



Oxford Cambridge and RSA

**GCE**

**Physical Education**

**H555/01: Physiological factors affecting performance**

Advanced GCE

**Mark Scheme for Autumn 2021**

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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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## 1. Annotations

Annotation	Description	Annotation	Description
	Tick	<b>KU</b>	Knowledge and understanding / indicates AO1 on Q9
	Cross	<b>EG</b>	Example/Reference / indicates AO2 on Q9
<b>BOD</b>	Benefit of doubt	<b>DEV</b>	Development / indicates AO3 on Q9
<b>TV</b>	Too vague	<b>L1</b>	Level 1 response on Q9
<b>REP</b>	Repeat	<b>L2</b>	Level 2 response on Q9
<b>S</b>	Indicates sub-max reached where relevant	<b>L3</b>	Level 3 response on Q9
<b>SEEN</b>	Noted but no credit given	<b>L4</b>	Level 4 response on Q9
<b>IRRL</b>	Significant amount of material which doesn't answer the question	<b>BP</b>	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	Mark	Guidance
1		Two marks for: 1. Hip 2. Shoulder	2  AO1 x 2	
2		Two marks for: 1. (ATP-PC/Phosphocreatine system): creatine kinase 2. (Aerobic system): ATPase / glycogen phosphorylase / GPP / GP / phosphofructokinase / PFK / lipase	2  AO1 x 2	Accept first answer only
3		Two marks for: 1. (active) ask <b>performer</b> to move injured body part (without assistance) 2. (passive) <b>someone else OR first-aider</b> moves injured body part (through full range of motion)	2  AO1 x 2	
4		Two marks for: 1. Microscopic tears in muscle <b>OR</b> delayed onset of muscle soreness 2. eccentric muscle contractions e.g. downhill running / plyometrics	2  AO1 x 1 AO2 x 1	
5		Two marks for: 1. (sagittal) somersault/ tumble turn in swimming 2. (transverse) pirouette / spin / pivot / arm action to throw discus	2  AO2 x 2	NB. If a skill has been named that moves through more than one plane - the joint or part of body that moves through the plane stated must be identified. E.g. Golf swing is TV for transverse unless rotation of trunk/body is identified)

## Section B

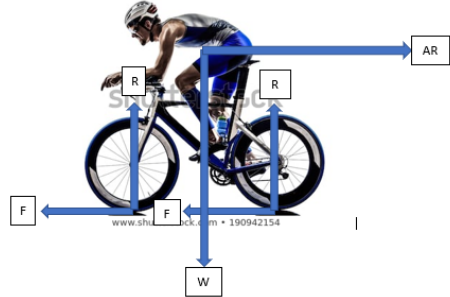
Question			Answer	Mark	Guidance										
6	(a)		<p>Four marks for:</p> <table border="1"> <thead> <tr> <th>Joint</th> <th>Movement</th> <th>Agonist</th> <th>Type of Contraction of agonist</th> <th>Antagonist</th> </tr> </thead> <tbody> <tr> <td>Elbow</td> <td><u>Extension</u></td> <td><u>Triceps brachii</u></td> <td><u>Concentric</u></td> <td><u>Biceps brachii</u></td> </tr> </tbody> </table>	Joint	Movement	Agonist	Type of Contraction of agonist	Antagonist	Elbow	<u>Extension</u>	<u>Triceps brachii</u>	<u>Concentric</u>	<u>Biceps brachii</u>	4 AO3 x 4	
Joint	Movement	Agonist	Type of Contraction of agonist	Antagonist											
Elbow	<u>Extension</u>	<u>Triceps brachii</u>	<u>Concentric</u>	<u>Biceps brachii</u>											
6	(b)		<p>Four marks from:</p> <ol style="list-style-type: none"> <li>(Pocket) valves – (one-way valves) that prevent backflow of blood</li> <li>Muscle/ skeletal pump - skeletal muscles contract squeezing veins</li> <li>Smooth muscle - in walls of veins contracts / venoconstriction</li> <li>Respiratory pump - pressure differences in thoracic to abdominal cavity during breathing</li> <li>Gravity helps blood from above heart return to heart</li> </ol>	4 AO1 x 4	NB: Mark first four answers only.										
6	(c)	(i)	<p>Three marks for:</p> <ol style="list-style-type: none"> <li>A = <u>14 breaths/min</u></li> <li>B = <u>0.5 litres</u></li> <li>C = <u>3 litres</u></li> </ol>	3 AO3 x 3											
6	(c)	(ii)	<p>Three marks for:</p> <ol style="list-style-type: none"> <li>More efficient gas exchange at alveoli / saturation of haemoglobin</li> <li>More efficient transport of oxygen <b>OR</b> greater number / density of RBCs</li> <li>More efficient use of oxygen at muscles <b>OR</b> better able to meet demands for oxygen <b>OR</b> more myoglobin / mitochondria <b>OR</b> higher aerobic capacity</li> </ol>	3 AO1 x 3											

