Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2018

Sports, exercise and health science

Higher level

Paper 3

16 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		2005 ✓		1
	b		16.9 – 9.8 ✓ = 7.1 ✓	*Accept the subtraction in a different order.*	2
	c		«relative» peak VO_2 «mL $kg^{-1}min^{-1}$» increased in 2013 (compared to 2005) ✓ relative peak power output «W kg^{-1}» increased in 2013 (compared to 2005) ✓ total body fat (kg/% of mass) decrease in 2013 (compared to 2005) ✓ body mass decrease in 2013 (compared to 2005) ✓ «relative» peak VO_2 is associated with increased endurance capacity ✓ decreased body mass which subsequently increased his relative peak power output ✓	*Award only one point if no data from the table is used.*	2 max

2.	a		hypothalamus / brain detects rise in body temperature ✓ sympathetic nervous system activates sweat glands ✓ plasma is the source of sweat formation ✓ sweat is formed in the (coil) secretory part of the sweat gland ✓ sweat passes through the (uncoiled) duct / pores of the gland onto the skin surface ✓ amount of sweat formed depends on the individual / exercise intensity / acclimatization / hydration status ✓		3 max
	b		when humidity is high, the vapour pressure gradient between the skin and the air is decreased ✓ high humidity decreases the capacity of air to accept more water ✓ high humidity limits sweat evaporation / cooling / heat loss ***OR*** when humidity is high sweat remains on the skin ✓	*Accept in the converse.*	2 max

Question			Answers	Notes	Total
2.	**c**		an exothermic / catabolic reaction is required ✓ a break in the chemical bond has a by-product of a release of heat ✓ energy derived from ATP is lost in a form of heat (typically 60–70 %) ✓ more exercise / intensity leads to more ATP hydrolysis and therefore more heat ✓		**2 max**
3.			this involves an eccentric contraction «followed by» concentric contraction «releases stored energy» ✓	*Only award **[1]** if they mention both contractions*	**1**
4.			«scientific / medical evidence» that the «prohibited» substance enhances sport performance / unfair advantage ✓ «scientific / medical evidence» that use of the «prohibited» substance presents a health risk to athletes ✓ «WADA determines that» use of the «prohibited» substance violates the spirit / Olympic oath of fair competition ✓		**2 max**
5.	**a**		physiological *eg*, reduced blood lactate concentration / resting heart rate returns to normal✓ symptomatic *eg*, reduced muscle soreness ✓ psychological *eg*, improved preparedness for the next session ✓	*Accept other examples as appropriate.*	**3**
	b		applying pressure at the body surface ✓ pressure garment acts as a placebo effect ✓ compressing / tightness / compact and supporting underlying tissue ✓ relatively low cost / easy to use / non-invasive ✓ evidence of any enhancement of recovery is inconclusive ✓		**2 max**

Question			Answers	Notes	Total
6.	a		*Definition of hypoxia* *Blood*: 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*: muscle fibre cross-sectional area decreases, not fully understood / loss of appetite / weight loss / protein breakdown in muscles ✓ capillary density in the muscle increases, so that more blood can be delivered to muscle fibres ✓	*Award **[2]** max for blood and **[2]** max for muscle or **[1]** max for definition and **[2]** max for blood or muscle.*	**3 max**
	b		minimal demands on oxygen transport system / aerobic metabolism ***OR*** most energy (for 100 m sprint) from anaerobic systems ✓ thinner air provides less aerodynamic resistance ***OR*** (less air resistance) aids the sprint running movement / performance ✓		**2**

Option B — Psychology of sport

Question			Answers	Notes	Total
7.	**a**		pride ✓		**1**
	b		5 – 4.5 ✓ = 0.5 ✓	*Accept the subtraction in a different order.* *Accept if calculation is correct but part (a) has been misidentified (ECF).*	**2**
	c		*Similarities*: referees experienced the same level of stress during the first round and finals ✓ referees experienced the same level of happiness during the first round and finals ✓ *Differences:* there is an inverse relationship between stress and happiness ***OR*** stress mean score is lower (1.5–2.5) than happiness (3.5–5) ✓ happiness is ranked higher in comparison to stress at all three events ✓ decrease in stress during semi-finals causes significantly higher happiness «relative to this relationship during the first round and final» ✓	*Award **[1]** max for similarities, and **[1]** max for differences.* *Accept converse*	**2 max**

8.	**a**		Intrinsic motivation is the internal motivation produced by the individual to practice and participate in sport or exercise *Exercise is done for:* its own sake / enjoyment✓ the pride / satisfaction that is achieved ✓ for competence / self-determination ✓		**2 max**

