

# REVISE BTEC TECH AWARD

## Sport

# REVISION GUIDE

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Published by Pearson Education Limited, 80 Strand, London, WC2R 0RL

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Typeset and illustrated by PDQ Media

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First published 2022

22 21 20 19

10 9 8 7 6 5 4 3 2 1

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 978 1 292 43614 2

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Printed in Slovakia by Neografia

Acknowledgements

<to be updated>

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# Introduction

## Revising Component 3 of your BTEC Tech Award

This Revision Guide has been designed to support you in preparing for the externally assessed component of your course.

The assessment for Component 3, Developing Fitness to Improve Other Participants Performance in Sport and Physical Activity, is in the form of a paper comprising short, long and extended writing questions. This will be completed under supervised conditions in a specified time. This assessment is likely to take place towards the end of your course. You will be expected to link knowledge and understanding with the other components.

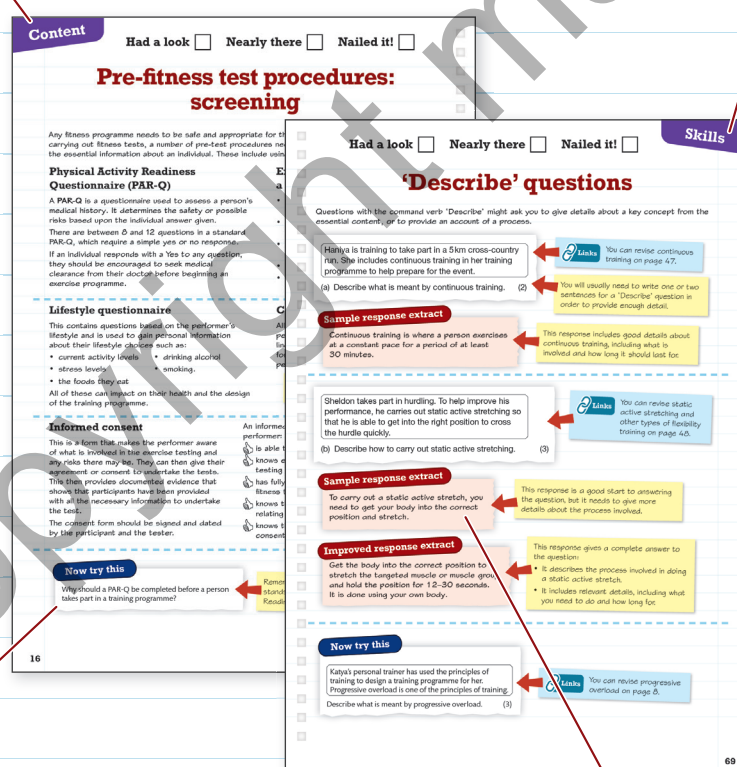
## Your revision guide

Each unit in this Revision Guide contains two types of pages, shown below.

**Content** pages help you revise the essential content you need to know for Component 3.

**Skills** pages help you prepare for your assessment.

Skills pages have a coloured edge and are shaded in the table of contents.



Use the **Now try this** activities on every page to help you test your knowledge and practise the relevant skills.

Look out for the **sample response extracts** to example assessment tasks on the skills pages. Post-its will explain their strengths and weaknesses.

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Had a look ☐Nearly there ☐Nailed it! ☐

# The importance of fitness for successful participation in sport

There are a number of different components of fitness. These are grouped into components of **physical fitness** and components of **skill-related fitness**. Many sports will require high levels of one or more specific components of fitness in order to perform well in that sport.

## Components of physical fitness

- **Aerobic endurance:** required for the cardiovascular system to keep supplying oxygen and nutrients to the body during events or sports lasting more than 30 minutes such as long-distance running.
- **Muscular endurance:** required for the muscles to be able to keep contracting for sports lasting more than 30 minutes such as cycling.
- **Muscular strength:** required for sports and events that require high levels of force such as throwing a shotput.
- **Speed:** required for sports or events requiring fast movement such as 100 m sprint.
- **Flexibility:** required for activities needing a wide range of movement around a joint such as gymnastics or martial arts.
- **Body composition:** particular types of body composition can be required to perform well in certain sports such as gymnastics requiring low body fat or rugby players having a high muscle mass.

## Components of skill-related fitness

- **Power:** required for explosive movement such as vaulting in gymnastics or performing a lay up in basketball.
- **Agility:** required for activities that need quick changes of direction such as dodging the opposition in a team game or in freestyle skiing.
- **Reaction time:** required for any activity where a quick decision or response to a stimulus is needed such as a swimmer diving into the pool to start a race.
- **Balance:** required for an activity where the person needs to control the distribution of their weight or to remain upright and steady such as a gymnast on a balance beam.
- **Coordination:** required for any activity where the person is having to move two or more body parts and can include the use of sporting equipment. For example, in tennis, the hand, eyes and tennis racquet all need to be coordinated to allow the person to connect with the tennis ball.

## Team sports

In many team sports, specific players will require high levels of different components of fitness to play well in their position.



In football, a goalkeeper will need high levels of power to be able to jump up high to reach an overhead shot on goal, high levels of flexibility when diving to save a ball, agility when changing direction to save a deflected shot and fast reaction times to respond quickly to a penalty shot.

## Now try this

Sheldon takes part in open-water long-distance swimming events that take one hour or longer to complete.

