



Oxford Cambridge and RSA

GCE

Physical Education

H155/01: Physiological factors affecting performance

AS Level

Mark Scheme for June 2022

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.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: Scoris Assessor Online Training; OCR Essential Guide to Marking.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the 10 practice responses (“scripts”) and the 10 standardisation responses

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the Scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the Scoris messaging system, or by email.
5. **Crossed Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into

RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)



Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
- there is nothing written in the answer space.
- Award Zero '0' if:
- anything is written in the answer space and is not worthy of credit (this includes text and symbols).
- Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.
8. The scoris **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.** If you have any questions or comments for your team leader, use the phone, the scoris messaging system, or e-mail.
9. Assistant Examiners will send a brief report on the performance of candidates to your Team Leader (Supervisor) by the end of the marking period. The Assistant Examiner's Report Form (AERF) can be found on the RM Cambridge Assessment Support Portal (and for traditional marking it is in the Instructions for Examiners). Your report should contain notes on particular strength displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.
10. For answers marked by levels of response:
- To determine the level** – start at the highest level and work down until you reach the level that matches the answer
 - To determine the mark within the level**, consider the following:

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. Annotations used in the detailed Mark Scheme

Annotation	Description	Annotation	Description
	Tick	KU	Knowledge and understanding / indicates AO1 on Q8
	Cross	EG	Example/Reference / indicates AO2 on Q8
BOD	Benefit of doubt	DEV	Development / indicates AO3 on Q8
TV	Too vague	L1	Level 1 response on Q8
REP	Repeat	L2	Level 2 response on Q8
S	Indicates sub-max reached where relevant	L3	Level 3 response on Q8
SEEN	Noted but no credit given	BP	Blank page
IRRL	Significant amount of material which doesn't answer the question		

- 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	(a)	<p>Five marks from:</p> <table border="1"> <tr> <td>1. (Movement)</td> <td><u>Dorsi flexion</u></td> </tr> <tr> <td>2. (Agonist)</td> <td>Tibialis Anterior</td> </tr> <tr> <td>3. (Contraction)</td> <td>(Isotonic) Concentric</td> </tr> <tr> <td>4. (Plane)</td> <td>Sagittal</td> </tr> <tr> <td>5. (Fixator)</td> <td>Rectus femoris/Vastus lateralis/Vastus intermedius/Vastus medialis</td> </tr> </table>	1. (Movement)	<u>Dorsi flexion</u>	2. (Agonist)	Tibialis Anterior	3. (Contraction)	(Isotonic) Concentric	4. (Plane)	Sagittal	5. (Fixator)	Rectus femoris/Vastus lateralis/Vastus intermedius/Vastus medialis	5 (AO3)									
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	(b)	<p>Five marks from: Submax four for points 1-5 / Must gain point 6 for max</p> <table border="1"> <tr> <td>1. (Formula for Q)</td> <td>Cardiac output/Q=HR x SV</td> </tr> <tr> <td colspan="2">Cardiac output at point A</td> </tr> <tr> <td>2. (Workings for A)</td> <td>80 x 70</td> </tr> <tr> <td>3. (Answer for A)</td> <td>5600 ml/min or 5.6 L/min</td> </tr> <tr> <td colspan="2">Cardiac output for point B</td> </tr> <tr> <td>4. (Workings for B)</td> <td>180 x 100</td> </tr> <tr> <td>5. (Answer for B)</td> <td>18000 ml/min or 18 L/min</td> </tr> <tr> <td colspan="2">Increase in cardiac output</td> </tr> <tr> <td>6. (Increase: B-A)</td> <td>(18000-5600=) 12,400 ml/min or (18 – 5.6 =) 12.4 L/min</td> </tr> </table>	1. (Formula for Q)	Cardiac output/Q=HR x SV	Cardiac output at point A		2. (Workings for A)	80 x 70	3. (Answer for A)	5600 ml/min or 5.6 L/min	Cardiac output for point B		4. (Workings for B)	180 x 100	5. (Answer for B)	18000 ml/min or 18 L/min	Increase in cardiac output		6. (Increase: B-A)	(18000-5600=) 12,400 ml/min or (18 – 5.6 =) 12.4 L/min	5 (AO3)	<p>Accept</p> <p>2. +/- 5 for each value. 3. error carried forward from point 2 if arithmetic correct. 4. +/- 5 for each value 5. error carried forward from point 4 if arithmetic correct. 6. answer 5-answer 3 if awarded within ecf.</p>
1. (Formula for Q)	Cardiac output/Q=HR x SV																					
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	(c)	(i)	<p>Two marks from:</p> <table border="1"> <tr> <td>1. (Muscle pump)</td> <td>(Skeletal) muscles contract which compress / squeeze the veins</td> </tr> <tr> <td>2. (Respiratory pump)</td> <td>Breathing causes a pressure difference between the thoracic/chest cavity and abdominal cavity</td> </tr> </table>	1. (Muscle pump)	(Skeletal) muscles contract which compress / squeeze the veins	2. (Respiratory pump)	Breathing causes a pressure difference between the thoracic/chest cavity and abdominal cavity	2 (AO1)	<p>Accept:</p> <p>Any specific terminology to describe breathing e.g. inspiration, ventilation, movement of the diaphragm.</p>													
1. (Muscle pump)	(Skeletal) muscles contract which compress / squeeze the veins																					
2. (Respiratory pump)	Breathing causes a pressure difference between the thoracic/chest cavity and abdominal cavity																					