8.	**b**		striving towards a tangible external reward (money / trophy / medal) ✓ gaining an intangible external reward (praise / adulation / reputational boost) ✓ earning a medal could control the behaviour of the sprinter ✓ beating or being beaten by a rival ✓ the place that the sprinter achieves provides information about the level of performance ✓ receiving external feedback from a coach / crowd / family / friends in the form of information about the performance can increase motivation ✓		**2 max**

9.			behaviour is a function of both the person and the environment ✓ trait effects can be modified by particular situations ✓ the training environment is more consistent than the competitive match environment ✓		**2 max**

10.			stress is an imbalance between demand and response capability «when the result is important» ✓ OWTTE *Environment*: environmental demand is common cause of stress✓ *Personality*: influence of trait anxiety / individual perception of the demand ✓ *Response*: stress response, individual perception of the situation, person's reactions ✓ *Behaviour*: actual behaviour, performance deterioration / increased effort and improved performance ✓		**4 max**

Question			Answers	Notes	Total
11.	a		mental imagery ✓ realistic goal setting ✓ effective evaluation of performance / self-evaluation ✓ self-reinforcement ✓ training outside of comfort zone ✓ handling failure ✓ performance arousal and control ✓		**2 max**
	b		development stage we have balanced amount of deliberate of play and deliberate practice ✓ mastery stage we have lower amount of deliberate play and higher amount of deliberate practice ✓ may encounter opportunities to help move to the next stage of development ✓ may need to overcome obstacles to move from one stage to the next / psychological behaviours help move past these obstacles ✓ unexpected success / turning point ✓ sport becoming the priority in life ✓ competition as a “yardstick” for success ✓ change in coach / coach philosophy (*eg*, a master coach) / more demanding coach ✓ fine-tuning performance is a huge “driver” for hard work / strengthened obsession / commitment ✓		**3 max**

Question			Answers	Notes	Total
12.	**a**		self-determination increases ***OR*** motivation increases ✓ enables us to make our own decisions (about what we do) ✓ enables us to be in control (of ourselves and our behaviours) ✓ example (*eg*, going to the gym / training because you want to, not because someone says you should)	*Award **[1]** max if no example given.* *Embed example.*	**2 max**
	b		motivation is a critical factor in the self-regulated learning framework ✓ *Forethought (planning) phase*: athletes who do not see value in tasks are less likely to spend much time setting goals and planning strategies ✓ higher self-efficacy beliefs increase the use of self-regulation strategies ✓ *Monitoring phase*: intrinsic motivation increases level of effort in completing tasks / use of self-regulation strategies ✓ *Reflection phase*: causal attributions affect engagement in future activity and use of self-regulation strategies ✓ athletes who are motivated to learn invest the time and energy needed to learn and apply self-regulated learning skills ✓ ***OR*** athletes who are able to employ self-regulation strategies successfully commonly become more motivated to complete learning tasks ✓		**3 max**

Option C — Physical activity and health

Question			Answers	Notes	Total
13.	**a**		Americas ✓		**1**
	b		450 000 000 – 250 000 000 ✓ = 200 000 000 ✓		**2**
	c		increase in the use of technology encourages sedentary lifestyle «motor vehicles, robots» ✓ changes in working patterns encourages sedentary lifestyle (less manual) ✓ changes in diet - fast food ✓		**2 max**

14.	**a**		at least 150 minutes of moderate-intensity aerobic physical activity throughout the week ***OR*** at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week ***OR*** an equivalent combination of moderate- and vigorous-intensity activity ✓ aerobic activity should be performed in bouts of at least 10 minutes duration ✓ for additional health benefits, older adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week ***OR*** engage in 150 minutes of vigorous-intensity aerobic physical activity per week ***OR*** an equivalent combination of moderate- and vigorous-intensity activity ✓		**2 max**

Question			Answers	Notes	Total
14.	b		loss of independence ✓ development of secondary complications as a result of long-term hospitalization ✓ long-term pain management ✓ limited movements / reduced ability to participate in some activities ✓		2
	c		uncontrolled disease state (unstable angina, poorly-controlled diabetes, uncontrolled hypertension) ✓ triggering of other health issues (*eg*, heart attack, respiratory tract infections) ✓ hazards of exercise (*eg*, cycling and swimming accidents) ✓ musculoskeletal injuries – osteoporosis ✓ weight-related issues – obesity ✓		3 max

15.	a		not passed from person to person ✓ usually of long duration and slow progression ✓ commonly related to lifestyle behaviours ✓ can be debilitating / limit productivity / be a financial burden / be preventable ✓		2 max
	b		«scientific evidence supports that» a physically-active lifestyle reduces the risk «of developing type 2 diabetes» ✓ exercise can reduce obesity and subsequently diabetes 2 ✓ exercise plays a major role in glycemic control (for people with type 2 diabetes) ✓ muscle contraction has an insulin-like effect / cell membrane permeability to glucose increases with muscular contraction ✓ lack of target cell response to insulin (insulin resistance) ✓ insulin cannot facilitate glucose transport (across the cell membrane) ✓		3 max

