Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2022

Sports, exercise and health science

Standard level

Paper 2

18 pages

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 semi colon (;) 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.

Section A

Question			Answers	Notes	Total
1.	**a**	**i**	heavy and protein;		**1**
1.	**a**	**ii**	90 – 80; 10 <g day^{-1}>;	*Accept 80–89* *9 <g day^{-1}>;* *No ECF*	**2**
1.	**a**	**iii**	for moderate exercise, carbohydrate intake is the same / does not change for both pre- and post-training <may be on 300 g day^{-1} both pre- and post->; for heavy training, carbohydrate intake increases / increases from 300 g day^{-1}< pre> to 340–350 g day^{-1} <post>;		**2**
1.	**a**	**iv**	mean values are similar / not substantively different; standard deviations large/greater than the difference in the mean/overlapping error bars, identifying a large spread of data about the mean, indicating unreliable results; coefficient of variation would be large/greater;		**2 max**
1.	**a**	**v**	heavy workload causes greater muscle tissue damage, greater protein intake is used for repair; heavier workload causes greater hypertrophy, protein required to build new muscle;	*Accept in the converse.* *Do not accept 'more calories required' or discussion of timings.* *There needs to be a specific function for protein.*	**2**
1.	**b**		glycerol and three fatty acids;		**1**
1.	**c**	**i**	power; strength; muscular endurance;		**1 max**

1.	**c**	**ii**	easier to achieve high ecological validity due to familiarity of environment ***OR*** results are more valid due to contextual/comfortable environment; relatively inexpensive/affordable compared to laboratory tests ***OR*** often accessible to coaches/athletes to use in their performance environments; therefore limited expertise required to deliver tests; able to test multiple participants/test participants simultaneously ***OR*** collection of data can be quicker/larger/more accessible compared to laboratory methods; typically, non-invasive therefore more engagement from coaches/athletes; improvements in technology have improved accuracy of field tests;		**4 max**

Question			Answer	Notes	Total
2.	**a**		flat;		**1**
2.	**b**		<isometric> contraction of muscles compresses blood vessels leading to increased blood pressure; diastolic blood pressure increases; systolic blood pressure increases;		**3**

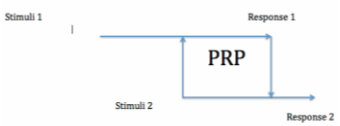
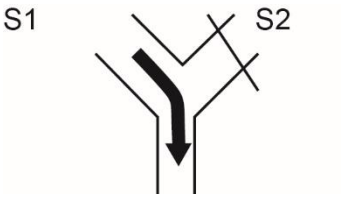
Question			Answer	Notes	Total
3.	a		the point around which the mass of a body is evenly distributed ***OR*** the point which the body is balanced in all directions / OWTTE;		**1**
3.	b		the manipulation of moment of inertia directly affects the gymnast's angular velocity in order to conserve angular momentum throughout the skill ***OR*** rotating objects have angular motion, moment of inertia and angular velocity work inversely to conserve angular momentum once an object is in motion; the moment of inertia of a rotating object can be changed by redistributing the mass of the object about the axis of rotation <enabling the gymnast to perform a somersault>; at the start of the flight phase, the gymnast begins flexes their hips to reduce their moment of inertia; the reduction in moment of inertia increases angular velocity, this allows the somersault to be executed; prior to landing they extend their hips to increase moment of inertia; increasing moment of inertia reduces rotation / slows the gymnast for landing;		**4 max**
3.	c		A: myofibril; B: actin;		**2**

3.	**d**		electrical impulse is generated by the sinoatrial (SA) node; impulse travels across atria <exciting the tissue> and arrives at the AV/VA/atrioventricular node; AV/VA node delays the impulse <0.1 sec> to allow time for atria to contract and force blood into ventricles; impulse passes from the AV/VA node to the AV/VA bundle / bundle of His <into the bundle branches>; impulse conducted rapidly through Purkinje fibres that spread along ventricle walls; once stimulated the ventricles contract/pressure in ventricles forces blood out through main arteries leaving heart;	*MPs can only be awarded in correct sequence order.*	**3 max**
3.	**e**		positive <acceleration>;		**1**

Section B

Question			Answers	Notes	Total
4.	a		*nervous system:* breathing is manipulated by the autonomic nervous system to increase rate <expiratory centre> & increase depth <inspiratory centre> of breathing in response to exercise; respiratory centre is found in the brain stem / medulla oblongata & pons in the brain; chemoreceptors relay information to the respiratory centre regarding lower pH or O_2 / higher CO_2 levels ***OR*** proprioceptors relay information to the respiratory centre regarding action of muscles / spindles / joint receptors; <inspiratory> respiratory centre increases stimulation <via phrenic nerve and intercostal nerves> to the inspiratory muscles <external intercostals and diaphragm>; during exercise inspiratory muscles are stimulated to contract more forcefully; <inspiratory> respiratory centre stimulates additional accessory muscles <sternocleidomastoid, pectoralis minor, scalenes> to contract <to increase depth of breathing>; during forceful ventilation nerve impulses from the inspiratory area activate the expiratory area; stretch / mechano receptors in the lungs <and bronchioles> relay information to the respiratory centre to prevent over inflation of the lungs; in response to stretch receptors, <expiratory> respiratory centre shortens the duration of inspiration / Hering-Bruer reflex; <expiratory> respiratory centre stimulates expiratory muscles <internal intercostals / obliques / rectus abdominus> to contract; expiration moves from passive to active control during exercise;	***Max [2]*** *if no reference to exercise.*	**3 max**

