International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

MARKSCHEME

May 2014

SPORTS, EXERCISE AND HEALTH SCIENCE

Standard Level

Paper 2

25 pages

*This markscheme is **confidential** and for the exclusive use of examiners in this examination session.*

*It 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 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✓		**1 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.

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

continued …

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**		Illinois agility ‹test›/standing broad jump✓		**1**
	b	**i**	(19.2 – 20.1) = 0.9 cm less on average✓	*For the marks to be awarded stages of working and units **must** be shown.*	**1**
	b	**ii**	$14.0 - 11.6 = 2.4$✓ seconds ‹longer on average›✓	*For the marks to be awarded stages of working **must** be shown.*	**2**
	c		components which are vital to ensure that an individual can meet the physical and physiological demands of an activity without excessive fatigue ***OWTTE***✓ health-related fitness includes body composition, cardio-respiratory fitness ‹aerobic capacity›, flexibility, muscular endurance, strength✓	*If this is the only answer, do not accept with any skill related components. There must be a minimum of two health related components.*	**1 max**

	d		Group 1/rural adolescents scored better in four of the six tests/majority of tests/ $\dot{V}O_2$ max, Standing broad jump, Hand grip strength, bent arm hang ***OWTTE*** ✓ based on the results one could argue that Group 1/rural adolescents are fitter overall ✓ group 2/urban adolescents were better at speed-agility, flexibility ✓ group 1/rural adolescents scored better in health-related components of fitness (compared to Group 2) ***OR*** three health related components ***OR*** muscular strength and muscular endurance and aerobic capacity ***OWTTE*** ✓ group 1 and 2 score the same on skill related components ✓ each group had scored higher than the other group in some components ✓ there may well be other components not tested here where Group 2/urban adolescents would score higher so the result could be deemed undetermined ✓ group 1/rural adolescents have on average a higher standard deviation compared to Group 2 in connection with the hypothesis ✓ Although the data presented supports the hypothesis, the difference between the two groups may not be significant. ✓	*Accept answer in the converse.* *Accept answers in the converse*	**3 max**
	e	**i**	$\dot{V}O_2$ max ✓		**1**
	e	**ii**	hand grip strength ✓		**1**
	f		*joint action:* plantar flexion ✓ *type of muscle contraction:* calf/back of lower leg contract concentrically ✓ gastrocnemius/soleus is/are the agonist/ prime mover ***OR*** tibialis anterior is relaxing (and acting as the antagonist) ✓	*Do not accept isotonic as a sole answer.*	**3**

2.	**a**		the controlled release of energy in the form of ATP (from organic compounds in cells) ***OWTTE***✓	*Mention of ATP or adenosine triphosphate should be included.* *Accept glucose and oxygen required to produce carbon dioxide, water and ATP.*	**1**
	b		*strengths:* the ATP–CP system allows ATP to gain a phosphate molecule very quickly/almost instantaneously✓ the ATP–CP system recovers very quickly also✓ the ATP–CP system does not require oxygen✓ the CP is readily available✓ provides energy for explosive high intensity exercise/movement✓ no fatiguing by-products✓ CP can itself be quickly re-synthesized so recovery time is quick✓ *weaknesses:* the ATP–CP system is used up very quickly up to 10 seconds/limited supply of CP✓ to continue with all-out effort beyond 10 seconds an additional energy source other than the ATP–CP system is required✓ for repeated bouts of all-out effort there needs to be sufficient time for recovery of this system✓	*Award **[1 max]** for just a description of the system without a strength or a weakness.* *Award **[2 max]** for strengths and **[2 max]** for weaknesses.*	**3 max**

3.	**a**		vastus intermedius	*Accept "vastus intermedialis".*	**1**
	b		type II/type IIa/IIb/Fast Twitch/Fast Glycolytic	*Accept II as 2*	**1**
	c		*acetylcholine ‹ACh›:* changes an electrical/neural impulse into a chemical stimulus ‹at the motor end plate›/transmits nervous impulse across synapse✓ increases membrane permeability ‹to sodium and potassium ions›✓ helps spread the impulse over the entire muscle fibre✓ the action of ACh allows the muscle to contract✓ *cholinesterase:* degrades/breaks down ACh ‹within 5 milliseconds›✓ immediately repolarizes the membrane✓ ‹action of cholinesterase› allows the muscle to relax✓	*Award **[2 max]** for acetylcholine.* *Award **[2 max]** for cholinesterase.* *Do not exceed **[3 max]** in total.*	**3 max**
	d		variations in $\dot{V}O_2$ max during different modes of exercise reflect the quantity of activated muscle mass ***OR*** treadmill running involves greater muscle mass compared to arm ergometry✓ $\dot{V}O_2$ max measured (on the same subjects) during treadmill running produces higher values compared with arm ergometry ***OR*** generally, with arm ergometry aerobic capacity of a person reaches only about 70 % of treadmill $\dot{V}O_2$ max✓ skill level/training status/experience can increase the values for both✓	*Accept in the converse* *Accept in the converse*	**2 max**

