

Markscheme

May 2023

Sports, exercise and health science

Standard level

Paper 2

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Subject details: Sports, exercise and health science SL paper 2 markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A [**30 marks**] and **ONE** question in Section B [**20 marks**].
Maximum total = [**50 marks**].

Markscheme format example:

Question			Answers	Notes	Total
5	c	ii	this refers to the timing of the movements OR the extent to which the performer has control over the timing of the movement ✓ external paced skills are sailing/windsurfing/receiving a serve ✓ internal paced skills are javelin throw/gymnastics routine ✓		2 max

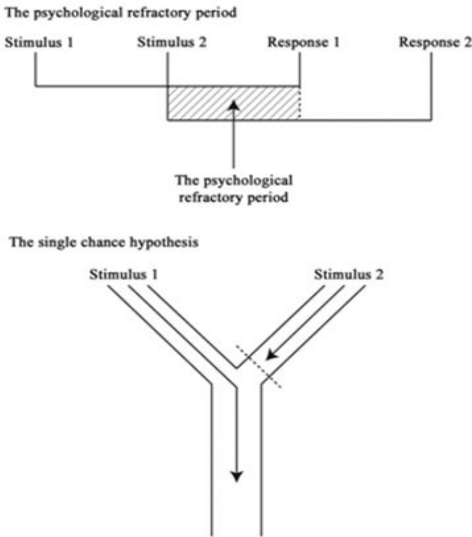
1. Each row in the “Question” column relates to the smallest subpart of the question.
2. The maximum mark for each question subpart is indicated in the “Total” column.
3. Each marking point in the “Answers” column is shown by means of a tick (✓) at the end of the marking point.
4. A question subpart 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 word is indicated in the “Answers” column by a slash (/). Either word can be accepted.
6. An alternative answer is indicated in the “Answers” column by “**OR**”. Either answer can be accepted.
7. An alternative markscheme is indicated in the “Answers” column under heading **ALTERNATIVE 1** etc. Either alternative can be accepted.
8. Words inside chevrons « » in the “Answers” column are not necessary to gain the mark.
9. Words that are underlined are essential for the mark.
10. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
11. 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) in the “Notes” column.
12. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
13. 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.
14. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

Question			Answers	Notes	Total
1.	a	i	800<ml>; ✓		1
1.	a	ii	80-63=17<cm>; ✓	Accept 79-80,61-64, i.e., difference of 19-15 cm (calculations must be accurate for values presented to be credited e.g., 79-64 = 15) Accept 0.5 cm increments	1
1.	b		Safety/ethics: The experimenter must make all reasonable efforts in order to ensure the safety of the participants and minimise the chances of injury; ✓ <Validity> of that data; a warm-up helps to prepare the body's muscles/nerve tissue/joints/ mental focus to optimise performance in the maximal test to provide more valid results; ✓ Reliability: A standardised warm-up is used so that every subject is prepared in the same manner/ allows a common baseline therefore greater chance of collecting reliable data; ✓	Note: practice effect not relevant because warm-up has not been described, therefore can't say they are practicing during the warm-up. Do not accept 'warm up- makes you prepared for the test' there needs to be reference to psychological or physiological aspects.	3
1.	c	i	Extension;		1

1.	c	ii	<p>Quadriceps – concentric; ✓ Quadriceps – isotonic; ✓ Hamstring – inhibited, relaxed; ✓</p>	<p><i>ECF: For example, answer to 1 Ci is flexion accept hamstrings concentric and quadriceps relax description, Award [2] max.</i></p> <p><i>Note: guide says opposing muscle relaxes eccentrically. May need to award mark if this is what student has been taught.</i></p> <p><i>Do not accept 'quads'</i> <i>Accept individual muscles of the hamstrings or the quadriceps groups</i></p>	2
1.	d		<p><i>Left carpals are:</i></p> <p>Superior to the left clavicle; ✓ Anterior to the left clavicle; ✓ Distal to the left clavicle; ✓ Lateral to the left clavicle; ✓</p>		2

