2015 VCE Physical Education examination report

General comments

The 2015 Physical Education examination provided students with the opportunity to demonstrate knowledge and understanding of the key concepts studied. Students who were able to correctly apply their understanding and knowledge to relevant physical activity, sporting and exercise contexts scored highly. Students who used the stimulus material and/or data provided in the question stem and constructed a response that clearly addressed the requirements of the questions using correct terminology were rewarded. Students who were able to draw on practical experiences were able to articulate the knowledge gained through these activities.

The following information may assist teachers and students in preparation for Section B of the examination.

- Performance enhancement strategies can be physiological, psychological and nutritional in addition to hydration techniques. Students are required to know the difference between these strategies, and ensure they provide a suitable example of the strategy identified in the stem of the question.
- Students' understanding of chronic adaptations to aerobic training that lead to an improved lactate inflection point (LIP) continues to require improvement. Lactate tolerance is **not** associated with an increase in LIP. An increase in LIP results in the body's ability to produce ATP aerobically at higher workloads (intensities). Teachers are reminded to refer to the advice on LIP published on the VCAA website via the Physical Education study page.
- The examinable Physical Activity and Sedentary Behaviour Guidelines are those released in 2014. Teachers should refer to the Notice to Schools issued in February 2015 and the amendment to the *VCE Physical Education Study Design* that accompanied this change.
- All information provided in graphs, diagrams and other stimulus material is relevant. Where a graph is provided, students are encouraged to read titles and axes as this will assist them to be more accurate in their response.
- Energy system interplay was handled well by students in 2015; however, a number of students did not relate their answers to the specific context provided in the question stem and were unable to receive full marks.
- Practical involvement in the measurement of physical activity and data collection (movement patterns, heart rates/intensity charts, skill frequencies, etc.) through an activity analysis is encouraged. This can provide students with appropriate opportunities and examples from which to draw to answer examination questions that relate to each of these methods of collecting data.

Specific information

Note: Student responses reproduced in this report have not been corrected for grammar, spelling or factual information.
This report provides sample answers or an indication of what answers may have included. Unless otherwise stated, these are not intended to be exemplary or complete responses.

The statistics in this report may be subject to rounding resulting in a total more or less than 100 per cent.

Section A – Multiple-choice questions

The table below indicates the percentage of students who chose each option. The correct answer is indicated by shading.

Question	% A	% B	% C	% D	Comments
1	11	6	6	76	
2	57	5	14	23	
3	14	81	2	4	
4	0	92	4	4	
5	6	11	79	4	
6	5	11	82	3	
7	25	10	26	39	VO_2 max. is the maximum amount of oxygen that can be taken up, transported and used by the body and is therefore a product of the cardiac output and arteriovenous oxygen difference (a-vO_2 diff.).
8	2	62	27	9	
9	26	2	4	69	
10	13	3	75	9	
11	58	13	17	12	
12	12	26	8	53	
13	10	84	5	1	
14	25	46	16	13	The table showed characteristics of the fuels used in ATP production. Students should recognise that ‘lipids’ is the correct term for this fuel.
15	46	4	28	22	The majority of students selected option A. Red blood cells increase due to a **low** oxygen environment; hyperbaric chambers have **high** oxygen levels that reduce swelling and fluid retention.

Students answered the multiple-choice section of the examination reasonably well.

Section B

Question 1

Question 1a. was not answered well. Question 1b. was answered well by students, although a common error was to suggest that a 1 repetition maximum test is a test of power. Responses to Question 1c. indicated that many students had not read the question correctly as their responses were about when to stretch rather than how to perform the stretches.

Question 1a.

Marks	0	1	Average
%	63	37	0.4

Informed consent

Question 1b.

Marks	0	1	2	3	4	Average
%	3	7	15	27	48	3.1

Fitness component	Recognised fitness test
flexibility	Any one of: • *sit and reach* • *shoulder and wrist elevation* • *trunk and neck extension* • *shoulder rotation* • *ankle dorsiflexion* • *bend, twist and touch* • *groin flexibility test* • *goniometric measures of joint range of motion*
body composition	body mass index (BMI)
agility	• *Illinois Agility Test* • *5-0-5 agility test* • *VicFit agility test* • *Semo agility test*
muscular strength	1 repetition maximum (RM)

Question 1c.

