



PHYSICAL EDUCATION STUDIES

ATAR course examination 2024

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Multiple-choice**20% (20 Marks)**

Question	Answer
1	d
2	a
3	a
4	b
5	c
6	a
7	c
8	d
9	d
10	b
11	b
12	b
13	c
14	d
15	c
16	a
17	a
18	d
19	b
20	c

Section Two: Short answer**50% (69 Marks)****Question 21****(10 marks)**

- (a) Identify and outline the **three** types of connective tissue found in skeletal muscle. (6 marks)

Description	Marks
For each type of connective tissue (3 x 2 marks)	
Identifies a type of connective tissue found in skeletal muscle	1
Outlines the type of connective tissue found in skeletal muscle	1
Total	6
Answers could include:	
<ul style="list-style-type: none"> • epimysium: connective tissue surrounding the whole muscle (creating tension on the bone to generate movement) • perimysium: connective tissue surrounding each fascicle • endomysium: connective tissue surrounding each muscle fibre. 	

- (b) Name and explain the predominant muscle fibre type that would be most beneficial to a basketball player. (4 marks)

Description	Marks
Name	
Type IIa	1
Subtotal	1
Explanation	
Type IIa muscle fibres allow for endurance and power/aerobic and anaerobic	1
power allows the basketball player to jump	1
endurance allows the basketball player to run up and down the court	1
Subtotal	3
Total	4
Accept other relevant answers.	

Question 22**(5 marks)**

- (a) With reference to the force–velocity relationship, describe a benefit of Meg slowing down the concentric phase of the squat. (2 marks)

Description	Marks
Describes a benefit of Meg slowing down the concentric phase of the squat	2
States a benefit of Meg slowing down the concentric phase of the squat	1
Total	2
Answers could include:	
<ul style="list-style-type: none"> • by slowing down the concentric phase of the squat Meg creates more time for the cross bridges • producing greater force because the force a muscle can produce is dependent upon the velocity at which the contraction occurs. 	
Accept other relevant answers.	

- (b) In the space provided below, draw and label a diagram that represents the relationship between the velocity of muscle contraction and force produced. (3 marks)

Description	Marks
Labels X axis correctly	1
Labels Y axis correctly	1
Draws line shape correctly	1
Total	3
Answers could include:	

Question 23**(13 marks)**

- (a) Identify the phase of competition that is represented during meso cycle 1 in the training program above. (1 mark)

Description	Marks
pre-season (preparation)	1
Total	1

- (b) Describe the process of periodisation and state **one** reason why a periodised training program is appropriate for the rugby players. (3 marks)

Description	Marks
Description	
Describes the process of periodisation	2
Makes a statement about periodisation	1
Subtotal	2
Reason	
States why a periodised training program is appropriate for the rugby players	1
Subtotal	1
Total	3

Answers could include:

Description:

- periodisation is a process of dividing an annual training plan (macrocycle) into a series of manageable phases (mesocycles).

Reasons – to:

- avoid overtraining
- optimise performance and ‘peaking’
- minimise injuries
- promote motivation amongst individuals/team
- plan for adequate rest/recovery
- ensure the principle of progressive overload can be suitably applied.

Accept other relevant answers.

Question 23 (continued)

- (c) Following meso cycle 2, one player decides to increase their training load in terms of volume and intensity. Explain why this would not be recommended at this stage of the season. (3 marks)

Description	Marks
Explains why an increase in training load would not be recommended at this stage of the season	3
Describes the training load for this stage of the season	2
Makes a statement about the training load	1
Total	3
Answers could include:	
<ul style="list-style-type: none"> • this is the competition phase • the principle of maintenance, not to overload or overtrain, should be applied in this phase, to allow for recovery/tapering • the player would likely suffer from fatigue, causing a decrease in performance and a higher chance of injury/overtraining. 	
Accept other relevant answers.	