Section A					
Question		Answer		Marks	Guidance
	(ii)	Two marks from:		2 (AO2)	Do not accept: Increase/decrease without explanation
		1. (Exercise)	More frequent/forceful muscular contractions / more frequent /deeper breathing cause VR to <u>increase</u>		
		2. (Recovery)	Less frequent/forceful muscular contractions / less frequent / deeper breathing cause VR to <u>decrease</u>		
	(iii)	One mark from		1 (AO2)	
		1. (Muscle pump)	The action of the muscle pump is maintained above resting level / gradually decreases		
		2. (Blood pooling)	Blood pooling reduced/avoided/ blood continues to move towards the heart		
		3. (Respiratory pump)	The action of the respiratory pump is maintained above resting level / gradually decreases (because ventilation rate/depth higher than at rest)		
	(d) (i)	Four marks from		4 (AO1)	Accept: 2. Any number within the given range Do not accept: pts 2 and 4 without correct units
		1. (Definition f)	The number of inspirations or expirations / breaths in or out taken in one/per minute		
		2. (Value for f)	11-15 <u>breaths/minute</u>		
		3. (Definition TV)	The volume of air inspired or expired / breathed in or breathed out in one/per breath		
		4. (Value for TV)	<u>500ml / 500cm³</u>		
	(ii)	A		1 (AO1)	

