

Markscheme

November 2015

Sports, exercise and health science

Standard level

Paper 3

This markscheme is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of the IB Assessment Centre.

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

Mark Allocation

Candidates are required to answer questions from **TWO** of the Options [**2×20 marks**]. Maximum total = [**40 marks**].

Markscheme format example:

Question			Answers	Notes	Total
4	a	i	<a stroke is> caused by a lack of blood flow/oxygen to the brain OR a condition in which blood supply to some part of the brain is impaired <due to a blocked/burst artery>✓		1

- Each row in the “Question” column relates to the smallest subpart of the question.
- The maximum mark for each question subpart is indicated in the “Total” column.
- Each marking point in the “Answers” column is shown by means of a tick (✓) at the end of the marking point.
- 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.
- An alternative wording is indicated in the “Answers” column by a slash (/). Either wording can be accepted.
- An alternative answer is indicated in the “Answers” column by “**OR**” on the line between the alternatives. Either answer can be accepted.
- Words in angled brackets < > in the “Answers” column are not necessary to gain the mark.
- Words that are underlined are essential for the mark.
- The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.

continued...

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	4.2✓		1
	b	hypothesis not confirmed/null hypothesis✓ older players are more likely to lose matches <i>OWTTE</i> ✓ players with more years as a professional are more likely to win <i>OWTTE</i> ✓ there is no substantive difference in the data for age and/or years as a professional✓	<i>Accept other reasonable responses supported by the data.</i>	2 max
	c	system of training that alternates short to moderate bouts of <reasonably> intense activity with short to moderate bouts of lower intensity activity/rest✓ popular training method employed predominantly by tennis players/runners/swimmers <i>OWTTE</i> ✓ used mainly to improve anaerobic capacity✓ can also be used to develop the aerobic system✓ spacing of work periods and low intensity/rest periods can enable an individual to achieve a greater amount of total work overall <in comparison to continuous training>✓ can be easily adapted in order to increase the training load as an individual develops their fitness level <by adjusting the frequency, intensity, or time of the interval segments>✓	<i>Accept marking points in form of a relevant example.</i>	3 max

2.	a	37 ± 0.6 °C✓	<i>Units must be provided</i>	1
	b	<p>a clear «mainly» watery liquid produced in the «approximately 2–4 million» sweat glands✓</p> <p>sweat is produced in the coiled hollow/tubular glands in the dermis of the skin✓</p> <p>the amount of sweat the body can produce is dependent on the amount of sweat the gland can produce/density of sweat glands «per cm²» on the surface of the skin✓</p> <p>in most individuals, the chest/back have the greatest sweating rates✓</p> <p>evaporation of sweat serves to dissipate excess heat produced by exercise✓</p> <p>the production of sweat can be calculated in units of millilitres of sweat produced per hour✓</p> <p>heavier individuals tend to have a higher sweat rate «at the same relative exercise intensity»✓</p> <p>sweat response is dependent on the intensity of the exercise <i>OWTTE</i>✓</p> <p>sweat response when the core/body temperature is rising <i>OWTTE</i>✓</p>		2 max
	c	<p>muscle spasms caused by heavy sweating, caused by involuntary contraction «of motor units» <i>OWTTE</i>✓</p> <p>occur in the abdominal muscles and large muscles of the arms and legs✓</p> <p>differs from exertion-induced cramps as entire muscle is not involved✓</p> <p>caused by inadequate consumption of fluids/electrolytes <i>OWTTE</i>✓</p> <p>associated with whole-body electrolyte (eg sodium) deficiency <i>OWTTE</i>✓</p> <p>does not usually result in permanent damage✓</p> <p>observed more in unacclimatized individuals✓</p>	<i>Accept answers in the converse.</i>	3 max

