph below depicts the percentage of fast twitch muscle fibre in elite athletes. Which athlete is most likely to be a *Tour de France* cyclist?

_____ (1)



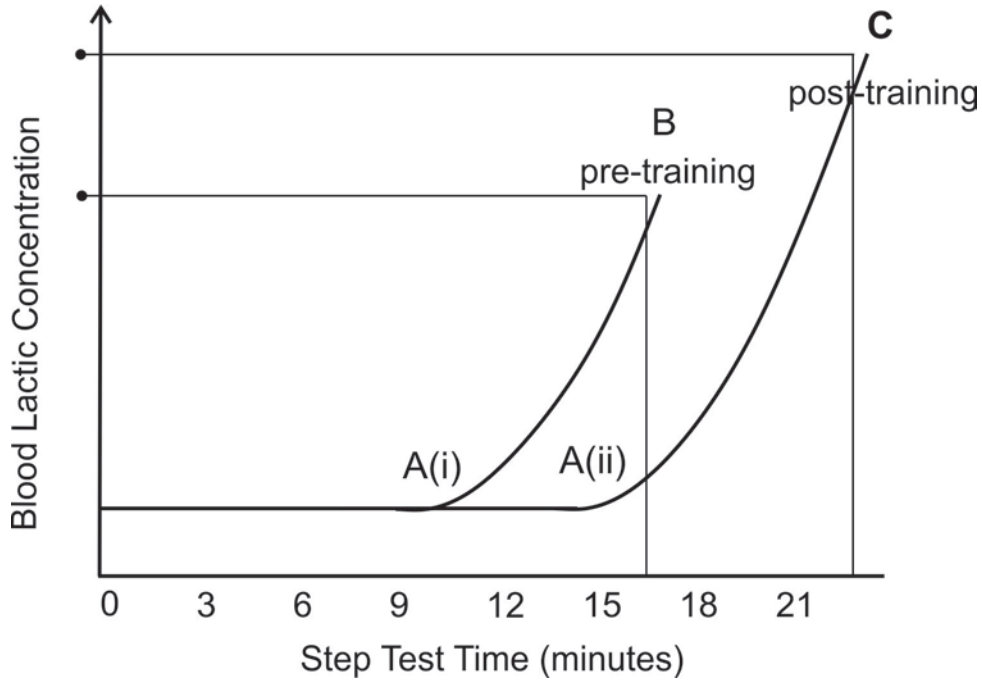
5.7 Motivate your response.

_____

_____ (2)
[16]

QUESTION 6

The graph below shows the relationship of blood lactate concentration in an athlete over time. Blood samples were drawn from venous blood at the end of each 3-minute incremental workload during a step test. The results shown (B and C) record Pre- and Post- 6-month training.



6.1 Initially, venous blood shows a steady concentration of lactic acid (A(i)). This is lower than was expected, given the rate of lactic acid production in the skeletal muscle. Explain why this is the case.

_____ (1)

6.2 The blood lactic acid concentration increased from A(i) to point B, and A(ii) to point C as a result of the training programme.

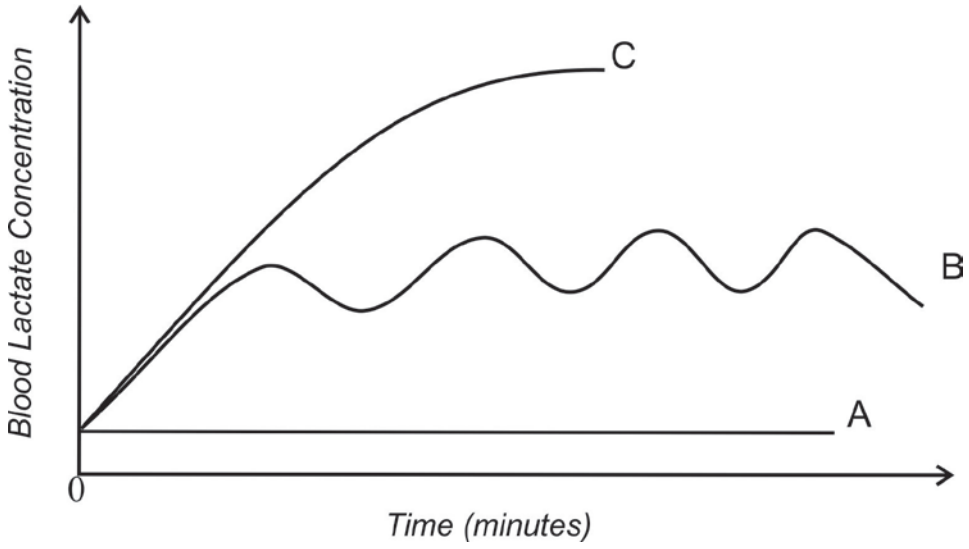
6.2.1 What physiological change has occurred to cause the increased blood lactic acid concentration tolerance?