6	(c)	(iii)	<p>Three marks from (sub-max 2 for during exercise):</p> <p>(during exercise)</p> <ol style="list-style-type: none"> <li>1. proprioceptors detect motor activity / movement (in joints/muscles)</li> <li>2. send messages to respiratory control centre / RCC / inspiratory centre</li> <li>3. <b>increased</b> stimulation of diaphragm / respiratory muscles</li> </ol> <p>(during recovery)</p> <ol style="list-style-type: none"> <li>4. proprioceptors detect that movement has stopped / reduced</li> <li>5. <b>reduced</b> stimulation of diaphragm / external intercostals / respiratory muscles</li> </ol>	<p>3</p> <p>AO1 x 3</p>	<p>Accept point 2 anywhere in the answer, but only credit once.</p>
6	(d)		<p>Three marks from:</p> <ol style="list-style-type: none"> <li>1. (additional) volume of oxygen needed to return body to pre-exercise state</li> <li>2. alactacid and lactacid <b>OR</b> fast and slow debt components</li> <li>3. aerobic energy production during recovery</li> <li>4. (oxygen used to) break down of lactic acid / replenishment of oxy-myoglobin</li> <li>5. (aerobic energy used to) resynthesise ATP / replenish muscle phosphagen or PC</li> </ol>	<p>3</p> <p>AO1 x 3</p>	

Question			Answer	Mark	Guidance
7	(a)		<p>Four marks for:</p> <ol style="list-style-type: none"> <li>Interval training</li> <li>under conditions of low oxygen</li> <li>(benefit) increased RBCs/ haemoglobin volume <b>OR</b> increased oxygen-carrying capacity of blood <b>OR</b> increased number/ density of mitochondria <b>OR</b> increased buffering capacity <b>OR</b> increased aerobic capacity/ <math>\text{VO}_2</math> max</li> <li>(risk) disruption to training <b>OR</b> decreased immune system <b>OR</b> increased risk of infection <b>OR</b> dehydration <b>OR</b> benefits are lost quickly</li> </ol>	<p>4</p> <p>AO1 x 2</p> <p>AO3 x 2</p>	Accept only 1 benefit and 1 risk.
7	(b)	(i)	<p>Two marks for:</p> <ol style="list-style-type: none"> <li><u>A</u> has greater aerobic capacity</li> <li><u>B</u> has greater strength endurance</li> </ol>	<p>2</p> <p>AO3 x 2</p>	
7	(b)	(ii)	<p>Four marks for:</p> <ol style="list-style-type: none"> <li>(age) from early 20s onwards <math>\text{VO}_2</math> max decreases <b>OR</b> A may be younger (than B)</li> <li>Due to reduced elasticity in heart / blood vessels / lungs <b>OR</b> reduced efficiency in inspiring / transporting oxygen</li> <li>(gender) females tend to have lower <math>\text{VO}_2</math> max <b>OR</b> B may be female</li> <li>Due to lower muscle mass / higher percentage body fat / smaller lung volumes / lower stroke volume / cardiac output <b>OR</b> lower haemoglobin levels</li> </ol>	<p>4</p> <p>AO2 x 4</p>	N.B credit reduced efficiency in inspiring/transporting oxygen once only. Accept opposites.

7	(c)	<p>Six marks for:</p> <ol style="list-style-type: none"> <li>1. (Preparatory phase) 6 – 12 weeks before start of competition season / e.g. July/August for hockey pre-season</li> <li>2. (objective) general conditioning / aerobic / strength / mobility training (all sports)</li> <li>3. (objective) sport-specific training / e.g. basketball skills and drills</li> <li>4. (Transition) 4 – 6 weeks after end of season / e.g. June for hockey transition season</li> <li>5. (objective) active rest / recovery / recuperation / variance (all sports)</li> <li>6. (objective) low-intensity / aerobic work / non-specific activities, e.g. footballer does cycling / swimming activities</li> </ol>	6 AO2 x 6	Look for application to the named sport, although objectives may be quite general.
7	(d)	<p>Four marks from:</p> <ol style="list-style-type: none"> <li>1. Poor coaching / poor technique / poor biomechanical / postural training</li> <li>2. e.g. poor tackling technique in rugby <b>OR</b> poor lifting technique in gym</li> <li>3. Incorrect equipment / clothing / footwear</li> <li>4. e.g. use of tennis racquet that is too heavy <b>OR</b> cricket helmet does not fit correctly impairing vision</li> <li>5. Inappropriate overload / overtraining / lack of variance</li> <li>6. e.g. overuse injuries such as tennis elbow / tendonitis / shin splints when running</li> </ol>	4 AO1 x 2 AO2 x 2	<p>Mark first two risk factors only.</p> <p>Practical example must match risk factor.</p>