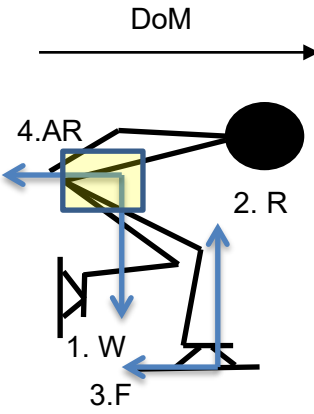
Section A																																
Question		Answer	Marks	Guidance																												
2	(a)	<p>5 marks from: (Advantages) Submax 4</p> <table border="1"> <tr> <td>1. (Glycogen)</td> <td>Increases (muscle and liver) glycogen stores/ glycogen synthesis</td> </tr> <tr> <td>2. (Endurance)</td> <td>Increases endurance or performer can compete for longer or increases V_{O2}max</td> </tr> <tr> <td>3. (Fatigue)</td> <td>Delays fatigue or glycogen stores take longer to deplete or increases time to exhaustion</td> </tr> <tr> <td>4. (Long distance)</td> <td>Benefits long distance/runners/swimmers/cyclists/ triathletes</td> </tr> <tr> <td>5. (Games)</td> <td>Benefits games players / (accept any appropriate game) Football/ Hockey/Rugby/ Netball/Tennis players</td> </tr> <tr> <td>6. (Legality)</td> <td>Legal</td> </tr> </table> <p>(Disadvantages) Submax 4</p> <table border="1"> <tr> <td>7. (Hypoglycaemia)</td> <td>Hypoglycaemia/low blood sugar (in the depletion phase)</td> </tr> <tr> <td>8. (Training quality)</td> <td>Low quality / intensity of training or lethargy (in the depletion phase)</td> </tr> <tr> <td>9. (Recovery)</td> <td>Increased time to recover between sessions/sets (in the depletion stage)</td> </tr> <tr> <td>10. (Fatigue)</td> <td>Fatigue during depletion phase (which increases risk of injury)</td> </tr> <tr> <td>11. (Weight gain)</td> <td>Weight gain in the loading phase as more water needed to store additional glycogen</td> </tr> <tr> <td>12. (Abdominal discomfort)</td> <td>Performer may suffer from abdominal discomfort/symptoms /gastrointestinal symptoms in depletion/ high fat / loading/high carbohydrate phase</td> </tr> <tr> <td>13. (Timing errors)</td> <td>Performer may not be accurate/may mis-time loading phase so glycogen stores are not optimised or can disrupt pre-event routine/quality of training</td> </tr> <tr> <td>14. (Explosive activities)</td> <td>Performer may not benefit from glycogen loading if they compete in short duration activities / (accept any appropriate short duration event or sport) Athletics thrower/sprinter/gymnast</td> </tr> </table>	1. (Glycogen)	Increases (muscle and liver) glycogen stores/ glycogen synthesis	2. (Endurance)	Increases endurance or performer can compete for longer or increases V _{O2} max	3. (Fatigue)	Delays fatigue or glycogen stores take longer to deplete or increases time to exhaustion	4. (Long distance)	Benefits long distance/runners/swimmers/cyclists/ triathletes	5. (Games)	Benefits games players / (accept any appropriate game) Football/ Hockey/Rugby/ Netball/Tennis players	6. (Legality)	Legal	7. (Hypoglycaemia)	Hypoglycaemia/low blood sugar (in the depletion phase)	8. (Training quality)	Low quality / intensity of training or lethargy (in the depletion phase)	9. (Recovery)	Increased time to recover between sessions/sets (in the depletion stage)	10. (Fatigue)	Fatigue during depletion phase (which increases risk of injury)	11. (Weight gain)	Weight gain in the loading phase as more water needed to store additional glycogen	12. (Abdominal discomfort)	Performer may suffer from abdominal discomfort/symptoms /gastrointestinal symptoms in depletion/ high fat / loading/high carbohydrate phase	13. (Timing errors)	Performer may not be accurate/may mis-time loading phase so glycogen stores are not optimised or can disrupt pre-event routine/quality of training	14. (Explosive activities)	Performer may not benefit from glycogen loading if they compete in short duration activities / (accept any appropriate short duration event or sport) Athletics thrower/sprinter/gymnast	5 (AO1)	SSU: accept 'hitting the wall' for point 3?
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Section A					
Question	Answer		Marks	Guidance	
	(b)	(i)	Two marks from: 1. Individual physiological make-up or genetics 2. Training	2 (AO1) Accept: 1. Examples of physiological make-up eg: Lung volume/maximal cardiac output/blood or RBC volume etc	
		(ii)	Four marks from: Submax 2 marks from even numbered points / Submax 2 marks from odd numbered points	4 (AO1 x2, AO3 x2) Do not accept: even numbered marks unless linked to specific adaptation. Maximum of 2 marks to be awarded for AO1. Maximum of 2 marks to be awarded for AO3.	
			(Cardiovascular adaptations AO1)		(Analyse affect on sports performer AO3) must be linked to adaptation
			1. Cardiac/myocardial hypertrophy		2. (Benefits endurance/aerobic performance due to...) increased contractility/filling capacity/SV/Q/O ₂ transport to working muscle
			3. Capillarisation (at muscle tissue and lungs)		4. (Benefits endurance/aerobic performance due to...) increased gaseous exchange at lungs/muscle or more O ₂ diffuses to working muscle or increased area for blood flow
			5. Increased elasticity of arterial walls		6. (Benefits performance due to ...) increased efficiency of the vascular shunt/redistribution of blood to working muscles
			7. Increased blood/plasma volume		8. (Benefits endurance/aerobic performance due to...) reduced blood viscosity which increases blood flow/VR
			9. Increased number of red blood cells/haemoglobin		10. (Benefits endurance/aerobic performance due to..) increased capacity to carry O ₂ to working muscles or increased gas exchange
			11. Increased buffering capacity		12. (Increases performance in higher intensity/intermittent exercise due to ...) neutralisation of acidic waste products/lactic acid/carbonic acid

