



GCE

Physical Education

H555/01: Physiological factors affecting performance

A Level

Mark Scheme for June 2023

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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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MARKING INSTRUCTIONS

PREPARATION FOR MARKING RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor 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 RM Assessor and mark the **required number** of practice responses (“scripts”) and the **number of required** 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 RM Assessor 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 RM Assessor 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 RM Assessor **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 RM Assessor messaging system, or e-mail.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths 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:
- a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
 - b. **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

Annotation	Meaning
	Tick
	Cross
	Benefit of doubt
	Too vague
	Repeat
	Indicates sub-max reached where relevant
	Noted but no credit given
	Significant amount of material which doesn't answer the question
	Knowledge and understanding / indicates AO1 on Q9
	Example/Reference / indicates AO2 on Q9
	Development / indicates AO3 on Q9
	Level 1 response on Q9
	Level 2 response on Q9

Annotation	Meaning
L3	Level 3 response on Q9
L4	Level 4 response on Q9
BP	Blank page

Sub-maxes are indicated with **S**; the guidance section of the mark scheme shows which questions these are relevant to.

KU/ EG/ DEV used instead of ticks on the extended response question to indicate where knowledge or development points from the indicative content have been made.

On this extended response question, one **KU/ EG/ DEV** does not necessarily equate to one mark being awarded; the marking is based on a levels of response mark scheme which awards a level and mark holistically based upon the quality of the response overall against the levels descriptors.

Section A						
Question			Answer	Marks	Guidance	
1			2 marks from: 1. (fibre) (promotes) normal function of the (large) intestine/ bowel or aids digestion or decreases constipation 2. (Iron) component of haemoglobin/ Hb/myoglobin or red blood cell/ RBC formation	2 (AO1)	Do not accept: Keeps you regular– TV	
2			2 marks from: 1. (joint type) shape of articulating bones affects the number of planes that a joint can move in or ball and socket joints have the greatest range of movement/ move in more/ 3 planes due to shape of bones (compared to hinge/ condyloid joint or opp.) 2. (length of connective tissue) the greater the length, the greater the range of movement before the stretch reflex is initiated/ further movement is prevented	2 (AO2)	Must have explanation	
3			2 marks from: 1. A 2. C	2 (AO2)	Accept first two answers only If all four boxes are ticked ZERO marks	
4			2 marks from: 1. (yield) 1ATP per PC/ 1:1 2. (example) long jump/ gymnastic vault/ 60-100m sprint/ sprint into the box in football	2 (AO1 x 1 AO2 x 1)	1. only 1 - TV Accept: 2. Any explosive (up to 10 secs) sports example	
5			2 marks from: 1. (Speed) The faster the speed of release the further the projectile travels 2. (Height) The higher the release (compared to landing) the further the projectile travels	2 (AO1)	Do not accept: Reference to angle of release (45°)	
			Section B			
Question			Answer	Mark	Guidance	

Section A								
Question			Answer			Marks	Guidance	
6	(a)		5 marks from:				5 (AO3)	Do not accept: Isotonic alone for points 2 or 5
			Phase of pull -up	Joint movement	Role of latissimus dorsi	Type of contraction		
			Upward phase	1. Adduction	Agonist	2. (Isotonic) Concentric		
			Downward phase	3. Abduction	4. Agonist	5. (Isotonic) Eccentric		
6	(b)		6 marks from: (Both muscles) 1. Recruited during exercise/ active inspiration/ expiration/ breathing or passive/ no role at rest or pressure gradient increased between atmospheric air and lung air pressure (or visa versa) (Sternocleidomastoid muscle) 2. (movement) lift the rib cage/ sternum further up and out (than at rest) 3. (volume) Increases the volume of the thoracic/ chest/ lung cavity further (than at rest) 4. (pressure) Reduces pressure in the thoracic/ chest/ lung cavity more (than at rest) or lung air pressure decreased further 5. More <u>air</u> inspired (than at rest) or increases breathing depth or increases tidal volume (Internal intercostal muscle) 6. (movement) to pull the rib cage/ sternum further/ faster in and down (than at rest) 7. (volume) reduces the volume of the thoracic/ chest/ lung cavity further (than at rest) 8. (pressure) increases pressure in the thoracic/ chest/ lung cavity more (than at rest) or lung air pressure increased further 9. More <u>air</u> expired (than at rest) or increases breathing rate or forced expiration				6 (AO1)	Accept: Credit point 1 once only Note for AEs: bold = required (alternative terminology can be used)