<p>3.</p>	<p>a</p>	<p>convective currents increase the rate of heat loss✓ conduction eg cold water increases the thermal gradient✓ greater heat loss is associated with longer duration in cold water✓ swimming speed increases amount and/or rate of heat loss OR water flow increases amount and/or rate of heat loss✓ vasoconstriction in blood vessels direct blood towards the periphery✓ skeletal muscles activated, causing shivering✓ non-shivering thermogenesis occurs, increasing metabolic rate✓</p>		<p>2 max</p>
	<p>b</p>	<p>the <u>rate</u> of heat loss is affected by the ratio of body surface to body mass✓ the larger the surface area-to-body mass ratio the less effective the person will be in preserving heat <i>OWTTE</i>✓ larger individuals generally have larger body masses which result in more heat being produced✓ larger individuals also usually have a smaller surface area relative to their body mass and are comparatively inefficient at radiating their body heat <i>OWTTE</i>✓ smaller individuals compared to larger individuals tend to have a large surface area-to-body mass ratio that makes it more difficult to maintain normal body temperature in the cold✓ a “stocky” body with short arms and legs is more efficient at maintaining body heat because it would have relatively less surface area compared to body mass✓ there is little difference in body temperature regulation between men and women with similar surface area-to-body mass ratios✓ volume increases twice as fast as the surface area✓ children are more susceptible to heat loss in a cold environment due to their larger BSA-to-mass ratio <i>OWTTE</i>✓</p>		<p>3 max</p>

<p>4.</p>		<p>proposed: the psychological response of feeling calmer <i>OWTTE</i>✓ decrease heart rate✓ decrease/slows CNS <i>OWTTE</i> (1 mark)✓ lowers anxiety/psychological benefit <i>OWTTE</i> (1 mark)✓ reduce hand tremors✓ can improve performance in sports that require accuracy/calm behaviour/ steadiness <i>eg archery</i>✓</p> <p>actual: actual benefits are consistent with the proposed benefits✓ for sports that require high levels of intensity or endurance activities, beta blockers are unlikely to improve performance <i>as a consequence of limiting the physiological capacity the heart in particular to work</i>✓</p>	<p><i>Award [2 max] per aspect.</i></p>	<p>3 max</p>
-----------	--	--	---	---------------------

Option B — Psychology of sport

Question		Answers	Notes	Total
5.	a	57–59%	<i>Accept answers in the range of 57–59%. Units must be provided.</i>	1
	b	quiet eye duration values were greater during the control trial for both hits and misses✓ participants were able to concentrate more during the control trial✓ there is a larger variability quiet eye duration values for hits during both the control and pressure trials✓ there is a smaller variability quiet eye duration values for misses during both the control and pressure trials✓ control misses were similar to pressure trial hits✓	<i>Accept answers in the converse for first two marking points.</i>	3 max
	c	subjective evaluation of a situation, and concept of jeopardy to one's self esteem during performance or social situations, physical danger, or insecurity and uncertainty <i>OWTTE</i> ✓		1

<p>6.</p>	<p>a</p>	<p>a process whereby muscle groups in sequence from head to toe are tensed for a number of seconds before being relaxed✓</p> <p>tensing muscles appears to enable the muscle to relax more fully when released✓</p> <p>experienced users of PMR are often able to apply the strategy of tensing and relaxing more quickly✓</p> <p>experienced users of PMR can utilize the strategy during competition <or natural breaks in the play of their chosen sport> <i>OWTTE</i>✓</p> <p>is used by a variety of athletes to maintain optimal levels of arousal✓</p>		<p>2 max</p>
	<p>b</p>	<p>involves concentrating on the negative thought briefly✓</p> <p>using a cue or trigger to stop the thought and clear your mind✓</p> <p>can be a simple one word or a trigger <eg clap of hands>✓</p> <p>best to be practiced before using in competition✓</p>		<p>2 max</p>

