Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2016

Sports, exercise and health science

Standard level

Paper 2

19 pages

1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.

3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded**.

4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.

5. Personal codes/notations are unacceptable.

6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, use the "zero" annotation to award zero marks. Where a candidate has not attempted the part question, use the "SEEN" annotation to show you have looked at the question. RM™ Assessor will apply NR once you click complete.

7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. RM™ Assessor will only award the highest mark or marks in line with the rubric.

8. Ensure that you have viewed every page including any additional sheets. Please ensure that you stamp "SEEN" on any additional pages that are blank or where the candidate has crossed out his/her work.

9. There is no need to stamp an annotation when a candidate has not chosen an optional question in Section B. RM™ Assessor will apply NR once you click complete.

10. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the "CON" stamp.

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 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 wording is indicated in the 'Answers' column by a slash (/). Either wording can be accepted.

continued…

6. An alternative answer is indicated in the 'Answers' column by '**OR**' on the line between the alternatives. Either answer can be accepted.

7. Words in angled brackets ‹ › in the 'Answers' column are not necessary to gain the mark.

8. Words that are underlined 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.

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.

Section A

Question			Answers	Notes	Total
1.	a		0.40 – 0.35 ✓ = 0.05 m ✓ ***OR*** 0.35 – 0.40 ✓ = –0.05 m ✓	*Units required.*	**2 max**
	b		centre of mass is the ‹mathematical› point around which the mass of a body or object is evenly distributed *OWTTE* ✓		**1**
	c		using the swing technique an individual will ‹on average› jump higher ✓ using the traditional technique an individual will ‹on average› have less horizontal displacement ✓ *Angle of release:* swing technique has a lesser angle of release ‹35–45 degrees› ✓ *Speed of release:* greater in the swing technique ‹as indicated by a horizontal displacement› ✓ horizontal velocity decreases as the angle of projection (release) increases and vice versa ✓ *Height of release:* is the same for both techniques ✓	*Accept answers in the converse for all marking points.*	**3 max**
	d		anterior thigh / anterior upper leg / quadriceps group ✓		**1**

<table>
<tr><td></td><td>e</td><td></td><td>
<table>
<tr><th>Men</th><th>Women</th></tr>
<tr><td>men have more muscle thickness</td><td>women have less muscle thickness ✓</td></tr>
<tr><td>men have less fascicle length DOM to ND</td><td>women have more fascicle length DOM to ND ✓</td></tr>
<tr><td>men have more fascicle length</td><td>women have less fascicle length ✓</td></tr>
<tr><td>men have more cross-sectional area</td><td>women have less cross-sectional area ✓</td></tr>
<tr><td>men have more cross-sectional area ND to DOM</td><td>women have less cross-sectional area ND to DOM ✓</td></tr>
<tr><td colspan="2">muscle thickness for dominant and non-dominant is the same for men and women ✓</td></tr>
</table>
</td><td>Award [1] per row.</td><td>3 max</td></tr>
<tr><td></td><td>f</td><td></td><td>standing broad jump ✓
vertical jump ✓</td><td></td><td>1 max</td></tr>
<tr><td>2.</td><td>a</td><td></td><td>matrix ✓</td><td></td><td>1</td></tr>
<tr><td></td><td>b</td><td></td><td>cell respiration is the controlled release of energy in the form of ATP <from organic compounds in cells> ✓</td><td></td><td>1</td></tr>
<tr><td></td><td>c</td><td></td><td>Breathing in:
external intercostal muscles contract
OR
rib cage moves upwards and outwards ✓
diaphragm flattens / contracts ✓
thoracic cavity volume increases/lungs increase in size/capacity ✓
thoracic cavity pressure decreases ‹therefore air rushes in›
OR
air rushes in from high pressure to low pressure/inhalation continues as long as the pressure difference exists / air flows from an area of higher pressure to an area of lower pressure ✓</td><td></td><td>2 max</td></tr>
</table>

