Unit 5 Principles of Training

Learning objective: To develop your knowledge and understanding of the principles of training and the application of training principles to different athletes' training programmes

Knowledge Checklist

	Revised	Understood	What you need to do
Be able to name, describe and apply the principles of training (SPORT)			
Be able to name, describe and apply the principles of overload (FITT)			
Be able to name and describe the different types of training, the purpose of each training method, training thresholds and rest periods required between sessions			
Be able to analyse types of training			

Key Terms

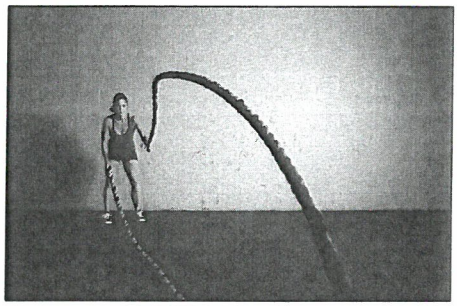
1. **Specificity** – how relevant training methods are to the sport or goal
2. **Progressive overload** – making training gradually harder in intensity or longer in duration to encourage positive adaptions from training
3. **Reversibility** – term given to explain that positive effects of training will be lost if training is not maintained
4. **Tedium** – being bored or uninterested
5. **Overload** – training should push the body harder each time, to maximise the benefits of training
6. **Frequency** – the number of times a person completes training
7. **Intensity** – how hard a performer works during training
8. **Time** – how long training takes place for
9. **Type** – the method or type of training used and its relevance to the sport or goal being trained for
10. **Circuit training** – training that consists of numerous stations, each targeting a specific component of fitness
11. **Continuous training** – exercise completed for a prolonged period of time, at a constant pace, without rest
12. **Fartlek training** – a mixture of continuous and interval training – the speed of exercise is manipulated
13. **Interval training** – high-intensity activities followed by periods of rest or low-intensity exercise
14. **Static stretching** – stretching a limb to its maximum range of movement and holding the stretch for a prolonged period of time
15. **Weight training** – the use of free weights to improve elements of strength and power
16. **Sets** – made up of reps; a specified number of reps constitutes a set
17. **Recovery** – the amount of time given to allow the body to replenish energy
18. **Repetitions/reps** – the number of times a skill or activity is carried out (in weight training it is the number of times a weight is lifted)
19. **Plyometric training** – high-intensity exercise involving hopping and bouncing movements
20. **Training zone** – the workload in which an athlete trains to improve a particular fitness component

Principles of Training and Overload

When planning a training programme the key principles of training and overload should be considered to maximise the positive effects of training.

Principles of Training (SPORT)

Principle	Description	Example
Specificity	The training should be specific to the sporting event that is being trained for.	A 100 m sprinter wouldn't find long-distance running beneficial to their sport.
Progressive **O**verload	The training should gradually progress in difficulty in either difficulty or intensity. This helps to prevent the performer plateauing in their progress. This can be achieved by using the principles of overload when training. This involves pushing the body past its normal level of intensity	A tennis player working at high intensities each session to allow them to work anaerobically for longer during a rally.
Reversibility	Regular training ensures positive adaptions due to training won't be lost (reversed)	A long-distance runner's muscular endurance will decrease if they cease to train due to an injury.
Tedium	Training should be varied with different activities to prevent boredom of the athlete	A golfer should not practise just putting for hours every day. They should vary activities to include different shots, different locations, different clubs, etc.



Principles of Overload (FITT)

The principle of overload in training is that training should constantly push the body further than last time. To do this efficiently, the following principles of overload should be followed:

Principle	Description	Example
Frequency	The number of times an individual participates in training.	This can vary depending on the training type, but involves how often they train, e.g. three times a week.
Intensity	How hard the performer is working during the training regime.	This can vary according to training type, but could include the weight they are lifting, or the aerobic/anaerobic capacity within which they are working.
Time	The duration of the training session.	One hour for continuous low-intensity training may be fine, but 20 minutes is sufficient for high-intensity interval training.
Type	Refers to the type of exercise being completed. Activities should be specific to the sport the performer participates in.	Whether it's aerobic or anaerobic and the type, e.g. continuous training for marathon runners (see next page).

