



Mark Scheme (Results)

Summer 2025

Pearson Edexcel Advanced Level

In Physical Education (9PE0)

Component 01 Scientific Principles of
Physical Education

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Summer 2025

Question Paper Log Number P78496A

Publications Code 9PE0_01_2506_MS

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Section A

Question Number	Answer	Additional guidance	Mark
Q01 (i)	Pectoralis/Latissimus Dorsi	Must have correct spelling. Accept pectoralis Major. Accept pectoralis Minor. Accept Pectorals.	(1)

Question Number	Answer	Additional guidance	Mark
Q01 (ii)	Deltoids	Must have correct spelling. Accept any word with the word deltoid e.g. lateral, anterior, posterior.	(1)

Question Number	Answer	Additional guidance	Mark
Q01 (iii)	Psoas major	Must have correct spelling. Accept hip flexor(s). Accept iliopsoas.	(1)

Question Number	Answer	Additional guidance	Mark
Q02 (a)	• Size of the base of support (bigger base means more stable) • Number of points of contact with the ground (more points means more stable) • Mass/weight of the object or athlete the greater mass means greater stability • Height/position of centre of mass (e.g. lower is more stable) • Body shape e.g. bringing limbs in closer to body/distribution of weight • Position of the line of gravity in relation to the centre of the base of support closer to base is more stable • Strength of stabilising muscles keep Centre of mass over base of support		(4)

Question Number	Answer	Additional guidance	Mark
Q02 (b)	• Tendons support at joints • Ligaments support at joints • Good strong posture/core strength assists with keeping the body stable • Muscular strength e.g. abdominals/back support the body position • Ensuring muscles are not imbalanced to prevent injury • Fixators stabilize the joint (where the prime mover originates keeping the performer more stable). • Synergist muscles help to stabilise movement at joints. • Short Bones provide stability e.g. in wrist and ankle • Antagonist muscle prevents overstretching		(4)

Question Number	Answer	Additional guidance	Mark
Q03 (a)	• End diastolic volume is the volume of blood in the (right or left) ventricle at the end of filling in diastole. • The amount of blood in the ventricles before the heart contracts (before systole)	Needs to include when and where (ventricle) for the mark. Accept at end of relaxation as 'when'.	(1)

Question Number	Answer	Additional guidance	Mark
Q03 (b)	• End systolic volume is the volume of blood in the (right or left) ventricle at the end of contraction (or systole).	Needs to include when and where (ventricle) for the mark.	(1)

Question Number	Answer	Additional guidance	Mark
Q04	• Venous return (starlings law)/EDV • Heart rate/resting HR • Blood pressure • Contractility of heart/strength of contraction • Blood volume • Intensity of exercise/taking exercise • Heat/humidity • Gender - men have higher usually • Age • Hypertrophy of the heart/size of heart or chambers		(4)

Question Number	Answer	Additional guidance	Mark
Q05	• Ground reaction force exerted on the ground by the body. • Friction from the ground pushing up on the athlete • Drag by the air/air resistance as the athlete runs/wind resistance • Gravity - e.g. centre of gravity can help propulsion/lean in running style or gravity pulling them down	No credit given for stating vertical or horizontal forces. A list is not acceptable.	(3)

Question Number	Answer	Additional guidance	Mark
Q06	• Isotonic, Concentric contraction involves the muscle shortening (origin and insertion move closer together) under tension (and example), for example, biceps brachii in the upward phase of a bicep curl. • Isotonic, Eccentric contraction involves the muscle lengthening under tension (origin and insertion move further away from each other), for example, the biceps brachii contracts eccentrically in the downwards phase of a bicep curl to lower the weight against resistance. • Isometric contraction is when muscles produce tension but stay the same length e.g. gymnast holding crucifix position with biceps brachii under tension or abdominals under tension for plank. • Stretch shortening cycle is an eccentric action immediately before a concentric action e.g. quadriceps during running.	Must link the example to the correct type. Other correct suitable examples will score marks. To score one mark you need info about contraction, correct muscle name and sporting example e.g. isometric and plank will not score because you need to say abdominals as well. The example needs to be specific. E.g. bicep curl will need to say if upward or downward phase. Or press up would need to say upward or downward phase.	(3)