			additional muscles can also be involved such as the trapezius, sternocleidomastoid / scalene / pectoralis minor / back muscles ✓		
	d		the aerobic energy system / aerobic glycolysis involves three processes: glycolysis, Krebs cycle, electron transport chain ✓ glycolysis takes place in the cell cytoplasm / outside the mitochondria ✓ Krebs cycle and electron transport chain takes place in mitochondria ✓ the aerobic energy system can produce ATP from all the main food groups of our diet ✓ it involves the production of ATP with oxygen ✓ in the presence of oxygen, pyruvate is processed by the Krebs cycle which liberates electrons that are passed through the electron transport chain producing energy ‹ATP› ✓ the oxidative system of energy production can generate up to 38 molecules of ATP from one molecule of glucose ✓ *Glucose oxidation:* during glycolysis glucose is firstly phosphorylated which uses up 2ATP ✓ glucose is split into two pyruvate molecules during glycolysis, <which regenerates 4ATP> ✓ glycolysis generates a net production of 2ATP ✓ during aerobic production of ATP pyruvate is converted to acetyl CoA which enters the Krebs cycle / which generates 2 ATP ✓ CO_2 and hydrogen ions are released from the Krebs cycle ✓ hydrogen ions are carried to the electron transport chain where energy and water are produced / which produces 34 ATP ✓		**3 max**

Question			Answers	Notes	Total
3.	a		contractility ✓ extensibility ✓ elasticity ✓ atrophy ✓ hypertrophy ✓ controlled by nerve stimuli ✓ fed by capillaries ✓		**2 max**
	b		interoceptors provide information from within the body ✓ interoceptors ‹joint receptors, muscle spindles and Golgi tendon organs, vestibular apparatus> provide information about the position of the body and limbs ✓ provide information about internal states such as pH, lung stretch, temperature ✓		**2 max**
	c		signal detection process consists of detection, comparison and recognition ‹DCR› ✓ it is the process by which the brain interprets and makes sense of the information it is receiving from the sensory organs ✓ the most important sensory information present in the environment, are generally visual and auditory ✓ detection is the process by which the brain identifies that a stimulus is present ✓ comparison is when we attend to something we have sensed and compare it to information in long-term memory ✓ recognition occurs when the code of the incoming information matches a code stored in the long-term memory ✓ detection of a signal is dependent on the intensity of the signal compared to the intensity of the background noise ✓ background noise is non-essential information such as auditory information or information from within the individual such as worrying about failure ✓		**3 max**

			likelihood of detection is influenced by sensitivity of sense organs *eg* eyes ✓ likelihood of detection is influenced by experience with familiar signals ✓ arousal level can impact on detection. Low arousal will see the signal missed, over arousal can see detection of a signal that does not exist ✓ signal detection proficiency can be improved by ensuring the performer is optimally aroused and be aided by selective attention ✓ selective attention can be improved through learning from past experience ✓		
4.	**a**		cardiac muscle ✓		**1**
	b		diastolic BP remains constant during dynamic exercise ✓ diastolic BP rises during static exercise ✓		**2 max**
	c		<absolute> VO_2 values are considerably lower in aged-matched females ‹15–30 % below male levels on average› ✓ female <absolute> VO_2 values are considerably lower due to size differences ***OR*** gender differences are related to body composition due to non-oxygen using body fat in females ✓ when compared in relative terms active, healthy adult females have lower VO_2 max than males ✓ gender differences are also related to greater hemoglobin concentration in males ✓		**2 max**

