PEAK PHYS ED presents

Discovery

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Australian Health, Physical Education and Sport Conference

Melbourne Cricket Ground (MCG) & National Tennis Centre (NTC), Melbourne, Australia

VCE Physical Education Examination Review

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PEAK PHYS ED
Innovation and Excellence in Physical Education

Acknowledgement

The Victorian Curriculum and Assessment Authority proudly acknowledges and pays respect to Victoria's Aboriginal and Torres Strait Islander communities and their rich and enduring cultures.

We acknowledge Aboriginal and Torres Strait Islander people as Australia's first peoples and as the Traditional Owners and custodians of the lands and waters on which we rely. We pay respect to Elders past and present of the lands where we conduct our work and recognise their ongoing contributions as the first educators on the land now known as Victoria.

Overview

- General comments about the Examination Report
- Areas of strength
- Areas of greatest challenge
- Overview of specific questions

Examination Assessment 2025

Applications to assess VCE Examinations are now open (general & lead team)

Pages - Become an External Assessor with the VCAA

Assessors will typically*

- be teaching the study in the current year
- have previous experience teaching the study design
- If in doubt – apply.

Each year we aim for a mixture of

- new and experienced assessors
- Government and non-government sector
- City- and country-based teachers

Assessment overview

- The **external assessment report** provides information relevant to the questions that were included on the 2024 examination paper.
- Reflects student performance relative to peers
- Additional (more detail) data provided to schools through the VCE Data Service
- Follow up with your VCE coordinator regarding school performance – Individual PL; analysis, reflection and goal setting.

Mark guide

- Task is to formulate a set of accepted responses that ensures the full scope of scores are accessible in a question

- Best enables students to obtain the score they are deserved – finalised after looking at extensive sample responses

General

- In 2024 9,901 students sat the PE exam – (a 13% increase since 2022, previous high 9,308 in 2020)
- 11,724 commenced U3 – 84% went on to sit exam – same as 2023
- Overall performance 46.6% lowest for the accredited period, down from 51.5% in 2023

Areas of strength

- Students who ‘do’ benefitted – Warm up & plyometrics
- Stages of learning & link to constraints-based coaching & types of practice
- Arousal strategies* (overlearnt)
- Fitness test understanding

Areas for improvement

- Graph interpretation (What story is being told & data used to tell story)
- Ensuring knowledge is nuanced to the context
- Accuracy of terms from study design
- Energy system interplay
- Critique
- HIIT
- Extended response

Multiple choice overview

- 10.35 average result (10.48 in 2023, 11.05 in 2022)
- Questions 1, 2, 5, 9 and 13 very well answered (over 80% correct)
- Question 10, 12, and 15 lower performance (under 50% correct)

Multiple choice overview

Question 10 (40% - Answer B)

- This graph is a force-velocity graph and therefore this rules out answer D
- Given speed and muscular strength sit at opposite ends of the force-velocity continuum, the correct answer is muscular power.

Question 12 (47% - Answer B)

- Aerobic training program produces aerobic adaptations to reduce oxygen deficit (increased oxygen uptake quicker)
- Reduced reliance on the anaerobic systems at the start of submaximal exercise.

Multiple choice overview

Question 15 (48% - Answer D)

- Angular momentum is conserved when manipulating a body position during a dive.

Question 1a

1a.

Identify the main fitness component targeted at the following stations

- Squat jumps – muscular power
- Abdominal crunches – muscular endurance

Question 1b

Outline how the inclusion of the 15 m repeat sprints in the circuit training session addresses the principle of specificity for a netball goal-keeper.

(2 marks)

Students were expected to:

- Show their understanding of specificity and provide a specific example of how it is important for a netball goal keeper's performance.

The 15m sprint mimics the movement patterns of a goal keeper when they are sprinting out of the goal circle to intercept the ball.

Question 1c

State two advantages of any athlete undertaking circuit training**.**

(2 marks)

Acceptable answers included:

- Many fitness components can be targeted.
- A variety of muscle groups can be trained.
- All energy systems can be trained.
- Can be highly specific to a sport.
- Variety is good for motivation.
- Easy to run with large groups.

