Cambridge Technicals
Sport

Unit 1: Body systems and the effects of physical activity

Level 3 Cambridge Technical in Sport and Physical Activity
05826 - 05829 & 05872

Mark Scheme for January 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

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 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 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 must give candidates the benefit of the doubt and **mark the crossed out response** where legible.

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 zero 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 lined pages 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 an annotation to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
- OR if there is a comment which does not in anyway relate to the question (e.g. 'can't do', 'don't know')
- OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question
Note: Award 0 marks - for an attempt that earns no credit (including copying out the question)

8. Use the annotation BP (Blank Page) for **all pages that have no writing**.

Assistant Examiners will email a brief report on the performance of candidates to your Team Leader (Supervisor) by the end of the marking period. Your report should contain notes on particular strength displayed as well as common errors or weaknesses.

9. Spelling

Accept incorrect or phonetic spellings if the word is recognisable.

9. Annotations used by examiners

Annotation	Meaning
BOD	Benefit of doubt
	Cross
DEV	Development (Use for Q21)
EG	Example/Reference
IRRL	Significant amount of material which doesn't answer the question
KU	Knowledge and understanding (Use for Q21)
L1	Level 1 (Use for Q21)
L2	Level 2 (Use for Q21)
L3	Level 3 (Use for Q21)
MAX	Max
REP	Repeat
	Tick
VG	Vague *(Use instead of old NBD)*

Multiple Choice Questions

Examiners indicate if answer given is correct or not using a tick or cross on the right hand side of the question.

All questions other than Multiple Choice and Extended response Question 21

Tick = correct
Cross = incorrect
BOD = benefit of the doubt given. Also tick as correct.
VG = answer is vague / no benefit of the doubt given / also used where additional material may have been seen but no more marks gained. No cross needed.
SEEN = response been read but no credit given / also used where no response attempted
REP = Point repeated and no further credit given
MAX = if maximum marks have been awarded for a question, then mark as MAX in left hand margin.

Extended response - Question 21

Please note that on the extended response question ticks and crosses are not used as it is not 1 tick = 1 mark.

Where applicable:

KU is used to indicate that a knowledge point from the mark scheme indicative content has been used.

DEV is used to indicate that a more developed or detailed point has been made (showing greater understanding).

EG is used to indicate where an example has been used or applied to support or develop the response.

L1 = Level 1 (for 'Levels-marked' questions only) – put at end of response to indicate level awarded
L2 = Level 2 (for 'Levels-marked' questions only) – put at end of response to indicate level awarded
L3 = Level 3 (for 'Levels-marked' questions only) – put at end of response to indicate level awarded

Examiner Guidance on annotations

1. General guidance:

- mark using RM annotations – **every** question to be marked
- record the total mark for each question in RM mark boxes
- **check carefully** that you input the correct mark – check the number of ticks recorded for each question (apart from Q21)
- **Do not** use ticks on Q21 – use KU (Knowledge and understanding credits) and DEV (Development credits)
- Only record KU and DEV **on left hand side** of script so that candidate's work is not obscured
- Record level on **left hand side** at the base of Q21 and record total mark for the question
- If candidate has attempted the question or even an attempt that is crossed out (still mark crossed out work), and deserves no credit then **record zero**
- If candidate leaves a question unanswered then use the annotation **'SEEN' and record NR** in the totals box (no response)
- Use **BP** on all blank pages to show that you have checked for any responses

2. For Multiple-Choice Questions (MCQs), use a **tick** or a **cross** to the right hand side of the option indicated by the learner as being their answer.

3. For points-marked questions (all apart from Q21):

- Structured scheme: one mark = one point, represented by a **tick**
- Keep referring to the requirements of each question
- Annotate **every** question answered

4. For the levels marked questions:

- Keep checking for relevance of the response to the requirements of the question
- Give **KU** for each KU credit achieved on the levels MS
- Give '**DEV**' for every point that has been sufficiently developed and shown understanding indicated on the levels MS
- Now **review again** the answer.
- Remember to **keep checking** whether the response actually answers the question set.
- REVIEW THE LEVELS' DESCRIPTORS AND ESPECIALLY THE DISCRIMINATOR POINTS TO PINPOINT THE MARK.
- Indicate the level awarded (**L1, L2** or **L3**) at the base of the answer on the **LHS**, then enter the total mark for Q21
- Some candidates may make relatively few points but develop them well to show good understanding, meet well the generic criteria descriptors in the top level and answer all parts of the question and therefore score well.
- Some candidates may make many points but may not show the depth of analysis required to match the generic criteria descriptors in the top level and therefore score less well.
- Do not be afraid to give full marks if all descriptors / discriminators are met at the required level.
- It is **unlikely for learners to score 0** (nil) marks if they have attempted to answer the question set, unless the material is entirely irrelevant.
- Use your professional judgement and **contact your Team Leader** if you need help in applying the scheme.

