



International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

Sports, Exercise and Health Science

Higher level

Specimen papers

For first examinations in 2018

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Sports, exercise and health science
Higher level
Paper 1

SPECIMEN PAPER

1 hour

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[40 marks]**.

- 1. Which statement describes flat bones?
 - A. Complex and varied in shape, such as the vertebrae
 - B. The type of bones found in the skull and the shoulder blade
 - C. Bones that are longer than they are wide
 - D. Bones found in the wrist and ankle

- 2. What fluid-filled sacs are associated with certain synovial joints?
 - A. Ligaments
 - B. Bursae
 - C. Articular capsule
 - D. Synovial membrane

3. The table below shows lung volumes for an endurance-trained athlete.

Respiratory rates and volumes	Recorded results
Pulmonary ventilation	61.0 litres min ⁻¹
Tidal volume at rest	0.5 litres
Maximal tidal volume	3.5 litres
Vital capacity	6.2 litres
Residual volume	1.2 litres

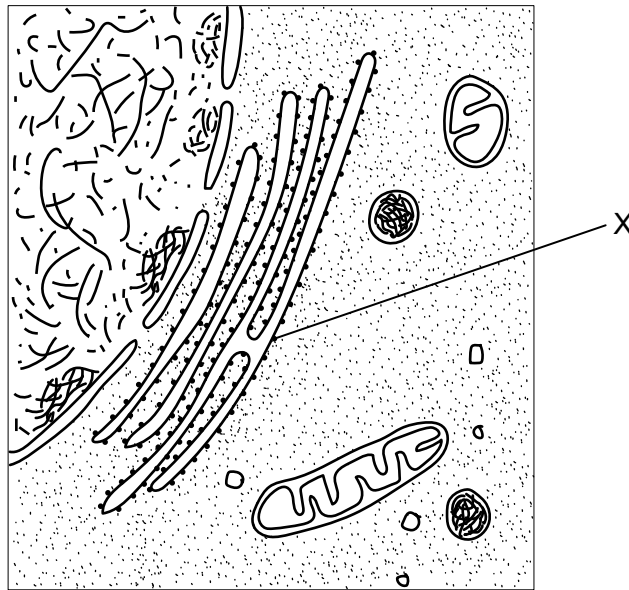
[Source: adapted from W L Kenny, J H Wilmore and D L Costill, (2012), *Physiology of Sport and Exercise*, 5th Edition, Champaign, IL: Human Kinetics, page 267]

What is the total lung capacity?

- A. 7.4 litres
- B. 6.7 litres
- C. 4.7 litres
- D. 10.9 litres

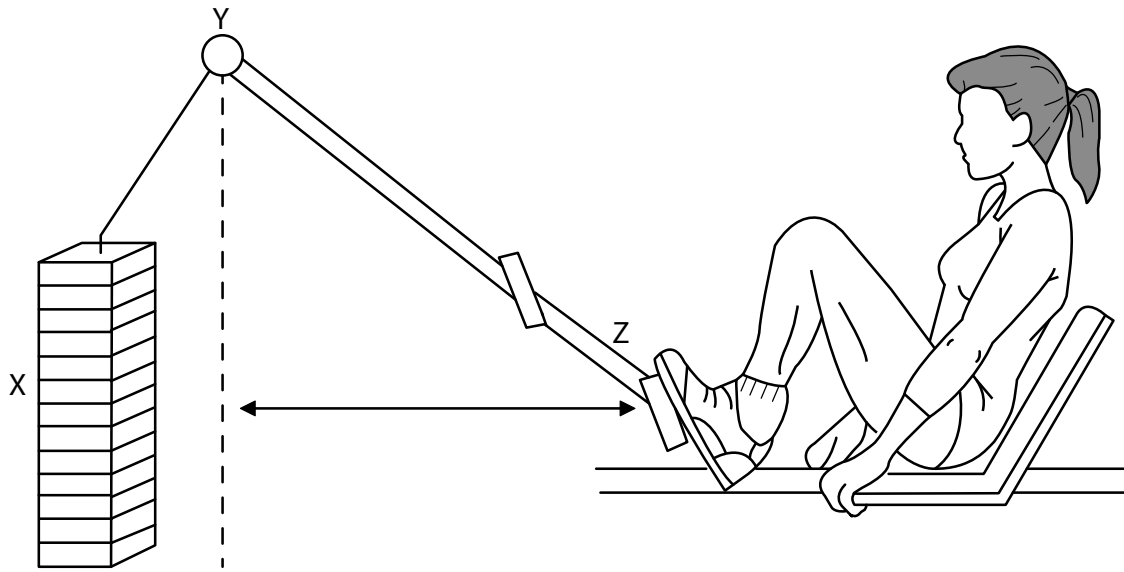
4. Which is responsible for the electrical impulse that regulates the contraction of the atria in the heart?
- A. Atrio-ventricular node
 - B. Purkinje tissue
 - C. Bundle of His
 - D. Sinoatrial node
5. Which correctly describes non-essential amino acids?
- A. They are synthesized by the human body.
 - B. They are unable to be manufactured by the human body.
 - C. They are found in abundance in plant-based food sources.
 - D. They must be obtained from the diet.
6. What needs to be considered when recommending a balanced diet?
- I. Habitual physical activity level of the person
 - II. Age of the person
 - III. Climate where the person lives
- A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III

7. The diagram below shows the ultrastructure of a generalized animal cell. What structure is labelled X?



- A. Lysosome
 - B. Rough endoplasmic reticulum
 - C. Nucleus
 - D. Mitochondrion
8. What is the name of the gap between two neurons?
- A. Synapse
 - B. Dendrite
 - C. Axon
 - D. Cell body

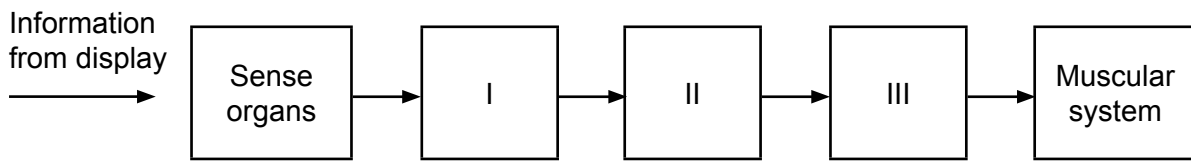
9. The diagram below demonstrates an athlete performing a leg press. Which correctly identifies the fulcrum, effort and load for this first class lever?



[Source: Malpeli and Telford, *Physical Education Exam VCE Units 1 and 2*, © 2008, Cengage Learning Australia. Reprinted with the permission of Cengage Learning Australia]

- A. X = Fulcrum, Y = Effort and Z = Load
 - B. X = Fulcrum, Y = Load and Z = Effort
 - C. X = Load, Y = Effort and Z = Fulcrum
 - D. X = Load, Y = Fulcrum and Z = Effort
10. What is the definition of the term *skill*?
- A. A stable, enduring characteristic that is genetically determined
 - B. Basic movements in sport
 - C. A set of movements which are genetically determined
 - D. The consistent production of goal-orientated movements, which are learned and specific to the task

11. What are the information-processing mechanisms that match the numerals in the diagram below?



	I	II	III
A.	Effector mechanism	Perceptual mechanism	Decision mechanism
B.	Decision mechanism	Perceptual mechanism	Effector mechanism
C.	Perceptual mechanism	Effector mechanism	Decision mechanism
D.	Perceptual mechanism	Decision mechanism	Effector mechanism

12. With respect to learning, which statement describes a positive acceleration curve?

- A. The performer has reached their best possible performance.
- B. The individual's learning is low in the early stages but increases in later stages.
- C. The performer enters a period where there is no improvement in learning.
- D. The rate of learning is faster in the early stages than in the later stages.

13. Which is/are true for an athlete who consistently weighs themselves on a set of broken scales?

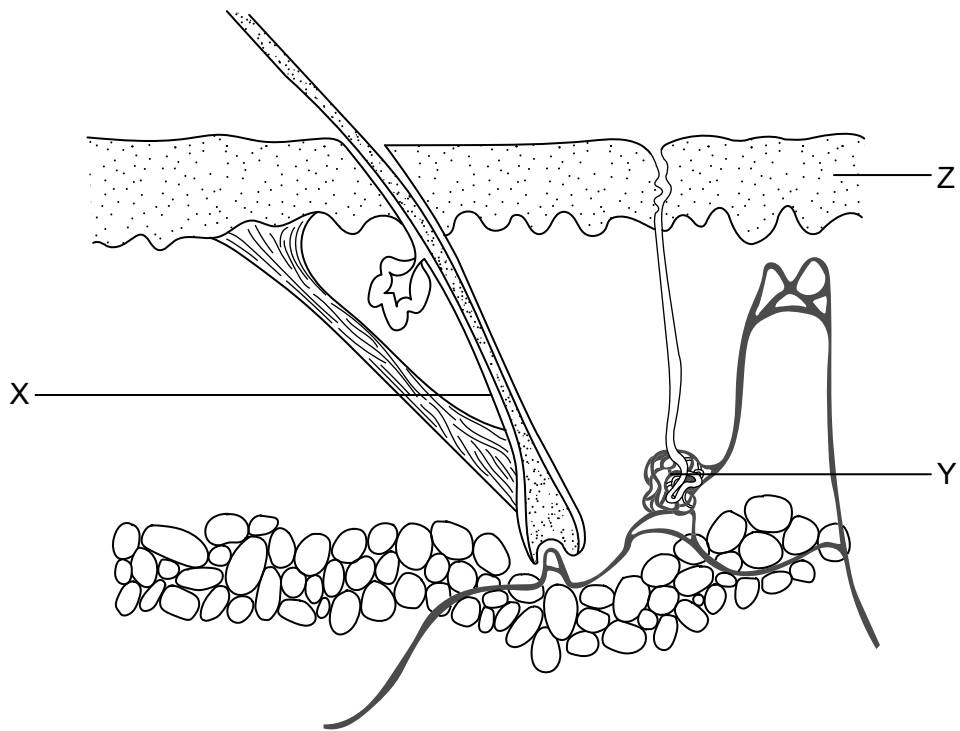
- I. The results are reliable.
 - II. The results are accurate.
 - III. The results are valid.
- A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III

14. What is the name of the method of assessing exercise intensity involving the following calculation?

$$\text{Training heart rate} = ((HR_{\text{max}} - HR_{\text{rest}}) \times \% \text{ intensity}) + HR_{\text{rest}}$$