Question 1d

Other than adjusting repetitions, suggest a suitable progression to one of the circuit exercises performed by this player

(1 mark)

Acceptable answers included:

- Add weight to squat jumps/dips/push ups
- Decline crunches
- Increase height of jump
- Increase distance of repeat sprints

Note:

Question specifically asked for one of the exercises, if vague no marks.

This should have been the starting point of the answer

i.e. Squat jumps: Add weight

Question 2

a. Use the information provided to explain the energy system interplay in the beach flags event.

(6 marks)

This question was marked ‘holistically’ using the following criteria

	Expected qualities
High (5-6)	• Clearly identify and discuss the interplay of all three energy systems. • Use data (multiple references) to illustrate when each energy system is the major contributor. • Explain the role of the ATP-CP system in providing immediate energy for the short, explosive sprints to the flags. • Discuss how the Anaerobic Glycolysis system contributes to energy production during repeated sprints as the event progresses and CP depletes. • Explain the role of the Aerobic system during recovery particularly in the longer rest interval before the final sprint, to replenish CP. • Terms such as **rate, yield, and recovery**, are expected to be used
Medium (3-4)	Difference in performance likely to include: • Data not integrated to enhance the response • Likely CP replenishment and impact of longer rest not discussed • Lower end likely to read as rote learned, formulaic response

Sample high level response

The ATP-CP system is the major provider of energy for the initial sprints as they are maximal intensity and short duration (3.6 seconds for the first three races). The ATP-CP has the fastest rate which allows for a rapid resynthesis of ATP. During rest time, the aerobic system restores CP. However, there is insufficient time for all CP to be restored. For example the 53 seconds after the first sprint would not restore all CP as 3 minutes is required for 98% of CP restoration. Therefore, as the sprints progress, there is an increased reliance on the anaerobic glycolysis system (due to CP depletion), which produces energy at a slower rate than the ATP-CP system. This results in slower sprints, such as 3.9 seconds for the 4th race. Between race number 7 and 8 there is significantly more rest time (4.05 seconds) which allows more CP to be restored and therefore available for the next sprint and it is run at the fastest time of 3.5 seconds.

Energy system interplay

Common issues

- Using the term ‘anaerobic systems’ rather than each system
- Referring to the information without specific data references
- Using the terms ‘dominant’ and ‘predominant’ incorrectly

Frequently asked question

Should the terms ‘dominant’ and ‘pre-dominant’ be used to describe energy system contribution?

- Not contained within the study design or the Support Materials.
- Some confusion for students, resulting in incorrect application. Can be used, if they are used correctly
- Students are encouraged to use the terms stated in the study design (including rate, yield, recovery rates) when referring to energy system contribution in an activity based on the intensity, duration and type of activity.
- Terms such as, ‘increased/decreased contribution’, ‘most relied upon’, ‘significant’ and ‘minimal’ can be used in conjunction with data.

Question 2b

b) In the table below provide a suitable example for each phase of an effective warmup that the athletes might complete prior to the beach flag competition.

(2 marks)

Students were expected to:

- Students were required to provide a suitable example for the three phases of a warm-up: general phase, dynamic stretching (with example) and sports specific phase. *They didn't need to label the 3 phases*
- linked the suggested exercises to the movement patterns and muscle groups required in beach flags
  - *5 min jog on the beach*
  - *Dynamic leg swings*
  - *Short maximal sprints along the beach*

Question 2c

c) Outline the characteristics of the muscle contraction sequence involved in a plyometric exercise**.**

(3 marks)

Students were expected to:

- Identify the correct contraction in the correct order
- Show an understanding of the contraction through descriptive characteristics

A rapid/fast eccentric contraction followed by a forceful/quick concentric contraction.

Question 2d & e

d) Describe and/or draw two exercises that could be used in the conditioning phase of a plyometrics training session to develop the explosive start required in beach flags.

(2 marks)

e) State a suitable number of repetitions you would prescribe for the plyometric exercises.