Section A				
Question		Answer	Marks	Guidance
6	(c)	6 marks from: (Krebs cycle) 1. Acetyl co enzyme A combines with oxaloacetic acid/ oxaloacetate or acetyl CoA/ pyruvic acid forms citric acid/ citrate 2. (site) <u>matrix</u> of the <u>mitochondria</u> 3. Citric acid is oxidised/ hydrogen removed/ dehydrogenated 4. (yield) 2 ATP resynthesised 5. (by-products) CO₂ released or H/ Hydrogen (atoms) released (into ETC) (Electron transport chain) 6. Oxidation/ reduction of NAD/ FAD 7. Hydrogen split into hydrogen ions/ protons and electrons or hydrogen is carried (through the ETC) 8. (site) <u>cristae</u> of the <u>mitochondria</u> 9. (yield) 34 ATP resynthesised or 1:34 yield or NAD 30ATP and FAD 4ATP 10. (by-products) H₂O/ water Either/both stages 11. (yield if fats) ATP yield is much higher for fats/ fatty acids/ triglycerides than glycogen/ glucose	6 (AO1)	Do not accept: One-word answers – question asks for a description

Section A						
Question			Answer	Marks	Guidance	
6	(d)		3 marks from: 1. Sprinting/ high intensity anaerobic work increases oxygen deficit 2. Sprinting/ high intensity anaerobic work produces lactic acid/ lactate production 3. (which) sprint has a greater EPOC or sprint has longer lactacid phase 4. (RR/HR) Respiratory/ heart rates/ metabolic rate stays above resting levels for longer 5. (oxygen) needs more O ₂ / aerobic energy produced in recovery to replenish oxymyoglobin/ resynthesise ATP/ PC stores/ oxidise lactic acid	3 (AO2)	Question requires explanation Accept: oxygen debt for EPOC in point 3 as BOD Accept: opposites if candidate explains why levels are lower for the jog in comparison to the sprint	

Question			Answer	Mark	Guidance
7	(a)	(i)	2 marks from: 1. (intensity) 50-80% HR _{max} / 40-65% VO _{2max} 2. (duration) 20+ minutes 3. (type) running/swimming/cycling/rowing	2 (AO2)	Do not accept: 1. Any number outside the stated range Accept: 3. Any example of exercise using large muscle groups

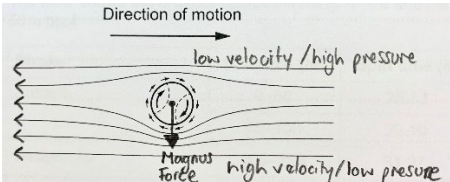
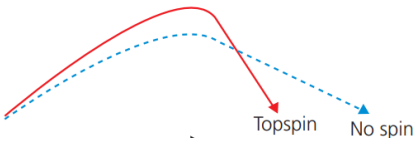
Question			Answer	Mark	Guidance
		(ii)	3 marks from: 1. (Cardiac) cardiac hypertrophy 2. (Respiratory) Increased strength of the <u>respiratory</u> muscles (or named example) 3. (SO) Hypertrophy/ increase in size of <u>slow oxidative/ SO/ type 1</u> muscle fibres 4. (FOG) Increased aerobic energy production of <u>fast oxidative glycolytic /FOG/ type IIa fibres</u> 5. (mitochondria) increase size/ number/ density of mitochondria or increased sites for oxygen utilisation or increases <u>aerobic</u> energy production 6. (myoglobin) increased (oxy)myoglobin stores 7. (fuels) increased stores of glycogen/ triglycerides	3 (AO1)	Do not accept: 1. Muscle hypertrophy (TV) 4. Increased energy production (TV)
7	(b)		4 marks from: (cross country skier) 1. Strength/muscular endurance 2. Skier needs muscles to contract repeatedly over time/ need muscles to resist fatigue Or 3. Dynamic strength 4. Skier needs to contract muscles to cause movement over prolonged periods/ combination of speed and strength/ maintain power on hills (ski jumper) 5. Explosive/elastic or dynamic strength 6. Skier needs to perform a powerful/ high force/ high speed/ explosive at take-off/ jump (from the ramp) Or 7. Static strength 8. Skier needs to maintain body shape on ramp/ in flight/ on landing (so isometric contractions are important)	4 (AO3)	Accept: endurance/ dynamic/ explosive/ static without ‘strength’ as in Q Accept: appropriate examples from the activity within the justification Do not accept: justification without the correct strength Credit dynamic strength for one performer only (question asks for a different type)