Types of Training

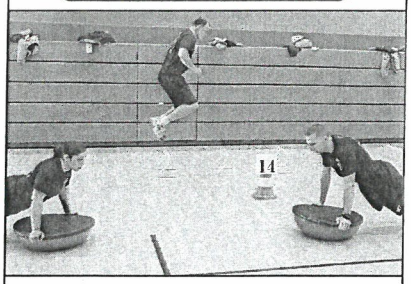
Different types of athlete must use the correct type of training to improve specific elements of their performance. Each type of training is suited to a specific type of athlete or to specific training goals.

Training Type	Outline	Training Purpose	Considerations	Training Threshold	Rest/Recovery
Circuit	Numerous stations that can be adapted to the training needs. Commonly formed of numerous stations.	Target different muscle groups or components of fitness (e.g. strength/endurance)	• Space needed/available • Equipment needed/available • Number of stations	Can be adapted to suit specific components of fitness	• 30-minute sessions • 30 seconds rest between each station • 3 complete circuits to be completed
Continuous	Exercise completed continuously without rest breaks at a constant level of intensity	Improve cardiovascular and respiratory endurance	• Should be at an intensity that pushes the athlete, but which is still maintainable over a long period of time • Should be specific to sport	• Calculated as a percentage of maximum heart rate • Aerobic exercise → 60 – 80% maximum heart rate	• ~ 3 times a week • 20-minute sessions • Days off (~ 4 days a week)
Fartlek	A mixture of continuous and interval training. Fartlek training varies the intensity of exercise.	Improve cardiovascular and respiratory endurance	• Intensity should vary • Exercises should be sport-specific (e.g. games players running, then jogging, then running again) • Ensure both aerobic and anaerobic systems are worked	• Dependent on aerobic/anaerobic system and training goals	• Dependant on intensity / duration of training
Interval	High-intensity activities followed by periods of rest or low-intensity exercise	Muscular endurance	• Work-to-rest ratio • Intensity of exercise for beginners	Depending on training aim: • Aerobic exercise → 60 – 80% maximum heart rate • Anaerobic exercise → 80% – 100% maximum heart rate	• 2:1 work-to-rest ratio
Static (stretching)	A type of stretching that involves a muscle contraction remaining at the same length (isometric contraction). Stretching to the muscle's limit for approximately 30 seconds.	Increase flexibility	• Do not 'bounce' when stretching • Do not overstretch muscles (injury risk)	N/A	• Stretches to be held for 30 seconds

Training Type	Outline	Training Purpose	Considerations	Training Threshold	Rest/Recovery
Weight	Using free weights to target and improve specific muscles or muscle groups. Made up of 'sets' and 'reps'	Increase strength	• Correct technique avoids injury • Spotters should be used at all times	• Dependent on aim of training • One-rep max = maximum weight that can be lifted in a single contraction • Increased strength = low reps, high weight (~70% 1RM, 4–8 reps) • Increased muscular endurance = low weight, high reps (<70% 1RM, 12–15 reps)	• Period of rest following each set
Plyometric	High-intensity jumping/hopping activities. Eccentric contraction – large concentric contraction.	Increase power	• Injury risk higher than other forms of training	• High intensity • Short duration	N/A

Advantages and Disadvantages of Training Types

Circuit Training



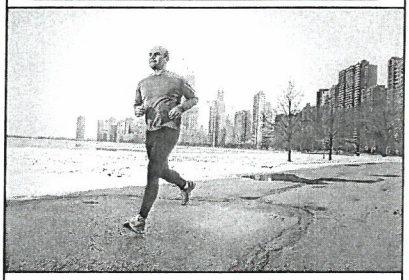
Advantages

- Training can be adapted to make activities simple or complex and different in intensity
- Adaptable for training different components of fitness
- Can be adapted to suit age and fitness levels
- Easy to monitor progress

Disadvantages

- Large space required to make circuit
- May require specialist equipment for certain activities
- May be difficult to appropriately set work:-to-rest ratio

Continuous Training



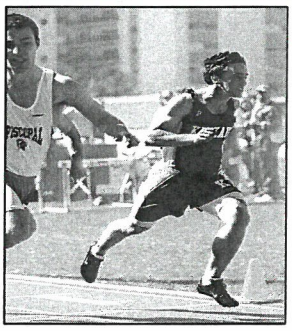
Advantages

- Little or no equipment required
- Running can be completed nearly everywhere
- Simple and cheap to do

