

**GCE**

**Physical Education**

Unit **H155/01**: Physiological factors affecting performance

Advanced Subsidiary GCE

**Mark Scheme for June 2017**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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## Annotations

Annotation	Description	Annotation	Description
	Tick	<b>KU</b>	Knowledge and understanding / indicates AO1 on Q4
	Cross	<b>EG</b>	Example/Reference / indicates AO2 on Q4
<b>BOD</b>	Benefit of doubt	<b>DEV</b>	Development / indicates AO3 on Q4
<b>TV</b>	Too vague	<b>L1</b>	Level 1 response on Q4
<b>REP</b>	Repeat	<b>L2</b>	Level 2 response on Q4
<b>IRRL</b>	Significant amount of material which doesn't answer the question	<b>L3</b>	Level 3 response on Q4
<b>SEEN</b>	Noted but no credit given / indicates sub-max reached where relevant		

Available but not used: 'BP' (blank page) – 'SEEN' is used; 'K' (knowledge) – Tick is used except on Q4 where 'KU' is used.

- Sub-maxes are indicated with **SEEN**; the guidance section of the mark scheme shows which questions these are relevant to.
- **KU** and **DEV** used instead of ticks on the extended response question to indicate where knowledge or development points from the indicative content have been made.
- On the extended response question (Q4), one KU or DEV does not necessarily equate to one mark being awarded; the marking is based on a levels of response mark scheme which awards a level and mark holistically based upon the quality of the response overall against the levels descriptors.

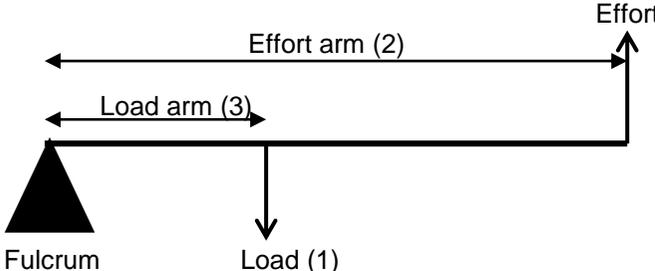
Section A							
Question			Answer			Marks	Guidance
1	(a)	(i)		<b>Movement</b>	<b>Agonist</b>	4 (AO3)	<b>Accept: Psoas Major / Iliacus</b>  <b>Do not accept: Gluteals / Glutes / Gluteus medius / Gluteus Minimus</b>
			<b>Left hip</b>	1. Flexion	2. Iliopsoas		
			<b>Right hip</b>	3. (Hyper)extension	4. Gluteus maximus		
		(ii)	1. Fast glycolytic / FTG/ FG / Type II(b)			1 (AO2)	<b>Do not accept: Fast Twitch on own / Fast oxidative/FOG</b>
		(iii)	Two marks from:  1. (force) High/ large force of contraction produced <b>therefore</b> high strength/ high power produced/ discus travels further greater distance/ stays in the air for longer 2. (speed) High/ speed of/ quick/ fast contraction produced <b>therefore</b> discus released at high speed/ explosively/ accelerates quickly/ high power produced/ discus travels further greater distance/ stays in the air for longer			2 (AO2)	<b>Each point must be explained, so both parts of answer are needed. Look for linking words e.g. 'which means' or 'therefore'</b>  <b>Look for two answers in one sentence (Speed and force of contraction high so the discus travels further)</b>
	(b)	(i)	Two marks from:  1. (Electrical) Impulse/ Stimulus causes an action potential/ travels down the axon 2. Release of sodium/ NA <sup>+</sup> (ions) causes depolarisation 3. <b>Neurotransmitter</b> or <b>acetylcholine</b> (ACh) is released/ travels across synaptic cleft/ binds with receptors in the sarcolemma 4. If the electrical charge is above threshold 5. Impulse stimulates/ innervates motor unit/ muscle fibres/ causes wave of contraction/ causes muscles to contract 6. 'All or none' law means all fibres within motor unit contract (or none contract)/ in an 'all or none' fashion			2 (AO1)	Accept any order as long as it doesn't hinder understanding  Do not credit: 'All or none' on its own