4.	**a**		1. cognitive/verbal 2. associative/motor✓	*Both required to award **[1]**.*	**1 max**
	b		physical proficiency abilities consist of gross movements/use of large muscle groups ‹eg physical factors›✓ perceptual motor abilities are a combination of how we make sense of our environment (perception) and how we act (motor control) ‹eg psychomotor factor›✓	*Award **[1 max]*** *Award **[1 max]*** *Examples will only be accepted in conjunction with a suitable definition.*	**2**

	c		*for example physical maturation:* young learners have difficulty in focusing on important cues, difficulty in processing information✓ young learners make a large number of errors✓ as learners mature, more motor plans are generated✓ *for example physical fitness:* size, shape and level of fitness may assist in learning✓ one learner may have more flexibility and strength than the other✓ a learner has an ability to make decisions more effectively if they are not fatigued✓ *for example motivation:* can be related to a person's inner drive ‹intrinsic› or external factors such as trophies ‹extrinsic›✓ the strength of a learner's drive to achieve is ‹very› individual✓ motivation is also linked to a person's state of arousal✓ *for example individual difference of coaches:* a coach's teaching style ‹command/reciprocal› may appeal to one learner but not the other✓ the quality and type of feedback received✓ *for example age:* physical maturation/experience/emotional maturity will affect the progress of a learner✓ *for example difficulty of task:* progress will be slowed if the task is too difficult for the learner✓ this may have an impact on the motivation of the learner✓	*Award **[2 max]** per factor.*	**3 max**

continued …

	c		*for example teaching environment:* a safe teaching environment/limited distractions/small group learning/attention/facilities and space available for learning✓ *for example time/volume of practice:* The longer amount of time a person has to practice the more likelihood they will increase the rate of learning a skill✓		

SECTION B

Question			Answers	Notes	Total
5.	**a**		smooth✓ cardiac✓ skeletal✓	*Award **[2]** for three correct responses. Award **[1]** for two correct responses.*	**2 max**
	b		epimysium is the outer surrounding layer (which consists mainly of collagen fibres)✓ perimysium surrounds bundles of muscle fibres✓ muscle fibres which are surrounded in a layer called the endomysium✓ these all connect to a tendon which attaches to the bone to allow muscles to move✓ the muscle cell/fibre is composed of smaller units called myofibrils✓ myofibril is composed of contractile components (protein filaments) known as myosin and actin✓ sarcomere is a basic/functional unit of the muscle cell✓	*Marks are not awarded for reference to striped/striated appearance.*	**4 max**

	c		*insulin:* is released due to high blood sugar✓ increases the uptake of glucose by cells✓ promotes glycogenesis✓ despite a lowering of insulin during exercise the role it had of moving glucose into the cell has enabled by other stimulants ‹eg Ca^{2+}›✓ *glucagon:* is released due to low blood sugar✓ stimulates the breakdown of glycogen into glucose in the blood/glycogenolysis✓ increases in the blood glucose particularly during prolonged periods of exercise when liver glycogen stores are being depleted✓ activates lipolysis✓ promotes the conversion of non carbohydrate sources into glucose for the muscles ‹fats and protein›✓	*Award **[2 max]** for insulin and **[2 max]** for glucagon.*	**4 max**
	d		*for example a highly trained endurance cyclist would:* require greater volume of macronutrients than untrained✓ require more carbohydrates than untrained✓ require more fats than untrained✓ require more protein than untrained✓ require more water than untrained✓ both athletes would require more/greater volume of macronutrients (than a sedentary person)✓	*Accept responses in the converse for an untrained cyclist.*	**3 max**

