Markscheme

November 2018

Sports, exercise and health science

Standard level

Paper 2

17 pages

Section A

Question			Answers	Notes	Total
1.	**a**	**i**	gymnasts with high training level ✓	*Both gymnast **and** high required for [1] mark*.	**1**
1.	**a**	**ii**	160–140 ✓ =20 **«**cm**»** ✓	*Accept the subtraction in a different order.* *Accept correct calculation if (a)(i) is incorrect.*	**2**
1.	**a**	**iii**	children who regularly participate in sport perform better on standing broad jump ✓ gymnasts perform better than children from other sports across all participation levels ✓ A high level/ >5hr per week of training appeared to have a significant effect on standing broad jump performance in every sport when compared to the other 2 groups/ the greater the training the greater the effect✓	*Accept other reasonable hypothesis.*	**2**
1.	**a**	**iv**	low to moderate training level group did not show **«**statistically**»** significant results ✓ moderate and high training level group did show **«**statistically**»** significant results/ showed they were significantly different to 95% ✓ low and high training level group did show **«**extremely statistically**»** significant results/ showed they were significantly different to 99% ✓	*Accept response if "significant" is mentioned once but implied in the rest of the answers. Eg the low to moderate training level did not show significant results but the moderate and high training level group and the low and high training level group did.*	**3**
1.	**b**	**i**	vertical jump/Sargent test ✓	*Accept valid tests eg Wingate, Margaria-Kalamen.*	**1**
1.	**b**	**ii**	place a vertical marker from a standing position ***OR*** create a "baseline" measurement ✓	*Despite current research award **[1]** mark for warm-up.* *Accept protocols for alternate valid test from (b)(i).*	**3 max**

			perform a two-foot take-off ✓ bending knees/swinging the arms for the take-off ✓ place a vertical marker at the apex of the jump ✓ power is measured as the distance from standing position marker to marker at the apex of the jump✓		
2.	**a**		elasticity ✓		**1**
2.	**b**		tendons connect muscles to bones ✓ ligaments connect bones to bones ✓ ligaments/ tendons stabilize joints ✓ tendons enable flexion and/ or extension of the joint✓	1 max for ligaments or tendons	**2 max**
2.	**c**		cycling produces higher maximal oxygen consumption/VO_2max values than arm ergometry ✓	*Accept in the converse.*	**1**
2.	**d**		Gases/O_2 move from a high to low partial pressure / concentration gradient✓ Oxygen partial pressure is higher in the lungs than in the capillary OR oxygen/O_2 moves from the lungs/alveoli to the pulmonary capillaries ✓ Gases/O_2 diffuse across the membranes / into blood✓ The capillary and alveoli walls are 1 cell thick <which assists in the high rate of diffusion>✓ A large surface area increases diffusion rate✓ the amount and rate of gas exchange that occurs across the membrane depends on the partial pressure of O_2, the thickness of the wall and the surface area <which is Fick's Law>✓ <98%> oxygen combines with hemoglobin <to form oxyhemoglobin>✓		**4 max**

2.	**e**		<table><tr><td></td><td>untrained</td><td>trained</td><td></td></tr><tr><td>stroke volume</td><td>lower</td><td>higher</td><td>✓</td></tr><tr><td>resting heart rate</td><td>higher</td><td>lower</td><td>✓</td></tr><tr><td><Maximal> cardiac output</td><td>lower</td><td>higher</td><td>✓</td></tr><tr><td colspan="3">For a set task at submax level Q will be the same but SV will be higher in trained</td><td>✓</td></tr><tr><td colspan="3">and HR will be higher in untrained</td><td>✓</td></tr></table>		**3**

3.	**a**		changes the electrical/neural impulse into a chemical stimulus at the motor end plate ***OR*** ACh is released when an action potential arrives at the motor end plate ✓ ACh binds to post synaptic receptors✓ increases membrane permeability to sodium ions/Na^+ ✓ which causes Ca^{++} to be released <into the muscle cell> ✓ ACh is broken down < by cholinesterase> to prevent continual muscle stimulation✓		**2 max**
3.	**b**		Type I has a high density of capillaries and mitochondria✓ high capillary density allows for increased oxygenation ✓ high mitochondrial density allows for increased use of oxygen ***OR*** high mitochondrial density allows for use of aerobic respiration **«**producing high amounts of ATP**»** ✓ both contribute to activities that require prolonged energy supply		**2 max**

