Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2019

Sports, exercise and health science

Higher level

Paper 3

22 pages

Subject details: Sports, exercise and health science HL paper 3 markscheme

Mark Allocation

Candidates are required to answer **ALL** questions from two of the options **[2×25 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.

Option A — Optimizing physiological performance

Question			Answers	Notes	Total
1.	a		71 <%> ✓		1
	b		12 – 3 ✓ = 9 <min> ✓	*Accept the subtraction in a different order.*	2
	c		there is an inverse relationship between humidity and the mean time to exhaustion ***OR*** higher levels of humidity result in lower/worse performance on mean time to exhaustion test ✓	*Accept in the converse.*	1
	d		humidity affects efficiency of sweat response/temperature regulation ✓ high humidity decreases capacity to accept more water molecules ***OR*** with high humidity, evaporation decreases ✓ when humidity is high, the vapour pressure gradient between the skin and the air is decreased ✓ sweat must evaporate to provide cooling / sweat remains on the skin in high humidity ✓ cooling is essential in maintaining homeostasis / to perform at an optimal level ✓ exercising for 60 minutes in higher humidity inhibits cooling	***[2 max]*** *if no reference to submaximal or maximal exercise.*	3 max

			OR performing maximal exercise at higher humidity is a thermoregulatory challenge ✓		
	e		lower/maintain core body temperature in high humidity/temperature environments ✓ acts analgesic and anti-inflammatory effects for soft tissue ✓ perception of enhanced recovery rates and improved performance ✓ cheaper than other recovery therapies ✓ pressure to maximize sporting performance <athletes often experiment with extreme interventions even if their safety and efficacy has not been established> ✓		**4 max**

2.	**a**		involves more than one type of activity/sport to exercise different muscle groups ✓ can be applied to training multiple fitness components <*eg* strength, flexibility and endurance> within the same training session ✓		**1 max**
	b		annual plan to 4-year plan ***OR*** long term plan ✓ season plan ***OR***		**1 max**

			peaking for the goal competition of the year ✓ subdivided into mesocycles / three phases ***OR*** preparation, competitive, and transition phases ✓		

3.	**a**		anabolic steroids ✓ hormones and related substances ✓ diuretics and masking agents ✓ beta blockers ✓	*Accept appropriate examples of classes of aids, not specific examples. Full names need to be used eg anabolic steroids not just steroids.*	**2 max**
	b		unfair advantage / moral obligation of athletes to compete fairly ✓ health/safety issue around the use of these substances ✓		**2**

4.	**a**		a condition in which the oxygen supply to cells is insufficient ✓		**1**
	b		dehydration leads to decrease in performance ✓ ambient air at elevated altitude has lower humidity, there is a decrease in water vapour in air low humidity causes an increase in insensible water loss and dehydration✓ physical activity exacerbates this fluid loss ✓		**3 max**

			altitude induces diuresis/increased urine production <further increasing dehydration> ✓ increased respiratory water loss ✓ increased sweat evaporation ✓ the greater need for energy increases the need for fluid intake ✓		
	c		training for athletes at altitudes above 2000 m ✓ for several weeks or months <in order to gain a competitive advantage in low altitude competitions / in order to acclimatize for competition at altitude> ✓ training where the oxygen partial pressure is low so that release of the hormone erythropoietin (EPO) can be triggered <stimulating red blood cell production> ✓	*Award **[1 max]** for physiological adaptations.*	**2 max**
	d		*Blood adaptations:* decreased plasma volume, associated with drier air / fluid loss ✓ increased hematocrit / increased hemoglobin concentration, associated with more EPO ✓ increased total number of RBC, associated with renal / kidney release of more EPO ✓ *Muscle adaptations:* *eg* reduced lean body mass muscle fibre cross-sectional area decreases / loss of appetite ✓	Accept other appropriate examples	**2 max**

			eg increased capillary density in the muscle increases and increased oxidative capacity in the muscles so that more blood can be delivered to muscle fibres ✓ *Cardiorespiratory adaptations:* *eg* increase in pulmonary ventilation both at rest and during exercise/VO_2 max ✓ *eg* increase in pulmonary capillarization ✓		

Option B — Psychology of sports

Question			Answers	Notes	Total
5.	**a**		Group 1 ***OR*** intrinsically motivated ✓		**1**
	b		140 – 55 ✓ =85 <min> ✓	*Accept the subtraction in a different order.*	**2**
	c		the less intrinsically motivated the participants, the lower their mean weekly engagement in physical activity ✓	*Accept in the converse.* *Accept other ways of wording the same association.*	**1**
	d		intrinsically motivated people have a perceived internal locus of causality ***OR*** intrinsically motivated people are driven by interest in/enjoyment for the task itself / extrinsically motivated people have a perceived external locus of causality ***OR*** extrinsically motivated people are driven by an external demand that carries a social value ✓ extrinsic reward can be seen as a way of controlling behaviour the more intrinsic motivation causes more enjoyment and sustainability in engagement in physical activity ✓	*Accept other valid examples from the data.*	**3 max**

			intrinsic motivation is preferable as it is not contingent on a reward ✓ there is a more gradual decrease in weekly minutes spent on walking as motivation becomes more extrinsic ✓ the higher rate of decrease in weekly minutes spent on sports as motivation becomes more extrinsic could be caused by the fact that engagement in sports is supported by more extrinsic motivators ✓		
	e		reflection can regulate emotions that subsequently determine motivation ✓ causal attributions affect motivation for future behaviour ✓ athletes learn to attribute success to internal stable controllable factors ***OR*** athletes learn to attribute failure to external, unstable, uncontrollable factors ✓		**2 max**