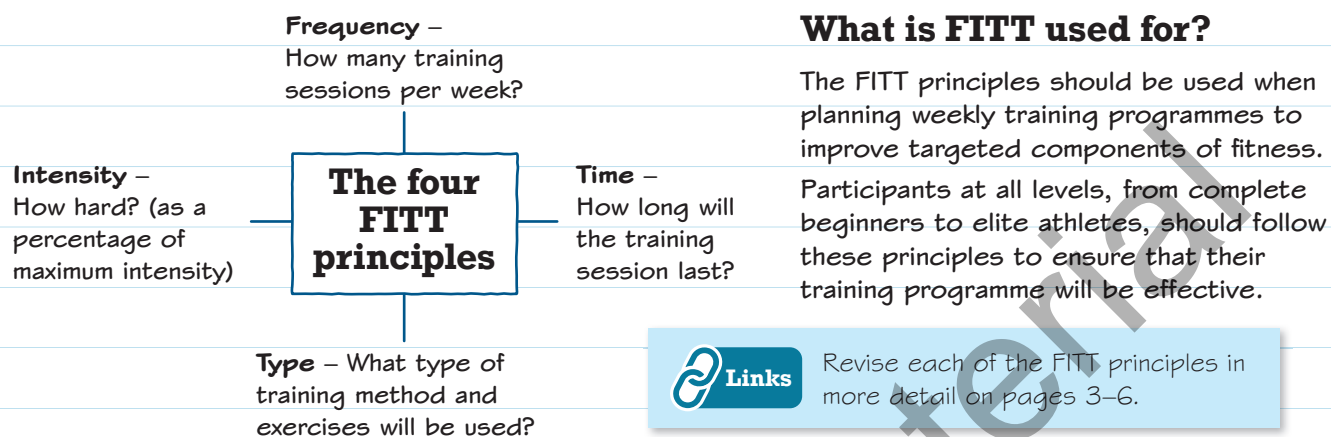
- Which **two** components of fitness will Sheldon require to do well in long-distance open-water swimming?
  - Speed and balance
  - Power and coordination
  - Muscular endurance and aerobic endurance
  - Muscular strength and agility

Sheldon will need to keep supplying his body with oxygen and nutrients and keep his arm and leg muscles contracting to propel him through the water for longer. Think about which components of fitness are required for sports that last longer than 30 minutes



# The basic principles of training: FITT principles

The letters of FITT stand for the key principles to follow when planning a training programme.



## Applying the FITT principles

Day	Training
Mon	30 minutes continuous training Jogging – 60% max heart rate
Tue	Rest day
Wed	30 minutes continuous training Jogging – 60% max heart rate
Thu	Rest day
Fri	30 minutes continuous training Jogging – 60% max heart rate
Sat	60 minutes continuous training Cycling – 60% max heart rate
Sun	60 minutes flexibility training (static stretching) Yoga class – moderate intensity

The table shows an example of a training programme for a 60-year-old male where the FITT principles have been applied.

**Frequency** has been applied – there are five training sessions this week.

**Intensity** for jogging and cycling is given as percentage of maximum heart rate.

**Time** is given – each training session lasts between 30 and 60 minutes.

**Type** of training is given (continuous, flexibility) and type of exercise (jogging, cycling, static stretching).



Make sure that the **type** of exercise chosen will help the participant achieve their goals. Yoga is a popular activity for developing flexibility.

## Now try this

The FITT principles are used to plan training programmes.

- 1 Identify what the letters F and I stand for in the FITT principles.
- 2 Give an example of how you can apply each of these principles in a weekly training programme.

Had a look ☐ Nearly there ☐ Nailed it! ☐

# Frequency

In the FITT principles, frequency means the number of training sessions completed every week.

## Deciding frequency

When deciding on the frequency of training sessions you need to strike a balance between:

- providing sufficient stress for adaptations in the body to occur
- allowing enough rest periods for the body to heal and repair from the exercise sessions.

## Progression and overload

You must take progression and overload into account when planning the frequency of sessions in a training programme.

There should be a gradual increase in stress placed upon the body, combined with a gradual increase in the frequency of training sessions.

Revise progressive overload on page 8.



## Beginner's training programme

Beginners should start with about three training sessions per week, and build up to more sessions per week as their bodies adapt to the training.

Week	1	2	3	4	5	6
Frequency of training sessions	3	3	4	4	4	5

This training programme provides a gradual increase in the number of training sessions each week.

## Why increase the frequency of training sessions?



Adaptations are the body's responses to training that make it more able to cope with the stresses of the exercise. For example, muscle tissue adapts to strength training by getting bigger.

## Frequency for training specific components of fitness

- **Muscular strength/muscular endurance** – two to three sessions per week.
- **Flexibility** – should be incorporated into the warm-up and cool down of every exercise session.
- **Speed and power** – frequency will depend on the specific sport, but two to three sessions a week are usually appropriate.
- **Aerobic endurance** – the weekly training programme should include a minimum of three sessions that target aerobic endurance, such as fartlek training.



Running up sand dunes and jogging back down is an example of fartlek training.

## Now try this

Adam is training for a 10 km road race.

- 1 Identify the minimum number of weekly training sessions Adam should complete to improve his aerobic endurance.

Jess is a 400 m hurdler and trains four times a week.

- 2 Identify how many times Jess should take part in flexibility training.

# Intensity

In the FITT principles, intensity means how hard a person is exercising or how much effort they are putting into the exercise. It is important to exercise at the right intensity so that the training targets the right component of fitness and leads to adaptations.

## Determining intensity

As with frequency, the intensity of the activity must overload the body so it will adapt. But the intensity must not be so high that it causes overtraining.

The level of intensity can be altered by changing factors in the training session such as:

- increasing or decreasing the weight used (resistance) in strength training
- covering a longer or shorter distance in aerobic endurance training
- spending more or less time exercising.

## Measuring intensity

The intensity of training can be measured using one of these two methods.

### 1 The Borg Scale – Rate of perceived exertion (RPE)

If a person does not have a heart rate monitor to measure their heart rate, they can use the Borg Rating of Perceived Exhaustion (RPE). The RPE scale ranges from 6 (rest) to 20 (exhaustion). The person exercising indicates the number that represents how hard they feel they are working.

