



PHYSICAL EDUCATION STUDIES

ATAR course examination 2023

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

Section Two: Short answer

50% (63 Marks)

Question 21

(8 marks)

Complete the table below by filling in the unshaded boxes, to show the characteristics of fast and slow twitch fibres.

Characteristic of fibre	Description			Marks
	Type I	Type IIa	Type IIb	
Colour of fibre	red			1
Muscle fibre size			large	1
Force production		high		1
Resistance to fatigue			low	1
Mitochondrial density		medium/intermediate		1
Capillary density	high			1
Contraction speed		moderate-fast/fast		1
Activity type			short term anaerobic/ specific activity to match	1
Total				8

Question 22

(6 marks)

- (a) On the graph below, draw the outcome of a vertical jump for an athlete jumping as high as possible, from bending their knees to landing on the ground. (1 mark)

Description	Marks
	1
Total	1

- (b) (i) Name and define the biomechanical principle that is represented by this graph. (2 marks)

Description	Marks
Name	
impulse/force-time	1
Subtotal	1
Definition – any of one	
<ul style="list-style-type: none"> • change in momentum • application of force over time 	1
Subtotal	1
Total	2

- (ii) Explain how the biomechanical principle named in part (b)(i) is beneficial in preventing injury to athletes landing after a vertical jump. (3 marks)

Description	Marks
bending knees	1
force is applied over a longer period of time	1
reduces peak force	1
Total	3
Answers could include: <ul style="list-style-type: none"> • bending knees: the body absorbs force by transferring it to the lower leg muscles by bending the knees • force is applied over a longer period of time: by bending the knees against the downward force the time the force can be dissipated over is increased • reduces peak force. Accept other relevant answers.	

Question 23

(10 marks)

- (a) Define 'coefficient of restitution' and justify how this experiment relates to this principle. (3 marks)

Description	Marks
Definition – any one of	
<ul style="list-style-type: none"> comparison of velocity after impact to the velocity before the collision the measure of the elasticity of an object after a collision measure of conservation of momentum/energy remains in a collision a number which indicates how much kinetic energy remains after the collision of two objects 	1
Subtotal	1
Justification – any one of	
<ul style="list-style-type: none"> this links to the experiment as the transfer of energy between a ball and bats of different materials (1) is being tested, attempting to find which bat will transfer more velocity to the ball (1) due to measuring how far the ball will go, the higher the COR of the bat, the greater the energy it will transfer to the ball (1) and, as such, the ball will travel further (1) or due to measuring how far the ball will go, the lower the COR of the bat, the lower the energy will transfer to the bat (1) and, as such, the ball won't travel as far (1) 	1–2
Subtotal	2
Total	3
Accept other relevant answers.	

- (b) Identify **one** factor that can affect the coefficient of restitution and state how it would influence the results of this experiment. (2 marks)

Description	Marks
Any one of	
<ul style="list-style-type: none"> material of the bat (1) – the type of material that the bat is made of will affect the distance of the ball, i.e. the metal bat would have the highest coefficient of restitution (COR) and the ball will be hit the furthest (1) temperature of the bat (1) – warmer bats have higher COR so will likely make the ball travel further due to less energy lost in the transfer (1) 	1–2
Total	2
Accept other relevant answers.	

Question 23 (continued)

- (c) Explain why it was important, for the validity of the experiment, for the students to make sure that the force of the bat applied to the ball was kept the same each time. Your answer should refer to Newton's Second Law of Motion. (3 marks)

Description	Marks
Newton's Second Law of Motion states that the acceleration of an object is directly proportional to the force applied to it and indirectly proportional to its mass	1
as such for hitting balls with consistent mass, the greater the force of the swing, the further the ball will travel due to its greater acceleration	1
with varied force of swing, the students won't be able to know if the differences in flight are due to changes (in COR or acceleration due to the swing force applied)	1
Total	3
Accept other relevant answers.	

- (d) If one of the sport science students was to hit the ball off the tee and then have the ball pitched to them by the machine, name and outline what effect this would have on their transfer of learning. (2 marks)

Description	Marks
positive effect	1
the student has the knowledge of the batting action, as this stays the same, which will enhance their success in learning to hit a moving ball	1
Total	2
Accept other relevant answers.	

