



GCE

Physical Education

H555/01: Physiological factors affecting performance

Advanced GCE

Mark Scheme for June 2019

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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 used in the detailed Mark Scheme

Annotation	Description	Annotation	Description
	Tick	KU	Knowledge and understanding / indicates AO1 on Q9
	Cross	EG	Example/Reference / indicates AO2 on Q9
BOD	Benefit of doubt	DEV	Development / indicates AO3 on Q9
TV	Too vague	L1	Level 1 response on Q9
REP	Repeat	L2	Level 2 response on Q9
S	Indicates sub-max reached where relevant	L3	Level 3 response on Q9
SEEN	Noted but no credit given	L4	Level 4 response on Q9
IRRL	Significant amount of material which doesn't answer the question	BP	Blank page

- Sub-maxes are indicated with **S**; the guidance section of the mark scheme shows which questions these are relevant to.
- **KU/EG/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 this extended response question, one KU/EG/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	Two marks from: 1. Increased heart rate/ cardiovascular drift 2. (vaso)dilation of arteries/arterioles to skin or increased blood flow to skin 3. decreased blood volume/cardiac output or increased blood viscosity or reduced plasma volume 4. decreased stroke volume 5. decreased venous return 6. reduced oxygen/oxygenated blood to muscles		2 (AO1)	Mark 1 st 2 only																					
2	Two marks from: <table border="1"> <thead> <tr> <th></th> <th>Goniometry</th> <th>Sit and Reach</th> </tr> </thead> <tbody> <tr> <td>1. (Equipment)</td> <td>(360°) protractor</td> <td>sit and reach uses box/bench and ruler</td> </tr> <tr> <td>2. (Method)</td> <td>measure joint angle/ degrees</td> <td>Measures distance of reach/ cms</td> </tr> <tr> <td>3. (Where)</td> <td>any joint/ planes of movement</td> <td>back/hamstring/leg/hip flexibility</td> </tr> <tr> <td>4. (Assistance)</td> <td>Requires assistance</td> <td>Can be performed on own</td> </tr> <tr> <td>5. (Validity)</td> <td colspan="2">Goniometers more sport-specific/ accurate/ preferred/ require more training</td> </tr> <tr> <td>6. (Cost/time)</td> <td colspan="2">Both methods are cheap/quick</td> </tr> </tbody> </table>			Goniometry	Sit and Reach	1. (Equipment)	(360°) protractor	sit and reach uses box/bench and ruler	2. (Method)	measure joint angle/ degrees	Measures distance of reach/ cms	3. (Where)	any joint/ planes of movement	back/hamstring/leg/hip flexibility	4. (Assistance)	Requires assistance	Can be performed on own	5. (Validity)	Goniometers more sport-specific/ accurate/ preferred/ require more training		6. (Cost/time)	Both methods are cheap/quick		2 (AO1)	Must compare tests for each mark or use comparative language for pt 5/6. Do not accept: simple/easy (TV)
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3	Two marks from: 1. (100m swim) lactic acid system/ glycolytic system/ anaerobic glycolysis 2. (gym vault) ATP-PC/ PC system/ alactic system		2 (AO2)	Do not accept: ATP/ glycolysis																					
4	Two marks from: 1. (second class) e.g. calf raise or take-off phase of high jump at ankle 2. (third class) e.g. bicep curl or knee extension when kicking a ball		2 (AO2)	Do not accept: Whole body examples, e.g. javelin throw/ long jump take off Reference to a specific location/joint required for example																					
5	Two marks from: 1. wind tunnels 2. limb kinematics		2 (AO1)																						