Score	Perceived exertion
6	No exertion
7–8	Extremely light
9–10	Very light
11–12	Light
13–14	Somewhat hard
15–16	Hard
17–18	Very hard
19	Extremely hard
20	Maximum exertion

Multiply the score by 10 to get an estimate of the person's heart rate (in beats per minute) during the workout:  $RPE \times 10 = HR \text{ (bpm)}$



To work out how to assess 1 Rep max see page XX

### 2 Percentage of maximum heart rate (Max HR)

For some types of activity, working at the right intensity means a person exercising so that their heart is beating at a percentage of their Max HR.

Use the formula:  $\text{Max HR} = 220 - \text{age}$

## Measuring HR

**Pulse points:** you can measure HR at pulse points. The radial pulse on the wrist and the carotid pulse in the neck are good places to measure HR. Count the number of heart beats for 30 seconds, and multiply by 2.

**Technology:** there are lots of technological devices that can be used to measure HR, including smart watches, apps and HR monitors (see page 14).

### Worked example

Zoya is 15 years old. She wants to work at 70 per cent of her Max HR to train her aerobic endurance.

**Step 1** Calculate Zoya's Max HR:

$$\text{Max HR} = 220 - 15 = 205 \text{ bpm}$$

**Step 2** Then work out 70 per cent of her Max HR:

$$205 \times 70/100 = 144 \text{ bpm}$$

## 1 Rep Max for strength

1 Rep max is the maximum amount of weight a person can lift in one go. It is used to work out the load a person should lift when they are training to increase strength.

This can be used as a measure of intensity. For example, if a participant's 1 rep max is 100kg, they can work out the weight they should lift to train at 80% intensity.

$$80/100 = 0.80$$

$$0.80 \times 100 = 80\text{kg}$$

To develop strength, heavy loads (above 70% intensity) are used and low reps.

## 15 Rep max for muscular endurance

15 Rep max is the maximum amount of weight a person can lift for 15 repetitions and is used to work out the load a person should lift when they are training to increase muscular endurance.

To develop muscular endurance, low loads (below 70% 1 rep max) and high reps are used.

### Now try this

Susie is 18 years old and takes part in continuous training. She wants to ensure that she is working at an intensity of 70–80 per cent Max

- Give your answers as the number of beats



Had a look ☐ Nearly there ☐ Nailed it! ☐

# Type

Make sure that the type of training you choose targets a specific component of fitness. You will need to consider both the type of exercise the person will take part in and the training method.

## Which training type?

The type of training selected for a training programme should be determined by:

- the sport or activity the person takes part in
- the component of fitness the person wants to develop.

### Worked example

A shot-put thrower wants to improve their strength. An appropriate activity would be free weight training, targeting the main muscles used to throw the shot put.

## Selecting the type of exercise and training method

Component of fitness	Types of exercise (examples)	Training methods (examples)
Aerobic endurance	Running, cycling, swimming, rowing	Continuous training, fartlek training, interval training
Muscular endurance	Body weight exercises – tricep dips, press-ups, lunges, squats, sit-ups	Circuit training
Strength	Free weights – bicep curls, bench press, knee extensions, hamstring curls, shoulder press	Resistance machines, free weights
Flexibility	Standing stretches, lying down stretches, using a partner or object to stretch	Static stretching, dynamic stretching, PNF stretching
Power	Bounding, lunging, jumping, hopping, sprinting up a hill, using different types of equipment to develop power in upper and lower body	Plyometrics, anaerobic hill sprints, CrossFit
Speed	Sprinting on a running track, using sport-specific speed and agility equipment	Interval training, sprint training, SAQ
Agility	Ladders, dodging opponents	SAQ Training
Balance	Standing on one leg, using a wobble board	Balance training
Coordination	Catching a ball, dance movements	Coordination training
Reaction time	Sprint start, football penalty kick goal saves	Reaction time

## Variety of training methods

It is important to vary the training methods to avoid boredom.

### Example

A person who wants to develop their aerobic endurance so that they can run 5km should carry out running-specific training, but use different types of training in different environments. Appropriate training activities could include:

- jogging on a treadmill
- cross-country jogging
- jogging round an athletics track
- jogging with a group of people in a running club
- using a cross trainer.



Running with a group can help to prevent boredom. Park Runs are free and staffed by volunteers – they cover a distance of 5km and are held weekly in many towns and cities across the country.

## Now try this

Tanya is a gymnast. She wants to improve her power so that she can jump higher when performing her floor routine.

You can revise the different training methods for developing power

## Time

The length of time spent in a training session should be enough to encourage progressive overload. It should also be appropriate to the type of training and the component of fitness being trained.

### High-intensity interval training (HIIT), cardiovascular and fat-burning activities

How long you should spend in a training session for these activities will depend on the component of fitness being developed and the purpose of the training.

- HIIT for developing aerobic and anaerobic fitness – short duration (30 seconds to 1 minute), with rest periods no longer than 30 seconds. Training sessions usually last up to 30 minutes.
- Cardiovascular activities for developing aerobic endurance – at least 20 minutes.
- Fat-burning activities use body fat as a fuel so are good for people who want to lose excess body fat – at least 28 minutes.

You can revise the different training zones on page 13.

### Strength and muscular endurance activities

Strength and endurance training timeframes are based on the number of sets and reps for each muscle group. The participant must train for the time it takes to complete the required number of sets.

- The number of reps is how many times the exercise is repeated.
- The number of sets is how many lots of reps the participant completes.

For example, to develop muscular endurance of the biceps, the training could be: bicep curls – three sets of 15 reps.



Strength training requires a:

- low number of sets
- low number of reps
- high load/heavy weights.



Muscular endurance training requires a:

- high number of sets
- high number of reps
- low load/light weights.

### Now try this

Sean is 28 years old, and is trying to lose excess body fat.