Question		Answer	Mark	Guidance
8	(a)	<p>Three marks for:</p> <ol style="list-style-type: none"> <li>1. Height of centre of mass</li> <li>2. Size of base / area of support</li> <li>3. Position of line of gravity</li> </ol>	<p>3</p> <p>AO1 x 3</p>	Mark first three answers only
8	(b)	<p>Four marks for:</p> <ol style="list-style-type: none"> <li>1. Ball travelling in straight line has linear motion</li> <li>2. (application of) a direct force / through CoM</li> <li>3. Swerving ball has angular motion</li> <li>4. (application of) an eccentric force / torque / not through CoM</li> </ol>	<p>4</p> <p>AO2 x 4</p>	
8	(c) (i)	<p>Four marks for:</p> <ol style="list-style-type: none"> <li>1. Weight / W – vertically down from CoM</li> <li>2. Reaction / R – vertically up from ground on both wheels which equal weight</li> <li>3. Air resistance / AR – backwards from CoM</li> <li>4. Friction / F – forwards from ground on both wheels</li> </ol>	<p>4</p> <p>AO3 x 4</p>	
8	(c) (ii)	<p>Four marks from:</p> <ol style="list-style-type: none"> <li>1. Skater brings arms or legs in (close to longitudinal axis of rotation)</li> <li>2. Reducing moment of inertia</li> <li>3. Increasing angular velocity</li> <li>4. Principle of conservation of angular momentum</li> <li>5. <math>AM = MI \times AV</math></li> </ol>	<p>4</p> <p>AO2 x 4</p>	

8	(d)		Five marks from:  1. Ski jumper adopts an aerofoil shape 2. Creates an angle of attack / angle of $17^\circ$ 3. Air travels <u>further</u> over top of ski jumper 4. Air travels <u>faster</u> / at higher velocity over top of ski jumper 5. <u>Lower</u> pressure above the ski jumper <b>or</b> creates a pressure gradient 6. Air moves from area of high to low pressure 7. Lift force created	5  AO2 x 5	Accept opposites for points 3-5

Section C		
Question	Answer	Guidance
9*	<p><b>Level 4 (17–20 marks)</b></p> <ul style="list-style-type: none"> <li>detailed knowledge and excellent understanding (AO1)</li> <li>well-argued judgements which are well supported by relevant practical examples (AO2)</li> <li>detailed analysis and critical evaluation (AO3)</li> <li>very 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>	<p><b>At Level 4 responses are likely to include:</b></p> <ul style="list-style-type: none"> <li>detailed knowledge of Newton's laws of motion, accurately applied to the vertical jump</li> <li>accurate definition of concussion, together with a range of ways that concussion can occur in sports</li> <li>detailed explanation with some evaluation of the 6 R's</li> <li>at the top of this level excellent knowledge is shown in all three areas, and criticisms/abuses of the 6 R's may be present</li> <li>AO1, AO2 and AO3 all covered well in this level.</li> </ul>
	<p><b>Level 3 (12–16 marks)</b></p> <ul style="list-style-type: none"> <li>good knowledge and clear understanding (AO1)</li> <li>judgements will be present but may not always be supported by relevant practical examples (AO2)</li> <li>good analysis and critical evaluation (AO3)</li> <li>generally accurate use of technical and specialist vocabulary</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>	<p><b>At Level 3 responses are likely to include:</b></p> <ul style="list-style-type: none"> <li>good knowledge of Newton's laws of motion, concussion and the 6 R's</li> <li>good application of Newton's laws, together with some examples of ways that concussion may occur in sport</li> <li>a good explanation of the 6 R's</li> <li>at the upper end of this level there must be some credit for AO3</li> <li>Two parts of the question may have been answered better than the other</li> </ul>
	<p><b>Level 2 (7-11 marks)</b></p> <ul style="list-style-type: none"> <li>limited knowledge and understanding (AO1)</li> <li>judgement given but often unsupported by relevant practical examples (AO2)</li> <li>some evidence of analysis and critical evaluation (AO3)</li> <li>technical and specialist vocabulary used with limited success</li> <li>the information has some relevance and is presented with limited structure. The information is supported by limited evidence.</li> </ul>	<p><b>At Level 2 responses are likely to include:</b></p> <ul style="list-style-type: none"> <li>limited knowledge of Newton's laws of motion, concussion and the 6 R's</li> <li>some evidence of application of Newton's laws to the vertical jump and/or some examples of how concussion may occur in sport</li> <li>limited explanation of the 6 R's</li> <li>One part of the question may have been addressed much more strongly than the others.</li> <li>maximum of 8 marks to be awarded for AO1 with no application</li> </ul>
	<p><b>Level 1 (1–6 marks)</b></p> <ul style="list-style-type: none"> <li>basic knowledge and little understanding (AO1)</li> <li>little or no attempt to give opinion or judgement (AO2)</li> <li>little relevant analysis or critical evaluation (AO3)</li> <li>little or no attempt to use technical and specialist vocabulary</li> <li>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.</li> </ul>	<p><b>At Level 1 responses are likely to include:</b></p> <ul style="list-style-type: none"> <li>basic knowledge of Newton's laws of motion and concussion.</li> <li>6 R's may be described with little or no explanation</li> <li>description of one or two ways that a concussion may occur</li> <li>some inaccurate or irrelevant information may be present</li> <li>mainly AO1 content.</li> </ul>
	<p><b>(0 marks)</b> No response or no response worthy of credit.</p>	

