GCE

Physical Education

H155/01: Physiological factors affecting performance

Advanced Subsidiary GCE

2020 Mark Scheme (DRAFT)

This is a DRAFT mark scheme. It has not been used for marking as this paper did not receive any entries in the series it was scheduled for. It is therefore possible that not all valid approaches to a question may be captured in this version. You should give credit to such responses when marking learner's work.

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

1. **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 / indicates sub-max reached where relevant		

Available but <u>not</u> 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 <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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>Five marks for:

<table><tr><td>Joint</td><td>Joint type</td><td>Movement produced</td><td>Agonist</td></tr><tr><td>Right shoulder</td><td><u>Ball and socket</u></td><td><u>abduction</u></td><td><u>deltoid</u></td></tr><tr><td>Left hip</td><td></td><td><u>extension</u></td><td><u>Gluteus maximus</u></td></tr></table></td><td>5

AO3 x 5</td><td></td></tr>
<tr><td>1</td><td>(a)</td><td>(ii)</td><td>Two marks for:

1. (agonist) prime mover / muscle responsible for creating movement
2. (fixator) a muscle which stabilises a joint</td><td>2

AO1 x 2</td><td></td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>Three marks for:

1. (capillary density) greater in SO fibres (or opposite in FG)
2. (myoglobin content) Greater in SO fibres (or opposite in FG)
3. (fatigue resistance) greater in SO fibres (or opposite in FG)</td><td>3

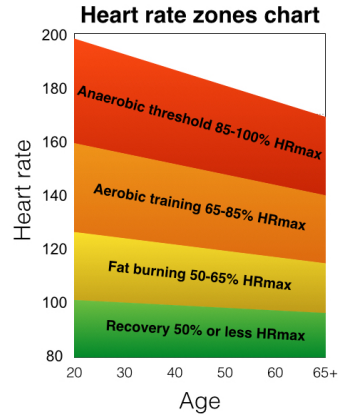
AO1 x 3</td><td>NB: comparisons must be made or comparative terms (higher/lower/etc) must be used.</td></tr>
<tr><td>1</td><td>(c)</td><td>(i)</td><td>Four marks for:

1. (before) caused by release of adrenaline
2. (increase during) caused by increased demand for oxygen at muscles / increased SA node stimulation / increased venous return / role of receptors
3. (plateau during) supply of oxygen meets demand
4. (recovery) caused reduced action of muscle pump / lower venous return / role of receptors</td><td>4

AO2 x 4</td><td>NB: Explanations of each change are required for each mark.</td></tr>
</table>

1	**(c)**	**(ii)**	Two marks for: 1. Increase in temperature of (cardiac muscle / blood ~~causes a change in HR~~ 2. Increased venous return / more blood enters right atrium 3. Increased stretch of ventricular walls/ end diastolic volume/ EDV 4. (greater stretch results in) more powerful **and** faster contractions / ventricular contractility	2 AO1 x 2	
1	**(d)**		Four marks from: 1. PCO_2 higher in the capillaries than in alveoli 2. Gases move from area of high to low pressure 3. Greater / steeper diffusion gradient 4. CO_2 enters alveoli at a faster rate **OR** more CO_2 enters alveoli 5. O_2 enters capillaries / blood at faster rate **OR** more O_2 enters capillaries / blood	4 AO1 x 4	

Question			Answer	Mark	Guidance
2	(a)		Three marks from: 1. (Positive) If intake > expenditure / positive energy balance runner will increase weight 2. (Positive) … which will reduce running efficiency/ stamina or increase strain on joints 3. (Negative) If expenditure > intake / negative energy balance runner will lose weight" 4. (Negative)… which means low energy for training/ race **OR** increase fatigue/ illness/ injury 5. (Balance) If intake = expenditure performance runner will maintain weight 6. (Balance) runner will try to match intake and expenditure to maximise training / maximise running efficiency	3 AO2 x 3	DNA: 'maximise performance' as this is in the question.
2	(b)		Five marks from (sub-max 3 for benefits and risks): (benefits) (Sub-max 3) 1. **Both** increase red blood cell count / haemocrit / haemoglobin levels 2. **Both** increase oxygen-carrying capacity of blood 3. **Both** increase aerobic capacity / cardiovascular fitness / stamina / increase performance in endurance events (risks) (Sub-max 3) 4. **Both** cause increased viscosity / thickness of blood **OR** reduce cardiac output 5. **Both** may lead to blood clots / heart failure / puts strain on heart 6. **Both** may lead to infections from contaminated needles / hepatitis / HIV (if injected) 7. EPO use will lead to reduced natural production of EPO **and/whereas** blood doping does not have this effect	5 AO1 x 5	