- (d) Apart from poor recovery strategies, suggest **two** reasons why overtraining may occur and name **two** psychological and **two** physiological symptoms of overtraining that these rugby players need to be aware of during the 8-week program. (6 marks)

Description	Marks
Overtraining – any two of <ul style="list-style-type: none"> • too high frequency • too long duration • too high intensity • poor application of progressive overload • lack of variety in training methods • insufficient time following injury • too many practice games 	1–2
Subtotal	2
Psychological symptoms – any two of <ul style="list-style-type: none"> • mood swings • irritability • increase in anxiety • depression • loss of motivation • loss of focus/concentration • decreased self-confidence 	1–2
Subtotal	2
Physiological symptoms – any two of <ul style="list-style-type: none"> • lack of energy • continual muscle soreness • changes in appetite/weight gain/loss • injury prone • prolonged/excessive fatigue • elevated heart rate at rest and during exercise • menstrual cycle disturbances • low immune health • insomnia/sleep-loss 	1–2
Subtotal	2
Total	6
Accept other relevant answers.	

Question 24

(6 marks)

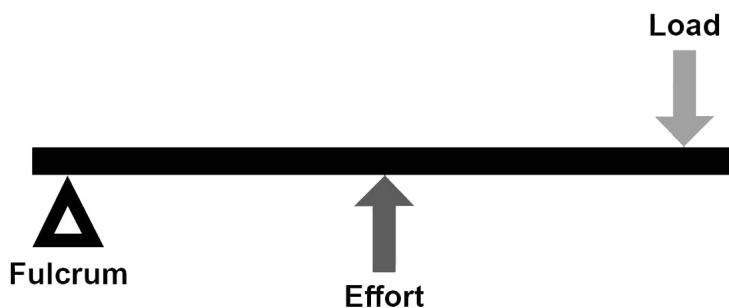
- (a) Identify the class of lever used to move the lower legs from Figure 1 to Figure 2, shown above. (1 mark)

Description	Marks
third class	1
Total	1

- (b) Draw and label a diagram in the space below that shows the lever system above. (3 marks)

Description	Marks
Labels the fulcrum correctly	1
Labels the load correctly	1
Labels the effort correctly	1
Total	3

Answers could include:



Accept other relevant answers.

- (c) Outline **two** ways the 'all or none' law applies to the athlete performing the lying leg curls, if they were to increase the weight lifted. (2 marks)

Description	Marks
For each (2 x 1 mark)	
Outlines a way the 'all or none' law applies to the athlete performing the lying leg curls, if they were to increase the weight lifted	1
Total	2

Answers could include:

- increase the size of the stimulus/frequency
- an increased number of motor units
- an increase in the of size of motor units
- the recruitment of the type of muscle fibre/Type II.

Accept other relevant answers.

Question 25**(10 marks)**

- (a) Identify and define the type of drag that is reduced by Madison de Rozario leaning forward in her wheelchair. (2 marks)

Description	Marks
form/pressure drag	1
the resistance created by a pressure difference between the front and rear of an object moving through fluid	1
Total	2

- (b) Discuss how the design of the wheelchair reduces drag. (4 marks)

Description	Marks
Discusses how the design of the wheelchair reduces drag	4
Explains the design of the wheelchair in relation to drag	3
Describes the design of the wheelchair in relation to drag	2
Makes a statement about the design of the wheelchair	1
Total	4

Answers could include:

Wheelchair has a smooth surface:

- this reduces the friction between the surface of the chair and the air
- reducing the turbulent flow, which restricts forward movement/creates surface drag
- by ensuring the airflow around the chair is smooth (laminar flow) this allows the chair to achieve greater speeds with less effort.

Wheelchair has a streamlined shape:

- this reduces the frontal area/cross sectional area
- this allows the airflow to pass by, decreasing the pressure differential between the front and back of the chair as it moves
- the later boundary layer of separation causes a smaller pressure difference between the front and the back, thus reducing form drag.