(1 mark)

d) Students were expected to:

Identify a suitable plyometric activity and provide a description or drawing that showed an understanding of how to perform that movement

- Box jumps
- Clap push ups
- Bounding
- Broad jumps

.A clap push up involves the athlete lowering quickly in the down phase then explosively pushing up, launching in the air and clapping while mid flight.

e) The correct answer was a number within the range 3-10

Question 2f

f. What intensity do these exercises need to be completed at?

(1 mark)

Students were expected to:

- Match the type of exercise (plyometrics – maximal intensity/short duration) with an appropriate measurement of intensity

Sample responses included:

- 100%, Maximum effort, Explosive, 9-10RPE

Note:

% HR max, %VO2 max and %RM were not accepted as these measures are not the most appropriate given the nature of the activity

Question 3

a) Identify the stage of learning a participant in the MiniRoos Kick-Off program is likely to be in.

(1 mark)

b) List one individual characteristic the learner may demonstrate at the stage identified in **part a.** and outline how this may impact their learning requirements in a soccer training session.

(2 marks)

a) Cognitive

b) Students were expected to:

Identify one characteristic of a cognitive learner

describe how this influences training requirements **specific to soccer**

- *makes frequent errors which would benefit from blocked practice*
- *unable to detect errors, so coach will need to provide more (augmented) feedback to assist*
- *poor understanding of skill technique & will likely benefit from direct coaching / a focus on blocked practice*

The soccer player will not be ablet to detect errors in their skill so the coach will need to be provide more (augmented) feedback to assist their skill development.

Question 3c

Select one of the constraints below by placing a tick in the box and explain how it can influence motor skill development.

(2 marks)

Students were expected to either:

- Explain that an increased opportunity to touch the ball/perform the skill will increase skill development (smaller pitch)
- Explain that easier skill execution (& more success) will increase motivation and enhance skill development (smaller/lighter ball)

A smaller pitch means players are closer together which increases their opportunity to touch the ball. More frequent touches on the ball increases participation and likely improves their motor skill development.

A smaller lighter ball means it is easier for the child to perform their skills. This increases their likelihood of success and therefore they will be motivated to participate and increase their motor skill development.

Question 3d

Using your understanding of practice distribution, explain why the coach noticed more improvement in skill development from Week 4 to Week 6 **(3 marks)**

Note:

Some students confused practice distribution with ‘frequency’ as a fitness training principle

Some students spoke about distribution of practice in a session and not across the week

Students were expected to:

- Identify the change to distributed practice
- Acknowledging that this means more frequent practice
- Link this to enhanced concentration, motivation, reduced fatigue= enhanced skill development

The coach changed the practice in week 4-6 from massed practice to distributed practice, which resulted in more improvement. Distributed practice means players were participating more frequently. This led to an increased skill development as players had more frequent opportunity to consolidate their technique.

**Practice distribution as a ‘broad term’ required both massed & distributed practice to be referred to.

Question 4a

Discuss the likely changes in fuel contribution to energy production from the first half of the ride to the second half of the ride and how this may have impacted performance.

(4 marks)

Note:

Responses that referred to generic ‘90 minutes’ for glycogen depletion were not mark attracting.

Students were expected to:

- Identify the decrease in carbohydrates (glycogen) stores
- Identify the increase in (fat) triglyceride contribution
- Link the use of fat to reduced rate of ATP resynthesis (greater oxygen cost)
- Reference the decreased performance linked to cycling

During the first half of the race, glycogen would be the major fuel to produce energy. But due to the long duration of the race, glycogen stores begin to deplete, meaning the body increasingly turns to triglyceride to provide energy. Due to triglyceride having a greater oxygen cost and therefore taking longer to break down than glycogen, this change in fuel use results in the cyclist slowing down during the second half of the race.

Question 4b

b. Making specific reference to the graph, explain the relationship between heart rate and power output throughout the lap shown in the graph and how this relationship impacts energy system requirements.