Question			Answer	Mark	Guidance
7	(c)		2 marks for: (Identification of diseases) 1. Asthma 2. Chronic obstructive pulmonary disease / COPD/ emphysema/ chronic bronchitis/ 3. Lung cancer 3 marks from: (Impact of training – sub-max. 3 marks) 4. (respiratory muscle) increased respiratory muscle strength which decreases respiratory effort/ alleviates symptoms of asthma 5. (breathing rate) decreased resting/ submaximal breathing frequency/rate which reduces fatigue/ makes everyday tasks easier 6. (full use) maintain full use of available lung volume/ tissue/ elasticity which decreases infection risk (associated with COPD) 7. (surface area) increases surface area of alveoli/ pulmonary capillaries or alveoli/ pulmonary capillarisation which maximises gas exchange/ oxygen diffusion/ respiratory health 8. (EIA) training may trigger an asthma attack if a performer suffers from exercise induced asthma 9. (COPD) someone with COPD may have reduced lung capacity/ difficulty breathing deeply/ persistent cough which may make training difficult/ impossible	5 (AO1 x 2 AO3 x 3)	Analysis required for points 4-9 Accept: alleviate symptoms of asthma/COPD for point 7 under 'respiratory health'

Question			Answer	Mark	Guidance
7	(d)		6 marks from: 1. Stress fracture 2. (description) small/ hairline crack in surface of the bone 3. (cause + e.g.) transfer of stress overload from muscles/ repetitive stress/ overtraining/ intensity overload and e.g. excessive distance running or intensity of gymnastics training too high 4. <u>Osteoarthritis</u> 5. (description) breakdown/ loss of articular/ hyaline cartilage or swelling of joint or development of bone spurs 6. (cause + e.g.) overuse of joint and e.g. knee joints of a career footballer 7. Medial tibial stress syndrome/ MTSS/ shin splints 8. (description) inflammation of periosteum/ bone to tendon connection 9. (cause + e.g.) repeated overuse/ excessive loading stress/ overtraining/ inadequate footwear and e.g. excessive running on hard surfaces 10. Tendinosis/ Epicondylitis/ Golfer's elbow/ Tennis elbow 11. (description) deterioration/ inflammation of a tendon 12. (cause + e.g.) repetitive stress/ poor recovery and e.g. repeated twisting of the forearm in tennis 13. Bursitis 14. (description) inflammation of bursa/ fluid-filled sacs 15. (cause + e.g.) repetitive stress/ poor recovery and e.g. overuse of shoulder rotation in butterfly	6 (AO1 x 4, AO2 x 2)	Do not accept: 'Mix and match' answers. Description and/or cause must match named injury to award credit Accept: Alternative relevant examples of causes Accept: Tendonitis - BOD

Question			Answer	Mark	Guidance
8	(a)	(i)	1 marks from: 1. 50 <u>m</u> or 50 <u>metres</u>	1 (AO2)	Do not accept: Answer without correct units
		(ii)	2 marks from: 1. (average velocity workings) = $\frac{d}{t}$ or $\frac{\text{displacement}}{\text{time}}$ or $\frac{50}{31.37}$ 2. (answer with units) = 1.59 <u>m/s / ms⁻¹</u>	2 (AO2)	Do not accept: Distance / time Accept: 1.6 m/s (to 1 decimal place) - BOD
		(iii)	2 marks for (workings): 1. (av. speed workings - freestyle) $\frac{50+50}{28.94+27.85}$ or $\frac{100}{56.79}$ 2. (av. speed workings - breaststroke) $\frac{50+50}{34.77+35.79}$ or $\frac{100}{70.56}$ 3. (subtraction of av. speeds) 1.76 – 1.42 or 1.42 - 1.76 1 mark for: 4. (answer) difference = 0.34 (m/s / ms ⁻¹)	3 (AO2)	Sub-max: 2 marks for workings

