OCR
Oxford Cambridge and RSA

GCE

Physical Education

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

Advanced Subsidiary GCE

Mark Scheme for June 2018

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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.

Annotations

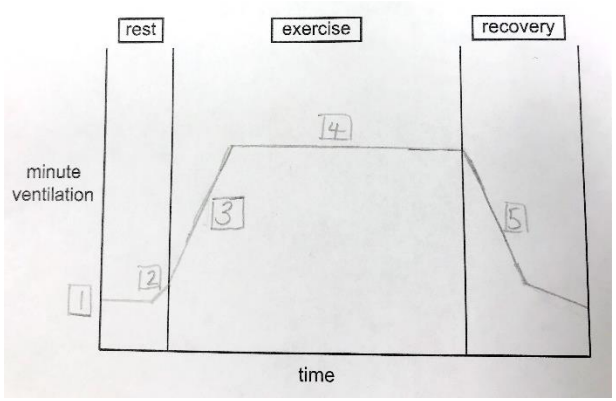
Annotation	Description	Annotation	Description
	Tick	KU	Knowledge and understanding / indicates AO1 on Q4
	Cross	EG	Example/Reference / indicates AO2 on Q4
BOD	Benefit of doubt	DEV	Development / indicates AO3 on Q4
TV	Too vague	L1	Level 1 response on Q4
REP	Repeat	L2	Level 2 response on Q4
IRRL	Significant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

Available but <u>not</u> used: '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** and **DEV** used <u>instead</u> 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)		6 marks for: Joint movement / Main agonist muscle / Plane of movement / Practical example Hip abduction / 1. gluteus medius/minimus / 2. frontal / 3. e.g. star jump or box splits Wrist flexion / 4. wrist flexors / 5. sagittal / 6. e.g. follow through after basketball shot	**6** (AO3)	**NB. Need specific phase of movement to qualify for the practical example.**
	(b)		4 marks from: Receptor (AO1) / Explanation (AO2) 1. chemoreceptors / 2. detect **increase** in blood acidity/CO_2/lactate / **decrease** in blood pH/O_2 causing heart rate to increase 3. proprioceptors/mechanoreceptors / 4. detect movement/changes in joint angles causing heart rate to increase 5. Baroreceptors / 6. detect **increase** in blood pressure and cause heart rate to decrease	**4** (AO1 x 2, AO2 x 2)	**Sub max 2 for identification of receptors** **Sub max 2 for explanation** **Mark first two receptors named only.** **Explanation must include what is detected and how HR is affected as the dance begins.** **Do not accept: thermoreceptors (in question)**

Section A					
Question			Answer	Marks	Guidance
	(c)		4 marks from: 1. Venous return mechanisms work to maximise / increase blood flow back to heart 2. … which means **netballer** won't get dizzy or faint or feel heavy legs / will maintain blood pressure/ speed up removal of lactic acid or waste products / decrease acute muscle soreness 3. (Pocket) valves in veins prevent backflow of blood (in legs) 4. (skeletal) muscle pump causes muscles of legs to contract squeezing veins (forcing blood back to the heart) 5. Smooth muscle in walls of veins contracts/venomotor tone (aids movement of blood) 6. Respiratory pump causes pressure differences within thoracic cavity (which aids movement of blood)	**4** (AO1 x 1, AO2 x 3)	**Do not accept: Gravity.** **DNA mechanisms on own, explanation required to gain mark.** Points 2 – 6 AO2 - application is implicit due to context but points need to be explained fully (e.g. point 3 requires 'prevent backflow of blood' to make it applied K&U, which is AO2)
	(d)	(i)	Four marks from:  1. Rest must be above 0 2. Show slight increase in minute ventilation just before exercise commences (anticipatory rise) 3. Rapid increase during exercise 4. Plateau must be for at least 5 minutes/half the exercise period 5. Rapid decrease during recovery	**4** (AO3)	**Do not accept pt 5 if line of graph drops below resting level or reaches zero.** **The question asks candidates to sketch, so slight inconsistencies can be accepted.**