Section A			
Question	Answer	Marks	Guidance
	(ii) Four marks for:  (frontal) 1. Divides body into front and back/ anterior and posterior portions (vertically)/ abduction and adduction occur in this plane 2. e.g. lateral raises or cartwheel (sagittal) 3. Divides body into left and right parts/ (vertically)/ flexion and extension/ plantar flexion and dorsi-flexion occur in this plane 4. e.g. biceps curl or forward roll	<b>2</b> (AO1) <b>2</b> (AO2)	Even if description is incorrect credit any correct examples.
	(c) Three marks for:  1. (Atrial systole) - atria contract <b>which</b> forces blood into the ventricles 2. (Ventricular systole) – ventricles contract <b>which</b> pumps blood out of the heart/ into the aorta and pulmonary artery/ to the body and the lungs 3. (Diastole) – relaxation phase or atria/ ventricles relax <b>which</b> allows blood to enter heart	<b>3</b> (AO1)	Candidate must link description of term to its effect on blood flow.
	(d) (i) Two marks for:  1. Minute ventilation = tidal volume/TV x (breathing) frequency <b>or</b> 0.5 x 12 2. <u>6 l/min</u> or <u>6 litres/minute</u> or <u>6lmin<sup>-1</sup></u>	<b>2</b> (AO3)	<b>Must have correct units for point 2</b>
	(ii) Two marks from:  1. Receptors to RCC (respiratory control centre)/ IC (inspiratory centre) or baroreceptors/ lung stretch receptors to EC (expiratory centre) 2. (Inspiratory centre) stimulates nerves/motor neurones to increase <b>depth</b> of breathing 3. Phrenic nerve stimulates diaphragm to contract <b>more</b> strongly 4. Intercostal nerves stimulate external intercostals to contract <b>more</b> strongly/with <b>more</b> force 5. Recruitment of any named additional muscle (e.g. Sternocleidomastoid/ scalenes/ pectoralis minor/ internal intercostals/ rectus abdominis/ external obliques)	<b>2</b> (AO1)	<b>Accept any named receptor e.g. chemoreceptor, proprioceptor, baroreceptor, mechanoreceptor, thermoreceptor for point 1.</b>

Section A					
Question	Answer		Marks	Guidance	
2	(a)	<p>Two marks from:</p> <ol style="list-style-type: none"> <li>1. Intervals of breathing air low in oxygen <b>and</b> normal air</li> <li>2. Using a mask (to deliver hypoxic air)/ altitude generator</li> <li>3. Work interval last several minutes or sessions last from 15-90 minutes</li> <li>4. Training can last from 4-8 weeks</li> </ol> <p>Two marks for:</p> <ol style="list-style-type: none"> <li>5. (Benefit) Increase in EPO/ haemoglobin/ red blood cells/ oxygen carrying capacity of blood or improved mitochondrial status/ volume / increase rate of aerobic adaptation to training/ don't require high altitude/ easier/ less expensive/ less disruptive than altitude training/ good for endurance performers/ increased intensity and duration before fatigue/ increase endurance</li> <li>6. (Risk) Reduced speed/ power output/ oxygen flux/ increased fatigue <b>or</b> not safe for those with respiratory or cardiovascular health issues/ lose motivation or disrupt training patterns/ decreased immune function/ benefits quickly lost after training ceases/ hard to reach normal work rates under hypoxic conditions</li> </ol>	<p><b>4</b> (2 x AO1 2 x AO3)</p>	<p><b>Sub max 2 for describing hypoxic training</b></p> <p>Do not credit reference to altitude training</p>	
	(b)	(i)	<p>Two marks for:</p> <ol style="list-style-type: none"> <li>1. (Age) <math>VO_2</math> max is reduced as a performer gets older/ from early 20s onwards/ <math>VO_2</math>max reduces approximately 1% per year from the early 20s/ reduction in tissue elasticity</li> </ol> <p><b>1 mark max from:</b></p> <ol style="list-style-type: none"> <li>2. (Gender) Males have a higher <math>VO_2</math> max than females/ males 10-15ml/kg/min higher than females</li> <li>3. (Gender) Males have better oxygen transportation capacities/ higher larger lung capacities/ higher stroke volume/ more blood plasma/ higher cardiac output</li> <li>4. (Gender) Males have greater oxygen utilisation capacity/ greater mass of slow twitch muscle fibres/ greater density of mitochondria</li> </ol>	<p><b>2</b> (AO1)</p>	<p>Accept opposites.</p>
		(ii)	<p>Three marks from:</p> <ol style="list-style-type: none"> <li>1. (Duration)allows players to last <b>full duration</b> of match/ <b>90 minutes</b></li> <li>2. (Fatigue) allows players to delay or offset OBLA/ delay fatigue/ <b>maintain</b> intensity (during extra</li> </ol>	<p><b>3</b> (AO3)</p>	

