ANSWERS

SECTION A ~ Multiple choice questions

QUESTION 1. B

QUESTION 2. C

QUESTION 3. D

QUESTION 4. B

QUESTION 5. A

QUESTION 6. D

QUESTION 7. D

QUESTION 8. D

QUESTION 9. A

QUESTION 10. A

QUESTION 11. B

QUESTION 12. A

QUESTION 13. B

QUESTION 14. B

QUESTION 15. A

SECTION B ~ Short-answer questions

Question 1 (4 marks)

a. What fitness component does the 300-yard shuttle run assess? **Anaerobic Capacity** **1 mark**

b. What is the most likely cause of fatigue in the 300-yard shuttle run? **Accumulation of H+** **1 mark**

c. Discuss one physiological factor that might explain why Men's basketball times and considerably faster than Women's basketball times for the 300-yard shuttle run? **2 marks**

- **Men have larger muscles than females (1 mark)**
- **Larger muscles are able to store more PC which delays contribution from anaerobic glycolysis system and hence delays H+ accumulation (1 mark)**
- **Larger muscles are capable of producing greater contractile forces / running speeds (1 mark)**

Question 2 (9 marks)

The following data was collected from the same runner after she had completed five repetitions of interval training on 3 different days, using 3 different intensities (A, B and C).

a. One of the intervals required the runner to complete 5 x 800m with a 30 second rest in between each repetition. Identify which letter (A, B or C) corresponds to this type of interval training and use information from the graph to support your answer.

3 marks

- **The prescription would indicate long interval training with a work greater than 1 in the 1: 1 W: R ratio. Because of this the aerobic energy system would be the major focus with very small amounts of H+ accumulation during the 5 x 800m session (2 marks).**
- **C – this best fits the prescription (1 mark)**
- **Responses could state that A and B have significant increases in blood lactate and likely to be training the two anaerobic energy systems (PC and anaerobic glycolysis)**

b. If the runner wanted to improve her lactate tolerance, why would she need to work above her LIP?

2 marks

In order to improve lactate tolerance, lactate / H+ needs to accumulate and the muscles need to develop increased buffering / tolerance to this. Training needs to occur above LIP in order for lactate / H+ to accumulate.

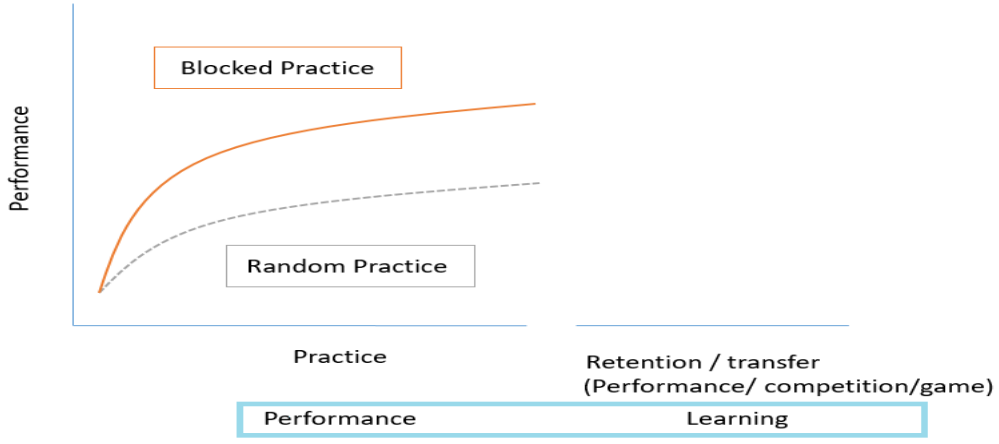
c. Her coach wants to run a series of fitness tests at the start of the next 'in-season' training. Discuss two sociocultural factors that might be considered by the coach in determining whether or not the tests are appropriate.