	e		*oxygen deficit:* oxygen deficit is found in the initial stages/at the start of the long distance cycle race✓ oxygen transport system will not immediately be able to supply the needed quantity of oxygen to the active muscles✓ it will require several minutes before a homeostatic level is reached which is when their aerobic system will be fully functioning✓ the oxygen deficit is calculated simply as the difference between the oxygen required for a given rate of work and the oxygen actually consumed✓ in spite of insufficient oxygen, your muscles still generate the ATP needed through the anaerobic pathways✓ a highly trained cyclist would get to a steady state quicker than if they were in an untrained condition/ their oxygen deficit would be smaller ***OWTTE***✓ *oxygen debt:* occurs after exercise has ceased, known as excess post-exercise oxygen consumption/EPOC✓ even though the muscles are no longer actively working, oxygen demand does not immediately decrease✓ oxygen consumption remains elevated✓ ***OR*** this elevated consumption exceeds that usually required when at rest✓ a highly trained cyclist would get back to a steady resting state quicker than if they were in an untrained condition/ their oxygen debt would be smaller ***OWTTE*** ✓	*Award **[4 max]** for oxygen deficit and **[4 max]** for oxygen debt, not exceeding **[7 max]** in total.*	**7 max**

continued …

	e		*initial stages of oxygen debt/alactacid* stage: removal of CO_2 ✓ replenishment of myoglobin stores with oxygen✓ replenishment of muscle phosphagens/ ATP/ PC stores✓ *later stages of oxygen debt/lactacid stage:* removal of lactic acid✓ replenishment of glycogen stores✓ *causes of EPOC:* re-synthesis of ATP and PCr✓ re-synthesis of blood lactate to glycogen✓ oxidation of blood lactate to energy metabolism✓ restoration of oxygen to blood/tissue fluids/myoglobin✓ the effects of elevated core temperature✓		

6.	**a**	**i**	when a force acts upon a mass, the result is acceleration of that mass/force = mass x acceleration ***OR*** acceleration is proportional to the force acting upon the mass and inversely proportional to the mass of the object ***OWTTE***✓	*Do not accept f = m x a*	**1**
	a	**ii**	the third law states: for every action, there is an equal and opposite reaction✓ must push backwards and downwards with large forces on to the blocks (action force)✓ according to Newton's third law, the blocks will push back with the same force, but in the opposite direction ‹forwards and upwards› (reaction force)✓ as the blocks are connected to the ground ‹which has a much larger mass than the athlete› the ground will not move backwards, but the athlete will move forwards and upwards out of the blocks✓		**2 max**

	b		the position of the centre of mass ‹centre of gravity› of a body or object is the point at which the mass and weight of an object are balanced in all directions/if the object was suspended from that position it would be balanced✓ the centre of mass moves in an object if the shape of that object is altered✓ *Fosbury Flop:* the athlete bends their body like a banana around the bar and their centre of mass is below and outside the body/may be below the bar ***OWTTE*** ✓ the jumper using the Fosbury technique will therefore not have to raise their centre of mass as high as an athlete performing the scissors when clearing the same height✓ using the Fosbury technique the jumper will be able to clear a higher bar compared to using the scissors ‹all other things being equal›✓ *scissors:* the upper body is upright and the legs are horizontal to the body – this puts the centre of mass above the legs/hips/bar✓ the distance between the centre of mass of the athlete and the greatest height cleared is generally 25–30cm✓	*Award **[1 mark]** for a general reference to centre of mass.*	**4 max**

	c		at rest muscles receive approximately 20 % of blood flow, organs receive approximately 80%✓ during exercise this increases to more than 80 % of blood flow at the muscles and a drop of approximately 20% at the organs✓ at rest the blood will be more evenly distributed to regions such as brain, stomach, kidneys, muscles✓ regions such as the stomach, kidneys will require relatively less during the race✓ regions such as the heart, lungs and skin will require greater flow during the race✓ vasodilation increases at regions requiring greater blood flow/vasoconstriction increases at regions not requiring blood flow✓ as the athlete is finishing the race the working muscles will be demanding the greatest percentage of their total body flow✓		**4 max**

	d		*breathing in:* external intercostal muscles contract✓ ***OR*** rib cage moves upwards and outwards✓ diaphragm flattens/contracts✓ additional muscles can also be involved such as the trapezius, sternocleidomastoid/scalene/pectoralis minor/back muscles✓ thoracic cavity volume increases/lungs increase in size/capacity✓ thoracic cavity pressure decreases (therefore air rushes in)✓ air rushes in from high pressure to low pressure/inhalation continues as long as the pressure difference exists✓ *breathing out:* external intercostal muscles relax✓ internal intercostal muscles contract ***OR*** rib cage moves down and inwards actively✓ diaphragm relaxes✓ additional muscles required when working during high intensity exercise would include abdominals/rectus abdominus/external obliques (which act to force air out faster)✓ thoracic cavity volume decreases✓ thoracic cavity pressure increases (therefore air is forced out)✓ Depth and rate of breathing increase during high intensity exercise due to chemoreceptors/proprioreceptors/stretch receptor stimulation✓	*Award **[3 max]** for breathing in and **[3 max]** for breathing out.*	**6 max**

	e		transports oxygen in the red blood cells✓ transports carbon dioxide in the red blood cells✓ carries oxygen from the lungs which has diffused across the tissue membranes (down a concentration gradient)✓ carries carbon dioxide from the working tissues to the lungs to be expired✓ carries oxygen from the lungs to the working tissues to be used✓ hemoglobin has a high affinity for oxygen ✓ higher amounts of hemoglobin will be found in a trained athlete✓		**3 max**