Section A					
Question		Answer	Marks	Guidance	
		time) 3. (Intensity) allows teams to play at high(er) tempo/pace/intensity/press/defend high(er) up pitch 4. (Recovery) allows quick(er) recovery after anaerobic work / can sprint often 5. Some players/goalkeepers do not need high VO <sub>2</sub> max			
	(c)	(i)	Three marks for:  1. (Carbohydrates) provide energy for training/ competition 2. (Vitamins) essential functions for health or strengthen/ repair tissue or boost immunity <b>which means</b> training is not disrupted by illness/muscle injury 3. (Fibre) digestive health or stabilises glucose/ cholesterol levels/ prevents constipation <b>which means</b> gymnast has more energy for training/ more comfortable for performance/ weight control/ absorb more nutrients	<b>3</b> (AO2)	<b>Function of each nutrient must link to gymnast in training.</b>  <b>Point 3: credit reference to fibre having any benefit for gymnast</b>
		(ii)	Two marks for:  1. (High fat) weight gain/ increased body fat mass/ increased % body fat/ obesity/ diabetes/ CHD/ a diet high in high density lipoproteins e.g. avocados could lead to less cholesterol. 2. (Low protein) lower immunity/ increased risk of illness/ infections or lower muscle mass/ less opportunity for muscle hypertrophy/ slower repair of muscle/ decreased efficiency of actin and myosin/ reduced efficiency of sliding filaments/ slower nerve transmission to muscle	<b>2</b> (AO3)	<b>Do not accept more fat/fatter on its own for point 1.</b>
	(d)		Six marks for:  1. (Preparatory) Pre-season training or training in 6-8 weeks leading up to season/ event/ high intensity and high volume of training/ developmental phase/ aim to increase general fitness or sport specific fitness/ principles of progressive overload and specificity applied/ develop technique 2. E.g. Have peak physical fitness for the start of rugby season/ athlete develops components of fitness in order to peak for summer competitions (Olympics/ World Cup etc)	<b>6</b> (AO1 x3, AO2 x3)	Credit appropriate description of sport specific fitness for point 1, e.g. increase strength

Section A					
Question			Answer	Marks	Guidance
			3. (Competitive) The full or 'in' season during which the sport/activity takes place/ aim to peak for significant events/ tapering to reduce work load/ allow plenty of recovery/ maintain intensity but reduce volume of training/ principles of moderation applied 4. E.g. Plan specific tactics for an up-coming rugby match <b>or</b> maintain fitness intensity during football season/ perform at peak level in open tennis tournament/ win a medal/ reach personal best. 5. (Transition) Post/Off-season/period of time (2-4 weeks) at end of the competitive season/ rest and recovery/ principles of variance, moderation and reversibility applied/ aim to maintain motivation and fitness with variety of non-specific activities 6. E.g. Rest and recovery from physical strain of rugby season <b>or</b> change of activity to maintain motivation for a gymnast without losing fitness		
3	(a)	(i)	1. B. The runner is at constant velocity	1 (AO2)	
		(ii)	1. Air resistance/AR is equal to friction/F <b>or</b> AR = F <b>or</b> balanced forces <b>or</b> net force = 0	1 (AO2)	
	(b)	(i)	1. 2 <sup>nd</sup> law of motion / law of acceleration / NL 2	1 (AO2)	
		(ii)	1. 1 <sup>st</sup> law of motion / law of inertia / NL1	1 (AO2)	
		(iii)	1. 1 <sup>st</sup> law of motion / law of inertia / NL1	1 (AO2)	
	(c)	(i)	1. The <b>quantity</b> of motion (possessed by a moving body) <b>or</b> the impetus gained by a moving object 2. mass x velocity <b>or</b> $70 \times 10$ 3. $700\text{kgm/s}$ <b>or</b> $700\text{kgms}^{-1}$	3 (AO1 x 1, AO3 x 2)	<b>Must have correct units to gain point 3.</b>