- A. Borg scale
 - B. Karvonen method
 - C. Cardiac output
 - D. Maximal oxygen consumption
15. The mean (\pm SD) exercise heart rate of a group in a physical education class is 155 beats per minute (bpm) (\pm 14). What percentage of the group has an exercise heart rate between 141 bpm and 169 bpm?
- A. 5%
 - B. 68%
 - C. 85%
 - D. 95%

16. What are the correct names for the features labelled X, Y and Z in the diagram of the skin below?



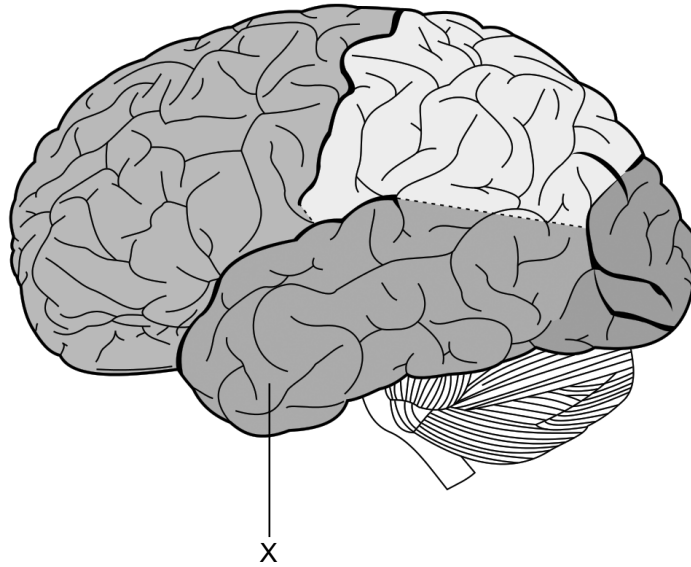
[Source: adapted from www.wikieducator.org/]

	X	Y	Z
A.	Hair follicle	Gland	Epidermis
B.	Gland	Fat	Dermis
C.	Hair follicle	Gland	Dermis
D.	Gland	Fat	Epidermis

17. Which reduces the rate of heat loss through the skin?

- A. Sweating
- B. Vasodilation
- C. Body hairs lie flat
- D. Vasoconstriction

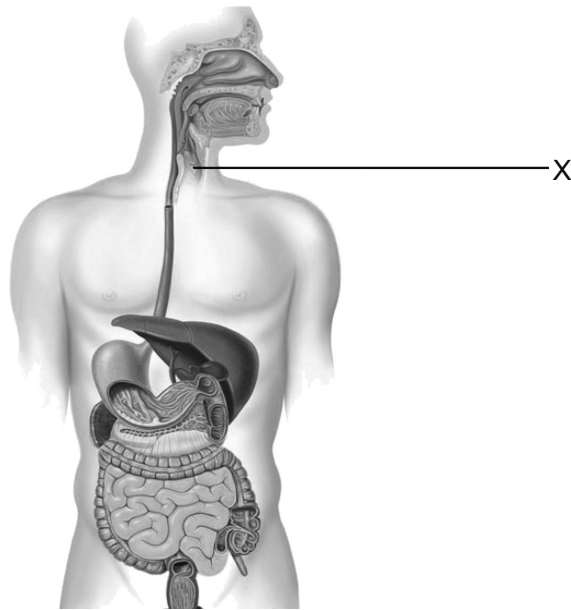
18. Which part of the brain is labelled X in the diagram below?



[Source: www.wikimedia.org/]

- A. Parietal lobe
 - B. Frontal lobe
 - C. Temporal lobe
 - D. Occipital lobe
19. During a long distance race an athlete experiences dizziness and mental confusion. What may be the cause of these symptoms?
- A. Dehydration
 - B. Low glucose levels in the blood going to the brain
 - C. High glucose levels in the blood going to the brain
 - D. Build up of carbon dioxide in the brain cells
20. Which describes the function of the cerebellum?
- A. Control of cardiovascular processes
 - B. Responsible for thinking, language and motivation
 - C. Perception of sensations such as pain and temperature
 - D. Coordinates sequences of skeletal muscle contractions

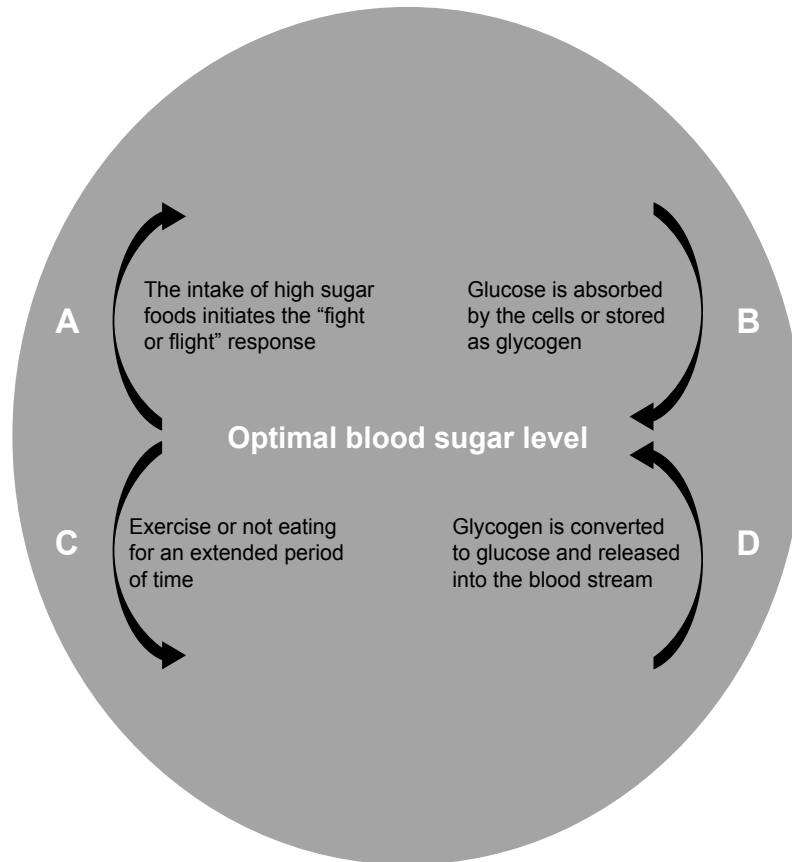
21. Which part of the endocrine system is labelled X in the diagram below?



[Source: www.otbabushek.ru/]

- A. Pituitary gland
 - B. Thyroid gland
 - C. Pineal gland
 - D. Hypothalamus
22. Which describes local hormones?
- I. They travel around the body in the blood.
 - II. They are released by endocrine glands.
 - III. They affect specific target cells.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

23. The diagram below shows a simple feedback loop to control blood sugar levels. Which stage of the process is most likely to lead to the release of glucagon?



- A. Arrow A
 - B. Arrow B
 - C. Arrow C
 - D. Arrow D
24. An athlete training in high temperatures becomes dehydrated. How does this affect the amount of antidiuretic hormone (ADH) and water absorbed by the kidney?

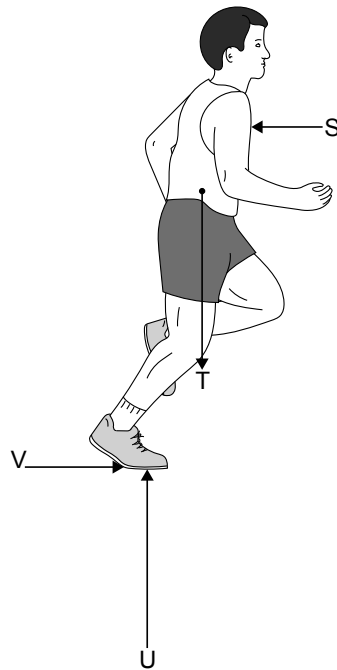
	Amount of ADH released	Amount of water absorbed by the kidney
A.	Less	Less
B.	Less	More
C.	More	Less
D.	More	More

25. What is the definition of *fatigue*?
- A. Training at high-intensity over a prolonged period of time
 - B. A permanent exercise-induced decline in performance
 - C. A reversible exercise-induced decline in performance
 - D. Pushing the body beyond its limits for a short period of time
26. Which describes central (or mental) fatigue?
- A. Rapid impaired function of the central nervous system
 - B. Impaired function of the central nervous system during prolonged exercise
 - C. Reduction in muscle cell force due to prolonged exercise
 - D. Impaired function of the central nervous system due to a reduction in muscle cell force
27. How long does high-intensity exercise last?
- A. More than 1–2 minutes but less than 3–4 minutes
 - B. More than a second or as long as 3–4 minutes
 - C. Less than a second or as long as 1–2 minutes
 - D. Less than a second or as long as 3–4 minutes
28. In cross-country skiing the coefficient of friction between the skis and snow can be reduced by applying a layer of wax to the base of the skis. How does this affect the frictional force and the normal reaction force?

	Frictional force	Normal reaction force
A.	No change	No change
B.	No change	Decrease
C.	Decrease	No change
D.	Decrease	Decrease

- 29.** The 1968 Olympic Games were held in Mexico City. Mexico City is at an altitude of around 2200 metres above sea level. Which is the most likely reason for a large number of records being set in short-distance races?
- A. The oxygen content at altitude is less than it is at sea level.
 - B. The oxygen content at altitude is higher than it is at sea level.
 - C. The air density at altitude is less than it is at sea level.
 - D. The air density at altitude is higher than it is at sea level.
- 30.** Which pair of surfaces has the lowest coefficient of friction?
- A. Rubber tyres on a wooden velodrome track in cycling
 - B. Powdered hand on a fibreglass bar in gymnastics
 - C. Rubber studs on grass in soccer
 - D. Waxed ski on ice in skiing

31. Which pair represents the force of friction and normal reaction force in the diagram below?



[Source: IB content]

	Friction	Reaction force
A.	S	T
B.	T	U
C.	U	T
D.	V	U

32. Which statement describes form drag?

- A. As a body pushes against a fluid, the fluid pushes back against the body.
- B. As a body moves through a fluid, its surface catches a layer of fluid slowing it down.
- C. When a body moves along a surface, some fluid is displaced to form a wave.
- D. When a body moves through a fluid, some fluid attaches to the surface and slows down.

