REVISE BTEC TECH AWARD

Sport, Activity and Fitness

REVISION GUIDE

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Pearson

REVISE BTEC TECH AWARD
Sport, Activity and Fitness

REVISION GUIDE

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Introduction

Revising Component 2 of your BTEC Tech Award

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

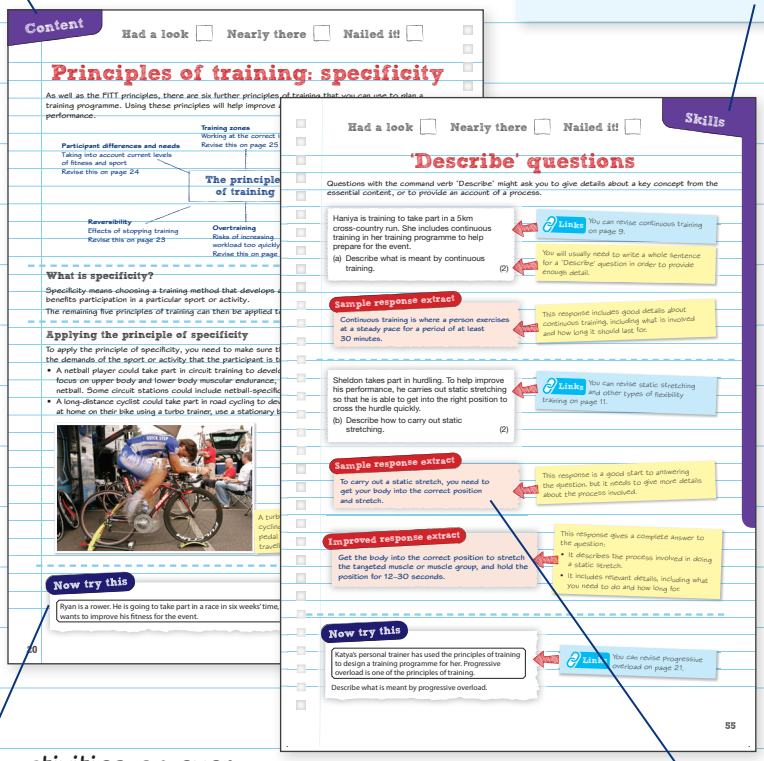
The assessment for Component 2, The Principles of Training, Nutrition and Psychology for Sport and Activity, is in the form of a paper comprising short, long and extended writing questions. This will be completed under supervised conditions in a specified time. This assessment is likely to take place towards the end of your course. You will be expected to link knowledge and understanding with the other components. In particular, you will use the knowledge and understanding of this component in Component 3.

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 each unit.

Skills pages help you prepare for your exam or assessed task. 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.

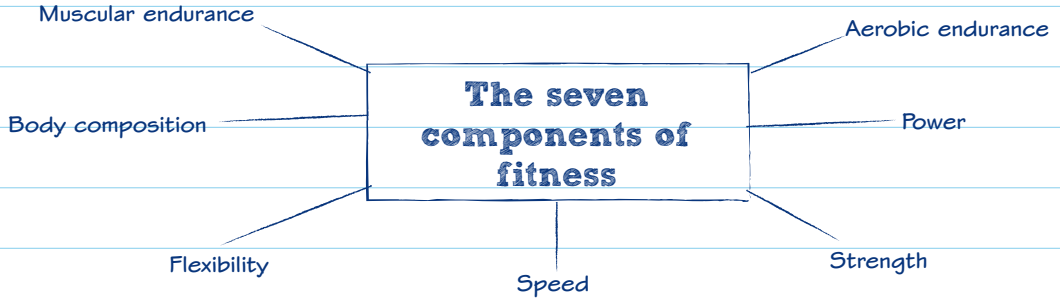
Look out for the **sample response extracts** to exam questions or set tasks on the skills pages. Post-its will explain their strengths and weaknesses.

Contents

A small bit of small print
Pearson publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions in *Now try this* have been written to help you test your knowledge and skills. Remember: the real assessment may not look like this.

Fitness testing

Fitness is an overall term covering seven different components. Different types of fitness test are carried out to provide measurements of each component of fitness.



Fitness tests

Tests have been designed to measure each component of fitness. The results are used to find out which components of fitness are a person's strengths and which components need to be developed.

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 on:

1. how the test should be set up
2. which equipment should be used
3. how to complete the test correctly
4. how to record the results accurately.

Fitness programmes can be developed which maintain a person's strengths and develop weaker components.

Interpreting fitness test results

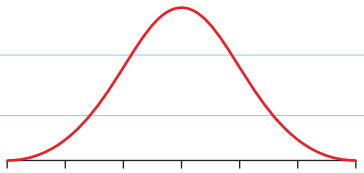
Fitness test results are interpreted by comparing an individual's results with the published **normative data** for other people of the same age group and gender.

- 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.

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

Part of a table showing normative data for male athletes

Normative data



When people's measurements are plotted on a graph, they form a shape like this. Most people's results are in the middle of the curve.