Disadvantages

- Can become tedious
- Injury due to repetitive overuse of limbs and muscles (e.g. shin splints)
- Can take a long time to complete
- Only 100% suitable for continuous sports (e.g. running and swimming)

Fartlek Training



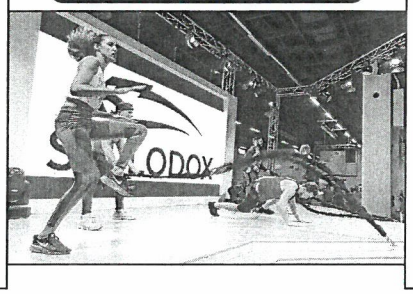
Advantages

- Is more varied than continuous training – reduces tedium
- Can be tailored to suit more 'game' sports (e.g. football, hockey, basketball)

Disadvantages

- Not suitable for all sports/athletes

Interval Training



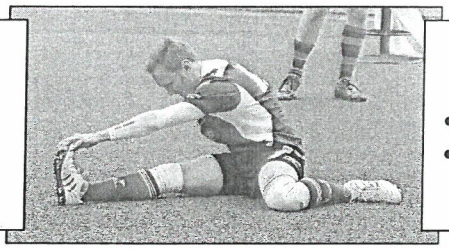
Advantages

- Burns off body fat (weight loss)
- Can be adapted easily to suit athlete
- Can be quick to complete
- Can be used to improve both the aerobic and anaerobic systems

Disadvantages

- Overtraining / high intensities can lead to injury
- High motivation levels are required by the athlete
- Exercise intensities too high can lead to nausea

Static Stretching



Advantages

- Increased flexibility
- Can be completed by anyone
- Limited risk of injury

Disadvantages

- Overstretching can lead to injury
- Time-consuming

Weight Training

Advantages

- Can be adapted to suit different components of fitness
- Relevant to any sport
- Relatively simple to complete
- Limited equipment required

Disadvantages

- High risk of injury (weight too heavy or incorrect technique)
- High levels of motivation required

Plyometric Training

Advantages

- Improves power, speed and strength
- Relatively little equipment required

Disadvantages

- High risk of injury

1. Match the principles of training to the correct statements.

Specificity	*'I was recently picked to join the British squash team. My coach is making training sessions harder every week so I am at the right fitness levels to compete at the highest levels.'*
Progressive overload	*'I am a 200 m sprinter for my local athletics club. My coach has changed by training plan because before I included long jogs and agility training as part of my routine.'*
Reversibility	*'Sometimes I complete circuit training because it gives me a variety of activities to complete such as press-ups, skipping and lunges.'*
Tedium	*'I often vary my training routine by using different training methods, so that I don't get bored. This helps maintain my motivation levels.'*
	'I recently broke my leg in a rugby match so I cannot train or compete until it has healed.'
	'Sometimes I complete circuit training because it gives me a variety of activities to complete such as press-ups, skipping and lunges.'

2. Explain how the principles of overload should be used to improve the fitness and skills of a football player.

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3. For each of the following training types, name a sport or an athlete that would benefit from the training method, and justify why you picked that sport.

	Fartlek Training	Weight Training	Continuous Training	Static Stretching
Sport/ Athlete				
Justification				

1. Continuous training is a popular training method.

   Discuss the suitability of continuous training for a football player.

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   (3 marks)

2. Training should be correctly tailored to the athlete taking part to maximise performance.

   Outline **two** principles of training that should be considered when planning a training session.

   1. .....

   2. .....

   (2 marks)

3. A hockey player is looking to apply the principles of overload in their training session. Evaluate the importance of this principle for training in hockey.

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   (6 marks)

Unit 5 Optimising Training and Preventing Injury

Learning objective: To develop your knowledge and understanding of injury prevention and methods used to optimise training. To develop knowledge of altitude training and seasonal training.