2.	a	Handball group;		1
2.	b	<p><46.5–41.9 = 4.6></p> <p>4.6/41.9 x 100 = 10.9 <%>; ✓</p>	<p>Accept 10.98 or 11.00 as alternative to 10.9</p> <p>Note: increase not vital for this question</p>	1
2.	c	<p>Hypothesis is supported:</p> <p>Multistage fitness distance increases from 1880 to 2480 <m>/31.9%</p> <p>OR</p> <p><Statistically> significant increase in Multistage fitness distance; ✓</p> <p>VO2 max increases from 41.9-46.5 / 10.9%</p> <p>OR</p> <p><Statistically> significant increase in VO2 max; ✓</p> <p>The hypothesis is supported by the data</p> <p>OR</p> <p>Evidence suggests that regular exercise improves Cardiovascular health; ✓</p> <p>Hypothesis is not supported:</p> <p>No change/ slight increase in Blood pressure contradicts the hypothesis</p> <p>OR</p> <p>Slight change in heart rate contradicts the hypothesis; ✓</p>	<p>(Accept 32% for distance ran MSFT)</p> <p>(Accept 10.98 or 11% for V02 max)</p> <p>Allow ECF from 2b</p> <p>Accept any valid cardiovascular adaption from regular exercise for third marking point</p>	3

2.	d				<p><i>Accept physical state (liquid/ solid) if this is not an absolute and only at moderate temp.</i></p> <p><i>Award (1) for a correct example of source saturated fat and unsaturated fat</i></p>	3	
			<i>Saturated</i>	<i>Unsaturated</i>			
		<i>Double bonds</i>	Contains no double bonds <u>between carbon atoms</u> within the fatty acid chain / / maximum number of bonds for each carbon atom /carbon atoms are saturated with hydrogen atoms	Contain one or more <u>double bonds between carbon atoms</u> within the fatty acid chain / unsaturated/ 2 hydrogen atoms are missing from carbon atom and double bonds are formed			; ✓
		<i>Branching</i>	Unbranched	One or more branches			; ✓
		<i>Animal sources</i>	Red meat / poultry / full-fat dairy products	None			; ✓
	<i>Plant sources</i>	Tropical oils, such as palm oils / coconut oils;	Originate from <non tropical> plant-based foods / olive oil / olives / avocado / peanuts, cashew nuts, canola oil and seeds, sunflower oil / rapeseed oil;	; ✓			
		Raise cholesterol	Improves/lowers blood cholesterol levels	; ✓			