33. Which term describes traditional pedagogy?
- A. Transmission of fixed knowledge from coach to athlete
 - B. Problem solving approach by coach and athlete
 - C. Non-linear solution from coach and athlete
 - D. Unpredictable situation addressed by coach and athlete
34. Which is **not** an application of notational analysis in sport?
- A. Technical evaluation
 - B. Tactical evaluation
 - C. Nutritional analysis
 - D. Analysis of movement
35. What principles are utilized in a phase analysis model in swimming?
- A. Force principles
 - B. Movement principles
 - C. Coordination principles
 - D. Speed principles
36. Which are examples of digital technology use in basketball analysis?
- I. Different types of skill
 - II. Motion tracking of your team
 - III. Performance analysis of the opposition
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

- 37.** Which statement describes the genetic relationship between a mother and her children?
- A. Each child has exactly the same set of genes as the mother.
 - B. Half of the genes of each child are inherited from the mother.
 - C. Every gene inherited from the mother is expressed in the child.
 - D. The contribution of genes inherited from the mother to elite sporting performance can be easily established.
- 38.** What is the phenotype of an individual?
- A. The characteristics that an individual exhibits
 - B. DNA coding for protein production
 - C. The genes present in an individual
 - D. Part of a chromosome
- 39.** Which process contributes to a change in characteristics during a person's lifetime?
- I. Genes can be switched on or off.
 - II. Multiple genes determine characteristics.
 - III. Gene expression can be affected by environmental factors.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
- 40.** Which environmental factors influence human physical performance in cycling?
- I. Nutrition
 - II. Technological aids
 - III. Anaerobic threshold
- A. I, II and III
 - B. I and II only
 - C. I and III only
 - D. II and III only
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Markscheme

Specimen paper

Sports, exercise and health science

Higher level

Paper 1

1.	<u>B</u>	16.	<u>A</u>	31.	<u>D</u>	46.	<u>-</u>
2.	<u>B</u>	17.	<u>D</u>	32.	<u>A</u>	47.	<u>-</u>
3.	<u>A</u>	18.	<u>C</u>	33.	<u>A</u>	48.	<u>-</u>
4.	<u>D</u>	19.	<u>D</u>	34.	<u>C</u>	49.	<u>-</u>
5.	<u>A</u>	20.	<u>D</u>	35.	<u>B</u>	50.	<u>-</u>
6.	<u>D</u>	21.	<u>B</u>	36.	<u>C</u>	51.	<u>-</u>
7.	<u>B</u>	22.	<u>C</u>	37.	<u>B</u>	52.	<u>-</u>
8.	<u>A</u>	23.	<u>A</u>	38.	<u>A</u>	53.	<u>-</u>
9.	<u>D</u>	24.	<u>A</u>	39.	<u>D</u>	54.	<u>-</u>
10.	<u>D</u>	25.	<u>C</u>	40.	<u>B</u>	55.	<u>-</u>
11.	<u>D</u>	26.	<u>B</u>	41.	<u>-</u>	56.	<u>-</u>
12.	<u>B</u>	27.	<u>C</u>	42.	<u>-</u>	57.	<u>-</u>
13.	<u>A</u>	28.	<u>C</u>	43.	<u>-</u>	58.	<u>-</u>
14.	<u>B</u>	29.	<u>C</u>	44.	<u>-</u>	59.	<u>-</u>
15.	<u>B</u>	30.	<u>D</u>	45.	<u>-</u>	60.	<u>-</u>

Sports, exercise and health science
Higher level
Paper 2

SPECIMEN PAPER

Candidate session number

2 hours 15 minutes

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Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer two questions.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[90 marks]**.



Section A

Answer **all** questions. Write your answers in the boxes provided.

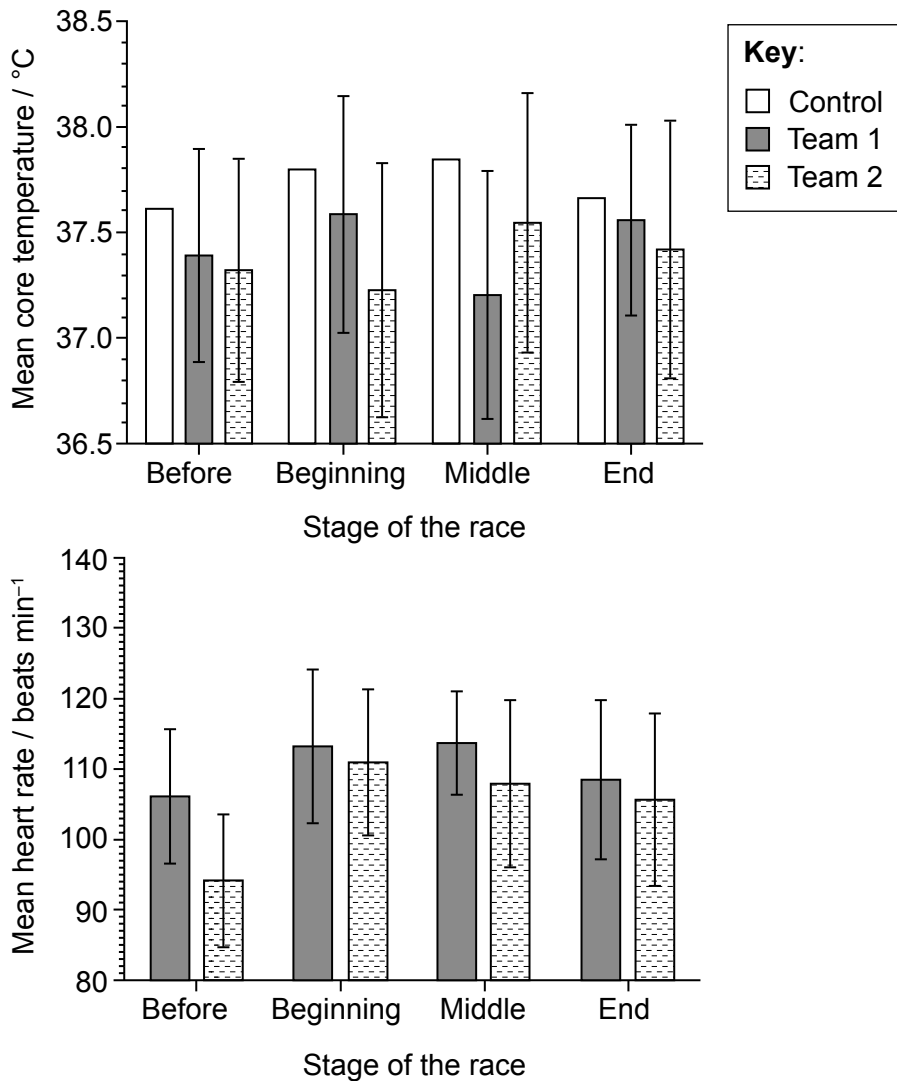
1. A study investigated the changes in heart rate and core temperature for pit crew during car racing.

The pit crew are athletes who possess speed, power and agility. For safety reasons they wear a helmet and a heavy fire-retardant suit.

Two groups of three people (Team 1 and Team 2) were monitored before, during and at the end of the race. Core temperatures and heart rates were measured at fixed time intervals, and the mean values were calculated for each team.

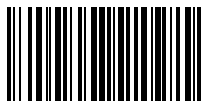
Core temperature data for a control individual who was not part of the crew were also recorded.

The error bars in the charts below show the range of values obtained for the measurements of each team.



[Source: D Ferguson *et al.*, (2011), *Journal of Strength and Conditioning*, 25(8)]

(This question continues on the following page)



(Question 1 continued)

(a) State the mean core temperature of Team 2 during the middle stage of the race. [1]

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.....

(b) (i) Outline **one** reason for including a control in this study. [1]

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(ii) Outline **three** ways to improve the validity of the control data. [3]

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(c) Suggest reasons why Team 1 had a higher mean heart rate than Team 2 before the race began. [3]

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(This question continues on the following page)



(Question 1 continued)

- (d) Calculate the difference between mean heart rates at the beginning and at the end of the race for Team 2.

[1]

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- (e) Explain why the mean heart rate increased at the beginning of the race for both teams.

[3]

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- (f) Suggest why the data supports the hypothesis that there was no difference in core temperatures between Team 1 and Team 2 during the race.

[2]

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- (g) Data from the study indicates that heart rates change. Discuss these changes in relation to core temperature.

[3]

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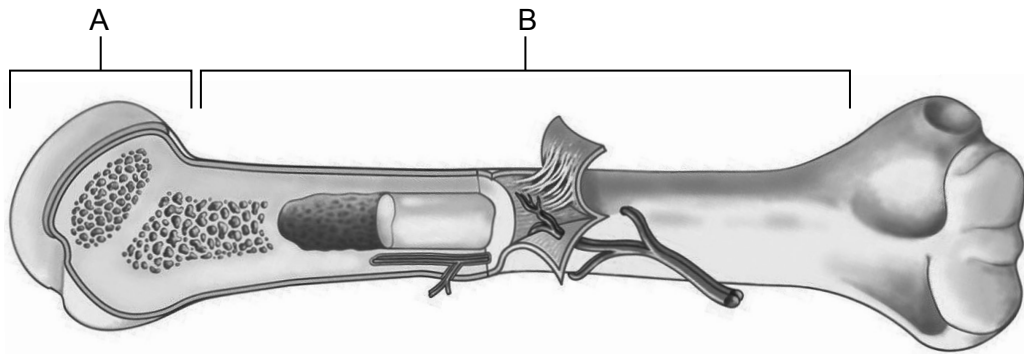
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2. (a) Identify the **two** parts of the bone labelled A and B in the diagram below. [2]

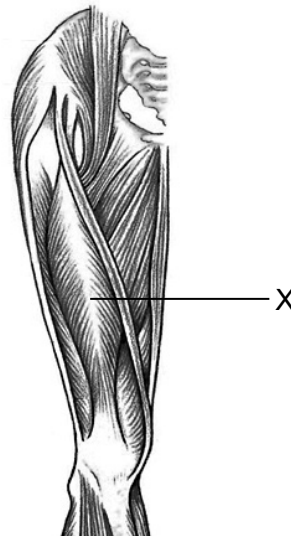


[Source: www.docstoc.com/]

A:

B:

- (b) State the name of the thigh muscle labelled X in the diagram below. [1]



[Source: M Cash, (1999), *Pocket Atlas of the Moving Body*, page 45]

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(This question continues on the following page)



20EP05

Turn over

(Question 2 continued)

- (c) Explain how the cerebellum controls the body movement of a track cyclist travelling around a bend.

[4]

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- (d) List **two** physiological factors that might affect the onset of fatigue for a cyclist during high-intensity exercise.

[2]

1:

2:

- (e) Compare and contrast the dietary macronutrient requirements of a trained endurance cyclist and a trained sprint cyclist.

