Markscheme

November 2022

Sports, exercise and health science

Standard level

Paper 2

19 pages

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 semi colon (;) 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. Words inside chevrons **< >** in the “Answers” column are not necessary to gain the mark.

8. Words that are <u>underlined</u> 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.

Section A

Question			Answers	Notes	Total
1.	**a**	**i**	52 <ml kg^{-1} min^{-1}>		**1**
1.	**a**	**ii**	61–55 = 6 <ml kg^{-1} min^{-1}>;		**1**
1.	**b**		<graphical> representation of the standard deviation ***OR*** <graphical> representation of the variability/spread of the data <around the mean>;		**1**
1.	**c**		VO_{2max} (ml kg^{-1} min^{-1}) improves post-cycling for cyclist; pre training VO_{2max} during low oxygen is <significantly> lower than post training for both IMT & CG; there was a significant difference between pre-cycling and post-cycling VO_{2max} (ml kg^{-1} min^{-1}) under normal oxygen conditions for CG; training with IMT improves VO_{2max} more 6 vs 3 ml $kg^{-1}min^{-1}$ than training (without IMT) ***OR*** training with IMT improves VO_{2max} more than training (without IMT) in low oxygen conditions; training with IMT improves VO_{2max} more 6 vs 5 ml $kg^{-1}min^{-1}$ than training (without IMT) ***OR*** training with IMT improves VO_{2max} more than training (without IMT) in normal oxygen conditions;	*Accept in the converse* *Award [1] max for* 'Similar trend in results seen with IMT and CG' *Accept in the converse* *Accept in the converse*	**4 max**

1.	**d**		fatty acids are broken down by beta oxidation; fatty acids are broken down into 2 carbon units ***OR*** each 2 carbon unit is converted to acetyl CoA; beta oxidation releases electrons which enter the electron transport chain; fatty acids produce more electrons than glucose therefore can produce greater number of ATP molecules;		**2 max**
1.	**e**		maximal oxygen consumption/VO_{2max} increases as muscle mass exercising increases; cycling uses larger muscle groups <in the legs> ***OR*** arm ergometry uses smaller muscle groups <in the arms>; therefore, cycling would have a larger maximal oxygen consumption/VO_{2max} compared to arm ergometry; training in a discipline can influence the maximal oxygen consumption ***OR*** someone trained to use an arm ergometer may perform higher than if they completed a cycle where they are untrained;	*Accept in the converse*	**3 max**

2.	**a**		reaction time + movement time ***OR*** it is the time from the introduction of a stimulus to the completion of a movement <in response to the initial stimulus>;	*Accept in the converse*	**1**
2.	**b**		*Population impact on physiology:* response time is individually variable *e.g.* affected by gender/age/height; *Structural impact on physiology:* the length/ effectiveness of nerve transmission; the percentage of fast twitch / type IIb fibres; *Training impact on physiology:* muscular power due to their training; *Stress and fatigue levels:* fatigued/ high levels of stress hormones;		**2 max**
2	**c**		selective attention involves focusing on relevant information <listening for the gun>; selective attention involves ignoring/filtering out irrelevant information <crowd noise>; a sprinter who is focused on the relevant information/sound of the gun is likely to have a faster response time ***OR*** a sprinter who ignores the irrelevant information, *e.g.,* crowd noise, is likely to have a faster response time; racing on a day without additional environmental factors *e.g.,* poor weather/noisy crowd is likely to have a faster response time; selective attention improves with experience/training therefore a more experienced sprinter may improve their response time;		**3 max**

3	**a**		*ATP-CP system:* breakdown of PCr frees Pi; creatine kinase is the controlling enzyme; Pi combines with ADP to form ATP; 1ATP is produced <per PCr>; lasts for 10-15 seconds; *Anaerobic glycolysis/Lactic acid system:* glucose breakdown during high intensity exercise is through anaerobic glycolysis; glucose is broken down into <2> pyruvate; due to insufficient supply of oxygen during high intensity activities pyruvic acid is converted into lactic acid; <net> 2ATP are produced; lasts for 2-3 minutes/is the predominant system;	*Candidates must identify the appropriate energy system to receive credit.* *Max* [2] *ATP-PC system* *Max* [2] *anaerobic glycolysis*	**3 max**
3	**b**		condensation <reaction>;		**1**