<table>
<tr><th colspan="5">Section A</th></tr>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)</td><td>Two marks for:

1. Tidal volume = minute ventilation ÷ breathing frequency or 80/32
2. TV = <u>2.5 litres</u></td><td>2
(AO3)</td><td>Must have correct units for 2.</td></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td>One mark for:

1. Insulation of nerves</td><td>1
(AO1)</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>One mark for:

1. Iron/copper</td><td>1
(AO1)</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Two marks from:

<table><tr><th>Pharmacological aid</th><th>Negative side-effect</th></tr><tr><td>1. Anabolic steroid</td><td>2. Mood swings or aggression or liver damage or heart failure or cancer or acne or hormonal imbalance / other known side effects</td></tr><tr><td>3. Human growth hormone/HGH</td><td>4. Abnormal muscle/bone growth or enlargement of vital organs or organ failure or cancer or diabetes</td></tr></table></td><td>2
(1 x AO1
1 x AO2)</td><td>One mark for aid and one mark for side-effect

Mark first aid named only. Side effect must link to named aid.

Accept all other known side effects.</td></tr>
</table>

Section A

Question	Answer	Marks	Guidance
(b)	Four marks from:	4 (AO1)	**No mark for naming tests.** **Two tests must be compared for each mark** **Stamp KU next to first point then tick when comparison achieved.**

	Direct gas analysis/VO_2 max test	Cooper 12 minute run	Multi-stage fitness test	Step tests (various)
1. (maximal or sub-maximal	Maximal/test to exhaustion	Maximal	Maximal	Sub-maximal
3. (Protocol)	Ergometer Cycle/run/row Measurement of Expired air	Run/walk as far as possible (on track) in 12 minutes	Run shuttles in time with bleeps on CD	Step on and off box (of set height) at set rate and time
4. (Evaluation)	Amount of oxygen used is calculated	Distance covered is compared to (normative) table	Level/shuttles achieved compared to (normative) table	Heart rate during recovery recorded and compared to (normative) table
5. (Direct or predicted value)	Direct/accurate /objective measure	Predicted measure / less accurate	Predicted measure / less accurate	Predicted measure / less accurate
6. (Ease of use)	Needs specialist equipment	Simple/cheap/ easy to set up/ large numbers can all do test together	Simple/cheap/ easy to set up/ large numbers can all do test together	Simple/cheap/ needs specific height of box
7. (Suitability)	Not suitable for those with health issues	Not suitable for those with health issues	Not suitable for those with health issues	Suitable for all **or** shorter subjects may be disadvantaged

Section A					
Question			**Answer**	**Marks**	**Guidance**
	(c)	**(i)**	Four marks from: 1. Use of free weights/multi-gym/resistance machines/pulleys 2. 50-75% of (one rep) max/1RM 3. 15-30 repetitions **/** 3-6 sets 4. 30-60 seconds rest between sets 5. Work:relief ratio 1:1/1:2	**4** (AO2 x4)	**DNA Weight Training as in question.** **Accept named relevant exercises for point 1.**
		(ii)	Four marks from: 1. Muscle hypertrophy **or** increase in size/thickness of muscle fibres/actin/myosin filaments 2. Muscle hyperplasia **or** splitting/increase in number of muscle fibres myofibrils/cross-bridges 3. Increase in speed/power/force of contraction 4. Increased strength of ligaments/tendons/ connective tissue or bone density /strength **or** increase in joint stability **or** reduced risk of osteoporosis 5. Increase in ATP/PC/glycogen stores 6. Increased enzyme activity 7. Increased tolerance/speed of removal of lactic acid/buffering/delayed OBLA 8. Increased recruitment of motor units/muscle fibres 9. Reduced inhibition to stretch reflex	**4** (AO1 x4)	**Do not accept: Increase in strength (in question)**
	(d)	**(i)**	Two marks for: 1. (static) The range of movement about a joint (without movement/speed) **or** the extent that muscles and connective tissue can lengthen (e.g.) the splits **or** arabesque 2. (dynamic) The range of movement at a joint performed at speed **or** muscles and connective tissues' resistance to movement (e.g.) Split leap **or** straddle jump	**2** (AO2 x 2)	**Examples must be related to gymnastics** **No examples no marks**
		(ii)	Two marks for: 1. (explosive Fast/powerful/dynamic movement) e.g. somersault or tumbling routine or sprint to the vault 2. (endurance repeated strength movements) e.g. floor/rings/bars/pommel horse	**2** (AO2)	**Accept suitable examples only as long as clearly linked to correct type of strength.**