4 marks

Factors:

- **Is a field test more accessible than a laboratory test (socioeconomic status / cost)?**
- **Is a test able to be performed with mixed gender (gender) – are there restrictions because of body image?**
- **Is the test run for an individual or groups of people?**
- **Is the test age appropriate (age) – is the test cognitively suitable?**
- **Are their cultural considerations (cultural) – performing in religious clothing; performing in a mixed setting?**

Question 3 (8 marks)



a. State the relationship that exists between Performance and Practice **1 mark**

The longer the period of practice, the greater the performance level. (1 mark)
Or
There is a direct relationship between practice and performance – as one increases so does the other, and conversely as one decreases so does the other. (1 mark)

b. (i) By referring to the above graph, which type of practice would lead to quickest improvements in skills for someone at the cognitive stage of learning? **1 mark**

Blocked practice

(ii) Discuss why the type of practice you have chosen above leads to the quickest improvements in skills for someone at the cognitive stage of learning

2 marks

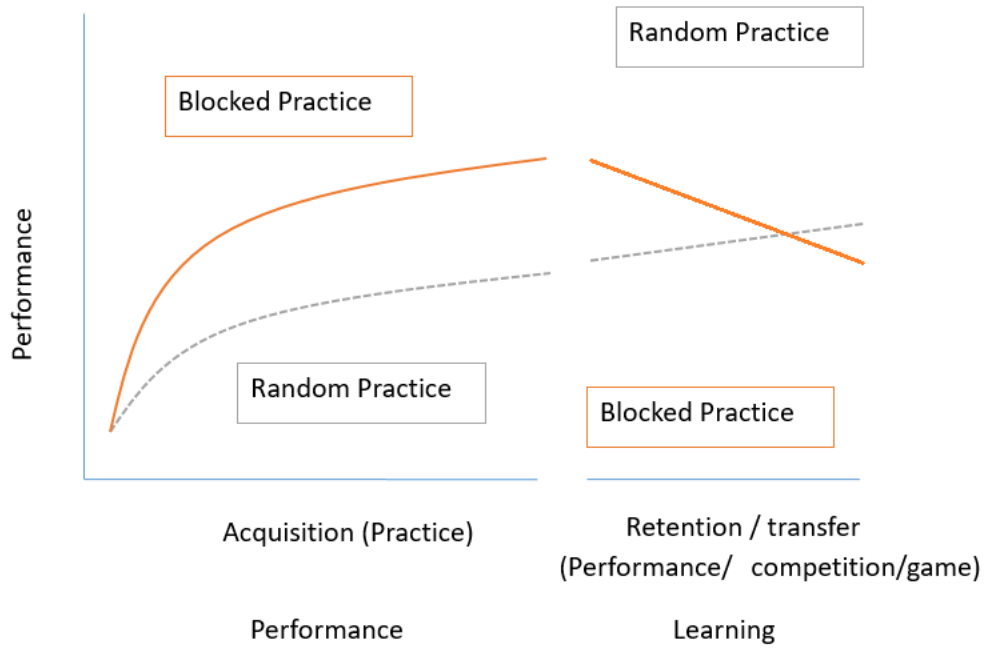
Blocked practice most suitable for cognitive stage learners because it allows the:

- **Same skills to be practiced in isolation from other skills (decreasing amount of information processing, increasing levels of concentration)**
- **Environment to be kept constant /closed**
- **Skill to be replicated with high frequency and consistency**

c. By drawing two lines on the above graph, clearly indicate what happens to retention/transfer of information (learning) when using blocked or random practice.

2 marks

1 mark for each correctly drawn line.



d. Provide an example of intrinsic feedback a National level tennis player might use during a match, and discuss how this might contribute to performance improvements. **2 marks**

Intrinsic feedback-information received by performers as a direct result of producing a movement through the kinaesthetic senses - feelings from muscles, joints and balance. From experience, performers know what correct technique feels like. Any of the following with associated discussion about improved performance:

- **Players know if they are not using correct technique and make immediate corrections so they 'feel right'**
- **Players can correct body position if they feel unbalanced to improve stability and hence shot performance / technique**
- **Players know how far their joints can move before being injured**
- **Players can hear the stroke being played by opponents (slice, topspin, etc..) and prepare / return accordingly**
- **Players process visual cues (body position, height of bounce, etc.) to make best shot selection.**

Question 4 (12 marks)

Australia's Stephanie Gilmore won her 7th world surfing title at Maui in November 2018 and the win establishes her as one of the greatest surfers of all time.

a. The following graphic shows how surfers catch a wave (start) and then ride a wave (continue surfing)

(i) List two strategies the surfer has used when riding the wave to improve balance? **2 marks**

Balance is improved by:

- **Lowering the centre of gravity**
- **Increasing the base of support by having feet wider than shoulders**
- **Leaning into the forward / rolling wave**
- **Ensuring the centre of gravity occurs over the base of support (moving hands and upper body as the lower body / board moves)**

(ii) How can Newton's third law of motion be applied to this surfing scenario? Briefly discuss. **2 marks**

For every action there is an equal and opposite reaction is shown by the surfer exerting a force downwards on the board/wave and the wave exerting an equal force I the opposite direction.

b. The following graph reveals the vertical force (Fz) exerted on the surfboard by a surfer during the different phases – waiting for a wave; paddling; surfing and end of wave:

(i) Discuss the energy system contribution during the 30 second period shown in the above graph

For the duration of the surf (waiting – end of wave) all the energy systems are always contributing at varying degrees at all times to ATP production.

Whilst the surfer is waiting to catch a wave, they are predominantly using their aerobic system.
For the first 3-4 seconds when the surfer is paddling they would predominantly be using the PC system, with the anaerobic glycolysis system also contributing significantly, but the aerobic energy system only contributing a small amount to ATP production.

The initial efforts are high intensity / short duration and require a fast rate of energy production. When the surfer stands and then exerts high force on the board whilst surfing the PC system still produces most of the ATP, but increasingly the anaerobic glycolysis system produces ATP and the aerobic system is also increasing its contribution.

The anaerobic glycolysis system will begin to produce most ATP half way through the surf as PC is depleted significantly. During the surf there is no time to recharge the ATP-PC system. As the surf ends and the surfer enters the water, they paddle at low intensity back out to the breakers and wait for the next wave to break which they can catch and surf back into the shoreline. While waiting the aerobic energy system is also partially recovering the intramuscular ATP and CP stores for other high intensity moves on the next wave.

Note: The VCAA are increasingly looking at a more holistic response rather than allocating marks for separate parts of the response of energy system interplay.

4 marks

(ii) By referring to the photo of Stephanie Gilmore, and the vertical force graph, select two fitness components that she would need to have developed to a high level in order to succeed in surfing. Clearly discuss how they contribute to successful performance. **4 marks**

1 mark awarded for correct component and 1 mark for correct link to data (diagram or graph). Cannot simply recall general knowledge of surfing.

- **Flexibility - Evident as joints such as ankle, knee, hip are taken through full range of motion whilst riding the wave.**
- **Balance – evident by the way surfer manoeuvres her body to stay on the board as it is moving in multiple directions**
- **Agility – able to change direction of the board/body rapidly and accurately as evident by variations in force exerted on the board**
- **Co-ordination – evident in the ability to perform a sequence of movements to paddle, catch and ride the wave**
- **Anaerobic power – evident by the forceful contractions exerted on the board by the rider whilst surfing for 20 seconds at high intensity primarily calling upon the PC and anaerobic glycolysis systems.**
- **Reaction time – evident by being able to respond to the wave breaking and being able to coincide this with them being able to paddle and then stand up on the board.**

Question 5 (13 marks)