Question			Answer	Mark	Guidance
8	(b)		4 marks from: 1. (mass) the greater the <u>mass</u> the more stable the performer 2. (height of CoM) the lower the centre of mass/ shorter the line of gravity the more stable the performer 3.(line of gravity) the closer to the centre of the base of support the line of gravity falls the more stable the performer or if the line of gravity falls inside the base of support compared to outside the stability is increased 4. (base of support) the larger the area of the base of support the more stable the performer	4 (AO2)	Accept: Opposites Do not accept: number of points of contact = TV
8	(c)	(i)	2 marks from: 1. <u>Mass</u> of the body/ body part 2. Distribution/ distance of the mass from the <u>axis of rotation</u>	2 (AO1)	Mark first 2 only Do not accept: pt 2. centre of mass
		(ii)	2 marks from: 1. They have an inverse relationship 2. (tucked e.g.) low moment of inertia and high angular velocity in gymnastic tucked somersault/ recovery leg of a runner/ tucked position of an ice skater in a spin Or a gymnast tucks their body position to decrease moment of inertia which increases their angular velocity 3. (straight e.g.) high moment of inertia and low angular velocity in gymnastic straight somersault/ drive leg of a runner/ when an ice skater opens arms out away from the body during a spin Or a gymnast opens their body position to increase moment of inertia which decreases their angular velocity	2 (AO1 x 1 AO2 x 1)	Accept: appropriate examples e.g. diving, trampolining, ice skating

Question			Answer	Mark	Guidance
8	(d)	(i)	5 marks from: 1. (Direction of flow top) airflow over the top of the ball is in the opposite direction to the surface of the ball/ direction of spin 2. (Direction of flow bottom) airflow underneath the ball is in the same direction as the surface of the ball/ direction of spin 3. (Speed of flow) airflow over the top of the ball travels slower/ at a lower velocity (compared to below the ball or opp.) 4. (Pressure top) The pressure above the ball is higher (compared to below the ball or opp.) or there is a pressure gradient / differential 5. (Magnus force) Magnus force acting downwards (from the CoM of the ball) 6. (Flight path deviation) Flightpath dips/ shortens/ ball spends less time in the air (compared to no spin) or drawing of dipped/ shortened flight path compared to no spin	5 (AO2 x 5)	Accept: Annotations on the diagram for points 3-5 if clear  Point 6 eg: 
		(ii)	1 mark from: 1. (Hit harder) can hit the ball harder and ball still lands in the court 2. (Hit higher/lob) hit ball higher and ball still lands in court 3. (Deceive) 'deceive' their opponent into leaving a ball that appears to be going out(or equivalent) 4. (Bounce) decreased angle/ accelerates on bounce (pushes opponent back/ into defence/ less time to react)	1 (AO3 x 1)	

9.	
Level 4 (17–20 marks) • detailed knowledge and excellent understanding (AO1) • well-argued judgements which are well supported by relevant practical examples (AO2) • detailed analysis and critical evaluation (AO3) • very accurate use of technical and specialist vocabulary • there is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.	At Level 4 responses <u>are likely</u> to include: • accurate definitions of HR, SV, Q, VSM, VR • detailed knowledge of how blood flow to working muscle increases during exercise which may refer to Q, HR, SV and the vascular shunt • detailed understanding of how venous return increases during exercise • accurate description of 2nd and 3rd class levers • detailed evaluation of both 2nd and 3rd class levers with reference to mechanical advantage • applied effectively to a badminton player or sports performer • at the top of this level, the advantage of range or speed of movement using 3rd class levers may have been covered well • AO1, AO2 and AO3 all covered well in this level.
Level 3 (12–16 marks) • good knowledge and clear understanding (AO1) • judgements will be present but may not always be supported by relevant practical examples (AO2) • good analysis and critical evaluation (AO3) • generally accurate use of technical and specialist vocabulary • there is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.	At Level 3 responses <u>are likely</u> to include: • definitions of HR, SV, Q, VSM, VR mainly correct • good knowledge of how blood flow to working muscle increases during exercise which may refer to Q, HR, SV and/or the vascular shunt. • Accurate description of venous return mechanisms with some understanding of how venous return increases during exercise • description of 2nd and 3rd class levers is good/ has only minor errors • some accurate evaluation of 2nd and/or 3rd class levers for top of this level • some application of levers to a badminton player or sports performer • maximum of 6 marks to be awarded for AO1 and 7 marks for AO2; some AO3 required for top of this level