[3]

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(This question continues on the following page)



(Question 2 continued)

(f) Describe how glucose molecules combine to form polysaccharides. [2]

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(g) Explain the role of insulin in the formation of glycogen. [3]

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3. Long distance open water swimmers often wear wetsuits.



[Source: <http://university.tri-sports.com/>]

(a) (i) Define *drag*.

[1]

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(ii) Outline how a wetsuit reduces surface drag.

[2]

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(This question continues on the following page)



(Question 3 continued)

(b) Explain how a swimmer could reduce drag, other than by wearing a wetsuit. [4]

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(c) Identify the movement that takes place at the shoulder joint during a front crawl arm phase in swimming. [1]

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(d) Describe the mechanism of inhalation of air for a swimmer. [4]

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(This question continues on the following page)



Please **do not** write on this page.

Answers written on this page
will not be marked.



(Question 3 continued)

- (e) Explain the differences in the performance of a dive start by a skilled swimmer and a novice swimmer.

[4]

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Section B

Answer **two** questions. Write your answers in the boxes provided.

- 4. (a) Outline the common characteristics of muscle tissue. [4]
- (b) Describe Newell's constraint-led approach on learning, using the example of shooting for water polo players. [3]
- (c) Explain the role of the cerebrum in decision making, using the example of performing a return of serve in tennis. [5]
- (d) Describe the role of short-term memory in skill performance during a team game situation. [3]
- (e) A rugby player uses a "dummy pass" to deceive an opponent. A "dummy pass" is when a player pretends to pass in one direction then steps/runs in the opposite direction. Explain how the information processing by the opponent gives an advantage to the player. [5]

- 5. (a) Outline the importance of completing a Physical Activity Readiness Questionnaire (PAR-Q) prior to fitness testing. [5]
- (b) Evaluate a named test that assesses muscular power. [5]
- (c) Describe the principles of overload and progression in a weight training programme to improve muscular power. [4]
- (d) Comment on the implications of genetic screening for elite sports team selection. [6]

- 6. (a) Discuss, with reference to the speed and angle of release, javelin technique. [4]
- (b) Outline the importance of friction between sport shoes and the running surface in long jump. [2]
- (c) Describe the roles of adenosine triphosphate (ATP) **and** adenosine diphosphate (ADP) in the process of muscle contraction. [3]
- (d) Explain how the structure and function of fast twitch muscle fibres contribute to the performance of a sprinter. [5]
- (e) Evaluate the use of digital technologies by elite athletes in field events. [6]



- 7. (a) Outline the term lipolysis. [2]
- (b) Describe excess post-exercise oxygen consumption (EPOC). [3]
- (c) Evaluate the relative contribution of the energy systems when competing in an endurance running event. [6]
- (d) Identify the innate mechanisms the body uses in response to infection. [3]
- (e) Explain how an athlete may plan strategies for minimizing the risk from infection. [6]

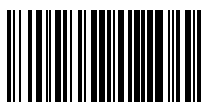
[Dotted writing area for answers]



A large rectangular area with a dotted grid pattern, intended for handwritten notes or calculations.



A large rectangular area containing horizontal dotted lines for writing.



20EP17

Turn over

A large rectangular area containing horizontal dotted lines for text entry.



A large rectangular area containing numerous horizontal dotted lines, serving as a template for text entry.



20EP19

Turn over

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20EP20

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Markscheme

Specimen paper

Sports, exercise and health science

Higher level

Paper 2

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.
3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.
5. Personal codes/notations are unacceptable.
6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the “zero” annotation to award zero marks. Where a candidate has not attempted the part question, use the “SEEN” annotation to show you have looked at the question. RM™ Assessor will apply NR once you click complete.
7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. RM™ Assessor will only award the highest mark or marks in line with the rubric.
8. Ensure that you have viewed every page including any additional sheets. Please ensure that you stamp “SEEN” on any additional pages that are blank or where the candidate has crossed out his/her work.
9. There is no need to stamp an annotation when a candidate has not chosen an optional question in Section B. RM™ Assessor will apply NR once you click complete.
10. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the “CON” stamp.

Subject Details: Sports, exercise and health science HL paper 2 markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A [**50 marks**] and **TWO** questions in Section B [**40 marks**].
Maximum total = [**90 marks**].

1. Each row in the “Question” column relates to the smallest subpart of the question.
2. The maximum mark for each question subpart is indicated in the “Total” column.
3. Each marking point in the “Answers” column is shown by means of a tick (✓) at the end of the marking point.
4. A question subpart may have more marking points than the total allows. This will be indicated by “**max**” written after the mark in the “Total” column. The related rubric, if necessary, will be outlined in the “Notes” column.
5. An alternative wording is indicated in the “Answers” column by a slash (/). Either wording can be accepted.
6. An alternative answer is indicated in the “Answers” column by “**OR**” on the line between the alternatives. Either answer can be accepted.
7. Words in angled brackets (< >) in the “Answers” column are not necessary to gain the mark.
8. Words that are underlined are essential for the mark.
9. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
10. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by *OWTTE* (or words to that effect).
11. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
12. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script. “ECF acceptable” will be displayed in the “Notes” column.
13. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

Section A

Question		Answers	Notes	Total
1	a	37.5 OR 37.6 ✓	<i>Would also accept 37.55</i>	1
	b	i	to compare any changes in core temperature of the control with that of the pit crew/teams ✓	OWTTE 1
		ii	more people could have been included in the control ✓ the heart rates of the control group could have been recorded ✓ the control could have worn the safety equipment ✓ the control remains inactive ✓	3 max
	c	<i>Team 1 may have:</i> lower average age ✓ lower level of fitness ✓ lower psychological stress ✓ higher activity levels immediately prior to heart rate measurement ✓ consumed fluid/food immediately prior to heart rate measurement ✓ more females ✓ small sample size can mean inconsistent data ✓	<i>Accept answers in the converse.</i>	3 max
	d	110 – 105 = 5bpm ✓	<i>Must show working for the mark.</i>	1

Question		Answers	Notes	Total
	e	<p>sympathetic nervous system (SNS) control predominates during physical or emotional stress OWTTE ✓</p> <p>intrinsic regulation/SNS stimulation increases the rate of depolarization of the sinoatrial (SA) node ✓</p> <p>increased rate of depolarization of the SA node increases conduction speed ✓</p> <p>Increased conduction speed increases heart rate ✓</p> <p>adrenaline/epinephrine prepares a person for immediate action (fight-or-flight response) OWTTE ✓</p> <p>effects of adrenaline/epinephrine include increased heart rate ✓</p>		3 max
	f	<p>error bars on the graphs show a large variation in core temperatures ✓</p> <p>error bars for the different teams overlap, showing that the mean differences are not significant ✓</p>		2
	g	<p>there is a rise in heart rate during the race, but there is no evidence of a significant change in core temperature ✓</p> <p>the increase in heart rate might be linked to an increase in rate of respiration ✓</p> <p>therefore the production of more heat in the body ✓</p> <p>however, core temperature does not increase because thermoregulatory processes (such as vasodilation) allow the body to lose heat ✓</p>		3 max

Question		Answers	Notes	Total
2	a	epiphysis ✓ diaphysis ✓		2
	b	vastus intermedius ✓	Accept "vastus intermedialis".	1
	c	the cerebellum is involved in maintenance of balance and posture by coordinating the timing and effort for different limb movements ✓ when a movement is conducted, sensory neurons send information to the cerebellum about what the body is doing ✓ the cerebellum compares body positioning and skeleton-muscular contraction to what is going on in the outside environment and what the body should be doing ✓ the cerebellum processes this information, and finds if something is not going as commanded ✓ more accurate coordinated movement/"fine-tuned" movement results ✓ it orders the motor neurons to smooth out the muscle functioning ✓		4 max
	d	depletion of energy sources (ATP and Creatine phosphate) ✓ increase in levels of lactate ✓ increase in levels of H ⁺ ✓		2 max
	e	endurance cyclist requires a greater proportion of carbohydrates to aid in slow release energy ✓ sprint cyclist requires greater proportion of protein to build muscle required for great power output ✓ both cyclists would have reduced fat intake/to increase power to weight ratio ✓ endurance cyclist would require greater quantity of water ✓		3 max

Question		Answers	Notes	Total
	f	condensation reaction ✓ linking monosaccharide to another monosaccharide, disaccharide or polysaccharide by removal of a water molecule ✓		2
	g	insulin is secreted in response to elevated/high levels of blood glucose ✓ insulin accelerates/speeds up diffusion of glucose into cells/removes glucose from the blood stream (especially in skeletal muscle cells) ✓ excess glucose in the cells is converted into glycogen, and stored in the liver and muscles ✓		3
3	a	i the force(s) that oppose(s) the motion of an object through a fluid medium ✓		1
		ii surface drag is caused when the surface of a body catches a layer of fluid nearby ✓ wetsuit makes the surface smoother causing less interaction with the water ✓		2
	b	swimming underwater at the beginning of a race for as long as permissible ✓ retaining an efficient body position by keeping head low in the water ✓ streamlining the arm pull ✓ optimizing the leg position/kick ✓ shaving body hair prior to a race ✓ optimizing head movement/efficient breathing technique (forming a well) ✓		4 max
	c	circumduction ✓		1

Question		Answers	Notes	Total
	d	<p><i>As the head is lifted from the water:</i> external intercostal muscles contract ✓ rib cage moves upwards and outwards ✓ diaphragm flattens/contracts ✓ additional muscles can also be involved such as the trapezius sternocleidomastoid / scalene/ pectoralis minor / back muscles ✓ thoracic cavity volume increases/lungs increase in size / capacity ✓ thoracic cavity pressure decreases (therefore air rushes in) ✓ air rushes in from high pressure to low pressure/inhalation continues as long as the pressure difference exists ✓</p>		4 max
	e	<p><i>Compared to a novice, the dive start of a skilled swimmer will be:</i> <i>fluent:</i> the movement appears to be in one flowing motion ✓ <i>Accurate/practiced:</i> to be an effective action it must be repeated and refined ✓ <i>Controlled/efficient:</i> the body position/height of the dive is controlled ✓ <i>Goal directed:</i> the diver completes the dive to create the most speed for the start of the swim ✓ <i>Learned:</i> the diver must learn the skill from a coach or teacher in order to perform it in a competition ✓ <i>Aesthetic:</i> when performed well the dive looks pleasing to the eye ✓</p>		4 max