Section B

Question			Answers	Notes	Total
5.	**a**		protection of vital organs *eg* ribs, skull ✓ support and maintenance of posture / structure *eg* vertebral column ✓ providing attachment points for the muscles / movement *eg* sternum ✓ storage and release of minerals such as calcium and phosphorus *eg* ribs ✓ blood cell production *eg* ribs, sternum ✓	*An example together with the bone is required for the mark to be awarded. Award **[1 max]** for each function*	**4 max**
	b		gaseous exchange takes place through the process of diffusion ✓ alveoli are one cell thick which assists in the process of gaseous exchange ✓ alveoli are surrounded by a dense capillary network ✓ alveoli have a large surface area ✓ gas will move along a gradient of higher partial pressure to lower partial pressure ✓ CO_2 passes from the capillaries through the alveoli to the lungs ✓ O_2 passes from the lungs through the alveoli to the capillaries ✓		**4 max**

	c		*Oxygen deficit:* because oxygen needs and oxygen supply differ during the transition from rest to exercise your body incurs an oxygen deficit ***OR*** occurs when exercise/aerobic work is above the requirement for oxygen at rest ✓ the oxygen deficit is calculated simply as the difference between the oxygen required for a given rate of work and the oxygen actually consumed ✓ when exercise commences abruptly the demand for ATP is immediate ✓ the initial energy is met with ATP stores ✓ in spite of insufficient oxygen, your muscles still generate the ATP needed through the anaerobic pathways ✓ oxygen deficit creates an oxygen debt which is paid back after exercise ✓		**5 max**
	d	**i**	Multistage Fitness test/bleep test/beep test/leger test ✓ Cooper's 12 Minute Run ✓ Harvard Step test ✓	*Award **[2]** for three correct and **[1 max]** for two correct.* *Accept other recognised tests.*	**2 max**
		ii	***Multistage Fitness test:*** *Validity:* the correlation to actual VO_2 max scores is high ✓ there are published VO_2 max score equivalents for each level reached ✓ *Reliability:* the reliability of the beep test would depend on how strictly the test is run and the practice allowed for the subjects ✓ reliability would be impacted by the running surface ✓ *Strengths:* the ability to test a large number of participants✓ no specialist equipment required ✓	*Accept other recognised tests.*	**5 max**

			cost to perform the test is minimal ✓ *Limitations:* it is a maximal test so practice and motivation levels can impact on score ✓ environmental conditions can affect results if the test is completed outside ✓ may be an advantage for team sports with an agility component ✓ ***Cooper's 12 Minute Run:*** *Validity:* Cooper ‹1968› reported a correlation of 0.90 between VO_2 max and the distance covered in a 12 minute walk/run ✓ *Reliability:* the reliability of this test would depend on practice, pacing strategies and motivation level. There should be good reliability if these issues are addressed ✓ reliability would be impacted by the running surface ✓ *Strengths:* the ability to test a large number of participants ✓ no specialist equipment required ✓ cost to perform the test is minimal ✓ *Limitations:* practice and pacing is required, and performance on this test can be affected greatly by motivation as it is a maximal test ✓ environmental conditions can affect results if the test is completed outside ✓ requires someone to accurately monitor the length of time of the test ✓ requires someone checking distance covered ✓ ***Harvard Step test:*** *Validity:* correlation to VO_2 max has been reported as between 0.6 to 0.8 in numerous studies ✓		

			Reliability: dependent upon the administration of the test and stepping at the correct cadence ✓ *Strengths:* can be used with larger groups ✓ cost for equipment is limited ✓ *Limitations:* biomechanical characteristics vary between individuals. For example, considering that the step height is standard, taller people are at an advantage as it will take less energy to step up onto the step ✓ body weight has also been shown to be a factor ✓ testing large groups with this test will be time consuming ✓ specific equipment is required eg metronome and bench at set height ✓		
6.	**a**		*Cognitive:* cognitive skill in team games such as rules, tactics and game objectives are associated with decision making in game play and contribute to success on the field ✓ success in chess is not associated with the movement tasks ✓ *eg* playing chess requires mostly cognitive because it requires a lot of thinking ✓ *Perceptual Motor:* these skills involve the interpretation of environmental stimuli and the motor response to this sensory information ✓ perceptual motor skills depend on high perceptual ability and are very important in activities that require the performer to adapt to the environment ✓ most sports involve perceptual motor skills because they involve thought, interpretation and movement ✓ *eg* dribbling with the ball to beat a defender in soccer ✓	*Award **[2 max]** per skill type.* *Award **[1 max]** for an example per skill type.*	**4 max**
	b	**i**	gross – fine ✓ open – closed ✓	*Award **[2]** for three correct and **[1 max]** for two correct.*	**2 max**