c		<p>education: the athlete learns about the importance of psychological skills and how they can affect performance</p> <p>OR</p> <p>the athlete ascertains the potential usefulness of PST✓ clarification of the role/level of commitment of the psychologist/coach/athlete✓</p> <p>acquisition: the athlete learns about the strategies and techniques to improve the specific psychological skills that they require✓ a needs analysis of the athlete would be carried out to ensure that any potential PST is centred around the needs of the athlete✓</p> <p>practice: the athlete develops their appropriate psychological skills through repeated practice, simulations and actual competition✓ to automate skills through over-learning or repeated practice✓ to teach athletes to systematically integrate psychological skills into their performance situations✓ to simulate skills athletes will want to apply in actual competition✓</p>	<p><i>Allow [1 max] for education.</i></p> <p><i>Allow [1 max] for acquisition.</i></p> <p><i>Allow [1 max] for practice.</i></p>	<p>3 max</p>
----------	--	--	---	---------------------

7.	a	internal mechanisms which arouse and direct our behaviour <i>OWTTE</i> ✓ external stimuli which arouse and direct our behaviour <i>OWTTE</i> ✓		2
	b	an athlete feeling that they have no control over whether they succeed or fail✓ failure is perceived to be a lack of ability and, regardless of their performance they will lose✓ may occur in circumstances where the athlete participates in a highly competitive environment where it is difficult for them to succeed✓ an athlete might assume that they are doomed to fail✓ can negatively affect motivation✓		2 max
8.		neither nature or nurture can fully be held accountable for an individual's behaviour or personality✓ accept the formula <i>ie B = f(PxE)</i> ✓ suggests that personalities are developed over time through an individual's interaction with their environment✓ considers the situation and the individual as co-determinants of behaviour <i>ie variables that together determine behaviour</i> ✓ traits and situational factors can work independently to determine behavior✓ at times traits and situational factors can interact to influence behaviour✓ we can better predict behaviour through knowledge of the specific situation and the ways individuals respond to particular situations✓ goal setting needs to consider the effect that the environment is having on the individual✓		3 max

Option C — Physical activity and health

Question		Answers	Notes	Total
9.	a	10%		1
	b	<p>there is a positive correlation with the exception of the most intense zone (191–200 bpm)✓</p> <p>players spend a smaller percentage of time in the low to moderate heart rate zones during the first half of the match✓</p> <p>players spend a higher percentage of their time in the low to moderate heart rate zones during the second half of the match✓</p> <p>players spend a large percentage of time with their heart rate within a moderate to high heart rate zone✓</p> <p>reference to highest and lowest heart rate zone values✓</p> <p>170 bpm and below the second half percentage of time is higher✓</p> <p>171 bpm and above the first half percentage of time is higher✓</p>	<p><i>Accept other reasonable responses related to the data.</i></p> <p><i>Accept answers in the converse.</i></p> <p><i>Accept answers in the converse.</i></p> <p><i>Accept answers in the converse.</i></p> <p><i>Accept answers in the converse.</i></p>	2 max

<p>c</p>	<p>social environment <i>eg</i> lack encouragement OR support OR companionship from family/friends OR safety✓ physical environment <i>eg</i> climate OR urban versus rural OR convenience✓ time <i>eg</i> work/family constraints✓ characteristics of physical activity offered <i>eg</i> cost OR provision✓ leader qualities <i>eg</i> inclusive OR motivational climate✓ social and cultural norms within ethnic groups <i>eg</i> religious dress OR beliefs OR values OR attitudes✓</p>	<p><i>Award examples of environmental barriers related to the marking points.</i></p>	<p>3 max</p>
-----------------	---	---	---------------------

<p>10.</p>	<p>a</p>	<p>habitual physical activity: any ‹bodily› movement produced by contraction of skeletal muscle that ‹substantially› increases energy expenditure✓</p> <p>sport: highly structured, goal directed activity governed by rules✓</p> <p>involves competition with others or against the individual themselves✓</p> <p>usually involves a degree of physical exertion or relatively complex physical skills✓</p>	<p><i>Award [1 max] for sport.</i></p>	<p>2 max</p>
	<p>b</p>	<p>to make the most of limited functional capacity✓</p> <p>to alleviate or provide relief from symptoms✓</p> <p>to reduce need for medication✓</p> <p>to reduce the risk of disease reoccurrence ‹secondary prevention›✓</p> <p>to help overcome social problems and psychological distress✓</p>		<p>2 max</p>