Now try this

1. Define what is meant by a fitness test protocol.
2. Describe why a normative data graph is highest in the middle.
3. Identify the two different groups of people that normative data tables can be produced for.

Aerobic endurance

Aerobic endurance is also known as cardiovascular fitness. This component of fitness is used when taking part in physical activity at a moderate intensity for at least 30 minutes.

Importance of aerobic endurance

The greater a person's **aerobic endurance**, the more efficient their cardiorespiratory system in supplying nutrients and oxygen to their working muscles. This helps the person to continue participating in the activity, at the same intensity, for longer.

Sports and activities that require aerobic endurance

Sports where aerobic endurance is ...	
a key component of performance	**part of the overall profile**
• Cross-country running • Long-distance swimming • Cycling • Triathlon	• Racket sports • Team sports such as football and netball during periods of moderate intensity, as these games last more than 30 minutes.

Cooper 12-minute run test

This fitness test is used to measure aerobic endurance. It involves running for 12 minutes and the distance covered is recorded.

Equipment

Athletics track, cones, whistle, stop watch, tape measure.

Protocol

Before taking part in the test, the participant should carry out an appropriate warm-up (look at page 28 for warm-up routines).

1. The participant stands at the starting line on the athletics track.
2. Blow a whistle for the participant to start running around the track.
3. At 12 minutes, blow the whistle again for the participant to stop running.
4. Place a cone at the point where they stopped running.
5. Measure the distance covered and record it to the nearest 10 m.

Advantages and disadvantages

- This is a good test for people whose sport involves running, as the test involves the type of activity used in their sport.
- The test does not require much equipment and is easy to set up.
- A number of people can take part in the test at the same time.
- The test may not reflect the true aerobic endurance of people who do not run in their sport, such as swimmers.
- The running surface and climate can affect the **reliability** of this test. A slippery surface or a hot day can result in lower scores.

Reliability

Reliability refers to how similar the results would be if the test were repeated. When someone takes the test again, their results should remain the same or very similar, as long as their fitness levels haven't changed.

Normative test data

Age	Excellent	Above average	Average	Below average	Poor
13–14	>2000 m	1900–2000 m	1600–1899 m	1500–1599 m	>1500 m
15–16	>2100 m	2000–2100 m	1700–1999 m	1600–1699 m	>1600 m
17–20	>2300 m	2100–2300 m	1800–2099 m	1700–1799 m	>1700 m
20–29	>2700 m	2200–2700 m	1800–2199 m	1500–1799 m	>1500 m

Part of the normative data table for female athletes. There is also one available for male athletes. The complete table would also show age ranges 30–39, 40–49 and 50+ years.

Now try this

Molly is 16 years old and swims in long-distance races at county level. She achieves a distance of 1650m in the Cooper 12-minute run test.

1 Look at the normative data table for female athletes. Identify the category for Molly's result.

2 Explain if you think this score is a true reflection of Molly's aerobic endurance.

Muscular endurance

Muscular endurance is the ability of a muscle group to perform repeated contractions over an extended time.

Importance

Muscular endurance is required in everyday activities such as walking and climbing stairs.

It is a key component of fitness for many sports and activities where a participant must perform repeated movements at a low to moderate intensity.

Sports requiring good muscular endurance

Activities that require high levels of muscular endurance include repeated squats, pull-ups, press-ups and sit-ups.

Sports where muscular endurance is ...	
a key component of performance	**part of the overall profile**
• Distance running, cycling, swimming, rowing • Triathlon	• Racket sports • Team sports: football, netball, basketball, rugby

One-minute sit-up test

This test measures the muscular endurance of the abdominal muscles. The participant performs as many sit-ups as possible in one minute, using the correct technique. This test can be used to provide an overall indicator of a person's muscular endurance.

1. The participant lies with their back on the floor, fingers on their temples or crossed across their chest and knees bent. You can hold the participant's feet so that they remain on the ground.

2. Say 'Go' and start the stop watch. The participant sits up until their elbows touch their knees.

3. They return to the start position with the back of their head touching the floor.
4. The participant does as many sit-ups as they can in one minute.
5. Say 'Stop' after one minute. Record the number of sit-ups completed.

Equipment	Protocol
Mat, stop watch.	Before doing the test, the participant should carry out an appropriate warm-up (look at page 28 for routines).

Normative test data

	Number of sit-ups	
Rating	**Males**	**Females**
Excellent	49–59	42–54
Good	43–48	37–41
Above average	39–42	32–36
Average	35–38	28–31
Below average	31–34	24–27
Poor	25–30	18–23
Very poor	11–24	3–17

A normative data table for male and female athletes

Advantages and disadvantages

- Minimal equipment – a stop watch and a mat.
- Quick and easy to perform.
- It can be carried out in most environments.
- Needs high levels of motivation to continue for one minute.
- It only assesses muscular endurance of the abdominal muscles. A person who has high levels of muscular endurance in their legs (such as a cyclist) may score poorly on this test.

Now try this

Phil is 20 years old and rows for his university rowing team.
He takes part in the one-minute sit-up test and completes 26 sit-ups.