<p>2.</p>	<p>e</p>	<p>The player fakes to initiate an action in one direction, e.g., a badminton player pretends that they will hit a serve in one direction OR This becomes stimulus one/S1 which the opponent first attends to; ✓</p> <p>At the last moment the player changes their action/ / Stimulus 2 (S2) e.g., the server hits the shuttle in the opposite direction; ✓</p> <p>When a stimulus/S1 is closely followed by a second stimulus/S2, the first stimulus/ response 1 must be cleared before the second/ response 2 can be processed OR Due to the single channel hypothesis the opponent cannot immediately switch their attention to the second stimulus; ✓</p> <p>The PRP therefore, slows down the opponent's response to S2 <gaining an advantage>; ✓</p> <p>If fakes become predictable or there is a large time gap between S1 and S2 the advantage for the PRP is reduced OR PRP can be affected by the experience of the performer/ opponent; ✓</p>	<p><i>Award [3] max if no example is given</i> <i>Accept a clearly annotated diagram</i></p>  <p>The diagram consists of two parts. The top part, titled 'The psychological refractory period', shows a horizontal timeline. It starts with 'Stimulus 1', followed by 'Stimulus 2', then 'Response 1', and finally 'Response 2'. A shaded rectangular area is positioned between 'Stimulus 2' and 'Response 1', with an arrow pointing to it from below. This shaded area is labeled 'The psychological refractory period'. The bottom part, titled 'The single channel hypothesis', shows two diagonal lines representing 'Stimulus 1' and 'Stimulus 2' entering a single vertical channel. A dashed line indicates a point where the two stimuli meet, and a single vertical arrow points downwards from this point, representing the single response.</p>	<p>4</p>
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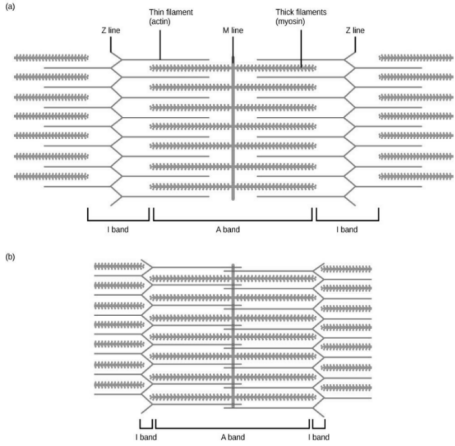
3.	a	<p>The predominant energy system involved is the lactic acid system/ anaerobic glycolysis; ✓</p> <p>This system does not use oxygen/is anaerobic; ✓</p> <p>Glucose is converted into pyruvic acid/ pyruvate; ✓</p> <p>1 glucose molecule produces 2ATP/4ATP gross; ✓</p> <p>Due to insufficient oxygen supply / anaerobic conditions during high intensity activities pyruvic acid/ pyruvate is converted into lactic acid/ lactate; ✓</p> <p>This system operates in the cytoplasm of the cell; ✓</p> <p>This system produces of lactate/lactic acid/H⁺, <which causes fatigue>; ✓</p>	<p><i>Second marking point must be explicitly stated not simply in reference to the system</i></p>	3
3.	b	<p>Running has a larger VO₂max <up to 30% more> than arm ergometry; ✓</p> <p>Running uses more/larger muscle groups <therefore requiring and accessing more O₂>; ✓</p> <p>If someone is highly trained in arm ergometry, VO₂max would be closer to their own running VO₂max; ✓</p>	<p><i>Remove more muscles from publishing and just leave larger muscle groups</i></p>	2

<p>3.</p>	<p>c</p>	<p>1st law: Inertia/an object remains at rest or continues to move at constant velocity unless acted on by an unbalanced force; ✓ e.g., at start of race, from stationary to moving can be maximised by having a light boat and light paddle; ✓ Harder to change when inertia is greater; ✓ e.g., once up to speed, kayaker needs to maintain inertia with less work, if too heavy, requires lots of work to maintain momentum; ✓</p> <p>2nd law: $F=ma$; ✓ Larger muscle groups to apply greater force to produce greater acceleration; ✓ Impulse=force x time / if force is applied for longer, it creates greater acceleration; ✓ In the direction of force applied; ✓ e.g., a lighter person who can generate the same amount of force as a larger person will kayak faster; ✓</p> <p>3rd law: Reactive force 'equal and opposite'; ✓ e.g., the kayaker pushes the paddle through the water, so that the water pushes back on it and propels the kayak forward; ✓ May consider paddle size/face of paddle – apply greater force; ✓ And the direction of the force applied; ✓</p>	<p><i>Credit only one of Newton's laws (award highest mark possible) remove the section in brackets for publication</i></p> <p><i>Not for publishing</i></p> <p><i>Credit for examples and description for a law. Do not penalise for incorrectly naming a law</i></p>	<p>3</p>
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4.	a	<p><i>Plank is a:</i></p> <p>Static exercise; ✓</p> <p>Which inhibits the ability of the muscular pump / increased peripheral resistance to limit the movement of blood around the body; ✓</p> <p>Systolic BP will increase; ✓</p> <p>Diastolic BP will increase; ✓</p>		3
4.	b	<p>Extrinsic: is information provided for the performer by someone and or something else e.g., coach giving feedback focusing on movement patterns; ✓</p> <p>Intrinsic: is not appropriate for a performer in the cognitive stage, as they would not have the necessary experience; ✓</p> <p>Knowledge of results: is post response information concerning the outcome of an action e.g. scoring a goal/ simple measure of success; ✓</p> <p>Knowledge of performance: is post response information concerning the nature of the movement; e.g. movement pattern e.g. the position of the racket at the start of a badminton service; ✓</p> <p>Positive: also prescriptive feedback, concentrates on how an action is done well, coach tells performer how to improve performance e.g. encouraging the athlete to continue performing; ✓</p> <p>Negative: concentrates on errors, coach followed up by prescriptive feedback e.g., often this is not appropriate for learners in the cognitive stage to prevent a loss of motivation; ✓</p> <p>Concurrent: information is provided while performing the skill e.g., Often this is not appropriate for learners in the cognitive stage to prevent a loss of motivation; ✓</p> <p>Terminal: information which is available after skill has been performed e.g. After the learner has completed hitting a badminton shuttle; ✓</p>	<p><i>M (2) for correct description for two or more types of feedback</i></p> <p><i>Award [1] max for a list of two or more types of feedback</i></p>	4