(4 marks)

Students were expected to:

- Outlining the (cause and effect) relationship between power output and heart rate
- Use data to emphasise the relationship
- Connect the relationship with energy system requirements
- Link to cycling performance

As power output increases, heart rate increases. For example, from the 16-19th minute Lucas increases his power output from 300W to 620W and his heart rate responds by increasing from 135bpm to 190bpm. This indicates he increased his intensity as he makes one of the steep climbs or surges to overtake an opponent. The increase in heart rate supplies the working muscles with more oxygen to help increase the amount of aerobic ATP resynthesized as energy demands rise.

Question 4c

i) During this time Lucas is experiencing (circle the best response):

1 mark

ii) Identify **two** responses made by the muscular system to meet the increased power output required during this time.

2 marks

i. Oxygen deficit

ii. Acceptable responses were:

- increased AVO_2 difference
- increased oxygen extraction
- increased enzyme activity
- increased blood flow to working muscle
- increased temperature
- decreased muscle substrate stores
- increased rate of motor units recruited
- increased number of motor units recruited
- increased firing rate of motor units
- increased lactate production

Question 5

a) Identify the speed that Mika was running at when he reached LIP.

(1 mark)

b) Justify your answer to **part a** by referring to the graph.

(2 marks)

a) 14 km/h.

b) Students were expected to:

- Show an understanding of the concept of LIP
- Use data to emphasise this understanding

From speeds 10km/h to 14km/h there is a slow increase of blood lactate, however at 15km/h there is a significant increase from ~4mmol/L to almost 8mmol/L suggesting 14km/h was the final speed when lactate could be removed as fast as it was being produced.

Question 5

c) Referring to the appropriate fatigue mechanism, explain why Mika was unable to complete the final block of the lactate test.

(3 marks)

c) Students were expected to:

Identify accumulation of metabolic by-products

Show an understanding of this fatigue mechanism

Link to the impact on performance

At 17km/h there was an increase in intensity and the aerobic system could no longer remove by-products as fast as they were being produced. Metabolic by-products (H+ ions) accumulated which slowed down muscle contraction and reduced force production. This would force Mika to fatigue, resulting in him being unable to complete the final three-minute block.

Question 5

d) Giving specific examples from the table, critique the effectiveness of Mika's training program to improve his LIP.

(4 marks)

Note

For the purposes of VCE PE, HIIT is an aerobic training method.

Students were expected to:

- Identify the program is effective/mostly effective
- Identify a positive aspect, referring to data
  - Frequency (must state why – not just 'met)
  - Duration (sessions: continuous, fartlek & reps: HIIT)
  - Intensity (Fartlek & HIIT)
- Identify a negative aspect & suggest an improvement
  - Short/intermediate interval replaced with aerobic session
  - Intensity should be in the aerobic training zone (70-85% max HR)
  - Appropriate progression of 10% to be applied

Sample response – Q5d

This program would be somewhat effective in improving Mika's LIP. A strength of this program is the Fartlek session, which includes periods of work at 85% of max HR. As this is at the top end of the aerobic training zone it will help improve LIP. A weakness of the program is the intensity of the continuous session on Sunday (65% max HR) is below the aerobic training zone. This should be increased to 80% max HR.

Question 6

a)

Other than the VO_{2max} test, identify the name of a fitness test that might be used to assess aerobic power.

(1 mark)

a) NOTE: Correct fitness test titles only accepted

- Cooper 12-minute run test
- 2.4 km run test
- 20m multi-stage fitness test or 20m shuttle run test
- Yo-YO intermittent recovery test
- Harvard step-test
- Rockport 1.6km walk test

Question 6

b)

With reference to the data from the table above, explain why elite athletes have a higher cardiac output and how this will impact their running performance.

(4 marks)

b) Students were expected to:

Provide an understanding of cardiac output (equation)

Provide SV data (as the difference in higher cardiac output)

Link to greater aerobic ATP production

Link to performance

Elite distance runners have a higher cardiac output (Q) than university students due to their increased stroke volume (187ml/ beat compared to 128ml/beat for university students) as Q=HR x SV. This means elite runners can deliver more oxygenated blood to working muscles, which increases the rate of aerobic ATP production. Therefore, elite runners can run at a faster pace aerobically.