Section A																
Question		Answer	Marks	Guidance												
		or OBLA/fatigue delayed														
(c)	(i)	<p>Three marks from:</p> <table border="1"> <tr> <td>1. (Macrocycle)</td> <td><u>Macrocycle</u> is the long term goal/ 6 months - 4 year goal eg: Football player aiming for national team selection or athlete aiming for pb in championship race</td> </tr> <tr> <td>2. (Mesocycle)</td> <td><u>Mesocycle</u> is a medium term goal/ 1-4 months eg: Football player focussing on applying skills in different tactical plays or athlete improving aerobic capacity</td> </tr> <tr> <td>3. (Microcycle)</td> <td><u>Microcycle</u> is a short term goal/ 1-4 weeks eg: Football player improving passing technique or athlete improving speed over the start phase.</td> </tr> </table>	1. (Macrocycle)	<u>Macrocycle</u> is the long term goal/ 6 months - 4 year goal eg: Football player aiming for national team selection or athlete aiming for pb in championship race	2. (Mesocycle)	<u>Mesocycle</u> is a medium term goal/ 1-4 months eg: Football player focussing on applying skills in different tactical plays or athlete improving aerobic capacity	3. (Microcycle)	<u>Microcycle</u> is a short term goal/ 1-4 weeks eg: Football player improving passing technique or athlete improving speed over the start phase.	3 (AO2)	Accept: Any reasonable sports example for each mark						
1. (Macrocycle)	<u>Macrocycle</u> is the long term goal/ 6 months - 4 year goal eg: Football player aiming for national team selection or athlete aiming for pb in championship race															
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(d)		<p>Four marks from:</p> <table border="1"> <tr> <td>1. (Atherosclerosis)</td> <td><u>Atherosclerosis</u> is the build up of fatty deposits/atheroma/fatty plaque on the arterial walls (causing narrowing of the lumen)</td> </tr> <tr> <td>2. (Coronary heart disease)</td> <td><u>Coronary heart disease</u> is the reduction in blood flow/oxygen supply to the coronary artery /heart</td> </tr> </table>	1. (Atherosclerosis)	<u>Atherosclerosis</u> is the build up of fatty deposits/atheroma/fatty plaque on the arterial walls (causing narrowing of the lumen)	2. (Coronary heart disease)	<u>Coronary heart disease</u> is the reduction in blood flow/oxygen supply to the coronary artery /heart	4 (AO1)	Accept: pts 3 and 4 'blood clot' for blockage = BOD								
1. (Atherosclerosis)	<u>Atherosclerosis</u> is the build up of fatty deposits/atheroma/fatty plaque on the arterial walls (causing narrowing of the lumen)															
2. (Coronary heart disease)	<u>Coronary heart disease</u> is the reduction in blood flow/oxygen supply to the coronary artery /heart															

Section A					
Question		Answer	Marks	Guidance	
		3. (Heart attack)			
		Heart attack / myocardial infarction is the complete/total blockage of a coronary artery (by atheroma/blood clot) which causes cell death/lack of O ₂ to the heart muscle			
		4. (Stroke)			
		Stroke is a blocked (ischaemic) / burst (haemorrhagic) blood vessel leading to / within the brain			
		5 (Angina)			
		Pain in the chest caused by blockage in the coronary arteries			
3	(a)	Six marks from: (Stationary preparation phase)	6 (AO2)	Accept: pt6. Opposites: W is less than R pt7. there is an overall force = BOD	
		1. (Balanced forces)			The forces are <u>balanced</u>
		2. (R=W)			The two (opposing) forces are equal in size and opposite in direction or the forces cancel (out) or the (ground/normal) reaction force is equal to the weight of the performer or the upward force on the performer is equal to the downward force
		3. (Net force)			There is no net /resultant force or net/resultant/sum of all forces acting = zero
		4. (Newton1)			so ... the body will remain at rest/there will be no change to its state of motion.
		(Upward execution phase)			
		5. (Unbalanced forces)			The forces are unbalanced
		6.(R>W)			The two (opposing) forces are not equal in size and opposite in direction or the forces do not cancel (out) or the (ground/normal) reaction force is greater than the weight of the performer or the upward force on the performer is greater than to the downward force
		7. (Net force)			There is a positive/upward net/resultant force acting on the performer
		8. (Newton 1)			The body will change its state of motion/ accelerates upwards/ develops or initiates upward velocity/ takes off
		9.(Newton 2)			The larger the reaction/upward force the faster the performer will accelerate/jump (upwards)