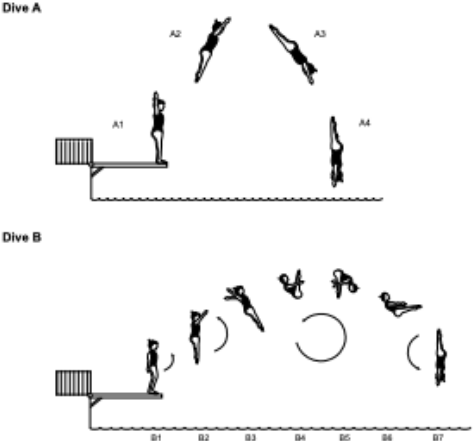
4	c	<p><i>Similarities:</i></p> <p>Both runners will use ATP-PC in initial stages; ✓</p> <p>Both will use all three systems at any one time during the race; ✓</p> <p>Lactic acid will be used when pace goes above 85/90% maxHR; ✓</p> <p>Both utilises carbohydrates as their substrates; ✓</p> <p><i>Differences:</i></p> <p>10 000m race predominantly utilises the aerobic energy system whereas 400m race predominantly utilises the lactic acid system; ✓</p> <p>10,000m race has a larger use of lipids, as a substrate as compared to the 400m; ✓</p>	<p><i>Award [3] max if no similarities or no differences are given</i></p>	4
4.	d	<p>Myocardial hypertrophy/ increased left ventricular volume; ✓</p> <p>Resulting in an increased stroke volume; ✓</p> <p>Increased maximal cardiac output, increased delivery of oxygen to working muscles; ✓</p> <p>Lower sub-maximal exercising heart rate allows them to increase intensity at Higher levels to access aerobic energy pathways; ✓</p> <p>Increased capillarization around heart, lungs, trained muscles; ✓</p> <p>Increased arterio-venous oxygen difference; ✓</p> <p>Increased haemoglobin/ red blood cell count; ✓</p>	<p><i>Award [1] max for list</i></p>	5
4.	e	<p>Control, greater ability to place ball during a point; ✓</p> <p>Learned, hours spent practicing strategy; ✓</p> <p>Efficiency, minimum movement/effort for maximum output/power; ✓</p> <p>Goal-directed, objective is to win point, novice to stay in the game; ✓</p>	<p><i>Award [2] max for a list</i></p> <p><i>Do not accept accuracy</i></p>	4