Section B					
Question	Answer		Marks	Guidance	
6	(a)	<p>Three marks from:</p> <ol style="list-style-type: none"> (Nerve) impulse/stimulus (from brain/spinal cord/CNS) travels down the axon/motor neuron Action potential Release of sodium/Na⁺ (ions) causes depolarisation (at neuromuscular junction) neurotransmitter/acetylcholine/ACh is secreted/transmits impulse impulse crosses synaptic cleft/gap to muscle fibres/motor unit/motor end plate If the impulse/stimulus/charge/action potential is above <u>threshold</u> all muscle fibres in motor unit will contract (or not at all) or 'all or none' law applies 	<p>3 (AO1)</p>	<p>Pt.5 accept 'synapse' for synaptic cleft/gap (BOD)</p>	
	(b)	<p>Five marks for:</p> <ol style="list-style-type: none"> A – extension or no change/movement B – isometric/static or concentric (only if extension stated in A) C – hinge D – plantar flexion E – gastrocnemius/soleus 	<p>5 (AO2)</p>	<p>If A = no change If B = do not accept 'concentric' (X)</p>	
	(c)	(i)	<p>Five marks from:</p> <ol style="list-style-type: none"> ATP-PC or alactic or PC system PC breakdown releases <u>energy</u> or high <u>energy</u> bond is broken or PC → P + C + <u>energy</u> Energy used to resynthesize ATP/ energy + ADP + P → ATP Using coupled reaction/ exothermic and endothermic reactions (reaction) anaerobic/without oxygen (enzyme) creatine kinase (site) sarcoplasm or cytoplasm of <u>muscle</u> cell (yield) 1 ATP per PC/ 1:1 energy yield 	<p>5 (AO1)</p>	<p>Do not accept: breakdown of ATP</p>
	(c)	(ii)	<p>Three marks from:</p> <ol style="list-style-type: none"> Quick or simple reactions or PC breaks down easily or fast ATP resynthesis Provides energy for high-intensity activities/speed/power/explosive strength 	<p>3 (AO3)</p>	

Section A					
Question	Answer			Marks	Guidance
			3. No delay to wait for oxygen 4. No fatiguing by-products 5. Quick/fast muscle phosphagen/PC recovery or only 30s for 50%/ 2-3min for full recovery 6. limited stores of PC or stores are exhausted quickly or only lasts 8-10 seconds 7. Only 1ATP per PC or low yield or inefficient		
	(d)		Four marks from: 1. EPOC restores PC/phosphagen/ATP/oxy-myoglobin and removes lactic acid 2. Warm up to reduce oxygen deficit/increase blood flow/oxygen to muscles/delay OBLA 3. Cool down/active recovery to speed up removal of lactic acid/maintain elevated respiration/circulatory rates/maintain blood flow 4. (Reduce EPOC by) monitoring intensity of training to delay OBLA 5. Include breaks to allow 30s 50%/2-3mins (full) PC restoration or work:relief ratio of 1:3+/ full recovery when training ATP-PC system/during speed/sprint work 6. Active recovery between intervals/work:relief ratio of 1:2/partial recovery when training lactic acid/glycolytic system 7. Use of cooling aids/ice baths to speed up recovery/reduce EPOC	4 (AO2)	Do not accept: WU/CD on own (TV) Explanations of key points required

7	(a)	(i)	Four marks from: 1. Increase HR/SV/Q to increase O ₂ /blood flow/ reduce O ₂ deficit 2. Vascular shunt/vasodilation to increase blood flow to muscles	4 (AO1)	Do not accept: <u>prevent</u> injury
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		<ol style="list-style-type: none"> 3. Increase RR/TV/VE to increase volume of O₂ in lungs/ for gaseous exchange 4. Increase elasticity of muscles/connective tissue to reduce risk of injury/ DOMS/ increase speed/force of contraction 5. Activate neural pathways/ speed up nerve transmission 6. Increase enzyme activity 7. Improve recruitment/synchronisation of motor units 8. Improved O₂ utilisation/ haemoglobin release O₂ more easily 		
(a)	(ii)	<p>Four marks from: (positives - sub-max 3)</p> <ol style="list-style-type: none"> 1. Reduce (core body) temperature/sweating/ delay overheating/ prevent dehydration/ early fatigue in hot environments/ heat stroke 2. Reduce thermal strain 3. Reduce cardiovascular drift 4. Causes vasoconstriction to reduce blood flow 5. Treat injuries to reduce pain/swelling/inflammation 6. (after use) vasodilation/increases blood flow to aid healing/repair/removal of LA/speed recovery/reduce DOMS <p>(negatives – sub-max 3)</p> <ol style="list-style-type: none"> 7. Hard to perceive exercise intensity/can lead to over-exertion 8. Can mask/complicate injuries 9. Can cause (ice) burns or nerve/tissue damage 10. Can be dangerous for performers with heart conditions/angina/chest pain 	4 (AO3)	<p>Sub-max 3 for positives/negatives only.</p> <p>Do not accept: prevent build-up of lactic acid</p>
(b)		<p>Four marks from:</p> <ol style="list-style-type: none"> 1. (static) ROM about a joint without movement 2. (e.g.) to be able to do the splits/ to perform the splits well/ gymnast will gain more marks if able to fully perform splits 3. (dynamic) ROM about a joint with reference to speed of movement 4. (e.g.) to be able to reach for an interception in netball/ kick boxer performing a high kick to head well/ goalkeeper can reach further 	4 (AO1 x 2, AO2 x 2)	<p>Example must highlight benefit</p> <p>Example can be marked correct if definition is wrong</p> <p>2: e.g. splits in gymnastics (TV) 4: e.g. reaching for interception in netball (TV)</p>
(c)		Five marks from:	5 (AO2)	

