

# Markscheme

November 2025

**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 <b>OR</b> 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.

**Section A**

Question		Answers	Notes	Total
1.	a	HIIT/ high-intensity interval training✓		1 max
1.	b	48-45=3 «mLO <sub>2</sub> kg <sup>-1</sup> min <sup>-1</sup> »✓	Accept +/- 1 from 48 and +/- 0 from 45 (e.g. 49-45 =4 or 47-45=2).	1 max
1.	c	<p>VO<sub>2</sub> max improves for both HIIT and MICT «however there is no evidence of significance»✓</p> <p>VO<sub>2</sub> max dropped for both HIIT and MICT groups' for Post- to 4-weeks after training/ TE</p> <p><b>OR</b></p> <p>VO<sub>2</sub> max remained higher than pre-training for both HIIT and MICT groups' for Post- to 4-weeks after training/ TE ✓</p> <p>VO<sub>2</sub> max <b>significantly</b> higher post-training for the HIIT group «compared to MICT group»✓</p> <p>VO<sub>2</sub> max <b>significantly</b> higher 4-weeks after training/ TE for the HIIT group «compared to MICT group»✓</p> <p>There was no significant difference between groups in VO<sub>2</sub> max pre-training✓</p>	<p>MP2.1 must refer to remain/ maintained or relative to pre-training.</p> <p>MP 3/4 must refer to the significance for credit.</p>	3 max
1.	d	<p>SD shows the variability of the data around the mean✓</p> <p>A small standard deviation indicates that the data is clustered closely around the mean value✓</p> <p>A large standard deviation indicates a wider spread of the data around the mean✓</p>		1 max

Question		Answers	Notes	Total
2.	a	111 «s»✓	Accept +/- 3.	1 max

Question		Answers	Notes	Total
2.	b	25 - 20 = 5 «kJ»✓	Accept 24.5-25.5 and 19.6-20 as ranges.  Reminder full workings and accurate answer required for the mark. E.g. 24.5-19.8 = 4.7«kJ».	1 max
2.	c	TTE and TWC improves for the BA group «after 28 days» ✓  TTE shows a lower value for the BA group compared to PLA as the error bars are not overlapping at pre to day 7 ✓  TWC shows similar values in BA the PLA groups between pre and day 7 as the error bars overlap ✓  TTE and TWC show no difference in the data between the BA and PLA group until 28 days of supplementation/ or between days 0 and 21 as error bars overlap ✓		3 max
2.	d	<b>Essential amino acids</b> Cannot be synthesized by the human body <b>OR</b> Must be obtained from the diet ✓ <b>Non-essential</b> Amino acids can be synthesized by the human body <b>OR</b> Do not need to be obtained from the diet ✓		2 max

2.	e	<p>Use measuring tools/ IV and DV that permit the demonstration of causality✓                  Control group allows a comparison between experimental group/ provides a baseline✓                  Placebo prevents bias/ avoid the psychological effects✓                  Use of blind/ double blind allocation prevents bias✓                  Use of «inferential» statistics shows the significance of the findings✓                  Randomization guards against bias/ ordering/ learned/ fatigue effects✓</p>		3 max
3.	a	<p>Describing a structure farther from the site of attachment/ axial skeleton/ centre of body/ trunk✓                  E.g. Radius is distal end of the humerus  <b>OR</b>                  E.g. Patella is the distal end of the femur✓</p>	<p><i>Do not accept midline.</i>  <i>Limit examples to the appendicular skeleton and must be within same limb.</i>  <i>Scapula/ clavicle &gt; humerus&gt; radius/ ulna &gt; carpals &gt; metacarpals &gt; phalanges.</i>  <i>Pelvis/ pelvic girdle/ ilium &gt; Femur &gt; patella &gt; tibia &gt; tarsals &gt; metatarsals &gt; phalanges.</i></p>	2 max
3.	b	<p><b>Origin</b>                  «Often proximal» attachment of a muscle tendon to a stationary bone✓  <b>Insertion</b>                  «Often distal» attachment of a muscle tendon to a moveable bone✓</p>		2 max
3.	c	<p>X: Tricuspid/ right atrioventricular valve✓                  Y: Left ventricle✓                  Z: «Superior» vena cava✓</p>		3 max

3.	d	«Cardiac output» = stroke volume/ SV x heart rate/ HR	<i>Accept BPM for HR.</i>	<b>1 max</b>
3.	e	<p>A neuromuscular reflex that inhibits opposing muscles «to enable voluntary movements»</p> <p><b>OR</b></p> <p>When the agonist contracts, the antagonist «is inhibited» and relaxes✓</p> <p>The triceps acts as the agonist/ «concentrically» contracting✓</p> <p>The biceps «brachii» act as the antagonist/ relaxing✓</p>	<i>Do not accept biceps relaxing eccentrically.</i>	<b>3 max</b>

Question		Answers	Notes	Total
3.	f	<p>Complex skill✓</p> <p>Serial skill✓</p> <p>Dangerous skill✓</p> <p>No constraint on time✓</p> <p>Performer has limited motivation and attention span✓</p> <p>Performer is inexperienced✓</p>		<b>3 max</b>