Question Number	Answer	Additional guidance	Mark
Q07	• Capillaries are one cell thick/narrow diameter/thin (1) to allow for gas exchange/nutrient delivery (1) • Capillaries have a narrow lumen (1) causing slower movement of blood (1) • Arteries have muscular and elastic walls/thick/smooth (1) to regulate pressure/flow/withstand high pressure (1) • Arteries have narrow lumen (1) to maintain a high blood pressure (1) • Veins have pocket valves (1) to prevent back flow of blood at low pressure (1) • Veins have a very wide lumen (1) to maximise venous return (1) • Veins have thinner walls (1) to carry blood at lower pressure (1) • Veins have thinner walls (1) which allow the muscular pump to work as muscles contract (1)	Points should be linked; one mark will be awarded for the structure, and one mark will be awarded for the associated function. Sub max will be used to ensure that the marks come from three different blood vessels. Marks would be accepted for arterioles and venuoles/venules e.g. Arterioles use smooth muscle to control the blood flow through the body Marks cannot be awarded for a function without a structure as they need to link together. However, structure can gain a standalone mark. For example, veins have valves would be one mark.	(6)

Question Number	Answer	Additional guidance	Mark
Q08	- Smoking could damage cells and tissues in lungs/limit gas exchange/ Nicotine/Tobacco reduce surface area for gas exchange - Vaping damages the cilia /Lung damage/tissue damage - Air pollutants could damage lungs - Lack of exercise can lead to a decline in lung function/intercostals not as strong - Excessive alcohol use can lead to lung infection - Obesity can reduce air flow/increase demand on respiratory muscles - Too much fatty food/high cholesterol can inflame respiratory airways - Sniffing toxic substances damages nasal passages	Any other suitable point will be rewarded. Each factor needs to be linked to respiratory system effect to score the mark Putting pressure on the respiratory system is too vague they need to give specifics. Sub max for each factor e.g. they cannot have two marks for smoking points. It needs to be four different factors for four marks. Do not give marks for CV effects e.g. on blood vessels or the heart	(4)

Question Number	Answer	Additional guidance	Mark
Q09	• Hypertrophy of the muscle fibres allows greater force production/strength of contraction • Adaptation of type IIa to IIx muscle fibres allows stronger contractions/Fewer fibres required to produce the force needed • Increased rate of fibre recruitment allows a stronger contraction • Increased recruitment of motor units allows more force to be produced • Increased amount of PC stores allow for faster contraction/high intensity performance for longer • Higher levels of actin and myosin allow for more forceful contraction of the muscle • Greater lactate tolerance (and removal of lactate) to allow them to resist fatigue for longer • Increased muscle elasticity allows for increased power • More glycogen stores means athlete can stay in anaerobic system longer • Increased neural firing speed allows faster reactions/speed • Increase in anaerobic enzymes allows for faster ATP production • Increased ATP stores allows athlete to perform at higher intensity	No lists of adaptations – must summarise the effect on the neuromuscular system. Two parts to the answer. Other effects can be accepted if correct and if linked to the neuromuscular system.	(6)