Marks	0	1	2	3	Average
%	32	30	31	8	1.2

- Static stretching involves slowly stretching the muscle/tendon and holding the position for a period of time (10–30 seconds).
- Ballistic stretching uses the momentum (or bouncing) of a moving body part to produce the stretch.
- Proprioceptive neuromuscular facilitation (PNF) involves a static stretch followed by an isometric contraction or contract and relax sequence.

Question 2

Marks	0	1	2	3	Average
%	31	21	20	28	1.5

- Haemoglobin transports oxygen from the lungs to the rest of the body tissue (and then transports carbon dioxide back from the tissue to the lungs).
- Myoglobin carries oxygen molecules to muscle tissue.
- Mitochondria are the cells in which aerobic respiration occurs, and oxidation of fats, carbohydrates and proteins occurs in these cells to release ATP.

Few students were able to correctly outline the role of haemoglobin, myoglobin and mitochondria in the aerobic production of ATP.

Question 3

Student responses indicated a lack of knowledge of the benefits of activity-based workstations. In part b. students were generally able to provide a suitable workplace initiative that could encourage physical activity or reduce sedentary behaviour. A common error was with policy level initiatives, where students suggested 'making' or 'forcing' employees to participate in physical activity, which is unrealistic.

Question 3a.

Marks	0	1	2	Average
%	36	26	38	1

Activity-based workstations only target the physical environment level. Efforts to change behaviour, including physical activity behaviour, should be based on the understanding of the interrelationship between the four levels of the social-ecological model: individual, social environment, physical environment and policy.

Question 3b.

Marks	0	1	2	3	4	Average
%	7	10	20	28	35	2.8

- Individual level: knowledge, attitudes, behaviours, beliefs; perceived barriers; motivation, enjoyment; skills (including fundamental motor skills and sports-specific skills); abilities; disabilities or injuries; self-efficacy. For example, education programs, cycling information sessions on safe cycling strategies, provide information to employees about the benefits of physical activity via factsheets, education seminars, posters and newsletters; promote the use of stairs instead of lifts or escalators by using posters, flyers, emails; remind employees to get out of their chair and stretch.

- Social environment level: influence of people, society and organisations. For example, commence a walking challenge such as using the 10 000 Steps program, organise and encourage corporate teams for events such as fun runs/walks, organise a corporate rate at the local gym for staff, promoting a culture of activity.
- Physical environment level: built environment and natural environment (walking paths, running tracks, open spaces, equipment, sporting spaces, access to facilities), posters and prompts to participate in activity; provide or organise on-site physical activity classes for employees such as yoga, pilates, swimming (whether free, partially subsidised or user-pays), facilities to enable physical activity such as showers/change rooms and secure storage areas for active transport options.
- Policy level: this refers to legislation, regulatory or policy-making actions that have the potential to affect physical activity. Introducing workplace policies such as flexible work hours or provision of 15 minutes work time to supplement 15 minutes of break time to be physically active.

Question 3c.

Marks	0	1	Average
%	30	70	**0.7**

Assessment is restricted to walking, so a pedometer does not capture physical activity associated with standing desks or sedentary behaviour.

Question 3d.

Marks	0	1	2	Average
%	23	25	52	**1.3**

- Method: accelerometer
  Reason: measures intensity, frequency and duration of physical activity
- Method: direct observation
  Reason: measures physical activity and sedentary behaviour in any context
- Method: self-report
  Reason: records detailed information on physical activity and sedentary behaviour

Question 4

Students performed reasonably well on this question. Common errors were not identifying a health-related component in part a. Part b. referred students to physiological recovery strategies, and those appropriate to the context were awarded marks.

Question 4a.