11.	a	<p>left/right coronary artery✓ circumflex artery✓ left anterior descending artery✓</p>		1 max
	b	<p>artery becomes damaged/blocked✓ accumulation of cholesterol/fatty material and other material (increasing the chance of thrombosis/formation of a blood clot)✓ formation of (atherosclerotic) plaque that sticks to/hardens/thickens the artery walls✓ narrowing/reducing width of blood vessel reduces blood flow✓</p>		1 max
	c	<p>risk factors can be classified as being modifiable and non-modifiable OR non-modifiable risk factors (eg age/gender/heredity/family history/ethnic background) OR modifiable risk factors (eg high blood pressure/elevated serum cholesterol/cigarette smoking/obesity/diabetes/stress)✓ higher risk in older individuals✓ ethnicity eg Africans/Asians are at higher risk✓ impact of risk factors is accumulative✓ it is not sensible to view the risk of having cardiovascular disease on the basis of a single risk factor✓ early detection of risk factors is essential in the treatment of cardiovascular disease✓</p>		3 max

12.	a	<p>values are widely accepted as valid and reliable measurements of obesity✓</p> <p>BMI is calculated by dividing an individual's weight in kilograms by their height in meters squared✓</p> <p>limitation of BMI is its inability to distinguish between muscle and fat <i>OWTTE</i>✓</p> <p>values above 30kg m² indicate obesity✓</p> <p>uncertainty about BMI cut-off point for indicating obesity</p> <p>OR</p> <p>debate about different BMI cut-off points for different races✓</p>		2 max
	b	<p>the main factor that affects body weight control is energy balance✓</p> <p>energy balance is the relationship between food intake and energy output✓</p> <p>energy expenditure is a product of both metabolic rate and activity✓</p> <p>metabolic rates affect energy balance✓</p> <p>basal metabolic rate <BMR> indicates energy you expend simply by being alive</p> <p>OR</p> <p>resting metabolic rate <RMR> is the energy resulting from rest plus BMR✓</p> <p>increased muscle mass from physical activity increases BMR✓</p> <p>a balance occurs when energy input equals energy output✓</p> <p>a positive energy balance can be achieved through food intake being greater than energy output✓</p> <p>body weight increases as a result of a positive energy balance</p> <p>OR</p> <p>body weight decreases as a result of a negative energy balance✓</p> <p>energy balance is affected by genetics/body size/body composition/level of physical activity✓</p> <p>the maintenance of energy balance in athletes can be assessed by monitoring body mass, body composition and food intake✓</p>	<p><i>Accept answers in the converse.</i></p> <p><i>Accept answers in the converse.</i></p> <p><i>Accept other reasonable responses that affect energy balance.</i></p>	3 max

Option D — Nutrition for sport, exercise and health

Question		Answers	Notes	Total
13.	a	1.3 min	<i>Units must be provided</i>	1
	b	<p>CHO group performed better <faster time trial> than the placebo group <at the first, third and fifth time trials>✓</p> <p>placebo group performed better than the CHO group during the second time trial✓</p> <p>both groups had an identical performance <time> during the fourth time trial✓</p> <p>the largest difference in time trial performances occurred in the final time trial</p> <p>OR</p> <p>the CHO group were faster by a greater margin during the final time trial <compared to the other four trials>✓</p> <p>CHO group fluctuated between time trials</p> <p>OR</p> <p>in some trials the CHO group became faster, in others, they were slower✓</p> <p>performances between both groups are not significantly different overall from one another <little advantage was evident to those cyclists who were part of the carbohydrate loading group>✓</p> <p>the overall trend for both groups was towards a decline in performance during the time trials✓</p>	<i>Accept other reasonable responses related to the data.</i>	3 max