			<p>1. <u>Protect</u> injury To prevent further damage Or by not attempting to run/walk/stretch injury off or support/carry athlete from jumping area</p> <p>2. <u>Rest</u> injury To allow sufficient time to repair/recover Or prevent from having any further jumps/ remove from event</p> <p>3. <u>Ice</u> injury To reduce swelling/inflammation/pain Or vasoconstrict/reduce blood flow (to the hamstring)</p> <p>4. <u>Compress</u> injury To reduce swelling/inflammation/blood pooling Or use pressure/tape/bandage to reduce blood flow (to the hamstring)</p> <p>5. <u>Elevate</u> injury To reduce blood flow (to the hamstring) Or raise the leg above heart level</p>		
	(d)	<p>Three marks from:</p> <ol style="list-style-type: none"> (enzyme) increases efficiency of ATP-PC system/aerobic system or delays ATP-PC threshold (mitochondria) increased use of oxygen/aerobic energy production/aerobic respiration (buffering) increased tolerance to lactic acid or reduce effects of lactic acid or prevents the decrease in pH 		3 (AO2)	<p>Do not accept: Reduce fatigue TV work aerobically for longer/ increase pH/ faster removal of lactic acid</p> <p>Accept: neutralize lactic acid/ blood acidity (point 3)</p>

8	(a)	(i)	Three marks from: 1. (A - B) at rest/no motion 2. (B - C) acceleration/increasing speed/ speeding up 3. (D - E) deceleration/decreasing speed/ slowing down	3 (AO3)	BOD point 1: no change in speed/ constant speed
	(a)	(ii)	Four marks for: 1. Line rises from 0 (x and y axes) 2. Positive gradient/ slopes up 3. Graph plateaus 4. Negative gradient/ slopes down	4 (AO3)	
	(b)		Three marks for: 1. (identify) weight and reaction (force)/ W and R (forces) 2. (handstand) $W = R$ 3. (Forces) Forces are equal (in size) and opposite (in direction) or <u>net force = 0</u> or forces are balanced or forces cancel each other out	3 (AO1 x 1, AO2 x 2)	Accept correctly labelled diagrams Accept ground reaction force/normal reaction for reaction Do not accept: equilibrium for balanced forces or 'balanced' if not clearly referring to the forces
	(c)	(i)	Two marks for: 1. movement of a body/part of body (in a circular path) about an axis of rotation or rotation of a body around an axis 2. force applied outside CoM/axis of rotation or eccentric force/torque/moment/off-centre force	2 (AO1)	
	(c)	(ii)	Two marks for: 1. <u>mass</u> 2. distance/distribution of mass from <u>axis of rotation/centre of mass</u>	2 (AO1)	Do not accept: weight for pt 1
	(d)	(i)	Three marks for: 1. (speed of release) greater speed/velocity/acceleration/force the greater the	3 (AO1)	

			<p>distance or the greater the change in momentum the greater distance</p> <ol style="list-style-type: none"> 2. (angle of release) (just) less than 45° optimal angle 3. (height of release) greater the release height the greater the distance travelled or release height is greater than landing height 		
	(d)	(ii)	<p>Three marks for:</p> <ol style="list-style-type: none"> 1. (nearly) parabolic/symmetrical flight path 2. weight is dominant force (as mass is high)/ $W > AR$ 3. air resistance is negligible/low (as speed is low) 	3 (AO2)	<p>Do not accept: inverted U for pt 1/ 'heavy' for pt 2 Do not accept: mass as an equivalent of weight</p>