<table>
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<tr><td>3</td><td>(a)</td><td></td><td>Five marks for five of:

<table>
<tr><th></th><th>Balanced forces</th><th>Unbalanced forces</th></tr>
<tr><td>1.</td><td>Two (or more)(opposing) forces are equal (in size)</td><td>Two (or more)(opposing) forces are not equal (in size)</td></tr>
<tr><td>2.</td><td>No change in motion</td><td>Change in motion</td></tr>
<tr><td>3.</td><td>Constant velocity/rest occurs</td><td>Acceleration/deceleration occurs</td></tr>
<tr><td>4.</td><td colspan="2">(Net force) The sum of all forces/resultant force acting on a body</td></tr>
<tr><td>5.</td><td colspan="2">(Net force) zero if forces are balanced</td></tr>
<tr><td>6.</td><td colspan="2">(Net force) positive/negative if forces are unbalanced / a net force shows the direction and magnitude of acceleration / deceleration / change in motion</td></tr>
</table></td><td>5
(AO1)</td><td>Accept example as equivalent.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>One mark for (AO1):
1. Acceleration = rate of change of velocity or ∆ velocity or (final velocity – initial velocity) ÷ time taken or fv – iv/time/ f /m

Three marks from (AO2):

2. (Increase force/velocity/speed) e.g. a sprinter can apply a greater force to the blocks/track
3. (Increase friction) e.g. a long jumper can wear spikes to increase friction with the ground
4. (Reduce mass/weight) e.g. a high jumper loses weight prior to competition or high jumper can move their mass at a greater velocity
5. (Improve technique) e.g. a runner adjusts technique/body position so that more force is generated in a forward/horizontal direction
6. (Reduce air resistance) e.g. a sprint cyclist adopts a streamlined shape to minimise air resistance / more aerodynamic</td><td>4
(AO1 x 1, AO2 x 3)</td><td>Sub max 3 for ways to increase acceleration.

Must use sporting examples or describe how acceleration increases during sport/physical activity.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>One mark for:

(Average) speed = (distance/time taken = 400 ÷ 27) = <u>14.8 metres/second / m/s / ms^{-1}</u></td><td>1
(AO3)</td><td>Must show correct units.</td></tr>
</table>

Section A					
Question			**Answer**	**Marks**	**Guidance**
	(c)	**(i)**	One mark for: 1. (Definition) A body continues in a state of **rest** or uniform velocity unless acted on by an external/unbalanced force (AO1)	**1** AO1	**For point 4 accept reference to the fact that Newton's first law would not apply to the ball in flight as external forces are acting on the ball at all times.**
		(ii)	Three marks from (AO2): 2. (On tee) The ball will remain at rest on the tee / ball has balanced forces applied 3. (On tee) Until it is struck by the golf club / an unbalanced force is applied 4. (In air) Ball is at maximum velocity as struck/ external or unbalanced force is applied 5. (in air) … the forces become unbalanced/ W/gravitational pull/ air resistance act on ball/change its velocity	AO2 x 3)	
		(iii)	Two marks from: 1. (N3 states) For every action (force) applied to a body there is an equal and opposite reaction force 2. E.g. A footballer applies a force from their foot to the ball and the ball applies an equal and opposite force back to the foot	**2** (AO1 x 1, AO2 x 1)	**Sub max 1 if no sporting example used.**
	(d)		One mark for: 1. (Sporting example) e.g. cyclist or F1 car or speed skater or downhill skier (AO2) Two marks for (AO3): 2. improve technique/ reduce drag/ air resistance **or** optimise body position of cyclist/skater/skier 3. Increase streamlining/aerodynamic design **or** improve flow of air around a body **or** increase lift/ downforce / improve design 4. External factors can be controlled (by scientists)/ variable can be explored One mark for (AO3): 5. Specialised facilities **or** expensive **or** not available to all 6. Data requires complex analysis / qualified professionals	**4** (AO2 x1, AO3 x3)	**Do not accept:**