Question			Answers	Notes	Total
16.	**a**		occur suddenly / result of a specific injury mechanism ✓ examples: fractured wrist / anterior cruciate ligament tear / concussion ✓	*Award **[1]** max if no example given.*	**2**
	b		Warm-up ✓ ignoring warning signs of discomfort can lead to overuse injuries ✓ rapid increase in training distance or intensity ✓ running surface ✓ footwear ✓ previous injuries ✓ running technique ✓ biomechanical imbalance ✓ twists and turns ✓		**2 max**

17.			improved metabolic rates and VO_2max improves aerobic capacity ✓ increased energy expenditure reduces risk of obesity ✓ improved plasma lipid profiles reduce risk of atherosclerosis ✓ decreased adiposity reduces risk of atherosclerosis ✓ decreased blood pressure reduces risk of cardiovascular disease ✓ reduced risk of skeletal injuries and potential periods of physical inactivity ✓ Social well-being *eg,* walking with groups/friends ✓ Psychological benefits *eg*, increased self esteem from losing weight ✓		**4 max**

Option D — Nutrition for sport, exercise and health

Question			Answers	Notes	Total
18.	**a**		Group 2 ✓ carbohydrate electrolyte plus whey protein ✓		**1**
	b		700 – 600 mL ✓ = 100 mL ✓	*Accept the subtraction in a different order.*	**2**
	c		better hydration is achieved using carbohydrate electrolyte drink with whey protein as after each hour «the cumulative urine» volume produced was less than the «cumulative urine» volume produced for the other two drink conditions ✓ «cumulative urine» volume produced every hour was similar using carbohydrate electrolyte drink with whey protein compared to the other drinks which increased in volume «exponentially» «after 3 hours» ✓		**2**

19.	**a**		the minimum level of energy expenditure that is required to sustain the body's vital functions ✓		**1**
	b		rugae: folds in the stomach «to increase surface area» ✓ lumen: open area in stomach «that is filled with nutrients» ✓ mucous coating / mucosa: a protective lubricant produced by mucous membranes ✓ gastric juices (containing hydrochloric acid) «pH 1–4» ✓		**2 max**
	c		specific temperature «*eg*, work at body temperature» ✓ specific pH «*eg*, pepsin only works in stomach pH 1–4» ✓ substrate specific «*eg*, pancreatic lipase breaks down fats» ✓		**2 max**

Question			Answers	Notes	Total
20.			decline in athletic performance ✓ may lead to serious medical problems (*eg*, symptoms of heat exhaustion or heat stroke) dehydration / thermoregulatory failure / disorientation / twitching / seizures / coma / lack of sweating / high core temperature / dizziness/ light headache ✓ stress on the cardiovascular system ✓ inadequate heat transfer to the skin and environment ✓ associated with increased plasma osmolality ✓ associated with decreased plasma volume ✓ may affect the intracellular and extracellular electrolyte balance ✓	*Award **[1]** max*	**3 max**
21.			body weight is reduced as more food is being used for energy than is consumed ✓ the body would have less «relative» fat ✓		**2**
22.			glucose uptake into a cell is facilitated by the glucose transport proteins / GLUT4 / GLUT1 ✓ during rest, most glucose enters cells via the GLUT1 transporters ✓ GLUT4 transporters are stored inside intracellular vesicles that are translocated to the cell membrane, when needed, to allow for greater glucose movement into the cell ✓ GLUT4 transporters can be stimulated during rest by raised levels of insulin after eating ✓ GLUT4 transporters can also be stimulated, without insulin, during physical exercise «the result of other stimuli such as calcium ions» ✓ glucose taken into the muscle cells is quickly converted to glucose-6-phosphate ✓		**4 max**

Question			Answers	Notes	Total
23.			(alcohol) inhibits gluconeogenesis ✓ reduces the production of ATP ✓ (loss of ATP) results in a lack of energy ✓ reduced / loss of endurance performance ✓	*Award **[2]** max if effect on endurance performance is not discussed.*	**3 max**

24.			free radicals are unstable and destructive to nearby molecules ✓ *Free radicals can*: affect cell / mitochondrial membrane integrity / permeability ✓ impair the function of molecules (*eg*, enzymes) ✓ impair DNA structure ✓ *Free radicals are linked to*: cancer / atherosclerosis / Alzheimer's disease / emphysema / diabetes / cataracts / macular degeneration / rheumatoid arthritis ✓		**3 max**