**Section B**

Question		Answers	Notes	Total
4.	a	<p><b>Articular cartilage</b> Smooth tissue which covers the surface of articulating bone✓ Absorbs shock/ allows friction free movement✓</p> <p><b>Synovial fluid</b> Lubricates/ reduces friction within the joint «capsule»/ between cartilage; Nourishes the «articular» cartilage✓</p> <p><b>Ligaments</b> Tough bands of fibrous «slightly elastic» connective tissue✓ Connects bone to bone «stabilizing the joint during movement»✓</p> <p><b>Synovial membrane</b> Location just inside the articular capsule✓ Secretes synovial fluid into the joint✓</p> <p><b>Articular capsule</b> A fibrous sac that surrounds/ encloses the joint✓ Provides strength to the joint✓</p> <p><b>Bursae</b> Fluid filled sacs located where a tendon moves over a bone✓ Reduces the friction between tendons and bones✓</p> <p><b>Meniscus</b> Fibro-cartilage located at the knee joint✓ Shock absorption «and load bearing» at the knee✓</p>	<p><i>Award max [1] per feature.</i></p> <p><i>Do not accept prevents friction (synovial fluid).</i></p>	<p><b>3 max</b></p>

<p>4.</p>	<p>b</p>	<p>Gases/ CO<sub>2</sub>/ O<sub>2</sub> diffuse across the alveoli membrane✓                  Gases/ CO<sub>2</sub>/ O<sub>2</sub> move from a high to low partial pressure/ down a concentration gradient✓                  PPO<sub>2</sub> is higher in the lungs than in the «pulmonary» capillary✓                  «Net» movement of O<sub>2</sub> from the lungs/ alveoli to the «pulmonary» capillaries;                  Alveoli/ capillary walls are 1 cell thick/ thin therefore provide a short diffusion pathway which aids diffusion✓                  Dense alveoli/ capillary network provides a large surface area which aids diffusion✓  <i>Exercise</i>                  PPO<sub>2</sub> lower in «pulmonary» capillaries «compared to rest» due to increased respiration within muscles✓                  Therefore «rate of» diffusion will be greater/ faster due to a steeper concentration gradient✓</p>	<p><i>Max [4] if no reference to exercise.</i></p> <p><i>MP3, 4 &amp; 8 Accept in the converse for PPCO<sub>2</sub>.</i></p>	<p><b>5 max</b></p>
<p>4.</p>	<p>c</p>	<p>Fast contractile speed/ decreased contraction time (compared to type 1 muscle fibres).                  Largest size of muscle fibre/ motor neurons to increase force generation/ power✓                  Primary fuel is creatine phosphate/ glycogen✓                  Relies on anaerobic glycolysis and rapid ATP synthesis✓                  High glycogen content✓                  Elevated glycolytic enzymes present to increase rate of glycolysis✓</p>		<p><b>4 max</b></p>

4.	d	<p><b>Motivation</b> A highly motivated player will persevere during difficult tasks/ times until they have mastered the task✓ Highly motivated learners tend to be more engaged/ on-task/ intrinsically focused on learning✓</p> <p><b>Physical fitness</b> Unfit players will not be able to complete drills and practice tasks to improve✓ E.g. an unfit player will not be able to focus on the set task such as one touch ball retention drill✓</p> <p><b>Coach</b> Positive coaching qualities will meet the needs of their performers enhancing their rate of learning✓ E.g. a dictatorial coach may hinder the players' ability to apply skills when they play the game as the players have to make decisions by themselves in a fluid/ game situation✓ E.g. a coach who only provides negative feedback may turn players off from being involved✓</p>	<p><i>Award max [2] per factor. Accept in the converse. Accept in the converse for examples.</i></p> <p><i>Accept any reasonable coach quality Mp5.</i></p>	<p><b>5 max</b></p>
4.	e	<p>At least one «C-C» double bond/ does not have all the hydrogen it could bind✓ Consider a healthier choice of fat✓ Predominately from plant-based sources✓ E.g. vegetable oils✓</p>	<p><i>Max [2] if no example.</i></p> <p><i>Do not accept avocado.</i></p>	<p><b>3 max</b></p>

Question		Answers	Notes	Total
5.	a	Diaphragm contracts and flattens✓ <u>Internal</u> intercostal muscles relax✓ <u>External</u> intercostal muscles contract✓ Raising the rib cage upwards <b>and</b> outwards✓ This increases the thoracic volume✓ This decreases the thoracic pressure «this results in air moving into the lungs»✓ Accessory muscles contract to elevate the ribcage further✓ Accessory muscles maximize inspiratory volume✓	Award max [5] if no mention of accessory muscles.  MP7 and 8 accept any relevant example of an accessory muscle.	6 max
5.	b	Regulated by a negative feedback loop✓ Hypoglycemia stimulates the release of glucagon from the pancreas/ alpha cells✓ Exercise will reduce the amount of muscle glycogen, further stimulating glucagon✓ Increased glucagon promote glycogenolysis «breakdown of glycogen in liver and active tissue»✓ Increased gluconeogenesis «using amino acids, lactate, to make glucose» Increased lipolysis «increased levels of fatty acids in the blood»✓	Accept low blood sugar.	4 max