Question			Answer	Marks	Guidance
1			**(b)** Cranium	1	
2			**(c)** Deltoid	1	
3			**(b)** Decrease in volume of the thoracic cavity	1	
4			**(c)** Veins	1	
5			**(c)** The main energy system used in an activity	1	
6			**(d)** Many mitochondria	1	
7			**(a)** Cross-country running	1	
8			**(a)** **A** alone is correct	1	
9			Biceps femoris / semimembranosus / semitendinosus	1	DNA: Hamstrings = VG Gastrocnemius = BOD NB. mark and credit 1st named muscle only – refer to marking guidance
10			Capillary / Capillaries	1	
11	(a)		A = Femur B = Ribs / Rib cage C = Ilium D = Patella	4	DNA: C - Ischium / pubis / hip = VG DNA: D – Kneecap / knee = VG C – Pelvis / Pelvic Girdle = BOD

Question			Answer	Marks	Guidance
11	(b)		4 marks for 4 of: 1. Shape / structure / posture 2. Support / stability 3. Movement / lever system / attachment for muscles 4. Blood **cell** production 5. Mineral **storage**	4	DNA: Produce minerals MP 5 DNA: Bone marrow production MP 4: Blood production = VG MP 3: Mobility = BOD MP 2: hold body upright / uphold body = BOD NB. Mark and credit first 4 responses only – refer to marking guidance NB. E.g. Shape & Stability in 1 line of response = 2 marks, next response refer to marking instructions.
12	(a)		A – Hinge (joint) B – Ball and socket (joint) C – Condyloid / Ellipsoidal (joint)	3	DNA C – Biaxial as relates to movements MP C – Saddle / Gliding / Condylar / Bicondylar BOD
12	(b)		4 marks for any 4 of: 1. Stronger / thicker bones / increased bone density 2. Increase in calcium / collagen 3. Increased stability / stronger joints 4. Stronger ligaments 5. Reduced risk of bone injury / cartilage injury / ligament injury / fractures / breaks 6. Reduced risk of osteoporosis 7. Reduced risk of (osteo)arthritis 8. Stronger / thicker (articular/hyaline) cartilage 9. Increased synovial fluid (production) 10. Reduced friction / wear and tear at joints / joints better able to absorb shock 11. Improved posture 12. Increased blood cell production	4	DNA: stronger tendons / prevents injuries / increased range of movement at joints / increased flexibility at joints / looser joints / bone disease. MP 1 Increased production of bone marrow = VG MP1 Bone growth = VG MP 2 Increased mineral storage = VG MP 4 Stronger connective tissue = VG MP 5 helps to prevent bone / cartilage / ligament injury / fractures / breaks = VG (can't prevent these injuries from happening) MP 8 Increased cartilage = VG MP 10 Decreased joint pain = VG NB. Mark and credit first 4 responses – refer to marking guidance

Question			Answer	Marks	Guidance
13	(a)		A = Tibialis anterior B = Gastrocnemius	2	A – Extensor Digitorum Longus = BOD B – Calf = VG
13	(b)		A = Dorsiflexion B = Plantar flexion	2	DNA: Flexion and Extension for either mark point
13	(c)		**Eccentric** muscle contractions occur when a muscle contracts and lengthens to control movement and resist gravity. **Isometric** muscle contractions occur when a muscle contracts but there is no movement. **Concentric** muscle contractions occur when an agonist shortens under tension.	3	For all MPs DNA Isotonic
14	(a)		(Agonist) a muscle that causes movement / working muscle (Antagonist) a muscle that relaxes / lengthens (during movement) **OR** a muscle that opposes movement **OR** a muscle that acts in the opposite direction to movement **OR** provides a resistance to movement / opposes the agonist	2	For Agonist: Shortens and contracts (during movement) = BOD Agonist contracts while another muscle relaxes = BOD Acting muscle (during movement) = BOD Prime mover = VG (just another name for it) Muscle that contracts = VG For Antagonist: Goes against Agonist = BOD
14	(b)		Pronator teres Supinator	2	Mark 1st two answers only – refer to marking guidance answers can be in any order Pronator = BOD