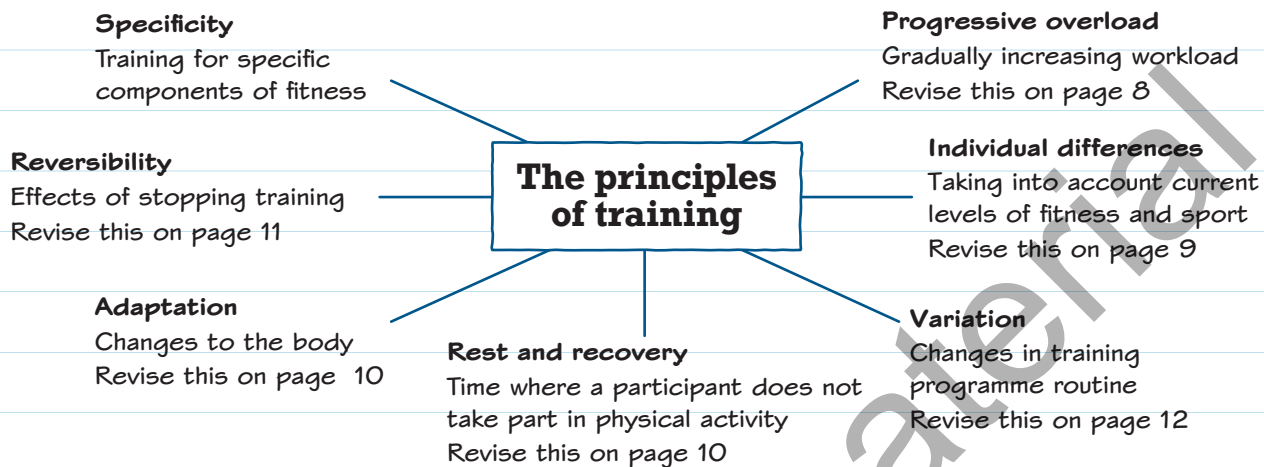
- 1 Identify one type of exercise Sean could take part in to help him lose body fat.
- 2 State the minimum length of time Sean should take part in the exercise, in order to lose excess body fat.

- Select exercises that Sean can keep performing for at least the minimum amount of time.
- Activities that are used to develop aerobic endurance or muscular endurance will be appropriate here.

Had a look ☐Nearly there ☐Nailed it! ☐

# Additional principles of training: specificity

As well as the FITT principles, there are six additional principles of training that you can use to plan a training programme. Using these principles will help improve a participant's physical fitness and sporting performance.



## What is specificity?

Specificity means choosing a training method that develops a specific component of fitness which benefits participation in a particular sport or activity.

The remaining six principles of training can then be applied to this specific training method.

## Applying the principle of specificity

To apply the principle of specificity, you need to make sure that the training methods are matched to the demands of the sport or activity that the participant is training for. For example:

- A netball player could take part in circuit training to develop muscular endurance. The stations would focus on upper body and lower body muscular endurance, as the arms and legs are used to play netball. Some circuit stations could include netball-specific drills such as passing and dodging.
- A long-distance cyclist could take part in road cycling to develop aerobic endurance. They could also train at home on their bike using a turbo trainer, use a stationary bike in a gym and take part in spin classes.



A turbo trainer is a device for cycling training. It allows you to pedal a normal bicycle but without travelling anywhere.

## Now try this

Ryan is a rower. He is going to take part in a race in six weeks' time, and wants to improve his fitness for the event.

Describe **two** ways in which Ryan could use the principle of specificity to improve his rowing performance.



## Progressive overload

Progressive overload means gradually increasing the participant's workload over time.

### Applying the principle of progressive overload

Fitness can only be improved by **overloading** – training at a higher level than you normally do. Working harder in exercise sessions stimulates your body to adapt to the training. This will improve your fitness levels in the component of fitness being trained.

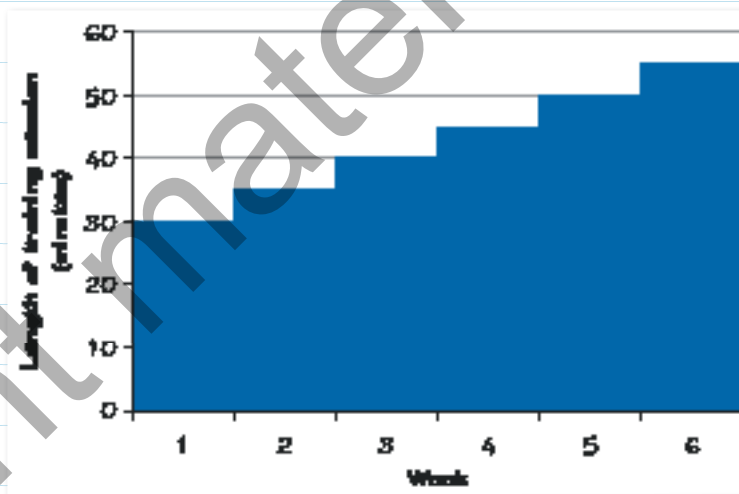
- If you do not overload, your fitness will not improve beyond its current levels.
- Overload is achieved by increasing the frequency, intensity and/or length of time spent training.
- Overloading should be **progressive** – the training programme should provide a gradual increase in the frequency, intensity or time spent exercising. This is necessary to avoid injury and overtraining.

Revise overtraining on page 11.

### Progressive overload using time

A person who is training to take part in a long-distance race might undertake continuous training to improve their aerobic endurance.

- To apply progressive overload in this situation, gradually increase the **time** the participant spends training.
- As the length of the training sessions increases, the distance the participant runs will naturally also increase over the course of the training programme.
- For example, they can run further in a 50-minute session than in a 30-minute session.



Start with a short training time and gradually increase.

