

2019 VCE Physical Education examination report

General comments

The examination gave students an opportunity to demonstrate the key skills and knowledge required in the study. Students who were able to reference specific knowledge and apply it to given situations achieved the best results. This was evident in questions about biomechanics and skill acquisition, where it was important that students understood concepts like inertia, Newton's law and types of practice, but were also able to show how these concepts were used in specific situations.

Students demonstrated the benefit of exposure to practical activities, as they were able to provide this knowledge in written answers. Those who were able to articulate their answers simply, accurately and concisely, generally scored very well. Using correct terminology enabled students to use fewer words in explaining concepts.

Students should understand question terms such as 'critique' and 'explain', and must read questions carefully to ensure they respond to everything the question requires.

Many responses provided generic answers without pointing to specific examples from data sets.

Many were challenged by the two extended response questions (Questions 8a. and 10) which required understanding of interplay of energy systems. Both questions provided a large amount of stimulus material that could be referenced.

Students should use the language and key terms provided in the questions, rather than using additional or inappropriate terms.

Specific 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

Students generally managed the multiple-choice section of the paper well. In the following table the correct answers are shaded.

Question	% A	% B	% C	% D
1	1	85	13	1
2	78	12	2	8
3	0	0	1	99
4	80	3	6	11
5	1	66	13	19
6	13	12	62	12
7	6	4	83	6
8	5	92	3	1
9	1	3	7	88
10	1	66	9	23
11	83	2	8	6
12	3	86	9	3
13	2	81	6	11
14	8	2	83	8
15	10	7	51	32

Section B

Question 1a.

Marks	0	1	2	Average
%	20	31	49	1.3

Students were required to provide a characteristic of a discrete skill and outline why the free throw movement is classified as a discrete skill in basketball. Characteristics accepted were:

- has a clear beginning and end
- consists of one clear movement.

It was not sufficient to state that a basketball free throw is a discrete skill because it has a beginning and an end, without further explanation.

The following is a possible response.

A discrete skill is a skill that has a clear beginning and end. A free throw in basketball is classified as discrete because it begins when the player receives the ball and ends when it leaves their hand.

Question 1b.

Marks	0	1	Average
%	32	68	0.7

An acceptable response was blocked practice.

Some students confused blocked practice and massed practice.

Question 1c.

Marks	0	1	2	3	Average
%	40	33	18	9	1

Students who scored highly:

- named practice distribution either in training (massed) or in a game (distributed)
- used actual data to explain the trends shown.

Some students did not refer back to practice distribution. (Massed practice can refer to a weekly training schedule or the grouping of the same activity during one practice session.) Others provided an explanation of the data without referring back to practice distribution.

The following is a possible response.

Players were practising using a more massed practice schedule. Massed practice led to better performance (74.5% versus 69.2%) at practice than it did in the game. In the game, the free throws are distributed during the game, which leads to a poorer result.

Question 1d.

Marks	0	1	2	Average
%	22	19	59	1.4

Students who scored highly:

- showed an understanding of Newton's first law of motion
- gave an example of this law in relation to the basketball free throw.

Students could also explain that the ball will stay in constant motion until acted upon by gravity, air resistance or the ring/backboard.

It was insufficient to simply state the 'law of inertia' without explaining the law.

The following is a possible response.

Newton's first law states that an object will stay at rest or in constant motion unless external forces act upon it. The athlete will overcome the inertia of the stationary ball with force from their body when shooting the ball towards the hoop.

Question 2a.

Marks	0	1	2	Average
%	18	51	31	1.2

Students who scored highly explained:

- at least one characteristic of informed consent (for example, the nature and purpose of the test, the risks associated, the procedure and methods of the test or the confidentiality of the test)
- that parent consent is also required, as the athlete is under 18.

Students who did not score well:

- confused informed consent with a par Q form, which details previous injuries
- did not explain a characteristic of informed consent but simply stated 'their parents must give permission for the testing'.

The following is a possible response.

The athletes must have the risks of the testing explained to them as well as their parents before consent can be given for the testing.

Question 2b.