1 State the component of fitness tested by the one-minute sit-up test.

2 Look at the table above and identify Phil's endurance rating for the one-minute sit-up test.

Flexibility

Flexibility is the range of motion available at the joints of the body. It includes a person's ability to move a joint fluidly through its complete range of movement.

Importance of flexibility?

The more **flexible** a person is, the more movement they have at their joints. Their muscle tissues and ligaments are more supple and longer than those of a less flexible person.

- Flexibility can be good in one area of a person's body but weak in another; for example, very flexible shoulders but less flexible hips.
- Flexibility can help to prevent injury. Flexible muscles can protect the body from injuries caused by overextension, such as when a football goalkeeper stretches their arms backwards to make a save.

Sports requiring flexibility

This component of fitness is used in all sports and activities. It allows the complete range of movement at the joints so that we can participate fully.

Sports where flexibility is ...	
a key component of performance	**part of the overall profile**
• Gymnastics • Diving	• Racket sports • Team sports

Sit and reach test

This fitness test measures the flexibility of the participant's hamstrings and lower back muscles. The length of their arms and legs should not affect how well they perform in this test.

1. The participant sits with their legs straight and their feet against the board.

2. Keeping their legs straight, they slowly reach as far forward as they possibly can, pushing the marker on the sit and reach board.

3. Record the measurement in centimetres of the furthest point reached.
4. Repeat the test three times and use the best result.

Equipment	Protocol
Sit and reach box.	Before taking part in the test, the participant should carry out an appropriate warm-up (see page 28 for routines). They should remove their shoes and wear clothing that does not restrict their movement.

Normative test data

Rating	Males (cm)	Females (cm)
Excellent	+17 to +27	+21 to +30
Good	+6 to +16	+ 11 to +20
Average	0 to +5	+1 to +10
Fair	–8 to –1	–7 to 0
Poor	–20 to –9	–15 to –8
Very poor	< –20	< –15

Normative data for males and females. The measuring scale for this test has the 0cm point at the level of the feet.

Advantages and disadvantages

- Minimal equipment is required – just a sit and reach box.
- The equipment is not expensive.
- The test is quick and easy to perform.
- It can be carried out in most environments.
- A person may be much more flexible in other areas of their body that are not tested in the sit and reach test.
- The reliability of the test results depends on how much time has been spent on the warm-up.

Now try this

Simon is male and Sara is female. They both achieve a result of +18 cm when they take the sit and reach test.

Using the table above, identify the flexibility rating for:

a Simon **b** Sara.

Speed

Speed is how much time it takes a person to travel over a specified distance. Speed is essential in some sports and offers an advantage in many others.

Calculating speed

Use this equation to calculate speed:

$$\text{speed} = \frac{\text{distance covered}}{\text{time}}$$

In a 100 m sprint race, the athlete must quickly get up from the blocks and start sprinting to reach their maximum speed as soon as possible.

Sports and activities that use speed

Sports where speed is ...	
a key component of performance	**part of the overall profile**
• Sprint events: 100 m run, 25 m swim, speed skating • Long jump	• Team sports: netball (to intercept the ball); basketball (dribbling with the ball) • Endurance events: 10 k race when overtaking; cycle race for sprint finish

Thirty-metre sprint test

This fitness test measures how fast a person can run over a distance of 30m.

Equipment

Flat non-slip running surface, tape measure (or marked track), stop watch.

Protocol

The person taking the test should thoroughly warm up before taking the test (see page 28 for routines).

1. The participant starts behind the line in a stationary position.
2. Stand at the finishing line, and shout 'Go' as you start the stop watch.
3. The participant sprints as fast as they can over the 30m distance.
4. Stop the stop watch when they pass the line. Record the result in seconds, to the nearest tenth of a second.
5. The participant has a three-minute rest period and then repeats the test.
6. Use the best result from the two tests to compare with normative data tables.

Normative data

Rating	Males	Females
Excellent	<4.0s	<4.5s
Above average	4.2–4.0s	4.6–4.5s
Average	4.4–4.3s	4.8–4.7s
Below average	4.6–4.5s	5.0–4.9s
Poor	<4.6s	<5.0s

Source: Davis B et al.: *Physical Education and the Study of Sport*; 2000

Normative data for adult males and females. The results are given to the nearest tenth of a second.

Advantages and disadvantages

- This is a good test of speed for a person whose sport involves running in a straight line.
- The test does not require any expensive equipment.
- It is quick and easy to perform.
- The type or condition of the running surface can affect the results.
- The test only measures speed in a straight line and with no equipment. For example, in rugby a player has to dodge opponents and hold the ball when running at speed.

Now try this

The table gives the 30-metre sprint test times achieved by three different adult athletes.

1. Use the normative data table above to identify the speed rating that each athlete has achieved.
2. Explain whether you think the ratings achieved are what you would expect for athletes who practise these sports.

	Gender	Sport	Time (s)
a	Male	Triathlon	4.2
b	Female	100 m sprint	3.7
c	Male	Shot put	5.2

Strength

Strength is the maximum force that can be generated by a muscle or muscle group. It is measured in kilograms (kg) or newtons (N).