### Progressive overload using percentage of maximum heart rate (Max HR)

You can apply progressive overload to a training programme by increasing the **intensity** at which the participant exercises, using percentage of Max HR.

- In interval training, the training sessions could be planned, so that each week the percentage of the participant's Max HR is increased to a slightly higher level during exercise periods.
- Once the desired maximum intensity has been achieved, increase the time spent exercising at the higher intensity in order to maintain progressive overload.

### Progressive overload in strength training

To train for **strength**, the weights or resistance used should progressively increase. The participant's muscles will continually have to adapt to meet the demands of lifting increasingly heavier weights.



The overload can be achieved by keeping the number of reps and sets the same, but increasing the weight lifted.

### Now try this

Give a definition of progressive overload.



Had a look ☐Nearly there ☐Nailed it! ☐

# Individual differences

For a training programme to be effective, the training should meet the needs of the individual. These will be different for each person.

## Factors to consider for individual differences

**Age** – a younger person may require more games-based training compared to an older teenager or adult.

**Sporting experience** – a beginner in a sport will require a very different type of training programme compared to an elite sports person.

**Current levels of fitness** – a person with high levels of fitness is able to train more frequently and at a higher intensity compared to a person with low levels of fitness.

**Each factor should be taken into account when planning a training programme for an individual.**

Low impact – where one foot is always in contact with the ground in the activity such as in walking  
High impact – both feet are off the ground at some point in the activity such as in running.

**Sex** – the sex of a person can have an impact on the type and intensity of training and recovery time frames due to the different hormone levels associated with the different sexes.

**Weight** – the weight of a person may impact on the type of training they can safely take part in, for example, if an individual had high body fat composition, then low impact training methods may be more appropriate to reduce the stress on their joints that could occur from high impact training.

## Training methods

The training methods selected must be appropriate to train the identified components of fitness.

The types of exercise used for each training method should be sport-specific.

Revise the principle of specificity on page 7.

## Individual lifestyle

It is important that the training is accessible to the individual. They must be able to:

- get to the location of the training
- afford to take part in the training
- fit the training around other commitments such as work or homework and family commitments.

## Meeting an individual's needs

To meet the individual's needs, the training programme should be:

- appropriate for their sport or activity
- appropriate for their fitness levels
- chosen to suit their likes and dislikes
- accessible – the equipment and facilities must be accessible, available and affordable
- varied, to avoid boredom and to work a range of body areas and/or components of fitness.

On page 60, you can revise gathering information to devise a personalised training programme.



The cost of taking part in training might include the cost of any special clothing, footwear and equipment required, as well as the hire of facilities, gym membership or class fees.

## Now try this

Jackie is a 15-year-old student and plays tennis. Her nearest tennis court is 5 miles away.

Describe **three** individual factors related to Jackie's lifestyle that may affect her accessibility to training.

This question is focused on accessibility to training which is related to how she can get to the training, the cost of training and commitments she may have that could impact on her availability to train.

## Rest and recovery and adaptation

Rest and recovery, and adaptation are two additional principles of training, and both are required so that a person's fitness levels can increase.

### Rest and recovery

**Rest and recovery** is the process of having time where a person does not take part in any physical activity. This principle must be followed to allow the body to recover and adapt to the training that the person has undertaken.

Most training programmes should have at least one rest day a week.

Adaptation takes place during the time given for rest and recovery.

### Nutrition

Appropriate nutritional intake should be included in a training programme to support the recovery process. For example, if a person is trying to increase their muscular strength they should consume foods high in protein to support muscular repair and growth process.

### Adaptation

An **adaptation** is a response of the body to training that makes it more able to withstand the stresses of the training.

Types of adaptations include:

- ✓ an increase in muscle size from strength training
- ✓ an increase in capillaries around muscle tissue from muscular endurance training.

These adaptations allow a participant to improve the component of fitness that is being trained.

However, these improvements are reversible. If training stops, the body will eventually return to its pre-exercise state.

- ✓ This could mean reduced muscle size or a reduced number of capillaries around muscle tissue.

### Examples of adaptation to training



Increase in muscle size from weight training.

These adaptations are **reversible**. If training stops, the body will eventually return to its pre-exercise state, such as a reduction in muscle size (see page 11 for more on reversibility).



Increased range of movement around a joint from flexibility training.

### Points to remember

- ✓ Training programmes should include at least one rest day per week
- ✓ Adaptation takes place when a person is resting and recovering from training
- ✓ Appropriate nutrition is important to help with muscle repair and to replenish the body's energy stores
- ✓ If appropriate rest and recovery is not included in a training programme it can lead to **overtraining** (see page 11).

### Now try this

Describe why it is important to include at least one rest day per week in a training programme.

Had a look ☐Nearly there ☐Nailed it! ☐

# Reversibility

Reversibility means that the fitness gains that have been made from previous training start to decline, and a person starts to lose their fitness levels. Reversibility can be summed up by the term, 'Use it or lose it'.

## Why does reversibility happen?

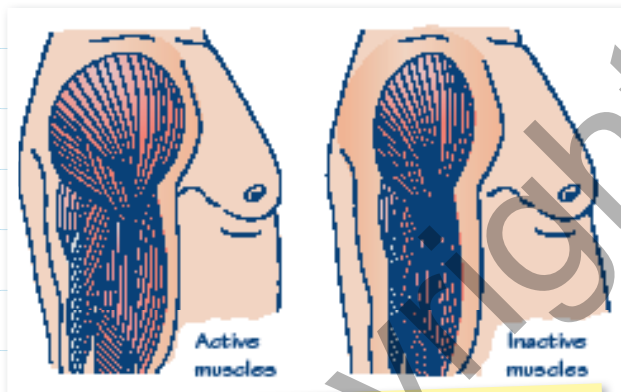
Reversibility occurs when a person is not able to take part in training for a period of time. This could be due to illness, injury or other factors such as going on holiday and not having access to training facilities.



