GCE

Physical Education

H155/01: Physiological factors affecting performance

AS Level

Mark Scheme for June 2024

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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.

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: Not applicable in F501
    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 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)	Six marks for:	6 (AO3)	**Accept** Accept points 2 and 3 without the correct movement for point 1.

Joint	Movement	Agonist muscle	Antagonist muscle	Type of contraction
(Shoulder)	**1.** (Horizontal flexion) **OR** flexion	**2.** Pectoralis major **OR** anterior deltoid	**3.** teres minor or posterior deltoid **OR** posterior deltoid	(Concentric)
(Hip)	(Medial Rotation)	**4.** Gluteus medius **OR** gluteus minimus **OR** adductor magnus **OR** adductor longus **OR** adductor brevis **OR** semitendinosus **OR** semimembranosus	**5.** Gluteus maximus	**6.** Concentric

Accept: tensor fasciae latae for MP 4 (agonist at hip)

Do not accept: biceps femoris for MP 4 (it laterally rotates hip, not medial rotator)

Accept: biceps femoris for MP 5 (antagonist at hip)

Accept: Adductor group for point 4 BOD.

	(b)		Four marks from: Sub-max 2 for structural characteristics Sub-max 2 for functional characteristics	**4** (AO1)	Accept any equivalent word to moderate. Accept correct comparisons with the other muscle fibre types. (ie faster speed of contraction than Type 1)

Structural characteristics	
1. (Neuron/motor unit/fibre size)	Large neuron size or large fibre size or large motor unit
2. (Fibres per neurone)	Many fibres per neurone
3. (Capillaries)	Moderate/high capillary density
4. (Mitochondria)	Moderate number of mitochondria
5. (Myoglobin)	Moderate myoglobin stores
6. (PC)	High phosphocreatine/PC stores
7. (Glycogen)	High glycogen stores
8. (Triglyceride)	Moderate triglyceride stores
9. (Sarcoplasmic reticulum)	High sarcoplasmic reticulum development
Functional characteristics	
10. (Speed)	Fast speed of contraction
11. (Force)	High force of contraction
12. (Fatigue)	Low/moderate resistance to fatigue
13. (Aerobic)	Low/moderate aerobic capacity
14. (Anaerobic)	High/moderate anaerobic capacity

<table>
<tr>
<td></td>
<td>(c)</td>
<td></td>
<td>Five marks from:

<table>
<tr><td>1. (Myogenic)</td><td>The heart is myogenic / cardiac muscle is involuntary</td></tr>
<tr><td>2. (SA node)</td><td>The sino-atrial node /SA node initiates an electrical impulse</td></tr>
<tr><td>3. (Atrial systole)</td><td>Impulse causes atrial systole/contraction of the atria which forces blood (through the atrio-ventricular/bicuspid and tricuspid valves) into the ventricles</td></tr>
<tr><td>4. (AV node)</td><td>(Impulse transmitted to) the atrio-ventricular node/AV node which delays the impulse (by 0.1 secs) (to allow the ventricles time to fill)</td></tr>
<tr><td>5. (Bundle of His)</td><td>(AV node transmits the impulse to) the bundle of His which carries the impulse (through the septum) to each ventricle/Purkyne fibres</td></tr>
<tr><td>6. (Purkyne fibres)</td><td>(Impulse transmitted to the) Purkyne fibres which distribute the impulse (up) through the ventricle walls</td></tr>
<tr><td>7. (Ventricular systole)</td><td>Impulse causes ventricular systole/contraction of the ventricles which pumps blood out of the heart / into the aorta and pulmonary artery / to the body and the lungs.</td></tr>
</table>
</td>
<td>5
(AO1)</td>
<td>Accept: Purkinje fibres for Purkyne fibres

Accept; reference to impulse only once through the answer.</td>
</tr>
</table>

(d)

Five marks from:
Changes in pressure gradients (sub-max. 4 marks):

1. (△ PPO_2 blood)	PPO_2 in the (capillary) blood (arriving at the muscles) **remains** high during recovery/ oxyhaemoglobin (almost) fully saturated
2. (△ PPO_2 muscles)	PPO_2 in the muscles is higher in recovery than during exercise (as less is being used in aerobic respiration)
3. (△ Pressure gradient O_2)	The pressure/diffusion gradient of O_2 becomes less steep/more shallow than in exercise
4. (△ Gas exchange O_2)	Less O_2 diffuses to muscles (during recovery compared to exercise)/slower diffusion of O_2 to muscles
5. (△ $PPCO_2$ blood)	$PPCO_2$ in the capillary blood (arriving at the muscles) **remains** low during recovery
6. (△ $PPCO_2$ muscles)	$PPCO_2$ in the muscles is lower in recovery than during exercise (as less is being made as a by-product of aerobic respiration)
7. (△ Pressure gradient CO_2)	The pressure/diffusion gradient of CO2 becomes less steep/more shallow than in exercise
8. (△ Gas exchange CO_2)	Less CO_2 diffuses to the blood (during recovery compared to exercise)/slower diffusion of CO_2 to blood

