GCE

Physical Education

H155/01: Physiological factors affecting performance

Advanced Subsidiary GCE

Mark Scheme for June 2019

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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

Annotations used in the detailed Mark Scheme

	?	Unclear
BOD	BOD	Benefit of doubt
	Cross	Incorrect
L1	L1	Level 1
L2	L2	Level 2
L3	L3	Level 3
REP	REP	Repeat
	Tick	Correct
VG	VG	Vague
SEEN	SEEN	Noted but no credit given
S	S	S (indicates 'sub max reached')
EG	EG	Example
K	K	Knowledge
DEV	DEV	Development

- Sub-maxes are indicated with **S**; the guidance section of the mark scheme shows which questions these are relevant to.
- **K** and **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 K or DEV does not necessarily equate to one mark being awarded; the marking is based on a levels of response mark scheme which awards a level and mark holistically based upon the quality of the response overall against the levels descriptors.

Section A

Question			Answer	Marks	Guidance
1	(a)		Six marks for: 1. Rectus femoris/vastus medialis/vastus lateralis/vastus intermedius 2. Hinge 3. (preparation) antagonist/opposing/braking force 4. (preparation) eccentric 5. (execution) agonist/prime mover 6. (execution) concentric	**6** (AO1 x 2, AO2 x 4)	**Mark 1st named muscle only.** **Do not accept: isotonic for pts 4 or 6.** **If phases of kick are not identified, credit only if answers follow correct order.**
	(b)	**(i)**	Two marks for: 1. A = 500 2. B = 20	**2** (AO3)	**Units are not required.**
		(ii)	Four marks from: 1. (Skeletal muscles) Increase in heart rate/stroke volume/cardiac output means greater volumes of blood to muscles 2. (Skeletal muscles) Vasodilation of blood vessels/arterioles leading to muscles 3. (skeletal muscles) Opening/dilation of pre-capillary sphincters to muscles 4. (Other organs) Vasoconstriction of blood vessels/arterioles leading to other organs 5. (Other organs) Closing/constriction of pre-capillary sphincters to other organs	**4** (AO3)	**DNA Veins** **BOD Arteries**
	(c)		Four marks from: 1. External intercostals/diaphragm contract with more force **which** increases the volume of thoracic/chest cavity **more** 2. (causing) a greater decrease in pressure in the lungs **which means** more air enters lungs 3. Sterncleidomastoid/pectoralis minor assist **which means** greater volume/lower pressure/more air in 4. Internal intercostals/rectus abdominis contract to **reduce** volume of thoracic cavity 5. (causing) increase in pressure in the lungs **which means** air is forced out of the lungs 6. Expiration becomes an **active** process to increase breathing rate 7. Greater volumes of air in/out **means** more gas exchange /more O_2 to working muscles /more CO_2 removed	**4** (AO3)	**Question asks to explain so answers must link cause to effect for each mark.** **Accept ribs move up and out further linking to points 1 and 3** **Accept ribs move down and in further linking to point 4**
	(d)		Four marks from:	**4**	**Comparison between rest**