Importance of strength

Strength is related to muscle mass:

- The larger a person's muscle mass, the more strength the person has. This is because muscle tissue produces force.
- The more muscle tissue a person has, the more force their muscles can produce.

Activities that use strength

Strength is needed in sports where the participant needs to move a heavy object or resist another person.

Sports where strength is ...	
a key component of performance	**part of the overall profile**
Moving heavy objects: • Weight lifting • Wrestling • Shot put	• Rugby (tackling, pushing against other players in the scrum) • Gymnastics

Hand grip dynamometer test

Measures strength of hand and forearm muscles.

Equipment

Hand grip dynamometer.

Protocol

1. Adjust the handle so that it fits the size of the hand of the person being tested.
2. The participant should hold the dynamometer in their dominant hand and allow their arm to hang by their side, with the dynamometer by their thigh.
3. The participant squeezes the dynamometer as hard as they can for around five seconds.
4. Record the reading (in kgw) from the dynamometer.
5. Repeat the test twice more, with at least a one-minute rest between tests. Record the results.

Males usually have more muscle mass than females, and muscle mass decreases with age so strength declines with age.

Normative test data

Rating	Females aged 15–19 years (kgw)
Excellent	>32
Good	28–31
Average	25–27
Below average	20–24
Poor	<20

Advantages and disadvantages

- 👍 Only the hand grip dynamometer is required.
- 👍 The test is quick and easy to perform.
- 👍 The test can be carried out in most places.
- 👎 The test only measures the strength of the forearms, which might not represent the strength of other muscle groups.
- 👎 The hand grip dynamometer can be expensive.

Now try this

Ola is a gymnast. Her rating in the hand grip dynamometer test was below average.

Explain whether this hand grip dynamometer test rating is a good indicator of Ola's overall body strength.

Do you think a gymnast might have high levels of strength in other areas of their body?

Power

Power is a combination of strength and speed. It is an important component of fitness in many sports.

Importance of power

In many sports, power is needed in order to apply the maximum force possible in the shortest time.

- On the starter's pistol, a sprinter pushes down on their starting blocks with as much power as they can, to push them up and out of the blocks to start sprinting as soon as possible.
- Power is also used in team sports where a player needs to be able to jump high (such as a basketball player jumping to perform a lay shot) or hit or kick an object with force (such as a football goalkeeper kicking the football down the pitch).

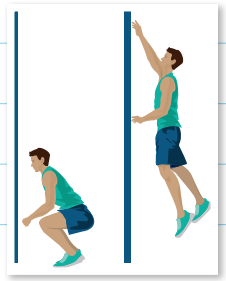
Activities that use power

- Power can also be applied to an object. A javelin thrower uses the power in their arm to throw the javelin as far as they can.

Sports where power is ...	
a key component of performance	**part of the overall profile**
• Boxing • Shot put • Power lifting	• Tennis (serving) • Sprinting (pushing off the starting blocks) • High jump (pushing off the ground)

Sargent jump test

The test measures the power in a person's legs. It is also known as the **vertical jump test**.



Equipment

Wall, chalk, ruler or tape measure.

Protocol

Before taking part in the test, the participant must be fully warmed up (see page 28 for routines).

1. The participant stands side on to the wall, with their feet flat on the floor.
2. With the hand closest to the wall, they reach as high as they can. Mark where their stretched fingers come to on the wall.
3. The participant then covers their fingers with chalk.
4. Again, standing side on to the wall, they crouch down and jump up as high as they can. At their highest point, the participant touches the wall to leave a chalk mark to show how high they have jumped.
5. Record the difference (in centimetres) between the participant's first mark and the chalk mark. This is the participant's score.

Normative test data

Rating	Males aged 16–19 years (cm)
Excellent	>65
Above average	50–65
Average	40–49
Below average	30–39
Poor	<30

Normative data tables are available for males and females of different ages. Males usually have a greater muscle mass than females so have more power. Power declines with age because muscle mass decreases as a person gets older.

Advantages and disadvantages

- The test assesses the power in a person's legs.
- It is quick and easy to perform.
- It does not require any expensive equipment.
- Jumping technique can affect the result. The participant must have a number of practice jumps to develop their technique.
- The test only measures the power in the legs and no muscles in the upper body.

Now try this

Jamie competes at a high level in the high jump. He scores an excellent rating in the vertical jump test.
Gavin competes at a high level in the discus throwing event.

1 **a** Explain why the vertical jump test is a good measure of power for Jamie.

b Explain why the vertical jump test is not a good measure of power for Gavin.

Body composition

Body composition is the proportion of fat mass and fat-free mass in the body. The fat-free mass is also called lean tissue, and consists of muscle, bone and vital organs.

What is body composition?

Our bodies are made up of the same parts – muscle, bone, organs, tissue, and fat. However, the percentage of body fat can vary immensely from person to person.

- The percentage of stored fat in a body versus the percentage of lean mass is the primary focus of body composition.
- Average amounts of body fat for females are around 25–31 per cent, and 18–24 per cent for males.