Question Number	Indicative Content	Mark
Q10	AO1 = 4 marks, AO3 = 4 marks All answers should be linked to how an athlete uses Newton's Laws. Reward acceptable answers. Responses may include, but are not limited to the following: An examination that gives all sides of the issue and any implications, that includes the following indicative Ao1 content: Law 1 - a body remains at rest or uniform motion unless acted on by an external force Law 2 - the amount of acceleration of a body is proportional to the acting force and inversely proportional to the mass of the body ($f=ma$) Law 3 - for every action there is an equal and opposite reaction. AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation. Application of Law 1 <i>Run-up</i> -The player remains stationary until muscular force is applied to the ground. <i>Strike of the ball</i> - The ball would remain on the penalty spot until it is kicked. -The ball remains at a constant velocity unless acted upon by air resistance/goalkeeper/goal. Application of Law 2 <i>Run-up</i> -The acceleration of the footballer is proportional to the muscular force applied to the ground. -The heavier the player the more force they will need to use in order to be able to accelerate towards the ball <i>Strike of the ball</i> - The harder it is kicked the greater the change in momentum (acceleration) of the ball. Application of Law 3 <i>Run-up</i> -As the player runs, the player will push down on the ground and the ground will push back onto their foot with an equal and opposite force.	

	<i>Strike of the ball</i> - As it is kicked there is an equal and opposite force back on the striking foot of the player. Also, the player pushes down on the ground and the ground will apply an equal and opposite force back to the player's non-striking foot. The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it.	(8)
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Level	Mark	Level descriptor
0	0	• No rewardable content
1	1 - 2	• Some accurate and relevant knowledge (AO1). • Simple or generalised statements supported by limited evidence (AO1). • Limited balancing of ideas against each other (AO3). • Limited evaluative statement (AO3).
2	3 - 5	• A good level of accurate and relevant knowledge (AO1). • A line of reasoning is presented and supported by some evidence (AO1). • Examines a wide range of ideas, balancing ideas against each other (AO3). • An evaluative statement which is relevant (AO3).
3	6 - 8	• A high level of accurate and relevant knowledge (AO1). • Articulates a clear viewpoint with clarity and precision which is well substantiated (AO1). • Critically examines a wide range of issues balancing ideas against each other (AO3). • Clear evaluative statement which is thorough and focussed (AO3).

Question Number	Indicative Content	Mark
Q11	AO1 = 4 marks, AO3 = 4 marks All answers should be linked to how an athlete uses ventilation and diffusion. Reward acceptable answers. Responses may include, but are not limited to the following. An examination that gives all sides of the issue and any implications, including details about the mechanics involved in the respiratory system, that includes the following Ao1 indicative content: <u>Mechanical process of ventilation - moving a volume of gas into or out of the lungs.</u> - Process of taking oxygen to the lungs but does not include gas exchange - Involuntary process - but can be voluntary as you can consciously alter rate and depth of breathing - Includes nose, pharynx, larynx, trachea, bronchi, bronchioles, diaphragm and intercostals - Includes inspiration and expiration based on pressure differences and gradients. - This is a physical process. <u>Diffusion in the lungs - exchange of oxygen and carbon dioxide across a membrane in alveoli or cells.</u> - Takes place in the cells - Involuntary process - Can happen in alveoli and cells (external or internal) and capillaries occurs by diffusion and exchange of oxygen and carbon dioxide can be external or internal Chemical process. AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation. The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it.	(8)

Level	Mark	Level descriptor
0	0	• No rewardable content
1	1 - 2	• Some accurate and relevant knowledge (AO1). • Simple or generalised statements supported by limited evidence (AO1). • Limited balancing of ideas against each other (AO3). • Limited evaluative statement (AO3).
2	3 - 5	• A good level of accurate and relevant knowledge (AO1). • A line of reasoning is presented and supported by some evidence (AO1). • Examines a wide range of ideas, balancing ideas against each other (AO3). • An evaluative statement which is relevant (AO3).
3	6 - 8	• A high level of accurate and relevant knowledge (AO1). • Articulates a clear viewpoint with clarity and precision which is well substantiated (AO1). • Critically examines a wide range of issues balancing ideas against each other (AO3). • Clear evaluative statement which is thorough and focussed (AO3).