Question			Answer	Marks	Guidance
15			3 marks for any 3 of: **1. Increased** blood / oxygen to **muscles** 2. **Increased** production of carbon dioxide / lactic acid 3. Increased breakdown of ATP / PC / glycogen **OR** depletion of energy / PC / ATP / glycogen stores **OR** increase in energy production 4. Fatigue 5. (Increased likelihood of) Muscle soreness / micro **muscle** fibre tears 6. **Increase** in flexibility / elasticity / range of movement / pliability 7. Depletion of myoglobin stores	3	DNA: Increased in Muscle Temperature (in question) = REP DNA: long-term effects of exercise on muscular system DNA: cramp/injury for point 4 or 5. DNA: DOMS / overuse injuries MP 1 Increased blood pressure in muscles = VG MP 1 Increased supply of haemoglobin on its own = VG MP 5 Muscle damage / Microtears (not linked to muscles) = VG MP 1 increased diffusion rate at muscles = BOD Increased speed of nerve transmission = BOD Increased enzyme activity = BOD NB. Mark and credit first 3 responses only – refer to marking guidance
16			The resting heart rate of an untrained individual is **higher** … The resting stroke volume of an untrained individual is **lower** … The maximal cardiac output of an untrained individual is **lower** …	3	Accept equivalent words for each.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>17</td><td>(a)</td><td></td><td>
<table>
<tr><th>Structure</th><th>Role</th></tr>
<tr><td>Bronchi</td><td>Hollow tubes ringed with cartilage. They branch off to the left and right lungs.</td></tr>
<tr><td>Alveoli</td><td>Tiny air sacs in the lungs where gaseous exchange takes place.</td></tr>
<tr><td><u>Larynx</u></td><td>Air enters here and passes over the vocal cords before moving into the trachea.</td></tr>
<tr><td>Bronchioles</td><td>Tubes which branch off from the bronchi to the alveoli / lobes of the lungs</td></tr>
<tr><td>Nasal cavity / nasal passage / nose</td><td>This warms, moistens and filters inspired air.</td></tr>
</table>
</td><td>5</td><td>Underlined answers must be as in MS.

Accept Bronchus = BOD
Accept Nostrils = BOD

Alveoli - air sacs (in the lungs) = BOD
Alveoli - where gas exchange takes place = BOD
Alveoli – allows diffusion = BOD

Bronchioles - tubes that carry air to the lobes of the lungs = BOD
Bronchioles - allow oxygen / air into alveoli = BOD
Bronchioles - tubes that branch off from bronchi = BOD</td></tr>
<tr><td>17</td><td>(b)</td><td>(i)</td><td>2 marks for any 2 of:
1. Diaphragm
2. Pectoralis minor
3. Sternocleidomastoid
4. Scalene</td><td>2</td><td>DNA MP 2 Pectoralis Major

External intercostals = BOD

NB. Mark 1st two answers only – refer to marking guidance</td></tr>
<tr><td>17</td><td>(b)</td><td>(ii)</td><td>Internal intercostals
Rectus abdominus</td><td>2</td><td>NB. Mark 1st two answers only – refer to marking guidance</td></tr>
<tr><td>18</td><td></td><td></td><td>(At rest – minute ventilation) = <u>6</u> (l/min)
(Exercise – tidal volume) = <u>3</u> (litres)</td><td>2</td><td>Units not needed.

Credit 1st answer provided – refer to marking guidance</td></tr>
</table>

Question			Answer	Marks	Guidance
19			4 marks for any 4 of: 1. (Differences in partial pressure) Causes a pressure gradient / diffusion gradient / concentration gradient 2. Gases move from (an area of) high pressure / concentration to (an area of) low pressure / concentration 3. In the alveoli / lungs the partial pressure of oxygen is high 4. In the alveoli / lungs the partial pressure of carbon dioxide is low 5. In the capillaries (around the alveoli) the partial pressure of oxygen is low 6. In the capillaries (around the alveoli) the partial pressure of carbon dioxide is high 7. Oxygen diffuses / passes into the capillaries 8. Carbon dioxide passes into the alveoli / lungs	4	DNA Differences in partial pressure (in question) PPO_2 is higher in alveoli than in capillaries = 2 marks (MS 3 and 5) $PPCO_2$ is lower in alveoli than in capillaries = 2 marks (MS 4 and 6)
20			3 marks for any 3 of: 1. (System) ATP-PC system **OR** alactic system 2. (Reaction) Anaerobic **OR** without oxygen 3. (Fuel) Phosphocreatine / Creatine phosphate 4. Phosphocreatine is broken down to produce creatine, phosphate and energy **OR** PC → P + C + energy 5. In sarcoplasm / cytoplasm (of muscle) 6. (Enzyme) creatine kinase 7. (Net yield of) 1 ATP (per phosphocreatine molecule) **OR** 1:1 **OR** one to one (ratio) 8. No (fatiguing) by-products 9. Phosphocreatine is resynthesised to produce more energy / ATP 10. System lasts (approximately) up to 10 seconds / athlete does not perform more than 10 seconds	3	DNA: reference to ATP breakdown ATPase = VG MP1 ATP system = VG MP 3 Accept **The fuel is** PC or CP = BOD