Section C		
Question	**Answer**	**Guidance**
4*	**Level 3 (8–10 marks)** • detailed knowledge & understanding (AO1) • clear and consistent practical application of knowledge & understanding (AO2) • effective analysis/evaluation and/or discussion/explanation/development (AO3) • 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.	**At Level 3 responses <u>are likely</u> to include:** • detailed and accurate description of ankle joints covering all aspects of movement analysis • comprehensive explanation of second and third class levers, with a detailed evaluation of the mechanical efficiency of each class of lever at the top of this level • synoptic links may be made between the ankle joint and second and third class levers • and there will be a range of practical examples used accurately • correct technical language is used throughout • AO1, AO2 and AO3 all covered well in this level.
	Level 2 (5–7 marks) • satisfactory knowledge & understanding (AO1) • some success in practical application of knowledge (AO2) • analysis/evaluation and/or discussion/explanation/development attempted with some success (AO3) • technical and specialist vocabulary used with some accuracy • there is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.	**At Level 2 responses <u>are likely</u> to include:** • A good movement analysis of the ankle joint, but at the bottom of this level there may be errors. • competent explanation of second and third class levers, • At the top of this level there will be some evaluation of the mechanical efficiency • Some use of examples • technical vocabulary is used with some accuracy • maximum of 3 marks to be awarded for AO1 and 3 marks for AO2; some AO3 required for top of this level.
	Level 1 (1–4 marks) • basic knowledge & understanding (AO1) • little or no attempt at practical application of knowledge (AO2) • little or no attempt to analyse/evaluate and/or discuss/explain/develop (AO3) • technical and specialist vocabulary used with limited success • 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.	**At Level 1 responses <u>are likely</u> to include:** • some knowledge and understanding is shown of the ankle movements • Some knowledge and understanding of 2nd or 3rd class levers with possibly an attempt at evaluation • gaps and inaccuracies may be a feature of this answer • maximum of 3 marks to be awarded for AO1 with no application.
	(0 marks) No response or no response worthy of credit.	

Question	Indicative content	Marks	Guidance
4*	**Analyse the movements possible at the ankle joint using sporting examples of your choice, with reference to:** • **Joint type** • **Movements produced** • **Plane of movement** • **Agonist and antagonist muscles involved** • **Types of muscle contraction taking place** **Explain and evaluate second and third class levers, using the movements at the ankle in practical examples to support your answer.** **(Movement analysis of ankle)** 1. Ankle is hinge joint **(AO1)** • Tibia, fibula and talus • Talus is one of tarsal bones 2. Movement – dorsiflexion **(AO1)** • Bringing toes up towards shin **or** decreasing angle between foot and lower leg/shin • E.g. Preparing to jump **or** landing after jump **or** downward phase of calf raise **or** leg recovery during breast stroke **(AO2)** • Agonist – tibialis anterior • Muscle which causes movement • Concentric contraction • Muscle shortens under tension • Antagonist – gastrocnemius/soleus • Muscle which opposes movement • Eccentric contraction in resistance movements / relaxation in non-resistance movements • Muscle lengthens under tension 3. Movement – plantar flexion **(AO1)** • Pointing toes downwards/away from shin **or** increasing angle between foot and lower leg/shin • E.g. Pointing toes during handstand **or** dancer on pointe **or** pushing away from ground during jump/sprint **or** striking football with laces **or** glide position during breast stroke **(AO2)**	**10** (AO1 x3, AO2 x3, AO3 x4)	**AO1 for factual information about ankle joint, movements, muscles and types of contraction, and for facts about second and third class levers.** **AO2 for application of knowledge to practical examples. Give credit for more than one example. Candidates may also apply knowledge practically to other points.** **AO3 for evaluation of mechanical efficiency of lever systems.** **N.B. Do not credit any reference to first class levers.** **Only credit descriptions of agonist/antagonist and concentric/eccentric in one movement. Candidate may cover plantar flexion first.**