Accept other relevant answers.

- (c) Name and explain the biomechanical principle behind the third smaller wheel. (4 marks)

Description	Marks
Name	
balance	1
Subtotal	1
Explanation	
increasing the base of support	1
• allows the line of centre of gravity (COG) to be well within the base of support (BOS)	1
OR	
• which allows de Rozario to lean forward more, lowering her COG	
makes it harder for the COG to go outside the BOS making it more stable and easier to manoeuvre to enhance performance	1
Subtotal	3
Total	4
Accept other relevant answers.	

Question 26**(6 marks)**

- (a) Describe **two** nutritional requirements a cross-country runner would need to consider on the morning of a race due to start at noon. (4 marks)

Description	Marks
For each nutritional requirement (2 x 2 marks)	
Describes a nutritional requirement a cross country runner would need to consider on the morning of a race due to start at noon	2
States a nutritional requirement of a cross country runner	1
Total	4
Answers could include:	
<ul style="list-style-type: none"> • easily digestible foods, low in fibre and fat – prevents stomach discomfort • carbohydrates – primary energy source for the event • a low GI meal prior to the race – leads to the slow release of glucose into the blood stream for sustained energy over the course of the event • a high GI snack 15–30 minutes prior to the race – quickly releases glucose into the blood stream to energise the runner at the start of the event • hyperhydration (800 mL–1 L of fluid) – delays dehydration. 	
Accept other relevant answers.	

- (b) Outline **two** advantages of consuming sports drinks. (2 marks)

Description	Marks
Advantages – any two of	
Sports drinks contain:	
<ul style="list-style-type: none"> • carbohydrates to assist with glycogen sparing to maintain energy • sodium and electrolytes to assist in maintaining hydration levels • potassium to maintain electrolyte balance and aid in muscle contraction during exercise • water to maintain fluid levels. 	1–2
Total	2
Accept other relevant answers.	

Question 27**(19 marks)**

- (a) Name and define the training activity that the coach would have used during the drill and describe how it would have been implemented in this situation. (4 marks)

Description	Marks
Name	
shaping	1
	Subtotal
	1
Definition	
learning a simplified or incomplete version of the skill and adding the missing parts as the skill is developed	1
	Subtotal
	1
Description	
Describes the training activity that the coach used in this situation	2
Outlines the training activity	1
	Subtotal
	2
	Total
	4
Answers could include:	
<ul style="list-style-type: none"> • the coach provides feedback/corrects the players • missing components are added to the technique • speed/accuracy is increased • skill is used in game/competition-style situations. 	
Accept other relevant answers.	

- (b) Name the most appropriate leadership style for this coach to use and explain **two** reasons why this would be the most suitable style. (7 marks)

Description	Marks
Name	
authoritarian/autocratic	1
Subtotal	1
For each reason (2 x 3 marks)	
Explains why the leadership style would be the most suitable	3
Describes a reason for the leadership style	2
States a reason for the leadership style	1
Subtotal	6
Total	7
Answers could include:	
Junior players	
<ul style="list-style-type: none"> are generally not knowledgeable of all the skills/game play tactics, so the coach needs to upskill them so that they can execute skills correctly/play the game properly, because the coach is responsible for all decisions are generally not able to self-correct, so the coach needs to provide all the feedback to help players improve and since it is important that they hear the feedback an authoritarian style works best require structure and boundaries/may be undisciplined or misbehave, which limits learning and performance outcomes, therefore they require a highly organised coach, which suits this style of leadership require more boundaries to increase their safety and decrease the chance of injury and maintain their wellbeing, so a disciplinarian is required, which is typical of this leadership style may lack intrinsic motivation, so may have to rely upon the coach for external/extrinsic motivation, which suits this style of leadership. 	
Accept other relevant answers.	