Relevance of body composition in sports

Sports where a particular body composition is beneficial	
Low body fat Low muscle mass	**High body fat High muscle mass**
• Jockey	• Sumo wrestler
Low body fat High muscle mass	**Mixed levels of body fat and muscle mass**
• Gymnast • Heavyweight boxer	• Racket sports • Team sports

Advantage of lower levels of body fat

Many athletes have lower percentages of body fat than the average because in some sports, higher amounts of body fat can have a negative effect on sporting performance.

Excess body fat increases body weight, which can make it more difficult to excel in sports such as long-distance running or high jump.

Assessing body composition

There are many ways of assessing body composition, some of which are used in gyms to help monitor body fat. This is useful for people who are trying to lose excess body fat.

Muscle tissue weighs more than body fat, so if a person has started to gain muscle mass from strength training, they might gain weight but still be losing body fat.

Having a low proportion of body fat helps high jumpers to be lighter so they are more able to lift high up from the ground and clear the bar.

Now try this

Sally takes part in 400 m hurdles. Her coach monitors her body composition and tells Sally that having high levels of body fat would have a negative effect on her performance.

Explain why having a high level of body fat would have a negative effect on hurdling performance.

When answering this question, think about what the athlete has to do when hurdling: run quickly around the track and jump hurdles.

Training for aerobic endurance

If you use the results of the Cooper 12-minute run test on page 2 to assess a person's level of aerobic endurance, you can choose appropriate training methods to improve it for their sport or activity.

Principles of aerobic training

Aerobic training aims to improve the efficiency of the cardiorespiratory system so that more oxygen and nutrients are delivered to the working muscles and more waste products are removed.

This allows the participant to take part in their sport for longer periods of time at the same intensity.

Types of training for developing aerobic endurance are:

1 interval training
2 continuous training
3 fartlek training.

Advantages and disadvantages

- Aerobic endurance training is good for all sports that last at least 30 minutes.
- No special facilities or equipment required, other than those for the participant's sport.
- It can take place inside or outside.
- If the training takes place outside, the weather can impact performance.
- You must have enough time for at least 30 minutes' regular training.

1 Interval training

Interval training involves exercising at 60–80 per cent Max HR followed by a recovery period.

- The time spent exercising can vary from a few seconds to many minutes.
- The recovery period may involve complete rest or exercising at very low intensity such as walking or jogging.
- To develop aerobic endurance, the length of the rest periods should be decreased and the exercise periods increased.

Advantages

- Interval training replicates a range of sports involving rest periods. For example, in netball, the players walk back to their positions after a team has scored before the game starts again.

2 Continuous training

Continuous training involves exercising at a constant intensity for at least 30 minutes. It can include jogging, swimming and cycling. The participant's heart rate (HR) should remain at 60–80% of their maximum. Revise intensity of training on page 17.

Advantages and disadvantages

- It is good for sports where a person exercises for long periods of time at the same intensity, such as a 10 km flat running race.
- It does not replicate the type of fitness needed for many sports, when the exercise intensity varies and the heart rate may go above 80% max.
- It can become tedious.

3 Fartlek training

Fartlek training combines continuous training with higher-intensity exercise.

- An example would be swimming at a set pace of 60–80 per cent maximum heart rate (Max HR) and then sprinting a few lengths beyond 80 per cent Max HR.
- Intensity can also be increased by using resistance, such as running uphill or with a weighted backpack.
- There are no rest periods in fartlek training.

Advantages and disadvantages

- Fartlek training helps to develop speed during the periods of higher-intensity training, as well as aerobic endurance during the periods of moderate-intensity training.
- This training method prepares participants for sports where they exercise at moderate intensity for long periods and then increase the intensity for brief periods. For example, in football, players jog continually up and down the pitch, and then occasionally do a fast sprint with the ball.
- Can be difficult to measure.

Now try this

Torin is a cross-country runner. He takes part in fartlek training and wants to increase the intensity of his training to help him prepare for a race.

Explain one method Torin can use to increase the intensity of his fartlek training.

Here you must give a reason for your answer.

Training for muscular endurance

Muscular endurance is usually needed in sports and activities where high levels of aerobic endurance are also required. Look back at muscular endurance and the one-minute sit-up test on page 3.

Principles of muscular endurance training

Muscular endurance training increases the ability of the trained muscles to contract repeatedly for long periods of time. Training for muscular endurance should include exercises:

- with a high number of repetitions (high reps)
- using low resistance or load (low weights).

Cycling is a good example of muscular endurance training for legs because it involves pushing down on the pedals many times (high reps) and the resistance is relatively low (low weights). Other methods of improving muscular endurance include circuit training and core stability training.

Circuit training

Circuit training involves stations of muscular endurance exercises arranged in a circuit. Participants carry out each exercise for a period of time before moving on to the next station. Short rest periods can be included between the stations.

Advantages and disadvantages

- 👍 It can be tailored to a specific sport, with drills from the sport included at some stations.
- 👍 Different muscle groups are exercised at each station to improve muscular endurance in the whole body.
- 👍 The stations can be changed at each training session to avoid boredom.
- 👍 Circuit training is usually a group exercise, which can help with motivation.
- 👎 Cards or signs for each station need to be made prior to the training.
- 👎 It takes time to set out the circuit with appropriate equipment.

Core stability training

Core stability is required for all sports and activities. It allows participants to maintain good posture and helps to prevent injuries to the back and neck.

There are many different types of core stability training methods, which concentrate on exercising the abdominals, obliques and muscles in the back. Examples include crunches, the plank, and leg raises.

Advantages and disadvantages

- 👍 No equipment is needed – most core stability exercises can be carried out using body weight alone.
- 👍 A stability ball can be used, which is inexpensive.
- 👍 It can be carried out at times that fit in with the participant's other commitments.
- 👎 High levels of motivation are needed to carry out exercises regularly.
- 👎 Exercises may need to be modified for the participant's level.
- 👎 A coach/instructor may be needed to advise on correct technique.

Now try this

Anita is taking part in circuit training for muscular endurance.

Describe how Anita should use weights in the circuit to develop her muscular endurance.

Think about the number of reps and what the load should be (how heavy the weights are).

Using a stability ball to perform sit-ups avoids having the hard floor surface underneath the spine. It helps to fully engage the core muscles as the participant has to balance on the ball while performing the sit-ups.

Training for flexibility

Flexibility training plays an important part in injury prevention and is beneficial for sporting performance. Sportspeople whose joints can move through their full range of movement are more able to perform specific sporting techniques correctly. Look back at the sit and reach test on page 4 which tests flexibility.

Methods of improving flexibility include static stretching, dynamic stretching and proprioceptive neuromuscular facilitation (PNF) stretching.

Static stretching

The participant gets into a position to target a specific muscle or muscle group, and holds the position to develop the stretch.

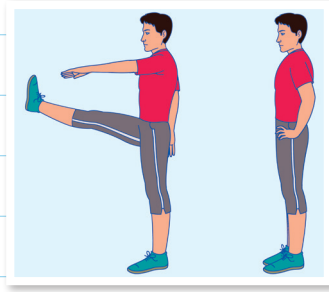
Static stretching can be done using your own body, another person or an object to keep the body part in the correct position. The stretch needs to be held for 12–30 seconds.

Advantages and disadvantages

- This helps to increase flexibility in specific areas of the body required for particular sports.
- As with all types of stretching, little or no equipment is needed, so there are no costs and no time required setting up equipment.
- High levels of motivation are needed to carry out exercises regularly.
- A coach/instructor may be needed to advise on correct technique.

Dynamic stretching

Dynamic stretching involves gradually increasing the range of movement of a muscle or group of muscles over a series of repetitions.



A dynamic stretch for the hamstrings

Advantages and disadvantages

- This helps to maintain an elevated heart rate, so it is good to include in a warm-up to help get the body ready for training.
- No equipment is needed so there are no costs and no time required setting up equipment.
- If a participant is not sufficiently warmed up, dynamic stretching could cause injury as they might overstretch when carrying out the movement.

Proprioceptive neuromuscular facilitation (PNF) stretching

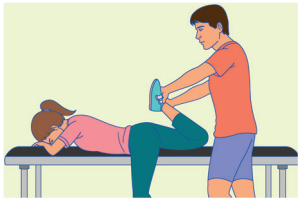
PNF stretching requires a partner to provide resistance.

1. The participant stretches the muscle or muscle group as far as possible.
2. The partner holds the body part being stretched while the participant pushes against their partner for 6–10 seconds.
3. The participant then relaxes the muscle while the partner pushes the body part to increase the stretch.

The process is repeated about three times.

Advantages and disadvantages

- It helps to develop flexibility at a faster rate than other types of flexibility training.
- Another person is needed and so the stretches cannot be performed alone.
- There is a risk of injury if the stretching partner lacks experience.



A PNF stretch for the quadriceps

Now try this

PNF is a type of flexibility training.

1. Identify two other types of flexibility training.
2. State one reason why a person might choose PNF training rather than other types of flexibility training.

For question 2, choose an advantage of PNF stretching that isn't a feature of the other types.

Training for speed

Speed is important for athletic track events and sprint cycling, as well as for team games (for example, when sprinting to intercept the ball or get ahead of an opponent). You can revise speed and the 30-metre sprint test on page 5.

The range of training methods designed to develop speed includes sprint training, sport-specific speed training (speed, agility and quickness – SAQ) and interval training.

Sprint training

Sprint training involves completing a set distance as fast as possible, such as in running, cycling or swimming.

- Resistance can be used to increase the load the participant has to sprint against. This overloads the muscles to make them stronger.
- Assisted sprinting, such as running downhill, makes sprinting easier and helps the muscles to get used to the process of moving at speed.

Resistance can be provided by using bungee ropes, a parachute or sprinting uphill.

Advantages and disadvantages

- It is good for sports that involve travelling at speed.
- It is good for sports that require sprinting in a straight line.
- Equipment can be used to add resistance and variety.
- The equipment can be expensive.
- It is only useful for sports that involve sprinting in one direction.

Sport-specific speed training (SAQ)

For this type of speed training, SAQ equipment and training principles are used.