Question		Answers	Notes	Total
5.	c	<p>High velocity of the air on the top side of the ball/ low velocity of air on the bottom side of the ball✓</p> <p>Low pressure on the top side of the ball/ high pressure on the bottom side of the ball✓</p> <p>The lift will be generated in the upwards direction/ ball stays aloft;</p> <p>As the air particles pass the ball they stick to the surface causing a change in air velocity✓</p>	<i>Accept annotated diagram.</i>	<b>3 max</b>
5.	d	<p>Cognitive is the ability to solve problems by thinking✓</p> <p>Perceptual uses a person's senses✓</p> <p>Motor skills use voluntary movement✓</p> <p>Perceptual motor skill is a skill where a person uses their senses to help execute a movement✓</p>		<b>3 max</b>

<p>5.</p>	<p>e</p>	<p><b>Overload</b> Each training session is trying to put strain on the body greater than previously done✓</p> <p><b>Frequency</b> Build up the frequency of rides i.e. so that you may be riding every other day✓</p> <p><b>Duration</b> Gradually build up the duration/ time cycling so that the body is used to the distance needed✓</p> <p>Push the training time beyond what you are normally training/ beyond the event time so that you will cope on the day✓</p> <p><b>Intensity</b> Gradually build up the riding speed over the distances so that you are maximizing this aspect✓</p> <p>Train on hills/ have periods of high intensity effort and periods of recovery on a training ride✓</p> <p><b>Variety</b> Train/ cycle in a variety of different environments e.g. hills, flat, spinning (gym)✓</p> <p><b>Periodization</b> Plan the programme to develop endurance for the first few weeks followed by speed endurance✓</p> <p>Ensure that there is a good balance between training days and rest days to allow recovery✓</p> <p><b>Specificity</b> Training should mimic performance/ movement/ muscle groups/ energy systems✓</p> <p><b>Reversibility</b> Be conscious that if no training occurs for whatever reason then training effects will slowly diminish✓</p>	<p><i>Award max [1] for each principle.</i></p> <p><i>Note: the principle doesn't need to be named; a description of the principle is sufficient.</i></p>	<p><b>4 max</b></p>
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Question		Answers			Notes	Total	
6.	a		<b>Phosphagen/ ATP-PCr</b>	<b>Anaerobic glycolysis/ lactic acid system</b>	<b>Aerobic</b>	Max [2] per system. Accept any duration within the range provided.  Aerobic system must reference carbohydrate AND fat for credit.	6 max
		<b>Duration</b>	Up to 20 sec✓	15 sec to 3 min✓	Greater than 2 minutes✓		
		<b>Fuel sources</b>	ATP stores/ creatine phosphate✓	Glucose/ glycogen✓	Glucose/ glycogen AND fat✓		
6.	b	<b>Causes</b> Muscle tissue damage resulting in inflammation✓ Inflammation will compress nerves leading to pain✓ The more unfamiliar/ intense the training is the greater the microdamage/ inflammation/ DOMS✓ The more eccentric training the greater the microdamage/ inflammation/ DOMS✓ <b>Prevention</b> Reducing eccentric component of muscle actions during early training✓ Starting training at a low intensity/ warm up appropriately AND gradually increase the intensity✓				4 max	

Question		Answers	Notes	Total
6.	c	<b>1st law</b> Inertia/ an object remains at rest unless acted on by an unbalanced force <b>OR</b> Continues to move at constant velocity unless acted on by an unbalanced force✓	Max [1] per law.	3 max

Question		Answers	Notes	Total
		<p><b>2nd law</b>  <math>F=ma</math>✓                      Greater force to produce greater acceleration✓</p> <p><b>3rd law</b>                      Reactive force 'equal <b>AND</b> opposite' to the direction of the force applied✓</p>		
6.	d	<p>Variability can be due to age/ gender/ height/ training✓</p> <p><b>Variables reducing reaction time:</b>                      Stimulus transmission likely constant/ could possibly be reduced with adequate sleep/ recovery✓                      Detection time can be reduced if athlete trains an expected outcome✓                      Decision of action to respond predetermined✓                      Nerve transmission velocity/ time to initiation of action would remain constant✓                      Hick's law: reducing the total number of possible decisions can reduce the time it takes to respond✓</p>	<p><i>Accept diagram for Hick's law.</i></p>	<p><b>4 max</b></p>

Question		Answers	Notes	Total
6.	e	Flexibility, sit and reach✓ Agility, Illinois agility test✓ Strength, hand grip dynamometer✓ Speed, 40-metre sprint✓ Body composition, body mass index/ anthropometry/ underwater weighing✓ Balance, stork stand✓ Coordination, hand ball toss✓ Reaction time, drop test/ computer simulation✓ Power, vertical jump/ standing broad jump✓	Max [1] for each component of fitness. Max [1] for three correct tests but no reference to component.	3 max