Question 24

(9 marks)

Outline **two** advantages and **one** disadvantage associated with each of these methods of analysis.

(a) Peer feedback (3 marks)

Description	Marks
Advantages – any two of	
<ul style="list-style-type: none"> athlete may relate better to their peer providing the feedback than their coach athlete does not feel judged when feedback is coming from a peer improve overall communication which could benefit relationship between athlete and coach/team improve psychology/wellbeing of athlete as they are able to express themselves more openly with their peer mentor increase social interactions between players providing the mentorship increase the capacity of the peer mentor, e.g. self-efficiency, conflict resolutions skills, leadership skills, greater connection to athlete/team 	1–2
Subtotal	2
Disadvantage – any one of	
<ul style="list-style-type: none"> peer may not have the appropriate knowledge to provide the feedback peer may not express what they actually see so as to not hurt the athlete's feelings athlete may ignore the feedback given as they might feel they know more peer may not have the capacity or confidence to provide the feedback 	1
Subtotal	1
Total	3
Accept other relevant answers.	

(b) Checklists (3 marks)

Description	Marks
Advantages – any two of	
<ul style="list-style-type: none"> as a written form of feedback, it can be filed and kept/referred to provides key aspects of the ideal performance/technique required able to arrange information into strengths and weaknesses for the athlete provide athlete time to go through the feedback at own pace and plan for improvements athlete can complete a checklist themselves coach/person filling in the checklist doesn't have to rely on their memory as they can write down what they see when they see it athlete and coach can use information together and plan for improvement can be used in conjunction with video analysis to enhance feedback 	1–2
Subtotal	2
Disadvantage – any one of	
<ul style="list-style-type: none"> checklist may be too simple in design and not provide enough feedback/comments on technique/athlete it may be lost or misplaced it may be time consuming to complete coach/person filling in the checklist may miss aspects of the performance while filling in the checklist 	1
Subtotal	1
Total	3
Accept other relevant answers.	

Question 24 (continued)

(c) Video

(3 marks)

Description	Marks
Advantage – any two of	
<ul style="list-style-type: none"> • can be stored for future use by athlete and track progress • can be compared against an exemplar • can be reviewed multiple times by coach/athlete • athlete can re-watch it immediately and make adjustments • can zoom in, pause or slow down to detect errors or focus on something in particular • multiple athletes can be filmed at once • can be used in conjunction with a checklist to enhance feedback • can be useful for athletes that are visual learners • can aid in injury prevention/management 	1–2
Subtotal	2
Disadvantage – any one of	
<ul style="list-style-type: none"> • can restrict seeing athlete as a whole, if videoed from one angle • it could be quite costly to purchase the video and analysis programs/apps • if no sound, could be difficult to recall what was said • may have limited storage capacity/quality of focus is poor 	1
Subtotal	1
Total	3
Accept other relevant answers.	

Question 25

(12 marks)

- (a) In relation to the contraction of Nedd's muscles during his run, outline **six** phases of the sliding filament theory. (6 marks)

Description	Marks
Any six of	
<ul style="list-style-type: none"> • motor neuron stimulates muscle fibre with impulse • calcium is released into the sarcomere (calcium released from the sarcoplasmic reticulum) • presence of calcium allows myosin to attach to actin (myosin reaches out to actin binding sites) or calcium causes actin to reveal binding site for myosin head to connect or calcium binds to troponin and moves the tropomyosin to reveal a binding site for myosin head to connect • myosin attaches to actin filaments creating a cross bridge • breakdown of ATP releases energy to stimulate cross bridges • myosin/cross bridges pull with a power stroke (oscillates) causing actin to slide over myosin • muscle/sarcomere shortens/H zone and I band decreases as actin filaments move closer together • ATP releases energy causing myosin to detach from actin and cross-bridge is broken or myosin detaches from actin and cross-bridge is broken or calcium leaves the sarcomere preventing further cross bridges forming or sarcomere/muscle fibre relaxes due to neural impulse ending 	1–6
Total	6
Accept other relevant answers.	

