2013 Physical Education GA 3: Examination

GENERAL COMMENTS

It was encouraging to see that the students who sat the 2013 Physical Education exam handled areas that had previously been addressed in the examination report better than students in previous years. Students' responses demonstrated a better understanding of acute responses to exercise, the characteristics of the three energy systems, physiological and psychological strategies to enhance performance and recovery, and the World Anti-Doping Agency (WADA) criteria for banning a substance. Students who had participated in practical activities demonstrated an ability to link their practical experiences to their written examination.

Areas of concern from the 2013 examination included

- energy system interplay
- lactate tolerance
- use of data in responses
- factors associated with the social-ecological model
- chronic adaptations to both aerobic and anaerobic training.

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

- A greater depth of understanding of the relationship between the multiple levels that influence physical activity behaviours is required.
- Acronyms used to teach concepts, or as tools for students to remember information, are not appropriate as an answer. If assessors cannot interpret student responses, no marks can be awarded.
- Identifying and listing the characteristics of each energy system does not address or demonstrate an understanding of energy system interplay.
- Responses that received full marks addressed the context in which the question was asked.
- An understanding of appropriate training methods to improve lactate inflection point (LIP) and what occurs when training exceeds LIP continues to be poorly understood by students. Teachers are reminded to refer to the advice on LIP published in the April 2011 *VCAA Bulletin VCE, VCAL and VET*. This information is also available on the VCAA website via the Physical Education study page.
- When a question asks students to refer to or use the data provided, full marks will not be awarded if students do not use the information provided in the question in their response. Use of data can mean reference to the information provided in the graph or table, actual numerical data or reference to a relationship as shown in a graph.
- Correct terminology is important for students to receive full marks. Accepted terminology is stated in the study design.
- Careful reading of the question is important so that in questions containing the phrase 'other than', students don't give the answer stated in the question.

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 the 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%.

Section A – Multiple-choice questions

Question	% A	% B	% C	% D	Comments
1	7	1	91	1	
2	50	10	18	21	The individual level of the social-ecological model includes factors that increase or decrease the likelihood of an individual being physically active. The message sent to the workstation is aimed at changing an individual's behavior.
3	11	73	4	12	
4	63	1	14	22	

Question	% A	% B	% C	% D	Comments
5	10	61	4	24	The World Anti-Doping Agency's role is to promote, coordinate and monitor the fight against doping in sport in all its forms. It does not have a role in measuring the effects of prohibited substances on performance.
6	60	4	12	24	
7	26	10	55	9	
8	18	8	5	70	
9	16	29	7	48	Aerobic adaptations result in an increase in the lactate inflection point (LIP). Increased mitochondrial mass was the only aerobic adaptation given. Students find it challenging to understand the difference between increased LIP (aerobic adaptation) and increased tolerance to lactate (anaerobic adaptation).
10	3	14	10	74	
11	1	4	86	9	
12	12	60	21	7	
13	56	35	7	2	
14	6	40	31	23	An understanding of the meaning of VO_2 max. (the maximum amount of oxygen that can be taken in and used by the body) was required for students to understand that if an individual is working above this intensity, then the additional ATP must be supplied anaerobically.
15	2	4	5	88	

Students handled the multiple-choice section of the paper reasonably well.

Section B

Question 1

In general, students answered part a. well. However, some students didn't use the information and data provided to answer part b. Student were asked to 'list' a factor in part ci. and many provided long explanations. However, those who were able to list the factor were generally able to explain how it would decrease the likelihood of either boy being physically active.

1a. and 1b.

Marks	0	1	2	3	Average
%	10	25	34	31	**1.9**

1a.

Physical education class, school or house sport

1b.

Scott is more likely to be up and doing chores around the farm (high activity levels, 1400 steps) and may have to walk to the bus stop (increase physical activity levels) before catching the bus to school (decreases in physical activity levels, 20 steps), whereas Leo is more likely to be relatively inactive, until he needs to walk to school (increase in physical activity levels).

1ci.–ii.

Marks	0	1	2	3	4	Average
%	6	9	14	28	42	**2.9**

1ci.

Individual

- self-efficacy
- intrinsic motivation
- injuries/disabilities
- health status

- ability/skill level
- socio-economic status
- attitude
- knowledge
- beliefs

Physical environment

- access to and availability of facilities
- safety of environment
- geographic location
- community design
- aesthetics or perceived qualities of the environment
- natural factors (weather, etc.).

ii.

Suitable answers included

- high-density housing is often in areas that have fewer open spaces, which reduces the access to places where people can be active
- skill levels can influence an individual's involvement in physical activity – if a person doesn't have the skill to ride a bike, play tennis, skate, etc., this can limit the type of physical activity they can be involved in.

Question 2

Marks	0	1	2	3	4	Average
%	12	13	20	27	27	2.5

Substances and methods can be prohibited by WADA if they meet any two of the three following criteria.

- evidence that the substance or method enhances or has the potential to enhance performance
- evidence that the substance or method represents an actual or potential health risk to the athlete
- WADA's determination that use of the substance or method violates the spirit of sport

Beta blockers reduce tremors and decrease heart rate, which can enhance the performance of an archer, pose a health risk to the athlete and give an unfair advantage over other athletes. This violates the spirit of the sport, and so beta blockers are therefore banned by WADA in this sport.

This question was well handled by students. Use of correct terminology was required to receive full marks.

Question 3

Parts a. and b. were well done by students. In part c., students were generally able to identify that if you work above the stated intensity, the training would require an increased contribution from the anaerobic energy systems; however, few students were able to explain the physiological changes that occur when the body works anaerobically. In parts c. and d., students were not asked to define fartlek training or tapering and were not awarded marks for a definition.

3a. and 3b.

Marks	0	1	2	Average
%	5	19	76	1.7

3a.

Aerobic capacity

3b.

60–85% of HR max. (aerobic training zone)

3c.

Marks	0	1	2	3	4	Average
%	34	26	20	15	5	1.3

If the athlete is working above this intensity, there will be a greater contribution from the anaerobic systems. These two systems, however, have a finite capacity and cannot continue to produce energy for extended periods of time, so the athlete will need to slow down (decrease the intensity) or stop, due to the increase in the production of metabolic by-products and depletion of stored ATP and PC.

3d. and 3e.

Marks	0	1	2	3	4	Average
%	16	20	24	26	14	**2**

3d.
Suitable answers included
- improvement of the aerobic and/or anaerobic energy systems
- develops speed
- adds variety to the training program
- specificity – training more specific to race conditions (hills, surges, etc.)

3e.
Tapering reduces the effects of fatigue, so the athlete is physiologically and psychologically refreshed prior to the event.

Question 4
Question 4a. was handled well by most students. Generally, in part b., students were able to identify that objective methods are less likely to overestimate physical activity levels and provide reasons for this; however, few used the data provided to support their answer and were therefore not awarded full marks.

4a.

Marks	0	1	Average
%	16	84	**0.9**

Day 3

4bi.–ii.

Marks	0	1	2	3	4	Average
%	19	14	15	30	22	**2.2**

4bi.
Objective

4bii.
Objective methods of measuring physical activity are more reliable, valid and/or accurate compared to subjective methods for measuring physical activity, which are more likely to overestimate physical activity because of social desirability, cognitive limitations or misinterpretation of physical activity, as shown by the data in the graph. Device 1 across all days records higher amounts of physical activity (for example, day 3, 80 minutes compared to 65 minutes).

Question 5
Student demonstrated a good understanding of cold-water immersion and factors affected by sleep. A common error was to explain contrast therapy and to write the same thing in different words in part b.

5a.

Marks	0	1	2	3	Average
%	13	23	30	34	**1.9**

Suitable answers included
- decrease core, muscle and skin (tissue) temperature
- decrease sweating and dehydration
- minimise muscle soreness (DOMS), injury or bruising
- reduction of fatigue or pain
- reduce oedema (fluid retention)
- reduce localised swelling

- reduce blood flow through vasoconstriction
- reduce inflammation (from muscle damage).

5b.

Marks	0	1	2	3	Average
%	8	21	42	30	2

Suitable answers included
- increased stress or anxiety (increased production of stress hormones)
- decreased tissue regeneration
- diminished immune and hormonal function
- decreased effective cognition (poor decision-making, thinking, decrease in skill learning, poor concentration or lack of focus)
- increased pre-disposition to injury
- decreased performance
- slower reaction time
- decreased health
- increased irritability
- lack of motivation
- change in heart rate
- increased recovery time between training sessions
- decreased release of growth hormone.

Question 6

Students found this question difficult. In part a., many didn't use the graph. In part b., students were unable to see that the direct linear relationship between the cross-sectional area and strength for both males and females was the same, and tried to use individual points on the graph to show a relationship. Students were generally able to identify the fitness components in part c. but found it difficult to provide different methods of overload. Question 6d. was very poorly done; students needed to establish that weight training produces anaerobic adaptations and then identify those that relate to increased muscle hypertrophy.

6a–b.

Marks	0	1	2	3	4	Average
%	24	56	5	8	7	1.2

6a.

Gender of the person or cross-sectional area of the muscle

6b.

True

From the graph, there is a direct linear relationship between the cross-sectional area and strength for both males and females. But because females generally have smaller muscles (they have a smaller cross-sectional area), as shown in the graph, the cross-sectional area is directly related to strength; therefore, they have less relative strength.

6c.

Marks	0	1	2	3	4	Average
%	6	16	33	37	8	2.3

Fitness component	muscular power	(local) muscular endurance	
Method of overload	Suitable answers included • jump onto a box/step • increase the reps or sets • increase speed of movement.		Suitable answers included • increase reps or sets • one-leg squat/split squat.

6d.

Marks	0	1	2	Average
%	65	27	8	**0.5**

Suitable answers included

- increased number of myofibrils
- increased size of myofibrils, actin and myosin (per muscle fibre)
- increased total amount of contractile protein (in the myosin filament)
- increased capillary density
- increased amounts of connective, tendinous and ligamentous tissue.

6e.

Marks	0	1	2	3	Average
%	19	27	37	18	**1.6**

The protein is used for muscle repair and adaptation to training, and the carbohydrate provides fuel to restore muscle glycogen levels. Carbohydrate stimulates an increase in the hormone insulin that, in turn, stimulates the muscle to take up the amino acids for rebuilding.

Question 7

Students were able to correctly identify the group that had used creatine; however, few received full marks as they did not use the data provided to answer part b. Students have a superficial understanding of the potential harms associated with creatine use.

7a.–c.

Marks	0	1	2	3	4	Average
%	4	43	27	17	8	**1.9**

7a.

Group A

7b.

Increased body mass; for example, 5 kg change in body mass in group A
Increased fat-free mass; for example, 4 kg change in FFM in group A
Increased strength; for example, increased number of kilograms lifted in the squat (approximately 35 kg) in group A
Increased strength; for example increased number of kilograms lifted in the bench press (approximately 22 kg) in group A

7c.

Examples of harm included

- muscle cramps, strains and tears (soft-tissue injury)
- tendon injury
- weight gain due to fluid retention
- gastrointestinal discomfort (excessive intakes) harmful effects
- damage to liver and kidney function
- headaches.

Question 8

Many students were unable to identify an appropriate reason for the slower final split time. Fatigue is specific to the intensity and duration of an event, and students must relate their understanding of fatigue to the given scenario. A common error in part b. was not to refer to the importance of hydrating prior to a marathon. Most students explained the importance of being hydrated or maintaining hydration during the marathon.

8a.

Marks	0	1	2	3	Average
%	36	17	19	28	1.4

As glycogen stores become depleted, there is an increased contribution from fats as a fuel source. Fats have a slower rate of ATP production, and increased oxygen is required for the oxidisation of the fats, resulting in a slower pace.

8b.

Marks	0	1	2	3	Average
%	20	41	28	11	1.3

Suitable answers included the following.

- If Brett commences the run sufficiently hydrated, he is able to maintain body fluid throughout the run and is therefore less at risk of dehydration and its effects (nausea, decreased concentration, headaches, dizziness, etc.)
- Brett is more likely to maintain a hydrated state, rather than having to drink excessively in response to dehydration (easier to maintain than start trying to 'catch up').
- Brett is less likely to need to drink excessively if he is adequately hydrated prior to the event to combat sweat losses, and so that gastrointestinal discomfort can be avoided.

Question 9

This question was generally well answered by students. Again, identifying a factor was problematic in part c., but the explanations provided demonstrated an understanding of how the factor may decrease the use of the bike racks on buses.

9a.

Marks	0	1	2	Average
%	20	52	28	1.1

Physical environment and policy

9b.

Marks	0	1	2	Average
%	24	14	62	1.4

The following are suitable changes to either the physical environment or policy that could lead to an increase in the number of people cycling to work or school.

- bike lanes – safer passage
- bike racks at school/workplace – safe place to store bike
- showers and changing rooms at work or school – can get changed out of cycling gear ready for school or work
- traffic-calming devices (speed bumps, etc.) around schools – safe passage
- construction of bike trails – safe passage
- reduce speed limits – safe passage
- flexible start and finish times for workers who cycle – allows workers to cycle when it is light

9c.

Marks	0	1	2	Average
%	22	15	62	1.4

Suitable answers included

- knowledge: lack of knowledge of road rules
- skill: lack of skill of riding a bike
- socio-economic status: unable to afford a bike, so not likely to use the racks
- age: too old or too young to be able to use the bike racks (lifting the bike on and off)

Question 10
Parts a. and b. were generally well answered. Common errors included naming tests that are not specific to the muscle groups and fitness component. Part c. was challenging for students. Conducting and participating in fitness tests allows students to understand this component of the study.

10a.

Marks	0	1	2	Average
%	12	31	57	1.5

Muscular power: vertical jump, standing broad jump
Agility: Illinois agility run, semo agility test

10b.

Marks	0	1	2	Average
%	8	37	55	1.5

Suitable answers included
- to identify strengths and weaknesses so that the training program can be tailored to improve or maintain specific fitness components
- to set a benchmark so that training adaptations can be measured
- motivation and/or goal-setting to provide incentive and feedback from training to maintain interest and motivation.

10c.

Marks	0	1	2	3	Average
%	36	19	21	24	1.3

Suitable answers included
- tests should be conducted at the same time of day
- athletes should have the same preparation; for example, same warm-up, nutrition, hydration levels, activity levels and health status
- same testing order should be used
- same/similar environmental conditions for both tests
- same equipment/clothing/shoes used for both tests
- ensure that testing protocols are followed
- ensure that equipment is calibrated.

Question 11

Marks	0	1	2	3	4	5	6	Average
%	15	10	14	19	21	15	7	2.9

Student responses needed to include the following.
- Understanding that for an initiative to be more likely to be successful it must address all aspects of the social-ecological model (individual, social, policy and physical environment).
- Discussion of each of the four levels of the social-ecological model with an example (may be positive or negative) of how it was or wasn't used in the initiative.
- Justify with examples, why these led to the program not being successful.

For example:
The program did not address all four components of the model and was therefore less likely to be successful. From a social perspective, students rode with others, which provided social interaction. The parent 'drivers' provided a safe environment for the students to be physically active; however, the reliance on volunteers as 'drivers' was an issue. Limited funding and the need to effect real change to physical environments outside school provided challenges to the program model. Traffic-calming devices and the availability of bike tracks needed to be implemented in conjunction with the running of the program, and some schools may not see travel to school as a school issue (no policy change). The riding group mainly catered for younger students (prep to grade 4) (individual) but the riding group may not operate every day, to and from school or in all areas the students lived in. Not all students may have owned or had access to a bike. The program did not make significant inroads into increasing the number of children who independently cycled to school (individual component) as it did not address the knowledge of the students in relation to

riding a bike or road rules. A bike education program at the school may have assisted in making the program more successful.

This question was poorly done by students. Students demonstrated a superficial level of understanding of this area of the course. Students needed to explain why the program was not successful and not simply list each level of the socio-ecological model with an example.

Question 12
Very few students received marks in part a., as students showed little or no understanding of the difference between relative and absolute measurement of VO_2 max. In part b., students needed to determine that the type of training was aerobic, and therefore the adaptations needed to be to aerobic training. Vascular adaptations continue to be challenging for students.

12a.

Marks	0	1	2	Average
%	83	9	8	**0.3**

Absolute VO_2 max. results do not take into account the athlete's body weight (kg). The greater the mass, the less oxygen is used per kilogram per minute, resulting in a lower relative VO_2 max. For example, a person with a body weight of 100 kg will have a lower relative VO_2 max. than a person weighing 70 kg if the absolute VO_2 max is the same.

12bi.

Marks	0	1	2	3	Average
%	25	32	27	15	**1.3**

12bii.

Marks	0	1	2	3	Average
%	43	25	20	12	**1**

12bi and ii.
Suitable answers included the following.

Respiratory
- increased lung volumes, greater amount of oxygen available for transport to working muscles
- increased ventilation (at maximal intensity), greater amount of oxygen available for transport to working muscles
- increased surface area, therefore increased diffusion
- improved elasticity of the lungs helps to increase oxygen uptake, thereby increasing oxygen concentration in the blood at the muscle site

Vascular
- increased capillarisation around the muscle site allows for greater diffusion of oxygen out of blood into the muscle cell
- increased red blood cell count, allowing for more oxygen to be carried to the muscle site via the blood
- increased haemoglobin, increased oxygen carrying capacity

Muscular
- increase in mitochondrial size and number, increased sites for aerobic respiration to occur
- increase in oxidative enzymes, increased ability to use the available oxygen
- increase in myoglobin, which assists in greater diffusion of oxygen from the capillaries into the muscle.

Question 13
Students did not read this question carefully and many stated that as the event went for 51.51 seconds it was anaerobic and that is why you would train anaerobically. Students continue to struggle to understand the benefits of training anaerobically for an aerobic event and the advantage of the anaerobic system in an aerobic event. There is also a very poor understanding of LIP and lactate tolerance: A higher LIP allows an athlete to work at a higher intensity aerobically, lactate tolerance allows an athlete to work anaerobically (for example, above LIP) for longer before the

accumulation of metabolic by-products causes fatigue. In part b., students had a reasonable understanding of active recovery, but many failed to use the data in the graph to support their answer.

13a.

Marks	0	1	2	3	Average
%	39	28	21	13	1.1

Anaerobic training allows for an increase in his capacity to generate very high levels of blood lactate during all-out exercise and increased tolerance to lactic acid (lactate and H+ ions), therefore using the anaerobic system to a greater degree during the event, generating more power and relying less on the less powerful aerobic system. A higher percentage of the race was swum using anaerobic sources of energy, so he could produce energy at a faster rate and swim faster.

Students were also able to refer to other anaerobic adaptations such as increased fuel stores, increased glycolytic enzymes and the advantage of these to improving the time.

13b.

Marks	0	1	2	3	4	5	Average
%	17	18	22	21	15	8	2.2

As shown in the graph, when an active recovery is performed (65–35% of HR max.) or (35% HR max.) lactate clearance is much faster. If an active recovery is performed above 65% of HR max. then lactate is cleared more slowly than a passive recovery. Ideally, an active recovery performed between 35% and 65% of HR max. is best for lactate clearance. An active recovery is used to promote recovery and clear lactate faster by

- maintaining oxygen levels to increase the rate of removal of lactate from the muscles
- increasing the rate of post-exercise lactate removal through increased blood flow through the muscles, which enhances oxidation of lactate to return the body to resting levels more quickly and increasing recovery between races
- creating a muscle pump and reducing venous pooling to promote venous return to the heart and increased waste removal via the circulation.

Question 14

Part a. was understood clearly by students. However, parts b., c., d. and e. were challenging for students. The use of practical activities such as having students wear a heart-rate monitor would assist students' understanding of this area. Energy system interplay continues to challenge students. Identifying the characteristics of the three systems does not address the concept of interplay. The misconception that the body 'switches' from one system to another is a common error. Interplay by definition is the interaction of the energy systems to provide the total amount of energy required for the activity being undertaken. Full marks were not awarded to students who did not refer to the data. In part d., glycogen is not a food fuel and was not accepted as an answer. Students were generally able to identify that the elite mountain bike rider would be able to glycogen spare; however, they did not have a strong understanding of the chronic adaptations to aerobic training that allowed elite athletes to do this.

14a.

Marks	0	1	Average
%	28	72	0.7

Either of

- 220 – age = 220 – 40 = 180 bpm
- 208 – (0.7 × age) = 208 – (0.7 × 40) = 180 bpm.

14bi.–ii.

Marks	0	1	2	3	Average
%	23	28	29	20	1.5

14bi.

Intensity or progressive overload

14b.ii.

By knowing her heart rate, Alice is able to monitor the training zone in which she is training. This allows her to understand which energy system she is predominantly using at each stage of the ride. She is also able to monitor the intensity she is training at to apply an appropriate overload to her training.

14c.

Marks	0	1	2	3	4	5	6	Average
%	14	15	22	23	15	8	3	2.5

Students needed to address the following points.

- All three energy systems contribute to the ATP production throughout each ride.
- In each ride, there is an initial period of oxygen deficit due to the lag time for the aerobic energy system to meet the demands of the exercise, as shown in the graph in the first 1.5 km where heart rate increases from 100 bpm to 120 bpm.
- The predominant energy system for each ride is the aerobic energy system. This is shown in the graph as all three rides are completed predominately in the aerobic training zone and/or the distance is 21 km.
- On Track 1, the rider maintains a steady state from approximately 7 km for the duration of the ride. The aerobic energy system would be dominant here as oxygen demand is met.
- On Tracks 2 and 3, the rider has periods of steady state interspersed with periods of high and low intensity (going up and down hills); for example, 11.5–13 km marks.
- The periods of high intensity require an increased contribution of the anaerobic energy systems.

14di.–ii.

Marks	0	1	2	3	Average
%	23	31	26	20	1.4

14.d.i.

Carbohydrates or glucose

14.d.ii.

In all tracks the predominant energy system was the aerobic system. Therefore, due to the intensity, carbohydrates would have been the preferred fuel source due to a higher yield of ATP for less oxygen.

14e.

Marks	0	1	2	Average
%	58	18	24	0.7

The elite mountain bike rider would be able to glycogen spare – greater use of fats at higher (sub-maximal) intensities – compared to Alice who would use her glycogen stores earlier.