Bryce has been training and competing in Triathlons for over 10 years now. He started this as a 17-year old when he was diagnosed with asthma and his doctor recommended taking up swimming as a way of improving his condition. Bryce had further tests done 5 years ago, including an echocardiogram (ultrasound) which provided an image of his heart. He again had an echocardiogram on his heart last week.

a. List three chronic cardiovascular adaptations Bryce would have experienced as a part of his triathlon training, and discuss how the adaptation leads to improved performances in the Triathlon. **6 marks**

Chronic Cardiovascular Adaptation	Performance Benefit
1.Increased stroke volume/cardiac output **If SV increases, Q must increase by default / as a matter of course.**	More blood ejected from heart per beat which supplies greater amounts of oxygen & fuels. Triathlete able to work aerobically sooner and work at higher intensities aerobically. Greater amounts of wastes/metabolic by-products removed delaying accumulation and contributing to faster oxidation/removal.
2. Increased blood volume	More blood = more oxygen carrying capacity and increasing amount

	of aerobic ATP produced.
3.Increased elasticity of arteries/blood vessels	Blood vessels contribute to faster supply of oxygen, fuels BUT more importantly return from the muscles to the heart of wastes happens more efficiently/quickly. Triathlete will have delayed accumulation of wastes and hence delayed fatigue during the event.
4. Increased contractility / elasticity of heart/cardiac muscle	Cardiac muscle able to pump out more blood per beat – as per increased SV or Q.
5. Increased capillarisation at muscle sites	Muscle has greater oxygen and fuel supply and greater ability to extract oxygen (higher a-VO2 diff) – as per increased blood volume.

b. The more Bryce trained for the triathlon, the harder he found it to achieve the same rate of improvement – i.e. it took longer for him to experience any gains. Identify the training principle evident in this example and in your own words discuss how it applies to all sports training. **3 marks**

Training principle: **Law of diminishing returns** **(1 mark)**

Application to sports: **The closer an athlete is to their genetic potential, the slower their rate of improvement will be.** **(2 marks)**
Or..
The initial rate of improvement when training commences will be greater than that evident as training continues and improvements occur.
Or..
When athletes start training, the rate of improvement is rapid, but as they improve, this rate lessens as they approach their genetic limits.

c. The training Bryce has undertaken for the triathlon would also have resulted in chronic muscular adaptations. Apart from increased mitochondria size & number, list two other muscular adaptations he is likely to have experienced. **2 marks**
Cannot state increased mitochondria size & number (focus on slow twitch aerobic adaptations)

- **increased capillary supply to muscle fibres, improving gaseous exchange & movement of fuels / wastes**
- **increased myoglobin content (transports oxygen from the cell membrane to mitochondria)**
- **increased size of slow twitch fibres, allowing more glycogen to be stored**
- **increased oxidative enzymes leading to more free fatty acids being used to produce ATP (glycogen sparing)**
- **increased a-VO^2 difference allowing for more oxygen to be extracted from blood directed to the muscles**

d. Bryce's coach has set him a fairly high work-rate to cycle at during training sessions. This has been set at 87% maxHR and when Bryce told his PE teacher he seemed a bit puzzled and said "Mate, that's above your LIP, are you sure you heard your coach correctly?"

Clearly discuss how it is possible for Bryce to cycle at 87% maxHR for 35 minutes. **2 marks**

As people improve/increase their LIP, they are able to work at higher intensities whilst still working aerobically. (Highest recorded LIP – 94% maxHR) Because of this, working at 87% maxHR would not see any accumulation in H+ which would typically occur I n people with lower values of LIP.

Question 6 (4 marks)
The following graph shows the heart rate and lactate responses to a graduated cycle ergometer test performed by a Veteran (35 year-old) Triathlete being tested before going overseas, to represent Australia.

a. Apart from increased muscle temperature, list two acute muscular variables likely to be seen as the test progresses.