			OR increases fatigue resistance ✓		
3.	**c**		insulin production is a response to high blood sugar/glucose levels ✓ insulin stimulates glucose uptake from the blood into skeletal muscle ***OR*** insulin improves cell membrane permeability to glucose ✓ muscle contraction stimulates glucose uptake from the blood into skeletal muscle ***OR*** exercise improves cell membrane permeability to glucose ✓ increased sensitivity leads to decreased insulin/glycogen production ✓	*Award [2 max] for either insulin or muscle contraction*	**3 max**

Section B

<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>Feature</th><th>Skeletal</th><th>Cardiac</th><th>Smooth</th><th></th></tr>
<tr><td>Movement</td><td>Voluntary</td><td>Involuntary</td><td>Involuntary</td><td>✓</td></tr>
<tr><td>Structure</td><td>Cells are bound together into bundles by connective tissue known as fascia connected to bone by tendon</td><td>Structure is somewhere between skeletal and smooth. The branched fibres are not attached to bone</td><td>Cells are small and not attached to bone.</td><td>✓</td></tr>
<tr><td>Striated</td><td>Yes</td><td>yes</td><td>no</td><td>✓</td></tr>
<tr><td>Nucleus</td><td>Cells or fibres are multinucleate</td><td>Cells have a single nucleus.</td><td>Cells are single nucleus.</td><td>✓</td></tr>
<tr><td>Location</td><td>Found in skeletal muscles, e.g.: biceps, triceps …</td><td>heart</td><td>hollow tubes such as digestive tract, blood vessels</td><td>✓</td></tr>
<tr><td>Nervous stimulation</td><td>somatic motor neurons</td><td>autonomic nervous system</td><td>autonomic nervous system</td><td>✓</td></tr>
</table>
</td><td></td><td>3</td></tr>
</table>

<table>
<tr>
<td></td><td></td><td></td>
<td>
<table>
<tr><td>Tension sensors</td><td>Yes</td><td>no</td><td>no</td><td>✓</td></tr>
<tr><td>Stretch receptors</td><td>Yes</td><td>no</td><td>no</td><td>✓</td></tr>
</table>
</td>
<td></td><td></td>
</tr>
<tr>
<td>4.</td><td>b</td><td>i</td>
<td>motor programme is a set of movements stored as a whole in the memory
«regardless of whether feedback is used in their execution»
OR
consists of an executive programme and subroutines✓</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><u>4.</u></td><td><u>b</u></td><td><u>ii</u></td>
<td>practice of the motor programme/subroutines for a jump/gymnastics routine improves proficiency ✓

improved proficiency reduces executive programmes to subroutines as the movement has become more fluid ✓

this results in opportunity to practice more complex motor programmes such as a hand spring ✓</td>
<td>Accept any valid example that refers to a gymnastics routine.</td>
<td>2 max</td>
</tr>
</table>

<table>
<tr>
<td>4.</td>
<td>c</td>
<td></td>
<td>
the nature of muscle contraction during static and dynamic exercise affect the peripheral vascular resistance differently ✓

during static exercise muscles create higher pressure on the blood vessels in contrast to dynamic exercise which results in lower pressure on the blood vessels ✓

during static exercise there is an increase even in diastolic BP because the muscles exert continuous pressure on the vascular system / the loss of the vascular pump ✓
<table>
<tr><td></td><td>Systolic BP</td><td>Diastolic BP</td><td></td></tr>
<tr><td>running</td><td>higher than rest
«~150 mm Hg»</td><td>Little or no change from rest
«~80 mm Hg»</td><td>✓</td></tr>
<tr><td>plank position</td><td>much higher than rest «~200 mm Hg»</td><td>higher than rest «~150 mm Hg»</td><td>✓</td></tr>
</table>
</td>
<td>Award [2 max] if no explanation.</td>
<td>4 max</td>
</tr>
<tr>
<td>4.</td>
<td>d</td>
<td></td>
<td>
input detection occurs / detected by the sense organs/interoceptors/exteroceptors ✓

information can come from intrinsic and extrinsic feedback/sources✓

information is briefly stored in short term sensory store ✓

relevant information is perceived/attended to through selective attention/signal detection process ✓

the necessary information is passed on to short-term memory ✓
</td>
<td></td>
<td>4 max</td>
</tr>
</table>