<table>
<tr><th colspan="6">Section A</th></tr>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>1. During exercise the partial pressure/pO_2 is lower in muscles than at rest
2. During exercise the partial pressure/pCO_2 is higher in muscles than at rest
3. (There is a) steeper diffusion / concentration gradient during exercise
4. More O_2/CO_2 diffuses/moves at a faster rate during exercise
5. Oxyhaemoglobin dissociation curves shifts to right during exercise or Bohr shift
6. Haemoglobin gives up/releases/dissociates O_2 more readily to muscles during exercise or more O_2 diffuses into muscles or oxyhaemoglobin saturation with O_2 is much lower <u>in muscles</u> during exercise</td><td>(AO1)</td><td>and during exercise must be made or implied using a comparative word i.e. lower.</td></tr>
<tr><td>2</td><td>(a)</td><td></td><td>Five marks for:
1. <u>High</u> carbohydrate meal
2. Eat 2.5 – 3.5 hours / 150 – 210 minutes before event
3. Slow-digesting / releasing /complex/low glycaemic index/low GI (carbohydrates)
4. Eat 1 - 2 hours / 60 – 120 minutes before event
5. Fast-digesting/ releasing /simple/high GI carbohydrates</td><td>5
(AO1)</td><td>Do not accept: Named foods containing carbohydrates.
Accept Carbs / CHO</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Five marks from:
<table>
<tr><td colspan="3">(Muscular)</td></tr>
<tr><td>Adaptation</td><td colspan="2">Evaluation</td></tr>
<tr><td>1. Muscle hypertrophy of SO/slow twitch fibres/ FOG / Fast Oxidative Glycolytic</td><td rowspan="4">More (aerobic) energy produced or increased stamina/endurance/VO_2 max or delays fatigue/OBLA</td><td></td></tr>
<tr><td>2. Increased size/density of mitochondria</td><td>More aerobic respiration</td></tr>
<tr><td>3. Increased stores of myoglobin</td><td>More oxygen to mitochondria</td></tr>
<tr><td>4. Increased stores of glycogen/fats/triglycerides</td><td>more use/metabolism of fats/FFAs</td></tr>
<tr><td colspan="3">(Metabolic)</td></tr>
<tr><td>5. Increased (aerobic) enzyme activity</td><td colspan="2">Increased metabolism of glycogen/fats or work at higher % of VO_2 max</td></tr>
<tr><td>6. Reduced fat mass</td><td colspan="2">Increased lean mass/body composition or better power to weight ratio or less weight to carry round pitch</td></tr>
<tr><td>7. Reduced insulin resistance</td><td colspan="2">Increased stamina/endurance or delays fatigue/OBLA</td></tr>
</table></td><td>5
(AO3)</td><td>Sub max 3 for both systems.

Adaptations must have an evaluation that explains how they are beneficial.</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Six marks from:
1. (static) force applied (against a resistance) with no movement/no change in muscle length
2. (static) e.g. crucifix on rings in gymnastics</td><td>6
(AO1 x 3, AO2 x 3)</td><td>Do not accept: ‘isometric strength’ on its own for pt 1</td></tr>
</table>

<table>
<tr><th colspan="5">Section A</th></tr>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>3. (dynamic) force applied with movement/change in muscle length
4. (dynamic) e.g. throwing a javelin
5. (maximum) maximum/greatest force applied in a single contraction/repetition/once
6. (Maximum) e.g. deadlift in weightlifting</td><td></td><td>Do not accept ‘weightlifting’ on its own for pt 6
Accept 1 rep max for point 5 for BOD.4</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>Four marks from:
<table>
<tr><td>1. (Method)</td><td>Sit and reach test</td><td>Goniometry/goniometer/flexometer</td></tr>
<tr><td>(Advantages – sub max 2)

2. Advantage 1

3. Advantage 2</td><td>• Easy/quick to administer
• Cheap/simple equipment
• Standardised tables available</td><td>• Objective/accurate/valid
• All joints can be measured
• Activity-specific</td></tr>
<tr><td>(Disadvantage – sub max 1)

4. Disadvantage 1</td><td>• Only measures lower back/hamstring flexibility
• Does not take into account arm/leg length ratio
• Not activity-specific
• Must follow correct protocol</td><td>• Difficult to locate <u>axis of rotation</u> of joint (goniometers)
• Expensive (flexometer)
• Inaccurate if not used correctly
• Training needed/ must follow correct protocol</td></tr>
</table></td><td>4
(AO1)</td><td>Sub max 2 for advantages

Sub max 1 for disadvantage</td></tr>
<tr><td></td><td>(d)</td><td>(ii)</td><td>One mark for:
Increase distance/range of motion over which force is applied or reduce tension in antagonists or increased speed of contraction/ power /explosive strength or increase momentum or decreased risk of injury</td><td>1
(AO2)</td><td></td></tr>
</table>