2 marks

- **Acute muscular responses include:**
- **Increased fibre / motor unit recruitment**
- **Increased lactate production**
- **Decreased fuels (ATP and PC @ high intensities and glycogen/triglycerides at sub-max intensities)**
- **Increased a-VO2 diff (accepted as muscular or cardiovascular)**

b. When the cycle speed goes above 35kph, the athlete struggles to keep going but manages to do so by using a couple of psychological strategies. List two strategies that might be used towards the end of this test to enable the athlete to keep going.

2 marks

Psychological strategies to improve concentration and/or arousal

- **Positive self-talk**
- **Positive / energising imagery**
- **Following set-plans/goals for the ride (following a set or predetermined routine)**
- **Switching to a narrow internal focus**

Question 7 (7 marks)
The following is an extract from a training log belonging to a Year 12 student completing her 6-week program during Term 3 this year.

Exercise number	***Exercise***	***One min. max.***	***75% max***	***Reps Week 1***	***Reps Week 2***	***Reps Week 3***	***Reps Week 4***	***Reps Week 5***	***Reps Week 6***
1	**Skipping**	100	75	75	82	90	105	112	130
2	**Sit-ups**	20	15	15	17	19	25	37	49
3	**Press-ups**	25	19	19	21	23	27	41	53
4	**Squat jumps**	35	26	26	29	32	36	49	52
5	**Shuttle runs (10 m)**	32	24	24	26	29	34	46	59
6	**Pull-ups**	6	4	4	5	6	8	10	15

a. What is this type of training known as? **1 mark**

Circuit training

b. How has overload been applied to this method? **2 marks**

By increasing the repetitions

c. Has overload been applied correctly? Briefly discuss by using examples from his program. **2 marks**

No, even though the overload is within the 2-10% range, it should not our every week as it is unlikely that adaptations would occur in such a short time span, thus it is likely that overtraining would occur.

d. List two **different** ways he could have applied overload to his program, other than those evident above.

2 marks

Increase the sets; increase the number of exercises in the program; reduce the time taken to complete the program; apply weights during some exercises; reduce recovery between exercises

Question 8. (12 marks)

Arizona coach Sean Miller aggressively tries to make a point to one of his players as he is subbed off after registering his 4th foul.

a. By referring to the photo, if the player was already over-aroused due to his team falling behind with only 3 minutes of play left, what effect would the coach's actions have on the player's performance when he returns to the court? Briefly discuss. **2 marks**

The coach's aggressive actions (pointing his finger in his face, showing discontent with facial expressions and yelling) would increase the player's arousal levels and if they are already over aroused, this would most likely lead to decreased performance levels upon returning to the court.

b. It is highly likely that the basketball player is at the autonomous stage of learning. Provide an example of an individual constraint the coach may focus on in an effort to improve the player's performances – clearly discuss how improving this factor might bring about improvements. **2 marks**

Individual constraints are characteristics of the individual that influence movement including: weight, body composition, fitness (speed, agility, etc), motivation, confidence, perception skills, learning styles and tactical knowledge.

Responses must link the individual constraint and how the coach can use it to bring about improved performances, e.g.

- **The coach may focus on improving components of fitness directly related to basketball that contribute to improved physical performance. Improved local muscular endurance will allow the player to keep performing for longer at high intensities and delay fatigue / performance drop off.**
- **The coach may focus on improving decision making/tactical skills based on what opponents are doing – as soon as the player detects a set play from opposing teams he reacts to counter this, providing more effective defence.**
- **The coach focusses on improving player's ability to self-monitor arousal levels and adopt strategies to keep this as close to optimal as possible throughout the game., leading to improved performance levels.**

c. Briefly discuss why the Semo agility test would be a better selection than the Illinois agility test to assess the agility of basketball players. **2 marks**

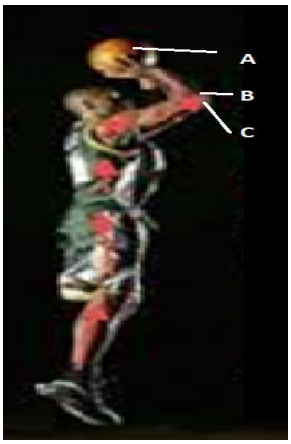
The Semo agility test is multi-directional and better replicates the actions/movements players would make during a game than he Illinois agility test which is unidirectional.

d. A photo shows a basketball player taking a jump shot.

(i) Briefly discuss how force summation is used by the player to improve the force applied to the basketball at point of release. **2 marks**

Force summation starts in the calves, moves onto the quads, trunk/torso, biceps, triceps and into the wrist, before finally being applied to the ball via the fingers. Maximal velocity at point of release occurs as momentum is generated in a sequential manner.

(ii) When considering the basketballer's shooting arm, clearly identify the force, axis and resistance and place your answer in the table below, as well as identifying the class of lever shown: **4 marks**



Letter	**Force** or **Axis** or **Resistance**
A	**Resistance**
B	**Force**
C	**Axis**
Class of lever	**Third - the triceps is connected to the forearm by a tendon close to the elbow joint, further emphasising this action as a third-class lever.**

Question 9 (12 marks)

a. Briefly discuss how Bannister's recovery in between throws would be different from Darren Clark's recovery in between the semi-final and 400m final. **2 marks**

- **Bannister would use a passive recovery to replenish as much PC in between throws (major energy system = PC system)**
- **Clark would use an active recovery to speed up oxidation and removal of H+, followed by a passive recovery prior to the final to ensure as much PC as possible present in leg muscles. (major system = Anaerobic glycolysis system)**

b. Which one of the above two athletes, would most likely achieve the best "core muscle strength test"? **1 mark**

Bannister – greater requirement on transferring momentum from lower to upper body than 400m runner.

c. Clark completes 6 repetitions of a 300-metre section of an athletics track in 40 seconds, with 160 seconds recovery between repetitions.

i. What is the name given to this type of training? **1 mark**

Intermediate interval training (not just interval training)

ii. What is the predominant energy system being trained whilst undertaking this training? **1 mark**

Anaerobic glycolysis system

iii. Calculate the **work: rest** ratio being applied. **1 mark**

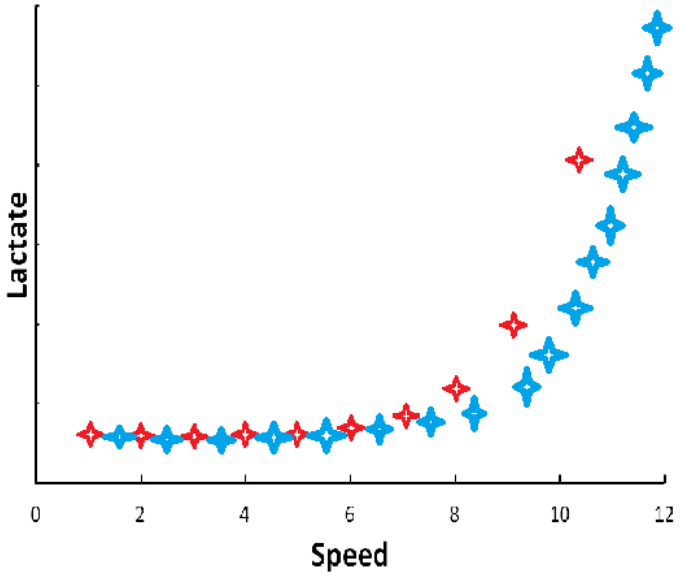
40:160 = 1:4

d**.** (i) As a result of their training, adaptations would have occurred to their muscles – specifically to their fast twitch fibres. Complete the following table by inserting the words ~ **increased, decreased or unchanged** to indicate the likely change following 2-3 years of training. **5 marks**

Characteristic	***Fast-twitch***
Oxidative enzymes	**Unchanged**
Glycolytic capacity	**Increased**
Mitochondria density	**Unchanged**
Capillary density	**Slight increase**
Myosin ATPase	**Increase**

(ii) The following graph shows the lactate levels of a 400m runner at the start of the 2015 season, in response to a graduated treadmill test.