4.	**b**		system can only use glycogen/glucose as a fuel source; glucose is converted into pyruvate; system produces a low yield / 1 glucose produces 2ATP <net>; in the absence of oxygen pyruvate is converted to lactate/lactic acid; byproducts of lactic acid system are lactic acid, <hydrogen ions, lactate>; system resynthesizes ATP at a rapid rate;		**4 max**
4.	**c**		contractility: capacity to shorten under tension; extensibility: stretches beyond resting length when other muscles act across a joint; elasticity: ability to return to resting length after being stretched beyond its normal resting length; atrophy: the partial or complete wasting away of muscle; muscular hypertrophy: the enlargement of muscle from the increase in size of its cells; controlled by nerve stimuli and fed by capillaries;		**3 max**

4.	**d**		psychological refractory period; is the increase in response time (RT) to a second stimulus caused when the second stimulus has been delivered while the performer is responding to the first stimulus ***OR*** time delay in RT caused by the arrival of a second stimulus before the first is processed ***OR*** when a second stimulus arrives before the first response is completed; reaction to the second stimulus is longer as the first response is still being processed ***OR*** player has to sort out new and correct stimulus, but first they have to disregard the old and now useless stimulus and this causes the delay; hoping the defender has been distracted by the fake move as they cannot respond until the full reaction/response 1 has been processed by the brain; brain processes one action at a time causing a time delay in responding to the second stimulus ***OR*** the single channel hypothesis states that each stimulus can only be processed one at a time ***OR*** a second stimulus must wait until the first has been processed ***OR*** each stimulus we process has to progress through a single track ***OR*** any subsequent stimulus must wait for the one before it to be processed before it can be dealt with;	*Award **[1]** stating for the concept.* *Accept diagram to assist with explanation.*  	**4 max**

<table>
<tr>
<td>4.</td>
<td>e</td>
<td></td>
<td>
<table>
<tr><td>marathon runner</td><td>OR</td><td>long jumper</td><td></td></tr>
<tr><td>higher proportion of slow twitch / lower fast twitch</td><td></td><td>higher proportion of fast twitch / lower slow twitch</td><td>;</td></tr>
<tr><td>high capillary density to increase delivery of nutrients and oxygen to muscle;</td><td>;</td><td></td><td></td></tr>
<tr><td>high myoglobin content to transport oxygen to mitochondria</td><td>;</td><td></td><td></td></tr>
<tr><td>high mitochondrial density where aerobic respiration occurs</td><td>;</td><td></td><td></td></tr>
<tr><td>high triglyceride stores are dominant energy fuel at rest</td><td>;</td><td></td><td></td></tr>
<tr><td>high oxidative enzyme activity assists in use of oxygen for aerobic respiration</td><td>;</td><td></td><td></td></tr>
<tr><td>low peak force produced</td><td></td><td>high peak force produced</td><td>;</td></tr>
<tr><td>low fatigability due to fatiguing byproducts <such as lactate, hydrogen ions></td><td></td><td>high fatigability due to fatiguing byproducts <such as lactate, hydrogen ions></td><td>;</td></tr>
<tr><td>Aerobic- the predominant energy system due to structural characteristics of fibres</td><td>;</td><td></td><td></td></tr>
<tr><td></td><td></td><td>high PC stores for rapid restoration of ATP</td><td>;</td></tr>
<tr><td></td><td></td><td>high carbohydrate stores as only food fuel to be broken down without oxygen;</td><td>;</td></tr>
</table>
</td>
<td>Require an explanation for mark, candidates cannot just list structural and functional characteristics.

Max [4] for either athlete.</td>
<td>6 max</td>
</tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Notes</th><th>Total</th></tr>
<tr><td>5.</td><td>a</td><td></td><td>
<table>
<tr><td></td><td>smooth</td><td>cardiac</td><td></td></tr>
<tr><td>striated</td><td>no</td><td>yes</td><td>;</td></tr>
<tr><td>location</td><td>hollow organs e.g., intestine, stomach
OR
wall of blood vessels
OR
lining of tracts e.g., respiratory tract</td><td>heart</td><td>;</td></tr>
<tr><td>stimulation external to organ</td><td>only external</td><td>internal and external</td><td>;</td></tr>
<tr><td>shape</td><td>single tapering cells</td><td>branching cells</td><td>;</td></tr>
<tr><td>intercalated discs</td><td>no</td><td>yes</td><td>;</td></tr>
</table>
</td><td>Candidates must distinguish muscle characteristics to be awarded a mark.