4.	**e**		during «approximately» the first minute all energy systems will be working ✓ during an 800 m run, energy systems do not respond in a sequential manner ✓ ATP-CP system: ATP production is from the breakdown of phosphocreatine <anaerobically> during initial seconds of activity ✓ 1 PC = 1 ATP ✓ may contribute at other times of rapid change in energy demand <as long as a steady state is found where the athlete settles into a pace> such as at the end of the race ✓ can only last for 10–15 seconds/ short bursts ✓ Lactic Acid System: partial breakdown of glucose anaerobically to produce ATP ✓ 1 glucose molecule = <net> 2ATP ✓ will dominate after the ATP-PC system up to 1–2 minutes <while the aerobic system gets fully functional> ✓ The lactic acid system will dominate at other times where effort increases towards 100% such as during the final sprint ✓ Aerobic System: The aerobic system will dominate from approx. 1–2 minutes as the runner settles into their race pace ✓ 1 glucose molecule = 38 ATP with the aerobic system ✓ Complete breakdown of glucose molecule in the presence of oxygen ✓	*Award [3 max] for each energy system and [5 max] if only 2 energy systems are discussed*	**6 max**

5.	**a**		ventilation is **«**chemically**»** regulated by blood acidity levels/low pH ✓ blood acidity levels increase/pH drops due to an increase in carbon dioxide levels ✓	*Accept appropriately labelled diagram.*	**3 max**

			blood acidity levels are detected by chemoreceptors ✓ medulla oblongata/ANS/respiratory control centre receive information from receptors ✓ increased blood acidity **«**and information from the proprioceptors**»** increases the depth / rate of ventilation ✓		
5.	**b**		deficit is calculated as the difference between the oxygen required for a given rate of work and the oxygen actually consumed ✓ deficit takes place during the initial stages of exercise ✓ muscles generate ATP through anaerobic pathways ✓ oxygen transport system is not immediately able to supply the needed quantity of oxygen to the active muscles ***OR*** oxygen consumption requires several minutes/time before a homeostatic level is reached ✓ homeostatic level is reached when the aerobic system meets the demands ✓ is repaid after exercise is finished✓		**3 max**

5.	**c**		rehearsal ✓ information is processed mentally or physically ✓ coding ✓ labelling sets of information to make it easier to access ✓ brevity ✓ giving a learner a small amount of information at a time to avoid overload ✓ clarity ✓ keeping learning / teaching simple at the beginning ✓ avoiding to teach / learn similar but distinct items in the same session **«**to avoid interference with the memory of the other**»** ✓ chunking ✓ learners retain more if the information is chunked **«**instead of being presented as individual items**»** ✓ organization ✓ we remember more easily if we organize the way in which we are to learn and ensure that the information is meaningful ✓ association ✓ ensuring that new learning is linked to what players already know ✓ practice ✓ establishes memory trace/pathway ✓	*Award [1 max] for a list of methods.* *Award [2 max] per memory aid.* *Description must correspond to the named method to obtain the mark.*	**4 max**