Knowledge Checklist

	Revised	Understood	What you need to do
Understand how to calculate and use training thresholds (weights and heart rates)			
Explain how training thresholds are used to train different fitness components			
Be able to describe strategies used to prevent injury			
Explain altitude training: how it is completed and the effects on the body			
Be able to describe the three seasons of training and what fitness components are trained in each season			

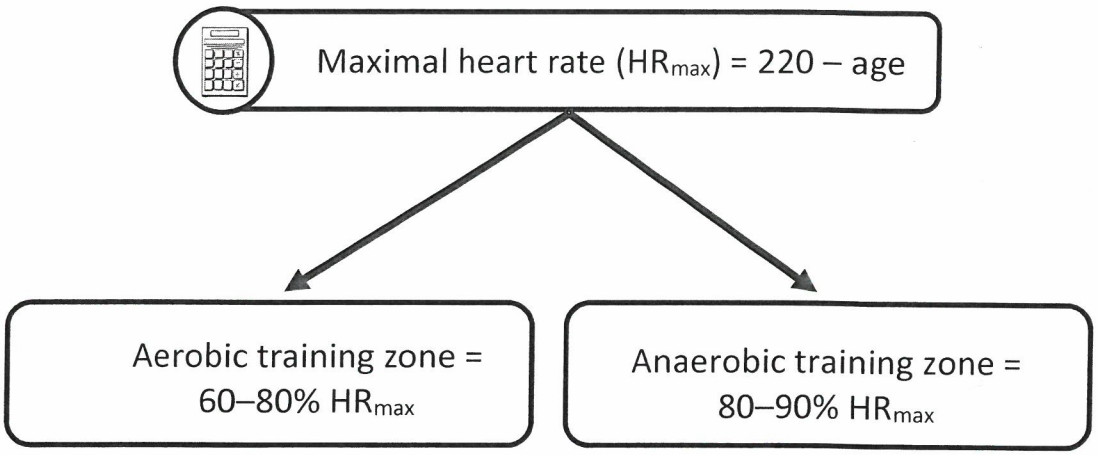
Key Terms

1. **Training threshold** – a performance threshold that an athlete exercises in (either by weight or heart rate)
2. **Maximal heart rate** – the maximum number of heartbeats per minute of an individual
3. **Aerobic training zone** – training aerobically, commonly exercising at 60–80% of maximal heart rate
4. **Anaerobic training zone** – training anaerobically at 80–90% of maximal heart rate
5. **One-repetition maximum** – the maximum weight an individual can lift in a single contraction
6. **Altitude** – the height of an object or area above sea level
7. **Pre-season** – period of time in an athlete's calendar following post-season and preceding competition season
8. **Competition season** – season in which athletes compete competitively (follows pre-season and precedes post-season)
9. **Post-season** – the rest period for athletes following competition season

When training, it is important to exercise at the correct intensity to effectively work a particular component of fitness. This is called a **training threshold**. Training types can also be adapted to benefit particular fitness aims; for example, circuit training can be altered by changing the activities at each station and the time-to-rest ratio between stations.

Calculating Training Thresholds/Zones

Training zones are used to control whether an athlete is working anaerobically or aerobically when exercising. To monitor whether an athlete is working aerobically or anaerobically, the athlete is instructed to work at a particular percentage of their maximal heart rate.



One-repetition Maximum (1RM)

When using weights, or when weight training, it is important for the athlete to know their one-repetition maximum (1RM). 1RM is the maximum weight an athlete can lift in a single contraction. This allows them to work at varying intensities of their 1RM, changing the type of training they are completing. In Chapter 6, the test to measure 1RM was outlined.

Equipment and Setup	Protocol
• Weights, bench press machine • Performer must know, or work out their maximum one-rep max (the maximum amount they can lift)	• The mass of the one-rep max is divided by body weight to give a score • Score is compared to previous research data • Maximal strength test = mass (kg) ÷ body mass (kg)