Section A					
Question			**Answer**	**Marks**	**Guidance**
3	**(a)**	**(i)**	Three marks from: 1. (NL2)Acceleration is proportional to the size of force applied/ Force = mass x acceleration/ F = ma 2. (Force)The hockey player applies a large force to increase acceleration 3. (Velocity)Size of force is dependent on velocity/speed of stick (as it contacts ball) 4. Player will attempt to maximise velocity/speed of stick/ power of the hit 5. Size of force is also dependent on mass of stick 6. Player may use a heavier stick to increase force 6. Heavier stick will increase/maximise acceleration as long as velocity/speed of stick is not lost/reduced/player can swing heavy stick as quickly as a lighter one	**3** (AO2)	
	(a)	**(ii)**	Two marks for: 1. Force = mass x acceleration / m x a / 0.16 x 30 2. = 4.8 Newtons/N	**2** (AO3)	**Units must be correct for pt 2**
	(b)		Four marks for: 1. Fulcrum, effort and load 2. Effort arm and load arm 3. 1st class = Effort – fulcrum – load **or** load – fulcrum – effort 4. E.g. movement of head to perform a header in football **or** elbow extension to throw a ball	**4** (AO1 x 3, AO2 x 1)	**Do not accept: EFL or LFE for pt 3 unless pt 1 is correct** **N.B. Examples using elbow must specify extension/straightening or triceps contraction**
	(c)		Five marks from: 1. To analyse **gait/walking/running** e.g. improve technique of marathon runner 2. To analyse **posture** of e.g. improve persistent back pain of rugby player 3. To measure/improve **balance** of e.g. to improve performance of swimmer on starting blocks 4. For **rehabilitation** from injuries e.g. to enhance recovery of a footballer after an ankle sprain 5. To measure **force/power/acceleration** e.g. to improve technique at take-off for a high jumper 6. To optimise **angle of take-off** for e.g. to improve technique of a long jumper 7. **Prevention of injury** on landing e.g. to improve a cricket fast bowler in delivery stride 8. To adapt/design **prostheses** for e.g. to enhance performance of a paralympic 100m sprinter	**5** (AO2)	**Sub max 3 if no practical examples used.** **Key words highlighted.**
	(d)		One marks for:	**6**	

Section A					
Question			**Answer**	**Marks**	**Guidance**
			1. (CoM def) the point at which a body is balanced (in all directions) **or** the point from which weight appears to act Five marks from: (at take-off) 2. CoM is raised by lifting arms/knee 3. CoM stays inside body (during flight – sub-max 4) 4. High jumper rotates about CoM 5. CoM is moved outside body (by arching back) 6. CoM passes under bar 7. While high jumper passes over bar 8. Enabling a greater height to be achieved	(AO1 x 1, AO2 x 5)	**Sub-max 4 for flight element of jump.**

Section C		
Question	**Answer**	**Guidance**
4*	**Level 3 (8–10 marks)** • detailed knowledge & understanding (AO1)	**At Level 3 responses <u>are likely</u> to include:** • detailed and accurate explanation of physiological adaptations to

Section C		
Question	**Answer**	**Guidance**
	• 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.	flexibility training • detailed range of structural and functional factors of fast oxidative muscle fibres have been evaluated • Practical examples have been used throughout to support the answer • 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:** • both physiological adaptations to flexibility training and characteristics of fast oxidative muscle fibres are covered, but one may be in more detail • An attempt has been made to explain and evaluate both parts of the question • there will be some use of practical examples • 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:** • a basic knowledge of the physiological adaptations to flexibility training which may be identified/described rather than explained • characteristics of fastoxidative fibres may be limited to a description of their functions • Limited use of practical examples to support knowledge • maximum of 3 marks to be awarded for AO1 with no application.
	(0 marks) No response or no response worthy of credit.	