Section B

Question		Answers	Notes	Total
4	a	contractility, contract and generate force ✓ stimulated by a nerve / fed by capillaries ✓ extensibility, stretch beyond its normal resting length ✓ elasticity, return to original length ✓ atrophy, wasting away due to disuse, disease or starvation ✓ hypertrophy, gain in muscle mass due to increased mass and length of each muscle cell ✓	<i>To gain the mark the word and description need to be provided.</i>	4 max
	b	the goal or task should be appropriate, eg size of goal/distance from goal ✓ conditions on task, eg no goalkeeper or defender ✓ rules on the equipment used eg size ball for age group ✓	<i>To gain the mark an appropriate example must be given in support of the answer.</i>	3
	c	the cerebrum is responsible for high level brain functions such as thinking and motivation ✓ <i>The three main functions are:</i> sensory, receives sensory impulses, player sees the ball flight/hears the impact of the strike ✓ association, interprets information and storing input and initiates a response (forms a motor programme), players assess spin/speed of ball, compares to previous motor patterns and plans a response ✓ motor, effector mechanism, transmits impulses to effectors, players response eg (topspin) forehand schema sent to muscles ✓ <i>different lobes of the brain work together to co-ordinate these functions:</i> frontal lobe responsible for movement motor areas ✓ parietal lobe responsible for sensory and motor areas, linked to movement, body awareness, orientation, navigation ✓ occipital lobe responsible for visual sensory ✓ temporal lobe responsible for auditory sensory and association visual memory ✓ limbic lobe responsible for motivation and long-term memory ✓		5 max

		<p>example of sensory eg players sees the ball flight ✓</p> <p>example of association eg player assesses the speed of the ball and compares to previous motor patterns and plans a response ✓</p> <p>example of motor eg forehand/backhand schema sent to muscles ✓</p>		
	d	<p>the player receives information/feedback from senses and short-term sensory store ✓</p> <p>selective attention filters information ✓</p> <p>compares/identifies characteristics of information to/from long-term memory stores (DCR process) ✓</p> <p>decisions made/thinking/problem solving/working memory ✓</p> <p>initiates motor programme subroutines and sends to effector ✓</p>		3 max
	e	<p>psychological refractory period ✓</p> <p>defender must react to first stimulus (dummy pass) ✓</p> <p>the time taken to react to first stimulus creates opening for attacker to move ✓</p> <p>CNS of defender can only process limited information and must attend to first stimulus ✓</p> <p>reaction to the second stimulus is slower as defender has to attend to first cue ✓</p>	<p><i>Accept drawing (must illustrate S1/R1, S2/R2).</i></p>	5

Question		Answers	Notes	Total
5	a	<p>pre-exercise screening is a key principle before sedentary individuals start becoming more physically active ✓</p> <p>determining one's readiness for physical activity involvement is an important first step in the fitness assessment and exercise prescription process ✓</p> <p>PAR-Q has been shown to be sensitive for detection of pre-existing medical conditions/injuries ✓</p> <p>if an answer is yes to one or more of the PAR-Q questions it is essential to consult/talk with a doctor before commencing an exercise programme</p> <p>OR</p> <p>if the answer is no to all PAR-Q questions, it can be reasonably assumed that it is safe to become more physically active ✓</p> <p>the possibility of undetected serious disease is diminished by administering the PAR-Q ✓</p> <p>the PAR-Q determines readiness to intensify a physical activity/exercise programme ✓</p> <p>PAR-Q is designed to help prevent sudden death syndrome/muscle/joint/bone injuries ✓</p>		5 max

Question		Answers	Notes	Total
	b	<p><i>Named Test:</i> Vertical Jump Test ✓</p> <hr/> <p><i>Strengths:</i> minimal equipment needed ✓ electronic equipment more accurate ✓ quick method / multiple performers assessed quickly ✓ low skill level of assessor required ✓ field based / portable ✓ can be self-conducted ✓</p> <p><i>Limitations:</i> inaccurate measurement depending on equipment used ✓ dependent on varying technique ✓</p>	<p><i>Award [1 max] for identification of test. Accept Sargent Jump.</i></p> <hr/> <p><i>Award [2 max] for Strengths.</i></p> <hr/> <p><i>Award [2 max] for Limitations.</i></p>	5 max
	b	<p><i>Named Test:</i> standing Broad Jump ✓</p> <p><i>Strengths:</i> minimal equipment needed ✓ electronic equipment more accurate ✓ quick method / multiple performers assessed quickly ✓ low skill level of assessor required ✓ field based / portable ✓ can be self-conducted ✓</p> <p><i>Limitations:</i> inaccurate due to forward momentum ✓ inaccurate measurement depending on equipment used ✓ dependent on varying technique ✓ affected by surface used ✓</p>		

Question		Answers	Notes	Total
c		<p><i>Overload:</i> making sure the weights used are heavy enough to bring about stress ✓ weights not too heavy to cause injury ✓ weights and repetitions are appropriate to required outcome ✓ hypertrophy/maximal strength ✓</p>	Award [2 max] for Overload.	4 max
		<p><i>Progression:</i> increase in weights/reps/sets are made ✓ small increases/increase gradually ✓ progression occurs as adaption occurs ✓ overtraining is avoided ✓</p>	Award [2 max] for Progression.	
d		<p>precludes late developing athletes OR high “miss rate” ✓ does not allow for multidimensional aspects of talent, (such as motivation and resilience) ✓ can predict susceptibility to injury/improve safety ✓ identify life threatening conditions ✓ ethical considerations ✓ results of test might place restrictions on employment ✓ might lead to gene doping to enhance selection ✓</p>		6 max

Question		Answers	Notes	Total
6	a	<p><i>Speed of release:</i> when projectile angle and height are held constant, speed of release will determine range (horizontal displacement) ✓ the run up prior to release increases speed and therefore momentum at the point of release ✓</p>		4
		<p><i>Angle of release:</i> activities requiring maximum horizontal range such as javelin tend to use smaller angles than those in which maximum height is the objective ✓ between 32 and 36 degrees is the optimal angle of release for javelin which should be incorporated into the athlete's technique ✓</p>		
	b	<p>spikes increase the contact area with the running surface and this prevents slipping ✓ increased friction allows runner to propel themselves forward more effectively ✓ additional grip on the heel to prevent slipping at the point of take off ✓</p>		2 max
	c	<p>cell respiration is the controlled release of energy in the form of ATP (from organic compounds in cells) through the release of a phosphate group (creating ADP) ✓ the conversion liberates (chemical) energy for muscle contraction ✓ no further energy can be created until ATP is resynthesized/(reversible process) ✓</p>		3
	d	<p>high anaerobic enzymes enables increased anaerobic metabolism ✓ size of muscle fibre is larger therefore generates greater force ✓ high glycogen content provides immediate energy for anaerobic glycolysis ✓ high force production allows explosion from the blocks ✓ high ATP-PC / phosphagen stores enables anaerobic ATP resynthesis ✓ high contraction speed allows athlete to reach high maximum velocity ✓</p>		5 max

Question	Answers	Notes	Total
e	<p><i>Strengths:</i> data not available through traditional analysis ✓ provides data that can track short or long timescales eg tracking trajectories during throwing ✓ accurate/objective ✓ can be processed to allow visualization ✓ provides immediate feedback ✓ adjusted for individual needs ✓ low cost of some technologies ✓</p>	<p>Award [4 max] for Strengths.</p>	<p>6 max</p>
	<p><i>Limitations:</i> coach training may be needed to use effectively ✓ high cost of some technologies ✓ not easily accessible ✓ limited use in some situations eg during competitions ✓ may lead to over reliance on objective data ✓</p>	<p>Award [4 max] for Limitations.</p>	

Question		Answers	Notes	Total
7	a	splitting up of triglyceride OR hydrolysis of triglyceride OR chemical decomposition of triglyceride OR process of breaking down of triglyceride ✓ triglycerides broken down to fatty acids plus glycerol ✓ carried out by enzymes known as lipases ✓		2 max
	b	EPOC explanation – volume of oxygen consumed in recovery above the resting volume ✓ replenishment of myoglobin stores ✓ re-synthesize ATP / PC levels ✓ 50 % PC stores replenished within 30 seconds / 75 % within 60 seconds ✓		3 max

Question	Answers	Notes	Total
c	at the start of the race all three systems are activated ✓ the ATP-PC system produces energy quickest ✓ it peaks at around five seconds and is exhausted after 12–15 seconds lactic acid system peaks at around 15 seconds and starts to decline ✓ at around the 55 second point the aerobic system is the dominant producer of energy ✓ if steady state is achieved, energy demands are being met by the aerobic systems; there is the opportunity to oxidize metabolic by-products therefore allowing the lactic acid system to contribute additional energy for a burst of higher intensity work when required/end of race ✓ the aerobic system continues to increase until either it meets the energy demands, the event finishes or maximum oxygen consumption is reached ✓ at the conclusion of the event the major system utilized is the aerobic which is reflected in the excessive post exercise consumption, it will return the body to resting conditions ✓ during this time anaerobic system will be returned to resting levels ✓	<i>Note: Exact times are not required for the third and fourth marking points.</i>	6 max
d	physical – skin, epithelial linings, mucosal secretions ✓ chemical – pH of bodily fluids, hormones and other soluble factors ✓ leucocytes – white blood cells that fight disease ✓		3
e	regular blood monitoring / checking leucocytes levels ✓ adjust training programme incorporate sufficient recovery time ✓ seek professional training/increased risk with unmonitored amateur athletes ✓ establish regular rest and sleep patterns ✓ do not train when unwell/tired ✓ keep training logs ✓ follow principles of training / progression/overload ✓		6 max

Sports, exercise and health science
Higher level
Paper 3

SPECIMEN PAPER

Candidate session number

1 hour 15 minutes

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Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the options.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

Option	Questions
Option A — Optimizing physiological performance	1 – 4
Option B — Psychology of sport	5 – 9
Option C — Physical activity and health	10 – 15
Option D — Nutrition for sport, exercise and health	16 – 20

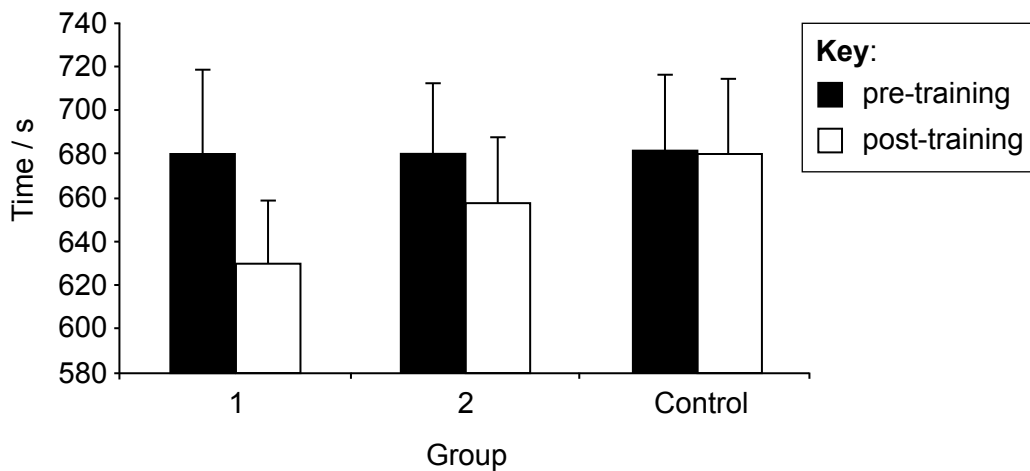


Option A — Optimizing physiological performance

- 1. A study was undertaken to compare the effects of training programmes on 3 km running performance time. The subjects were divided into three groups and trained twice a week for 10 weeks. Each training session lasted for 60 minutes.