Marks	0	1	2	3	4	Average
%	13	16	44	10	17	**2**

- Fitness component: flexibility
  Justification: in order to perform the straddle (splits), increased range of motion around the hip is required.
- Fitness component: strength
  Justification: to hold the body up in this straddle position, good upper body muscular strength (maximum amount of force in a maximal contraction) is required.
- Fitness component: body composition
  Justification: Having a good balance of muscle to fat enables the individual to hold themselves on the pommel.

Question 4b.

Marks	0	1	2	Average
%	40	11	49	1.1

- Strategy: cryotherapy, ice bath, icepack
  Description: apply ice directly to the sore muscle with compression after every performance
- Strategy: compression garments
  Description: wear during and after other performances to aid in reducing swelling and decreasing the athlete's perception of pain and other effects
- Strategy: contrast water therapy
  Description: shower or bath from hot to cold to aid vasodilation and vasoconstriction to improve recovery
- Strategy: thermotherapy (heat)
  Description: before the next performance apply heat to an area to aid blood flow to warm the area
- Strategy: massage
  Description: to help recover, prepare and warm the area for performance
- Strategy: sleep
  Description: resting allows the body to recover to optimal level
- Strategy: passive recovery
  Description: by performing a passive recovery the gymnast enhances replenishment of muscle phosphocreatine (PC)

Question 5

Parts a. and d. of this question proved challenging for students. Full marks were awarded to students who demonstrated an understanding of the oxygen requirements at rest, during sub-maximal exercise and in recovery, and how that impacted on ATP production. Many students incorrectly reported that ATP was not required at rest. Many student answers reflected a superficial understanding of being able to work 'harder for longer', but failed to identify that with a higher lactate inflection point (LIP) the athlete is working aerobically at a higher intensity. For full marks, students then needed to relate this to race performance and the given data.

Question 5a.

Marks	0	1	2	3	4	Average
%	20	20	27	21	12	1.9

At rest the body is easily able to take in the required oxygen. As exercise begins, oxygen demand increases and the body is unable to meet this demand. During this period of oxygen deficit, ATP is produced anaerobically. During steady state, the oxygen supply is equal to demand and ATP is produced aerobically. At the completion of the exercise, excess oxygen is taken in to enable the body to return to pre-exercise levels.

Question 5b.

Marks	0	1	2	Average
%	33	27	40	1.1

- VO_2 max test (cycle/rowing/treadmill/ergometer)
- Open-circuit spirometry is used to measure expired oxygen and carbon dioxide (gas analysis).

Students were able to draw the athlete on a treadmill, wearing a face mask and connected to a computer.

Question 5c.

Marks	0	1	Average
%	15	85	0.9

16 km/hr

Question 5d.

Marks	0	1	2	3	Average
%	21	32	32	14	1.4

The athlete is able to continue to produce ATP aerobically at higher intensities due to greater mitochondrial mass, increased oxidative enzymes and the ability to oxidise fats and carbohydrates. A higher LIP will allow the athlete to run at a faster pace (16 km/hr), without accumulating metabolic by-products (exceeding LIP).

Question 6

The most common error was students not differentiating between the psychological and physiological benefits of stimulant use by athletes.

Question 6ai.

Marks	0	1	Average
%	28	72	0.7

Power lifter

Question 6aii.

Marks	0	1	2	Average
%	33	45	22	0.9

Two of:

- increased alertness/mental sharpness
- increased concentration/attention
- decreased perception of fatigue
- increased aggressiveness
- increased competiveness.

Question 6aiii.

Marks	0	1	2	Average
%	26	51	23	1

Two of:

- coordination and balance problems
- heat regulation problems
- heart attack
- increased blood pressure (hypertension)
- gastric upset (nausea)
- tremors
- insomnia
- dependence/addiction
- dizziness.

Question 6b.

Marks	0	1	2	Average
%	53	28	19	0.7

The caffeine may have enabled Serena to respond more quickly to the external stimuli due to improved central nervous system speed to parts of her brain and body. The caffeine may also have had a slight glycogen sparing effect, allowing her to improve her performance and win the match.

Other benefits include:

- improved muscle contractility
- increased time to exhaustion
- reduced fatigue.

Students needed to include an explanation of how the caffeine would benefit performance in tennis; for example, increased power in serve.