Section A				Marks	Guidance																		
Question		Answer																					
	(b)	Five marks from: <table border="1" data-bbox="443 507 1688 1299"> <tr> <td>1. (Load)</td> <td><u>Load</u> is the weight / resistance / limb / body part to be moved</td> </tr> <tr> <td>2. (Effort)</td> <td><u>Effort</u> is the muscular force applied (at the insertion point) to move/counteract the load or <u>Effort</u> is the force applied by the agonist muscle</td> </tr> <tr> <td>3. (Fulcrum)</td> <td><u>Fulcrum</u> is the fixed/pivot point or joint (about which the lever moves)</td> </tr> <tr> <td>4. (Effort arm)</td> <td>Effort arm is the (perpendicular) distance between the fulcrum and the effort</td> </tr> <tr> <td>5. (Load arm)</td> <td>Load arm is the (perpendicular) distance between the fulcrum and the load</td> </tr> <tr> <td>6. (Movement)</td> <td>Movement about the fulcrum will occur if the turning effect of the effort is larger than the turning effect of the load (or vice versa) or if the moment of the effort is greater than the moment of the load (or vice versa)</td> </tr> <tr> <td>7. (Efficiency)</td> <td>A large effort arm (compared to load arm) increases the efficiency of the lever system/efficient movement/gives mechanical advantage or a 2nd class lever system is more efficient than a 3rd class lever system (or vice versa)</td> </tr> <tr> <td>8. (Speed / range)</td> <td>A large load arm (compared to effort arm)/ 3rd class lever can increase speed of movement or large load arm (compared to effort arm)/ 3rd class lever can increase range of movement</td> </tr> <tr> <td>9. (Class)</td> <td>The order of the load, effort and fulcrum in a lever system determines which class it is/ 1st, 2nd or 3rd class</td> </tr> </table>		1. (Load)	<u>Load</u> is the weight / resistance / limb / body part to be moved	2. (Effort)	<u>Effort</u> is the muscular force applied (at the insertion point) to move/counteract the load or <u>Effort</u> is the force applied by the agonist muscle	3. (Fulcrum)	<u>Fulcrum</u> is the fixed/pivot point or joint (about which the lever moves)	4. (Effort arm)	Effort arm is the (perpendicular) distance between the fulcrum and the effort	5. (Load arm)	Load arm is the (perpendicular) distance between the fulcrum and the load	6. (Movement)	Movement about the fulcrum will occur if the turning effect of the effort is larger than the turning effect of the load (or vice versa) or if the moment of the effort is greater than the moment of the load (or vice versa)	7. (Efficiency)	A large effort arm (compared to load arm) increases the efficiency of the lever system/efficient movement/gives mechanical advantage or a 2 nd class lever system is more efficient than a 3 rd class lever system (or vice versa)	8. (Speed / range)	A large load arm (compared to effort arm)/ 3 rd class lever can increase speed of movement or large load arm (compared to effort arm)/ 3 rd class lever can increase range of movement	9. (Class)	The order of the load, effort and fulcrum in a lever system determines which class it is/ 1 st , 2 nd or 3 rd class	5 (AO1)	
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Section A												
Question	Answer		Marks	Guidance								
(c)	(i)	<p>Four marks from:</p>  <table border="1" data-bbox="896 590 1680 893"> <tr> <td>1. Weight</td> <td>Arrow vertically downwards from centre of mass</td> </tr> <tr> <td>2. (Ground)Reaction</td> <td>Arrow vertically upwards from front skate <u>same length as weight arrow</u></td> </tr> <tr> <td>3. Friction</td> <td>Horizontal arrow from front skate <u>against direction of motion (of front skate)</u></td> </tr> <tr> <td>4. Air Resistance</td> <td>Horizontal arrow from centre of mass <u>against direction of motion</u></td> </tr> </table>	1. Weight	Arrow vertically downwards from centre of mass	2. (Ground)Reaction	Arrow vertically upwards from front skate <u>same length as weight arrow</u>	3. Friction	Horizontal arrow from front skate <u>against direction of motion (of front skate)</u>	4. Air Resistance	Horizontal arrow from centre of mass <u>against direction of motion</u>	4 (AO2)	<p>Do not accept: Arrows unless labelled</p> <p>Accept: A range of starting points for the AR and Weight arrows for the COM of the skater. See box in diagram.</p>
1. Weight	Arrow vertically downwards from centre of mass											
2. (Ground)Reaction	Arrow vertically upwards from front skate <u>same length as weight arrow</u>											
3. Friction	Horizontal arrow from front skate <u>against direction of motion (of front skate)</u>											
4. Air Resistance	Horizontal arrow from centre of mass <u>against direction of motion</u>											
	(ii)	<p>Two marks from: Submax one mark for why and one mark for how</p> <table border="1" data-bbox="448 1181 1680 1372"> <tr> <td colspan="2">Why</td> </tr> <tr> <td>1. (Direction)</td> <td>Because the friction is acting against the direction of motion and so will decelerate/slow down the skater</td> </tr> <tr> <td colspan="2">How</td> </tr> <tr> <td>2. (Skate)</td> <td>By making the skate/blade surface smooth or keeping the blade straight/inline</td> </tr> </table>	Why		1. (Direction)	Because the friction is acting against the direction of motion and so will decelerate/slow down the skater	How		2. (Skate)	By making the skate/blade surface smooth or keeping the blade straight/inline	2 (AO2)	
Why												
1. (Direction)	Because the friction is acting against the direction of motion and so will decelerate/slow down the skater											
How												
2. (Skate)	By making the skate/blade surface smooth or keeping the blade straight/inline											