Changes in the dissociation of oxyhaemoglobin:

9. (LH shift)	The oxyhaemoglobin dissociation curve moves to the left/back towards resting position during recovery..
10. (Causes of LH shift)	... due to reduced acidity/increased pH/ reduced CO_2 /reduced temperature
11. (△HbO_2 dissociation)	HbO_2 dissociation (at the muscle) becomes lower during recovery/less O_2 is released for diffusion/Hb affinity for oxygen is higher in recovery than exercise/higher saturation

5 (AO3)

Accept:
Concentration instead of PP throughout.

Do not accept:Just PO2 and PCO2 without second P for partial pressure

<table>
<tr>
<td>2</td>
<td>(a)</td>
<td></td>
<td>Five marks from: (submax 2 marks for points 2-4)
<table>
<tr><td>1. (Pharmacological aids)</td><td>increase the levels of hormones/neural transmitters naturally produced by the body (which may benefit maximal strength)</td></tr>
<tr><td>2. (Anabolic steroids)</td><td>Weightlifter might use anabolic steroids</td></tr>
<tr><td>3. (Human growth hormone/HGH)</td><td>Weightlifter might use human growth hormone/HGH</td></tr>
<tr><td>4. (EPO)</td><td>Weightlifter might use EPO (but not as their main aid)</td></tr>
<tr><td>5. (Muscle mass)</td><td>Increased muscle mass/ muscle hypertrophy which increases strength/power / force of contraction</td></tr>
<tr><td>6. (Speed of recovery)</td><td>Increased speed of recovery from weight training/high intensity sessions/between competitions</td></tr>
<tr><td>7. (Intensity of training)</td><td>Allows the weightlifter to increase the intensity/duration of training/more weight lifted/reps in training</td></tr>
<tr><td>8. (Rehab from injury)</td><td>Increased speed of rehabilitation/recovery from soft tissue injury</td></tr>
<tr><td>9. (Anabolic steroids - aggression)</td><td>Increased aggression may be beneficial to weightlifting</td></tr>
<tr><td>10. (HGH fat mass)</td><td>Increased fat metabolism/decreased fat mass /increased lean body mass will benefit maximal/explosive strength /
Or increased power to weight ratio.</td></tr>
<tr><td>11. (connective tissue)</td><td>increased strength of connective tissue/ bone density</td></tr>
</table>
</td>
<td>5
(AO2)</td>
<td>Accept:
Points 4,5,6 and 7 can be linked to either anabolic steroids or HGH.

Do not accept:
Points 4-8 without named aid.

Award each mark once only.

SSU - Consider accepting Rh EPO as it is in the spec list and internet searches suggest its use by bodybuilders and it is on WADA prohibited list for all sports suggesting potential benefits</td>
</tr>
</table>

<table>
<tr><td></td><td>(b)</td><td>(i)</td><td>A</td><td>1
(AO1)</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>D</td><td>1
(AO1)</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Five marks from:
<table><tr><td>1. (Type of training)</td><td>Weight training/plyometrics/multigym/circuit/interval training</td></tr><tr><td>2. (Type of strength/specificity)</td><td>High jumper needs to improve explosive/elastic strength/focus on leg muscles</td></tr><tr><td>3. (Example of exercises)</td><td>Squat jumps/bench hops/leg press/calf raise/star jumps / box jumps / depth jumps / bounding or other relevant example</td></tr><tr><td>4. (Warm up/cool down)</td><td>High jumper should perform a warm up before the session/cool down/active recovery after the session</td></tr><tr><td>5. (Intensity)</td><td>75-85% of 1RM</td></tr><tr><td>6. (Repetitions)</td><td>6-12 reps (performed quickly)</td></tr><tr><td>7. (Sets)</td><td>4-6 sets</td></tr><tr><td>8. (Work relief ratio/recovery)</td><td>1:3 / 3-5 mins / full recovery between sets</td></tr><tr><td>9. (Time)</td><td>Session time 20-60 minutes</td></tr></table></td><td>5
(AO2)</td><td>Accept numbers within the range. However if the candidate gives a range which moves outside the given range TV.</td></tr>
</table>