Injury is one of the main reasons that reversibility occurs.

## The effects of reversibility on fitness

Reversibility is also known as **detraining**. When a person doesn't take part in training for some time, any training adaptations that have been developed as a result of the training will deteriorate.



The trained muscle on the left is much larger than the untrained muscle on the right.

## Overtraining

Overtraining occurs when the training workload is increased too quickly or there are not sufficient periods of rest and recovery.

- ✓ It leads to a greater risk of injury or of fitness levels not improving due to fatigue, as the body is not able to recover sufficiently between sessions.
- ✓ It can also mean a person's fitness declines as they are training too much.

## Applying the principle of reversibility

A person who has had a period away from training, for whatever reason, will need to work out how this has affected their fitness levels.

- Taking part in fitness tests and comparing their results to previous fitness test results is a good way of doing this.
- They will then need to restart their training programme at a level appropriate to their current, somewhat reduced, fitness levels.

## Now try this

Identify **one** reason why an athlete might experience reversibility.



## Variation

It is important to add variation to training programmes to avoid boredom and maintain motivation to train.

### Varying training routines

Minor changes in routine can produce large fitness gains. This change is known as **variation**.

Some basic things that could be done to ensure variation include changing the:

- type of equipment
- training environment
- order of training
- type of exercise
- nature of your training.

### Why is variation important?

Variation is important because it helps to:

- ✓ keep you interested and maintain the motivation and enjoyment associated with training. If you are doing the same training all the time you are likely to become bored and so more likely to give up
- ✓ provide new challenges for your body and reduces the risk of injuries caused by the repetition of the same actions and training methods.

### Variation in practice



You still need to consider the specificity principle (see page 7) so that any variation is beneficial to the individual and their training goals.

An example of variation in practice is a footballer who uses both bounding ladder drills and weight training to help build both leg power and strength. This will allow for recovery and adaptation to take place while maintaining enjoyment. This way they are more likely to persist with training.

### Now try this

Sanjid is a long-distance runner. He runs on his own following the same road-based route to improve his aerobic endurance.

Give **two** examples of how variation could be applied to reduce boredom in Sanjid's training.

Think about what you could do if you took part in long-distance running to make it a bit more interesting or different and then consider if these may work for Sanjid.



Had a look ☐ Nearly there ☐ Nailed it! ☐

# Training zones

A training zone is the correct intensity at which a person should exercise in order to experience fitness improvement.

## Why are training zones used?

To improve particular components of fitness, the participant must work at a specific training intensity. For example, to train for aerobic fitness, an individual must work at a lower intensity than someone who wants to train for anaerobic fitness.

- Working above or below the specified training zone will result in the incorrect component of fitness being trained.
- If the training zone is at too low a level, there will be no training effect.





Revise the FITT principle of intensity on page 4.

## Anaerobic fitness

- Anaerobic fitness is required for sports that don't use oxygen as the main supply of energy, such as the 100m sprint.
- Anaerobic fitness training is only recommended for people who already have good levels of fitness, as it can be harmful to the health of someone with low levels of fitness.

## Percentage of maximum heart rate (Max HR) and training zones

A percentage of Max HR is used to calculate how hard you should work your heart to develop either aerobic or anaerobic fitness.

Warm-up or cool down zone		50–60% of Max HR	This zone can also be used for people new to training and to maintain current fitness levels.
Fat-burning zone		60–70% of Max HR	In this zone, body fat is used to provide energy. It is good for people who wish to lose excess body fat.
Aerobic training zone		70–80% of Max HR	This zone is used to develop aerobic endurance.
Anaerobic training zone		80–100% of Max HR	In this zone, the anaerobic energy systems are used to produce energy.

## Calculating heart rates for the training zones

Max HR =  $220 - \text{age}$

50% Max HR =  $50/100 \times \text{Max HR}$

60% Max HR =  $60/100 \times \text{Max HR}$

70% Max HR =  $70/100 \times \text{Max HR}$

80% Max HR =  $80/100 \times \text{Max HR}$

100% Max HR = Max HR

Revise methods of measuring and estimating heart rate on page 4.

### Now try this

- 1 Sunita is 22 years old. Calculate her maximum heart rate.
- 2 Calculate what Sunita's minimum and maximum heart rate should be for training in the aerobic training zone.

Remember to give your answers in beats per minute (bpm) and round your answers to the nearest whole number.

## Technology to measure exercise intensity

A range of different types of technology are now available to help people to measure the exercise intensity they are working at. This technology helps to provide reliable, accurate data that can easily be seen while the person is still taking part in exercise.

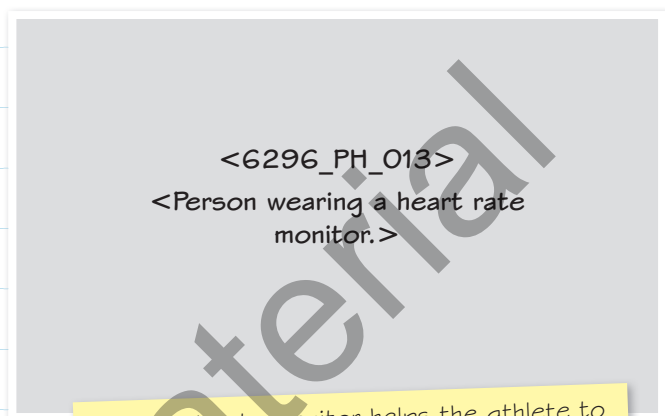
### Heart rate monitor

A heart rate monitor can be used to measure exercise intensity when a person is taking part in exercise.

A strap is worn around the chest that detects the heart rate. The signal is transmitted to a receiver that can be worn on the wrist for an individual to easily see their heart rate when they are taking part in training to measure their exercise intensity.