- (c) Name and outline Steps One to Four of the Knudson and Morrison model that an under-8's soccer team coach could use to improve the players' performance. (8 marks)

Description	Marks
For each step (4 x 2 marks)	
Names the step	1
Outlines the step	1
Total	8
Answers could include:	
<ul style="list-style-type: none"> Step One: preparation – develops a good understanding and knowledge of the skills and their teaching points Step Two: observation – the gathering of appropriate information about the performance of the skill Step Three: evaluation – identify errors/strengths/weaknesses and prioritise areas of improvement Step Four: intervention – provide feedback and drills to help improve his players' performance. 	
Accept other relevant answers.	

Section Three: Extended answer

30% (40 Marks)

Question 28

(20 marks)

- (a) Describe **three** physiological adaptations that Joshua Cheptegei would benefit from by training at a higher altitude. Explain **two** reasons why he would be able to train at a higher intensity closer to sea level. (12 marks)

Description	Marks
For each physiological adaptation (3 x 2 marks)	
Describes a physiological adaptation that Cheptegei would benefit from by training at a higher altitude	2
States a physiological adaptation that Cheptegei would benefit from by training at a higher altitude	1
Subtotal	6
For each reason (2 x 3 marks)	
Explains why Cheptegei would be able to train at a higher intensity closer to sea level	3
Describes Cheptegei's ability to train at a higher intensity closer to sea level	2
Makes a statement about training at a higher intensity closer to sea level	1
Subtotal	6
Total	12

Answers could include:

Physiological adaptations:

- increase in number of red blood cells (erythrocytes)/haematocrit – more oxygen can be carried to the working muscles and organs for better aerobic performance
- increase in number of mitochondria/mitochondrial density – increases the rate of energy production
- increase in myoglobin – increases the amount of oxygen stored in the muscles which improve aerobic performance
- increase in aerobic enzymes in the muscles – increases ATP/energy production
- increase in capillarisation – increases the distribution of blood/oxygen to the working muscles
- increase in haemoglobin – increased ability to carry oxygen to the working muscles for increased aerobic performance.

Reasons:

Availability of oxygen

- at sea level, the concentration of oxygen in the air is higher compared to high-altitude environments
- this means that during exercise, athletes can take in more oxygen per breath, leading to better oxygen delivery to the muscles
- increased oxygen availability enhances aerobic energy production, which is crucial for sustaining high-intensity exercise and facilitating faster recovery between bouts of activity.

Increased aerobic capacity

- athletes can maintain a higher aerobic capacity (VO_2 max) during exercise at sea level than at altitude
- aerobic capacity refers to the body's ability to use oxygen to produce energy. Enhanced aerobic capacity allows athletes to perform at higher intensities for longer durations before fatigue sets in
- this results in quicker recovery times between training sessions and allows athletes to push themselves harder during workouts.

Optimal temperature/humidity

- environments closer to sea-level typically provide an optimal temperature and humidity level compared to high-altitude in that the conditions are more moderate
- moderate environmental conditions help athletes regulate their body temperature more effectively during exercise, preventing excessive overheating or dehydration
- this allows for higher-intensity sessions and quicker recovery post-exercise.

Increased gaseous exchange

- at sea level, due to the partial pressure, the diffusion of oxygen into the circulatory system is increased
- this means that during exercise, leading to better oxygen delivery to muscles
- increased oxygen availability enhances aerobic energy production, which is crucial for sustaining high-intensity exercise and facilitating faster recovery between bouts of activity.

Accept other relevant answers.

