Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2018

Sports, exercise and health science

Higher level

Paper 3

18 pages

Option A — Optimizing physiological performance

Question			Answers	Notes	Total
1.	a		3200 «g» ✓		1
1.	b		3200–2800 ✓ = 400 «g» ✓	*Accept the subtraction in a different order.*	2
1.	c		CWI did not affect muscle mass ACT helped in the development of muscle mass ✓ CWI is «significantly» less effective than ACT in developing muscle mass ✓	*Accept in the converse.*	2

2.	a		overreaching is transient overtraining ✓ increasing frequency/intensity/duration of an exercise for improvement ✓		1
2.	b		overtraining is when an athlete attempts to do more training than he or she is able to physically and/or mentally tolerate ✓		1
2.	c		decreased appetite. Noticeable behavioural change in food intake leading to body weight loss/fat and muscle loss ✓ chronic soreness such as muscle or bone tenderness/soreness «which is a sign the muscles are not recovering» ✓ fatigue indicators including sleep disturbance «combination of nervous system and or hormonal system overload» / nausea ✓ elevated resting HR / BP ✓ unexplained decline in performance ✓	*Award **[1 max]** for listing three indicators.*	3 max

			increased susceptibility to infections/reduced immune function / continual catabolic state ✓		

Question			Answers	Notes	Total
2.	**d**		periodization / mesocycle would be used for training for the world championships ✓ there may be multiple preparation phases within a macrocycle ✓ the preparation phase can be broken into mesocycles with a specific focus (1–3 months) ✓ used for optimizing performance where training will start broad and become more specific *eg* fitness ✓ multiple mesocycles can be broken down into microcycles (7–14 days) ✓ elicit specific adaptations for the sprinter by balancing high intensity work with rest and recovery ✓		**4 max**

Question			Answers	Notes	Total
3.	a	i	low-intensity exercise to promote recovery either immediately after / or in the days following, an intense training session or competition ✓	*OWTTE*	**1**
3.	a	ii	raised circulation rate ✓ enhanced blood lactate removal ✓ accelerated raising of blood pH ✓		**2 max**
3.	b	i	shivering ✓ non-shivering thermogenesis ✓ «peripheral» vasoconstriction ✓		**1 max**
3.	b	ii	*Strengths:* acts as an analgesic and anti-inflammatory for soft tissue ✓ some methods are easily affordable ✓ perception of enhanced recovery rates lead to improved performance ✓ *Limitations:* current recommendations are largely based on anecdotal rather than scientific research ✓ can be costly ✓ Risks associated with exposure to prolonged or extreme cold ✓	*Award **[2 max]** for strengths.* *Award **[2 max]** for limitations.*	**3 max**

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>4.</td><td>a</td><td></td><td>
<table>
<tr><th></th><th>Sea level</th><th>Altitude</th><th></th></tr>
<tr><td>Hemoglobin saturation</td><td>High (98.5 %)</td><td>Lower (~60 %)</td><td>✓</td></tr>
<tr><td>Respiratory rates at exercise</td><td>Lower</td><td>Higher</td><td>✓</td></tr>
<tr><td>Submaximal heart rate</td><td>Normal</td><td>Elevated</td><td>✓</td></tr>
<tr><td>Effectiveness of glycolysis</td><td>Normal</td><td>Decreased</td><td>✓</td></tr>
<tr><td>Lactic acid production</td><td>Normal</td><td>Elevated</td><td>✓</td></tr>
<tr><td>Maximal oxygen consumption (VO_2 max)</td><td>Normal</td><td>Reduced</td><td>✓</td></tr>
<tr><td>Body mass</td><td>Normal</td><td>Decrease</td><td>✓</td></tr>
<tr><td>Cardiac output</td><td>Normal</td><td>Increase</td><td>✓</td></tr>
<tr><td>Mitochondria</td><td>Normal</td><td>Increase</td><td>✓</td></tr>
<tr><td>Plasma volume</td><td>Normal</td><td>Decrease</td><td>✓</td></tr>
</table>
</td><td></td><td>2 max</td></tr>
<tr><td>4.</td><td>b</td><td></td><td>Blood adaptations:
increased number of red blood cells / viscosity to compensate for each carrying less oxygen at low oxygen levels ✓
smaller reduction in hemoglobin saturation ✓excretion of base via the kidneys to restore acid-base balance ✓