6.	**a**		those relatively stable and enduring aspects of individuals which distinguish them from other people, making them unique but at the same time permit a comparison between individuals ✓		**1**
	b		a positive mood is more likely to prime us to remember positive previous outcomes, and increase our confidence to perform ✓ a negative mood is more likely to prime us to remember negative memories of past failures, and thus reduce our feelings of confidence to perform ✓		**2**

7.	**a**		drive<reduction>theory ✓		**2 max**

			inverted-U hypothesis ✓ catastrophe theory ✓		
	b		*Education phase:* period when psychological skills need to be learned, developed and refined ✓ *Acquisition phase:* period when different psychological strategies are tailored ✓ *Practice phase:* psychological skills are applied from practice to competitions ✓ focus is on integration and automation ✓	*Award **[1 max]** for each phase.*	**2 max**

8.	**a**		a natural aptitude / skill / a multidimensional concept identified by characteristics that are both genetic, <physiological/psychological>, and environmental <sociological> ✓		**1**
	b		subjective assessments <*eg* coach's opinion during selection process> ✓ objective testing that may be physiological <*eg* aerobic capacity, anaerobic power, speed and strength> / anthropometric <*eg* height, weight, body composition> / performance-based <*eg* skill and agility> ✓		**2 max**
	c		an injury ✓ plateau in performance / loss of motivation ✓ desire to prolong an athlete's sporting career / geographical reasons ✓		**2 max**

			desire for a greater success than that in the first sport / financial reasons ✓		
	d		progressions through the stage and transition into the next stage *eg* mastery to maintenance/perfection stage will affect the performance ✓ changes in participation goals / change in motivation type, *eg* change in focus to performance mastery/enjoyment ✓ new opportunities, *eg* chance to train with a specialist coach / increase in hours of deliberate practice ✓ increased obstacles could cause an injury ✓ changes in factors may cause different psychological behaviours, *eg* coach-led versus self-determined motivation ✓ family influence, *eg* parental support ✓		**4 max**

Option C — Physical activity and health

Question			Answers	Notes	Total
9.	**a**		Group 3 / both parents exercise ✓		**1**
	b		46 – 23 ✓ = 23 <%> ✓	*Accept the subtraction in a different order.*	**2**
	c		girls are more likely to exercise if one or both parents engage in physical activity ***OR*** the majority of girls are more likely not to exercise even if their parents exercise ✓		**1**
	d		*Personal factors:* past behaviours, *eg* not having a positive experience in the past through poor modelling or discouragement ✓ insecurities around body image ✓ *Environmental factors:* social environment, *eg* lack encouragement/companionship from parents ✓ social and cultural norms within various ethnic groups, *eg* false belief/values/attitudes that females should not engage in exercise ✓ lack of effective leaders/role models ✓		**3 max**

10.	**a**		cigarette smoking ✓ physical inactivity ✓ poor diet ✓		**1 max**
	b		improved metabolic rates increase energy expenditure ✓ improved plasma lipid profiles increase blood vessel health / decreased chance of clotting ✓ decreased adiposity around organs ✓ improved body composition lowers strain on skeletal system / heart / joints / blood vessels/ chances of developing Type ii diabetes ✓ decreases blood pressure <as a result of fewer fatty deposits in blood vessels> which creates less strain on vascular system ✓ endorphin release / reduction in stress-related hormones ✓		**2 max**
	c		exercise reduces anxiety ✓ exercise may increase the release of endorphins / increase serotonin / norepinephrine synthesis ✓ exercise has acute effect on state anxiety ✓ regular exercise has compounding effect on trait anxiety ✓ lower intensity rhythmic exercise allows for greater duration / increased neurotransmitter activity ✓		**2 max**

11.	**a**		body mass index (BMI) ✓ waist girth / anthropometry ✓	*Accept other appropriate methods, eg underwater weighing.*	**2**
	b		changes in diet to reduce sugar and fat intake in order to reduce excess weight ✓ gradual increase in physical activity levels ✓ oral medication and/or insulin ✓		**2 max**

12.	**a**		injuries related to soft tissue <muscles/bones/tendons/blood vessels/nerves, *eg* sprains, strains and inflammation> ✓		**1**
	b		*Acute injuries:* occur suddenly as a result of a specific injury mechanism, *eg* fractured wrist, anterior cruciate ligament tear, concussion ✓ *Chronic injuries:* develop over a period of several weeks and are often caused by repetitive activity, *eg* tennis elbow, shin splints ✓		**2**
	c		*Lower limb injuries:* *eg* football players may experience lower limb injuries such as a meniscus tear ✓ ***OR*** shearing injury occurs when there is extreme friction between two surfaces/sliding friction on two surfaces as in a sliding tackle in football	*Accept other suitable examples.* *Award **[1 max]** per type of injury*	**2 max**