- (b) Excluding nutritional considerations, outline **two** physiological strategies that Nedd could have implemented to prevent injuries and aid in his recovery. (2 marks)

Description	Marks
Any two of	
<ul style="list-style-type: none"> • static or dynamic stretching before or after the days' run • heat pack before run to aid in blood circulation to muscles, so they are ready for the run • cryotherapy/ice pack before or after run to restrict blood flow to reduce inflammation • massage to reduce muscle tension, increase blood flow and remove waste products • recovery clothing, e.g. compression pants which aid in reducing inflammation and increase blood flow to muscle to remove waste products in order to prevent venous pooling • adequate sleep and rest each day • active recovery/cool down – active or passive to increase blood flow in muscles and remove waste products 	1–2
Total	2
Accept other relevant answers.	

Question 25 (continued)

- (c) Using the information below, identify which nutritional plan would benefit Nedd the most in meeting his requirements for this event. Justify your choice. (4 marks)

Description	Marks
plan 2	1
Subtotal	1
Justification – any three of	
<ul style="list-style-type: none"> • plan 2 has the highest percentage of carbohydrates as these are needed as the main source of nutrients as these provide the body with energy • plan 2 has a total fuel source of 85% (carbohydrates + fats) • fats are the body’s second main source of fuel at rest and during prolonged submaximal exercise and plan 2 has a higher fat intake • since Nedd is running an endurance event, fats are important to aid in glycogen sparing and plan 2 has a higher fat intake • there’s no need for a high protein intake as endurance event means less muscle tears and plan 2 has a lower protein intake • the protein intake is too high in plan 1 as it doesn’t allow enough room for an appropriate intake of carbohydrates and fats 	1–3
Subtotal	3
Total	4
Accept other relevant answers.	

Question 26

(6 marks)

- (a) Identify the most likely style of leadership suggested by this interaction between Zoe and her coaches. (1 mark)

Description	Marks
democratic	1
Total	1

- (b) Outline **five** benefits to Zoe of this style of leadership. (5 marks)

Description	Marks
Any five of	
<ul style="list-style-type: none"> • allows Zoe to have input in the conversation/decision-making (making her feel valued/validated/respected/heard)/allows Zoe to express her thoughts on how she is playing (feedback)/issues she is having • reduced/less pressure from coaches; allows for consulting style/joint decision making • empowerment/ownership; allows Zoe to make her own decisions (rather than being told what to do)/involved in the decision-making process • can increase her motivation; allows Zoe to be involved in the establishment of goals/involved in the decision-making process • can increase her confidence; allows Zoe and her coaches to discuss positives in her game • improves team cohesion/allows Zoe to feel part of a team • shared responsibilities; Zoe and her coaches are all invested in the outcome • can increase level of trust; allows Zoe to express her issues or ideas without fear of ridicule 	1–5
Total	5
Accept other relevant answers.	

Question 27

(12 marks)

(a) Personal

(3 marks)

Description	Marks
Considerations – any two of	
<ul style="list-style-type: none"> individual characteristics of the players, i.e. motives for playing, sense of ownership aspirations for being part of the AFLW through recognition of representing region in WAFLW self-motivation, affiliation or task motivation (related to playing for their region, satisfaction of being a part of a team) individual differences i.e. abilities to play certain positions to fulfil roles and responsibilities 	1–2
Subtotal	2
Strategy – any one of	
<ul style="list-style-type: none"> coaches could review training structures or camps, divide into smaller groups so they get to know each other more, improving social cohesion increase task motivation by focusing on the professional requirements of being part of a WAFLW team coach engages with players and discusses self-motivation to see if they can reignite the motivation/passion 	1
Subtotal	1
Total	3
Accept other relevant answers.	