Question 7

a) Other than mental rehearsal, recommend a psychological strategy Kaylee could use to assist her with her concentration for each day's racing and outline how this will be of benefit her.

(**2 marks)**

Note

- Mental imagery was not accepted
- Many linked skill to arousal instead of concentration

a) Students were expected to:

Identify a psychological strategy that enhances concentration.
Possible answers included:

quality and quantity of sleep

set routine

Positive self talk or cue words

meditation

breath control

PMR

Justify how this strategy will benefit Kaylee

Kaylee could use controlled breathing and focus on taking slow deep breaths, enabling her to eliminate any external distractions and enhance her concentration.

Frequently asked question

The intended scope of knowledge contained within the psychological skills (confidence, motivation, optimal arousal and concentration) remains the same, as do appropriate strategies to improve these skills.

Examples of theoretical concepts that remain in scope when teaching the psychological skills and their aligned strategies are; Nideffers Attention Model (concentration), Inverted ‘U’ theory (optimal arousal), intrinsic and extrinsic motivators (motivation).

Question 7

b) Following her 200m backstroke semi-final in 2023, in which her time was 2:03.14 (mins:secs), suggest the likely recovery strategy Kaylee would have completed in preparation for the final the following night? **(1 mark)**

c) Describe the recovery strategy suggested in **part b** and justify why this type of recovery is the most suitable?

(4 marks)

b) Active recovery

c**) Students were expected to:**

- Outline of strategy (specific to swimming)
- Physiological description of strategy
- Benefit of this strategy ('justify' - over passive)
- Link to fastest rate of recovery / return to pre exercise condition

Kaylee would undertake a lower intensity swim following her 200 m backstroke semifinal. This active recovery maintains heart rate and therefore blood flow to the muscles, which results in a faster rate of metabolic by-product removal. This allows Kaylee to return to pre-exercise conditions fastest.

Question 7

d) i) Explain how **one** type of physiological data could be used to assist with monitoring her performance and recovery during this training program.

(2 marks)

d) Students were expected to:

- Provide a piece of suitable physiological data
  - Effort level (RPE) during training
  - Heart rate responses (resting, exercise and recovery)
  - Muscle soreness during rest and training
  - Sleep patterns (quality and quantity)
  - Nutritional information such as type/amount of food
  - Body weight
  - Illness and/or injury
- Explain how this data would inform performance/recovery monitoring

A low resting heart rate would suggest that her body is recovering effectively from her previous training sessions, informing Kaylee she can maintain/increase her training volume/intensity.

Question 7e

Identify **one** chronic muscular adaptation that would occur as a result of this effective training program and explain how this would enhance Kaylee's performance in the 200m backstroke event.

(3 marks)

Note:

Many students referred to an anaerobic adaptation. Not specific to the question, given stimulus presented an aerobic program

Students were expected to:

- Identify one muscular adaptation
  - Increased size and number of mitochondria
  - Increased myoglobin stores
  - Increases in the muscular storage of glycogen/triglycerides,
  - Increase in oxidative enzymes
  - Increase in glycolytic enzymes
  - Increased oxygen extraction (a-VO2 difference)
- Show an understanding of the adaptation (increased rate of aerobic ATP)
- Link the adaptation to the performance benefit

Kaylee would experience an increase in stores of oxidative enzymes as a result of training. This means fuel can be broken down more rapidly, which increases the rate of aerobic ATP production. As a result, Kaylee would be able to swim at a faster pace aerobically.

Question 8

a)

Define agility. **(1 mark)**

b)

Identify **one** factor that affects agility and outline how this can impact badminton performance **(2 marks)**

a) The ability to change direction quickly while maintaining balance.

b) Students were expected to:

- Identify one correct factor (i.e. age, sex/gender*, range of motion at joints, fibre type):
- Link the correct factor to badminton

Having a large percentage of fast twitch fibres will increase the athlete's ability to change direction quickly to reach a shuttle on the other side of the court.

