2017 VCE Physical Education examination report

General comments

The 2017 Physical Education examination was well handled by a majority of students. Students who were able to use their knowledge and understanding to demonstrate the key skills addressed by the questions and the contexts provided were able to score highly. This was exemplified in Section B, Questions 3 and 12, where students were asked to 'discuss' three reasons or factors. Students who simply listed three responses for each of these questions were not awarded full marks. Furthermore, for questions that required students to 'outline' more than one or two words in response was needed to receive a mark. For example, in Question 10c. students were asked to outline one advantage and one limitation of using a physical activity diary for assessing physical activity and sedentary behaviour. Those students who provided a response in a full sentence that used correct terminology were more likely to receive full marks.

Responding in dot-point format can be useful to provide clear and concise answers; however, when the question asked students to explain, justify or critique, for example, it was difficult for students to achieve full marks with a response in dot-point format. Students are expected to be able to demonstrate their ability to analyse, apply, compare, contrast, critique, describe, design, evaluate, explain, identify, justify and report (key skills) in addition to being familiar with and understanding the key knowledge.

Students who were able to draw on practical experiences were able to articulate the knowledge gained through these activities. This was evident in Question 2 (understanding of plyometrics) and Question 7 (particularly understanding the phosphate recovery test results). Students are encouraged to participate in a variety of practical experiences that include fitness testing and training methods.

Students generally used acceptable scientific abbreviations when appropriate. If students wish to use another abbreviation and are unsure if it is appropriate, then they should define the term in the first instance and use the abbreviation in the remainder of their response. Students are also reminded that symbols, such as arrows, are not acceptable without an indication of what the arrow represents.

A number of students confused fitness components with energy systems (for example, in Question 13a.) and training methods with training principles (for example, in Question 11c.). Differentiating between the aerobic energy system and aerobic power is important when specifically asked for the system providing the ATP as opposed to the fitness component required for an event.

Where data was provided, many students demonstrated skills in reading, interpreting, analysing and evaluating the information and ensuring that the data was incorporated to support their response. Full marks were awarded to students who were able to correctly use the data in their answer. It is important to note that when asked for a chronic adaptation (for example, in Questions 11e. and 14e.), students **must** indicate if there has been an increase or decrease in the component identified. It is not sufficient to say that the adaptation is mitochondria; for example, it must be an increase in mitochondria.

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 errors resulting in a total 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	9	86	3	2	
2	2	33	8	57	
3	53	9	33	5	
4	84	10	3	3	
5	8	67	15	11	
6	2	12	0	86	
7	1	17	74	8	
8	86	6	7	2	
9	28	34	23	15	Both options A and B were accepted as the question could have been answered in relation to all field tests in general or the 20-metre shuttle run test specifically.
10	23	2	4	71	
11	8	76	4	12	
12	9	79	10	3	
13	2	5	86	7	
14	30	6	54	11	
15	4	12	71	13	

Section B

Question 1a.

Marks	0	1	Average
%	10	90	**0.9**

Policy

Question 1b.

Marks	0	1	2	Average
%	49	19	32	**0.9**

It is unlikely that the Guidelines will be effective in changing the behaviour of students.

For a program promoting physical activity and reducing sedentary behaviour to be successful, all four components (policy, individual, social environment and physical environment) of the social-ecological model need to be addressed.

Question 1c.

Marks	0	1	2	Average
%	13	18	70	**1.6**

The student would not meet the Guidelines because a Year 9 student completing 100 minutes per week of physical education and 100 minutes per week of sport would not have a sufficient duration (must be 60 minutes per day) or frequency (5 days per week at school) of physical activity to meet the Guidelines.

Question 1d.

Marks	0	1	2	Average
%	8	31	61	**1.6**

Individual factors

- psychological factors (attitudes, intentions, self-efficacy, preferences)
- behavioural factors (knowledge, skills, habits)
- prompts to activity
- cultural background
- gender

Physical environment factors

- built environment and natural environment (walking paths, running tracks, open spaces, equipment, sporting spaces, access to facilities)

Students responded to this question well. Responses where students referred to the now superseded National Physical Activity Guidelines were not awarded full marks.

Question 2a.

Marks	0	1	Average
%	29	71	**0.7**

Plyometric training

Question 2b.

Marks	0	1	Average
%	43	57	**0.6**

Power

Question 2c.

Marks	0	1	2	Average
%	78	11	11	**0.4**

A forceful rapid stretch (eccentric) immediately before the shortening (concentric) phase of the action

Question 2d.

Marks	0	1	2	Average
%	14	40	46	1.3

- a strength base is required prior to starting a plyometric training program
- ensure that the individual does not have any existing injuries
- ensure appropriate footwear
- appropriate warm-up
- appropriate surface for activity to be performed
- start with lower-intensity exercises, progressing to higher intensity
- rest periods between sets and/or sessions are needed
- caution is needed for children and older adults when using this method of training
- correct techniques must be used to avoid injuries

Many students were able to correctly identify plyometrics as the type of training; however, a common error was to state that balance or flexibility can be developed through this type of training.

Question 3

Marks	0	1	2	3	Average
%	5	22	45	28	2

- Water hydrates effectively.
- Sports drinks may contain electrolytes and/or glycogen to replace those lost during play.
- Sports drinks are more palatable, so may encourage the player to drink more and stay hydrated.
- Water may change the osmolality of the sports drink consumed (dilute to minimise gastric upset), allowing for faster absorption.

Students were required to discuss three reasons why a player may use both water and sports drinks. Students who listed reasons why a player may use either drink were unlikely to be awarded full marks.

The following is an example of a high scoring response.

> *Both water and sports drinks are liquids, thus they are both able to rehydrate athletes by replacing fluids lost through exercise. The sports drink contains carbohydrates which replaces the glycogen levels that may have depleted during exercise. Sports drinks also contain electrolytes that are lost through sweat, which are essential for brain function and muscle contractions. Water when used in conjunction with sports drinks assists in the uptake and absorption of these carbohydrates and electrolytes.*

Question 4

Parts a., b. and d. were not handled well by students. Students had some difficulty in determining what the data in the graph was showing and were therefore unable to identify that detraining was occurring. In parts a. and d., if students were unable to identify the relationship it was challenging then to discuss and explain the effect of the variables on cardiac output (part a.) and aerobic capacity (part d.).

Question 4a.

Marks	0	1	2	3	4	Average
%	19	17	28	24	12	2

- Cardiac output = stroke volume × heart rate.
- Increases in left ventricle volume mean that there is more blood available to be pumped out with each beat (increased stroke volume).
- At rest and submaximal intensities, cardiac output remains the same (or decreases slightly) due to aerobic training.
- Therefore, the increase in stroke volume is associated with a decrease in heart rate as the heart does not have to work as hard to supply the oxygen needed.

Question 4b.

Marks	0	1	Average
%	55	45	0.5

Detraining, reversibility or training is reversible

Question 4c.

Marks	0	1	Average
%	33	67	0.7

The difference between the O_2 content of arterial blood and venous blood. The measure of the amount of oxygen extracted by the muscle

Question 4d.

Marks	0	1	2	3	Average
%	49	28	17	6	0.8

- VO_2 max = Q × a-vO_2 difference
- Therefore, if there is a decrease in each of these variables, there is an overall decrease in VO_2 max. and aerobic capacity.
- The graph shows a decrease of 5–15% in each of the variables.

Question 5

In part b., many students discussed the increasing duration of the tests as if the test were continuous and that the 10, 30 and 90 seconds were time points within the one test. This resulted in responses that discussed energy system interplay and not the reasons for the difference. The reason for the difference was the duration of the test and the fact that the anaerobic systems have a finite capacity. The student's ability to discuss these reasons with correct use of data to demonstrate understanding was rewarded with full marks. A common error in part c. was to discuss all three tests, not just the 30-second test.

Question 5a.

Marks	0	1	Average
%	51	49	0.5

Anaerobic capacity

Question 5b.

Marks	0	1	2	3	Average
%	23	39	28	10	**1.3**

- All three energy systems contribute to the energy requirements for all three tests.
- As the duration of the test increases the contribution for the aerobic system increases.
- The shorter tests (10-second and 30-second tests) have a greater contribution for the anaerobic systems (52% for ATP-CP for 10 seconds or 46% for anaerobic glycolysis for 10 seconds) as they are capable of producing ATP rapidly.
- The anaerobic systems have a finite capacity and cannot continue to supply ATP for extended periods of time (shown in the 90-second test).

Question 5ci.

Marks	0	1	Average
%	36	64	**0.7**

Emily

Question 5cii.

Marks	0	1	2	3	Average
%	44	14	21	21	**1.2**

Either:

- The event is predominately anaerobic (70% total contribution from the anaerobic systems). Anaerobic energy production results in metabolic by-products (e.g. inorganic phosphates, H+), which cause fatigue. The ability to buffer the hydrogen ions is beneficial in allowing an athlete to continue working at high intensities while accumulating the by-products (without a loss of muscle function due to increased acidity or a decrease in muscle pH).
- An increased LIP allows for great production of energy aerobically, so while this may allow the athlete to produce a greater percentage of ATP aerobically at a high intensity, it is unlikely to benefit the athlete in a 30-second maximal effort.

Question 5d.

Marks	0	1	Average
%	43	57	**0.6**

- (sodium) bicarbonate citrate
- caffeine
- creatine supplementation
- protein powders
- calcium ingestion
- beta-alanine supplementation

Question 6a.

Marks	0	1	2	3	4	Average
%	11	14	33	30	12	**2.2**

Suitable answers included:

- Efforts to change behaviour, including physical activity behaviour, based on the understanding of the interrelationship between the four levels of the social-ecological model: individual, social environment, physical environment and policy.
- A critique of how each level is or is not addressed in the program with a suitable example from the stem, such as:
    - individual: developing skills, knowledge
    - social environment: team play, social competition
    - policy: initiative of VicHealth, pay as you play
    - physical environment: it is unclear if there is access to facilities or facilities made available at flexible times

Question 6b.

Marks	0	1	Average
%	24	76	**0.8**

Physical environment level examples include:

- facilities
- equipment
- netball spaces
- is located near public transport or walking paths
- lighting

Question 7

Students who did not write ‘informed’ consent were not awarded marks. Informed consent means that the test protocols have been explained to the participant, the inherent risks and benefits outlined, and that they agree to the testing to be undertaken. Students who were unable to correctly interpret the data in part b. (for example, a higher time in the 20 m sprint represents lower speed and a higher decrement in the phosphate recovery indicates a poorer anaerobic capacity) were unable to access full marks for this question.

Question 7a.

Marks	0	1	Average
%	48	52	**0.5**

Informed consent or Physical Activity Readiness Questionnaire (PAR-Q)

Question 7bi.

Marks	0	1	2	Average
%	8	23	69	**1.6**

Fitness test	Fitness component	Ranee	Lisa	Thalia
20 m sprint	speed	2.82 s	2.92 s	3.21 s
Illinois agility	agility	17.22 s	17.13 s	17.99 s
20 m shuttle run	aerobic capacity	level 11.4	level 12.2	level 12.2
vertical jump	muscular power	62 cm	62 cm	57 cm
phosphate recovery	anaerobic capacity	17% decrement	8% decrement	8% decrement

Question 7bii.

Marks	0	1	2	3	Average
%	25	8	28	39	**1.8**

Lisa

Although Lisa has a slower 20 m sprint than Ranee (2.97 s compared to 2.82 s), Lisa has a greater ability to repeat sprint (only 8% decrement in the phosphate recovery) and to recover quicker with a higher 20 m shuttle run (level 12.2).

Question 8a.

Marks	0	1	Average
%	43	57	**0.6**

Skinfold measurements

Question 8b.

Marks	0	1	2	3	Average
%	36	24	28	12	1.2

	Advantages	Disadvantages
Body mass index (BMI)	• easy to obtain as only need height and weight • suitable as it may be accessible (cost-effective and easy to administer)	• does not take into account body composition (fat, muscle, bone, etc.) • not suitable as it often misclassifies muscular athletes as overweight or obese
Skinfold measurements	• would be suitable for athletes because it provides useful information about body fat and its distribution • can be used to record changes in body composition over time • can be converted to body fat percentages using generalised equations	• when assessing skinfolds, expertise and proper technique is required • can be invasive • there may be no access to the required equipment and assessors • can over-predict total body fat percentages in older adults

Students had very poor understanding of each of the tests, so found it challenging to critique the suitability of the test for use with a group of amateur athletes. It is important to note that students were able to critique either method's suitability for this group of athletes and receive full marks.

Question 9

Marks	0	1	2	3	Average
%	25	34	28	13	1.3

- fat is an essential fuel source for aerobic energy production
- fat is the main fuel source during rest and prolonged sub-maximal intensity exercise
- fats require greater amounts of oxygen to be broken down
- aerobic respiration involves more complex reactions
- fats produce a high yield of ATP per molecule
- fats produce ATP at a slower rate, therefore suitable for low intensity exercise when energy demand is low

The ability to discuss the role that fats play in energy production proved to be challenging for students. Students who were able to discuss **why** fats are the predominant fuel at rest and how this changes as intensity increases were able to receive full marks. For example:

> *Fats are the primary fuel source at rest as they have the greatest or highest yield of ATP. They although have a high oxygen cost and produce ATP at a slower rate than carbohydrates and therefore as intensity increases during exercise they are less relied upon.*

Question 10a.

Marks	0	1	2	3	Average
%	17	29	34	20	**1.6**

Cindie is meeting the following aspects of the physical activity guidelines (18–64):

- 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 of moderate intensity physical activity or 75 to 150 minutes of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous activities, each week.

Question 10b.

Marks	0	1	Average
%	49	51	**0.5**

- Do muscle strengthening activities on at least two days each week.
- Do some activity on Thursday or Sunday to meet ‘all days’.

Question 10c.

Marks	0	1	2	Average
%	8	20	72	**1.7**

Advantages: easy to complete; low cost, suitable for small groups or large groups; detailed information on context of activity; provides frequency, duration, and intensity; provides type of activity

Limitations: social desirability; misrepresentation; inaccuracy of recall; subject burden; reactivity, not suitable for individuals with cognitive limitations

Correct terminology was rewarded. For example, students who gave responses such as ‘people can lie’ as a limitation of a diary were not awarded marks. Students who were able to outline that ‘due to social desirability, a physical activity diary can over-represent the amount of physical activity undertaken’ as a limitation were awarded one mark.

Question 11

A common error in part a. was to try to determine maximum heart rate from the graph. To receive the mark in part d., responses needed to be specific; a general statement about increasing the intensity or duration of the session was not awarded marks.

Question 11a.

Marks	0	1	Average
%	37	63	**0.7**

Either:

- 220 – age = 189 bpm
- 208 – (0.7 × age) = 186.3 bpm

Question 11b.

Marks	0	1	2	Average
%	20	46	35	**1.2**

As the body starts to move it is in a state of oxygen deficit, or the oxygen demand is greater than the oxygen supply and the respiratory, muscular and cardiovascular systems start to increase their ability to transfer oxygen to the working muscles. This starts with increased respiratory rate, ventilation, heart rate, blood flow, diffusion, motor unit recruitment and rate of ATP resynthesis at the muscle sites within the ATP-CP system.

Question 11c.

Marks	0	1	2	3	4	Average
%	16	12	25	21	25	**2.3**

- Intermediate or long interval training: The heart rate and pace data both indicate periods of higher intensity (heart rate spikes at 155 before declining to 150) and lower intensity, representing a possible work period and rest period.
- Fartlek training: The heart rate and pace data show waves of higher intensity interspersed with lower intensity but with not as much variation as with interval training. Thus, showing the lower intensity period being completed at a faster pace and representing fartlek.
- Continuous training: Over the duration of the run, the individual was running for at least 20 minutes or the heart rate data and/or speed show a period of steady state.