			discrete – serial – continuous ✓ external – internal paced skills ✓ individual – coactive – interactive ✓		
		ii	gross – fine *eg* gross = kicking a ball/fine = throwing a dart ✓ open – closed *eg* open = receiving in tennis/closed = serving in tennis ✓ discrete – serial – continuous *eg* discrete = handstand/serial = tumbling routine in gymnastics/continuous = running ✓ external – internal paced skills *eg* external = batting in cricket/internal = bowling in cricket ✓ individual – coactive – interactive *eg* individual = archery/coactive = running race/interactive = game of football ✓	*Award marks for examples of approaches stated in (bi), not for repeating the approach. Each approach stated in (bi) must have an example.* *Award **[2 max]** per classification approach.*	**4 max**
	c		skilled footballer <u>consistently</u> performs at a high level *eg* regularly able to juggle ball with body over 100 times ✓ skilled footballer is <u>accurate</u> in execution of skills *eg* penalty shots on goal at a high percentage ✓ skilled footballer has the ability to <u>control</u> the ball *eg* under pressure from opposition ✓ skilled footballer has <u>learnt</u> skills *eg* practiced over many years✓ novice footballer lacks <u>efficiency</u> *eg* passing and dribbling skills are executed poorly with mistakes apparent ✓ skilled footballer is <u>goal directed</u> *eg* when shooting at goal, passing to team mates, tackle attacking player ✓ skilled footballer movements are <u>fluent</u> *eg* completed with ease and grace ✓	*Accept answers in the converse.* *Award **[2 max]** if the underlined features are listed rather than discussed*	**4 max**

	d		relative contributions of the energy systems will be determined by the skill and fitness of the opposition / breaks in play/ pace of the game ✓ relative contributions of the energy systems will be determined by the position of the player ✓ relative contributions of the energy systems will be determined by the individual's fitness level ✓ *ATP–PC:* short duration ‹one to ten seconds› at maximal intensity ✓ fuel source Creatine Phosphate ✓ no fatigue causing by-products ✓ *eg* sprinting to stop an attacking move by opposition; goal kicker diving to save goal ✓ *Lactic acid:* moderate duration at a high intensity, between 20 seconds to two minutes ✓ fuel source is anaerobic glycolysis/ glucose ✓ lactic acid is a fatigue causing by-product and will see cessation of activity or reduced intensity ✓ *eg* broken play up and down field for 20 + seconds✓ *Aerobic:* play at lower intensity ✓ fuel source is aerobic glycolysis/ glucose, fat and protein ✓ no fatigue causing by-products ✓ duration can continue as long as fuel supply exists ✓ *eg* passing and low intensity play off ball ✓	*Award **[2 max]** for first three marking points.* *Award **[5 max]** for just descriptions of energy systems.* *Award **[2 max]** per energy system.* *Award **[1 max]** for a valid example in a match per energy system.*	**6 max**

Question			Answers	Notes	Total
7.	**a**	**i**	to train harder than you have previously ✓		**1**
		ii	overload involves increasing intensity *eg* when running increasing target heart rate from 70 % maximum HR to 75 % maximum HR ✓ overload involves increasing duration *eg* when running increasing training time from 20 minutes to 30 minutes ✓ overload involves increasing frequency *eg* increasing training frequency from three times a week to five times a week ✓	*Each application method must have an example.*	**2 max**
	b		*Platelets/ thrombocytes:* assist in the process of repair following injury ✓ allow the blood to clot ✓ *White blood cells / leucocytes:* involved in immune function / produce antibodies ✓ protect the body from infection / foreign substances ✓ *Red blood cells / erythrocytes:* contain hemoglobin and transport oxygen ✓ hemoglobin binds with oxygen forming oxyhemoglobin ✓ hemoglobin increases the blood's oxygen carrying capacity 65–75 times that above that normally dissolved in plasma ✓ hemoglobin <contains a central iron ion which> can hold up to four oxygen atoms <per heme> ✓ *Plasma:* is the fluid component of the blood ✓ assists in transport of substances such as food / waste products/ gases / hormones / antibodies ✓	*Award **[2 max]** per component.* *Marks must come from 2 components only.*	**4 max**
	c		increased left ventricular volume / increased stroke volume so that it pumps more blood per beat ✓	*Award **[3 max]** if adaptations are listed rather than described*	**5 max**