Section A			
Question	Answer	Marks	Guidance
	(ii) 1. Speed/velocity = $(700 \div 100 =) \underline{7\text{m/s}}$ or $\underline{7\text{ms}^{-1}}$	1 (AO3)	
(d)	Two marks from: (weight) 1. Downward force 2. Acts from centre of mass (CM) 3. Due to gravity/gravitational pull  Three marks from (air resistance) 4. ((Frontal) cross-sectional area) Decrease $f_{\text{xa}}$ = decrease AR, <b>e.g.</b> sprint cyclist tuck head and hands in and lift knees high 5. (Shape/ streamlining) Aerofoil/teardrop/smooth air flow around shape/ aerodynamic = decrease AR, <b>e.g.</b> shape of a discus in flight 6. (Surface characteristics/smoothness/roughness) Smooth surface = decrease AR, <b>e.g.</b> lycra suits of a speed skater/ shaved down in cycling 7. (Speed/velocity) Increased speed/velocity = increased AR, <b>e.g.</b> high speed of sprinter 8. (Air density) Air density decrease = decrease AR <b>e.g.</b> drafting in cycling/ javelin travels further at altitude	5 (2 x AO1 3 x AO2)	<b>Accept causes a parabolic flight path under first section (GCE spec content but relevant to question).</b>  <b>Air resistance – mark 1<sup>st</sup> 3 answers only</b>  <b>Stamp KU for explanation and TICK when example given.</b>
(e)	(i) Three marks for: 1. Load between fulcrum and effort 2. Effort arm shown from fulcrum to effort 3. Load arm shown from fulcrum to load  	3 (AO1)	

Section A				
Question		Answer	Marks	Guidance
	(ii)	1. Standing on tip toes to defend a shot in netball <b>or</b> jumping from the ball of the foot for rebound in basketball <b>or</b> press up where fulcrum is toes/feet.	1 (AO2)	Must be related to a sporting example and position of 2 <sup>nd</sup> class lever is identified e.g. ball of foot. Accept ankle joint.
	(iii)	Two marks from:  1. Effort arm is longer than load/resistance arm <b>or</b> effort is further from the fulcrum than the load 2. More effective/efficient at moving heavy loads <b>or</b> can move a large load with relatively small effort 3. Mechanical advantage = effort arm ÷ load arm/resistance arm 4. The closer the load is to fulcrum the greater the advantage 5. The greater the distance between load and effort the greater the advantage	2 (AO1)	

Section C		
Q	Answer	Guidance
4*	<b>Level 3 (8–10 marks)</b> <ul style="list-style-type: none"> <li>detailed knowledge &amp; understanding (AO1)</li> <li>clear and consistent practical application of knowledge &amp; understanding (AO2)</li> <li>effective analysis/evaluation and/or discussion/explanation/development (AO3)</li> <li>accurate use of technical and specialist vocabulary</li> <li>there is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</li> </ul>	<b>At Level 3 responses <u>are likely</u> to include:</b> <ul style="list-style-type: none"> <li>detailed and accurate understanding of both the immediate effects of aerobic exercise on the vascular system and a range of lifestyle diseases described</li> <li>comprehensive range of effects are applied, and the impact of exercise on lifestyle diseases of the CV system is evaluated</li> <li>At the top of this level, the negative impact of training has been addressed.</li> <li>correct technical language is used throughout</li> </ul>
	<b>Level 2 (5–7 marks)</b> <ul style="list-style-type: none"> <li>satisfactory knowledge &amp; understanding (AO1)</li> <li>some success in practical application of knowledge (AO2)</li> <li>analysis/evaluation and/or discussion/explanation/development attempted with some success (AO3)</li> <li>technical and specialist vocabulary used with some accuracy</li> <li>there is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</li> </ul>	<b>At Level 2 responses <u>are likely</u> to include:</b> <ul style="list-style-type: none"> <li>both the effects of aerobic exercise and some lifestyle diseases of the CV system are covered, but there may be some inaccuracies.</li> <li>competent explanation of the effects of exercise on the vascular system, but lifestyle diseases may only be identified and the impact of exercise briefly described</li> <li>there may be some inaccuracies in the use of technical vocabulary</li> <li>maximum of 3 marks to be awarded for AO1 and 3 marks for AO2; some AO3 required for top of this level.</li> </ul>
	<b>Level 1 (1–4 marks)</b> <ul style="list-style-type: none"> <li>basic knowledge &amp; understanding (AO1)</li> </ul>	<b>At Level 1 responses <u>are likely</u> to include:</b> <ul style="list-style-type: none"> <li>some knowledge and understanding is shown in either the effects of</li> </ul>