See page 4 for more on heart rate intensity.



This heart rate monitor helps the athlete to see their exercise intensity at a glance.

### Smart watch

A smart watch can be worn around a person's wrist. It provides the user with their current heart rate as well as an overview of the person's heart rate during and post exercise. This can be used to:

- work out if the person was training at the right intensity for the component of fitness they were training
- show how quickly their cardiovascular system recovers from an exercise session.



Wearing a smart watch can help you work out if you are training at the right intensity.

### Apps

Many apps are available that can be downloaded and used on smart watches, smartphones or on wearable clothing to help to record exercise intensity.

Many of these apps will allow the individual to select the type of exercise they are taking part in and then set the app to sound an alarm if they are exercising outside of the set training threshold they are targeting to train a specific component of fitness.



### Now try this

Explain **one** benefit of using technology to measure exercise intensity.



This question is looking at the advantages of using technology to measure exercise intensity, which usually means heart rate is being recorded by the technology. Try to give a reason as to why it is a benefit

Had a look ☐ Nearly there ☐ Nailed it! ☐

# Fitness testing: importance to sports performers and coaches

It is important for a fitness training programme to focus on the targeted components of fitness. Therefore, fitness testing should be carried out before, during and after the training programme to be able to monitor whether the training is working.

## Baseline data

Fitness testing provides **baseline** data from which we can monitor and improve performance.

Baseline data are the scores/results recorded at the start of any training programme.

Over time these tests can be repeated, helping to show improvements and areas for further attention.

## Training programme design

Training programmes can be designed to focus on performer's strengths and weaknesses.

For example, if a sprinter has good speed but their reaction time is below average, it gives the coach and athlete an area of training to focus on.



## Determine if training programmes are working

Fitness testing also allows you to see if training programmes are working. By repeating the same tests before and after a training block you can see if programmes have been effective.

If fitness test data shows that no improvements are being made to the targeted component of fitness, it confirms that the training programme is not working for the individual.

Baseline data for a gymnast might be used to give the first set of results for flexibility, strength and speed. From this, the coach and performer can then work out which of these components of fitness need to be developed.

## Goal-setting aims

Fitness test results can help a performer set themselves goals. This can be motivating and will encourage them to work hard in training.

For example, a netball wing attack may set themselves a target of improving their Illinois agility run test scores by three seconds over a six-week training period (see page 35). By testing at regular intervals they will be able to see their progress towards the goal to improve their agility.

## Provide performers with something to aim for

Taking part in regular training does require a lot of dedication from a performer. So, having key areas to focus on can help to encourage them to put in full effort when they are training and ensure they attend every training session knowing that this training can have a big impact on their fitness test results.

### Now try this

Give **one** reason why it is important to record baseline fitness scores.

Think about what the term baseline means and how this would be relevant for training programmes.

## Pre-fitness test procedures: screening

Any fitness programme needs to be safe and appropriate for the person who will be using it. Before carrying out fitness tests, a number of pre-test procedures need to be conducted to ensure you have the essential information about an individual. These include using a PAR-Q and a lifestyle questionnaire.

### Physical Activity Readiness Questionnaire (PAR-Q)

A **PAR-Q** is a questionnaire used to assess a person's medical history. It determines the safety or possible risks based upon the individual answer given.

There are between 8 and 12 questions in a standard PAR-Q, which require a simple yes or no response.

If an individual responds with a Yes to any question, they should be encouraged to seek medical clearance from their doctor before beginning an exercise programme.

### Example of questions from a PAR-Q

- Do you have chest pain when performing physical activity?
- Are you pregnant or have you given birth in the last six months?
- Do you have a bone or joint problem that causes you pain when exercising?
- Have you had recent surgery?
- Are you currently taking prescribed medications for a chronic condition?

### Lifestyle questionnaire

This contains questions based on the performer's lifestyle and is used to gain personal information about their lifestyle choices such as:

- current activity levels
- stress levels
- the foods they eat
- drinking alcohol
- smoking.

All of these can impact on their health and the design of the training programme.

### Confidentiality

All information that is taken from a sports performer should be kept confidential in line with the latest legal requirements for storing and using other people's personal information.

Pre-fitness checks for participants are revised on page 17.

### Informed consent

This is a form that makes the performer aware of what is involved in the exercise testing and any risks there may be. They can then give their agreement or consent to undertake the tests. This then provides documented evidence that shows that participants have been provided with all the necessary information to undertake the test.

The consent form should be signed and dated by the participant and the tester.

An informed consent form confirms that the performer:

- 👍 is able to follow the test method
- 👍 knows exactly what is required of them during testing
- 👍 has fully consented to their participation in the fitness tests
- 👍 knows that they are able to ask any questions relating to the tests
- 👍 knows that they are able to withdraw their consent at any time.

### Now try this

Why should a PAR-Q be completed before a person takes part in a training programme?

Remember that PAR-Q stands for Physical Activity Readiness Questionnaire.



Had a look ☐Nearly there ☐Nailed it! ☐

# Pre-fitness test procedures: calibration of equipment and test protocol

Before carrying out fitness tests, you also need to ensure the test protocol is being followed, calibrate equipment and complete a participant pre-fitness check. These ensure that the participant is ready to take part in the tests, and that the test results are valid and reliable (for more on validity and reliability, see page 19).

## Test protocol

Each test needs specific equipment. The person carrying out the test needs to follow a **protocol**, which is the set method of administering the test. The protocol includes information related to:

- how the test should be set up
- which equipment needs to be used
- how to complete the test correctly
- how to record the results accurately.

It is important to remember that calibration of equipment is **not** the process of checking if the equipment is broken! It is checking to ensure that it is producing accurate measurements.

## Calibration of equipment

This is the process of checking and, if necessary, adjusting pieces of fitness testing equipment to ensure they record data accurately. Equipment should be calibrated regularly to ensure results are valid and accurate.