Question 11d.

Marks	0	1	Average
%	52	48	**0.5**

- make each interval/fartlek sprint longer by up to 10%
- make each rest period in the interval shorter by up to 10%
- increase intensity/speed of run by up to 10%
- running up hills or on sand

Question 11e.

Marks	0	1	2	Average
%	30	28	43	**1.2**

Any two of the following aerobic chronic muscular adaptations:

- increase in fibre size (hypertrophy)
- increased capillary density
- increased myoglobin
- increased mitochondria
- increased glycogen stores
- increased triglyceride stores
- increased oxidative enzymes
- increased oxidation of fats (at rest and sub-maximal exercise)
- decreased oxidation of glycogen (at sub-maximal exercise)
- increased oxidation of glycogen (at maximal exercise)
- increased glycogen sparing (at sub-maximal exercise)
- increased a-vO_2 difference (at sub-maximal and maximal exercise)

Question 12

Marks	0	1	2	3	Average
%	12	22	36	29	**1.8**

Suitable answers included a discussion of any three of the following factors:

- Bike paths: The availability of safe cycling routes can enable the use of the bike share program as people may feel more comfortable and safe riding on a designated path.
- Safety of the area to cycle in: this may include lighting, low crime rates, heavy traffic, etc.
- Traffic-calming devices: Reduced speed limits and speed-limiting devices may add to the success of the initiative as cyclists may feel safer riding on streets where the speed for motor vehicles has been limited.
- Helmets: The availability or lack of availability of helmets may provide a barrier or may be an enabler to the use of the bike share program.
- Terrain: Hilly or steep terrain may reduce the likelihood of individuals riding. Flat terrain may encourage more individuals to use the bike share program.
- Location of bike banks: Accessibility of bikes for individuals may provide a barrier or may enable to the initiative to be successful.
- Prompts (posters, billboards, ads, etc.) to use the bikes in and around the location of the bike banks to encourage usage may increase the likelihood of the initiative being successful.
- Aesthetically pleasing bikes: People may be more inclined to use the bikes if they 'look' nice and are in good condition.

Students who were awarded full marks were able to identify the factors and discuss how or why this may increase or decrease the likelihood of the initiative being successful.

Question 13

Question 13 proved to be quite challenging for students. Students are encouraged to ensure that their answers make sense. For example, there needed to be alignment of the answers for parts c., d. and e. based on student understanding of the energy systems. If the answer provided in part c. was for a passive recovery, then the answer to part b. could not be an accumulation of metabolic by-products as they need an active recovery to remove.

Question 13a.

Marks	0	1	2	3	Average
%	9	24	32	34	**1.9**

- Sprint test: anaerobic capacity
- 20 m shuttle run: aerobic capacity
- 3 km time trial: aerobic capacity

Question 13b.

Marks	0	1	2	Average
%	66	19	14	**0.5**

The repeat sprint test requires athletes to sprint as fast as they can with little rest. If their aerobic capacity is higher they can oxidise more by-products in both of the anaerobic systems to improve sprint times. A higher aerobic capacity will allow greater PC replenishment between sprints.

Question 13c.

Marks	0	1	Average
%	72	28	0.3

ATP-PC system

Question 13d.

Marks	0	1	Average
%	69	31	0.3

Fuel (PC) depletion

Question 13e.

Marks	0	1	Average
%	48	52	0.5

Passive or rest recovery

Question 14

Part a. challenged students to use the data to discuss the energy requirements in the passage of play from which the data was provided. Responses that outlined the characteristics of each of the three energy systems were not awarded more than one or two marks. Students who scored highly provided specific data to support and justify the usage of each of the three systems within this passage of play. Students are reminded to read the question carefully, as in part b., many explained one of the two strategies given in the question stem (meditation and imagery) or provide an example of a strategy that clearly could not be used while shooting the free throws in the game.