Accept any suitable example of the location of smooth muscle. Do not accept organs only.

Accept any accurate additional structural difference.</td><td>2 max</td></tr>
</table>

5.	**b**		velocity / speed of take-off: increasing acceleration / momentum so that their greater force at take-off results in greater distance; ensure their run up is long enough to so that they are at maximum speed; ensure their run up is measured so that they do not do any stutter steps and lose speed; ensure that they jump off their favoured foot for maximum power transfer; angle of take-off: alter angle of take-off by jumping higher or lower to achieve optimal release angle; height of take-off: centre of mass higher on take-off than landing to increase flight time ***OR*** raising arms leads to a higher centre of mass which leads to greater flight time / distance jumped;	***Max [1]*** *if 3 factors are only listed.* ***Max [3]*** *if only 1 described factor is given.*	**4 max**
5.	**c**		improved oxygen transport <from the lungs> to the muscles; increased oxygen levels allow the body to utilize aerobic system to a greater degree; wider availability / variety of fuel sources as aerobic system can use carbohydrates, fats and protein as fuels; reduced reliance of lactic acid system which produces fatiguing byproducts; able to work at a higher intensity for a longer period without fatigue; improved A-VO_2 difference / efficiency of oxygen exchange;		**4 max**

5.	**d**		*elite athlete:* detection: able to filter actual signals from the distraction of “noise”; can correctly interpret signals more than novice athlete due to experience; selective attention to correct stimulus / ability to detect signals sooner than novice; comparison: has a more extensive long-term memory bank to draw on to compare the stimuli to; recognition: the process of finding a corresponding stimulus in memory is more developed; able to spend little/no attention focused on executing movement they are in autonomous phase of learning therefore full focus on signals received;	*Accept appropriate explanation in the converse.*	**4 max**
5.	**e**		*closed loop:* *e.g. handstand in gymnastics / downhill skiing;* error detection made during the execution of motor programme; correction made during execution of motor programme; memory trace: recall of previous actions initiates action; memory trace strengthened from practice and feedback; perceptual trace: guidance of body part during the action. In the event of an error the limb is adjusted; *open loop:* *e.g. action phase of a golf swing / hitting a baseball;* postulated that movements require attention only for initiation of the first action; feedback is received however ongoing movements cannot be modified when unforeseen changes occur;	***Max [4]** per loop**.*** ***Max [2]** for correct sporting examples; open [1] and closed loop [1] perspectives.*	**6 max**

Question			Answer	Notes	Total
6.	**a**		command style teacher led instruction with minimal student autonomy; inherent dangers within activity / to control safety factors; teaching style most appropriate for novice / low skill level;		**3**
6.	**b**		solid/liquid at rtp*;* mainly animal*;* only single bonds between carbon atoms;	***Max [1]*** *for an example.* *Accept the converse for unsaturated fats.*	**3**
6.	**c**		*Phenomenon* occurs during prolonged submaximal exercise; reduction in blood volume due to sweating ***OR*** reduction in blood volume leads to increase blood viscosity; reduced blood volume results in decrease in stroke volume; heart rate increases to maintain cardiac output; vasodilation causes a reduction of blood flow to working muscles; *Prevention* maintain hydration to maintain blood viscosity; decrease exercise intensity; exercise during cooler part of day; wear clothing which allows air flow;	***Max [4]*** *for phenomenon.* ***Max [1]*** *for prevention.*	**5 max**

6.	**d**		action of rotation causes the air to be dragged around the rotation of the ball; this causes increased air velocity underneath the ball and a decreased air velocity on the top; there is an inverse relationship between air flow velocity and air pressure which is expressed in the Bernoulli principle; resulting in a high pressure area on the top and a low pressure on the bottom of the ball; the ball will move towards the low pressure area / downwards; the ball will drop on to the table sooner <than with either no spin or backspin> / reduce the distance the ball travels before hitting the table;	*Accept marking points as annotations on a diagram.*	**4 max**
6.	**e**		intensity of activity; *e.g.* in explosive activities the dominant activity is the ATP–PC system ***OR*** *e.g.* sprint finish which will cause a switch from aerobic to anerobic; duration of activity; *e.g.* 100m will be dominated by ATP–PC, 800m anaerobic glycolysis, marathon aerobic; availability of fuel sources; *e.g.* not having sufficient ATP–PC drives energy system to anaerobic glycolysis ***OR*** *e.g.* previous interval training loads will deplete muscle glycogen which will reduce the use of anerobic/aerobic glycolysis and cause switch to fat oxidation; the amount of recovery time available; *e.g.* submaximal activity / passive rest to replenish PC ***OR*** *e.g.* sufficient time to rid the body of <negative by-products> hydrogen ions/lactate;	***Max [2] f****or each given factor.* ***Max [3]*** *for stating the factors with no relevant example/explanation.*	**5 max**