Section A					
Question		Answer		Marks	Guidance
		3.(Ice)	Pressure on ice creates a thin layer of water which reduces friction or ice rink resurfaced/smoothed for competition		
	(d)	Three marks from:		3 (AO1 x2, AO2 x1)	Accept: pt.3 any relevant example that links one of the factors in pt2 to an example in sport. Do not accept: pt.3 a sporting example that only links CoM to application of force or resulting motion.
		1. (Definition)	The point at which a body is balanced in all directions or The point at which weight is considered/appears to act		
		2. (Distribution of mass)	The distribution of body mass affects the position of the centre of mass or Body position affects the centre of mass or Differing densities within the body affects the centre of mass		
		3. (Example)	(Changing body position) eg: A diver raises their arms above their head which raises their centre of mass or a sprinter moves their weight forward in the set position to get their centre of mass closer to the start line. or (Distribution of mass / differing densities) eg: A cyclist may have a lower centre of mass due to a high level of muscularity in their legs compared to upper body or a female hockey player may have a lower center of mass than a male due more mass centred around the hips e.g The high jumper arches their back to move the COM under the bar allowing a higher jump.		

Section C		
Question	Answer	Guidance
4*	<p>Level 3 (8–10 marks)</p> <ul style="list-style-type: none"> • 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. 	<p>At Level 3 responses are likely to include:</p> <ul style="list-style-type: none"> • detailed description of strength tests • selection or adaptation of a range of appropriate tests for a heptathlete • Detailed positive and negative evaluation of the use of force plates for a heptathlete • correct technical language is used throughout • AO1, AO2 and AO3 all covered well in this level.
	<p>Level 2 (5–7 marks)</p> <ul style="list-style-type: none"> • 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. 	<p>At Level 2 responses are likely to include:</p> <ul style="list-style-type: none"> • good description of strength tests • tests are applied to a heptathlete • good evaluation for the use of force plates, although there may more positive points given • At the top of this level the evaluation will be applied to the heptathlete and there may be some negative evaluation • maximum of 3 marks to be awarded for AO1. • Either the strength tests or the evaluation must be applied to the example to access this level.
	<p>Level 1 (1–4 marks)</p> <ul style="list-style-type: none"> • 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. 	<p>At Level 1 responses are likely to include:</p> <ul style="list-style-type: none"> • identification of test(s), limited description • reference to the heptathlete may not be evident • force plates may be described rather than evaluated. There may be some limited evaluation at the top of this level. • maximum of 3 marks to be awarded for AO1 with no application.
	(0 marks) No response or no response worthy of credit.	