Question Number	Indicative Content	Mark
Q12	AO1 = 5 AO3 =10 Students who only show achievement against AO1 will not be able to gain marks beyond Level 1. AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation. Reward acceptable answers. Responses may include, but are not limited to, the following. A discussion that gives all sides of the issue and any implications, including details about the energy systems, that include the following indicative content: <u>ATPPC System</u> • ATPase enzyme that catalyses it • ATP is broken down into ADP and Phosphate • This releases energy • Phosphocreatine is broken down into Creatine and Phosphate • Creatine Kinase is the enzyme which causes the breakdown of the PC • The energy from this reaction is enough to resynthesise 1ATP. Duration -Lasts 10-12 seconds, most of the phosphocreatine is resynthesised in 2-3 minutes Intensity - High intensity Anaerobic work For example, 100m, long jump, sprinting, shot put <u>Glycolytic System</u> • Glycolysis is the breakdown of Glycogen without oxygen. • Glucose breaks down to pyruvate • Generates Lactate (limit of the system) • 2 ATPS generated Duration -Peak output around 45 seconds and limit approximately 3 minutes. Intensity - high intensity anaerobic work For example, 400m sprint, 200m swim	

	<u>Aerobic System</u> • Uses carbs, fats , proteins for fuel • Starts with glycolysis making 2 ATP (glucose -pyruvic acidacetyl coA) • Krebs Cycle - generating Hydrogen and 2 ATP releasing CO2 • Electron Transport Chain • Gives 34 ATP - oxidation of hydrogen Duration -long duration work Intensity - aerobic work For example, distance running, distance swimming, marathon, rowing events, long cycling events AO3 marks come from discussion about sporting examples and application, for example energy continuum or positions in different games and tactics that would effect the pathways used. The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it.	(15)
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Level	Mark	Level descriptor
0	0	• No rewardable content
1	1-3	• Limited understanding of the factors that underpin performance and involvement in physical activity and sport. This is communicated in a basic way with simple or generalised statements (AO1). • Limited analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). • Little analysis of performance due to limited application of relevant skills and techniques in physical activity and sport (AO3). • Analysis is not used to make a judgement (AO3)

2	4-6	• Attempts some understanding of the factors that underpin performance and involvement in physical activity and sport and organises or expresses ideas with some clarity (AO1). • Attempts some analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). • Attempts to apply relevant skills and techniques in physical activity and sport to analyse performance (AO3). • Analysis may not be used to make a clear judgement (AO3)
3	7-9	• Evidence of some basic understanding of the factors that underpin performance and involvement in physical activity and sport and offers a logical clear writing structure (AO1). • Evidence of some analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). • Some application of relevant skills and techniques in physical activity and sport to analyse performance (AO3). • A judgement may be given but with limited substantiation (AO3).
4	10-12	• Key issues are explored, but not all viewpoints may be addressed. The answer is generally well organised, communicated with clarity but may lack precision (AO1). • Analyses the factors that underpin performance and involvement in physical activity and sport (AO3). • Application of relevant skills and techniques in physical activity and sport to analyse performance (AO3). • Uses analysis to make a clear judgement and supports this with examples (AO3).
5	13-15	• Excellent knowledge and understanding of factors that underpin performance and involvement in physical activity and sport. Communicated in a coherent writing structure with clarity and precision (AO1). • Sophisticated analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). • Uses analysis to make a fully informed judgement and supports this with examples (AO3).

Section B

Question Number	Answer	Additional guidance	Mark
Q13	• Strain • Shin splints (periostitis) • Tendonitis (tennis elbow/golfers elbow/Jumpers knee (patellar tendonitis)/Achillies tendonitis • Stress fracture/ hairline fracture • Thrower's shoulder (impingement syndrome), • Runner's heel (plantar fasciitis).	One mark per bullet - must be overuse and not an acute injury.	(3)

Question Number	Answer	Additional guidance	Mark
Q14	• Air travels further over the top of the discus • Air over the top moves faster than the air underneath • Pressure on top of the discus is lower than the pressure underneath • (This creates a pressure difference) resulting in a lift force • The lift force helps keep the discus in the air for longer helping its travel further	If the pressure difference has already been referenced in bullet 3 then 'this creates a pressure difference' does not need to be used for the 4 th point to get the mark for lift/lift force.	(3)