9\* 20 marks

**Indicative content:**

AO1 - KU	AO2 – EG	AO3 - DEV
<b>(Newton's laws of motion)</b>		
1. A body continues in a state of rest or uniform velocity unless acted on by an external force	Jumper will remain on floor until an external / unbalanced force acts	Gravity is external force that prevents constant velocity upwards
2. Law of inertia	Greater the mass of jumper greater the inertia	Force must be greater than weight to cause jumper to leave floor
3. A body's rate of change in momentum is proportional to the size of the force applied  and acts in the direction that the force is applied	The greater the force applied to the ground, the greater the acceleration	The force must be applied directly downwards to produce a vertical jump/ acceleration is vertically upwards
4. Law of acceleration	The greater the acceleration or change in momentum the higher the performer will jump AO2 greater action force applied = greater change in momentum	$F = ma$ / momentum = mass x velocity
5. For every action (force) there is an equal and opposite reaction (force)	The jumper applies an action force into the ground	
6. Law of reaction	The ground provides an equal and opposite force to the jumper	
<b>(concussion and its possible causes)</b>		
7. A (traumatic) brain injury		Disturbance of brain function
8. direct impact	e.g. punch in boxing / kick to head in kick boxing	Impact of brain on inner lining of cranium
9. blow to head / whiplash	e.g. clash of heads in rugby / football e.g. whiplash following a dominant tackle in rugby	May or may not result in unconsciousness
10. contact with ground	e.g. fall in horse racing / off high bar in gymnastics	

<b>(Explain and evaluate 6 R's)</b>		
11. (Recognise) be aware of / signs / symptoms of concussion/ that the situation / incident may result in concussion	Symptoms include headaches / dizziness / nausea / impaired balance and hearing	Parents / players / coaches / officials all have role to play Signs or symptoms may not be obvious
12. (Remove) take player off field of play immediately	Stop play immediately / do not wait for next stoppage in game / ball out of play	Legal obligation of officials / coaches to players in their care But player may deny concussion / want to stay on field
13. (Refer) player to a qualified healthcare professional for evaluation	Head injury assessment / HIA a part of the game of rugby (and other sports)/ e.g. scans	At lower levels healthcare professionals may not be immediately available Monitor for signs of deterioration for at least 24 hours While asleep player should also be closely monitored
14. (Rest) abstain from exercise until symptom-free		Player should abstain from alcohol / work / school / physical exertion
15. (Recover) Player must allow fully recovery or be symptom-free before returning to play / training	Named specific treatments, e.g. graduated return to play / GRTP programme	Adults 1-week minimum recovery in RU <b>OR</b> U18s 2-weeks minimum recovery in RU
16. (Return) Player must be symptom-free to return to play	Written authorisation from healthcare professional Player must follow minimum timescale for recovery Player has completed graduated return to play programme	
17. Abuse of concussion laws in sport / rugby union		Use of HIA to allow player to get extra treatment for other injuries without making an official substitution  Intimidation of healthcare professionals to enable player to return to field and play on  In football once a player is substituted they cannot return to pitch, so incentive to leave player on pitch to see if player is OK / can run off injury before removing
18. Ease of 6Rs protocol		Easy to remember / learn / educate / advertise / use 6Rs protocol

**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](mailto:general.qualifications@ocr.org.uk)

[www.ocr.org.uk](http://www.ocr.org.uk)

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