Question 28 (continued)

- (b) Identify the major fuel source used for energy production by Joshua Cheptegei, including the role that the glycaemic index (GI) has, and justify the type of GI foods he may consume during and immediately post-performance, to ensure adequate energy is available and recovery maximised. (8 marks)

Description	Marks
Major fuel source	
carbohydrates	1
	Subtotal
	1
Role of glycaemic index (GI)	
GI ranks carbohydrates according to their effect on blood glucose (0-100) – carbohydrates are ranked high, medium or low GI	1
	Subtotal
	1
Justification	
During:	
<ul style="list-style-type: none"> • high GI foods • break down quickly during digestion, releasing glucose rapidly into the bloodstream • assists with glycogen sparing, prolonging energy for longer 	1–3
Post:	
<ul style="list-style-type: none"> • high GI foods • muscles are more responsive to topping up fuel supplies immediately after exercise • enable the start of the recovery process 	1–3
	Subtotal
	6
	Total
	8
Accept other relevant answers.	

Question 29

(20 marks)

- (a) Describe how each of the **four** main components of the neuromuscular system would be involved in the process described above. (8 marks)

Description	Marks
For each main component of the neuromuscular system (4 x 2 marks)	
Describes how the component is involved in the process	2
Outlines how the component is involved in the process	1
Total	8
Answers could include:	
<ul style="list-style-type: none"> • the brain receives the incoming information from the sensory neurons and processes it. Selects the appropriate response (steer left/right/brake etc). Sends out a signal to the central nervous system to initiate movement • spinal cord receives the signal from the brain and passes it onto the appropriate motor neurons required to be activated for Verstappen to respond • motor neurons receive the signal from the spinal cord, passing it to the muscle fibres. It travels down the axon to innervate the muscle fibres which are required for Verstappen to steer/brake/accelerate etc. • the motor unit receives the signal, then the muscle fibres contract, creating the desired movement for Verstappen (steer left/right/brake/accelerate). 	
Accept other relevant answers.	

Question 29 (continued)

- (b) List **four** physiological effects of competing at extreme heat and describe the process of heat acclimatisation that Max Verstappen could have implemented in the weeks prior to arriving in Qatar. Identify **three** physiological adaptations that result from acclimatisation and outline the benefit of each. (12 marks)

Description	Marks
For each physiological effect (4 x 1 mark)	
Lists a physiological effect of competing at extreme heat	1
Subtotal	4
Description	
use of artificial sources of heat e.g. saunas, climate chambers, sweat clothing	1
45–60 minutes daily for 8–9 days gradually increasing exercise intensity/living and training in the heat	1
Subtotal	2
For each physiological adaptation (3 x 2 marks)	
Identifies a physiological adaptation that results from acclimatisation	1
Outlines a benefit	1
Subtotal	6
Total	12
Answers could include:	
<p>Physiological effects:</p> <ul style="list-style-type: none"> • rapid dehydration/increased viscosity/increase in sweating/decrease in blood plasma • peripheral vasodilation/increased skin temperature • faster rate of fatigue • elevated heart rate/cardiac drift • increase in ventilation • decrease in stroke volume • decrease in cardiac output • higher core body temperature • double heat load. 	
<p>Physiological adaptations with benefits:</p> <ul style="list-style-type: none"> • earlier onset of sweating – allows for the cooling mechanism to happen earlier • increase sweat rate – to increase cooling mechanism via evaporation • dilution of sweat – to retain salts for normal body function • increase in blood plasma volume – increases time to dehydration/increases sweating • lower heart rate – more efficient at cooling the body • lower core body temperature – reduces the need to send blood to the skin for cooling (more blood sent to working muscles). 	
Accept other relevant answers.	

Question 30

(20 marks)

- (a) Define 'segmental interaction' and analyse how Glenn Maxwell could have applied this concept during his innings to generate maximum velocity on the ball after he hit it.
(12 marks)

Description	Marks
Definition	
the transfer of momentum across the joints of the body	1
the optimal timing of the limbs being moved	1
Subtotal	2
Analysis	
use many body segments – Maxwell would step with his legs, rotate his hips, upper body shoulders arms and wrist	1–2
use the body segment with the greatest mass first – Maxwell would start using his legs first in the movement	1–2
sequentially accelerate each body part to optimise transfer of momentum from one body part to the next – Maxwell would time his movements, so that the momentum transferred is greatest for each body part	1–2
have a stable base of support to allow for optimal transfer of momentum between body parts – Maxwell would step to plant his feet on the ground to have a solid base of support	1–2
use a follow-through to prevent deceleration of the final body segment – Maxwell would continue swinging after he has hit the ball	1–2
Subtotal	10
Total	12
Accept other relevant answers.	