2	**(c)**	**(i)**	Four marks from: 1. Warm up and at least 2 components named/described e.g. pulse raiser / mobilising / stretching exercises 2. (Duration) 20+ minutes 3. (Intensity) 60 – 85% of max HR **OR** 55 – 80% of max VO_2 4. (Type) Jogging / swimming / cycling / rowing / aerobics (or equivalent) 5. Cool down **with** description e.g. dynamic stretching of major muscle groups	4 AO2 x 4	Sub-max 2 if no named player or sport identified.
2	**(c)**	**(ii)**	Two marks from: 1. Heart rate a good indicator of work intensity / direct correlation (with VO_2max) 2. Different target rates / training zones target different benefits (see guidance for examples that may be credited) 3. If performer works below target heart rate no adaptations will occur / no training benefit 4. If performer works above target heart rate anaerobic benefits occur / may fatigue quickly 5. Highly trained performers will work at the upper end of band / zone	2 AO1 x 2	
2	**(d)**	**(i)**	Four marks for: 1. Goalkeeper **and** tennis player are excellent, midfielder is average **and** high jumper is below average. 2. (goalkeeper is excellent because) she needs strong grip to save powerful shots/ hold on to the ball 3. (Tennis player is excellent because) he needs strong grip to hold racquet / play shots with power 4. Midfielder / high jumper does not use grip strength to enhance performance **OR** training will focus on other areas / core / lower body / leg development	4 AO3 x 4	NB: All 4 performers' results must be correctly identified for pt. 1
2	**(d)**	**(ii)**	Two marks from: 1. Adjust the grip to suit hand size 2. Hold dynamometer with straight arm (above head) 3. Squeeze the grip **maximally** / with **maximum** force (bringing the arm down slowly)	2 AO1 x 2	Use of maximum force must be implied for pt. 3

			4. Three attempts **OR** use both dominant and non-dominant hand		

Question			Answer	Mark	Guidance
3	**(a)**	**(i)**	Three marks from: 1. Footballer applies a (action) force on the ball 2. Ball applies a reaction force to / on the **head** 3. (Reaction force) is equal (in size) to the (action) force from the head 4. (Reaction force) is in opposite direction to (action) force	3 AO2 x 3	NB: Head not needed for pt. 1 as heading is in the question, but must be specified for pt. 2
3	**(a)**	**(ii)**	Two marks for: 1. Force = mass x acceleration **OR** 90 x 2 2. 180 Newtons / N	2 AO3 x 2	
3	**(b)**	**(i)**	One mark from: 1. The point at which the body is balanced (in all directions) 2. The point from which weight appears to act 3. The point around which a body may rotate	1 AO1 x 1	
3	**(b)**	**(ii)**	Five marks from (sub-max 3 if no sporting examples are used): 1. Stability is maintained if CoM is over base of support, e.g. swimmer on starting blocks 2. The larger the base of support the greater the stability, e.g. wrestler widening points of contact on floor 3. The lower the CoM the greater the stability, e.g. rugby player lowers CoM when going into tackle to maintain balance 4. The closer the line of gravity (vertically downwards from CoM) to edge of base of support the less stable, e.g. 'Set' in sprinting athlete moves CoM forward reducing stability for a quick start. 5. (example) Sports performers, e.g. gymnasts move their CoM to middle of base of support to increase stability in a handstand	5 AO2 x 5	NB: If only one sporting example is used, only 4 marks can be awarded. no e.g.s = SM3 1 e.g. = SM4