Question Number	Answer	Additional Guidance	Mark
Q15	• Agility of the athlete - ability to change direction at speed • Age - reduced speed at older age • Muscle elasticity/flexibility - length of muscle tissue affects ability to sprint • Fat/weight- the amount of body fat; if carrying more will be slowed down • Speed - the speed of the athlete impacts their ability to cover the ground • Power of the athlete impacts their ability to turn • Reaction time - the speed the athlete can react to the 'go' will determine their time • Injury - carrying an injury could restrict movement • Body shape/limb length/height affects ability to change direction quickly. • Learning effect – if you know the route you will be faster/lack of understanding of test protocol • Proportion/recruitment of fast twitch fibres – the more the quicker you will be • Floor/contact surface/terrain – if a slippery surface can slow you down	Other acceptable answers could be awarded e.g. valid factors that affect test reliability such as timings in the day, timings of meals/hydrate on, sleep, if not recovered properly etc Need to be described not listed 'Fitness' of the athlete is too vague – it needs to be specific components of fitness which are described.	

	• Warm-up, if you are prepared ready you will be quicker • Acceleration/deceleration – ability of athlete to do this will enable them to corner more effectively • Accuracy of recording, more accurate e.g. • timing gates, reaction of timer will not negatively effect score. • Footwear can impact the ability to change direction/grip • An under motivated athlete may not perform as well • Coordination to turn and change direction • Gender - males have a faster time generally • Core strength/balance/stability of an athlete will impact their stability and balance for the turn.		(4)
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Question Number	Answer	Additional guidance	Mark
Q16	• Swelling/inflammation/muscle damage can be reduced • Can increase blood pressure • Can lessen muscle soreness/minimise DOMS/reduce pain • Reduce blood pooling • Raise skin temperature/keep muscles warm to increase blood flow • Improved blood flow/venous return will help bring oxygen to area • Helps thermoregulation which helps metabolic functions involved in recovery • Helps removal of waste products/lactate		(4)

Question Number	Answer	Additional guidance	Mark
Q17	• Footwear such as spikes will help grip when sprinting/climbing and therefore acceleration or Studs on boots to help turning in rugby/football • Grip socks would allow friction between sock/trainer or foot and sock to improve stability/ increase surface contact, less in shoe movement • Indoor/outdoor court surfaces technology -clay versus grass allows more friction with ball/surface • Spin/slice shots - tennis/table tennis /cricket - 3D analysis of technique to help use friction by understanding how their technique works • Temperature of the ground and surface contact (track and tyres) for example F1 changing tyres and warming tyres/squash ball for more grip • Characteristics of ball surface (e.g. cricket seam) and contact surface (e.g. long pimples on a table tennis bat, dimples on a golf ball allow more friction and reduce drag, ball design to increase hand grip • Downforce (e.g. spoiler, Bernoulli effect) reduces friction • Chalk will increase friction from sweat to grip e.g. climbing/weightlifting/gymnastics • Gloves between hand and equipment to grip and reduce friction • Tyres in cycling – knobbly tyres for grip and stability/traction, smooth	Other suitable examples will be rewarded. Footwear – studs/spikes is all one point even if made for multiple sports. Points must be linked to HOW they improve friction They need to be right about whether it increases or decreases friction. E.g. if they say studs reduce friction this is wrong. Examples where friction is minimised are fine e.g. ice skates to reduce friction on the ice	

	tyres for speed e.g. F1 tyres for weather surfaces • Handball player using glue on the hands to get a better grip on the ball • Different skis for different snow conditions		(4)
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Question Number	Answer	Additional guidance	Mark
Q18	• Completed in a laboratory • Expired gases measured/uses gas analysis • Done on Treadmill/bike • Done above max steady state (e.g. 120% of VO2 max) • Performed at a constant speed • Performed until athlete is exhausted/maximal • Comparison against a prior test (which would have told us how much oxygen they need at a given speed or cycle power) (for example 10x 4 mins sub max exercise at different intensities) • Calculate difference between total oxygen required and total oxygen consumed, i.e. energy produced by the anaerobic.	Wearing a mask is not enough for bullet 2 – it needs to talk about the gas analysis.	(5)

Question Number	Answer	Additional guidance	Mark
Q19	• There is no storage for water in the body so must be replenished • Maintains body temperature/prevent overheating/ thermoregulation • Aids removal of waste products • Helps transportation of nutrients • Need to replace water lost through sweating • Maintain blood volume/ circulation/viscosity/osmolity • Maintain blood pressure • Aids digestion • Lubricate joints/protect organs • Replenishes water content of blood plasma • Prevent dizziness/feel faint • Performance can drop • Maintain cognitive ability/decision making	Maintains energy is too vague on its own. Viscosity decreases or maintains not increases with more hydration. It does not provide nutrients it delivers them.	(4)

Question Number	Answer	Additional Guidance	Mark
Q20	• Need to be able to support own body weight for example on rings/bars • Increase strength/power to weight ratio • Increased strength means increased time of flight to perform skills • More explosive power for difficult moves such as somersaults/vaults • Free weights/pulleys/resistance bands enables replicating specific moves needed e.g. vault • Stronger tendons and ligaments means less likely to sustain an injury • Increased bone density may reduce injury risk • Strength/Muscular endurance e.g. pommel horse to be able to keep going longer • Increased eccentric strength, e.g. improve landing from tumbles, dismounts, etc. • Increased ATP PC stores to delay fatigue • Increased muscular stability/core strength to maintain balance	Need to describe. Do not reward flexibility/ coordination as weight training would not be the chosen method of training to improve this.	

	• Increased 2X fibres for explosive movements • Increased grip strength for rings/bars		(4)
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Question Number	Indicative Content	Mark
Q21	AO1 = 4 marks, AO3 = 4 marks All answers should be linked to how an athlete would use interval training for an outfield player in games of their choice. Reward acceptable answers. Responses may include, but are not limited to the following. An examination that gives all sides of the issue and any implications, including details about interval training, that includes the following indicative Ao1 content: Explanation of interval training - high intensity anaerobic power work with an aerobic recovery period. Explanation that interval training would improve power. Can be used to improve VO2 Max Interval training is intervals of work and rest. This could include high intensity or low intensity if appropriately justified. AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation. This would need to be linked to specific sports outfield players for AO3 marks. For example, Adaption of the work to rest ratio linked to the position with examples Answers should be sports specific perhaps linked to skills Used to aid in sprinting past players/dodging in attack or being able to get back down field with speed to help defend. AO3 marks can also discuss the appropriateness of this training - that it will need to form part of a varied training regime and that other training methods should also be utilised e.g. continuous to be able to last the 80/90 mins depending on the activity. Fartlek may be better due to the varied speeds needed in outfield. It may include recovery, high intensity needs longer to recover and may lead to more injuries. Specificity where training linked to player/sport The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the	

	bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it.	(8)
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Level	Mark	Level descriptor
0	0	• No rewardable content
1	1 - 2	• Some accurate and relevant knowledge (AO1). • Simple or generalised statements supported by limited evidence (AO1). • Limited balancing of ideas against each other (AO3). • Limited evaluative statement (AO3).
2	3 - 5	• A good level of accurate and relevant knowledge (AO1). • A line of reasoning is presented and supported by some evidence (AO1). • Examines a wide range of ideas, balancing ideas against each other (AO3). • An evaluative statement which is relevant (AO3).
3	6 - 8	• A high level of accurate and relevant knowledge (AO1). • Articulates a clear viewpoint with clarity and precision which is well substantiated (AO1). • Critically examines a wide range of issues balancing ideas against each other (AO3). • Clear evaluative statement which is thorough and focussed (AO3).

Question Number	Indicative Content	Mark
Q22	AO1 = 4 marks, AO3 = 4 marks All answers should be linked to how a swimmer uses fluid mechanics. Reward acceptable answers. Responses may include, but are not limited to the following: An examination that gives all sides of the issue and any implications, including details about fluid mechanics. The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation. Swimmers use their knowledge of fluid forces For example, how technique might be modified and stroke technique to maximise pull against water and limit friction/drag – to maintain laminar flow. Stroke action adapted to maximise forces. The body rubbing against water particles slows it down - what can the athlete do e.g. swim wear to limit drag/cap/goggles Athlete would do analysis of technique and use underwater cameras to analyse where drag is slowing them down. Athlete would work on turn technique to maximise propulsion. Also start propulsion from push off blocks/dive/wall to gain thrust, More drag in water because denser – comparison of more drag in water to air Consideration of buoyancy forces and mass of the swimmer. Technique/stroke action - reduce front cross section area (FXSA), keep body flat/legs high, dolphin-kick/swim under water. Reduce turbulence - remove body hair/swimwear (e.g. Speedo LZR - compression, buoyancy, lightweight and water-resistant). Streamlined body shape and position to reduce friction. Swimming in a pool not open water reduces current. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it.	(8)

Level	Mark	Level descriptor
0	0	• No rewardable content
1	1 - 2	• Some accurate and relevant knowledge (AO1). • Simple or generalised statements supported by limited evidence (AO1). • Limited balancing of ideas against each other (AO3). • Limited evaluative statement (AO3).
2	3 - 5	• A good level of accurate and relevant knowledge (AO1). • A line of reasoning is presented and supported by some evidence (AO1). • Examines a wide range of ideas, balancing ideas against each other (AO3). • An evaluative statement which is relevant (AO3).
3	6 - 8	• A high level of accurate and relevant knowledge (AO1). • Articulates a clear viewpoint with clarity and precision which is well substantiated (AO1). • Critically examines a wide range of issues balancing ideas against each other (AO3). • Clear evaluative statement which is thorough and focussed (AO3).

Question Number	Indicative Content	Mark
Q23	AO1 = 4 marks, AO3 = 4 marks All answers should be linked to flight path and bounce. Reward acceptable answers. Responses may include, but are not limited to the following. An examination that gives all sides of the issue and any implications, including details, that includes the following indicative Ao1 content: • When an object spins, the air molecules in contact with it spin with it. • Air molecules collide with the airflow on one side of the object. • This causes a decrease in velocity and a higher pressure on one side of the ball. • The pressure difference causes a Magnus effect. • Backspin vs sidespin • Magnus effect is heightened with a new ball in tennis because the fuzz of the ball traps a larger boundary layer of air causing a greater pressure differential. • The higher the air pressure is/the more air is inside a ball, the better it can rebound and the less it deforms on impact. This means that less energy is lost, so there is more spring in the bounce. This all means that the hardness or softness of the ball has an impact. • The ball's shape changes when it hits the ground due to pressure inside the balls. This means balls with less pressure dent more on impact so have less energy to be pushed back up. • Surface textures can affect bounce: a harder surface means less energy is absorbed, so the ball will bounce back well; whereas a soft surface absorbs more energy, so the ball does not bounce as well. Texture, such as dimples on a golf ball, or the surface making contact (a racket club) are part of this effect. • A ball will bounce higher if it is warmer because the gas molecules inside will expand. This higher pressure leads to an increased bounce of the ball, while a lower pressure leads to a lower bounce. • Texture of surface (e.g. clay, hard court or grass). • Comparison of ball movement. • The weight of the ball can affect its flight path. • Depending on your angle of attack, this will impact the trajectory.	

	• Speed of release of the ball. • Air resistance. • Rate of spin. • Identification of different flight and bounce patterns e.g. top spin/side spin/back spin The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation. • For example, squash players will warm up the ball before matches. Tennis balls will lose pressure over time so new balls are called for every 7 games and 9 after. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it.	(8)
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Level	Mark	Level descriptor
0	0	• No rewardable content
1	1 - 2	• Some accurate and relevant knowledge (AO1). • Simple or generalised statements supported by limited evidence (AO1). • Limited balancing of ideas against each other (AO3). • Limited evaluative statement (AO3).
2	3 - 5	• A good level of accurate and relevant knowledge (AO1). • A line of reasoning is presented and supported by some evidence (AO1). • Examines a wide range of ideas, balancing ideas against each other (AO3). • An evaluative statement which is relevant (AO3).
3	6 - 8	• A high level of accurate and relevant knowledge (AO1). • Articulates a clear viewpoint with clarity and precision which is well substantiated (AO1). • Critically examines a wide range of issues balancing ideas against each other (AO3). • Clear evaluative statement which is thorough and focussed (AO3).

Question Number	Indicative Content	Mark
Q24	AO2 = 5 marks, AO3 = 10 marks Reward acceptable answers. Responses may include but are not limited to the following. An evaluation that gives all sides of the issue and any implications, including details about the role that technology plays in athletes preparing for their events, that includes the following indicative content: <u>Performance Analysis Data</u> such as: - Forces - Heart rates, training thresholds, recovery rates, training zones - GPS tracking - Blood monitoring e.g. lactate levels - Fitness test results data e.g. weightlifting maxes, sprint timing - Times/distance/speed/velocity/displacement - Competition statistics e.g. tackles made/passes made/shots - Calorie expenditure v intake <u>Evaluative Comments:</u> -how accessible are these technologies to different athletes - Reliability of software could be an issue e.g. GPS, accelerometers, HR, or timing issues, calibration of equipment - Over reliance from athletes can take the 'going with the flow' and flair away. - Measurement error in data collection - Cost of technology could be prohibitive - Knowledge of how to use equipment - Maintenance of the equipment - Stats don't always tell you best team players/leaders - Reliability of the data - Quantitative data v qualitative data - Readiness of individual e.g. motivation/mood can affect scores, prior experience in doing the test - Fitting of the equipment e.g. HR monitor - Performance stats e.g. FIFA data analysis (fifatrainingcentre.com) - Experience in interpreting the data to be able to effect change <u>References to the coaches</u> and their selection of correct and useful data Coaches may use data to: set training programs, assistance	

	selection, injury management, tactical selections, match tactics substitutions AO3 marks will be rewarded by justification or exemplification of a point using analysis or evaluation The indicative content is a guide to the responses candidate may give. Other valid responses which answer the question correctly can be credited as appropriate. The candidate's response must be read in conjunction with the level descriptor below in order to give the appropriate mark. For example, a response that is firmly in the level would receive the middle mark in the level, a response that is just into the level would receive the bottom mark in the level, a response which nearly reaches the next level would receive the top mark in the level preceding it	(15)
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Level	Mark	Level descriptor
0	0	No rewardable content
1	1-3	- There are limited links between theory and practice. Limited technical language supports isolated elements of knowledge and understanding (AO2). - Limited analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). - Analysis is not used to make a judgement (AO3).
2	4-6	- Makes few links between theory and practice. Basic technical language supports some elements of knowledge and understanding (AO2). - Attempts some analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). - Analysis may not be used to make a clear judgement (AO3).
3	7-9	- Makes some links between theory and practice. Some appropriate technical language supports a good knowledge and understanding (AO2). - Good analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). - Uses analysis to make a judgement but without full substantiation (AO3).

4	10-12	• Makes strong links between theory and practice. Appropriate technical language supports a very good knowledge and understanding (AO2). • Comprehensive analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). • Uses analysis to make a clear judgement and supports this with examples (AO3).
5	13-15	• Makes many insightful and significant links between theory and practice. Appropriate technical language supports a significant level of knowledge and understanding (AO2). • Sophisticated analysis of the factors that underpin performance and involvement in physical activity and sport (AO3). • Uses analysis to make a fully informed judgement and supports this with examples (AO3).