<table>
<tr>
<td>4</td>
<td>a</td>
<td></td>
<td>contractility:
ability to generate force / create tension;

extensibility:
ability to be stretched beyond its normal resting length;

elasticity:
ability to return to resting length after it has been stretched;

atrophy:
a decrease in myofibrils / fibre diameter/ muscle size <due to a lack of physical activity>;

hypertrophy:
an increase in myofibrils / fibre diameter/ muscle size <due to an increase in activity/training>;</td>
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<td>2 max</td>
</tr>
<tr>
<td>4</td>
<td>b</td>
<td></td>
<td>
<table>
<tr><td>Joint</td><td>Joint action</td><td>Muscle contraction</td></tr>
<tr><td>Knees</td><td>extension;</td><td><isotonic> concentric;</td></tr>
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<td>2</td>
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5	**a**		relatively permanent change in performance brought about by experience;		**1**
5	**b**		whole–part–whole is when a skill is presented in full *e.g.,* the long jump; the coach would then break down the skill into discrete part *e.g.,* the run up/take off ***OR*** coach breaks the skill down into discrete parts allowing the performer to focus their attention on that element and receive <specific> feedback; then the discrete part is combined with the whole skill ***OR*** coach presents the whole skill allowing performers to experience the skill as a whole;		**3 max**

Section B

Question			Answers	Notes	Total
6	a		marathon runner will have a high percentage of slow twitch/lower fast twitch fibres; high mitochondrial density, for aerobic energy production; high capillary density, results in high blood/oxygen/fuel supply <to produce energy aerobically>; high density of myoglobin, results in efficient transport of oxygen; high triglyceride stores, provide an energy supply; high density of aerobic enzymes, for aerobic energy production;		**4 max**

6	**b**		***40m sprint test*** this is a relevant/ valid/ reliable test for measuring speed <and a basketball player requires speed to *e.g.,* attack at pace>; however, a basketball player usually sprints for less than 40m, therefore it is not specific to the needs; ***Drop test*** a drop test is a relevant/ valid/ reliable test for measuring reaction time <and basketball players require reaction time to rebound the ball/ defend/eliminate players>; however, the test only measure's reaction in the hand so not useful to basketball ***OR*** it doesn't assess whole body movements which would be specific to basketball; ***Standing broad jump test*** this is a relevant/ valid/ reliable test for assessing power <which a basketball player requires to jump for rebounds>; however, the test is not specific to the use of power in basketball;	*Award [2] max per test* *Max [1] per test if no evaluation <if only strengths OR limitations of a test are provided>* *Credit an overarching limitation [Max 1] that all three tests do not provide a complete picture of a basketballer's performance due to only focusing on three components of fitness*	**6 max**
6	**c**		<deoxygenated> blood returns to the heart via <venules> and veins; <deoxygenated> blood enters the right atrium via the vena cava; <deoxygenated> blood travels into the right ventricle via the tricuspid valve; <deoxygenated> blood is ejected from the ventricle via the pulmonary valve; <deoxygenated> blood travels to the lungs via the pulmonary artery; blood passes through the capillary bed of the lungs<to be oxygenated>;	*Accept suitably annotated diagram*	**5 max**

6	**d**	**i**	150/20 = 7.5 <m/s>;		**1**
6	**d**	**ii**	*Contrast*: runner A completes the race in 45 seconds, runner B completes the race in 50 seconds ***OR*** runner A is faster than runner B; runner B maintains steady state for longer than runner A; runner A achieves higher speed than runner B in the early part of the race; runner A achieved a higher top speed than runner B during the race; *Compare*: both runners accelerate at the beginning of the race; both runners maintain a steady state during the middle phase of the race; both runners decelerate at the end of the race; both runners are stationary at 60 seconds;	*Max [3] for contrast* *Accept 43-45 seconds as the time for runner A* *Max [3] for comparison*	**4 max**

7	**a**		circumduction: the circling of a body segment at a joint ***OR*** circumduction: *e.g.,* the arm action at the shoulder during butterfly; plantar flexion: the extension of the ankle joint ***OR*** plantar flexion: *e.g.,* the ankles during backstroke/freestyle; dorsi flexion: flexion of the ankle joint ***OR*** dorsi flexion: *e.g.,* the ankles during recovery/action phase of breaststroke; supination: lateral rotation of the radioulnar joint ***OR*** supination: *e.g.,* sculling/pulling phase of arms in breaststroke supinates the hand at the wrist; pronation: medial rotation of the radioulnar joint ***OR*** pronation: *e.g.,* arm entry into the water during freestyle pronates the hand at the wrist; flexion: closing of the joint angle ***OR*** flexion: *e.g.,* the arm at the elbow during recovery over the water in freestyle; extension: opening of the joint angle ***OR*** extension: *e.g.,* the arms at the elbow / legs at the knee in the streamlined position during a dive; abduction: movement of a limb away from the midline ***OR*** abduction: *e.g.,* the movement of the legs at the hip kicking out in breaststroke;	*Not limited to examples given* *Award [1] max for each type of movement*	**5 max**

			adduction: movement of a limb towards the midline ***OR*** adduction: *e.g.,* the movement of the legs at the hip during the glide phase of breaststroke; rotation: movement of a bone around a central axis ***OR*** rotation: head turns to breath in freestyle;		
7	**b**		*elevated breathing during recovery*: initial stages of the race, oxygen supply cannot meet the demand for the aerobic system <oxygen deficit> ***OR*** initial stages are met by anaerobic processes; oxygen deficit is paid back/oxygen debt after exercise; breathing remains elevated until recovery is complete <EPOC>; the greater the intensity of the individual medley the greater the oxygen deficit/oxygen debt; therefore, the longer the recovery period; the more <aerobically> trained the swimmer the quicker they return to resting breathing rate ***OR*** the more <aerobically> trained the swimmer the quicker they return to pre-race levels ***OR*** the more <aerobically> trained the swimmer the smaller their EPOC compared to their pre-trained levels;		**5 max**

7	**c**		gross as it uses large muscle and body segments for the different strokes/ actions; relatively closed as it is performed in a stable predictable environment/the performer knows what to do and when; continuous as there is no clear beginning and end with the type of swimming stokes/movements; externally paced as the swimmer is listening to the starter/looking at opponents; internally paced as the swimmer can ignore external distractions/elements such as opponents and choose to race their own way; co-active as swimmers are performing at the same time but they are separated by lane ropes;		**5 max**
7	**d**		cardiac output is redirected to working muscles; sympathetic stimulation of blood vessels <areas of blood flow reduction *e.g.,* kidneys>; increases in acidity/temperature/CO_2 causes vasodilation in skeletal muscles; enhanced venous return in large muscle groups due to muscular & respiratory pumps; vasodilation of arterioles to working muscle; vasoconstriction of arterioles to non-active tissue; pre-capillary sphincters within non-active tissue vasoconstrict; pre-capillary sphincters within working muscles vasodilate; vasodilation to skin for cooling purposes;		**5 max**

<table>
<tr>
<td>8</td>
<td>a</td>
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<table>
<tr><td></td><td>Structure name</td><td></td><td>Structure annotation</td><td></td></tr>
<tr><td>A</td><td>sarcomere</td><td>;</td><td>Compartments of myofilaments / the functional units of muscle fibre</td><td>;</td></tr>
<tr><td>B</td><td>myosin</td><td>;</td><td>Thick filaments which have myosin heads which attach to actin during contraction <formation of cross bridges></td><td>;</td></tr>
<tr><td>C</td><td>actin</td><td>;</td><td>Thin filaments containing myosin binding sites <regulated by troponin and tropomyosin></td><td>;</td></tr>
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<td></td>
<td>6 max</td>
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<tr>
<td>8</td>
<td>b</td>
<td></td>
<td>as carbohydrates are commonly the readily available fuel for runners;

endurance runners involved in more intense training need greater amounts of CHO <55–75%/ 6–10g/kg>;

endurance runners are able to utilize fat stores more efficiently and earlier during exercise;

therefore, fat consumption should be <slightly> higher for endurance runner <20–35%>;

protein should increase compared to non-athletes <10–35% 1–1.5g/kg>;

in order to help recovery and maintain strength;

carbohydrate should predominantly contain low GI foods e.g. vegetables/acidic fruits/wholemeal products/pulses;

athlete may need to increase their fluid levels;</td>
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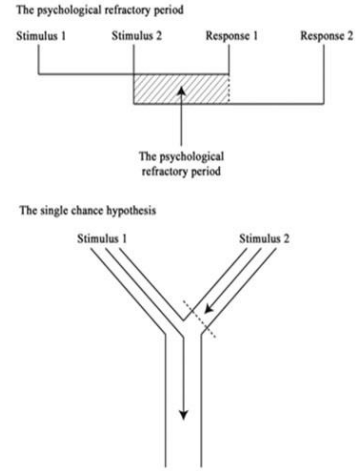
8	**c**		faking to shoot means that the soccer player will pretend to shoot with the intention of deceiving the opponent <in order to gain an advantage> ***OR*** a soccer player may fake/dummy a shot to send an initial cue/stimulus to the opponent; due to the single channel mechanism the opponent will begin to respond to this initial stimulus/fake shot; whilst the opponent is responding to the initial stimulus the soccer player will perform a second stimulus <*e.g.* begin to dribble around the opponent>; due to the opponent having to respond to stimulus 1 first <single channel hypothesis> there is an increase in the opponent's reaction time to the second stimulus; this time delay is called the psychological refractory period/ PRP; <PRP> can be used to help a performer have a greater chance of success *e.g.,* pretending to shoot/run the other way; <PRP> provides a player with a greater range of options in their play/reduces their predictability;	 *Accept an annotated diagram*	**4 max**

8	**d**		*marathon training:* increases left ventricular volume/stroke volume; therefore, increases cardiac output; therefore, greater blood supply to muscles during a race; increased capillarization of the muscles/lungs; results in increased gaseous exchange at muscles/lungs; increased hemoglobin levels which results in increased oxygen carrying capacity/gaseous exchange; increased arterio-venous oxygen difference; therefore more oxygen is transported into the muscles and increases aerobic energy production; increase in plasma volume resulting in increased ability to transport gases; increased elasticity of blood vessel walls to direct blood to and from the muscles/lungs;		**5 max**