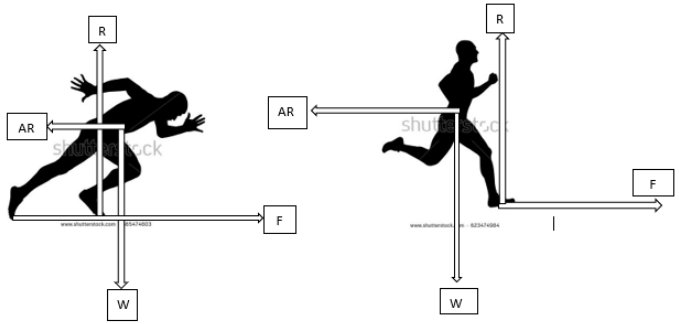
			6. (example) Sports performers, e.g. trampolinists move their CoM outside base of support so they are unstable allowing rotation / somersaults		
3	**(c)**	**(i)**	Three marks from: 1. Third class lever 2. fulcrum – effort - load **OR** LEF / FEL (accept labelled diagram) 3. Fulcrum is <u>elbow joint</u> 4. Effort is <u>contraction of biceps (brachii)</u> 5. Load is <u>weight/resistance</u> (and (weight of) forearm) 6. Lever arm is <u>forearm</u> (and hand)	3 AO2 x 3	
3	**(c)**	**(ii)**	Two marks from: 1. Mechanical disadvantage 2. Large effort is needed to move a small load 3. Can move loads at high velocity / speed / acceleration	2 AO3 x 2	
3	**(d)**		Four marks from: 1. Video / motion / 3D analysis of sporting action 2. Joint / limb / angle / velocity / acceleration / gait / movement efficiency evaluated 3. (+ve) Accurate / objective / immediate data produced 4. (+ve) To enhance / adjust technique 5. (-ve) Requires specialist training / correct placement of markers 6. (-ve) Expensive **OR** laboratory conditions	4 AO3 x 4	

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 understanding of the forces acting on a sprinter at the start and finish of the race, and the factors affecting explosive strength • clear practical application of factors affecting strength to a range of sporting examples, and effective analysis of many of these factors • At the top of this level, the changes in air resistance and friction have been clearly explained • 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:** • Some of the forces acting on the sprinter are shown accurately, and factors affecting explosive strength have been described • competent explanation of factors affecting strength, using some sporting examples, but explanation of changes in the relationship between air resistance and friction may be limited • there may be some evaluation of the factors affecting strength • use of technical language is generally correct
	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 factors affecting strength • an attempt may have been made to show the forces acting on the sprinter, but the origins of some arrows may be incorrect • There may only be a very limited evaluation of the factors affecting strength, with few sporting examples used • The changes in the relationship between air resistance and friction may not be addressed.
	(0 marks) No response or no response worthy of credit.	

4* 10 marks (AO1 x 4; AO2 x 3; AO3 x 3)

Indicative content:

AO1 - KU	AO2 – EG	AO3 - DEV
(vertical forces)		
1. Weight acting downwards from CoM		Length of W arrow equal on both images
2. Reaction from foot on ground upwards and vertical		
(horizontal forces)		
3. Air resistance from CoM, horizontal and opposing direction of motion		AR smaller at start / greater at finish
4. Friction from foot on ground, horizontal and in direction of motion		F greater at start / smaller at finish
(changes in relationship between AR and F)		
5. At start F > AR	Sprinter is accelerating Use of spikes / starting blocks maximises friction High mass of sprinter Line of gravity at front / in front of base of support AR is low due to low speed / velocity of runner Use of lycra / smooth clothing / lower body position	(Due to) reduced frontal cross-sectional area
6. Approaching line AR significantly increased	Speed / velocity is high Upright posture increases AR increased frontal cross-sectional surface area	
7. At finish F = AR	Sprinter is maintaining maximum velocity	



(physiological factors affecting explosive strength)

8. Size of muscle / hypertrophy	e.g. large deltoids of javelin throwers	Cross-sectional area not necessarily an advantage for explosive strength
9. Muscle fibre type	e.g. elite long jumpers have high proportion of FTG fibres	Fast twitch fibres produce much high speed/force of contraction FTG/type IIb more explosive/quicker than FOG/type IIa
10. Genetics / inherited characteristics from parents	e.g. Leroy Sane / Colin Jackson	If both parents had high % of FT fibres, then children tend to have higher %
11. Age	Peak strength at 20-30 years Males18-30 **OR** females 16-25 After peak, explosive strength deteriorates with age e.g. age range of discus men's world champions is 24-34	Strength decreases due to decreased elasticity of muscle / lower testosterone
12. Gender	Males tend to produce more explosive strength than females e.g. separate competitions for explosive strength / speed for males and females e.g. Caster Semenya / Dutee Chand / named females with very high testosterone	Due to higher testosterone / higher muscle mass But, per unit of cross-sectional area strength is almost equal
13. Training	Use of plyometric / explosive strength training	Increased number of cross-bridges/myofibrils / contractile proteins Increased ATP / enzyme activity

14. Neurological / neural adaptations		Increased recruitment / co-ordination / timing of motor units Decreased inhibition of stretch reflex Decreased inhibition / increased stretch of antagonist
15. Ergogenic aids / drugs	e.g. anabolic steroids / HGH / synthetic hormones	Aid muscle growth / repair / recovery Increase quality of training/increase aggression Dangerous side-effects Illegal / risk of getting caught / banned

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk