

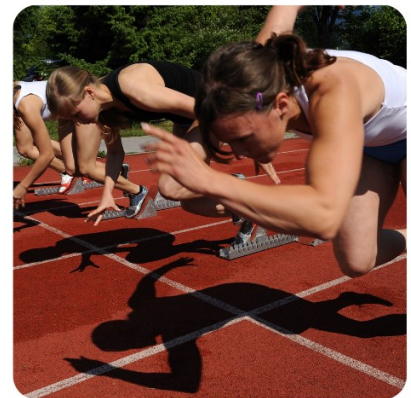
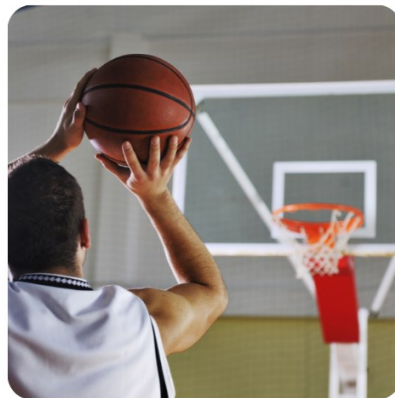


Answer Booklet

Applied Anatomy & Physiology/Skill Acquisition

Name _____

Class _____





Topic	Description	Pupil comments – How confident do you feel on this topic?
Energy Systems	Energy transfer during short duration/high intensity exercise. Energy transfer during long duration/lower intensity exercise. Impact of specialist training methods on energy systems.	
Impact of skill classification on structure of practice for learning	Types of practice	
Principles and theories of learning and performance	Stages of learning and how feedback differs between the different stages of learning. Learning plateau.	

Unit: Energy Systems

Anaerobic Energy Systems:

There are two anaerobic energy systems.

1. ATP-PC System
2. Anaerobic Glycolytic System (Lactic Acid System)

ATP-PC System:

ATP = Adenosine Triphosphate

PC = Phosphocreatine

This system can supply energy for **maximal** activity over a very short period of time – up to 10 seconds. Muscles have a store of phosphocreatine which can be readily broken down into creatine and **phosphate**. This breakdown results in one molecule of **ATP** being produced. Phosphocreatine is extremely limited, hence why a time limit of 10 seconds of intense exercise is present.

ATP phosphate maximal

Anaerobic Glycolytic System (Lactic Acid System):

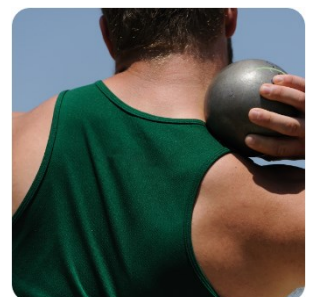
This system can supply energy for **submaximal** activity, up to a period of 3 minutes. This system results in the speeding up of the Krebs Cycle in order to produce energy at a **faster** rate. However, the cells cannot keep up with the speed and as a result not enough pyruvate or **oxygen** can be produced. Therefore, lactic acid is produced which causes pain and **fatigue** in the muscles.

This energy system produces two molecules of ATP being produced.

oxygen submaximal faster fatigue

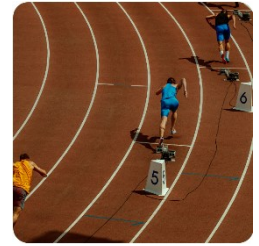
A shot putter is preparing their body for a throw. Explain which energy system will be used by the shot putter during their event.

- The shot-putter will use the ATP-PC energy system
- This is because shot-put requires maximal energy for a very short period of time



A 400m runner is preparing for a race. Explain which energy system will be used by the 400m runner during their event.

- A 400m runner will use the anaerobic glycolytic (lactic acid) system
- This is because 400m is a submaximal activity which takes longer than 10 seconds, but less than 3 minutes



Energy Continuum of Physical Activity:

The energy continuum is the sequence which covers the type of respiration required during exercise. It regulates which energy system will provide energy in any given activity.

Further to this it will also regulate which type of muscle fibre will be used during exercise. Remind yourself of the three types of muscle fibres:

Type I – Slow Twitch – Oxidative:

This slow twitch muscle fibre is most beneficial for endurance events such as marathon running or long distance swimming. Muscle fibres will be dark in colour and contain lots of myoglobin.

Type IIa – Fast Twitch – Oxidative Glycolytic:

This fast twitch muscle fibre is most beneficial for submaximal activity such as an 800m race. The muscles will be able to work at a relatively powerful rate and will not fatigue quickly.

Type IIx – Fast Twitch – Glycolytic:

This fast twitch muscle fibre is most beneficial for maximal activity such as weight lifting or shot put. The muscles will work at an explosive and powerful rate but they will fatigue very quickly.



Complete the table below to show how the energy continuum works.

Energy System	Number of ATP	How long does it last	Example of sport/event	Muscle Fibre Used
Aerobic	36-38	Up to several hours	Marathon Running	Type I Slow Twitch
Glycolytic/Lactic Acid	2	Up to 3 mins	800m Run	Type IIA – Fast Twitch
ATP-PC	1	Up to 10 seconds	Shot Put	Type IIX – Fast Twitch

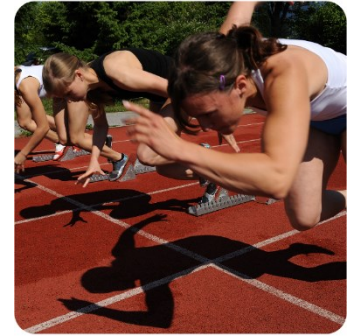
Pick two sports that you regularly take part in. How does the energy system/muscle fibres used differ between the two sports? Why?

Individual Pupil Answer



Energy Transfer during anaerobic activity:

The glycolytic/lactic acid system must produce energy rapidly for power/sprint activity. This rapid energy transfer will result in lactate being present.



Match the definitions given below to the key terms.

Lactate Accumulation – **The increase of lactate as a result of anaerobic activity**

Lactate Threshold – **The point during exercise at which lactic acid quickly accumulates in the blood**

OBLA - **Onset of blood lactate accumulation – The point at which blood lactate levels go above 4 millimoles per litre**

<p>The point during exercise at which lactic acid quickly accumulates in the blood</p> <p>The increase of lactate as a result of anaerobic activity</p> <p>The point at which blood lactate levels go above 4 millimoles per litre</p>
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The factors affecting the rate of lactate accumulation are given below. For each factor, explain how this affects lactate accumulation.

Intensity of exercise

Lactic acid is present during/following **submaximal** exercise. It isn't present during maximal exercise due to its short nature. It isn't present during long periods of exercise due to the oxygen present in the muscles.

Fitness of performer

The fitter a performer is, the longer it will take them to accumulate lactic acid

Vo2 Max of a performer

The greater the V02 max of a performer, the longer it will take them to accumulate lactic acid

Performer's OBLA



The OBLA will remain at 4mmol/l but a fit performer will take longer to get to this point during exercise

Find a partner and discuss which of the two of you would accumulate lactate faster during a 400m sprint. Explain your conclusions below.

Individual pupil answer

Energy Transfer during aerobic activity:

Oxygen consumption during exercise can be split into two categories.

Maximal Oxygen Deficit – When a performer lacks oxygen due to the intensity of the activity and anaerobic respiration occurs.

Submaximal Oxygen Deficit – When a performer lacks oxygen after exercising aerobically for a long period of time.

Explain what type of oxygen deficit would be present in a marathon runner towards the end of a race.

A marathon runner would suffer from submaximal oxygen deficit. This is because a marathon is an endurance event which requires aerobic respiration of a long period of time. Due to the long period of exercise, muscles will require oxygen to help them to recover.

Explain what type of oxygen deficit would be present in a javelin thrower.

A javelin thrower would suffer from maximal oxygen deficit. This is because javelin is a very short but intense activity. The muscles will require oxygen to help them to replace the ATP that has been used.

Oxygen consumption during recovery:

After taking part in exercise a performer will continue to breathe heavily for some time. This is because **EPOC** is taking place.

EPOC stands for excess post-exercise oxygen consumption. It is the **volume of oxygen consumed in recovery above the resting rate.**

EPOC occurs for several reasons:

- To repay the oxygen debt and begin to break down lactic acid
- To resynthesise ATP levels
- To resaturate myoglobin with oxygen

EPOC usually takes 2-3 minutes.



A 5000m runner has just completed a race. Explain how EPOC will aid her recovery.

After the 5000m runner has finished the race, they will continue to breathe heavily for some time because their muscles still require oxygen. They will have likely used a sprint finish and the oxygen consumed during EPOC will breakdown the lactic acid that has been produced. ATP levels will be replenished and the myoglobin found within the slow twitch muscle fibres will be resaturated.



Impact of Specialist Training Methods on Energy Systems

There are four **specialist** training methods that you need to understand. Match the descriptions given below to the correct training method in the table.

Specialist Training Methods	Description	Who should use it?	Which energy system is used during this training?
Altitude Training	Carried out at more than 2000m above sea level. Due to a low level of oxygen being present, the body will produce more red blood cells.	Marathon runners	Aerobic
High Intensity Interval Training (HIIT)	Alternates short periods of high intensity exercise, with periods of recovery.	Sprinters	Anaerobic Glycolytic/ATP-PC
Plyometrics	Uses bounding and jumping exercises to create muscular strength and power.	High Jumpers	Anaerobic Glycolytic/ATP-PC
Speed Agility Quickness	Includes the use of ladders and utilises short periods of intense exercise.	Rugby players	Anaerobic Glycolytic/ATP-PC

Descriptions:

Uses bounding and jumping exercises to create muscular strength and power.

Alternates short periods of high intensity exercise, with periods of recovery.

Carried out at more than 2000m above sea level. Due to a low level of oxygen being present, the body will produce more red blood cells.

Includes the use of ladders and utilises short periods of intense exercise.



Which specialist training method would be most suitable for you and your sport? Which energy system will be improved during training?

Individual pupil answer

Discuss the specialist training methods that could be used by a cyclist and which energy system this training method will help to improve.

A cyclist is most likely to benefit from altitude training as a specialist training method. This is because many stages of cycling tours take part in the mountains at altitude. The training will also help them to create more red blood cells which will improve their endurance at sea level. This training will help a cyclist to improve their aerobic energy system.



Energy Systems Exam Questions

1. A 400m runner is told that EPOC is occurring following a race. Explain what is meant by EPOC and describe three reasons why EPOC occurs. **(4 marks)**

Mark One – EPOC stands for ‘excess post-exercise oxygen consumption’. It is the volume of oxygen consumed in recovery above the resting rate.

Mark Two – EPOC occurs in order to repay the oxygen debt and begin to break down lactic acid

Mark Three – EPOC occurs in order to resynthesise ATP levels

Mark Four – EPOC occurs in order to resaturate myoglobin with oxygen

2. Explain what is meant by lactate threshold and OBLA. **(2 marks)**

Mark One – Lactate threshold is the point during exercise at which lactic acid quickly accumulates in the blood

Mark Two – OBLA stands for ‘onset of blood lactate accumulation. This is the point at which blood lactate levels go above 4 millimoles per litre.

3. Evaluate the specialist training methods that could be used by a high jumper and which energy system this training method will help to improve. **(3 marks)**

Mark One - A high jumper is most likely to use plyometrics training as a specialist training method.

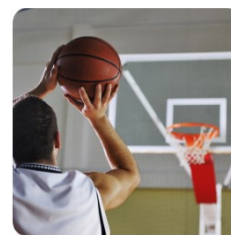
Mark Two - This is because the jumping and bounding exercises most closely replicate what is required during the high jump.

Mark Three - This training will help to develop the jumper’s ATP-PC energy system.



Unit: Types of Practice

Massed practice is where a skill is practiced until it is learned, without taking a break. This is usually for athletes who are **fit and experienced**.



Distributed practice is where the skill is practiced over several sessions or with rest breaks. This is usually for players of **low ability or fitness**.

Variable practice involves practicing the skill in a variety of situations so that it can be adapted within matches. **Open skills** are often learned through **variable practice**. This may mean changing the situation for each training session.

Mental Practice is when a performer imagines themselves taking part in a particular skill prior to a performance. It can help create **confidence** and reduce **anxiety**. It is easier for an elite performer to use as they know how a skill should look and feel. For example a footballer may imagine the striking of the ball before taking a free-kick.



Skill	Massed or Distributed Practice?	Is variable Practice required? Why?	Is mental practice required? Why?
A beginner learning archery	Distributed	No – The environment in archery is stable and doesn't change	Yes, concentration can be enhanced by using mental practice
A professional footballer learning a new free-kick technique	Massed	Yes, free-kicks are from different areas of the pitch and require different technique	Yes, there is time to imagine the flight of the ball before striking a free-kick
A professional hockey player learning a new dribbling technique	Massed	Yes, dribbling technique must vary depending on different opponents/areas of the pitch	Not so much, as the player will not have as much time to think about a dribble before it occurs
A beginner learning to putt in golf	Distributed	To an extent, the putting technique is always the same, although it requires a differing amount of force	Yes, a golfer has plenty of time to reduce anxiety by imagining their shot



What are the advantages and disadvantages of each type of practice?

Type of Practice	Advantages	Disadvantages
Massed	<p>Great for elite performers who have a high level of fitness</p> <p>Helps to create motor programmes within the memory</p> <p>Ensure that skills are improved as quickly as possible</p>	<p>Fatigue can be produced which could lead to injury</p> <p>Beginners may not have the fitness or motivation levels required to use this practice</p> <p>Beginners won't have a basic understanding of how the skill should look and feel</p> <p>Practicing without breaks ensures that the skill becomes automatic</p>
Distributed	<p>Allows for advice and feedback to be delivered between sessions/during rest</p> <p>Motivation is less likely to be lost as shorter intervals are used</p> <p>Allows for recuperation and recovery</p>	<p>Time consuming</p> <p>Will result in less progress for elite performers</p>
Variable	<p>Different drills will keep motivation high and decrease boredom</p> <p>Allows for open skills to be practiced in different situations</p>	<p>The learning of closed skills will not benefit from this type of practice</p>
Mental	<p>Can also be done during injury, helping to maintain memory of a skill</p> <p>Can help to stimulate the muscle receptors and prepare an athlete for performance</p> <p>Improves confidence and lowers anxiety</p> <p>Can be used during a warm-up, prior to a match or during a performance</p>	<p>If this is used poorly, it could actually create anxiety</p> <p>Training is required to use this practice effectively</p>



Types of Practice Exam Questions

Using an example from a sport of your choice, explain why a coach would use variable practice in order to improve performance. **(2 marks)**

Mark One – Variable practice could be used to teach an open skill such as passing in football

Mark Two – This is because the environment is unstable for the skill of passing in football, so variable practice is required

Accept Other Appropriate Answers

Explain two advantages of using mental practice in order to improve performance. **(2 marks)**

Mark One – Mental practice can improve confidence and lower anxiety

Mark Two – Mental practice can also be used during injury, helping to maintain memory of a skill

Accept Other Appropriate Answers

Evaluate the use of massed and distributed practice when coaching a group of elite performers in the sport of hockey. **(8 marks)**



A01 – 2 A02 – 3 A03 – 3

A01 – Knowledge of types of practice e.g.

- **Massed Practice** – Repeating a skill without rest intervals
- **Distributed Practice** – Taking regular breaks from a skill to allow for rest and recuperation

A02 – Application of practice used in the sport of hockey e.g.

- Massed practice is usually used by elite performers in order to create an automatic response to situations. For example the act of shooting in hockey could be repeated again and again until perfected
- Distributed practice would involve a short amount of time taking part in a drill such as dribbling, before taking a break. This will keep performers motivated and prevent fatigue
- Although elite performers, there will still be times that distributed practice is required to break down new skills or techniques

A03 – Evaluation of the required method of practice for elite performers e.g.

- The group of players are elite performers and therefore massed practice would be most suitable as the players will have the fitness levels and experienced motor programmes required to use this practice effectively

- Distributed practice would be time consuming for the elite performers and they wouldn't necessarily require the recovery time in between drills or sessions. However some distributed practice may be introduced when using new skills or tactics
- The coach should also consider using variable practice when teaching open skills such as dribbling, as well as encouraging mental practice to reduce anxiety and improve confidence of the players

Unit: Stages of Learning

All skills are learned. There are three stages of learning.

<u>Stage of Learning</u>	<u>Type of Performer</u>	<u>Description</u>	<u>Type of Feedback Required</u>
The Cognitive Stage	Novice/Beginner	-Performer lacks mental image -Observational learning -Requires instruction	Extrinsic Feedback
The Associative Stage	Mediocre Performer	-Trial and error used to improve performance -Movements become smoother	Both Extrinsic/Intrinsic Feedback
The Autonomous Stage	Expert/Elite Performer	-Skill is habitual -High level of consistency -Decisions made quickly	Intrinsic Feedback

Have a go at completing a set of 'keepy uppys' with a football. Explain which stage of learning you are currently at for this skill.

Individual Pupil Answer





Have a go at completing a cartwheel. Explain which stage of learning you are currently at for this skill.

Individual Pupil Answer

Have a go at bowling a cricket ball. Explain which stage of learning you are currently at for this skill.

Individual Pupil Answer



Complete the table below using three skills of your choice. (different to those shown above).

Sport	Skill	Stage of Learning	Why I am at this level
		Cognitive Stage	Individual Pupil Answer
		Associative Stage	
		Autonomous Stage	

Feedback:

Feedback in sport is vital for keeping performers **motivated**.

Use the descriptions below to complete the **description column** in the table. Try to explain why each type of feedback will/won't be useful at the cognitive or associative stages of learning?

Type of Feedback	Description	Useful at the cognitive stage of learning?	Useful at the autonomous stage of learning?
Intrinsic	Comes from the performer themselves, as they think about how they performed	No – A novice performer will not understand how the skill should feel	Yes – An expert will understand how the skill should look and feel
Extrinsic	Comes from an outside source e.g. coach/teacher	Yes – This is the only way that a novice will understand how the skill should look and feel	Yes, but to a lesser extent than when at the cognitive stage of learning
Knowledge of Performance	Gives reasons why the skill was successful or not – concerned with technique	No – A novice may not yet have the ability to understand the reasons why a skill is unsuccessful	Yes – An elite performer must fully understand the process of learning a successful skill
Knowledge of Results	Gives an indication of whether the skill has been successful – concerned with outcome	Yes – It is important that a novice understands a successful outcome in order to repeat the skill	No – An elite performer will already understand whether or not the intended outcome has been reached
Positive	Information about what was good – praise & encouragement	Yes – If only negative feedback is given, the performer will quickly become demotivated	Yes – Even elite performers still require praise and encouragement
Negative	Error correction and information about what is going wrong	Only limited as negative feedback can result in demotivation	Yes – Elite performers will have the mind-set to deal with negative feedback and make appropriate changes

Learning Plateau:

Plateau can be defined as 'a period of no improvement in performance'. Plateau can occur at various times within the learning stages.

Cognitive Stage – At this stage, rate of learning can be slow due to the performer not being comfortable with the skill

Associative Stage – At this stage, learning will take place at a rapid rate as the performer begins to master the skill

Autonomous Stage – At this stage, plateau can occur whereby the performer finds it difficult to improve any further

Pick one of the following skills. Start a stopwatch and keep going practising the skill until you feel that you have reached a learning plateau.

3 Ball Juggle

Basketball
Free Throw

Tennis Serve

Cricket –
Forward
Defensive Shot

Did you have previous experience within this skill? What stage of learning did you start at?

Individual answer

What stage of learning did you get to before you reached plateau? Individual answer

Why do you think plateau occurred?

Individual answer – may be linked to fatigue/boredom/difficulty/demotivation

Causes of Plateau:

Plateau can occur for a range of reasons. These can include...

- Task is too difficult for the level of the performer
- Fatigue
- Boredom/Lack of Motivation
- Low Quality Coaching

Strategies to Overcome Learning Plateau:

- Distributed practice sessions to allow for rest
- Reset goals or make tasks more challenging
- Offer extrinsic rewards and praise
- Use of mental rehearsal
- Make practices more fun/enjoyable

A 14 year old elite tennis player feels like she has plateaued in her ability to play backhand shots. Explain why this may have occurred and suggest methods you would use to help her to overcome this learning plateau. Give details in your answer.

The tennis player may have experienced low quality coaching. This may have led to them feeling bored which results in demotivation for the activity. Alternately, the performer may have experienced fatigue from taking part in intense training sessions too frequently.

To overcome the plateau, a coach could implement distributed coaching sessions which offer time for rest in between intense activity. Extrinsic rewards such as praise, medals or even prize money could also be offered. Coaching should also be enjoyable and focussed in order to prevent boredom.



Stages of Learning Exam Questions

1. Which one of the following types of feedback is concerned with technique rather than outcome?
(1 mark)

- A Intrinsic Feedback
- B Extrinsic Feedback
- C Knowledge of Performance
- D Knowledge of Results

Mark One – C

2. Which of the following is the 'second stage of learning where motor programmes are developed'?
(1 mark)

- A Cognitive Stage of Learning
- B Initial Stage of Learning
- C Autonomous Stage of Learning
- D Associative Stage of Learning

Mark One – D

3. Explain what is meant by the following types of feedback and using examples, state how each may affect the performance of an U9 netball team.

Positive: **(3 marks)**

Mark One – This type of feedback offers praise and encouragement.

Mark Two – An example is telling the team that their passes are accurate.

Mark Three – This is likely to keep the young children motivated, meaning that they enjoy the sport and want to continue to participate.

Negative: **(3 marks)**

Mark One – This type of feedback highlights what is going wrong/error correction.

Mark Two – An example is telling the team that their shooting is off target too often,

Mark Three – As the children are very young, this feedback is likely to discourage/demotivate them, meaning that some players may drop out from the team.

Accept other appropriate answers