Muscle adaptations:
reduced lean body mass ✓
increased capillary density, particularly in skeletal muscle to aid saturation ✓
increased mitochondrial density and enzyme concentration ✓
erythrpoietic response increases ✓

Cardiorespiratory adaptations:
increased pulmonary ventilation to compensate for vasoconstriction ✓
a decrease in maximum cardiac output a decreased maximum heart rate ✓</td><td>Accept other appropriate adaptions.
Adaptation must be explained for [1] mark.</td><td>2 max</td></tr>
</table>

Option B — Psychology of sport

Question			Answers	Notes	Total
5.	**a**		control ✓		**1**
5.	**b**		38.33–32.21 ✓ = 6.12 «kg» ✓	*Accept the subtraction in a different order.*	**2**
5.	**c**		*Data:* imagery improved 1RM «5.88 kg» score more than the control group «0.91 kg» ✓ imagery improvement «5.88 kg» was «almost» as effective as physical practice improvement «6.12 kg» ✓ *Theory:* cognitive-based imagery aids task performance by improving focus / concentration ✓ cognitive-based imagery aids skill learning ✓ motivational-based imagery improves confidence ✓ imagery can be used to improve motivation ✓	*Mere presentation of figures from table without stating improvement is not sufficient for mark. Reference to numbers must be the difference in values.* *Award **[2 max]** for theoretical points.*	**3 max**

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>6.</td><td>a</td><td></td><td>the internal mechanisms and external stimuli which arouse and direct our behaviour ✓</td><td>Accept other appropriate definitions.</td><td>1</td></tr>
<tr><td>6.</td><td>b</td><td></td><td>extrinsic rewards can be a controlling influence on behaviour ✓
extrinsic/controlling rewards reduce intrinsic motivation «while possibly increasing extrinsic motivation» ✓
extrinsic rewards seen as information providing feedback on performance ✓
information rewards can increase intrinsic motivation ✓
intrinsic motivation leads to greater satisfaction with performance therefore satisfaction may be decreased with extrinsic rewards ✓</td><td></td><td>3 max</td></tr>
<tr><td>7.</td><td>a</td><td></td><td>eg personal best ✓</td><td>Accept any appropriate example containing reference to judgement against a self-referenced numeric value.</td><td>1</td></tr>
<tr><td>7.</td><td>b</td><td></td><td>
<table>
<tr><th></th><th>Cognitive</th><th>Somatic</th></tr>
<tr><td>characterised by thoughts</td><td>Y</td><td>N</td></tr>
<tr><td>characterised by physiological response</td><td>N</td><td>Y</td></tr>
<tr><td>involves worry and self-doubt</td><td>Y</td><td>N</td></tr>
<tr><td>involves butterflies, dry mouth, shaking, etc.</td><td>N</td><td>Y</td></tr>
<tr><td>typically increases immediately before performance</td><td>N</td><td>Y</td></tr>
</table>
✓ ✓ ✓ ✓ ✓
</td><td></td><td>2 max</td></tr>
<tr><td>7.</td><td>c</td><td></td><td>progressive muscular relaxation (PMR) reduces muscular tension ✓
breathing techniques can control heart rate and respiratory rate, reducing tension ✓
biofeedback can be used to monitor somatic symptoms ✓</td><td>Award [1 max] for list.
Accept other techniques as appropriate.</td><td>2 max</td></tr>
</table>