Strength/Power Training

70% of 1RM

Muscular Endurance

<70% of 1RM

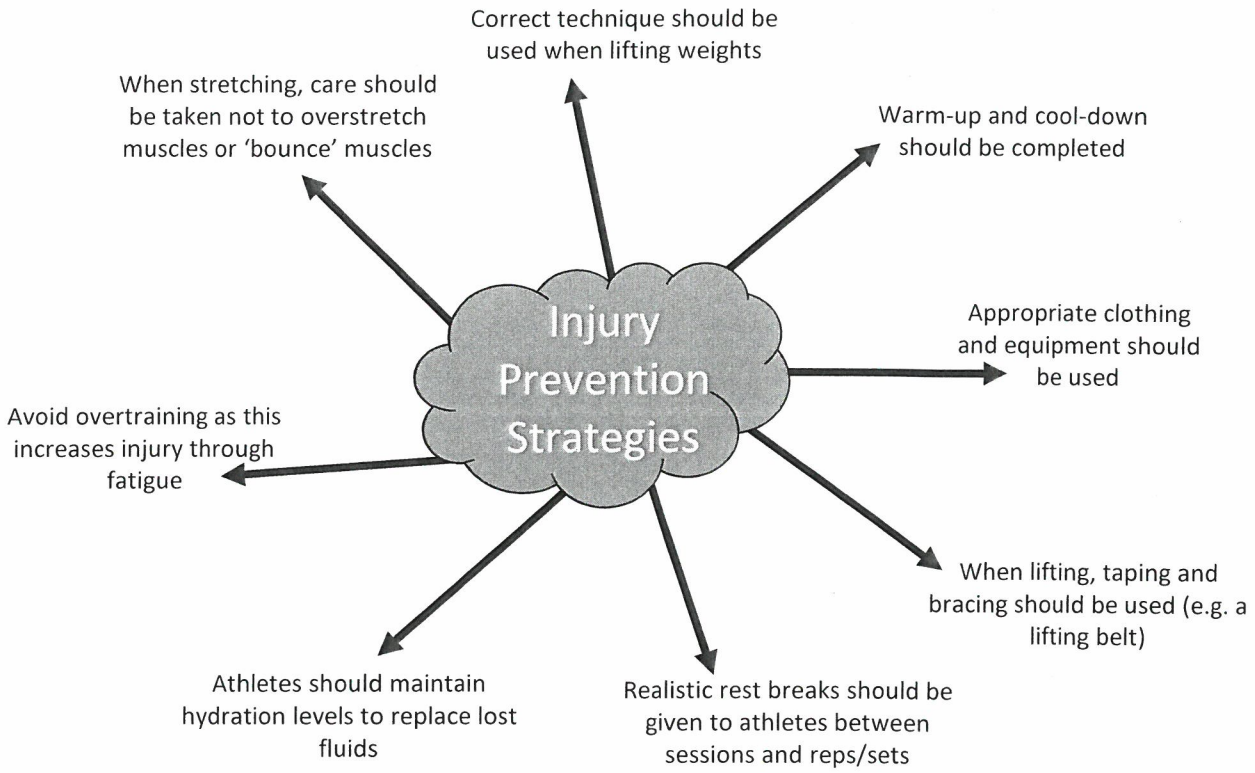
Sets and Reps

As strength/power training and muscular endurance training target very different fitness components, weight training must be adjusted to match this. This is achieved by altering the sets and reps an athlete completes. **Set** is the name given to a group of repetitions that will be completed one after another (e.g. one set may be comprised of 15 repetitions). A **repetition** is completing the movement once (e.g. lifting a weight once = 1 rep, lifting a weight five times = 5 reps).

- Strength/power training sets should use high weights and low reps – three sets of 4 to 8 reps
- Muscular endurance training sets should use lower weights but higher reps – three sets of 15 reps

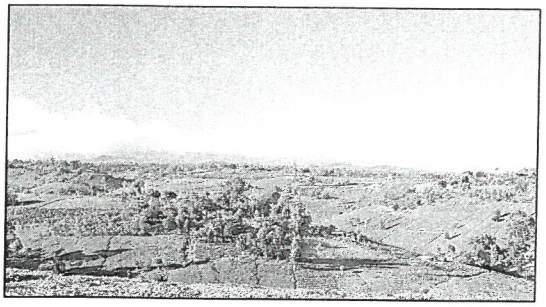
Considerations in Preventing Injury

Training can benefit the performer in a wide range of ways, depending on the type of training they are completing. However, it is important to always complete training safely to avoid injury. If injury occurs, any benefits from training may be lost, as the performer cannot carry on training until they have recovered.



Altitude Training

Athletes who take part in aerobic events such as marathon running often resort to altitude training in order to maximise the adaptations that they experience during their training programme. Altitude training is the process of training in terrains high above sea level. At high altitude, there is less oxygen in the atmospheric air, reducing the capacity of blood being carried to the working muscle cells. This initially leads to a reduction in performance as an athlete finds it hard to breathe in enough oxygen to fuel their normal aerobic capacity. However, after acclimatising to the atmosphere, the athlete's body begins to produce more red blood cells. Having more red blood cells means more oxygen can be taken from the limited supply in the atmospheric air, and transported to the muscles.

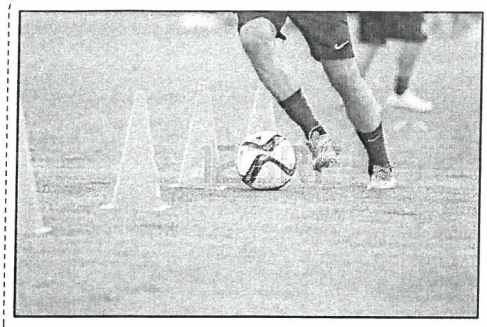


Kenya is a popular place for runners to train. This is because Kenya has very high areas to train in. At its highest, the Kenyan landscape can reach up to 5,000 m – although runners wouldn't train this high!

Benefits of Altitude Training	Limitations of Altitude Training
• Benefits aerobic athletes, e.g. marathon runners, cyclists • Increased red blood cell count in the body • Increased aerobic efficiency once the athlete returns to sea level	• Effects of altitude training are not permanent • Some athletes will get altitude sickness • Training at altitude is hard – some athletes may not be able to complete training

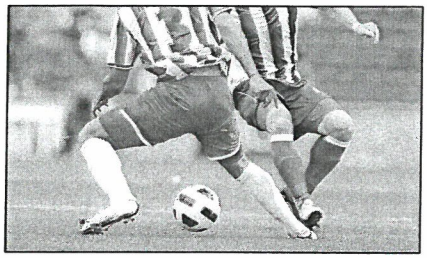
Seasons of Training

Within a year, or sporting calendar, athletes will go through three different 'seasons' of training. This is because it would not be possible for an athlete to be performing at 100% for the whole of the year. Therefore, athletes tailor their training around competitions and major events. The three seasons of training are **pre-season**, **competition** and **post-season**.



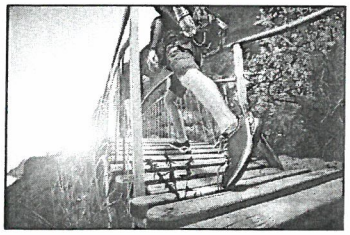
Pre-season (preparation)

The athlete will be at base levels of fitness. In this stage the primary aim will be to improve general fitness levels. Normally, this is the aerobic fitness of the athlete. By the end of pre-season, athletes should be at a competitive level of performance. Individual skills can also be worked on in pre-season.



Competition (peak/playing) season

Fitness levels (carried over from pre-season) need to be maintained throughout the competition season to compete at the highest levels. Skill sets will be continually trained.



Post-season (transition)

Athletes are allowed to rest and recover following the competitive season. Some exercise should still be undertaken to retain some fitness levels in preparation for pre-season.

Revision Activities - Unit 5

1. a. Calculate the maximal heart rate of a female marathon runner who is aged 33.

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b. As a marathon runner, what percentage of her maximal heart rate would she need to train in?

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c. Calculate the maximum heart rate the marathon runner should train at, to train aerobically.

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2. A weightlifter has a bench press 1RM of 168 kg.

Calculate the minimum weight the weightlifter should be lifting to improve their strength.

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3. Give three examples of athletes who would want to train at altitude. What do they all have in common?

1. .....

2. .....

3. .....

4. Using a sport of your choice, name and describe the three training seasons.

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2. .....

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3. .....

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1. Define the terms 'aerobic training zone' and 'anaerobic training zone'.

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(2 marks)

2. Outline **two** injury prevention strategies used by a weightlifter when training.

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(2 marks)

3. Outline **two** benefits of altitude training to an elite marathon runner.

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(2 marks)

4. Athletes must plan each year to ensure that they are at full fitness in time for major competitions.

Identify two characteristics of pre-season training.