Question 14a.

Marks	0	1	2	3	4	5	6	Average
%	19	15	18	20	15	10	3	2.4

Suitable responses included a discussion of the energy system requirements with use of relevant data from the stem.

The following is an example of a possible response.

During the passage of play all energy systems are being used to help Kobe move and play the game. During periods of rest such as the free throws, timeouts and substitutions there would be a short period where Kobe's highly developed aerobic system will assist with PC recovery. Depending on the period of time, but at least with timeouts up to 70-80% of PC stores could be restored. After these breaks, Kobe would use his ATP-CP system to explode to the basket and weave past players to score for example with his driving layup. His anaerobic glycolysis system would increase its contribution when Kobe was exploding through the key on the attack to score baskets and run back on defence particularly with high intensity repeated efforts. His aerobic system would overall be predominant through the period due to having played 42 minutes of the total game time.

Question 14b.

Marks	0	1	2	Average
%	37	8	54	**1.2**

- Breathing control/techniques: use of controlled slow breathing to help Kobe focus on the target and calm his mind
- Progressive muscle relaxation: Kobe would contract and release his muscles to help him relax his muscles and help him focus his mind/body towards the target
- Cue words/Routines: Kobe would have a number of cue words and a set routine for a free throw that helps focus his mind
- Positive self-talk: Kobe would use positive self-talk to increase his confidence and concentration to make the shot

Question 14c.

Marks	0	1	2	Average
%	46	27	27	**0.8**

Either:

- Accumulation of metabolic by-products: H+ ions continue to build in Bryant's body through the interval, inhibiting his ability to continue running at a higher intensity
- Thermoregulation: redistribution of blood flow from the working muscles to the skin decreasing the delivery of oxygen to the working muscles

Question 14d.

Marks	0	1	2	Average
%	7	22	71	**1.7**

- Nutritional strategy: high GI foods such as lollies, muesli bars, sandwiches, fruits such as oranges, sports/soft drinks; protein supplementation
- Physiological strategy: active recovery, passive recovery, stretching, dynamic stretching, walking, cold bath/shower, cryotherapy

Question 14e.

Marks	0	1	2	Average
%	42	35	22	**0.8**

- respiratory rate decreases at rest and sub-maximal levels
- minute ventilation increases at maximal exercise intensities
- lung diffusion increases
- increase in alveoli surface area
- increased lung volumes
- increased ventilatory efficiency
- increased VO_2 max

Question 15a.

Marks	0	1	Average
%	13	87	**0.9**

Blood doping

Question 15bi.

Marks	0	1	Average
%	47	53	**0.6**

- diuretics
- plasma expanders
- epitestosterone

Question 15bii.

Marks	0	1	2	Average
%	46	25	29	**0.8**

Masking agents go against the spirit of the sport and can harm the athlete's health, meeting two of the three criteria for banned substances.

It was not sufficient for students to list the three WADA criteria. To receive full marks correct identification of the two criteria that a masking agent violates was required.

Question 15biii.

Marks	0	1	2	Average
%	30	38	32	**1**

Benefit: mask the use of illegal substances by elevating plasma ratios to balance increased red blood cell counts caused by the use of blood boosters, which means the doping could be undetected or could increase the amount of urine in the body to flush out illegal substances

Harm: dehydration (electrolyte loss), kidney failure, heart failure, headaches, disqualification

Question 16a.

Marks	0	1	2	3	Average
%	29	18	28	25	**1.5**

To be successful in the modern pentathlon, athletes need to perform successfully in each event. A drug that may improve performance in one event may be detrimental to another. For example, using a beta-blocker for pistol shooting may decrease performance in the fencing event.

Question 16b.

Marks	0	1	2	Average
%	23	15	62	**1.4**

Beta-blockers lower heart rate and reduce tremors so the athlete can shoot more accurately.

Question 16c.

Marks	0	1	Average
%	44	56	0.6

- meditation
- breathing
- sleep
- stress inoculation
- aerobic training
- biofeedback