<table>
<tr>
<td></td>
<td>(c)</td>
<td>(i)</td>
<td>One marks from:
<table>
<tr><td>1. (Distance)</td><td>Increased range of motion enables increased distance for a sports action
Eg: longer stride length in running / longer stroke length in rowing or leg kick in breaststroke or longer ‘take back’ in football/rugby kicking</td></tr>
<tr><td>2. (Force)</td><td>Increased range/distance/time that a force can be applied or increased impulse or increased speed of movement
Eg: increased force/distance/speed/momentum achieved on kick in football/rugby or increased force in weightlifting leg drive or increased power in running stride/rowing stroke</td></tr>
<tr><td>3. (Efficiency)</td><td>Increased efficiency of skill
Eg: hurdler can keep lower over hurdles or tighter pike/tuck in diving/gymnastics (for more efficient for rotation) or tighter tuck position in (downhill) skiing.</td></tr>
<tr><td>4. (Increase performanc e)</td><td>Increased aesthetics of skills / to increase quality of performance
Eg: Full splits in gymnastics/(ice) dance skills (for better score)</td></tr>
<tr><td>5. (Injury)</td><td>Decreased risk of injury
Eg: decreased risk of muscle strain during straddle vault</td></tr>
</table></td>
<td>1
(AO2)</td>
<td>Accept
any suitable example of hip flexibility in any point.

Accept
any suitable type of injury for pt. 5.

Do not accept:
point without application to a sport.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii)</td>
<td>Three marks from:
<table>
<tr><td>1. (What)</td><td>(A goniometer is) a 360^{o} protractor (with 2 arms)</td></tr>
<tr><td>2. (Use)</td><td>Can be used for any joint / in any plane of movement / for any joint movement</td></tr>
<tr><td>3. (How - position)</td><td>(Head of) goniometer/central pivot is placed on the centre of the joint/axis of rotation/ fulcrum</td></tr>
<tr><td>4. (How - joint movement)</td><td>Performer holds joint at full range of motion or holds static stretch</td></tr>
<tr><td>5. (How- arms)</td><td>Arms of goniometer are lined up with articulating bones</td></tr>
<tr><td>6. (Measurement)</td><td>Angle between goniometer arms is taken/angle measured between start and full range of motion position</td></tr>
</table></td>
<td>3
(AO1)</td>
<td></td>
</tr>
</table>

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>Four marks from:
<table><tr><th>Periodisation term</th><th>Description</th></tr><tr><td>(Preparatory phase)</td><td>1. General conditioning/develop a fitness base/strength and conditioning/aerobic training/progressive overload/building to more specific training</td></tr><tr><td>2. Competitive phase</td><td>(Fitness is maintained; focus is on tactics and strategies.)</td></tr><tr><td>(Tapering)</td><td>3. Reduction of (one of:) training intensity is maintained with a reduction in volume (frequency) / training frequency is maintained with a reduction in intensity</td></tr><tr><td>4. Transition phase</td><td>(Active rest and recuperation.)</td></tr></table></td><td>4
(AO1)</td><td></td></tr>
</table>

<table>
<tr>
<td>3</td>
<td>(a)</td>
<td></td>
<td>Six marks for:
<table>
<tr><td>1. (N1 at rest)</td><td>The ball will remain at rest on the penalty spot</td></tr>
<tr><td>2. (N1 force applied)</td><td>until a force is applied by the kick/foot/footballer.</td></tr>
<tr><td>3. (N2 size of force)</td><td>The greater the force of the kick/foot striking the ball, the greater the acceleration of the ball/ rate of change of momentum/change in motion</td></tr>
<tr><td>4. (N2 direction of force)</td><td>The acceleration/change in momentum occurs in the direction of the kick/the direction that the force is applied to the ball</td></tr>
<tr><td>5. (N3 action force)</td><td>The footballer/foot applies an action force forwards/upwards to the ball</td></tr>
<tr><td>6. (N3 reaction force)</td><td>The ball applies an equal and opposite or backwards/downwards reaction force to the player’s foot</td></tr>
</table></td>
<td>6
(AO2)</td>
<td>Do not accept:
Without application to the penalty kick

Accept definition of law of reaction with application of penalty to cover action and reaction</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td></td>
<td>Four marks for:
<table>
<tr><td>1. (Weight)</td><td>Gravitational/ Vertical force acting on a body/acts downwards /towards the centre of the earth AND from the centre of mass of a body OR weight is proportional to mass/weight = mg</td></tr>
<tr><td>2. (Reaction)</td><td>Equal and opposite force applied in response to an action force on a body OR vertical force which occurs when two bodies are in contact OR normal reaction force acts perpendicularly upwards from the contact point with the ground</td></tr>
<tr><td>3. (Friction)</td><td>Force which opposes the motion of two (contacting) surfaces against each other OR force which occurs parallel to the sliding surface</td></tr>
<tr><td>4. (Air resistance)</td><td>Force that opposes the motion of a body travelling though air OR Horizontal force (air) acting against the direction of motion</td></tr>
</table></td>
<td>4
(AO1)</td>
<td></td>
</tr>
</table>