			Fluency, ability to move effectively, smoothly, look effortless; ✓		
5.	a		<p><i>Similarities:</i> When they stop exercising, heart rate will decrease; ✓ Heart rate will return to resting rate; ✓</p> <p><i>Differences for trained athlete:</i> Speed of recovery is faster for trained athlete; ✓ Has lower O₂ debt/ EPOC; ✓ Faster to return to resting heart rate; ✓ PC stores restored more quickly; ✓ Lactic acid/ lactate/H⁺ removed more quickly</p> <p>OR</p> Glycogen stores restored more quickly; ✓	<p><i>Accept in the converse for untrained</i> <i>Award [2] max if no similarities or differences given</i></p>	3
5.	b		Gases/O ₂ move from a high to low partial pressure / concentration gradient; ✓ During exercise, <rate of> diffusion will be greater because the relative partial pressures are greater, so greater amount of O ₂ reaches blood; ✓ Oxygen partial pressure is higher in the lungs than in the capillary	<p><i>Accept in the converse CO₂ for O₂</i> <i>Do not accept reference to transport.</i></p>	4
			<p>OR</p> Oxygen/O ₂ moves from the lungs/ alveoli to the pulmonary capillaries; ✓ Gases/O ₂ diffuse across the membranes/ into blood; ✓ The capillary and alveoli walls are 1 cell thick <which assists in the high rate of diffusion>; ✓ A large surface area increases diffusion rate; ✓ The amount and rate of gas exchange that occurs across the membrane		

		depends on the partial pressure of O ₂ , the thickness of the wall and the surface area <which is Fick's Law>; ✓		
5.	c	<p>Progressive water loss through sweating increases the viscosity of the blood; ✓</p> <p>Decrease in plasma volume decreases central venous cardiac pressure/ lower rate of venous return (starlings' law) which reduces stroke volume; ✓</p> <p>Reduced stroke volume initiates increased heart rate to maintain nearly constant cardiac output; ✓</p> <p>Cyclist will fatigue as their heart rate rises towards maximum / needs to exercise at lower intensity than if cardiac drift does not occur; ✓</p> <p>Cyclist will reach their maximum heart rate at a lower intensity than usual / earlier; ✓</p> <p>Increase in core temperature increasing movement of blood to extremities for body cooling; ✓</p>	3	
5.	d	<p>Calcium ions are released from the sarcoplasmic reticulum <when stimulated by an action potential>; ✓</p> <p>Calcium ions bind to troponin; ✓</p> <p>Tropomyosin/troponin complex exposes the binding site «on actin»; ✓</p> <p>ATP on the myosin head is broken <into ADP & Pi>, causing myosin heads to recoil <storing potential energy>; ✓</p> <p><Myosin «head» creates a cross-bridge with the actin; ✓</p> <p>Power stroke takes place <releasing ADP & Pi>; ✓</p> <p>Pulling Z lines together/shortening the sarcomere; ✓</p> <p>Cross bridge is broken <via the breakdown of ATP>; ✓</p> <p>Crossbridge cycling continues until the muscle fiber is no longer stimulated; ✓</p>	<p>Accept an annotated diagram where appropriate.</p>  <p>(a)</p> <p>(b)</p>	6

			H zones shrink/ I band disappears/ a band is unchanged; ✓	
5.	e		<p>Selective attention/SA is the ability to attend to relevant/important cues/signals/stimuli; ✓</p> <p><i>In cognitive phase:</i> A performer has reduced ability to select relevant cues OR A performer does not know what cues to selectively attend to; ✓</p> <p>Reduced SA ability can result in information overload and confusion, as the brain would not be able to cope with streams of information; ✓ Reduced experience therefore reduced relevant long-term memory to draw from; ✓ Performance is commonly erratic/inconsistent/large errors; ✓ Still learning/building up memory of the skill requirements OR Should try to avoid overwhelming the short-term memory; ✓</p>	4

6.	a	<p>With exercise there is an increase in the production of CO₂; ✓</p> <p>Increase in CO₂, increases blood acidity/low pH levels; ✓</p> <p>Detected by the respiratory centre/ chemoreceptors; ✓</p> <p>This results in an increase in the depth of ventilation; ✓</p>		3
6.	b	<p>Insulin encourages glycogenesis; ✓</p> <p>Insulin allows glucose to enter the muscle cell; ✓</p> <p>Insulin moves GLUT4 to surface of cell to allow glucose to enter cell; ✓</p> <p>Muscle contraction moves GLUT4 to surface to allow glucose to enter cell; ✓</p> <p>Therefore reduced reliance on insulin for glucose uptake during exercise; ✓</p> <p>Insulin encourages uptake of glucose for storage / insulin and skeletal muscle Action on GLUT4 allow insulin to enter the cell for glycogenesis/glycolysis; ✓</p> <p>Exercise reduces blood glucose levels which stimulates release of glucagon and therefore more glucose enters the bloodstream; ✓</p>	<p><i>Accept annotated diagram</i></p> <p><i>Award [3] max for either insulin or muscle contraction effect on glucose uptake</i></p>	4