_____ (1)

6.2.2 What type of training is most likely to have resulted in peak blood lactic acid concentration shifting to point C?

_____ (1)

6.3 From the activities listed below, select the **THREE** activities which correspond to the lines on the graph.



Activity	**Line on graph**
Person at rest	
A 200 m sprint runner	
A mid-field hockey player	

(3)

6.4 Draw in a line on the graph above estimating the lactate levels of a person walking their dog at a moderately even pace. Label it **D**.

(1)
[7]

QUESTION 7

Critically examine the data provided, then answer the questions below:

Table of fitness tests results from 4 different athletes.

Athlete	Age	Male/ Female	Predominant sport	Results					
				Beep test (stage)	Vertical jump (cm)	Sit and reach (cm)	40 m sprint (sec)	Bicep curl (kg)	Illinois Agility run (sec)
A	28	F	Netball	7	35	+9	8.5	10	22.1
B	13	F	Gymnast	6	58	+28	6.7	10	17.1
C	44	F	Triathlon	11	30	+5	7.0	20	40.1
D	28	M	Body building	7	52	0	6.0	60	20.5

7.1 What is the projected maximum heart rate of Athlete **A** in Table 1?

_____ (1)

7.2 What fitness component is being tested in the 'sit and reach' test?

_____ (1)

7.3 Provide **ONE** reason which would explain the result obtained by Athlete **B** 'sit and reach' test results.

_____ (1)

7.4 Provide an explanation for the result in the vertical jump of Athlete **C**.

_____

_____ (2)

7.5 What is the value of the data derived from the fitness tests applied from a coach's perspective?

_____

_____

_____

_____

_____ (4)

7.6 Why would Athlete **C** participate in these fitness tests?

_____

_____ (2)

[11]

QUESTION 8

The following table shows the results of a 60 m shuttle run test performed by a 200 m track athlete.

Sprint time	Rest time
7.5 seconds	4 minutes
7.3 seconds	3 minutes
8 seconds	1 minute
9.2 seconds	10 seconds
12 seconds	end

8.1 What method of training is best suited to improving this athlete's performance?

_____ (1)

8.2 How should the following training principles be applied to the method of training best suited to this athlete?

8.2.1 Intensity

_____

_____ (2)

8.2.2 Frequency

_____

_____ (2)

8.2.3 Specificity

_____

_____ (2)

8.3 Elite Sprint Athletes (100 m – 400 m) follow training programmes that produce injury-free, competition-ready outcomes.

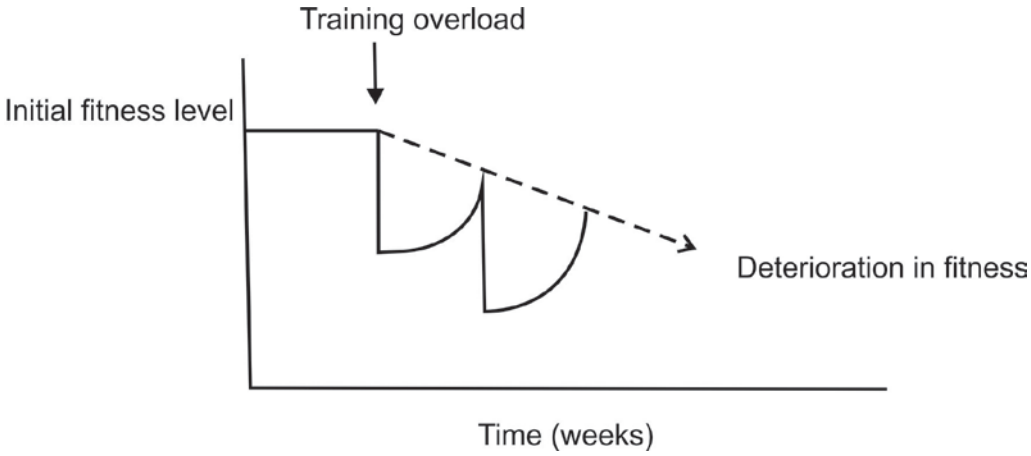
In the table below, provide **ONE** cardiovascular adaptation and **ONE** muscular adaptation which occurs as a result of the given training focus.