Marks: Total 10 (AO1 x 3, AO2 x 4, AO3 x 3):

	Indicative content		
	AO1 = KU	AO2 = EG	AO3 = DEV
	Description of strength tests appropriate for a heptathlete		
<ul style="list-style-type: none"> 1. (Vertical jump) 	<ul style="list-style-type: none"> Identification of vertical jump/sergeant jump test 	<ul style="list-style-type: none"> To test explosive/elastic strength Important for hurdling/sprint start/jump take off/throwing release Because maximal force produced in one or a series of quick/rapid contractions Test specific to jumping/sprinting 	<ul style="list-style-type: none"> less relevant for measuring explosive strength in the upper body for throwing events Wingate test is a more specific dynamic strength test for events such as 100m hurdles or 200m.
<ul style="list-style-type: none"> 2. (protocol) 	<ul style="list-style-type: none"> (use of classic equipment) Highest reach measured with one outstretched arm then height of outstretched arm measured when jumping OR use of a contact mat 	<ul style="list-style-type: none"> (first method using classic equipment) Mimics action in jump take-off 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 3. (results) 	<ul style="list-style-type: none"> The difference between the two heights is calculated OR data sent to computer depending on amount of time in air. 	<ul style="list-style-type: none"> Explosive strength evaluation by comparing to standardised tables 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 4. (1RM) 	<ul style="list-style-type: none"> Identification of 1RM 	<ul style="list-style-type: none"> To test maximum strength 	<ul style="list-style-type: none"> Hand grip test not specific to

	Indicative content		
		<ul style="list-style-type: none"> Important for sprint start/jump take off/throwing release 	<ul style="list-style-type: none"> heptathlete Could be applicable to throwing events
<ul style="list-style-type: none"> 5. (protocol) 	<ul style="list-style-type: none"> High weight selected on multi-gym/free weight exercise to isolate a muscle group 	<ul style="list-style-type: none"> squat to relevant to take off/throwing release bench press relevant to throwing events. 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 6. (results) 	<ul style="list-style-type: none"> Increase weight until only one repetition can be performed 	<ul style="list-style-type: none"> The maximum weight/resistance is the 1RM evaluation Full recovery between attempts is needed to ensure accuracy 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 7. (Sit-up/Abdominal curl test) 	<ul style="list-style-type: none"> Identification of sit-up/abdominal curl test 	<ul style="list-style-type: none"> To test strength endurance Important for middle distance running or hurdles Because repeated force exerted over a period of time 	<ul style="list-style-type: none"> Test not specific to leg muscles, although running is whole body exercise Press up test not specific to heptathlete as strength endurance in arm muscles of heptathlete is not a key fitness requirement
<ul style="list-style-type: none"> 8. (protocol) 	<ul style="list-style-type: none"> Performer completes abdominal curls/sit ups at progressive intensities (using abdominal curl test cd) until exhaustion OR performer completes sit ups repeatedly until they need to stop for a break. 	<ul style="list-style-type: none"> Uses abdominal muscles/rectus abdominus or hip flexors/iliopsoas muscles which are important in all heptathlon events 	<ul style="list-style-type: none">