Level 2 (7-11 marks) • limited knowledge and understanding (AO1) • judgement given but often unsupported by relevant practical examples (AO2) • some evidence of analysis and critical evaluation (AO3) • technical and specialist vocabulary used with limited success • the information has some relevance and is presented with limited structure. The information is supported by limited evidence.	At Level 2 responses <u>are likely</u> to include: • some accurate definitions of HR, SV, Q, VSM, VR although some errors may be evident • limited knowledge of how blood flow to working muscle or venous return increases during exercise • 2nd or 3rd class levers may be described with some accuracy • A benefit of 2nd or 3rd class levers may be suggested • There may be an attempt to apply knowledge of levers to a badminton player or sports performer • maximum of 6 marks to be awarded for AO1 with no application
Level 1 (1–6 marks) • basic knowledge and little understanding (AO1) • little or no attempt to give judgement (AO2) • little relevant analysis or critical evaluation (AO3) • little or no attempt to use technical and specialist vocabulary • the information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.	At Level 1 responses <u>are likely</u> to include: • definitions of HR, SV, Q, VSM, VR are incomplete or have significant errors • basic knowledge of the cardiovascular system and/or venous return mechanisms • some components of levers may be described • there may be an attempt to apply knowledge of levers to a practical example • mainly AO1 content
(0 marks) No response or no response worthy of credit.	

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

Indicative Content:

9*		
Section C		
20 Marks (AO1 x 6, AO2 x 7, AO3 x 7)		
Guidance: Maximum of 6 marks to be awarded for AO1, Maximum of 7 marks to be awarded for AO2, Maximum of 7 marks to be awarded for AO3, Note most examples are applied to badminton but answers can be applied to any sports performer		
Increased blood flow to muscles		
AO1- KU	AO2 – EG	AO3 - DEV
1. (HR definition) Heart rate is the number of ventricular contractions in a minute	During the (Badminton) match/ sporting activity • HR increases as SA node increases its firing rate • HR increases from 50-72bpm before the match to (up to) 220-age during maximal intensity rallies	• Due to neural control mechanisms/ neural receptors • sympathetic stimulation/ action of CCC/ cardiac accelerator nerve • Due to intrinsic control/ increased stretch in the right atrium/ increased venous return • Due to hormonal control/ release of adrenaline • Due to increased temperature/ increased the speed of nervous transmissions
2. (SV definition) Stroke volume is the amount of blood ejected from (left) ventricle in one contraction	During the (Badminton) match / sporting activity • SV increases as ventricle contracts with more force • SV increases from 70-100ml before the match to 100-200ml during high intensity rallies	• Due to increased venous return/ventricular stretch/ventricular contractility • Starling's Law
3. (Q definition) Cardiac output is the volume of blood ejected by the ventricle per minute/ $Q = HR \times S$	During the (Badminton) match / sporting activity • Q increases from 5L/min at rest up to 10-40L/min (depending on fitness and intensity) • Due to a combination of HR and SV increasing • Player can play more shots/longer points without fatigue • Player can recover more quickly between points/games	• Increased temperature during the match decreases blood viscosity so increases flow
4. (Vascular shunt) The vascular shunt is the redistribution of cardiac output/ blood flow during exercise	During the (Badminton) match/ sporting activity • At rest/ before the match 20% of blood flow/ Q is to muscle, whereas during the match more than 80% is to working muscles • Arterioles/ pre-capillary sphincters leading to muscle capillaries vasodilate/ relax to increase (oxygenated) blood flow to working muscles • Arterioles/ PCS leading to non-essential organs vasoconstrict/ contract to reduce blood flow to non-essential organs, e.g. gut	• Due to neural control mechanisms/ neural receptors • Controlled by the Vasomotor Control Centre/ VCC • Sympathetic stimulation decreased to capillary beds of skeletal muscles • Sympathetic stimulation increased to capillary beds of non-essential organs