Note

- Students must use a factor other than one of those used in the definition (i.e. speed and balance not appropriate).
- As of 2025, gender will no longer be accepted as a factor. The acceptable term linked to the difference in hormones (& other physiological characteristics) - sex.

Question 8

c) Use the information above to select the most suitable test to use prior to developing a training program for badminton. Justify the selection from a physiological perspective by referring to the badminton data

(4 marks)

d) Outline **two** ways the test administrator could increase reliability of the test chosen in **part c.**

(2 marks)

c) Students were expected to:

- Identify semo agility test as most suitable
- Justify suitability of the test (replicates the movement patterns of badminton)
- Provide data that emphasises the above
- Provide a link to Illinois test as being unsuitable, as per the skill of justify (one over the other).

The Semo Agility Test involves side stepping, running backwards and forwards. This test best replicates the movement patterns of badminton as shown by the frequency of movement, 30 sideways, 26 forwards and 12 backwards movements, making it more specific than the Illinois Agility Test, which is limited to just running forwards.

d) Suitable answers included

- the weather conditions are controlled or run indoors
- same time of the day
- same nutritional status
- same clothing /footwear worn

Question 8e

Describe a process the test administrator should undertake before athletes attempt the agility test.

2 marks

Students were expected to:

- Identify either a PARQ or informed consent
- Describe the process

*New clients should complete a **PAR-Q or health screen** to ensure there are no risk factors and the athlete is physically capable of participating.*

*They should have **informed consent** explained so they are aware of the benefits of the tests, risks associated with the test and understanding of test methodology, with an allowance to withdraw at any time. Confidentiality of test results would also be explained.*

Note: Some students identified both processes but didn't describe either.

Question 9

a)

Using your understanding of projectile motion describe **one** similarity and **one** difference in performance of the free throws of athletes A and B by referring to the height of release and the angle of release. **3 marks**

Students were expected to:

- Describe a similarity (angle of release, relative to target)
- Describe a difference (height of release)
- Impact the difference in height of release has on angle of release

Both Athlete A and B have a height of release lower than their landing height, which means they both need a high angle of release. However, as Athlete B has a lower height of release than Athlete A, they will require an even high angle of release to project the ball upwards and into the ring.

Note:

- Don't need to refer to specific angles (i.e 45 deg) – qualitative terms 'lower/higher or 'increased/decreased' is recommended
- Speed of release not relevant here (fixed distance & no cue of short or long free throw)

Question 9

b)

Explain how sitting in a wheelchair will impact **two** factors contributing to summation of momentum during the free throw.

(3 marks)

d) **Students were expected to:**

- Provide an understanding of summation of momentum
- Explain the influence sitting in a wheelchair has on two factors influencing summation of momentum
    - Sitting down will mean more force will need to be applied as there are not as many body parts to use to use
    - More difficult to use larger muscle groups e.g. leg muscles
    - Sequential transfer of force
    - Time that force is applied to the ball
    - The base of the chair may not be as stable

Summation of momentum refers to the correct sequencing and timing of body segments to produce force. Sitting in a wheelchair will impact the athlete's ability to produce this force as they are unable to use as many body parts as possible. Additionally, this seated position impacts their capacity to sequence their slower body parts first.

Question 9

c)

Outline the final step the coach needs to take as part of a QMA and explain how this may improve Athlete A's technique.

(3 marks)

d) **Students were expected to:**

- Identify 'error correction'
- Describe the error correction stage
- Connect the error correction stage to improving the free throw

The final stage of a QMA is error correction. Here the coach would give Athlete A feedback on the criteria that needs improving from the evaluation and have them undertake skill and drill practice to correct any errors identified.

Note:

Some students gave several options such as evaluation and error correction, and are reminded that when one answer is required, giving two options will not receive full marks.

Question 10

a)

State the likely training method described above that Jessica includes in her training program and outline one advantage of this method to improve her performance in the 1500m event.