Question 6c.

Marks	0	1	2	Average
%	24	62	15	0.9

WADA may want to monitor caffeine use because:

- it enhances performance via increased alertness and glycogen sparing
- it poses a small risk to the health of the athlete through addiction and dehydration
- it goes against the spirit of the sport as it provides an unfair advantage over other athletes
- there is potential to mask other drugs due to its potential use as a diuretic.

Question 7a.

Marks	0	1	Average
%	13	87	0.9

Social environment and/or individual level

Question 7b.

Marks	0	1	2	3	4	Average
%	19	25	31	18	7	**1.7**

'TeamUp' may not address all four components of the social-ecological model and is likely not to be successful unless physical environment and policy factors are addressed. It may be a good prompt to participate in physical activity, but needs to be supported by physical environment and policy level factors.

Student responses needed to consider that:

- there may be good intentions to participate, but unless the community has good cycling access or running access/facilities it may be difficult to change behaviour
- the effectiveness of campaigns to promote physical activity is enhanced when policy level factors are addressed
- the individual level is addressed to some extent as the app is designed to remove some of the perceived barriers to being active (time, cost, transport, etc.).

Question 7c.

Marks	0	1	2	Average
%	34	51	15	**0.8**

Any of the following VicHealth roles were accepted:

- supports health promotion goals for all Victorians
- partners with all levels of government; sports, active travel and recreation agencies; the arts; media; communities; and workplaces to create new opportunities to promote physical activity
- supports research into models of good practice for increasing physical activity behaviour and reducing sedentary behaviour
- its primary focus is on preventing chronic disease at a population level
- funds activity related to the promotion of good health and safety, or the prevention and early detection of disease
- increases awareness of programs for promoting good health in the community through the sponsorship of sports, the arts and popular culture
- encourages healthy lifestyles in the community and supports activities involving participation in healthy pursuits
- funds research and development activities in support of physical activity promotion and sedentary behaviour reduction.

Students struggled to critique the 'TeamUp' initiative. Many students listed components of the social-ecological model and failed to make a judgment based on the extent to which the initiative addressed each level of the social-ecological model.

Question 8

To receive full marks students were required to use information from the question stem to illustrate energy system interplay in this passage of play. Key factors relevant to the provided context included an understanding that PC stores would not fully deplete in a 20 m sprint and leap. The period of rest between the high-intensity efforts would allow for replenishment of PC stores. The run up to goal is not a maximal sprint and would therefore not be anaerobic. In part c., many students did not name the relevant training principle. Students demonstrated a good understanding of the purpose of an active recovery.

Question 8a.

Marks	0	1	2	3	4	5	6	Average
%	6	11	23	27	20	11	2	2.9

For the high-intensity, short duration efforts such as the sprint to the ball and the leap for the mark or kicking the ball, Zach would rely on the ATP-CP system to provide the required ATP as it can provide ATP at a very fast rate.

During the low-intensity periods such as walking back to take his kick and jogging to pick up his opponent, the aerobic system would be supplying most of the ATP as the demand for ATP is low.

Anaerobic glycolysis would contribute to the total ATP demand (all three systems contribute); however, in the period of play described in the question, there were no repeated efforts and the aerobic system would allow the ATP-CP system to replenish sufficiently.

Question 8b.

Marks	0	1	Average
%	38	62	0.6

- video footage (for example, Eye in the Sky)
- direct observation
- time in heart rate (HR) zones (HR monitors)
- visual tracking (apps such as DartFish, etc.)

Question 8c.

Marks	0	1	2	Average
%	39	29	32	1

Specificity: by understanding the major movement patterns in a game of football, training can be more specific and simulate match play.

Question 8di.

Marks	0	1	2	Average
%	39	29	32	1

Because midfielders perform more continuous (aerobic) activities, fitness staff should build in steady state running periods (active recovery). Forwards perform more intermittent efforts. For recovery after high-intensity (anaerobic) efforts, rest recovery is more beneficial.

Question 8dii.