Increased venous return		
5. (VR definition) the return of blood to the right atrium/heart (from the vena cava/veins)	During the (Badminton) match/ sporting activity • Player needs high VR so that SV/ cardiac output can be maintained	• Starlings Law/ SV depends on VR
6. (VR mechanisms) Mechanisms of venous return assist the return of blood back to the heart (against gravity)	• (Pocket) Valves in veins prevent backflow of blood • Gravity from areas of body above the heart/ arms (if raised in the match) /head • Skeletal muscle pump during increased movement the muscles squeeze the blood through the veins • Respiratory pump during increased breathing the difference in respiratory pressure draws the venous blood upwards • Smooth muscle in walls of veins vasoconstrict to increase venous pressure/ maintain venomotor tone	
7. (VR increase) VR increases in exercise due to increased impact of muscle/ respiratory pump	During the (Badminton) match / sporting activity • Increased movement (e.g. running to play shot) increases VR • Increased depth of breathing (e.g. during long points) increases VR	• Increased force and number of contractions of the (leg) muscles causes increased 'squeeze' on the veins and increases flow towards the heart (due to one-way pocket valves) • Greater pressure difference between the thoracic and abdominal cavity causes an increased suction effect on blood in veins
Description and evaluation of 2nd and 3rd class levers		
8. Class of lever determined by the order of Effort, load and fulcrum	• Lever = bone • Effort = muscular force • Fulcrum = joint • Load = weight of the object or body	• Order of the components determines the mechanical efficiency of the lever

9. 2 nd class have load between effort and fulcrum (ELF/FLE) OR correctly labelled diagram	• Eg when ball of foot is the fulcrum during plantar flexion/ankle • Used when player pushes off to run for a shot/jumps to play a smash • Credit other practical application of (weighted) plantar flexion i.e.: Push off ball of foot to run/dodge/jump in any sporting activity. • E.g. Contraction of gastrocnemius/soleus can move body weight	<u>(+ve)</u> • 2nd class levers have mechanical advantage • Effort is further from the fulcrum than the load or effort arm>load arm • Relatively small effort force required to move a large load <u>(-ve)</u> • Range of movement very small or shortening of the muscle (effort) causes less movement of the load (compared to other classes of lever)
10. 3 rd class have effort between load and fulcrum (FEL/LEF) OR correctly labelled diagram	(accept any other relevant examples of 3rd class levers in sports performance, i.e. any other joint movement except elbow extension or neck flexion/extension (1st class) or plantar flexion (2nd class)) • E.g. Shoulder extension during overhead shot execution or hip extension when lunging for a net shot or wrist flexion during forehand serve • Or (other sports performance), e.g. Knee extension during the execution phase of a driven shot in football • Player can generate enough muscular force to move the load as it is small (arm and racquet are light) • Or Football player can generate the force to move the lower leg by contracting the quadriceps muscle group • Small shortening of the deltoid causes a large movement of the hand and racquet • Or small shortening of rectus femoris muscle causes a large movement of the foot • Faster speed of the racquet head enables faster/more powerful shots to be played/shuttlecock has greater velocity e.g. smash	<u>(+ve)</u> • Mechanical disadvantage is not problematic when load is light • Range of motion is much larger than for a 2nd class lever • Shortening of the (agonist muscle) causes a relatively large movement of the lever/limb or reference to arc length • Speed of movement of the lever arm/arm/leg is much faster (than for a 2nd class lever) • Effect greater if lever is longer <u>(-ve)</u> • 3rd class levers have mechanical disadvantage • Load is further from the fulcrum than the effort or load arm>effort arm • Relatively large effort force required to move a smaller load

	• Or faster speed of the foot enables a powerful kick/ball to travel faster • If player has long limbs/plays with a full-length racquet, they can hit the shuttlecock harder/faster • Or if a player has long legs they can kick the ball harder (provided they have the muscular strength) • Larger force of contraction of the deltoid (than the weight of the arm and racquet) is needed to swing the racquet in the overhead shot • Or a larger force of contraction of the rectus femoris (than the weight of the lower leg) is needed to extend the knee to kick the ball.	
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