<table>
<tr><td></td><td>(c)</td><td>(i)</td><td>Two marks for:

<table><tr><td colspan="2">Force</td></tr><tr><td>1. (Working)</td><td>F = ma / mass x acceleration OR F = 80 x 2.25</td></tr><tr><td>2. (Answer)</td><td>=180 (Newtons)</td></tr></table></td><td>2
(AO2)</td><td>N.B. Units not required as stated in question.</td></tr>
<tr><td></td><td>(c)</td><td>(ii)</td><td>three marks for:

<table><tr><td colspan="2">Momentum</td></tr><tr><td>1. (Working)</td><td>Momentum = mv / mass x velocity OR momentum = 6.75 x 80</td></tr><tr><td>2. (Answer)</td><td>540</td></tr><tr><td>3. (Units)</td><td>Kilogram metres per second / Kgm/s / Kgms^{-1}</td></tr></table></td><td>3
(AO2)</td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td>Five marks from: Sub max 3 for each

<table><tr><td colspan="2">Limb Kinematics</td></tr><tr><td>1. (Assessment)</td><td>Can be used to assess/ measure gait/movement efficiency/velocity/acceleration</td></tr><tr><td>2. (Improve Technique)</td><td>Can be used to improve or optimise technique / gait / movement / efficiency/velocity / acceleration</td></tr><tr><td>3. (Selection of equipment)</td><td>Helps with selection of appropriate equipment (eg weight of hockey stick)</td></tr><tr><td>4. (injury prevention)</td><td>Helps reduce overuse (chronic) injury risks</td></tr><tr><td>5. (Data)</td><td>Data immediately available or accurate</td></tr><tr><td colspan="2">Wind tunnels</td></tr><tr><td>6. (Assessment)</td><td>Assess technique / body position / shape / aerodynamics and air resistance / drag / equipment design</td></tr><tr><td>7. (Improve Technique)</td><td>Improve technique/body position /shape to reduce drag/air resistance /optimise aerodynamics/Improving equipment design</td></tr><tr><td></td><td></td></tr><tr><td>8. (Controllability)</td><td>Wind speed/direction are controllable to mimic competitive situations</td></tr></table></td><td>5
(AO3)</td><td></td></tr>
</table>

Section C		
Question	**Level descriptors**	**Discriminators**
4*	**Level 3 (8–10 marks)** • detailed knowledge & understanding (AO1) • clear and consistent practical application of knowledge & understanding (AO2) • effective analysis/evaluation and/or discussion/explanation/development (AO3) • accurate use of technical and specialist vocabulary • there is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.	**At Level 3 responses <u>are likely</u> to include:** • detailed and accurate explanation of the changes in VE with good coverage of control. • exercise and recovery discussed • benefits and drawbacks of both aerobic training methods are discussed, and at the top of the level are linked specifically to games players • correct technical language is used throughout • AO1, AO2 and AO3 all covered well in this level.
	Level 2 (5–7 marks) • satisfactory knowledge & understanding (AO1) • some success in practical application of knowledge (AO2) • analysis/evaluation and/or discussion/explanation/development attempted with some success (AO3) • technical and specialist vocabulary used with some accuracy • there is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.	**At Level 2 responses <u>are likely</u> to include:** • satisfactory explanation of the changes in VE will be present but may lack balance or detail in either exercise or recovery • use of both aerobic training methods may be evaluated with some success • some attempt to apply to games players • maximum of 3 marks to be awarded for AO1 and 3 marks for AO2; some AO3 required for top of this level.
	Level 1 (1–4 marks) • basic knowledge & understanding (AO1) • little or no attempt at practical application of knowledge (AO2) • little or no attempt to analyse/evaluate and/or discuss/explain/develop (AO3) • technical and specialist vocabulary used with limited success • the information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.	**At Level 1 responses <u>are likely</u> to include:** • basic knowledge and understanding of the changes in VE during exercise and/or recovery • little or no attempt to evaluate aerobic training methods • there may be little or no application to games players • at the bottom of this level answers may be limited to a description of changes to VE and/or a description of continuous or HIIT training • maximum of 3 marks to be awarded for AO1 with no application.
	(0 marks) No response or no response worthy of credit.	
	Guidance: Description of changes to minute ventilation are AO1 Explanations of changes to minute ventilation are application of knowledge to exercise and recovery and are AO2 Evaluations of training methods are AO3 Candidates are not asked to describe continuous training or HIIT but at the bottom of Level 1 this may be the only creditable knowledge offered.	