Marks	0	1	2	Average
%	17	46	37	1.2

- enhanced removal of metabolic by-products
- accelerate the removal of blood lactate
- resynthesise ATP and PCr
- resynthesise lactate to glycogen
- prevent venous pooling
- reduced chance of DOMS
- restore oxygen to myoglobin and blood
- thermoregulation of the body

Question 9a.

Marks	0	1	2	Average
%	58	31	11	0.6

The anaerobic energy systems have a finite capacity, so the additional energy required to complete the 1500 m event compared to the 400 m event must come from the aerobic energy system.

Question 9b.

Marks	0	1	2	Average
%	41	26	34	1

The percentage contribution to the 400 m event from the anaerobic systems is greater than in the 1500 m. The rate of ATP produced anaerobically is greater than that produced aerobically, therefore the 400 m event can be completed at a higher average speed.

The finite capacity of the anaerobic energy systems and the implications this has on performance were not well understood by students.

Question 10

Students were rewarded for the use of data in part a. and correct terminology in part b.

Question 10a.

Marks	0	1	2	3	Average
%	13	31	34	21	1.7

Approximately 15 to 20 per cent of total blood flow is directed to muscles at rest, with this increasing to 80 to 85 per cent during maximal intensity exercise. An increase in blood flow to the active muscles and a reduction in blood flow to the organs occurs to meet the greater oxygen and nutrient demands.

Question 10b.

Marks	0	1	2	Average
%	53	8	39	0.9

This redistribution takes place by prompting vasodilation of blood vessels in regions requiring increased delivery of oxygen and nutrients, and vasoconstriction of blood vessels in regions that do not.

Question 11

Students' knowledge and understanding of Australia's Physical Activity Guidelines was very poor. In part a., most students were unable to identify from the information provided how the individual had or had not addressed each of the four guidelines for physical activity. Part b. was answered well by some students; those providing appropriate evidence from the training program received full marks. In part c., students demonstrated a good understanding of the role of the warm-up and cool-down.

Question 11a.

Marks	0	1	2	3	4	Average
%	41	27	21	8	2	1

The program meets the following guidelines from Australia's Physical Activity Guidelines for adults 18–64 years:

- Doing any physical activity is better than doing none. If you currently do no physical activity, start by doing some, and gradually build up to the recommended amount.
- Be active on most, preferably all, days every week.
- Accumulate 150 to 300 minutes (2 ½ to 5 hours) of moderate intensity physical activity or 75 to 150 minutes (1 ¼ to 2 ½ hours) of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous activities, each week.

The program does not meet the following guideline:

- Do muscle strengthening activities on at least 2 days each week.

Question 11b.

Marks	0	1	2	3	4	Average
%	22	7	15	13	44	2.5

Two of:

- Intensity: all sessions were in the aerobic training zone; for example, at 70% HR max.
- Frequency: training was conducted four times a week (Sunday, Tuesday, Wednesday and Friday).
- Duration: training sessions were at least 20–30 minutes long
- Variety: different types of training were used; for example, running, riding and circuit training.
- Specificity: activities are sub-maximal and continuous, which is specific to increasing aerobic fitness.

Question 11c.

Marks	0	1	2	Average
%	8	31	61	1.6

Warm-up:

- allows the body to adjust to the changing physiological demands of the training session
- prepares the athlete psychologically
- reduces oxygen deficit
- improves range of motion of the joints and muscles
- may reduce the risk of injury.

Cool-down:

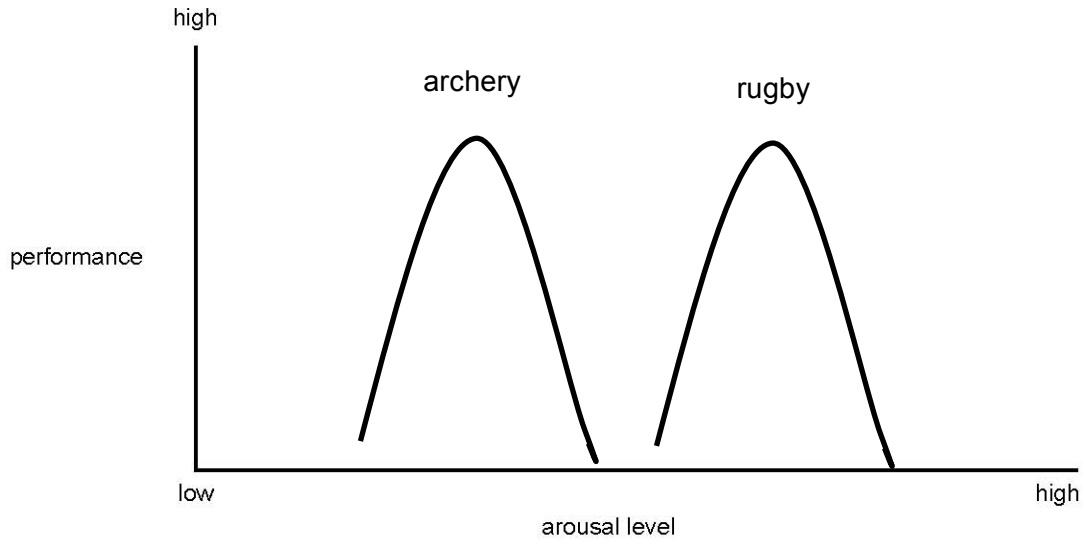
- allows for gradual recovery of heart rate and blood pressure
- returns the body to pre-exercise levels
- allows for the removal of metabolic by-products
- decreases the risk of DOMS.

Question 12

Students needed to read the axes on the graph before providing their response. Many students incorrectly linked arousal level to time and failed to represent the relationship between arousal level and performance in the graphs drawn.

Question 12ai.

Marks	0	1	2	Average
%	35	11	54	1.2



Rugby needed to be shown to the right of archery as a higher arousal level is required and graphs needed to be about the same height.

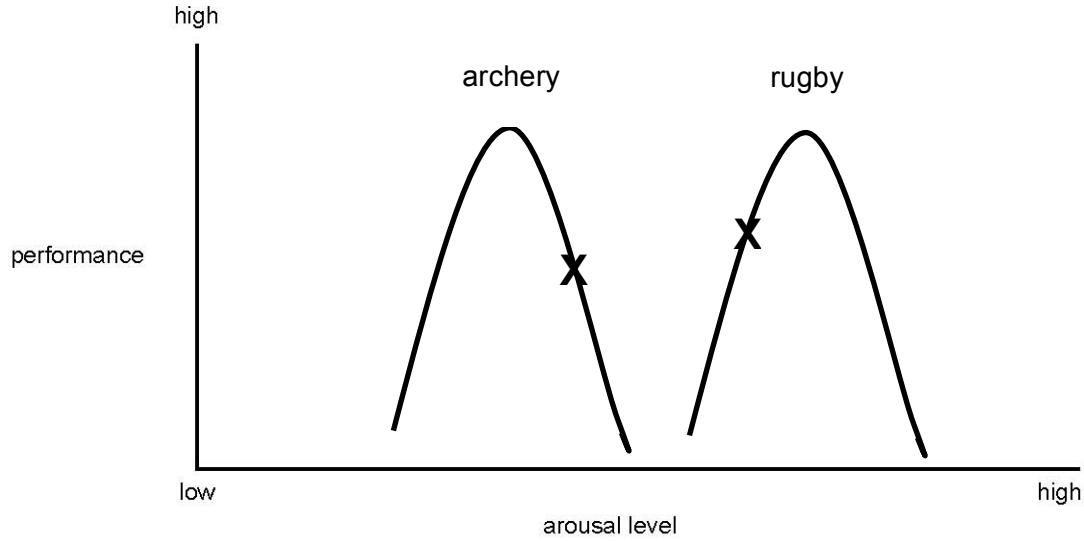
Question 12aii.

Marks	0	1	2	Average
%	31	20	49	1.2

- Archery: lower level of arousal is optimal – for archery you need to be focused and able to control movements.
- Rugby: higher level of arousal is optimal – as a rugby player you want to be aggressive and able to tackle the opposition with force. This means that you want to be at a higher level of arousal at the start of the match.

Question 12bi.