This method involves sprinting and then changing direction over a set course which is designed to replicate sport-specific speed requirements.

SAQ involves sport-specific drills such as running around or over obstacles.

Advantages and disadvantages

- It can be made sport-specific.
- It is good for sports that include changes of direction when sprinting.
- The equipment is cheap and easy to use.
- The equipment adds variety and helps prevent boredom.
- Time is needed to set up the equipment prior to the training.

Interval training

For interval training that aims to develop speed, very short, high-intensity work periods are followed by a rest or recovery period.

Advantages and disadvantages

- It is good for sports that have varied intensity with recovery periods.
- No equipment is needed.
- No training facility is required.
- It does not always replicate sport-specific movements.

Now try this

Freddie is a rugby player. He wants to improve his speed to help his rugby-playing performance.

Choose one method of speed training and give a reason why this method is suitable for improving speed for Freddie's sport.

Training for strength

The purpose of strength training is to increase the size of a person's muscles. The larger the muscles, the more force they can exert and the more strength they have. Look back at page 6 to revise strength and the hand grip dynamometer.

Principles of strength training

To increase strength, muscle tissue needs to be overloaded using heavy weights to cause muscle **hypertrophy** (an increase in muscle size). Strength training exercises involve carrying out low numbers of reps using heavy weights. Free weights and resistance machines can be used to help increase muscle size and improve a person's strength.

Free weights

A free weight is one that is not attached to machinery.

- A dumbbell is a short bar with a weight at each end, used with one in each hand.
- A barbell is a longer bar with a weight at each end, used with both hands.

Dumbbells are available in different weights to suit different levels of strength and to allow for progression.

Advantages

- Free weight training increases strength over a large range of movements.
- They allow the participant to focus on certain movements or specific muscle groups.
- Targeting specific muscle groups helps increase strength for particular sports.
- Free weights can be stored and used at home.
- The same equipment can be used to train different muscle groups.

Disadvantages

- Weight training exercises rarely replicate the movements carried out in sport fully – although muscle size will increase, the range of movement actually used in sport might not.
- Training cannot be carried out alone – a spotter is needed to ensure the participant's safety.
- To ensure the participant's safety, training should not be carried out when fatigued. This can increase the chance of not being able to lift the weight and incurring injuries.

Resistance machines

Resistance machines use stacks of weights attached to pulleys or air pressure to provide resistance.

Each machine is designed to perform one type of strength training exercise, and so only permits specific movement patterns to train specific muscles or groups of muscles.

Advantages and disadvantages

- They can increase the strength of targeted muscles and muscle groups for particular sports.
- They are safer than free weights for people new to weight training – there is less chance of injury from not being able to lift the weight.
- Participants can train alone.
- The equipment is expensive.
- You might need to join a gym or leisure centre to use the equipment.
- Each machine usually exercises only one muscle or muscle group, so many different pieces of equipment are required.

Now try this

Molly wants to improve her strength but has never carried out any strength training before.

Explain which method of strength training you would recommend for Molly.

Think about the two types of equipment used for strength training. Which one is easiest and safest for a person who is new to strength training? Make sure you give the reason for your choice.

Training for power

Power training involves using lower weights or resistance than strength training, and the types of exercises carried out allow the participant to perform a high number of repetitions. This simulates repeated use of power in sports such as the shot put, basketball and gymnastics. Look back to page 7 to revise power and the Sargent jump test. Plyometrics, anaerobic hill sprints and CrossFit are all training methods for improving power.

Plyometrics

Plyometric training involves making a muscle produce its maximum force in the fastest possible time.

- It uses movements which lengthen the muscle and then immediately shorten it, such as jumping on and off benches or over bars to develop power in the legs.
- The shorter the time between the lengthening and shortening of the muscle, the more power is generated.

Advantages and disadvantages

- It can be targeted for the muscle groups that require power.
- The equipment usually consists of benches or boxes, which are cheap and relatively easy to set up.
- It can be performed alone at times to suit the individual.
- Benches and bars need to be set up.
- It can cause injury as the muscles have to withstand high levels of stress.

Upper body plyometric training – the participant does a press-up then pushes hard off the ground to lift their upper body into the air before landing back into a press-up.

Anaerobic hill training

This training involves repeatedly running up a hill as fast as possible. The participant then has a recovery period walking back down the hill.

- The steepness of the hill has an impact on the intensity a person works at for this type of training, so participants should try to find a hill at the right incline for them.
- This type of training is anaerobic as the systems used to provide energy for it do not require oxygen.

Advantages and disadvantages

- It is beneficial for sports that are carried out at high intensity and involve running.
- No setting up or costs involved.
- It can be performed alone at convenient times.
- It is only suitable for sports that involve running.
- Access to a hill is needed.
- It is a high-intensity training method, which is not appropriate for people with low levels of fitness.

CrossFit

This type of training involves a variety of exercises including:

- using body weight as a form of resistance
- lifting weights
- aerobic-based exercises.

A range of different equipment can be used to add variety and interest to the training.