Group	Method of training
1	High-intensity running bouts with a work-to-rest ratio of 1:1
2	High-intensity running bouts with a work-to-rest ratio of 1:3
Control	Steady state running

The graph below shows the pre-training and post-training 3 km running performance times.



[Source: F Esfarjani and P Laursen, 'Manipulating high-intensity interval training: Effects on VO₂max, the lactate threshold and 3000m running performance in moderately trained males', *Journal of Science and Medicine in Sport*, copyright ©2012, 10(1), pages 27–35. Reprinted with permission from Elsevier.]

- (a) State the **two** different methods of training used in this study. [2]

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- (b) Compare the pre-training 3 km running performance times of the three groups. [1]

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(Option A continues on the following page)



(Option A, question 1 continued)

- (c) Identify which group had the most improved post-training 3 km running performance time. [1]

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- (d) Suggest **one** reason why the work-to-rest ratio has resulted in a difference in the post-training running performance times between groups 1 and 2. [1]

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- (e) Identify a different training method that could be used to improve a 3 km running performance time. [1]

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- 2. (a) Explain the relationship between cellular metabolism and the production of heat in the human body during rest and exercise. [2]

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- (b) Describe the formation of sweat during exercise in hot, dry environments. [2]

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(Option A continues on the following page)



(Option A, question 2 continued)

- (c) Outline **two** steps that an individual can take to prevent heat-related disorders during sports competitions in hot, dry environments. [2]

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- (d) Explain why the body surface area-to-body mass ratio is important in terms of thermoregulation during exercise. [3]

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- 3. (a) State **one** reason for active recovery immediately after a training session. [1]

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- (b) Describe the use of cold water immersion (CWI) for recovery in sport. [3]

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(Option A continues on the following page)



(Option A continued)

4. (a) State **two** physiological effects of high altitude on the body. [1]

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(b) Evaluate the impact of the “live high, train low” (LHTL) approach to altitude training for a 5000 m runner. [5]

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End of Option A



Option B — Psychology of sport

5. A study examined achievement goal orientation (high task group versus high outcome group) in Spanish male football players aged between 9 and 12 years. Achievement goal orientation profile differences were assessed on the following variables: positive friendship; conflict with teammates; football enjoyment and satisfaction (with own or team performance). Higher scores are associated with a stronger correlation between variable and group. The profile differences are shown in the table below.

Variable	High task group	High outcome group
Positive friendship	3.96	3.71
Conflict with teammates	1.65	2.26 ¹
Football enjoyment	4.89	4.11 ²
Satisfaction (with own performance)	4.53	3.78 ¹
Satisfaction (with team performance)	4.78	4.06 ¹

¹ P < 0.05

² P < 0.01

[Source: Smith *et al.*, (2006), *Journal of Sports Sciences*, 24(12), pages 1315–1327]

(a) (i) State which group reported more conflict with teammates. [1]

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(ii) State which variable had the strongest significant difference between groups. [1]

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(iii) State which group reported a lower satisfaction with their own performance. [1]

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(Option B continues on the following page)



(Option B, question 5 continued)

(b) Distinguish between an outcome goal oriented athlete and a task goal oriented athlete. [4]

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6. Explain when to use imagery to improve sports performance. [3]

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7. Discuss the measurements of personality in sporting situations. [4]

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(Option B continues on the following page)



(Option B continued)

8. (a) Outline the term talent. [2]

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(b) Explain factors that may affect progression through the stages of talent evolution for an athlete according to Bloom (1985) and Cote (1999). [2]

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(c) Outline the talent transfer from gymnastics to high board diving. [4]

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(Option B continues on the following page)



(Option B continued)

9. Discuss how motivation can influence the forethought phase of self-regulated learning (SRL) in sport.

[3]

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End of Option B



20EP09

Turn over

Option C — Physical activity and health

10. Regular brisk walking reduces the risk of chronic health problems. A study investigated the perceived barriers elderly people had against walking in their neighbourhood. The table below shows details of the types of perceived barriers pre (before) and post (after) attendance at a 12 month neighbourhood “walking the way to health” scheme led by trained walk leaders.

Perceived barriers (I would walk around my neighbourhood, but...)	Response pre-walking scheme / %	Response post-walking scheme / %
I have no one to walk with.	25.4	20.5
There is nowhere pleasant to walk near my home.	8.0	11.7
I worry about my personal safety.	30.5	19.1
I worry about being knocked down by a cyclist riding on the pavement.	10.8	17.0
I worry about tripping over broken paving stones.	17.9	23.5
There is too much traffic on the roads where I live.	17.6	22.1

[Source: adapted from *British Journal of Sports Medicine*, (2007), 41, pages 562–568; reproduced with permission from the BMJ Publishing Group]

(a) Identify which was the greatest perceived barrier before attending the walking scheme. [1]

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(b) Calculate the percentage change for worrying about tripping over broken paving stones after attending the walking scheme. [1]

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(Option C continues on the following page)



(Option C, question 10 continued)

- (c) Comment on the positive outcome of this study in relation to the perceived barriers to walking. [2]

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11. (a) Outline the characteristics of the following hypokinetic diseases:

- (i) Stroke [1]

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- (ii) Osteoporosis [1]

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- (b) Discuss the main factors affecting energy balance in individuals with sedentary occupations (for example, sitting for long periods during the working day). [4]

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(Option C continues on the following page)



(Option C continued)

12. (a) Describe **two** aims of therapeutic exercise for individuals with a hypokinetic disease. [2]

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(b) Outline the effects of exercise on changing mood states. [2]

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13. (a) Distinguish between non-communicable and communicable diseases. [2]

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(b) The population attributable risk (PAR) of diabetes associated with a sedentary lifestyle is 30%. Outline what is meant by this statement. [2]

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(Option C continues on the following page)



(Option C continued)

14. Explain why there is a relationship between moderate exercise and a lower risk of mortality. [3]

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15. (a) State **one** type of bone injury caused by running? [1]

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(b) Explain how the risks and hazards of running can be reduced. [3]

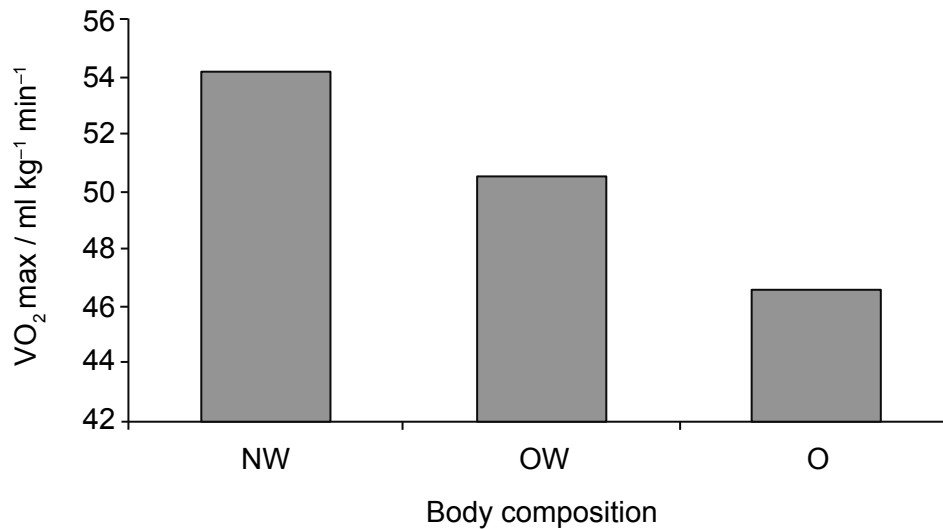
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End of Option C



Option D — Nutrition for sport, exercise and health

16. A study investigated the relationship between cardio-respiratory fitness levels and body composition in Irish girls aged 7 and 10 years. Body mass index (BMI) was used to divide the girls into three groups based on body composition; normal weight (NW), overweight (OW) and obese (O). The 20 m multistage running test was used to estimate cardio-respiratory fitness (VO_2 max). The graph below shows the relationship between body composition and VO_2 max reported in the study.



[Source: adapted from *British Journal of Sports Medicine*, (2007), 41, pages 562–568; reproduced with permission from the BMJ Publishing Group]

(a) State the VO_2 max of the normal weight group.

[1]

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(b) Using the data above, analyse the relationship between body composition and cardio-respiratory fitness.

[2]

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(Option D continues on the following page)



(Option D, question 16 continued)

- (c) Discuss the limitations of using body mass index (BMI) to assess the categories of normal weight, overweight and obese.

[3]

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- 17. (a)** State **three** areas where extracellular fluid can be located in the body.

[3]

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- (b) Explain why endurance athletes require a greater water intake.

[3]

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(Option D continues on the following page)



(Option D, question 17 continued)

- (c) Outline the role of the anti-diuretic hormone (ADH) in maintaining the water balance of the blood in endurance athletes. [3]

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- 18. (a) State the normal level of blood glucose at rest. [1]

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- (b) Outline the cause of hypoglycemia. [2]

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- 19. Explain the ergolytic effects of alcohol on the performance of a 100 m swimmer during a race. [3]

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(Option D continues on the following page)



(Option D continued)

20. (a) Describe free radical production during exercise. [2]

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(b) Explain the harmful effects of free radicals at the cellular level. [2]

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End of Option D



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will not be marked.