			self-talk ✓ mental imagery ✓ thought stopping ✓ music ✓		

Question			Answers	Notes	Total
8.	a		<table><tr><th></th><th>Talent identification (TI)</th><th>Multidimensional talent identification and development (TID)</th><th></th></tr><tr><td>predominantly physiological assessments</td><td>Y</td><td>N</td><td>✓</td></tr><tr><td>incorporates psychological skill</td><td>N</td><td>Y</td><td>✓</td></tr><tr><td>recognises the evolution of talent</td><td>N</td><td>Y</td><td>✓</td></tr><tr><td>monitoring takes place as a snapshot</td><td>Y</td><td>N</td><td>✓</td></tr><tr><td>monitoring takes place over time</td><td>N</td><td>Y</td><td>✓</td></tr></table>		**3 max**
8.	b		bloom (1985) / Cote (1999) suggested stages of athlete development ✓ stages were initiation, development, mastery, and maintenance / perfection ✓ during early stages, practice is coach- or parent-led ✓ as athletes master skill, practice becomes more self-determined ✓ development is dependent on opportunities, obstacles, and progressions ✓ psychological skill is key to coping with unstable periods and determines development ✓		**3 max**

Question			Answers	Notes	Total
8.	c		relationship is bi-directional, in that motivated athletes engage in more self-regulated learning, which in turn serves to enhance motivation ✓ stages forethought, monitoring, reflection *Forethought (planning) phase:* athletes must see value in task to spend time planning for it ✓ higher self-efficacy beliefs increase the use of self-regulation strategies ✓ *Monitoring phase:* intrinsic motivation affects level of effort in completing tasks and use of self-regulation strategies ✓ *Reflection phase:* athlete attributions affect future engagement in self-regulation strategies ✓		**4 max**

Option C — Physical activity and health

Question			Answers	Notes	Total
9.	**a**	**i**	Southeast Asia ✓		**1**
9.	**a**	**ii**	60–30 ✓ = 30 «%» ✓	*Accept the subtraction in a different order.*	**2**
9.	**a**	**iii**	*Compare:* adults aged ≥ 60 highest proportion of physical inactivity in both regions ✓ from 30+, there is a similar trend in increasing levels of inactivity ✓ *Contrast:* when comparing each age group, Americas have more inactivity than Western Pacific ✓ inactivity increases with age in Americas but does not in Western Pacific ✓ ***OR*** there is a greater increase in inactivity from 30–44 to 45–59 and to >60 in Americas compared to Western Pacific ✓ 15–29 year olds are the most active / least inactive in Americas but they are more inactive than 30–44 years and 45–59 years in Western Pacific ✓	*Award **[2 max]** for contrast.* *Must be clear that comparison is age group to same age group between regions.* *Accept other appropriate interpretations.*	**3 max**
9.	**b**		a condition that involves narrowing or blockage of blood vessels that supply the heart «leading to heart attack / angina» ✓		**1**

Question			Answers	Notes	Total
9.	**c**		*Inactive individuals are more likely to have:* high blood pressure ✓ atherosclerosis ✓ obesity ✓ type 2 diabetes ✓ low HDL-cholesterol ✓	*Award **[2 max]** for list.*	**3 max**

10.	**a**		a state of emotional or affective arousal of varying, and not permanent duration ✓	*Accept other appropriate definitions.*	**1**
10.	**b**		exercise seems to have a positive correlation with alleviating depression ✓ being sedentary has been shown to be related to higher levels of depression ✓ no causal link has been established between exercise and depression ✓ exercise involving rhythmical abdominal breathing is likely to have a positive effect ✓ ***OR*** exercise at least 20 minutes in duration is likely have a positive effect ✓ exercise may increase the release of endorphins / increase serotonin / norepinephrine synthesis ✓ exercise groups convey a sense of mastery and increased self-esteem ✓ may also provide social interaction and promote social support ✓		**4 max**

Question			Answers	Notes	Total
11.	a		*Acute injuries:* occur suddenly as a result of a specific injury mechanism ✓ *Chronic injuries:* develop over a period of time and are often caused by repetitive activity ✓		**2**
11.	b		rapid increase in training distance or intensity ✓ warm-up ✓ ignoring warning signs of discomfort can lead to overuse injuries ✓ running technique ✓ twists and turns ✓ running surface **«***eg* hard surfaces can lead to stress fractures**»** ✓ footwear **«***eg* incorrect type fails to compensate for over pronation**»** ✓ previous injuries **«***eg* tight muscles straining tendons**»** ✓ running experience **«***eg* novice runners less aware of body limits**»** ✓ biomechanical imbalance **«***eg* poor gait leads to joint issues**»** ✓		**3 max**