Advantages and disadvantages

- It can target specific areas of the body.
- The equipment is relatively cheap and does not take long to set up.
- Intensity can be varied to cater for different ability levels.
- You need to attend a class because there is a wide range of exercises, which require specialist knowledge.

Now try this

Cathy is a basketball player. She takes part in plyometric training to improve her power for basketball.

Give **two** advantages for Cathy of taking part in plyometric training to improve her basketball performance.

The FITT principles

The letters of FITT stand for the key principles to follow when planning a training programme. These are **F**requency, **I**ntensity, **T**ype, and **T**ime. The FITT principles should be used when planning weekly training programmes to improve targeted components of fitness. Participants at all levels, from complete beginners to elite athletes, should follow these principles to ensure that their training programme will be effective.

Frequency – How many training sessions per week?

Intensity – How hard will the participant train? (for example, as a percentage of maximum heart rate)

The four FITT principles

Type – What type of training method and exercises will be used?

Time – How long will the training session last?

Revise each of the FITT principles in more detail on pages 16–19.

Real world Applying the FITT principles

This an example of a training programme where the FITT principles have been applied.

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

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

Intensity for jogging and cycling is given as percentage of Max HR. The intensity for flexibility training is based on a scale of low/moderate/high intensity.

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

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

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.

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 21.

Real world 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?

1. Participant takes part in a training session.
2. Increased level of fitness due to **adaptation** to training.
3. The participant can train more frequently.
4. Further increases in the participant's level of fitness.

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.

Deciding 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. Revise overtraining on page 22.

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)

The Borg RPE scale ranges from 6 (rest) to 20 (exhaustion). The person exercising indicates the number that represents how hard 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 × 10 = HR (bpm)

2 Percentage of maximum heart rate (Max HR)

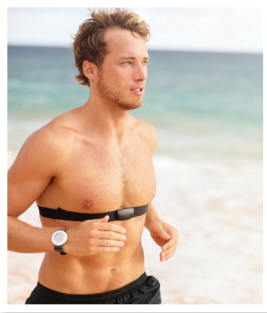
For some types of activity, working at the right intensity means a person exercising so that their heart is beating at a percentage of their Max HR.

Use the formula: Max HR = 220 – 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.



This chest strap monitors heart rate and the wrist watch records the information.

Real world For 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:

Max HR = 220 – 15 = 205 bpm

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

205 × 70/100 = 144 bpm

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 HR, in order to train aerobic endurance.

1 Calculate Susie's Max HR.

2 Calculate 70 per cent of her Max HR.

3 Calculate 80 per cent of her Max HR.

- Give your answers as the number of beats per minute (bpm).
- If your answer has any decimal places, round to the nearest whole number.

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.

Real world Specific training

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, 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

Variety of training methods

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

Real world 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:

- running on a treadmill
- cross-country running
- running round an athletics track
- running 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.

1 Identify a training method that Tanya could use to improve her power.

2 Describe a type of exercise that Tanya could carry out to improve her power.

You can revise the different training methods for developing power on page 14.

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 training (HIT), 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.

- HIT 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 25.

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.

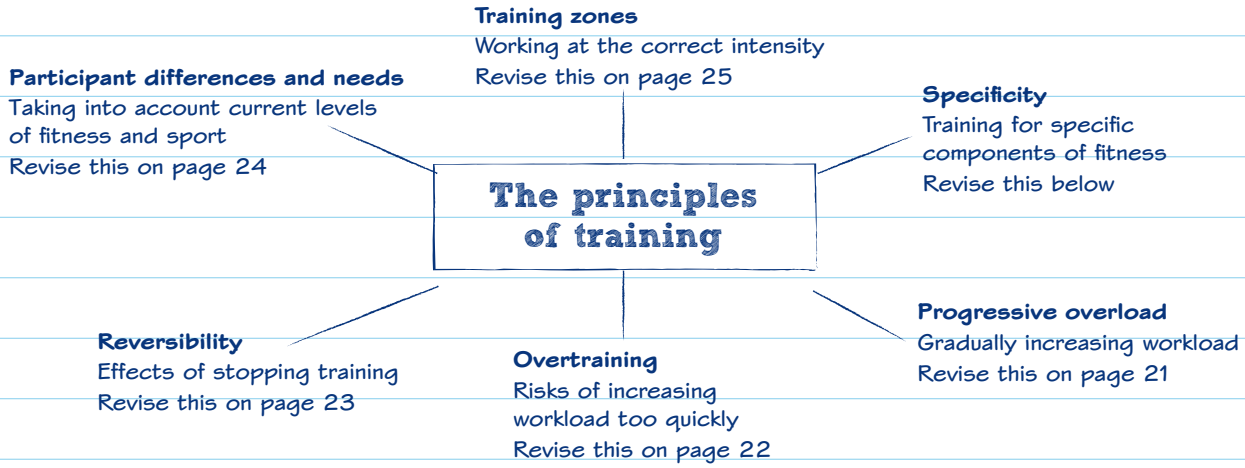
2 State the minimum length of time Sean should take part in the exercise, in order to lose excess body fat.

- 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! ☐

Principles of training: specificity

As well as the FITT principles, there are six further 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 five 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.