20EP18

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Answers written on this page
will not be marked.



20EP19

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Answers written on this page
will not be marked.



20EP20

Markscheme

Specimen paper

Sports, exercise and health science

Higher level

Paper 3

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.
3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.
5. Personal codes/notations are unacceptable.
6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the “zero” annotation to award zero marks. Where a candidate has not attempted the part question, use the “SEEN” annotation to show you have looked at the question. RM™ Assessor will apply NR once you click complete.
7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. RM™ Assessor will only award the highest mark or marks in line with the rubric.
8. Ensure that you have viewed every page including any additional sheets. Please ensure that you stamp “SEEN” on any additional pages that are blank or where the candidate has crossed out his/her work.
9. There is no need to stamp an annotation when a candidate has not chosen an optional question in Section B. RM™ Assessor will apply NR once you click complete.
10. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the “CON” stamp.

Subject Details: Sports, Exercise and Health Science HL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **TWO** of the Options [**2×30 marks**]. Maximum total = [**60 marks**].

1. Each row in the “Question” column relates to the smallest subpart of the question.
2. The maximum mark for each question subpart is indicated in the “Total” column.
3. Each marking point in the “Answers” column is shown by means of a tick (✓) at the end of the marking point.
4. A question subpart may have more marking points than the total allows. This will be indicated by “**max**” written after the mark in the “Total” column. The related rubric, if necessary, will be outlined in the “Notes” column.
5. An alternative wording is indicated in the “Answers” column by a slash (/). Either wording can be accepted.
6. An alternative answer is indicated in the “Answers” column by “**OR**” on the line between the alternatives. Either answer can be accepted.
7. Words in angled brackets (>) in the “Answers” column are not necessary to gain the mark.
8. Words that are underlined are essential for the mark.
9. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
10. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by *OWTTE* (or words to that effect).
11. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
12. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script. “ECF acceptable” will be displayed in the “Notes” column.
13. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

Option A — Optimizing physiological performance

Question		Answers	Notes	Total
1	a	interval running with different work-to-rest ratios ✓ continuous / long, slow distance running ✓		2
	b	all nearly identical / equal/similar / ‹approximately› 680 seconds ✓	<i>Award [1] only if all three groups are referred to.</i>	1
	c	‹group› 1 ✓		1
	d	the 1:3 work-to-rest ratio allowed for too much recovery time between work bouts ✓ the 1:1 work-to-rest ratio provides a greater aerobic stress / overload <i>OWTTE</i> ✓ the group 1 programme resulted in an improved anaerobic threshold compared to group 2 ✓ the intense group 1 programme provided greater training stimulus ✓ group 2 recovery time was too long for a maximum training effect ✓		1 max
	e	fartlek training / speed play ✓ cross-training/circuit training with a high aerobic component ✓ uphill running ✓ high-altitude training ✓		1 max

Question		Answers	Notes	Total
2	a	<p>humans require energy to produce heat in order to maintain the internal body temperature at around 37°C ✓</p> <p>humans require energy to perform mechanical work, which includes exercise ✓</p> <p>the body utilizes oxygen and food to produce energy ✓</p> <p>during biochemical reactions heat energy (enthalpy) becomes available ✓</p> <p>ATP is the only form of chemical energy that can be converted into other forms of energy used by living cells ✓</p> <p>during exercise there is a net increase in ATP production ✓</p> <p>typically 60 % to 70 % of the total energy expended by the human body is degraded to heat</p> <p>OR</p> <p>all biochemical reactions are inefficient, which means that not all the energy released can be conserved or used to do work, therefore some energy is always lost as heat <i>OWTTE</i> ✓</p> <p>when metabolism increases, additional heat is produced</p> <p>OR</p> <p>when metabolism decreases, less heat is produced ✓</p> <p>constant rate of heat production at rest if within a stable thermoneutral environment ✓</p>		2 max

<p>b</p>	<p>sweating is the body's major way of getting rid of excess body heat, which is produced by metabolism and working muscles ✓</p> <p>the amount of sweat produced depends upon air temperature and the level of physical activity ✓</p> <p>the thermoregulatory centre is sensitive to the temperature of the blood</p> <p>OR</p> <p>elevated blood temperature results in nerve signals being sent to the sweat glands ✓</p> <p>sweat is formed by the secretory portion of the sweat glands</p> <p>OR</p> <p>sweating is an active secretory process from sweat glands ✓</p> <p>sweat secretion over a given region of skin is dependent on the density of the sweat glands (that is, number/cm²)/on the amount of sweat secreted per gland ✓</p> <p>sweating provides moisture which evaporates from the skin surface to try to maintain homeostasis ✓</p> <p>sweat is formed through the filtration of plasma ✓</p> <p>sweat is mostly water with some sodium and chloride and a low concentration of potassium ✓</p> <p>during exercise in hot, dry environments there is likely to be increased peripheral blood flow ✓</p>		<p>2 max</p>
<p>c</p>	<p>acclimatize in similar temperature and/or humidity to the competition environment prior to the sports competition ✓</p> <p>wear lightweight, loose-fitting clothing during competition ✓</p> <p>avoid lengthy warm-up periods on the day of the competition ✓</p> <p>know his/her sweat rate and the amount of fluid that he/she should drink/ingest ✓</p> <p>ensure that acclimatization training allows for frequent hydration ✓</p>		<p>2 max</p>

		<p>hydrate to ensure that his/her body weight is within 1 % of his/her normal body weight during the day of the competition ✓</p> <p>learn how to monitor his/her urine colour with reference to hydration status ✓</p> <p>exercise in an environmental chamber ✓</p> <p>tapering ✓</p>		
	d	<p>the body surface area is directly related to the heat exchange between the body and the environment ✓</p> <p>individuals with a greater body surface area relative to mass should speed up/expedite heat dispersion ✓</p> <p>heat transfer between the body and the environment is related to the exposed surface area ✓</p> <p>the processes of sweat evaporation and convection eliminate body heat at the skin surface ✓</p> <p>when the air/ambient temperature is lower than skin temperature, individuals with a greater body surface area relative to mass should reduce heat storage / thermoregulate more effectively during exercise ✓</p> <p>when the air/ambient temperature is higher than skin temperature a higher body surface area-to-body mass ratio acts disadvantageously to absorb body heat from the environment ✓</p>		3 max

Question		Answers	Notes	Total
3	a	<p>raises circulation rate ✓</p> <p>enhances blood lactate removal ✓</p> <p>accelerates raising of blood pH ✓</p>		1 max
	b	<p>individuals immerse their body in large containers filled with water of low temperatures (5–15°C) for up to 15 minutes ✓</p> <p>popular intervention method used to reduce/prevent the symptoms of DOMS and speed up the recovery of the muscles after exercise ✓</p> <p>believed to cause vasoconstriction to the immersed muscles which stimulates waste transportation ✓</p> <p>believed to reduce nerve transmission and therefore reduce pain receptors/reduce pain perception ✓</p> <p>believed to decrease inflammation/swelling ✓</p> <p>psychological impact can be the feeling of being “alert” and less fatigued ✓</p>		3 max

Question		Answers	Notes	Total
4	a	hyperventilation ✓ elevated sub-maximal heart rate/cardiovascular changes ✓ metabolic changes ✓	<i>Award [1] for any two marking points.</i>	1 max
	b	most studies show there is no significant improvement in sea-level performance from training at altitude ✓ the adaptations to the hypoxic environment could provide some aerobic benefits in the initial days after returning to sea level ✓ living high exposes the athlete the hypoxia which would bring about physiological adaptations that support aerobic capacity ✓ exposure to hypoxia can cause acute mountain sickness/ high-altitude pulmonary edema/high-altitude cerebral edema ✓ “training low” enables athletes to maximise their training intensities ✓ thought to be the most effective method of altitude training compared to LHTH and LLTH ✓ altitude tents which are used to simulate living at high altitude have not produced significant increases in sea level performance ✓ an individual athlete may be a non-responder to altitude ✓		5 max

Option B — Psychology of sport

Question			Answers	Notes	Total
5	a	i	high outcome group ✓		1
		ii	football enjoyment ✓		1
		iii	high outcome group ✓		1
	b		<p><i>Outcome goal-oriented:</i> judges success by how they compare to others ✓ emotionally fragile when they perceive they may be evaluated negatively ✓ is more likely to reduce their efforts/cease trying/make excuses ✓ is more likely to select tasks in which they are guaranteed success ✓ is associated with higher levels of competitive state anxiety ✓</p>	<i>Award [2 max] for Outcome goal-oriented.</i>	4 max
			<p><i>Task goal-oriented:</i> has a strong work ethic OR good at maintaining effort without immediate reward ✓ does not fear failure ✓ is protected from disappointment/frustration OR less prone to emotional changes as a result of negative outcomes ✓ is protected from having a lack of motivation when the performance of others is superior ✓ selects realistic tasks and challenges ✓ associated with intrinsic motivation/effort/persistence/enjoyment ✓</p>	<i>Award [2 max] for Task goal-oriented.</i>	

Question	Answers	Notes	Total
6	<p>before and after practice for example to focus concentration/to review skills and strategies ✓</p> <p>before and after competition for example part of a pre-event routine or after competition, to replay success and increase self-confidence ✓</p> <p>during breaks in the action for example to correct an error in the execution of a skill ✓</p> <p>during personal time for example to develop routines of deep breathing and positive self-talk whilst imagining a successful penalty in football/hockey ✓</p> <p>when recovering from injury for example to reduce anxiety about the injury</p> <p>OR</p> <p>to rehearse the emotions they anticipate experiencing upon return to competition ✓</p>		3 max