7.	**a**		*specificity:* involves the swimmer training the muscles, skills and/or energy systems that are relevant for their sport✓ a 200 m swimmer should apply specificity by doing most of the training in the pool✓ dry land weights and stretching of the appropriate muscles/movements are useful✓ butterfly swimming at an intensity that the swimmer would expect to perform in the actual event✓ *overload:* involves the swimmer training harder/longer/both than they have previously done✓ the swimmer should apply overload by manipulating combinations of duration/intensity/frequency✓ butterfly swimming at intensities greater than normal to induce adaptation to enable to swim more efficiently/powerfully✓	*Award **[2 max]** per principle.*	**4 max**
	b		a number of subroutines can be put together to make up an executive programme ✓ subroutines: for example start position – feet up on wall/hands gripping and arms lifting body/spring and backward dive/kicking/arm circumduction/arm rotation✓ executive programme: backstroke✓		**2 max**

	c		*open loop:* utilized when skills are well learnt✓ utilized when skills are executed quickly✓ skills are completed without feedback✓ all the information for one movement is sent in a single message to the effectors✓ it will depend on task difficulty and/or level of skill of the performer✓ *closed loop:* closed loop is when a skill uses feedback throughout its execution✓ errors are detected and adjustments are made ‹for example juggling – a performer detects that there is a change in trajectory and adjusts their movements to match›✓ a memory trace is formed in the performer's long-term memory which tells them what to do – that is, the motor programme✓ a perceptual trace is then generated as they perform and this is compared to the memory trace✓	*Award **[2 max]** per programme.*	**4 max**

	d		*memory:* memory allows us to benefit from our past experiences✓ all incoming information is held for a short time in the short-term sensory store ‹STSS›/most of the information in the STSS is lost within about 0.5 second✓ incoming information is only retained and processed if it is attended to in the short-term memory ‹STM›✓ most/90 % of all information entering the STM is lost within 10 seconds✓ retention and passage to the long-term memory are dependent on rehearsal that is processed mentally/physically/both✓ the STM has a small capacity/space limitation✓ the long-term memory has large capacity/no space limitations✓ the way we overcome the limited capacity of the short term memory is by the use of selective attention✓	*Responses should discuss the relationship between memory and selective attention, not simply distinguish between them.*	**4 max**

continued …

	d		*selective attention:* selective attention ‹SA› operates in the short term sensory store ‹STSS›✓ only the relevant information is passed to the short-term memory ‹STM› where it is held for several seconds✓ information selected to the STM can be determined through previous experience and information in the LTM✓ SA ensures that information overload does not occur and prevents confusion as the brain would not be able to cope with streams of information✓ a filtering mechanism operates, which separates the relevant information from the irrelevant ‹noise› information so that athletes concentrate on one cue/stimulus ‹for example the ball, position of player in a game of tennis› to the exclusion of others✓ SA is very important when accuracy/fast responses are required✓ SA can be improved by learning through past experience/practice/coaching✓ which improves a person's anticipation/interaction with long-term memory/memory trace✓		

<table>
<tr>
<td></td>
<td>e</td>
<td></td>
<td>
<table>
<tr><th>Factor</th><th>Skilled</th><th>Novice</th></tr>
<tr><td>consistency</td><td>high</td><td>low✓</td></tr>
<tr><td>accuracy</td><td>high</td><td>low✓</td></tr>
<tr><td>learned nature</td><td>good/autonomous</td><td>poor/cognitive✓</td></tr>
<tr><td>control</td><td>high</td><td>low✓</td></tr>
<tr><td>efficiency</td><td>high</td><td>low✓</td></tr>
<tr><td>fluency</td><td>smooth</td><td>erratic✓</td></tr>
<tr><td>goal direction</td><td>good</td><td>poor✓</td></tr>
</table>
</td>
<td>Award [1] for each correct row. Accept marking points above in form of a valid example, for example efficiency of technique – a swimmer will move further for each stroke and kick made.</td>
<td>6 max</td>
</tr>
</table>