(2 marks)

a) **Students were expected to:**

- Identify HIIT (only accepted answer)

The stimulus provided several signposts for HIIT

- *Active recovery between repetitions*
- *Her aim – increasing maximal aerobic speed, replicating the pace of her event (partially above VO_{2max}.)*

- Provide an advantage of HIIT as a training method
  - Adaptations can be achieved more rapidly
  - Can aid motivation due to shorter session time
  - Specificity in pace/replicating event
  - Improvement in speed/pace for the 1500m event
  - Increases VO2max
  - Increases lactate tolerance

Question 10

b)

Identify the cause of the plateau in VO_2 reached at approximately 700m during this event. **(1 mark)**

c)

Provide **one** reason for your response to **part b**. by referring to the graph. **(1 mark)**

b) VO_{2max} was reached

c) Possible responses included:

- *A VO_2 level of almost 70mL/min/kg is too high to be a submaximal steady state.*
- *VO_2 plateaus but intensity increases, indicating VO_{2max} has been reached.*
- *After the plateau, split times decrease but VO_2 remains stable, indicating VO_{2max} has been reached.*

Question 10d

By referring to the graph, discuss the relationship between intensity, VO_2 and energy system between 1000m and 1500m.

(3 marks)

Students were expected to:

- Use the graph to determine that split time got faster/decreased between 1000m and 1500m (this challenged many students). This is not the first exam which has shown split times.
- Identify that this caused VO_{2max} to be reached
- Link this to an increased contribution from the anaerobic energy systems

Between 1000m and 1500m VO_2 has remained stable at almost 70 mL/kg/min but the split times decrease from approximately 14.3 sec at 100m to 13.7 sec at 1500m. This indicates that even though VO_{2max} has been reached, intensity has increased. This requires an increase in contribution from the anaerobic glycolysis system to accommodate the rise in energy demands.

Question 11

Using the information above., explain why pickleball has gained popularity with older Australians by applying your understanding of the interrelationship between physiological, biomechanical and skill acquisition principles for motor skill development.

Your response should include a discussion of:

• levers

• task constraints

• Newton's second law of linear motion

• fitness components

(8 marks)

Holistically marked supported by criteria.To achieve in the 'High' (6-8) range students are expected to:

- Ideas are well organised and clearly articulated
- Interrelationship between older adults, their fitness component capacity and levers are thoroughly analyzed
- Strong connection to the stimulus in all knowledge areas
- Task constraint of reduced court dimension and paddle comprehensively discussed and linked to other knowledge areas
- Link between Newton's Second Law and the reduced court dimension / paddle mass

Note:

- *Students who structured their response as four different paragraphs(theoretical concepts) likely fell in middle range.*

Pickleball has gained popularity with older Australians due to the task constraints that have been implemented. Both tennis and pickleball require the control of a striking implement which acts as a third-class lever. These levers require great force to overcome the resistance due to the mechanical advantage being less than one. However, the paddle for pickleball is shorter than the tennis racquet (41cm vs. 67cm) which reduces the resistance arm to make it easier to move due to less force required to overcome the resistance. ***This suits older Australians*** *since their muscle mass and therefore their capacity to produce peak force (muscular strength) as well as their ability to produce this explosively (muscular power) is reduced due to their age.* ***Moreover, the concept is reinforced*** *by Newton's 2nd law of linear motion in which a force applied to an object will result in an acceleration that is inversely proportional to its mass and directly proportional to the size of the force (f=ma). A reduction in the mass of the paddle results in the force required by* ***older Australians*** *to decrease to accelerate the paddle and successfully hit the ball. Another fitness component impacted by the change in muscle size and mass as age increases is speed. A task constraint of reducing the court size to 13.41m x 6.1m means that the playing area is smaller and therefore does not require as much speed to cover the court and hit the ball.*

This allows older Australians more opportunity to execute skills successfully which enhances the enjoyment of the game and therefore the likelihood of continued participation and motor skill development.

Comparison

	0 marks	Low range (1-3)	Medium (4-6)	High (7-8)	Average
2018	15%	47%	36%	9%	3.0
2023	11%	47%	39%	3%	3.1
2024	17%	54%	28%	2%	2.5