5.	**d**		Angular momentum=moment of inertia x angular velocity ✓ angular momentum is conserved after push off/take off ***OR*** the magnitude of angular momentum remains constant ✓ with decrease in radius the body has lower moment of inertia ✓ the speed of rotation/rotational velocity increases with decreased radius/body being in a compact shape ***OR*** *eg* moving arms/legs closer in will increase the speed of rotation ✓ when an athlete wants to stop the spin, they increase the radius to decrease the rotational velocity ✓	*Award [2 max] if no reference to an example is included.*	**4 max**
5.	**e**		sodium ions/Na^+ enter the muscle and change the polarization in the myofibril ✓ the sarcoplasmic reticulum releases calcium ions ✓ calcium ions bind to troponin ✓ Tropomyosin/troponin complex exposes the binding site **«**on actin**»** ✓ myosin **«**head**»** creates a cross-bridge with the actin ✓ power stroke takes place ✓ z lines come closer together / H zone gets smaller✓ myosin releases actin if new ATP appears ✓ myosin head reattached further down the actin filament repeating the cycle < called the ratchet mechanism>✓ process goes on until acetylcholine-esterase breaks the acetylcholine down ✓		**6 max**

6.	**a**		<table><tr><td>fibrous/ synarthrosis</td><td>no movement</td><td>✓</td></tr><tr><td>cartilaginous/ amphiarthrosis</td><td>slight movement</td><td>✓</td></tr><tr><td>synovial/ diarthrosis</td><td>freely movable</td><td>✓</td></tr></table>		**3**

6.	**b**		Cardiovascular drift is an increase in heart rate during prolonged exercise <despite effort remaining the same>✓ during prolonged exercise there is an increase in core temperature ✓ the rise in core temperature causes redistribution of blood to the periphery in order to cool ✓ the blood volume redistribution causes the heart to work harder in order to maintain muscle blood flow / energy demands✓ blood flow to skin increases and water is lost via sweating ✓ prolonged cooling/sweating causes a decrease in blood volume / increase in viscosity✓ reduction in venous return/stroke volume causes the heart rate to increase to maintain cardiac output ✓		**3 max**
6.	**c**		creatine phosphate/CP/PCr is a high-energy molecule/fuel ✓ speed of breakdown is increased by creatine kinase ✓ CP is broken down to provide a phosphate molecule for the re-synthesis of ATP/ energy released is used to add Pi to ADP **«**endothermic reaction**»** ✓ reaction is a coupled reaction where one reaction is linked to another reaction ✓ releases energy **«**exothermic reaction**»** and phosphate molecule/Pi ✓ 1 PC = 1ATP✓ does not require oxygen✓ is the first system to provide ATP / occurs in the first 10–15sec of exercise✓	*Accept a reaction equation.*	**4 max**

6.	**d**		force is proportional to acceleration / F=ma ***OR*** more force yields greater acceleration ✓ *eg* kicking harder/application of more force increases the acceleration of a ball ✓ mass is proportional to the force / $m = \frac{F}{a}$ ***OR*** smaller mass yields greater acceleration with application of the same amount of force ✓ *eg* decreasing the weight of gear in cycling allows for more acceleration when the same force in pedaling is applied ✓ longer application of the same force causes greater acceleration ✓ acceleration occurs in the direction of the force ✓	*Accept other valid examples.* *Award [3 max] if no example provided*	**4 max**

6.	**e**		psychological refractory period/PRP is the increase in reaction time to a second stimulus caused when the second stimulus has been delivered while the performer is responding to the first stimulus OR it is the time delay in reaction time caused by the arrival of a second stimulus before the first is processed ✓ this is believed to take place due to brain processing information on a single track/using the single channel mechanism ✓ in sports you can use PRP as an advantage by introducing a dummy stimulus before the real movement ✓ strengths: can be used to help a performer have greater chances of success *eg* pretending to pass / run one direction then quickly changing to pass / run the other way ✓ provides a performer with a greater range of options in their play ✓ external noise *eg* other players calling, or crowd noise can enhance the effectiveness of the PRP ✓ the more options that a player has will increase the reaction time to the stimulus <Hick's law> ✓ limitations: if a performer uses it too often, they will become predictable and this limits success✓ PRP may be reduced by anticipation / early cue detection / effective coach analysis / practicing «open» skills ✓ anxiety might make the performer get the timing wrong and thus the PRP is not effective ✓	*Award [2 max] for an annotated diagram of the single channel hypothesis for mark points 1 and 2.* *Award 4 [max] if only strengths or limitations provided* *Award [4 max] if no example given*	**6 max**