(b) Environmental

(3 marks)

Description	Marks
Considerations – any two of	
<ul style="list-style-type: none"> the players' eligibility to represent their region the selection process, i.e. best in the state for their region players pride in representing their region and playing WAFLW factors binding them together, e.g. age range, location of where they all come from group size of a WAFLW team is quite large they all sign a contract which states expectations 	1–2
Subtotal	2
Strategy – any one of	
<ul style="list-style-type: none"> increase opportunities for social interactions (team training camps and social events) split trainings more evenly in metro and country venues change the contract obligations to ensure fairness 	1
Subtotal	1
Total	3
Accept other relevant answers.	

(c) Leadership

(3 marks)

Description	Marks
Considerations – any two of	
<ul style="list-style-type: none"> style of leadership used by coaching staff and captains meets the needs of the players the coach and player relationship or coach and team relationship is valued and respected by players the coaching staff have a high level of communication skills to engage with players 	1–2
Subtotal	2
Strategy – any one of	
<ul style="list-style-type: none"> coaching staff/captains adapt their style depending on the situation allow players an opportunity to discuss their concerns through open and transparent communication build on relationships with players by developing trust organise coaching staff and leadership group to have access to leadership courses or mentors to improve their leadership 	1
Subtotal	1
Total	3
Accept other relevant answers.	

(d) Team

(3 marks)

Description	Marks
Considerations – any two of	
<ul style="list-style-type: none"> desire for team success (goals or aims) expected behaviours of players (norms or standards) stability of players being part of the team for a period of time the goals and visions shared by all team's sense of identity team's past experiences 	1–2
Subtotal	2
Strategy – any one of	
<ul style="list-style-type: none"> coaches to ensure players place team goals before individual ones review goals with the players, have their input and set short/long term goals that they revisit regularly coaching staff get players to work together to complement each other's strengths ensure all players understand their role and responsibilities, team tactics and strategies 	1
Subtotal	1
Total	3
Accept other relevant answers.	

Section Three: Extended answer

30% (30 Marks)

Question 28

(15 marks)

Describe **four** reasons why a dimpled golf ball travels further than a smooth ball and analyse how the fluid mechanics behind a golf ball can create a left to right curve in flight.

Description	Marks
smooth golf ball has laminar flow moving over it (1) dimpled golf ball has turbulent flow moving over it (1)	1–2
laminar flow has an early boundary layer separation (1) turbulent flow sticks to ball for longer causing later boundary layer separation (1)	1–2
early boundary layer separation causes greater low pressure behind ball (1) later boundary layer separation causes smaller low pressure behind ball (1)	1–2
increased pressure/form drag created due to greater low pressure behind ball (1) smaller low pressure behind ball decreases pressure/form drag (smaller pressure differential) (1)	1–2
Subtotal	8
Analysis	
identifies Magnus Effect (as cause of ball moving left to right in flight)	1
golfer applies an eccentric force to left side of the ball to cause ball to spin	1
left side of spinning ball has low velocity due to boundary layer hitting oncoming air	1
low velocity causes a high-pressure system to be formed on left side of ball	1
right side of spinning ball has high velocity due to boundary layer moving in same direction as oncoming air	1
high velocity causes a low-pressure system to be formed on right side of ball	1
lift/magnus force is created from air moving from area of high pressure to area of low pressure (left to right)	1
Subtotal	7
Total	15
Accept other relevant answers.	

Question 29

(15 marks)

Explain how a marathon runner's performance can be improved through their training program, in relation to the following **five** aspects:

- specific energy system requirements
- tapering
- peaking
- periodisation
- avoiding overtraining.