Section C		
Q	Answer	Guidance
	<ul style="list-style-type: none"> <li>little or no attempt at practical application of knowledge (AO2)</li> <li>little or no attempt to analyse/evaluate and/or discuss/explain/develop (AO3)</li> <li>technical and specialist vocabulary used with limited success</li> <li>the information is basic and communicated in an unstructured way. The information is supported by limited evidence and relationship to the evidence may not be clear.</li> </ul>	<p>aerobic exercise on the vascular system or the impact of regular training on lifestyle diseases.</p> <ul style="list-style-type: none"> <li>Some immediate effects of exercise may only be identified, with little development</li> <li>There may only be one or two lifestyle diseases identified</li> <li>maximum of 3 marks to be awarded for AO1 with no application or evaluation.</li> </ul>
<b>(0 marks)</b> No response or no response worthy of credit.		

Question	Indicative content	Marks	Guidance
4*	<p>Explain the immediate effects of jogging on the vascular system, and evaluate the impact of regular training on lifestyle diseases of the cardiovascular system.</p> <p><b>AO1</b> <b>(Effects of aerobic exercise on vascular system)</b></p> <ol style="list-style-type: none"> <li>Redistribution of blood/ vascular shunt <ul style="list-style-type: none"> <li>Increase in blood flow to working muscles/ decrease in blood flow to organs</li> <li>More oxygen needed for energy production/ increased removal of CO<sub>2</sub></li> <li>Vasoconstriction of blood vessels/arterioles/pre-capillary sphincters to non-essential organs</li> <li>Vasodilation of blood vessels/arterioles/pre-capillary sphincters to working muscles</li> </ul> </li> <li>Vasomotor control <ul style="list-style-type: none"> <li>VCC (vasomotor control centre) receives information</li> <li>Proprioceptors detect increase in movement</li> <li>Chemoreceptors detect increase in CO<sub>2</sub> or lactic acid or acidity/ decrease in O<sub>2</sub> or pH</li> <li>Baroreceptors detect increase in pressure on blood vessel walls</li> <li>sympathetic stimulation</li> </ul> </li> <li>Increased venous return <ul style="list-style-type: none"> <li>Muscle/skeletal pump</li> </ul> </li> </ol>	<p><b>10</b> (AO1 x3, AO2 x3, AO3 x4)</p>	<p><b>Annotations:</b> <b>AO1 use KU</b> <b>AO2 use EG</b> <b>AO3 use DEV</b></p> <p><b>Reference to cardiac muscle/ heart not relevant to first part of question</b></p>