Training focused on improving:	**Cardiovascular adaptation**	**Muscular adaptation**
Anaerobic capacity		
Aerobic capacity		

(4)
[11]

QUESTION 9

Interpret the graph below:



[5]

QUESTION 10

10.1 Explain what physical attributes predispose individuals for the following sports:

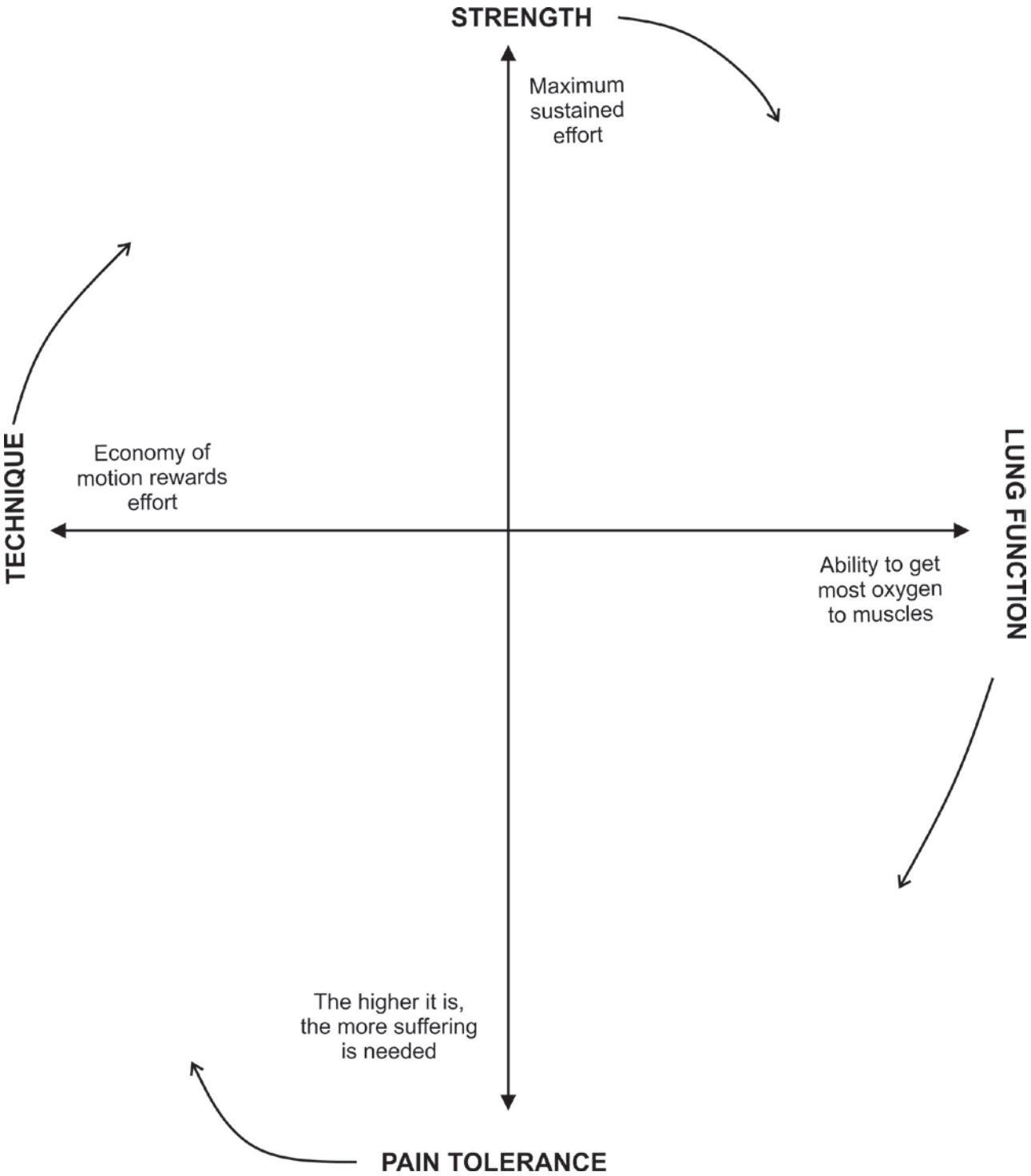
10.1.1 Marathon running

10.1.2 Shot put

10.1.3 Squash

10.1.4 Rowing (4)

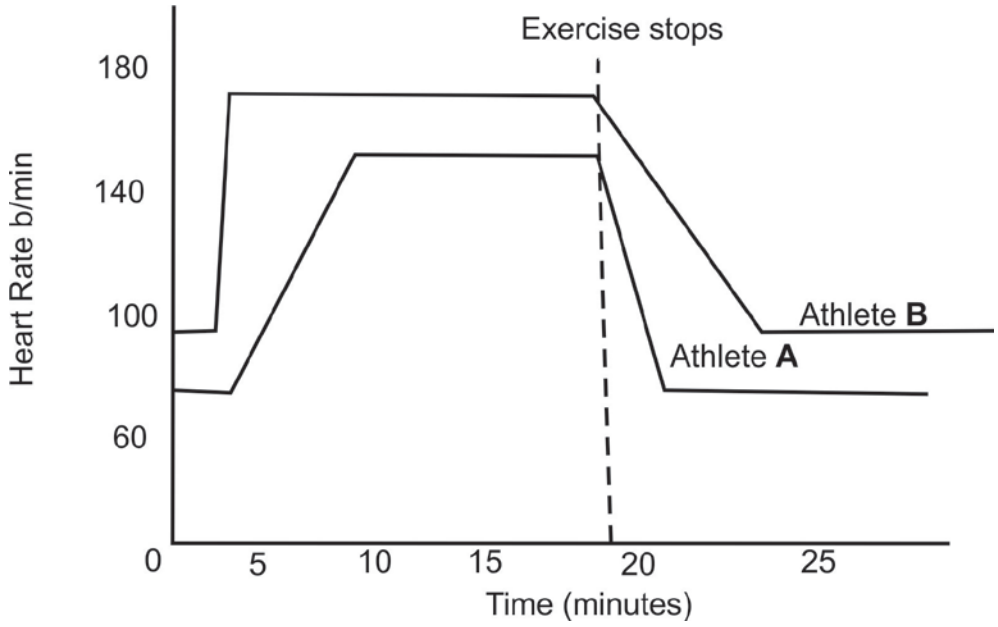
10.2 Plot the following sports onto the Fitness Matrix below:
Decathlon; Archery; Springboard Diving; Water Polo; Steeplechase; Weight Lifting; Pole Vault; Boxing; 100 m Sprint.



(9)
[13]

QUESTION 11

The graph below depicts heart rate of 2 athletes exercising at the same intensity.



11.1 Which Athlete (**A** or **B**) can one assume is fitter? Motivate your answer.

(5)

11.2 Describe the well-documented physiological adaptations of endurance training to the heart and circulatory system.

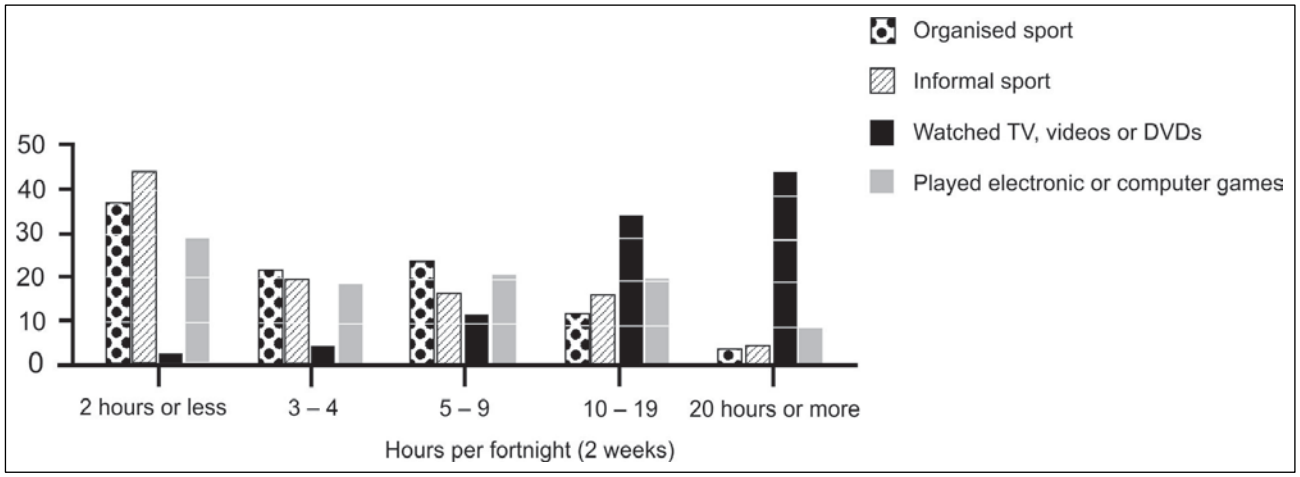
(5)

11.3 Describe the endurance training adaptations to lung function.

(5)
[15]

QUESTION 12

The graph below depicts the average time spent by children ages 5 – 14 years outside of school hours in recreational activities.



[ABS Children's participation in Cultural and Leisure Activities, Australia, April 2006]

12.1 Comment on the trend depicted in the graph above.

_____

_____

_____

_____ (3)

12.2 Given this trend, what would you do to change the health-compromising choices of these Australian children?

_____

_____

_____

_____ (3)
[6]

QUESTION 13

Our South African gold medalist, superstar Oscar Pistorius is a legend. However, prior to his participation in the Olympic Games, London 2012, there was much debate whether he should be allowed to compete against able-bodied athletes, albeit that he qualified. What was the debate about? In your response argue for, or against the continuation of the Paralympic Games.

[12]

Total: 150 marks