On the same graph draw a line to indicate the lactate levels following 12 months of lactate tolerance training. **1 mark**



Question 10

Brendan is a promising young rugby player who has recently been selected to train with the Victorian team. The table below is an extract from his training diary which shows some of the activities undertaken during the physical session on Tuesdays, which is then followed by a skills session (2 hours later).

Activity	Sets & Reps
Side throws (medicine ball)	5 x 10
Zig Zag Hops	4 x 8
Overhead throws (medicine ball)	6 x 10

a. What type of training does this represent? **1 mark**

Plyometrics

b. How is the principle of 'specificity' being applied during this particular type of training? **2 marks**

The activities/actions (side throws/zig-zag hops & overhead throws) all mimic/replicate the actions used in a game of rugby.

c. Discuss two sociocultural influences that would have contributed to Brendan increasing his rate of skill development as a junior player. **4 marks**

- **SES – May have had access to higher rated coaches which would lead to quicker skill acquisition**
- **Family – support in the form of encouragement to play/practice, etc. so greater practice opportunities/motivation leading to faster improvements in skill**
- **Peers – having peers who also played/practiced rugby would contribute to greater motivation/practice and thus skill improvement**
- **Many cultures focus social activities on participation in sports, so weekends might be spent playing or watching rugby with friends or family. This would lead to improved understanding of how the game is played as well as providing more practice opportunities.**
- **Self-belief/perceived competence – With increased levels of self-belief performer more likely to practice with high frequency leading to improved skill development**

d. As Brendan improves is skill development, discuss two reasons why his coach would increase the practice variability, with particular emphasis on performance improvements