Question	**Indicative content**	**Marks**	**Guidance**

4* **(Adaptations to flexibility training)**

10 (AO1 x 3, AO2 x 3, AO3 x 4)

1. Increased range of motion/movement(AO1)
   - Reduced risk of injury
   - e.g. sprains/strains/torn muscles
   - during dynamic movements
   - e.g. performing a side step in rugby(AO2)

2. Increased resting length of muscle(AO1)
   - And connective tissue/tendons/ligaments
   - Plastic/semi-permanent adaptations
   - Muscle spindles adapt to new/increased/change of length
   - e.g. greater stride length during sprinting in athletics(AO2)

3. Increased elasticity of muscle/connective tissue(AO1)
   - Reduction/inhibition of stretch reflex (stimulus)
   - Stretch reflex is initiated at greater range of motion
   - e.g. Goalkeeper stretching to save a ball going for the top corner(AO2)

4. Increased force/power/speed can be generated(AO1)
   - Reduced inhibition/contraction of antagonists
   - Increased stretch/relaxation of antagonists
   - e.g. allows greater follow through during punt in rugby, increasing distance of kick(AO2)

5. Improved posture/alignment(AO1)
   - Reduced tension in back/hamstring muscles
   - Prevent chronic injuries
   - e.g. back pain/sciatica/hamstring tightness(AO2)
   - e.g. improved running/jumping technique in basketballer(AO2)

6. But … too much flexibility may reduce joint stability (AO3)
   - Cause dislocations/joint injuries/rotator cuff injuries
   - In high impact sports
   - e.g. shoulder dislocation when making a tackle in rugby(AO2)

(fast oxidative fibres)

7. Large neuron/motor unit(AO1)
   - Many muscle fibres per neuron/motor unit
   - Allows large force of contraction

If no practical examples have been used, then answer cannot get out of level 1.

Some of the DEVs can be linked to more than one physiological adaptation. Give credit wherever they appear in the answer.

Adaptations to training are AO1
Characteristics of fibre types are AO1
Applied practical examples are AO2
Evaluations of fibre types and negatives of increased flexibility are AO3

Functional characteristics can link to more than one structural factor. E.g. pts 7 and 8 relate to anaerobic

- e.g. jumping or moving quickly into position in volleyball(AO2)
- But … less force than fast glycolytic/FG fibres or more force than SO fibres (AO3)

8. High phosphocreatine/PC/phosphagen stores(AO1)
   - Allows high speed/power output
   - e.g. rugby player bursting through a tackle(AO2)
   - But … not as powerful as fast glycolytic/FG fibres or more speed than SO fibres (AO3)

9. High capillary density/many capillaries(AO1)
   - Allows more oxygenated blood to muscles
   - More efficient removal of waste products

10. Moderate/good level of mitochondrial density(AO1)
    - More sites for aerobic respiration

11. Moderate myoglobin content(AO1)
    - Greater transfer of oxygen to mitochondria
    - Greater aerobic capacity than FG fibres or smaller aerobic capacity than SO fibres (AO3)

12. Good/moderate resistance to fatigue(AO1)
    - High intensity work for several minutes e.g. 800m race(AO2)
    - Good for muscular/strength endurance (AO3)

(Overall evaluation)

13. Good for games players e.g. tennis/football/rugby (AO3)
    - greater anaerobic capacity than SO fibres but lower than FG fibres (AO3)
    - greater aerobic capacity than FG fibres but lower than SO fibres (AO3)
    - Good for activities with aerobic and anaerobic components (AO3)

capacity. Pts 9-11 relate to aerobic capacity/endurance and fatigue resistance.

At Level 3 candidates should be comparing effectiveness of FOG fibres with either SO or FG fibres, and identifying practical examples where FOG fibres are most effective.

At level 2 expect more of an explanation of characteristics, but with an attempt at evaluation.

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