Description	Marks
Specific energy system requirements	
runner needs to train the aerobic energy system as a marathon event is longer in duration and requires oxygen	1
Any one of: <ul style="list-style-type: none"> • short recovery time between sets is an important feature of interval training for marathon runners (1). The short recovery ensures the body uses aerobic pathways for energy production (as short recovery does not allow for anaerobic fuel sources to be stored) (1) • long distances are an important feature of continuous/fartlek training for marathon runners (1). The continuous nature ensures the body uses aerobic pathways for energy production (due to exhaustion of anaerobic fuel sources) (1) • large repetitions of medium/long interval sessions allows for more time spent at higher intensities (1); the higher intensity results in greater improvements in the runner's maximum aerobic capacity and works more muscle fibres overall compared to longer, slower jogs (1) 	1–2
Subtotal	3
Tapering	
runners need to ensure they are reducing volume and increasing or maintaining intensities to maximise performance	1
Any two of: <ul style="list-style-type: none"> • it allows for recovery at appropriate times during the program when events occur, to optimise performance (1) • ideally, they would want to taper 4 to 28 days (depending on event) prior to any major event (1) • it leads to athletes peaking with their bodies in optimal condition to perform (1) • to ensure they have adequate glycogen stores (1) • each runner should individualise the program to suit their needs (1) 	1–2
Subtotal	3
Peaking	
enabling the body to be in an optimal performance state or 'in the zone', with runner ready to perform from a psychological, physiological, technical and tactical perspective	1
Any two of: <ul style="list-style-type: none"> • ensure peaking is completed in line with the runner's major event/competition (1) • used in conjunction with tapering (1) • used in conjunction with recovery periods/blocks to reduce risk of injuries/overuse (1) • each runner should individualise the program to suit their needs (1) 	1–2
Subtotal	3

Question 29 (continued)

Periodisation – any three of	
<ul style="list-style-type: none"> organising their program into periods assists in preventing overtraining and allows for peaking to occur for the runner i.e. macro/micro cycles, pre-season, in-season or off-season (1) explains the objectives for pre-season, i.e. increase aerobic conditioning to prepare for the physical demands of the season (1) explains the objectives in-season, i.e. runners to perform at their optimal best for competitions/events (1) explains the objectives off-season, i.e. to rest from the demands of the season and manage any injuries (1) explains the objectives of macro or micro cycles with examples (1) 	1–3
Subtotal	3
Overtraining – any three of	
<ul style="list-style-type: none"> runner will want to avoid exercising too much so that it exceeds their recovery period/capacity, which no longer leads to performance improvement (imbalance between their work and rest) (1) implement progressive overload/periodisation correctly by increasing volume and intensity with appropriate recovery periods to ensure adequate work:rest ratio at the right time (1) runner should have a variety of activities in the training program to avoid loss of interest or staleness, i.e. different methods, such as cross training (1) runners or coaches need to have knowledge of overtraining symptoms to ensure they can immediately make changes and treat appropriately (1) 	1–3
Subtotal	3
Total	15
Accept other relevant answers.	

Question 30

(15 marks)

- (a) Explain the mental skills strategy of goal-setting and describe how Jessica could use this strategy to manage her motivation, arousal and concentration prior to a major event, to try to ensure her success. (9 marks)

Description	Marks
Explanation	
Goal-setting is a process of deciding what one wants to achieve by implementing and following certain steps in order to achieve a goal.	1
Any two of: <ul style="list-style-type: none"> it can be broken down into short- and long-term goals/use of an example of a short- or long-term goal short-term goals are stepping stones to long-term goals use SMART goals/use of an example of a SMART goal a multi-goal approach, including performance, process and outcome goals, can be used to enhance performance and ensure success/use of an example of a multigoal 	1–2
Subtotal	3
Motivation	
Jessica could set short-term goals leading up to her major event. By achieving these short-term goals, her motivation will be improved, keeping her on track to achieve her long-term goal of the Olympics.	1
Jessica needs to ensure that she sets realistic and challenging goals, otherwise if her goals are too hard or easy her motivation might decrease, thus reducing her performance.	1
Subtotal	2
Arousal – any two of	
<ul style="list-style-type: none"> Jessica could set realistic goals during training, to enhance then help maintain an optimal level of arousal, resulting in improved performance to ensure she is at peak mental performance for the event Jessica could set realistic performance goals to optimise her peak arousal state (be 'in the zone') come event day Jessica could try to ensure she is not under or over aroused as this will affect her training and performance if short- or long-term goals are set too hard/easy 	1–2
Subtotal	2
Concentration – any two of	
<ul style="list-style-type: none"> Jessica should set medium/long-term goals that focus on her desired performance outcome, to provide focus for training and preparation for the major event it is effective to use short-term goal setting to break up a larger goal into manageable/achievable parts to keep her focussed Jessica could set a performance goal that by the end of the first lap she will have run her preferred pace and be placed in the front half of the pack ready to launch into the final 400 m to keep her focussed during the race 	1–2
Subtotal	2
Total	9
Accept other relevant answers.	