7		<p>when measuring personality we should consider both situations and psychological traits to understand and predict behaviour ✓</p> <p>sport-specific measures of personality predict behaviour in sport settings better than general personality tests do ✓</p> <p>CSAI-2 ✓</p> <p>Cattell developed a personality inventory with 16 independent personality factors (16 PF) that he believed describe a person who is participating in sport <i>OWTTE</i> ✓</p> <p>all psychological tests contain a degree of measurement error/use caution in interpreting their results ✓</p> <p>benefits and limitations of questionnaires and amounts of data ✓</p> <p>benefits and limitations of observation and ecological validity ✓</p> <p>benefits and limitations of interviews and complex/"rich" information ✓</p> <p>individuals need special training in psychological assessment to be qualified to interpret results from personality tests ✓</p> <p>using personality inventories alone to select athletes for a team/to cut them from a team is an abuse of testing (that should not be tolerated) ✓</p> <p>no specific personality profile has been found that consistently distinguishes athletes from non-athletes ✓</p>		<p>4 max</p>
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Question		Answers	Notes	Total
8	a	<p>multidimensional concept identified by characteristics that are partially genetically determined ✓</p> <p>it involves <u>psychological</u> as well as <u>physiological</u>, motor, <u>sociological</u> and environmental factors <i>OWTTE</i> ✓</p>		2
	b	<p><i>Athletes may encounter opportunities such as:</i></p> <p>training with a specialist coach ✓</p> <p>increased hours of deliberate practice ✓</p> <p>self-determined progression ✓</p> <p><i>Athletes may encounter obstacles such as:</i></p> <p>injury ✓</p> <p>extrinsic motivation eg peer pressure ✓</p> <p>transition to a different stage of development which makes the performance become unstable ✓</p>	<i>One obstacle and one opportunity required.</i>	2 max
	c	<p>talent transfer is a reduction/cessation of participation in one sport in order to pursue another that involves similar skills/physiological requirements ✓</p> <p>transfer may occur due to a plateau in performance ✓</p> <p>plateaus may occur due to a loss of motivation or injury ✓</p> <p>may be initiated by athlete or sporting organization ✓</p> <p>can enable an athlete to prolong their career/achieve greater success than in their first sport ✓</p> <p>greater success can be achieved due to improved motivation, exploiting existing physiological traits, developing psychological behaviours to respond to challenges ✓</p>		4 max

Question	Answers	Notes	Total
9	the task must have value for the athlete ✓ the athlete is more likely to spend time and energy on setting appropriate goals ✓ the higher the self-efficacy beliefs the more likely they are to be motivated to continue with SRL ✓ this belief may arise from prior success when using SRL ✓	<i>For example, if they have previously used observation–emulation–self-control–self-regulation in the planning phase of SRL.</i>	3 max

Question			Answers	Notes	Total
11	a	i	<p>⟨a stroke is⟩ caused by a lack of blood flow/oxygen to the brain ✓ a condition in which blood supply to some part of the brain is impaired ⟨due to a blocked/burst artery⟩ ✓</p>		1 max
		ii	<p>decreased bone mineral content that causes increased bone porosity ✓ osteoporosis means bone ⟨osteο⟩ that is porous ⟨porosis⟩ ✓ loss of bone mineral density ✓ accelerated bone loss ✓ a disease that causes bones to weaken/become brittle/break more easily ✓</p>		1 max
	b		<p>energy balance is the state at which the number of calories eaten equals the number of calories used OR energy/caloric balance is the main factor that affects body weight control ✓ a positive energy balance means that you consume more calories than you expend, that is, you will gain body weight <i>OWTTE</i> ✓ energy balance can be unbalanced to cause weight loss by reducing caloric intake below the daily energy requirements/maintaining caloric intake and increasing energy expenditure ⟨physical activity⟩ / combining reduced caloric intake with increased energy expenditure ⟨physical activity⟩ ✓ metabolic rates affect energy/caloric balance ✓ basal metabolic rate ⟨BMR⟩ indicates the energy/calories you expend simply by being alive OR resting metabolic rate ⟨RMR⟩ is the energy/calories resulting from rest plus BMR ✓</p>		4 max

		<p>increased muscle mass from physical activity results in increased BMR</p> <p>OR</p> <p>reduced muscle mass from physical inactivity results in decreased BMR ✓</p> <p>energy balance is affected by genetics/body size/body composition/level of physical activity ✓</p>		
12	a	<p>to make the most of limited functional capacities</p> <p>OR</p> <p>to help maintain mobility ✓</p> <p>to alleviate/provide relief from symptoms ✓</p> <p>to reduce the need for medication ✓</p> <p>to reduce the risk of disease reoccurrence</p> <p>OR</p> <p>to limit deterioration of hypokinetic disease / possible cognitive decline ✓</p> <p>to help overcome social problems and psychological distress ✓</p> <p>to increase energy levels ✓</p>		2 max
	b	<p>decreases fatigue/anger/anxiety/depression/confusion/tension/stress ✓</p> <p>is recognized / accepted as a useful treatment for depression ✓</p> <p>increases vigour / clear thinking / energy / alertness / sense of well-being / motivation / arousal ✓</p> <p>regular exercise has been shown to prevent relapses into depression ✓</p>		2 max

Question		Answers	Notes	Total
13	a	<p><i>Non communicable diseases:</i> not passed from person to person, and usually of long duration and slow progression ✓</p> <p><i>Communicable diseases:</i> caused by an infectious agent or its toxins which pass by direct or indirect transmission ✓</p> <p>from person to person, or <i>via</i> an animal, vector or the inanimate environment ✓</p>	Award [1 max] for <i>Communicable diseases</i> .	2 max
	b	<p>a calculation of the percentage public health burden that is caused by a particular risk factor ✓</p> <p>30% of cases of diabetes can be associated with a sedentary lifestyle.</p>		2
14		<p>due to an improved metabolic rate / increased energy expenditure ✓</p> <p>reduced fat mass/reduced obesity / improved plasma lipid profile / decreased adiposity ✓</p> <p>decrease in blood pressure and reduced risk of hypertension ✓</p> <p>reduced cholesterol and reduced atherosclerosis ✓</p>		3 max
15	a	<p>sport-induced osteoarthritis (damage to the bones of one or more joints) ✓</p> <p>stress fractures; hairline fracture of a bone caused by overuse ✓</p> <p>fractures breaks in a bone; usually caused by a high force impact ✓</p>		1 max

	b	<p>regular moderate exercise will help the body adapt to exercise stress ✓</p> <p>prior to exercise, carry out health assessment of the chosen exercise to ensure it is suitable for the fitness level of the individual ✓</p> <p>protective equipment (eg suitable footwear) can be worn to prevent injury through impact injuries ✓</p> <p>follow recommended injury prevention strategies such as warming up/cooling down/stretching ✓</p> <p>injury prevention education/safety demonstrations (eg gait analysis) through guidance from exercise professionals ✓</p> <p>route checking/weather conditions ✓</p>	OWTTE	3 max
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Option D — Nutrition for sport, exercise and health

Question		Answers	Notes	Total
16	a	54.5 (ml kg ⁻¹ min ⁻¹) ✓	Accept answers in the range 54–55 ml kg ⁻¹ min ⁻¹ .	1
	b	body composition is inversely related/negatively correlated to cardio-respiratory fitness/VO ₂ max <i>OWTTE</i> ✓ VO ₂ max/cardio-respiratory fitness reduces by 4 ml kg ⁻¹ min ⁻¹ between NW and OW OR VO ₂ max/cardio-respiratory fitness reduces by 4 ml kg ⁻¹ min ⁻¹ between OW and O OR VO ₂ max/cardio-respiratory fitness reduces by 8 ml kg ⁻¹ min ⁻¹ between NW and O ✓		2 max

c	<p>body mass index/BMI fails to consider the body's proportional composition</p> <p>OR</p> <p>factors other than excess body fat (bone, muscle mass, increased plasma volume due to training) affect the numerator of the BMI equation ✓</p> <p>a high BMI could lead to an incorrect interpretation of over-fatness in lean individuals with excessive muscle mass due to training ✓</p> <p>there is a possibility of misclassifying an individual as overweight or obese using BMI standards with large sized athletes (for example field athletes/bodybuilders/rugby players) ✓</p> <p>racial differences that is, BMI is derived mainly from caucasian populations – but there is evidence that other racial groups may differ from caucasians in their levels of total body fat at a given BMI ✓</p> <p>some countries use different cut-off points, with an emphasis on health risks (for example heart disease/diabetes) instead of weight ✓</p> <p>BMI assumes an average degree of maturation, but adolescents can go through puberty early or late ✓</p> <p>BMI can underestimate fatness on those with a less lean body mass (for example the elderly) ✓</p>		2 max
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Question		Answers	Notes	Total
17	a	for example blood plasma ✓ for example lymph ✓ for example saliva ✓ for example fluid in the eyes / aqueous humour and vitreous body ✓ for example fluid surrounding nerves/spinal cord/cerebrospinal fluid ✓ for example synovial fluid ✓		3 max
	b	water intake helps to maintain hydration/avoid dehydration ✓ water intake helps to maintain body temperature/thermoregulation ✓ water intake helps to maintain plasma volume ✓ water loss during prolonged exercise may lead to a decline in athletic performance ✓ water loss during prolonged exercise may lead to serious medical problems (for example heat exhaustion or heat stroke) ✓ water loss during prolonged exercise may result in stress on the cardiovascular system ✓ water loss during prolonged exercise may result in inadequate heat transfer to the skin and environment ✓ water loss during prolonged exercise is associated with increased plasma osmolality ✓ water loss during prolonged exercise is associated with decreased plasma volume ✓ water loss during prolonged exercise may affect the intracellular and extracellular electrolyte balance ✓		3 max
	c	when water levels are low ADH is released (by the pituitary gland) ✓ water permeability of the renal tubes/collecting ducts increase ✓ leading to an increased re-absorption of water ✓		3

Question		Answers	Notes	Total
18	a	4.0 mmol/L–4.5 mmol/L ✓	<i>Unit of measurement must be included.</i>	1
	b	insufficient food intake low amounts of glucose provided by digestion OR excessive exercise stores of glucose have been used up OR high insulin levels among diabetics ✓ insulins removes glucose from the blood ✓		2
19		longer reaction times eg slower off the blocks ✓ reduced speed eg the swimmer will be slower in the race / turn slower ✓ reduced power and strength eg reduced impulse from dive off blocks ✓ reduced balance eg unable to apply weight evenly <so cannot push off from the blocks effectively> ✓ reduced coordination eg timing of the stroke challenging <especially alternating strokes such a front crawl and backstroke> ✓ diuretic effect/dehydration may cause cramp and/or injury ✓ increase incidence and severity of injury as they may fall, mistime turns/mistime dives ✓		3 max

Question		Answers	Notes	Total
20	a	free radicals are produced as a by-product of normal cell function and cells produce natural antioxidants to counteract them ✓ exhaustive exercise generates high levels of free radicals that cannot be controlled by natural antioxidants <so that damage to cells may occur>/oxidative stress ✓ these effects are less significant in a trained athlete ✓		2 max
	b	free radicals can damage parts of the cell by removing electrons to create paired electrons in their structures ✓ removing electrons from cell and mitochondrial membranes, so affecting their permeability ✓ removing electrons from molecules such as enzymes and DNA and so impairing their function ✓		2 max