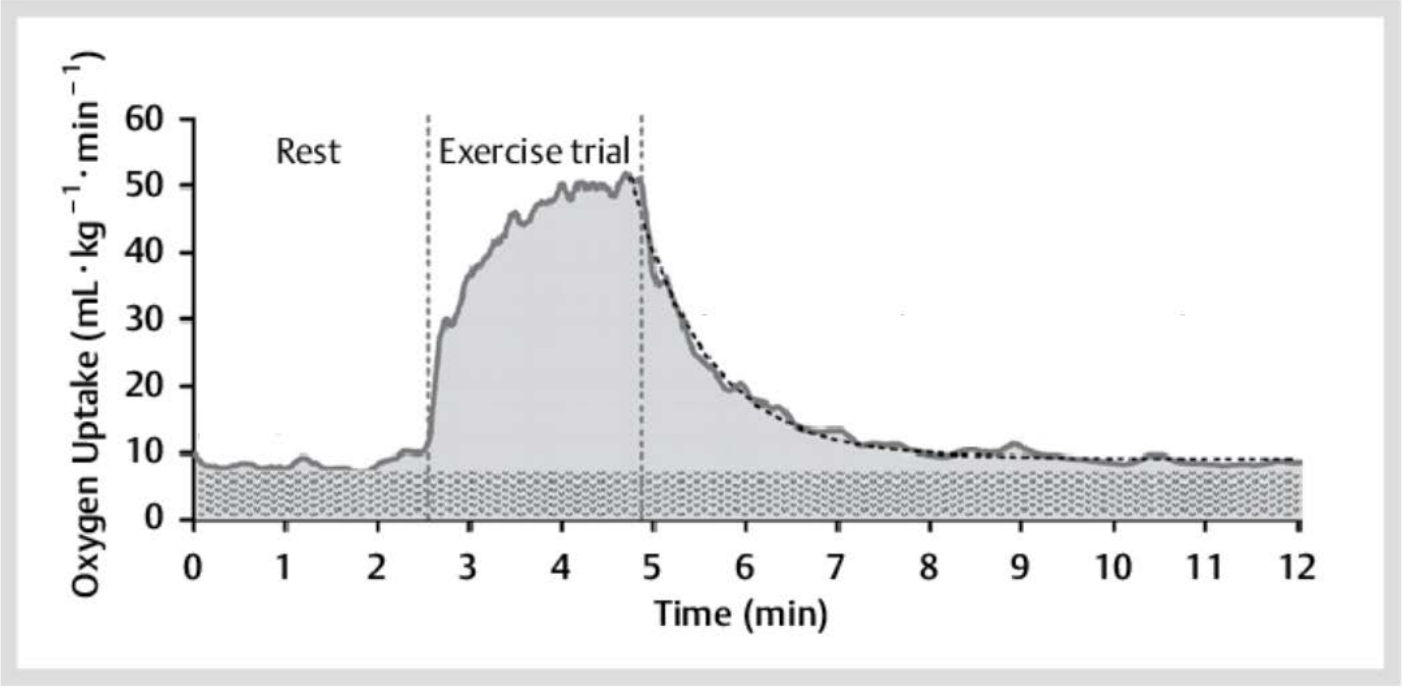
4 marks

Practice variability leads to:

- **More game-like simulations**
- **Greater problem solving from players**
- **Higher retention post-training and in a game (higher levels of learning)**
- **More external focus of attention on intended movements**

Question 11 (10 marks)

The following graph reveals the oxygen uptake during an all-out/maximal effort by a State Triathlon rep on a bicycle ergometer. The subject is able to cycle maximally for just over 2 minutes before experiencing severe localised fatigue requiring the test to be stopped.



a. Other than increased oxygen uptake, list two other acute respiratory responses to the cycle ergometer test. **2 marks**

Any two from: Increased respiratory rate, increased tidal volume, increased gaseous exchange/diffusion, increased ventilation

b. How long does the oxygen debt last for? **1 mark**

Recovery oxygen consumption above rest = 5 – 11 – 12 minutes. ANS Approx. 6-7 minutes

c. Assuming the subject does a passive recovery, list two key recovery mechanisms that would occur. Any two from:

Any two from: PC restoration / replenishment; Lactate/H+ oxidation and removal; conversion/returning FFA's back to adipose stores; increased oxygenation of blood;

2 marks

d. On the above graph, draw the likely oxygen consumption during rest, a maximal effort on the cycle ergometer followed by a passive recovery for an Australian Representative Triathlete. **3 marks**

e. It is likely that the higher performing Triathlete has a higher LIP. How would this be an advantage during a Triathlon? **2 marks**

A higher LIP allows performers to work at higher intensities whilst still working predominantly aerobically and delaying the point at which H+ starts to accumulate. This means triathletes can run, cycle and swim faster without accumulating H+ and contributes to quicker overall times.

Question 12 (3 marks)

Outline three ways maintaining a core temperature for longer in the marathon leads to improved performances and quicker running times. **3 marks**

Outline requires less detail than discuss when placed in the stem of a question. Responses can be in bullet point:

- **Maintaining a core temperature delays elevated body temperature and associated dehydration (1 mark)**
- **Delaying dehydration delays increases in blood viscosity and elevated HR**
- **Delaying dehydration decreases rate of blood, oxygen and fuels being redirected to the heart (away from working muscles) (1 mark)**
- **Maintaining core reduces likelihood of oxidative and glycolytic enzymes not working efficiently and contributing to either ATP production or oxidation of by-products**
- **Maintaining core temperature delays athletes going above their LIP, and accumulating H+ ions, and keeps them working aerobically at high intensities due to regular delivery of oxygen to working muscles – elevated body temp redirects oxygen away from working muscles.**

END OF EXAM