			Spinal injuries: *eg* gymnasts may experience spinal fractures from a poor landing ✓ ***OR*** tension injury occurs when tissue is stretched / strained beyond its normal limits as in gymnastics *Head injuries:* *eg,* cyclists may experience concussion from a fall ✓ ***OR*** compression injury where a collision occurs in rugby		
	d		regular moderate exercise to maintain flexibility ✓ use/maintain correct footwear / protective clothing / equipment such as cycle helmet ✓ professional medical assessment to check for early signs of illness/injury ✓ injury prevention strategies, *eg,* correct warm-up/gradual intensity increase in training and cool-down, and stretching routines ✓ risk assessment of environment prior to exercise ✓ education of coaches/referees/athletes about overtraining / recognizing an injury/ recognize the correct running surfaces/ correct running technique/risk assessment of facilities ✓		**4 max**

Option D — Nutrition for sports, exercise and health

Question			Answers	Notes	Total
13.	**a**		experimental <group> ✓		**1**
	b		302.00 – 282.80 ✓ = 19.20 <kg> ✓	*Accept the subtraction in a different order.*	**2**
	c		time-restricted diet decreased fat mass and had a positive effect / increased strength ***OR*** statistically significant change in fat mass bench press and leg press as a result of time-restricted diet ✓		**1**
	d		body mass relates directly to the energy cost of exercise when the body is unsupported ✓ an increased fat mass increases the energy cost of movement ✓ fat contributes nothing to the production of force ✓ maximizing fat-free mass is desirable for athletes involved in activities that require strength ✓ correlation does not establish that there is a causal relationship ✓ greater fat free mass but lower fat mass is positively associated with increased strength ✓	*Accept valid examples from the data.*	**3 max**

14.	**a**		glycemic index (GI) is the ranking system for carbohydrates based on the immediate effect of the food on blood glucose concentrations <when compared with a reference food such as pure glucose> ✓		**1**
	b		low-intensity exercise predominantly uses slow-twitch muscle fibres / less glycogen ✓ high-intensity exercise predominantly uses fast-twitch/type II muscle fibres / more glycogen ✓		**2**
	c		*Location:* located in muscle fibres ✓ stored inside intracellular vesicles that are translocated to the cell membrane ✓ *Role:* facilitates glucose uptake ✓ allows for greater glucose movement into the cell <than GLUT1> ✓	*Sub max **[1]***	**2 max**

15.	**a**		urine colour ✓ urine osmolarity ✓ variation in body mass ✓		**2 max**
	b		minimize dehydration (compensate water loss through sweat, urine and respiration) during endurance events in order to maintain level of performance ✓ maintain thermoregulation capacity via maintaining plasma volume ✓		**2 max**

			decrease health risks, *eg* heat exhaustion / heat stroke / stress on the cardiovascular system ✓		

16.	**a**		increased urine production ✓ dehydration caused by the effect of alcohol on the release of ADH ✓ loss of coordination/ reduced ability to concentrate ✓ reduced inhibitions «become more aggressive» ✓ markedly reduced heart rate, potentially leading to unconsciousness or coma ✓ cognitive impairment - slurred speech/vision impairment ✓ vasodilation to the skin ✓ decreased blood viscosity ✓ reduced core body temperature ✓ raised blood pressure ✓ effects on kidney function ✓ slowed / impaired adaptation to heat and cold ✓	*Accept appropriate example of effect.*	**1 max**
	b		*Brain:* loss of memory / blackouts ✓	*Award **[1 max]** per organ.*	**2 max**

			causes poor muscle coordination ✓ anxiety and depression ✓ causes mental confusion ✓ cerebral hemorrhage ✓ causes paralysis of the eye ✓ deficiency in thiamine (B1) ✓ <due to liver disease> disturbed sleep patterns / mood / personality ✓ <due to liver disease> shaking hands ✓ *Liver:* inflamed liver / liver disease ✓ cirrhosis/ scarring ✓ cancer ✓ fatty liver disease ✓		

17.	**a**		produced as a by-product of normal cell function ✓ exhaustive exercise generates high levels of free radicals ✓ free radicals can create oxidative stress <when free radical production cannot be controlled by natural antioxidants and cell damage occurs> ✓		**2 max**
	b		a free radical is a particle that possesses at least one unpaired electron ✓ free radicals cause damage by removing electrons from parts of the cell in order to create paired electrons in their own structures ✓ electrons can be removed from cell and mitochondrial membranes, thereby affecting their permeability ✓ electrons can be removed from molecules such as enzymes and DNA, thereby impairing their function ✓ free radicals in the body include superoxide, hydroxyl, and nitric oxide ✓ **free radicals** are generated through exposures to **external** sources including **environmental** pollution, toxic metals, cigarette smoke, and pesticides, which add damage to our body's burden of oxidative stress ✓		**4 max**