	Indicative content		
<ul style="list-style-type: none"> 9. (results) 	<ul style="list-style-type: none"> Stage and sit up number noted at exhaustion. 	<ul style="list-style-type: none"> Strength endurance evaluation by comparing the score to standardised tables 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 10. 30 metre sprint test 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> To test dynamic strength 	<ul style="list-style-type: none"> For the 100m hurdles, 200m, sprinting Long jump run up
<ul style="list-style-type: none"> Protocol 	<ul style="list-style-type: none"> Performer sprints 30m 3 times. The mean of the 3 scores is taken 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> Results 	<ul style="list-style-type: none"> Results compared to normative data 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Evaluation of the use of force plates to aid performance of the athlete 		
<ul style="list-style-type: none"> 10.(description of use) 	<ul style="list-style-type: none"> Metal plate which measures reaction force generated by the athlete 	<ul style="list-style-type: none"> athlete runs or balances or jumps (onto or off) or hops or changes direction on the force plate plate measures forces in 3 dimensions or vertical and shear forces measured information sent to computer / forces displayed in graphical form 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> 11.(+ve - Size of force) 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> eg: in sprint start, long jump take-off 	<ul style="list-style-type: none"> Gives information about the size/magnitude of the forces that the athlete is generating
<ul style="list-style-type: none"> 12. +ve - Power 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> eg: in running stride, take off 	<ul style="list-style-type: none"> Gives information about the speed of application of the forces /power that the athlete is generating
<ul style="list-style-type: none"> 13. (+ve – bilateral) 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> eg; in running, take off, throw release 	<ul style="list-style-type: none"> compares force produced between left and right foot.

	Indicative content		
<ul style="list-style-type: none"> 14. (+ve – conc v ecc) 	•	<ul style="list-style-type: none"> e.g. take off and landing in jumps/hurdles 	<ul style="list-style-type: none"> compares force produced at take off/concentric phase and landing/eccentric phase. any imbalance can guide training programme to reduce risk of injury (at take off or landing)
<ul style="list-style-type: none"> 15. +ve - Direction of force 	•	<ul style="list-style-type: none"> eg: angle of take-off in jumping/hurdling 	<ul style="list-style-type: none"> Direction that the forces are applied gives information about efficiency of technique
<ul style="list-style-type: none"> 16. +ve - Acceleration 	•	<ul style="list-style-type: none"> eg: acceleration from start/from take-off 	<ul style="list-style-type: none"> Knowledge of forces can be used to calculate acceleration of the athlete (also using mass of athlete)
<ul style="list-style-type: none"> 17. +ve - Gait 	•	<ul style="list-style-type: none"> eg: In hurdling/sprinting/running events 	<ul style="list-style-type: none"> (If used in conjunction with motion cameras) Efficiency of gait/running technique can be evaluated
<ul style="list-style-type: none"> 18. +ve - Balance 	•	<ul style="list-style-type: none"> eg: In preparation/execution phases of throwing events 	<ul style="list-style-type: none"> Balance/ posture and alignment of athlete can be evaluated
<ul style="list-style-type: none"> 19. +ve – rehabilitation from injury 	•	<ul style="list-style-type: none"> eg: If athlete recovering from strain/sprain 	<ul style="list-style-type: none"> Data can be used to evaluate rehabilitation from injury
<ul style="list-style-type: none"> 20. +ve – fast/accurate 	•	•	<ul style="list-style-type: none"> Data is generated quickly and is accurate/valid/reliable
<ul style="list-style-type: none"> 21. +ve- plan conditioning 	•	<ul style="list-style-type: none"> eg: coaches can plan explosive strength training programme to improve sprint start 	<ul style="list-style-type: none"> Data can be used (alongside limb kinematics) to plan tailored/specific training and conditioning programmes for the athlete
<ul style="list-style-type: none"> +ve technique / efficiency improvements 	•	<ul style="list-style-type: none"> eg: long jumper needs to change the angle his foot hits the take off board 	<ul style="list-style-type: none"> can be used to identify technique and efficiency improvements for sports performers

	Indicative content		
<ul style="list-style-type: none"> • 22. -ve - expensive 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • eg: elite heptathlete only may have access to the technology 	<ul style="list-style-type: none"> • limited availability to athletes
<ul style="list-style-type: none"> • 23. -ve - specialist 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Specialist staff are needed to interpret the results • Equipment needs to be maintained / calibrated to be accurate
<ul style="list-style-type: none"> • 24. -ve - laboratory 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • eg: cannot be used for several hurdles in a row/ assess bend running for middle distance event 	<ul style="list-style-type: none"> • Force plates (usually) housed in laboratories • Causing athletes to alter technique (to land on plate) • Cannot be used for multiple actions at once • Results may be less valid/reliable

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