21* (Identify the four components of blood. Explain how each component affects performance in physical activity.) 10 marks	
1. Red blood cells / erythrocytes • Contain haemoglobin • (Haemoglobin (Hb)) transports oxygen • As oxyhaemoglobin / HbO_2 • Hb also transports some carbon dioxide to the lungs • As Carbaminohaemoglobin / CO_2Hb • 1 Hb molecule can carry up to 4 oxygen molecules • If Hb levels high more oxygen can be carried to the muscles • More oxygen at muscles means higher aerobic capacity / stamina • Better performance in aerobic activities, e.g. triathlon • Better performance in activities with aerobic and anaerobic elements • Haematocrit range (percentage of RBCs in total blood volume) • Anaemia – low red blood cell count means lower performance / fatigue (only credit if linked to anaemia / low RBC's) • Too high haematocrit levels can increase blood viscosity / thicken blood / cause dehydration 2. Platelets / thrombocytes • Cause blood to clot (when exposed to the air) • Prevent blood loss from cuts / grazes • Prevent infections / bacteria / viruses entering body • In many / contact sports bleeding is a regular occurrence • E.g. nosebleed in rugby / cuts in boxing • Participation in most sports is not allowed until bleeding is stopped • Contamination from blood / hepatitis / HIV is a risk • Use of blood bins / substitutions will limit performance • Haemophilia – inability of blood to clot / lack of clotting proteins	3. White blood cells / leukocytes / leucocytes • Protect the body from infection / disease / pathogens / bacteria • Reference to immune / lymphatic systems / antibodies / antigens • Maintain good health for performer **OR** Low levels of white blood cells will limit health / fitness / performance • Good health / strong immune system necessary for best performance • … and for consistent training / high intensity training 4. Plasma • Fluid that carries all the cells around the body • Mainly water • Carries carbon dioxide to the lungs • Carries glucose / proteins / fats / triglycerides / nutrients • Carries metabolites / enzymes / hormones / other chemicals • Oxygen is dissolved in Plasma (2% in total) • Plasma volume about 50% of blood volume • Blood viscosity / relative thickness of blood affects ability to flow • Lower plasma volume increases viscosity / blood pressure • Heart must work harder to get enough oxygen to muscles • Lower plasma volume reduces performance / stamina • Lower plasma volume may be due to dehydration / due to endurance work • Training increases plasma volume / reduces blood viscosity • Training improves blood's ability to transport nutrients / oxygen 5. (Other roles of blood) • Homeostasis - maintains body's state of equilibrium • Temperature regulation - increased blood flow to skin to release heat • Buffering capacity – maintain a stable blood pH / remove lactate

Level 3 (8–10 marks) **A comprehensive answer:** Detailed knowledge & understanding. Effective analysis/critical evaluation and/or discussion/explanation/development. Clear and consistent practical application of knowledge. Accurate use of technical and specialist vocabulary. High standard of written communication.	**At Level 3 responses <u>are likely</u> to include:** Detailed knowledge and excellent analysis of the functions of all four components of blood and how they affect performance in physical activity. **At the top of this level** the benefits of all four components may have been explained and limiting factors of at least two components may have been addressed. **At the bottom of this level** there may be a detailed understanding of the functions of all four components of blood and a lack of limiting factors **OR** there may be a detailed explanation of the effects of at least three components of blood.
Level 2 (5–7 marks) **A competent answer:** Satisfactory knowledge & understanding. Analysis/critical evaluation and/or discussion/explanation/development attempted with some success. Some success in practical application of knowledge. Technical and specialist vocabulary used with some accuracy. Written communication generally fluent with few errors.	**At Level 2 responses <u>are likely</u> to include:** Satisfactory knowledge of the functions of the components of blood and the effects of these components on performance in physical activity. **At the top of this level** the functions of at least three components of blood may have been explained with some references to effects on performance in physical activity. **At the bottom of this level** the four components of blood may have been identified with some explanation of their functions and effects on performance **OR** knowledge of some components may be good while knowledge of the functions of others may be limited.
Level 1 (1–4 marks) **A limited answer:** Basic knowledge & understanding. Little or no attempt to analyse/critically evaluate and/or discuss/explain/develop. Little or no attempt at practical application of knowledge. Technical and specialist vocabulary used with limited success. Written communication lacks fluency and there will be errors, some of which may be intrusive.	**At Level 1 responses <u>are likely</u> to include:** Basic knowledge and understanding of the functions of the components of blood and the effects of these components on performance in physical activity. Answers may show a limited application of knowledge to effects on performance in physical activity. **At the top of this level** knowledge of all four components of blood may be shown **OR** some components of blood have been addressed and effect on performance may be limited to one function, e.g. transport of oxygen. **To score 1 mark** one component of blood has been identified **OR** one function of blood has been identified.
[0 marks] No response or no response worthy of credit.	

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