Section C		
Question	Level descriptors	Discriminators
9*	<p>Level 4 (17–20 marks)</p> <ul style="list-style-type: none"> • detailed knowledge and excellent understanding (AO1) • well-argued, independent opinion and judgements which are well supported by relevant practical examples (AO2) • detailed analysis and critical evaluation (AO3) • very accurate use of technical and specialist vocabulary • there is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. 	<p>At Level 4 responses <u>are likely</u> to include:</p> <ul style="list-style-type: none"> • detailed knowledge of mechanics of inspiration and expiration which has been applied to the changes of both during exercise • detailed description of contrast therapy and anti-inflammatory drugs, with positive and negative evaluations of both • Detailed knowledge of range of ankle injuries • AO1, AO2 and AO3 all covered well in this level
	<p>Level 3 (12–16 marks)</p> <ul style="list-style-type: none"> • good knowledge and clear understanding (AO1) • independent opinions and judgements will be present but may not always be supported by relevant practical examples (AO2) • good analysis and critical evaluation (AO3) • generally accurate use of technical and specialist vocabulary • there is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. 	<p>At Level 3 responses <u>are likely</u> to include:</p> <ul style="list-style-type: none"> • good knowledge of mechanics of breathing that covers the changes to inspiration and expiration during exercise • good knowledge of ankle injuries, and of both contrast therapy and anti-inflammatory drugs is shown, with a good evaluation of both treatments • At the top of this level both parts of the question may have been addressed well • At the middle of this level one part of the question may be addressed better than the other
	<p>Level 2 (7-11 marks)</p>	<p>At Level 2 responses <u>are likely</u> to include:</p>

Section C		
Question	Level descriptors	Discriminators
	<ul style="list-style-type: none"> limited knowledge and understanding (AO1) opinion and judgement given but often unsupported by relevant practical examples (AO2) some evidence of analysis and critical evaluation (AO3) technical and specialist vocabulary used with limited success the information has some relevance and is presented with limited structure. The information is supported by limited evidence. 	<ul style="list-style-type: none"> limited knowledge of mechanics of breathing that may cover some of the changes to inspiration and/or expiration during exercise Limited identification of ankle injuries, limited knowledge of treatments has been shown and at this level there may be limited evaluation At the top of this level there should be some knowledge of mechanics of breathing during exercise, together with some evaluation of one of the treatments
	<p>Level 1 (1–6 marks)</p> <ul style="list-style-type: none"> basic knowledge and little understanding (AO1) little or no attempt to give opinion or judgement (AO2) little relevant analysis or critical evaluation (AO3) little or no attempt to use technical and specialist vocabulary the information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. 	<p>At Level 1 responses <u>are likely</u> to include:</p> <ul style="list-style-type: none"> basic knowledge of the mechanics of breathing that may not show the changes during exercise An ankle injury may be identified but treatments may be limited to a basic description, and one of the treatments may not be addressed
	<p>(0 marks) No response or no response worthy of credit.</p>	