Marks	0	1	2	3	4	Average
%	16	24	29	21	10	1.9

Students who scored highly:

- clearly justified the reason for this testing from both a physiological and psychological point of view
- explained the validity and overall suitability of the test.

Students who did not score well:

- stated incorrectly that undertaking a fitness test will help improve their performance or help them train for a skill
- did not explain validity in terms of fitness testing (the test is testing the correct fitness component – muscular power, lower body)
- confused validity with suitability or specificity
- argued that the test is not suitable when the question asks for **justification** for its inclusion..

The following is a possible response.

The standing vertical jump test is an appropriate test selection for the national team. It replicates the specific movement required in the sport (i.e. leaping for a spike) (physiological). The vertical jump test is a standardised or accepted/recognised test of lower body muscular power, which makes it valid. The elite team members are highly motivated to competition and improvement in this test may serve as a motivating factor (psychological) to help with producing a strong performance.

Question 2c.

Marks	0	1	2	3	Average
%	23	31	24	22	1.5

Students who scored highly:

- showed their understanding of impulse (e.g. force v time)
- showed how impulse can be manipulated to land correctly
- gave the reason for the importance of a correct landing.

Students who did not score well:

- simply stated that it is important to bend your knees to reduce injury – without any mention or understanding of impulse
- stated that impulse is decreased or increased to reduce injury, which did not show a correct understanding of impulse.

The following is a possible response.

Impulse is the product of force and time ($I=Ft$), which is equal to change in momentum of an object. In the landing, the force x time relationship is manipulated favourably by the athlete by flexing at

the hip, knee and ankle to increase the time, thus spreading the force of the landing and decreasing their risk of injury.

Question 2d.

Marks	0	1	2	Average
%	69	11	20	0.5

Students needed to name and describe one of these tests.

- standing long/broad jump test
- Margaria–Kalamen stair sprint test.

Students who did not score well:

- named tests for different components (e.g. Illinois agility test) or tests that are not standardised (e.g. box jump test)
- described the standing broad jump without actually naming it (the name and description were required).

The following is a possible response.

Standing broad jump or long jump – the volleyball player will line up and stand stationary behind a line and jump forward from two feet as far as they can.

Question 3a.

Marks	0	1	2	Average
%	26	33	42	1.2

Accepted methods in response to this question included any two of:

- plyometrics
- resistance training
- short interval training
- intermediate interval training
- circuit training.

Students who did not score well listed:

- HITT training (this is an aerobic training method)
- interval training without specifying short or intermediate.

Question 3b.

Marks	0	1	2	3	Average
%	7	23	27	43	2.1

Students were required to indicate the physiological changes (increase, decrease, stay the same) that would be expected in the runners at the end of the 400 m for each of the parameters.

Accepted answers (one mark per correct answer) were as follows:

- (i) Diastolic blood pressure stays the same.
- (ii) Tidal volume increases.
- (iii) Intra muscular ATP decreases.

Question 3c.

Marks	0	1	2	3	Average
%	46	29	16	10	0.9

Students were required to reference the data and, using their understanding of anaerobic chronic adaptations, explain the differences in the sprint and distance runners' blood lactate levels.

For full marks, students needed to:

- clearly outline an anaerobic adaptation and how it would contribute to increased use of the anaerobic system for the sprint athlete
- clearly and correctly reference data.

Students who did not score well:

- spoke about aerobic adaptations such as increased LIP, when the question required students to focus on an anaerobic adaptation
- did not reference or incorrectly referenced the data.

The following is a possible response.

The sprint athlete blood lactate level is higher than the distance runner blood lactate level after the 1600 m run (14.8 mmol/L compared to 8.8 mmol/L). This is due to the anaerobic adaptations of increased lactate tolerance, increased fibre size, fuel storage (ATP-CP) and an increase in glycolytic enzymes, which assists with resynthesising ATP anaerobically. This increases the production of metabolic by-products from increased use of anaerobic systems. The sprint athlete is also more likely to tolerate the build-up of by-products than the distance athlete.

Note: This example mentions a number of anaerobic adaptations; only one is required. Students may also have referenced data related to the 400 m run.

Question 3d.

Marks	0	1	2	Average
%	31	52	17	0.9

Students needed to show on the graph the change in the muscle creatine phosphate (CP) level during a 400 m sprint and passive recovery. The initial muscle CP level was 16 mmol/kg. To receive full marks student responses needed to show:

- a downward trend in CP stores to the 400 m mark without the stores hitting the zero point
- from the 400 m mark, a gradual upward trend in the recovery phase.

Students who did not score well:

- showed a downward trend to almost zero by the 100 m mark and then a flat line along the bottom of the graph
- showed CP stores reaching zero or recovering to higher than 16.

Question 3e.

Marks	0	1	2	3	Average
%	43	33	18	6	0.9

Students were required to:

- recognise that the anaerobic systems are required during periods of oxygen deficit
- state that energy production occurs more rapidly when using the anaerobic systems

- show how an increased rate of ATP production may then improve their race performance.

Students who did not score well:

- spoke about LIP as an anaerobic adaptation.
- did not recognise how training the anaerobic systems benefits the athlete in the race.

The following is a possible response.

The anaerobic systems are required to provide energy during periods when the aerobic system cannot immediately supply the required energy (oxygen deficit). If an athlete can increase their anaerobic capacity, they are able to derive more energy from anaerobic systems, which allows for a faster rate of energy production. This allows the runner to work at a higher intensity (e.g. for a surge at the finish line).

Question 4a.

Marks	0	1	2	Average
%	42	34	24	0.8

Accepted responses were:

- speed climbing power:
 - basketball throw/seated basketball throw
- endurance:
 - flexed arm hang test
 - 60-second push-up test/timed push-up test
 - pull-up/modified pull-up test.

Students who did not score well:

- identified standardised lower body tests
- used the incorrect name of a test (e.g. 'push-up test' was not accepted without reference to a time frame).

Question 4b.

Marks	0	1	2	3	4	5	6	Average
%	7	9	17	22	22	17	7	3.3

Students were required to:

- mention the intensity and duration of both events and link to correct energy systems
- correctly apply energy system interplay with specific detail for the two climbing events
- justify the correct fitness components that may link energy systems and events
- use data interspersed within a coherent discussion.

Students who did not score well:

- provided a generic discussion of energy system interplay without applying it to the specific events – this was especially evident with the lead climbing event, where students explained the generic ATP–PC system was prevalent for first 10 seconds, followed by anaerobic glycolysis, and so on, rather than suggesting it is mainly an aerobic event with some contributions from the anaerobic systems at specific times
- were not able to compare the interplay of systems
- did not mention specific fitness components for each event.

The following is a possible response.

In the speed and lead climbing events, both athletes use all three energy systems at all times in varying amounts. For speed climbing the duration of the event is approximately 5.48–7.32 seconds; this means the ATP–PC system is providing most of the energy. The ATP–PC system provides ATP at a fast rate but has a low yield, allowing this climber to climb quickly: 2.04 metres per second. For lead climbing the event lasts a total of six minutes, meaning the aerobic system is providing most of the required ATP. The energy supplied by the aerobic system is produced at a slower rate, yet has a greater yield. The speed of climbing for this climber is slower, at 0.41 metres per second. For both events the ATP–PC is utilised at the beginning due to oxygen deficit and energy being required at a fast rate. There would be negligible contributions from the anaerobic glycolysis system in the speed climb, whereas there would be a greater contribution during the lead climbing as there would be times during the six minutes where the intensity of movement would increase and the ATP for muscular movements would be derived from the anaerobic glycolysis system. Muscular power is needed in speed climbing as the climber performs explosive efforts of movement up the wall and muscular endurance is needed for lead climbing due to repetitive movements over an extended period while in a fatigued state.

Question 4c.

Marks	0	1	2	Average
%	64	25	11	0.5

Students were required to identify a clear link between muscular strength and both muscular power and muscular endurance.

Students who did not score well were not able to:

- explain the link that muscular power requires strength along with speed
- provide a clear example of why strength is important as part of muscular endurance in the lead climbing event.

The following is a possible response.

Power involves the ability to generate maximal force (strength) over a short period of time (velocity), so a speed climber will need to generate maximal contractions quickly as they scale the wall, requiring muscular power. The lead climbing event requires the climber to be able to grasp the wall repeatedly with strength over an extended period of time, requiring muscular endurance.

Question 4d.

Marks	0	1	2	Average
%	33	36	31	1

Accepted strategies were:

- carbohydrate ingestion for replenishment of carbohydrate stores
- protein ingestion for muscle recovery
- a mix of protein and carbohydrates to increase carbohydrate absorption as well as to aid muscle recovery.

Students who did not score well:

- spoke only of the glycaemic index (GI) of foods without mentioning carbohydrates
- mentioned carbohydrate loading, which is incorrect for the scope of this question.

The following is a possible response.

A mix of protein ingestion with carbohydrates which would increase the absorption and update of carbohydrate and provide protein for improved muscle recovery.

Note: GI and study of sports drinks is not part of the study design.

Question 4e.

Marks	0	1	2	3	Average
%	20	32	32	15	1.4

Students needed to give a positive of the program as well as a negative and a possible way to effectively correct the negative, to achieve full marks.

Students who did not score well were not able to apply all the elements of a critique (identifying positives, negatives and opportunity for improvement). Many students only focused on errors in the program without looking at positive aspects or giving suggestions.

The following is a possible response.

This climbing program is generally appropriate for a lead climber. It trains muscular endurance with the wall hangs and planks with the length of time appropriate to training the correct fitness component. One exercise that could be made more appropriate for endurance is the bench press exercise – it contains too few repetitions and too much rest. The bench press exercise should have more reps (e.g. 15) to make it more suitable to muscular endurance.

Question 5a.

Marks	0	1	2	Average
%	6	9	84	1.8

Students needed to outline the difference between a fine motor skill and a gross motor skill with an appropriate example.

The following is a possible response.

Darts is an example of a fine motor skill with the grasp of the dart being precise with small muscle groups, in contrast to weightlifting, where use of large muscle groups makes it a gross motor skill.

Question 5b.

Marks	0	1	2	3	Average
%	21	27	34	18	1.5

Students were required to:

- show their understanding of the inverted U principle
- use an example from Question 5a. to explain the impact of arousal levels on performance.

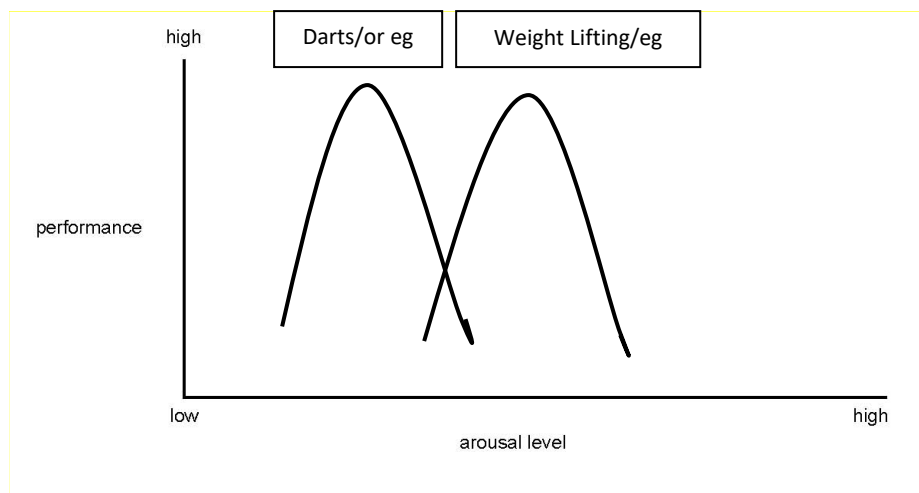
Students who did not score well:

- explained the principle in general terms but did not apply it to a specific example
- did not link the impact of arousal levels to the performance
- incorrectly suggested that a fine motor skill (e.g. darts) meant the performer needs to be under aroused, whereas in fact the entire curve shifts to the left.

A diagram was not necessary to access full marks but many students used a diagram effectively to illustrate their response.

The following is a possible response.

To perform at your best for a sporting event, you need to be at the optimum level of arousal. Optimal arousal for darts is generally at a lower level, due to the precise nature of the skill, in comparison to weightlifting, which requires higher level of arousal due to the physical nature and use of large muscle groups. The inverted U principle on arousal levels for sport means that if the level of arousal is too high an athlete will not perform at their best. For example, if you were going into a darts final and you were highly aroused, you might not have the muscle control to perform highly precise movements.



Question 5c.

Marks	0	1	Average
%	32	68	0.7

Students were required to name one strategy that an athlete in a heightened state of arousal may use to regulate their arousal levels.

Accepted responses were:

- meditation
- progressive muscle relaxation
- breathing control
- relaxing music
- Stress Inoculation Training (SIT)
- biofeedback.

Question 6ai.

Marks	0	1	Average
%	14	86	0.9

Accepted responses were:

- training log or diary
- electronic device to monitor training
- heart rate monitor.

Question 6aii.

Marks	0	1	2	Average
%	11	48	41	1.3

Students were required to:

- give a clear reason why a record should be kept
- provide a clear example to justify this.

The following is a possible response.

Noah could use a training diary to monitor his training from a physiological or psychological perspective (e.g. overtraining or progression). For example, Noah could write down out of 10 how he felt the session went or how sore he may have been through certain sets.

Students who did not score well did not provide an example but simply stated that training should be monitored to check progress.

Question 6b.

Marks	0	1	2	Average
%	27	33	40	1.2

Students were required to state if progression had been applied correctly and give a clear example of data from the program.

The following is a possible response.

Progression has been applied correctly to the Monday, Wednesday and Saturday sessions as no session has increases of more than 10% in more than one variable (repetitions).

Students who did not score well stated that progression had been applied correctly but were not able to give a specific example from the data.

Students could argue that progression was not applied correctly on some days but had to point to a specific section of the data (e.g. too many variables being changed).

Question 6c.

Marks	0	1	2	3	4	5	Average
%	17	14	19	21	19	10	2.4

Students needed to mention each of the four frequency, intensity, time and type (FITT) principles in relation to the program as well as give an overall evaluation of the effectiveness of the program.

Students who did not score well:

- did not cover all of the FITT principles
- did not show correct knowledge of the application of the FITT principles (e.g. stating that intensity was too high).

The following is a possible response.

This is an effective training program for a sprint cyclist. **Frequency** has been applied correctly as there are three sessions included each week for anaerobic bike training and an anaerobic athlete should complete two to four sessions. **Type** is applied correctly as most of the sessions are specific to the energy systems, fitness components and skills of track cycling. **Time** is applied correctly as each session is of relevant length appropriate for a 500–1000 m sprint cyclist – timing is relevant and appropriate as most repetitions last between 20 and 25 seconds / the work:rest

ratio is suitable for anaerobic training / the overall length of the session is appropriate for a sprint cyclist. Finally, **intensity** is appropriate with RPE at 9/10 and the resistance training program at 95% of RM, suitable for a high-intensity sprint cyclist.

Question 6d.

Marks	0	1	2	Average
%	50	28	22	0.7

Students were required to explain how an increase in the firing rate of motor units would aid Noah's performance in track cycling. To gain full marks, student responses needed to explain how motor unit recruitment would aid performance.

Students who did not score well focused on:

- the amount of force production being increased, rather than the rate of force production
- energy systems that were not relevant to this question.

The following is an example of a possible response.

An increase in firing rate would allow Noah to increase the rate of force development, meaning he could cycle faster during the sprint race, as maximal force can be generated more rapidly.

Question 7a.

Marks	0	1	2	Average
%	35	17	49	1.2

Acceptable responses were:

- direct observation – it is immediate feedback to the athlete at a low cost and would be relatively easy to do
- videorecording – it is stored for future analysis and can be replayed or paused to obtain correct data
- a combination of direct observation and videorecording.

Students who did not score well referred to the type of data collection (e.g. skill frequency table) whereas the question required a **method** for collecting the data.

Question 7b.

Marks	0	1	2	3	Average
%	22	23	34	21	1.6

Students needed to:

- explain how a coach may use a qualitative analysis to fix errors in technique and to provide the chance to fix errors
- state that a quantitative analysis is unable to provide error correction data.

Students who did not score well were not able to articulate that a quantitative analysis alone will not provide the required data to fix errors in technique.

The following is a possible response.

Using a qualitative analysis provides the coach with opportunities to learn more about the athlete's technique; they can then provide feedback to the athlete and prescribe an appropriate form of practice for future improvement. The quantitative data alone does little to help the coach or the athlete make corrections to the movement.

Question 7c.

Marks	0	1	2	3	4	Average
%	11	17	31	29	12	2.2

Students were required to:

- reference stages of learning for player 2
- make a link between improvement of performance and motivation to continue
- reference data in their answer.

Students who did not score well did not cover all aspects of the question and did not reference stages of skill learning as well as linking this to motivation to continue.

The following is a possible response.

After session 1, player 2 had only achieved a successful serving rate of less than 10%, suggesting player 2 was still in the cognitive stage of learning. After session 2, the success rate was around 45%, as the player had most likely improved and moved to the associative stage. This data correlates strongly with the player being more motivated to continue, as the player has gained more confidence with their improvement in motor skill development. This would then allow the player to continue to improve by further participation in the sport.

Question 8a.

Marks	0	1	2	3	4	5	6	7	8	Average
%	8	11	17	18	16	13	10	5	1	3.4

Students were required to demonstrate their understanding of energy system interplay as applied specifically to the phosphate recovery test, including:

- linking rate/yield/fatigue factors
- linking CP decline and increase of metabolic by-products (fatigue)
- understanding increased reliance of anaerobic glycolysis and rate of energy production
- understanding the role of the aerobic system in recovery.

The following is a possible response.

Students who did not score well:

- provided generic answers without applying their knowledge to the phosphate recovery test
- did not acknowledge the important role of the aerobic system during the recovery periods.

All three energy systems will be contributing to energy requirements for this test with varying levels of involvement. During the initial sprints the ATP–CP system will have a high level of contribution with the 23-second recovery period allowing for the aerobic system to replenish CP stores. This is shown by the initial high levels of eight cones and seven cones as the ATP–CP system can provide energy at a very fast rate. However, as the reps continue, the ATP–CP system will begin to deplete as there is insufficient time to fully replenish it. Once this CP depletion occurs, there will be a greater reliance on the anaerobic glycolysis system, which does not produce energy as fast. This system also leads to an accumulation of metabolic by-products. These will begin to inhibit muscle function. The aerobic system has a vital role during the short recovery periods to oxidise metabolic by-products and to resynthesise CP stores during the short recovery periods. This is shown by a decrease to five cones and then four by the completion of the sixth repetition. By the final repetition there is an increased contribution by the aerobic system to provide energy. This will have a much slower rate of energy production due to the complex nature of chemical reactions required with the addition of oxygen. This can be seen by the final repetition scoring only three cones.

Question 8b.

Marks	0	1	2	3	Average
%	12	28	38	23	1.7

Any three of the following responses were required:

- keeps heart rate elevated to promote blood flow
- assists with thermoregulation / slowly reduces core temperature
- replenishes oxygen levels to myoglobin
- provides a muscle pump for blood flow back to the heart (reduction of doms)
- decreases venous pooling.
- increases oxygen to help break down metabolic by-products.

Question 8c.

Marks	0	1	2	Average
%	34	39	27	1.0

Students were required to identify one positive consequence and one negative consequence of performing a passive recovery.

The following is a possible response.

PC is resynthesised at a faster rate with a passive cool down, however metabolic by-product removal would be slower than if undertaking an active recovery.

Question 9

Marks	0	1	2	3	4	Average
%	16	18	27	24	14	2.0

Students were required to reference the four different biomechanical principles mentioned and discuss them clearly in reference to the bat length and weight.

Students who did not score well:

- were not able to make the link between force and angular velocity
- described the mass of the bat in a generalised way and were not able to incorporate lever length into the discussion.

The following is a possible response.

In theory, a longer and heavier bat (lever) should increase angular velocity; however, a child may not have the strength to benefit from the increased mass or length of the bat. This is because they are unable to provide enough force to swing the bat quickly and overcome the moment of inertia of the bat. This would mean that they would not achieve an increase in angular velocity. The increased lever length creates a longer resistance arm, which makes it difficult to overcome the moment of inertia and being able to swing the bat quickly or in a controlled way.

Question 10

Marks	0	1	2	3	4	5	6	7	8	Average
%	18	15	17	14	14	10	8	4	1	2.8

Students were required to:

- show a correct analysis of data to select appropriate fitness components and methods to train for a specific goal/s
- show the application of correct training methods, which must be aligned to goal justification from data analysis (with reference to data).

Students who did not score well:

- attempted to cover too many fitness components in their answer (the question did not specifically ask for more than one component)
- listed fitness tests as a method of training (e.g. stork stand, yo-yo test)
- did not refer to the stimulus data in giving the reason for the creation of their goal
- did not show the correct training principles in their table.

The following is a possible response.

The data shows that an improvement in aerobic power is required, shown by below-average scores in the yo-yo test (14.5) and the 1.6 km run (9 minutes) as well as below-average distance covered in a game (5.9 km). The continuous, HITT and long interval training methods all target improved aerobic power. As a result of training mainly the aerobic system, after six weeks, progression of 2–10% can be applied as improvements are made after this amount of time without a risk of overtraining. Training at least four times a week allows for improvements rather than maintenance with a duration of at least 20 minutes being important. Improvements in aerobic power will allow Jan to improve her total distance covered in a game to meet AFLW standards.

Goal: To improve aerobic power to meet AFLW standards

Day	Monday	Wednesday	Thursday	Saturday
Program	Continuous 5 km run	HITT	Continuous 5 km run	Long interval
Week 1	75% HR max. 25 minutes	20 minutes 85% HR max.	75% HR max. 25 minutes	80% HR max. 2 minutes work 30 seconds rest 20-minute duration
Program	Continuous 5km run	HITT	Continuous 5 km run	Long interval
Week 4	75% HR max. 25 minutes	20 minutes 85% HR max.	75% HR max. 25 minutes	80% HR max. 2 minutes work 30 seconds rest 20-minute duration

Program	Continuous 5.5 km run	HITT	Continuous 5.5 km run	Long interval
Week 7	75% HR max. 25 minutes	20 minutes 90% HR max.	75% HR max. 25 minutes	80% HR max. 2:10 minutes work 30 seconds rest 20-minute duration

Question 11a.

Marks	0	1	Average
%	63	37	0.4

The only acceptable response was aerobic training.

Students who did not score well provided a training method (e.g. continuous training) whereas the question required a training **type**.

Question 11b.

Marks	0	1	2	3	Average
%	52	20	18	9	0.9

Students were required to:

- identify reduced use of glycogen as a fuel by referencing data from the graph
- give a clear example of how glycogen sparing would assist an athlete in an event such as this.

Students who did not score well were unable to:

- identify glycogen sparing as shown in the graph but explained why using fats can give a greater energy output
- explain the benefit of glycogen sparing for the athlete in the race.

The following is a possible response.

The graph shows that at 70% VO_2 max., the trained athlete can use 45% fat as opposed to the untrained athlete using only 20%. Being able to use more triglycerides at this intensity enables the athlete to decrease the reliance on glycogen (glycogen sparing). The spared glycogen would then be available if there were periods of the race that moved at a higher intensity, such as an incline of a breakaway run, to fuel these efforts.

Question 11c.

Marks	0	1	2	Average
%	45	32	23	0.8

Students were required to state that both respiratory rate and tidal volume increase and that tidal volume will plateau at submaximal intensities and respiratory rate will continue to increase, **or**

predict that tidal volume rate is higher in the post-trained athlete and that respiration rate is lower at submaximal intensity in post-trained athletes during submaximal intensity exercise.

The following is a possible response.

At submaximal intensities the trained athlete will have a higher tidal volume and lower respiratory rate due to their training.

Students who did not score well were unable to:

- make links between tidal volume and respiratory rate
- state that tidal volume plateaus at submaximal intensities.