Question 30 (continued)

- (b) Describe **three** nutritional strategies Jessica should consider following between four hours and 30 minutes before an event. (6 marks)

Description	Marks
<p>Any three of (3 x 2 marks)</p> <ul style="list-style-type: none"> • consume medium – low glycaemic index (GI) carbohydrate foods 2–4 hours prior to race (1) as they release glucose slowly into the blood stream for use during the race (1) • focus on eating carbohydrates (1) as they are the primary fuel source for an event (1) • hyper-hydration/increase fluid intake/maintain hydration/use of hydration strategies (1) as it delays the effects of dehydration or is essential for fuelling the body's natural cooling mechanism (sweat)/ (prevents heatstroke) (1) • avoid high fibre foods (1) as they can cause stomach cramps/upset stomach (1) • avoid high GI foods (1) as they can cause an insulin spike (1) • avoid foods high in fats and proteins (1) as they are not the primary fuel source during exercise (1). 	1–6
Total	6
Accept other relevant answers.	

Question 31

(15 marks)

- (a) Name **three** physiological effects of participating in a high-level sport, such as soccer. For each, outline the effect when participating in extreme heat **and** in extreme cold.

(9 marks)

Description	Marks
For each physiological effect (3 x 3 marks)	
Names the physiological effect	1
Outlines the physiological effect in extreme heat	1
Outlines the physiological effect in extreme cold	1
Total	9
<p>Answers could include:</p> <p>Increased peripheral blood flow:</p> <ul style="list-style-type: none"> in hot conditions blood flow/vasodilation is further increased in cold conditions blood flow/vasodilation is reduced. <p>Increased sweat rate:</p> <ul style="list-style-type: none"> heat causes further increase in sweat rate cold causes reduction in sweat loss. <p>Increased heart rate:</p> <ul style="list-style-type: none"> heat causes further increase in heart rate cold causes little/to no change in heart rate. <p>Increased stroke volume:</p> <ul style="list-style-type: none"> heat causes decreased stroke volume increased stroke volume in cold conditions. <p>Increased VO_2:</p> <ul style="list-style-type: none"> heat causes little to no change in VO_2 increase VO_2 in cold. <p>Increase in blood lactate levels/use of muscle glycogen:</p> <ul style="list-style-type: none"> further increase in blood lactate levels/use of muscle glycogen in heat further increase in blood lactate levels/use of muscle glycogen in cold. <p>Increased blood pressure:</p> <ul style="list-style-type: none"> further increase in blood pressure in heat further increase in blood pressure in cold. <p>Cardiac output increases:</p> <ul style="list-style-type: none"> in heat, the cardiac output initially increases (and then decreases) in cold, little to no change of cardiac output. <p>Increased respiration/ventilation:</p> <ul style="list-style-type: none"> further increase in respiration/ventilation in hot conditions further increase in respiration/ventilation in cold conditions. <p>Skin temperature increases:</p> <ul style="list-style-type: none"> in heat, skin temperature further increases in cold, skin temperature decreases. 	
Accept other relevant answers.	

Question 31 (continued)

- (b) Describe **three** ways that using the stimulant caffeine could work to assist athletes competing at the FIFA World Cup. (6 marks)

Description	Marks
Any three of (3 x 2 marks)	
<ul style="list-style-type: none">• improves alertness/reaction time (1), which increases the ability to respond quickly to what is happening (1)• spare glycogen use (1) through preferential use of free fatty acids (FFAs), leaving more glycogen available for use in muscles (1)• reduces ratings perceived effect (masks fatigue) (1) and, as such, will allow athletes to push themselves at a higher intensity for longer (1)• enhances competitiveness (1), which allows athlete to attack the ball with more pressure (1).	1–6
Total	6
Accept other relevant answers.	

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