Question			Answers	Notes	Total
12.	a		underlying medical history / genetic disorders ✓ underlying problem when accompanied with high intensity exercise ✓ underlying problem when accompanied with habitual weekly exercise ✓		**2 max**
12.	b		moderate exercise (*eg* walking) is associated with a lower risk of mortality ✓ improved metabolic rates and VO2max 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 ✓		**3 max**

Option D — Nutrition for sport, exercise and health

Question			Answers	Notes	Total
13.	**a**		1.55 «minutes» ✓		**1**
13.	**b**		29.49–26.46 «minutes» ✓ = 3.03 «minutes» ✓	*Accept subtraction in a different order.*	**2**
13.	**c**		there was no significant change in running or cycling performance from start to end of study for the control group ✓ there was no significant change in running performance from start to end of study for the early consumption group ✓ there was a significant change / improvement in cycling performance between start and end of study for the early consumption group ✓ *Conclusion:* early carbohydrate consumption may be beneficial in some activities/sport ✓	*Award **[2 max]** if no conclusion.*	**3 max**

14.	**a**		pepsin ✓ trypsin ✓	***Two*** *required in list to award* ***[1]*** *mark.*	**1 max**
14.	**b**		a catalyst for the breakdown of large food molecules into smaller molecules ✓ smaller molecules are more soluble ✓ substances, which can be absorbed from the gut into the bloodstream ✓ speed up the rate of digestion ✓ carbohydrates are acted on by amylase ✓ ***OR*** proteins are acted on by pepsin ✓ ***OR*** fats are acted on by lipase ✓	*Award* ***1 [max]*** *for specific example.* *Accept other relevant examples.*	**3 max**

Question			Answers	Notes	Total
15.	**a**		*low:* apples/fish sticks/butter beans/kidney beans/lentils/sausage/fructose/peanuts/ tuna ✓	***N.B.*** *The guide has brown rice as medium GI.* *Accept any suitable example (<15).*	**2**
15.	**b**		*Before race:* simple sugars/high-GI foods immediately pre-competition causes blood sugar to rise rapidly/ excessive insulin release/ negatively impacts endurance ✓ low-GI immediately pre-competition has a slower rate of glucose absorption into the blood/ eliminates the insulin surge/ is beneficial for endurance ✓ *During race:* Triathlete should consume high-GI «in optimal amounts» during a race ✓		**3**

16.	**a**		*Several causes but most commonly:* high insulin levels among diabetics ✓ *Can also exist in non-diabetics through:* insufficient food intake ✓ excessive exercise ✓ illness ✓ postponing or skipping a meal or snack drinking alcohol		**3 max**

Question			Answers	Notes	Total
16.	**b**		glucose uptake into a cell is facilitated by the glucose transport proteins GLUT4 and GLUT1 ✓ GLUT4 transporters are stored inside intracellular vesicles that are translocated to cell membrane to allow greater glucose movement into cell ✓ GLUT4 transporters can be stimulated without insulin during physical exercise from other stimuli such as calcium ions ✓ glucose taken into muscle cells is quickly converted to glucose-6-phosphate to maintain glucose movement ✓		**3 max**

17.			antioxidants are found in many foods and so are consumed as part of a healthy, well-balanced diet ✓ free radicals are unstable and destructive to nearby molecules ✓		**4 max**

			OR free radicals can: affect cell / mitochondrial membrane integrity / permeability / impair the function of molecules (*eg* enzymes) / impair DNA structure ✓ free radicals are a by-product of normal cell function that can lead to oxidative stress without sufficient antioxidants ✓ many athletes consume antioxidants in dietary supplements as extra defence against free radical damage ✓ no consistent evidence that these supplements reduce oxidative stress or have positive training or performance impact ✓ excess intake above RDA may have detrimental effects on the body ✓ a lack of adequate regulation means that some products are poorly formulated and may even contain banned substances ✓		