Scales: use a fixed weight to test they are measuring accurately.

Use a stopwatch to check the beeps from the multi-stage fitness test recording are timed accurately.

## Participant pre-fitness check

Before the participant takes part in any fitness tests, the person administering the test should check the following. The participant should:

- have medical clearance for any health conditions
- be free of injuries
- should not have taken part in exercise prior to testing other than warm-up exercises
- be wearing appropriate clothing
- not have had a heavy meal three hours before the test
- have had a good night's sleep
- not have trained on the day and be fully recovered from previous training
- have avoided stimulants such as tea, coffee or nicotine for two hours before the test.

## Indoor fitness test location checks

The area where the tests are performed should be:

- at room temperature (around 18 degrees)
- well ventilated
- clean and dust-free.

## Now try this

Before taking part in a fitness test, the participant should have completed a PAR-Q questionnaire.

Suggest **three** other participant pre-fitness checks that should be carried out before a participant takes part in a fitness test.

These are checks to ensure the results from the fitness test are not affected by factors related to the participant not being able to perform at their best.

# Choosing appropriate fitness tests and interpreting results

Fitness tests should be selected that are appropriate for the individual and the component of fitness being tested. Once the fitness tests have been completed, the results need to be analysed to find out what they show about the participant's component of fitness that is being assessed – this is the process of interpreting fitness test results.

## Choosing appropriate fitness tests

When selecting a fitness test for an individual there are a number of factors that should be considered.

Does it measure the targeted component of fitness

### Selecting appropriate fitness tests

Does it replicate movements of the participant's sport

Is it appropriate for the participant's level of fitness



Jules is 56 years old and hasn't taken part in sport or exercise for a number of years. She is starting an exercise programme and wants to improve her fitness so she can take part in a 5 km Park Run. Her personal trainer wants to measure her aerobic endurance. He selects the 12-minute Cooper run test for Jules rather than the multi-stage fitness test (MSFT). This is because the Cooper run test allows the participant to run, jog or walk at their own pace, whereas the MSFT provides the pace that they have to travel, which may result in Jules over exerting herself and becoming unwell or becoming demotivated.

To revise the MSFT test, see page 20 and to revise the 12-minute Cooper run test, see page 22.

## Recording fitness test results

Once the fitness test has been completed, the results should be recorded accurately (using appropriate templates where needed) and using the correct units of measurement specified in the test protocol.

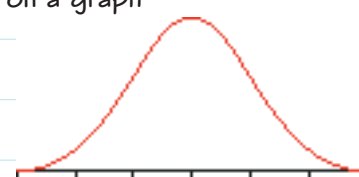
## Interpreting fitness results

Fitness test results are interpreted by comparing an individual's results with other people of the same age group and gender. This is done by using published **normative data tables**.

- This shows whether an individual has lower or higher results than most of the population.
- The normative data tables are produced by calculating the average scores from fitness test results.

## Normative data

When measurements of people are taken in a population and plotted on a graph the results form a shape like this. Most people's results are in the middle.



Normative data curve

Age	Excellent	Above average
13–14	>2700m	2400–2700m
15–16	>2900m	2500–2800m
17–19	>3000m	2700–3000m
20–29	>2800m	2400–2800m
30–39	>2700m	2300–2700m
40–49	>2500m	2100–2500m
>50	>2400m	2000–2400m

Part of a table showing normative data for male athletes

## Now try this

Why is it important to select fitness tests that are appropriate for the participant's level of fitness?

These factors are there to make sure the test being selected will get the best results for that participant's needs.

Had a look ☐Nearly there ☐Nailed it! ☐

# Reliability, validity and practicality of fitness testing

Part of the process of fitness testing requires the person administering the test to ensure the fitness test results are reliable and valid. The practicality of the fitness testing should also be considered.

## Validity

**Validity** is how accurate a set of results are. That is, do the results really measure what we want them to?

This can also be applied to the part of the body being tested or how closely the fitness test replicates the participant's sport.



### Example

A javelin thrower has to have high levels of flexibility in their shoulders to be able to throw the javelin long distances. The sit and reach test (see page 26) measures flexibility of the lower back and hamstrings. If a javelin thrower took part in a sit and reach fitness test it would not provide a valid assessment of the flexibility of their shoulders.

## Reliability

**Reliability** is the ability to repeatedly carry out the same test and expect comparable results each time.

Things that can influence reliability when a participant is taking part in follow-up fitness tests are:

- calibration of equipment
- motivation of the participant
- conditions of the testing environment (indoor versus outdoor conditions; weather conditions)
- experience of the person administering the test
- whether the standardised test procedures are followed
- length and type of warm-up
- time of day
- amount of sleep the subject has had
- different clothing or footwear worn by the participant.



### Example

If a participant took part in a multi-stage fitness test outside and then repeated the test in an indoor location, the results of the test could be different due to the change in fitness test location conditions.

Fitness testing outside could be affected by factors such as the weather and the running surface being wet or slippery, so could have a negative effect on performance.

## Practicality

**Practicality** refers to how suitable the test is for the given situation, the person administering the test and the people taking part in the test.

Things to consider when taking into account practicality include:

- cost
- time taken to perform the test
- time taken to set up the test
- time taken to analyse data
- number of participants that can take part in the test at the same time.



### Example

A football coach may find fitness tests that can be carried out by the whole team at the same time have more practicality for them, as they will take less time to administer compared with fitness tests that have to be carried out one person at a time.

## Now try this

You are working as a fitness coach for a football team. Having completed the multi-stage fitness test six weeks ago in a sports hall, you want to test the football team again to check for improvements.

List **three** things you should consider to ensure the test is reliable.

Remember reliability is ensuring the test conditions and participant pre-fitness test check are as similar as possible to previous testing processes.