Question	Indicative content	Marks	Guidance
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Question	Indicative content	Marks	Guidance
9*	<ol style="list-style-type: none"> 1. (Inspiration) Diaphragm and external intercostals contract (AO1) <ul style="list-style-type: none"> • with more force/ and at quicker rate (AO2) 2. Additional muscles contract such as sternocleidomastoid/ scalenes/ Pectoralis <u>minor</u> (AO1) 3. Ribs/sternum move upwards/outwards further (AO2) <ul style="list-style-type: none"> • Greater volume in thoracic/chest cavity/lungs (than at rest) (AO2) 4. Decreasing pressure in the lungs further (AO2) <ul style="list-style-type: none"> • Gases move from an area of high to low pressure or down pressure/concentration gradient (AO1) • Gradient increases/steepens during exercise (AO2) 5. More air enters lungs/is inspired/inhaled (AO2) <ul style="list-style-type: none"> • Decreasing inspiratory reserve volume/ increasing TV (AO2) 6. (expiration) Diaphragm and external intercostals relax (AO1) 7. Additional muscles contract such as <u>internal</u> intercostals/rectus abdominis/obliques (AO1) <ul style="list-style-type: none"> • Expiration becomes active/active process (AO2) 8. Ribs/sternum move inwards/downwards further (AO2) <ul style="list-style-type: none"> • Greater decrease in volume in thoracic/chest cavity/lungs (AO2) 9. Increasing pressure in lungs further (AO2) 10. More air is breathed out/expired/exhaled (AO2) <ul style="list-style-type: none"> • Air forced out during exercise (AO2) • Decreasing expiratory reserve volume (AO2) 	<p>20 (7 x AO1, 7 x AO2, 6 x AO3)</p>	<p>AO1 for knowledge and understanding '<u>KU</u>'</p> <p>AO2 when knowledge is applied to differences during exercise '<u>EG</u>'</p> <p>AO3 for evaluation and analysis of treatments '<u>DEV</u>'</p> <p>Acknowledge reference to the control of breathing as '<u>SEEN</u>'</p>
	<ol style="list-style-type: none"> 11. Fractures (AO1) 12. Sprains (AO1) 13. Strains (AO1) 14. Dislocation/subluxation (AO1) 15. Contusion/haematoma/bruise (AO1) 16. Achilles tendonitis/tendonosis (AO1) <ul style="list-style-type: none"> • Reference to acute or chronic injury/ soft and hard tissue injury (AO1) 		

Question	Indicative content	Marks	Guidance
	<p>17. (contrast therapy) Use of heat and cold treatments (AO1)</p> <ul style="list-style-type: none"> • 3-5 days after injury occurs (AO1) • After swelling/inflammation has reduced (AO1) <p>18. Immerse ankle in cold water bath/ice (AO2)</p> <ul style="list-style-type: none"> • Followed by warm water/heat pack/hot towels (AO2) • Use in conjunction with ankle mobilising exercises (AO2) • Cold:warm ratio of 1:3 or 1:4 minutes (AO2) <p>19. Cold vasoconstricts blood vessels (AO1)</p> <ul style="list-style-type: none"> • Heat vasodilates blood vessels (AO1) • Causing pumping action (AO1) • Increasing blood flow/oxygen/nutrients to damaged tissue (AO1) <p>(evaluation) (All AO3 unless indicated otherwise)</p> <p>20. Reduces swelling/inflammation (of ankle)</p> <ul style="list-style-type: none"> • Reduces pain • Speeds recovery/repair/healing <p>21. Use of incorrect timing/ cold:warm ratios can limit effectiveness</p> <p>22. Risks associated with heat</p> <ul style="list-style-type: none"> • Apply heat too early/too long • can cause increased swelling/oedema <p>23. Risks associated with ice</p> <ul style="list-style-type: none"> • Ice burns/tissue damage • Nerve damage (if in contact too long) • Uncomfortable <p>24. More effective than heat therapy on its own</p> <ul style="list-style-type: none"> • Limited benefit over cold therapy on its own • Limited changes in tissue temperature • Limited effect on changes in blood flow in tissues • Not suitable for those who have negative reactions to cold treatment (AO3) e.g. Raynauds (AO2) • Not suitable for fractures/hard tissue injury 		

Question	Indicative content	Marks	Guidance
	<p>(anti-inflammatory drugs)</p> <p>25. Pills/medication (AO1)</p> <ul style="list-style-type: none"> • Non-steroidal/NSAIDs • available over counter/from chemist • e.g. ibuprofen/aspirin/cortisone (AO2) <p>(evaluation) (All AO3 unless stated otherwise)</p> <p>26. Prescription not needed/ easily accessible/cheap</p> <ul style="list-style-type: none"> • Can be used for acute and chronic injuries <p>27. Reduce (ankle) swelling/temperature/pain</p> <ul style="list-style-type: none"> • Inhibit cause of inflammation/hormone released • Speed up recovery/healing process <p>28. Can cause side-effects, such as heartburn/nausea/diarrhoea/headaches</p> <ul style="list-style-type: none"> • May result in further damage (to ankle if performer returns to training too early) • Potential pain/injury masking • Can have limited effectiveness <p>29. Long-term use should be avoided</p> <ul style="list-style-type: none"> • Monitored by doctor/health professional • Chronic health consequences • e.g. gastro-intestinal bleeding/anaemia/heart conditions (AO2) 		<p>Do not accept: pain relief medication e.g. paracetamol</p>

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