AO1	AO2	AO3
Explain changes in minute ventilation (Increase in VE)		
1. Increase in VE is more gradual at first	• Because MSFT starts slowly / becomes progressively more intense / workload increases gradually	
2. Neural / chemical control of breathing	• Receptors send information to respiratory control centre/RCC/ inspiratory centre/IC in medulla • Chemoreceptors detect increased acidity or lower pH/ increased CO_2/ decreased O_2, • Proprioceptors / mechanoreceptors detect movement • Thermoreceptors detect increased body temperature • Intercostal nerve stimulates **external** intercostal muscles to contract with more force • Phrenic nerve stimulates diaphragm to contract/flatten with more force	
3. Anticipatory rise/increase at start of MSFT	• Caused by release of adrenaline	
4. Rapid initial rise in VE 5. **followed by** a more gradual rise towards the end of the exercise 6. Increased VE is due to increased depth/rate of breathing or VE = TV x f	• Recruitment of additional inspiratory muscles • Sternocleidomastoid/SCM /pectoralis m**inor/** scalenes	
7. Recruitment of expiratory muscles/forced expiration	• Expiratory centre/EC stimulated • Baroreceptors or lung stretch receptors detect increased stretch in the lungs • Internal intercostals/rectus abdominis • Expiration becomes active • Hering-Breuer reflex	
8. Increased VE towards maximal values/ 160L/min	• Maximal values as multistage fitness test is a maximal test/exhaustive	
(decrease in VE)		
9. VE decreases rapidly at first after exercise has stopped 10. **AND** then more gradually to resting levels	• E.g. when performer drops out of the MSFT/reaches exhaustion • Chemoreceptors detect decreased acidity or higher pH/ decreased CO_2/ increased O_2, • Proprioceptors/mechanoreceptors detect reduced movement • Thermoreceptors detect decreased body temperature • Baroreceptors/lung stretch receptor detect reduced stretch	
11. Receptors detect changes during recovery	• Decreased stimulation of the EC • Reduced nervous stimulation of respiratory muscles	

<table>
<tr><th colspan="3">Evaluate both continuous training and HIIT training as methods used to improve aerobic capacity for games players. Continuous training for games player)</th></tr>
<tr><td rowspan="2">12. Low or moderate intensity work for a prolonged period of time
13. Any reference to the parameters for continuous training</td><td rowspan="2">Any game specific examples give EG for AO2.</td><td>(Advantages)
• Improves the aerobic system / aerobic capacity
• Targets SO muscle fibres
• Any reference to aerobic adaptations
• Increases intensity and duration of performance
• Can be adapted to fartlek training which is more specific for games players
• Does not require much specialist equipment</td></tr>
<tr><td>(Disadvantages)
• Does not improve anaerobic systems
• Tedium / boredom
• Can be time consuming
• Risk of overuse injuries / overtraining
• Not sport-specific / games players do not usually work continuously at moderate intensity
• Slower gains / adaptions than HIIT
• Lower energy expenditure than HIIT</td></tr>
<tr><td colspan="3">(High intensity interval training/HIIT for games player)</td></tr>
<tr><td rowspan="2">14. Periods of short duration, high intensity exercise intervals at near maximal or maximal effort interspersed with periods of lower intensity active or passive rest
15. Any reference to the parameters for HIIT training</td><td rowspan="2">Any game specific examples give EG for AO2.</td><td>(Advantages)
• Improves aerobic and anaerobic systems / aerobic and anaerobic capacity
• Can be modified for differing fitness levels/positions in the team
• Faster gains /adaptations than continuous training
• Higher energy expenditure during/after session so greater reduction in body fat
• Time efficient / (can be) shorter session than continuous
• Improves repeated sprint ability/RSA / sport specific example
• Develops acceleration/speed/explosive leg power.
• Can work for longer at a higher intensity
• Rest intervals lower blood lactate concentrations.
• Less tedious/boring than continuous training
• Less risk of overuse injuries than for continuous training</td></tr>
<tr><td>(Disadvantages)
• May be unsafe for those with very low fitness/health conditions
• Longer recovery needed (after session)
• May cause DOMS / delayed onset of muscle soreness / muscle injuries
• Due to excessive eccentric muscle contractions</td></tr>
</table>

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