<p>c</p>		<p>gaining muscle mass: adequate protein intake must be consumed (in addition to correct strength training)✓</p> <p>changes in body composition as a result of this strategy occur slowly over time✓</p> <p>excess protein cannot be stored in the body and is excreted✓</p> <p>there are risks associated with excessive protein intake relating to damaging the kidneys (in addition to causing dehydration and constipation)✓</p> <p>reducing fat mass: low energy intake (negative energy balance) causes the body to metabolize stores of fat (causing them to lose weight)✓</p> <p>associated with lean athletes and particularly women✓</p> <p>there are risks associated with losing excessive levels of body fat that can prevent the normal functioning of the body (eg amenorrhea and menstrual disorders)✓</p> <p>dehydration: participants may deliberately avoid or restrict food and fluid intake in order to remain weight category OR to gain entry to a lower weight category (eg boxing/martial arts and rowing)✓</p> <p>there are risks associated with dehydration (due to the impact on the functioning of the cardiorespiratory system)✓</p>	<p><i>Accept other reasonable responses up to [2 max] per dietary practice.</i> <i>Award [2 max] for gaining muscle mass.</i></p> <p><i>Award [2 max] for reducing fat mass.</i></p> <p><i>Award [2 max] for dehydration.</i></p>	<p>3 max</p>
-----------------	--	--	---	---------------------

14.	a	storage of bile✓	<i>Award [1] for two sources.</i>	1
	b	aid the breakdown of large food molecules into smaller, more soluble substances, which can be absorbed from the gut into the bloodstream✓ speed up the rate of digestion✓ different enzymes with different functions are produced in particular areas of the digestive tract✓ enzyme activity increases with temperature until around 37°C (normal body temperature)✓ as temperature rises beyond body temperature, the rate of reaction falls rapidly✓ very high temperatures denature the enzymes✓ usually function optimally over a narrow range of pH✓ cellular changes in pH can alter the affinity of an enzyme (for its substrate)✓		2 max

15.	a	monitoring of urine colour✓ urine osmolarity✓ variation in body mass loss/weight✓ a hydrometer measures the specific gravity of urine✓		2 max
	b	when fluid moves down descending limb/arm of the loop: does not actively transport sodium chloride/ impermeable to sodium chloride✓ highly permeable to water/water is filtered out✓ when fluid moves up ascending limb/arm of the loop: chloride is actively transported/ sodium follows passively✓ impermeable to water/prevent additional water loss✓		2 max

16.	a	<p>whole grains✓ beans, lentils and legumes✓ tofu and other soy products✓ nuts, seeds and nut butters✓</p>	<p><i>Award [1] for two sources. Accept other reasonable responses.</i></p>	<p>1 max</p>
	b	<p>examples of high intensity athletic activities that require high rates of muscle glycogen utilization would be 400m sprint OR 50–200m swimming events✓ is the main metabolic fuel during high intensity <and prolonged> exercise✓ is used after approximately 20 seconds, where creatinephosphate stores have been depleted✓ eg soccer, high intensity intermittent running during a prolonged defensive phase OR eg cycling, overtaking an opponent during a lengthy up-hill stage✓</p>	<p><i>Permit all other suitable athletic activities.</i></p> <p><i>Accept other reasonable examples.</i></p>	<p>2 max</p>
	c	<p>acts as a buffer to blood pH levels OR increases pH <decreases acidity of blood>✓ athlete can increase their tolerance to H⁺ generated by the lactic acid system <formed during high intensity activity>✓ can increase the performance of an athlete during high intensity activity <1–7 minutes>✓ an adverse affect from taking bicarbonate can include gastrointestinal upset✓ athletes would take a dosage of 0.3g per kg body weight before exercise✓ variability in response to bicarbonate use in athletes✓</p>	<p><i>Accept values in the range of 0.2–0.4g.</i></p>	<p>3 max</p>