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(2 marks)

Unit 5 Warm-ups and Cool-downs

Learning objective: To develop your knowledge of effective warm-ups and cool-downs and the effect these have on the body and performance

Knowledge Checklist

	Revised	Understood	What you need to do
Be able to identify the key components of a good warm-up			
Explain the effects of a good warm-up on the body			
Be able to identify the key components of a good cool-down			
Explain the effects of a good cool-down on the body			

Key Terms

1. **Stretching** – the process of increasing flexibility by lengthening (stretching) the muscles about a limb or joint
2. **Mental preparation** – the umbrella term used to describe the processes of increasing focus and motivation used for sport
3. **Lactic acid** – a waste product of anaerobic processes. This acid causes fatigue in the muscles.
4. **DOMS** – (delayed onset muscle soreness) the fatigue and soreness felt by muscles hours to days following exercise

Constituents of a Good Warm-Up

Warm-ups are an important consideration for athletes. Warm-ups can increase performance through stretching, increasing the range of motion (flexibility) of an athlete as well as reducing the likelihood of injury.

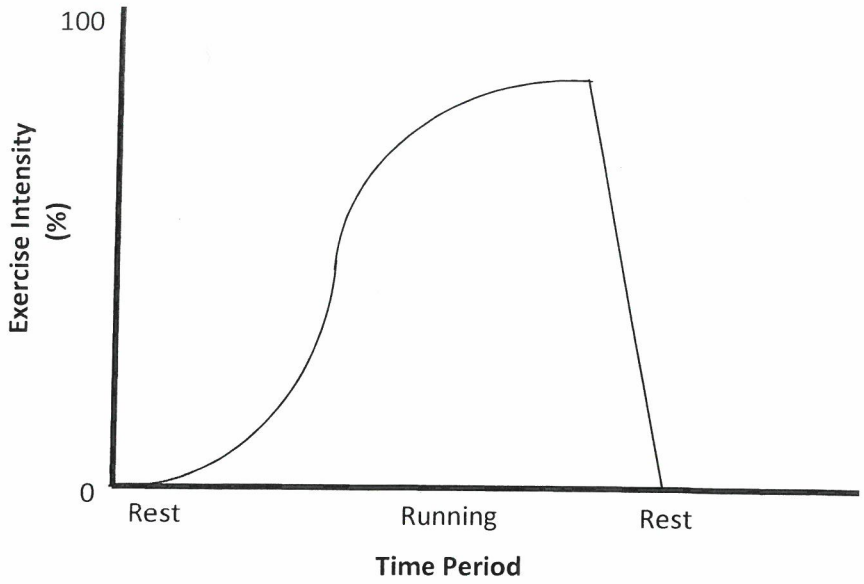
Components of an effective warm-up	Benefits of an effective warm-up
Pulse should be raised gradually	• Body temperature is gradually increased, preparing the body for exercise • Increased amount of oxygen to the working muscles • Gradual preparation of the body for exercise reduces the shock exercise that will have on the body
Stretching	• Stretching increases the range of movement about a joint • Reduced likelihood of injury
Sport-specific skill-based drills	• Athlete is able to practise sport-specific skills in preparation for exercise
Mental preparation	• The athlete will be physiologically and psychologically prepared

Constituents of a Good Cool-Down

Cool-downs are used by athletes to gradually bring their bodies back to their resting states. They are also used to reduce the effects of fatigue on the athlete in the hours and days following exercise.

Components of an effective cool-down	Benefits of an effective cool-down
Maintain breathing rate and heart rate	• Reduced shock of stopping exercise on the body • Allows the body to recover
Gradually reduce the intensity of exercise being undertaken (gradually reducing breathing rate and heart rate	• Removal of lactic acid, carbon dioxide and other waste products from the body • Reduced likelihood of injury/fatigue
Stretching	• Helps to prevent delayed onset muscle soreness (DOMS)

1. Below is a graph mapping the intensity of exercise undertaken by a recreational runner during training.



Identify a feature of this exercise regime that is missing, and outline the benefits of this feature to the athlete.

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2. Describe the benefits that an effective warm-up has on an athlete.

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3. How would mental preparation and sport-specific drills help a professional football player in preparation for a match?

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1. Which of the following is a benefit of an effective warm-up?

A	Allows the body to recover from exercise	☐
B	Removal of lactic acid and waste products	☐
C	Athlete is able to practise sport-specific skills in preparation for exercise	☐
D	Prevents DOMS	☐

(1 mark)

2. A cool-down is often used by athletes following performance or exercise.

State **two** reasons why athletes use cool-downs.

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(2 marks)