			lower resting heart rate as the heart is stronger from training doesn't need to work so hard at the same level ✓ lower exercising heart rate when working at the same load as when untrained ✓ increased arterio-venous oxygen difference so the muscles are able to extract a greater volume of oxygen from incoming blood ✓ larger and more numerous mitochondria in trained skeletal muscle to produce more aerobic energy/ assist with recovery ✓ increased level of aerobic system enzyme activity so it can create more ATP / energy ✓ increased ability of the muscle to mobilize, deliver and oxidize lipid to prevent glycogen stores from running out ✓ increased glycogen storage in the muscle due to increased muscle size / efficiency ✓ increased capacity for glycogenolysis so you are able to turn more glycogen into glucose for ATP production ✓ slight cardiac hypertrophy/increase in heart size due to training of the heart muscle ✓ increase in blood ‹plasma› volume to support the bodies sweating needs and due to the increase in blood cells / maintain viscosity ✓ increase in cardiac output as the heart is stronger/ larger so the heart can potentially pump more blood in a minute ✓ increase in capillarization which will mean that greater volumes of blood / oxygen can be transported to muscle ✓ increase in blood volume/RBC which means blood can carry more oxygen ✓		
	d		DOMS occurs after exercise / up to 48 hrs post exercise <and can last three or four days> ✓ eccentric and isometric actions tend to produce the greatest post exercise discomfort ✓		**3 max**

<table>
<tr>
<td></td><td></td><td></td>
<td>concentric contraction does not cause DOMS to the degree that it is produced by eccentric contractions, due to greater microscopic tears in eccentric contractions ✓
with DOMS comes a reduction in the force generating capacity of the affected muscles / negatively affects performance ✓
DOMS can be produced by:
microscopic tears ✓
osmotic pressure causing fluid retention in the surrounding tissues ✓
muscle spasms ✓
overstretching and tearing of muscle connective tissue ✓
acute inflammation ✓
alteration in the cells' mechanism for calcium regulation ✓</td>
<td>Award [2 max] for what DOMS can be produced by</td>
<td></td>
</tr>
<tr>
<td></td><td>e</td><td></td>
<td>
<table>
<tr><th></th><th>Slow:</th><th>Fast:</th><th></th></tr>
<tr><td>force production</td><td>low</td><td>high</td><td>✓</td></tr>
<tr><td>contraction speed</td><td>slow</td><td>fast</td><td>✓</td></tr>
<tr><td>fatigue resistance / aerobic capacity</td><td>high</td><td>low</td><td>✓</td></tr>
<tr><td>glycogen content</td><td>low</td><td>high</td><td>✓</td></tr>
<tr><td>mitochondrial density</td><td>high</td><td>low</td><td>✓</td></tr>
<tr><td>capillary density</td><td>high</td><td>low</td><td>✓</td></tr>
<tr><td>myoglobin</td><td>high</td><td>low</td><td>✓</td></tr>
<tr><td>oxidative enzyme capacity</td><td>high</td><td>low</td><td>✓</td></tr>
<tr><td>colour</td><td>red</td><td>white</td><td>✓</td></tr>
<tr><td>fibre diameter</td><td>small</td><td>large</td><td>✓</td></tr>
<tr><td>primary function</td><td>endurance activities</td><td>high intensity rapid activities</td><td>✓</td></tr>
</table>
</td>
<td>Award [1] per row.</td>
<td>5 max</td>
</tr>
</table>