Marks	0	1	2	Average
%	39	12	49	1.1



Question 12bii.

Marks	0	1	2	Average
%	19	28	53	1.4

Archery	Rugby sevens
controlled/centred breathing – slow breathing used to relax, refocus and release tension	*elevated breathing rate – increases the state of awareness*
progressive muscle relaxation – by contracting and relaxing muscles it will calm heart rate and return the player to the optimal level of arousal	act energetically (psych up) – move around and jump, push and bump teammates to increase arousal levels
meditation – sitting quietly helps them to focus their mind on one thing and can be used to help relax the athlete	positive talk and sounds (include upbeat music) – by saying strong words or listening to upbeat music it can increase arousal
biofeedback – using a monitoring tool to collect data on HR or RR and using relaxation strategies to calm them	energising mental imagery – picturing themselves doing energising and uplifting movements
calming mental imagery – picturing themselves in a calm state for their event	pre-competition workout – go through set plays, stretching and getting used to conditions
calming/relaxing music – listening to music that is soft and mellow	

Question 13a.

Marks	0	1	Average
%	64	36	0.4

Simulation

Question 13b.

Marks	0	1	Average
%	65	35	0.4

PC depletion

Question 13c.

Marks	0	1	2	3	Average
%	42	35	17	6	0.9

Fast bowlers are able to bowl faster in the T20 matches as they are able to use their anaerobic systems more than in a test match. As the fast bowler sprints to the wicket, they will use their ATP-PC system predominantly.

In a test match, due to the nature of cricket they do not have the required time (30 seconds for 70%, 3 minutes for 90% and 7–10 minutes for 100% replenishment) to fully replenish the stores of PC.

While in a T20 match, players only need to bowl four overs, and if each ball gives the bowler about 25 seconds of recovery, they should be able to bowl with higher maximum speeds.

Students who performed well on this question evaluated the information provided in their explanation. Many students understood why the T20 bowler could bowl faster but were unable to link this to the physiological mechanisms associated with fatigue and recovery to obtain full marks.

Question 14

Students had difficulty identifying benefits of core strength training. Many incorrectly identified increases in strength, assuming this was different from core strength.

The majority of students answered part b. very well; however, part c. challenged students to think of an alternative exercise that overloaded the same muscle group. In part d. it was evident that some students failed to read the information in the graph (neural adaptation), and few were able to explain how these adaptations occur in the muscle. Chronic adaptations are specific to the system and the training undertaken, and students needed to recognise this in their responses to part e. An understanding of the term ‘hypertrophy’ would benefit students.

Question 14a.

Marks	0	1	2	Average
%	28	61	11	0.9

- greater efficiency of movement
- improved body control
- increased power output
- improved balance and stability

Questions 14b. and 14c.

Question 14b.

Marks	0	1	Average
%	10	90	0.9

Question 14c.

Marks	0	1	Average
%	76	24	0.3

The exercises needed to be different but target the same muscle or muscle group. For example:

14b.

- i. holding a V-sit with hand support on a balance board
- ii. oblique sit-ups on the stability ball
- iii. sit-up holding a medicine ball

14c.

- i. stability ball jackknives
- ii. medicine ball twist
- iii. core climber on stability ball

Question 14d.

Marks	0	1	2	Average
%	69	20	11	0.4

Neural adaptations result in initial increases in strength, which result in:

- greater efficiency in neural recruitment
- increased motor neuron excitability
- increased central nervous system activation
- increased motor unit recruitment
- increased firing rates
- increased twitch summation
- inhibition of Golgi tendon organs.

Question 14e.

Marks	0	1	2	Average
%	60	10	30	0.7

One of:

- increased glycogen stores – more fuel available for ATP production
- increased ATP stores – more energy to break down
- increased CP stores – more fuel available for energy production
- increased enzymes – increased breakdown of fuel
- increased motor unit recruitment – more forceful contractions
- increased speed of contractions – increased speed
- increased strength of tendons and ligaments – increased ability to withstand force, reducing the risk of injury

- increased tolerance to metabolic by-products – ability to perform repeated efforts while fatigued.