- (b) Describe **four** strategies Glenn Maxwell could have used when batting to manage his concentration, motivation and stress levels.
(8 marks)

Description	Marks
For each strategy (4 x 2 marks)	
Describes a strategy Maxwell could have used when batting to manage concentration, motivation and stress levels	2
States a strategy to manage concentration/motivation/stress levels	1
Total	8
Answers could include:	
<ul style="list-style-type: none"> • self-talk: he could say a positive statement to himself prior to playing a shot, e.g. 'follow through on hit' that will remove distraction/keep focus on cues • relaxation: he could perform an activity such as controlled breathing to reduce stress/tension/decrease heart rate/relax muscles and mind, prior to playing a shot • performance routines: he could perform a ritual/sequence of actions before each shot to ensure a sense of calm and help his mind to refocus • imagery: he could visualise/mentally rehearse hitting the ball off the sweet spot of the bat to maintain focus • goal-setting: he could set a short-term goal at the start of each over, such as attempt to strike the ball each time it is bowled. 	
Accept other relevant answers.	

Question 31**(20 marks)**

- (a) Analyse the biomechanical principle the strikers would have used to kick a curve ball from left to right to avoid the goalkeeper and make the shot. (8 marks)

Description	Marks
player creates sidespin on the ball applying eccentric/off-centre force	1
on the left side of the ball	1
the boundary layer of air then collides with the oncoming air causing low velocity	1
this creates an area of high pressure	1
on the right side of the ball the boundary layer of air will be moving with the oncoming air causing high velocity	1
this creates an area of low pressure	1
this causes the ball to move from high to low pressure (pressure differential)	1
this movement is called the Magnus force/effect	1
Total	8

- (b) Define 'social cohesion' and 'task cohesion' and describe the **five** strategies the Matildas' coach, Tony Gustavsson, could have used to ensure a high level of group cohesion within the team in the lead up to and during the World Cup. (12 marks)

Description	Marks
Definitions	
Social cohesion: the interpersonal connection between members of a team that allows them to interact positively	1
Task cohesion: the degree to which members of a team work together to achieve success/common goal	1
Subtotal	2
For each strategy (5 x 2 marks)	
Describes a strategy the Matildas' coach could have used to ensure a high level of group cohesion	2
States a strategy to ensure group cohesion	1
Subtotal	10
Total	12
Answers could include:	
Leadership:	
<ul style="list-style-type: none"> • Gustavsson could have ensured that he used a leadership style that best suited the needs of his players OR • Gustavsson could put in place a team captain and leadership group that the players' respected. 	
Communication:	
<ul style="list-style-type: none"> • Gustavsson could be clear and concise in his communication with the players so that they have clarity regarding the team goals, i.e. social/task cohesion. 	
Goal setting (team and individual):	
<ul style="list-style-type: none"> • Gustavsson could put a set of team goals in place for the Matildas to aim for and individual goals for each player. 	
Team building:	
<ul style="list-style-type: none"> • Gustavsson could make the players take part in team building activities as well as social activities for the players to build respect/rapport/trust/confidence in each other. 	
Roles and expectations:	
<ul style="list-style-type: none"> • Gustavsson could allocate and clearly outline roles for each player and their responsibilities to ensure team success. 	
Accept other relevant answers.	

ACKNOWLEDGEMENTS

Question 23(b) Dot point 1 adapted from: TREK. (n.d.). *Periodisation*. Retrieved August, 2024, from <https://exercise.trekeducation.org/principles/periodisation/>

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