Question	Indicative content	Marks	Guidance
	<ul style="list-style-type: none"> <li>• (Pocket) valves</li> <li>• Respiratory pump</li> <li>• Smooth muscle/ venomotor tone</li> </ul> <p>4. Increase in blood pressure</p> <ul style="list-style-type: none"> <li>• linked to intensity of exercise and fitness</li> <li>• Due to greater volumes of blood pumped out of heart / greater cardiac output</li> </ul> <p><b>AO1</b>  <b>(Impact of regular training on lifestyle diseases of CV system)</b>  (description of lifestyle diseases)</p> <p>5. CHD</p> <ul style="list-style-type: none"> <li>• Coronary heart disease/ CHD</li> <li>• Narrowing of blood vessels of heart/ coronary arteries</li> <li>• High blood pressure/hypertension</li> </ul> <p>6. Stroke</p> <ul style="list-style-type: none"> <li>• Damage to brain cells caused by lack of oxygen</li> <li>• Ischaemic/caused by blockage of blood to brain</li> <li>• Haemorrhagic/caused by bleeding in the brain</li> </ul> <p>7. Atherosclerosis</p> <ul style="list-style-type: none"> <li>• Build-up of fat/ cholesterol/ plaque/ atheroma</li> <li>• on the wall of the coronary arteries</li> <li>• narrowing of the lumen of the arteries</li> </ul> <p>8. Heart Attack</p> <ul style="list-style-type: none"> <li>• Damage to cardiac muscle caused by complete blockage of coronary artery</li> </ul> <p><b>AO2</b>  <b>(Application of regular training on CV system that affect lifestyle diseases)</b></p> <p>9. Exercise must be moderate intensity</p> <ul style="list-style-type: none"> <li>• &gt;50% max HR</li> </ul>		

Question	Indicative content	Marks	Guidance
	<ul style="list-style-type: none"> <li>• At least 3 times per week</li> <li>• At least 30 minutes in duration</li> </ul> <p>10. Cardiac hypertrophy</p> <ul style="list-style-type: none"> <li>• Increased SV/ CO</li> <li>• Decreased resting HR/ bradycardia</li> </ul> <p>11. Capillarisation/ increased capillary density</p> <ul style="list-style-type: none"> <li>• Increased elasticity of blood vessels</li> </ul> <p>12. Increased RBC (red blood cell) volume/ haemoglobin/ plasma/ blood volume</p> <ul style="list-style-type: none"> <li>• Increase oxygen carrying capacity</li> </ul> <p>13. Reduced LDLs (low density lipoproteins)</p> <ul style="list-style-type: none"> <li>• Increased proportion of HDLs (high density lipoproteins)</li> <li>• Decreased plaque/ atheroma build up</li> </ul> <p><b>AO3</b>  <b>(Positive impact of regular training)</b></p> <p>14. Less strain on heart</p> <p>15. Reduces the risk/ incidence of CHD</p> <ul style="list-style-type: none"> <li>• reduce the risk of a heart attack / myocardial infarction / coronary thrombosis</li> <li>• limits the risk of death/ life-changing conditions</li> </ul> <p>16. Reduces high blood pressure/ hypertension</p> <ul style="list-style-type: none"> <li>• Reduced blood viscosity</li> <li>• Reduced risk of stroke</li> </ul> <p>17. Decreased risk of atherosclerosis</p> <ul style="list-style-type: none"> <li>• Reduced risk of blood clots</li> </ul> <p>18. Reduction in weight</p> <ul style="list-style-type: none"> <li>• Less strain on body/ back/joints</li> </ul> <p>19. Increase in exercise tolerance</p> <p>20. Reduced risk of (type 2) diabetes</p> <p><b>(Negative impact of regular training)</b></p> <p>21. Exercise can increase risk of heart attack/ causes very high blood pressure/ severe strain on CV system</p> <ul style="list-style-type: none"> <li>• Risk is very small</li> <li>• E.g. deaths during London marathon</li> <li>• If pre-existing CV disease intense training not recommended</li> </ul>		

Question	Indicative content	Marks	Guidance
	<ul style="list-style-type: none"><li>• Medical advice should be sought</li><li>• Age increases risk</li></ul> 22. Other risk factors still exists e.g. heredity <ul style="list-style-type: none"><li>• Exercise is only managing symptoms</li><li>• CHD cannot be cured</li></ul> 23. To gain the most benefit regular training carried out in conjunction with other healthy lifestyle changes <ul style="list-style-type: none"><li>• E.g. Stopping smoking</li><li>• e.g. healthier diet/ e.g. reduced alcohol consumption</li></ul>		

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