Question	Indicative content	Marks	Guidance
	• Agonist – gastrocnemius/soleus - concentric • Antagonist – tibialis anterior – eccentric with resistance / relaxation without resistance 4. Plane is sagittal (for both movements) **(AO1)** • Divides body into left and right • From medial/midline to lateral/outside 5. (No movement) Isometric contraction if position of joint is static/stationary **(AO1)** • E.g. Plantar flexion/pointing toes throughout gymnastic routine on rings/bar **(AO2)** • E.g. Dorsiflexion/foot up and held of hopping leg during flight in triple jump **(AO2)** **(Levers)** 6. Lever systems consist of fulcrum, effort and load • Lever = bones • Fulcrum = joint • Effort = muscular force • Load = resistance/weight of limb/limb and object • Order of components determines class of lever 7. Two main functions of lever systems in human body • Generate muscular force/strength/effort (to overcome a load) • Generate/increase speed **(Second class levers)** 8. Fulcrum – load – effort/FLE or Effort – load – fulcrum/ELF **(AO1)** - Load is in the middle of the lever system - Least common lever system in body - Unusual for load to be closer to fulcrum than effort in human body 9. (Practical example) E.g. Ankle plantar flexion during take-off phase of jump **(AO2)** - Fulcrum = ball of foot (do not accept: ankle) - Lever = metatarsals - load = body weight		

Question	Indicative content	Marks	Guidance
	- effort = (contraction of) gastrocnemius / soleus **(Third class levers)** 10. Fulcrum – effort – load/FEL or Load – effort – fulcrum/LEF **(AO1)** - Effort is in the middle of lever system - Most common lever system in the body - Muscle is usually close to the fulcrum in the body 11. (practical example) E.g. Dorsiflexion in recovery/kick phase in breast stroke **(AO2)** - Fulcrum = ankle joint - Load = weight of foot - Effort = (contraction of) tibialis anterior **(Evaluation of second and third class levers) (AO3)** 12. (Efficiency) Efficiency of levers is dependent on length of effort arm and load arm - …and dependent on the order of the component parts - The greater the distance, the greater the significance of each - e.g. the further the effort from the fulcrum the larger the effort force becomes (and same for load) - Causes a mechanical advantage or disadvantage 13. Second class levers have a mechanical advantage - Most efficient at moving heavy loads - Effort arm is longer than the load arm **or** effort is further from fulcrum than load - The greater the difference between effort arm and load arm the greater the mechanical advantage / less force is needed to move the same load - E.g. Gastrocnemius/soleus/calf muscle generates relatively small force to lift weight of body to stand on tiptoes/perform calf raises **or** large and powerful muscle capable of creating large effort – helps to move large loads **(AO2)** 14. Third class levers have a mechanical disadvantage - Load arm is longer than effort arm **or** load is further from fulcrum than effort - The greater the difference between effort arm and load arm the greater the mechanical disadvantage / more force is needed to move the same load - E.g. in breast stroke a performer with a longer foot will need to generate more		

Question	Indicative content	Marks	Guidance
	force to dorsiflex the ankle as one with a short foot **(AO2)** - E.g. Two performers with identical length of effort arm, but one has the insertion of tibialis anterior tendon further away from the ankle joint will need to generate less force **(AO2)** - 15. (Negative of 2nd class) Efficiency is only over a small range of movement - Cannot generate much speed/velocity 16. (Positive of 3rd class) Longer levers can generate greater forces/momentum - (3rd class levers) Can generate greater speed/velocity/acceleration - E.g. Reference to swimmers with large feet e.g. Ian Thorpe **(AO2)**		

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