<p>6. c</p>		<p>Angular momentum is defined as moment of inertia x angular velocity / angular Velocity and moment of inertia are inversely proportional; ✓</p> <p>Angular momentum is when a body is spinning about an axis; ✓</p> <p>A moment of inertia is determined by the distance of the load from the rotational axis; ✓</p> <p><i>Similarities:</i></p> <p>Angular momentum remains constant unless the diver is acted upon by an unbalanced force; ✓</p> <p>Start: longer maximal radius <arms / legs> to correct body position/stability to execute chosen dive; ✓</p> <p>Final phase: <maximized radius,> maximized moment of inertia, which reduces angular velocity / rotation and therefore diver can enter water vertically without rotation>; ✓</p> <p>Rotating about the same <transverse> axis; ✓</p> <p><i>Differences:</i></p> <p>Change in arm position B1–B2 upward thrust to initiate rotation; ✓</p> <p>Going into pike/phase B4, <radius is reduced,> moment of inertia reduced, angular velocity is increased, therefore spin faster to allow diver to complete somersault; ✓</p> <p>Diver A does not change moment of inertia during dive</p> <p>OR</p> <p>Final phase: coming out of pike/phase B6 to maximise moment of inertia which reduces angular velocity, therefore reduce spin speed to allow diver to enter water vertically <without rotation>; ✓</p>	<p><i>Award [2] max for definition</i></p> <p><i>Award [3] max if no similarities or differences given</i></p> 	<p>5</p>
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<p>6.</p>	<p>d</p>	<p>Whole; ✓</p> <p>Skill is practised in its entirety. The learner can appreciate the end product and can develop a feeling for the flow of the movement necessary for smooth and efficient production of the skill / fast and explosive movement, must be practised specific to the required movement, therefore can't be broken down into component parts; ✓</p> <p>e.g., Golf swing / basketball shot; ✓</p> <p>Whole-part-whole; ✓</p> <p>Where the learner first tries the whole skill to get a feel of the performance requirements and to help identify the easy and hard elements. This may be different for each individual. They can then practice the difficult portion before integrating back into whole skill; ✓</p> <p>e.g., Golf swing, set-up, golf swing, break into component parts; ✓</p> <p>Progressive part; ✓</p> <p>When the skill is too complex and or difficult for the learner and each additional part can build on the previous parts; ✓</p> <p>eg. Swimming kick practice, then with kick board, then kick and bubbles, kicking and arms, kicking and breathing, swim; ✓</p> <p>Part; ✓</p> <p>When the skill is too complex and or difficult for the learner and or when there is an element of danger, but the sequence is not vital; ✓</p> <p>e.g., Pole vault, practice run up with pole, practice pole plant, practice plant on to mat and swing through, in gym; ✓</p>	<p><i>Award [1] for type of presentation</i></p> <p><i>Award [2] max for description</i></p> <p><i>Award [1] max for a list</i></p>	<p>3</p>
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6.	e	<p>Contractility: the ability of muscle to contract; ✓</p> <p>Extensibility: ability of the muscle to stretch beyond normal resting length; ✓</p> <p>Elasticity: the muscles' ability to return to its normal resting length after the stretch is removed; ✓</p> <p>Atrophy: where the muscle reduces in size when not used/stimulated by activity; ✓</p> <p>Hypertrophy: where the muscle increases in size when used/stimulated by activity; ✓</p> <p>Controlled by nerve stimuli: generate force when stimulated by a nerve; ✓</p> <p>Fed by capillaries; ✓</p>	<p><i>Award [2] max for a list, min 3 in a list for [1]</i></p>	<p>5</p>
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References: