

Unit 1: Fitness for Sport and Exercise

Learning objectives

- A) Know about the components of fitness and the principles of training.
- B) Explore different fitness training methods.
- C) Investigate fitness testing to determine fitness levels.



Components of fitness

Components of fitness can be used separately or in combination with each other.

6 components of physical fitness:



Muscular Strength

Definition - The ability to exert a large amount of force in a single maximum effort



Think. Pair. Share – What sports require a high level of muscular strength?



Aerobic Endurance

Definition - The ability of the cardio-respiratory system to supply oxygen to working muscles during sustained physical activity

The cardio-respiratory system deals with the heart, lungs and blood vessels of the body.



Training increases the efficiency of the heart to transport oxygen to working muscles.



Muscular Endurance

Definition - The ability to use voluntary muscles, over long periods of time without getting tired

Also known as stamina means that the muscles keep working for a long time without getting tired. Essential for long distance events.



Speed

Definition - Time taken to cover a set distance.

Sporting examples:

- 100m sprinter
- Movement of a badminton player to return the shuttle.



Speed is very important in many sports – it can often be the thing that separates a good performer from a great performer.



Flexibility

Definition - A full range of motion at a joint.

Also known as suppleness refers to the ability of the muscles to stretch and then return to their original position.

It is important for reducing the risk of muscles strains and injuries.



Body Composition

Definition - The proportion of body weight that is fat, muscle and bone.

Some body shapes are better suited to certain sports than others.



Think. Pair. Share – Describe the ideal body composition for 3 different sports.



Components of Skill Related Fitness

Everyone's fitness level will differ depending on the particular sports they play. Each activity has its own set of fitness requirements that the individual must meet in order to compete with others.



The following are the 5 main components of skill-related fitness:



Agility

Definition - this is the ability to change direction quickly.

Athletes with good AGILITY keep their entire body under control throughout.



Agility is especially important in sports that require a sharp movement or turn. *i.e. goal keeper*



Balance

Definition - is the ability of the performer to retain their centre of mass over their base of support without falling.

Balance can be:

Static – This is a still action. *i.e. handstand.*

Dynamic – Keeping your balance on a board *i.e. skateboard or surfing.*



Coordination

Definition - is the smooth flow of a movement needed to perform efficiently and accurately.



i.e. An effective tennis stroke requires coordinating footwork and arm action.



Reaction time

Definition - The time between the presentation of a stimulus and movement.

A **stimulus** could be anything from a starting gun to a sudden side-step by an opponent.



i.e. how quickly a table tennis player reacts to a serve.



Power

Definition – This is a combination of strength and speed.

$$\text{Power} = \frac{\text{Force} \times \text{Distance}}{\text{Time}}$$

Power is important in explosive events like throwing and sprinting.

Power is vital to getting a good start in short races.



Sport Specific Fitness Components



Think. Pair. Share – What components of fitness are required for each sport above?



Fitness Components & Sports performers

Successful performances in any sport are dependant on having:

1. The right skill-related fitness components
2. The ability to meeting the demands of the environment

You might also consider the persons position within the event.

i.e. A rugby forward will have different requirements to that of a back.



Exercise intensities

Heart rate: The number of beats per minute.



Measuring Heart rate:

Use the pulse in your neck (carotid pulse) or on your wrist (radial pulse). Use your index and middle finger **only**.



Count for 15 seconds x 4 = _____
Beats per minute



Calculating working intensities – Heart rate

An estimate of **maximum heart rate** is calculated as:

$$\text{Maximum Heart Rate (MHR)} = 220 - \text{age}$$

Worked example:

A 25 year-old would have a maximum heart rate of:

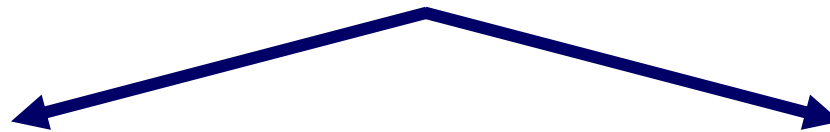
$$220 - 25 = \mathbf{195\text{bpm}}$$



Exercise Intensity

To improve fitness from regular exercise you must push your heart rate above a certain level, known as the training thresholds.

There are two training thresholds:



Aerobic Training Threshold

= 60-85 % of the
maximum heart rate

Anaerobic Training Threshold

= 85% + of the
maximum heart rate



Rate of Perceived Exertion

The Borg scale is a simple method of rating perceived exertion (RPE) and is used to measure a performer's level of intensity during exercise.

During exercise, the Borg scale is used to assign numbers to how you feel about the exercise undertaken.

Borg scale

6	No Exertion at all
7	Extremely light
8	
9	Very Light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion



Rate of Perceived Exertion & Heart Rate

Rating of perceived exertion (RPE) can also be used to predict heart rate. The following equation is used:

$$\text{RPE} \times 10 = \text{Heart Rate (BPM)}$$



Basic Principles of training – F.I.T.T.

For training to improve an individual's fitness they must follow the FITT basic principle of training.



Frequency - How often we train

The body needs time to recover from each training session. Training should be spread over the week and varied.



Intensity - How hard we train

Fitness gains are only achieved if the body systems work hard enough.

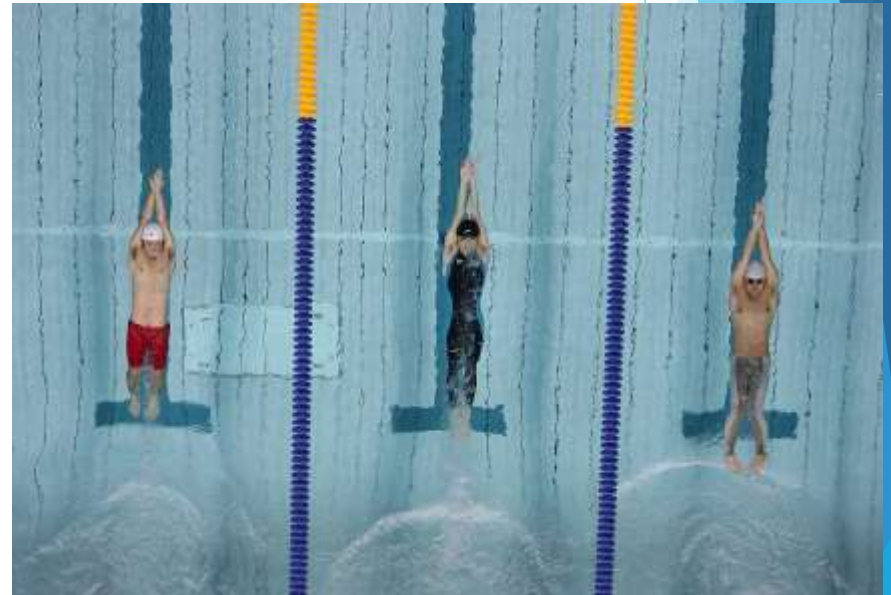
Athletes must start at the right intensity, depending on our current fitness. An understanding of training thresholds also help.



Time - How long we train

Each session must last at least 20 minutes to get any benefits.

To improve **aerobic** fitness training sessions should last longer and **working heart rate** should rise between 60-80% of maximum.



Type - What type of training used

Athletes should analyse our particular sport to know the fitness and skills they need.

The training programme should include types of activity to develop these skills and fitness.



Additional Principles of training

There are certain **principles of training** which should be followed to improve performance.



Specificity

Your training should be geared **specifically** towards your chosen sport or activity.



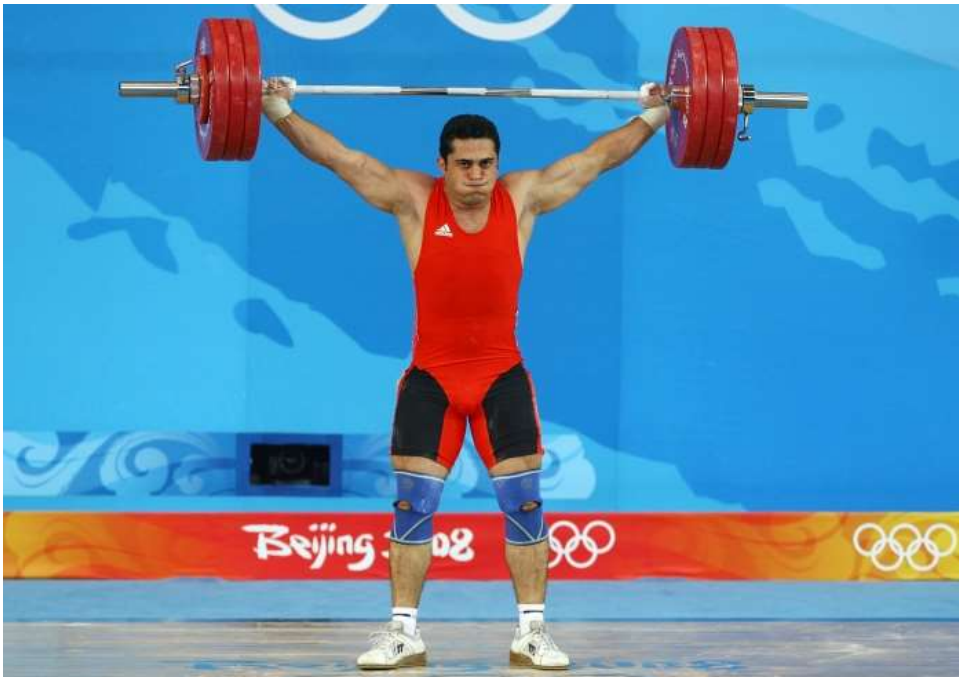
You need to train **specifically** to develop the right...

- Muscles – if your sport requires a lot of running, work mainly on your legs.
- Type of fitness – do you need strength, speed, stamina or a combination?
- Skills – you need to practice any relevant skills like kicking, serving and passing.



Specificity

The training for a shot putter would be different from the training for a marathon runner. You would not ask your shot putter to run 2 miles nor ask a runner to use heavy weight based exercises.



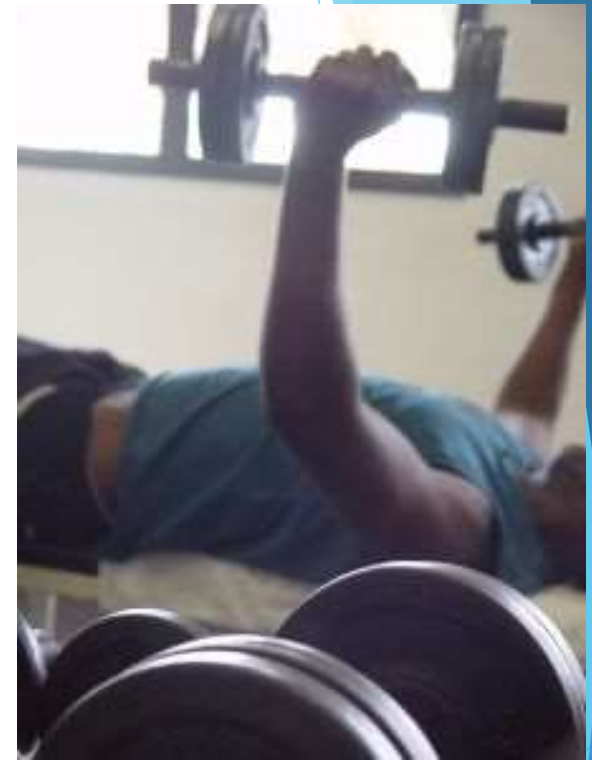
i.e. if you're training for a weightlifting competition, it's no use going swimming every day.

You need to concentrate on strength training for your arms and legs.



Progressive Overload

This principle involves working the body harder than normal and gradually increasing the amount of exercise you do.



This makes our body adapt to the training levels and therefore getting fitter.



Progressive Overload

Athletes need to monitor performance levels and adjust the programme in order to take fitness level to a higher level.



Think. Pair. Share – How would you achieve progressive overload?



Individual difference/needs

Everybody's fitness level differ and should therefore tailor training to their specific needs.



Understanding an individuals needs will mean training is set at their level and accounts for their strengths and weaknesses.



Elite performers may adjust their training in the run up to a competition.



Adaptation

This is how the body reacts to training loads placed on it. The more the body is pushed the better its ability to cope.



Adaptations occur during recover periods between training sessions.



Reversibility

Reversibility is process of an athletes body **losing fitness levels.**

It the opposite of progressive overload and can occur if training has stopped due to illness or injury.

This simply means that unless you keep training, any fitness gains will be lost.

Athletes say.....

“If you don’t use it, you lose it!”



Reversibility

This means that instead of progressing or remaining at the same level, the athlete loses fitness. It only takes 3 or 4 weeks to get out of condition.

This has implications does for an elite performer who's season has just finished and may become out of shape.

Reversibility may also take place after an injury or illness as normal training can become difficult.



Variation

Using a variety of training methods (or exercises) relieves tedium and avoids **boredom** in training. When training becomes dull, it can lead to poor performance, activities should stimulate interest.



Athletes can also combat tedium by training with a partner, using music or through accurate goal setting.



Rest and Recovery

For effective training, performers should achieve the right balance between rest and recovery.



Recovery allows the body to:

1. Replenish energy stores
2. Repair muscles fibres



Retrieval Practice

How might Agility, Balance and Coordination be used by a gymnast?

Describe the FITT principle.

Components of fitness and principles of training

Explain the principle of reversibility and progressive overload.

Using a hockey player as an example, suggest the most important components of fitness.



Exam Question Application

1. One important component of fitness needed for success in football is **agility**.

(a) Define the term agility.

(2)

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(b) Give one example of how a football player would use agility when taking part in a football game.

(1)

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.....

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Exam Question Application

2. Which one of the following performers relies most heavily on a high level of cardiovascular fitness for success? (1)

- A 200m runner
- B 400m runner
- C 800m runner
- D 1500m runner



Exam Question Application

3. Briefly explain how the gymnast has used power and coordination to achieve the position shown in Figure 3.

(i) Strength (2)

(ii) Coordination (2)



Exam Question Application

Marks Scheme:

1. (a) Agility is the ability of a sports performer to quickly and precisely move or change direction (1) without losing balance or time (1)

(b) Agility can be used:

- so that a player can quickly get up from the ground after a tackle / goalkeeper makes a save (1)
- so that a player can dodge to get away from an opponent / maintain possession of the football (1) Accept any other appropriate answer.

2. D



Exam Question Application

Marks Scheme:

3.

i) Strength is the ability to exert a force against a resistance (1)
/ Strength is require to hold the body off the horse and enable gymnastics movement/sequence (1)

ii) Two or more body parts moved together to achieve the position/shape shown/both legs need to be moved together/
(1) Coordination is used to execute the technique correctly/perform the move well/perform with control/make position aesthetically pleasing (1)



Fitness training methods

Every training method requires a full warm up and cool down to ensure the performer's safety.

Warm up: All performer should prepare well for exercise. A thorough warm up is vital to prepare the mind and body.



Cool down

A cool down will return the body to a complete resting state. Gentle stretching will remove lactic acid and prevent muscles cramps. A cool down will also prevent DOMS (*delay onset muscle soreness*)



Flexibility Training

Static stretching can be active or passive.

Active stretching: The performer works on one joint, pushing it beyond its point of resistance (lengthening the muscles)



Passive stretching: the stretch occurs with the help of an external force, such as a partner, gravity or a wall.



Flexibility Training

Ballistic stretching involves performing a stretch with swinging or bouncing movements to push a body part even further.



Think. Pair. Share – What are the advantages and disadvantages of this type of stretching?



Flexibility Training

Advantages	Disadvantages
Easy to do – no equipment required.	Must be undertaken with care as it can cause muscle soreness/strains.



Flexibility Training

PNF (proprioceptive neuromuscular facilitation) is where the muscle is contracted isometrically for a period of at least 10 seconds. It is then relaxed and stretched again, usually going further the second time.

PNF stretching is often used in rehabilitation programmes.

It must be performed by trained individuals or injury can occur.



Strength, Endurance & Power Training

Plyometrics is one method of strength training that can be used to improve power or muscular strength.

i.e. Good for long jumpers, 100 m sprinters or basketball players

Plyometrics exercises cause the muscle to lengthen (eccentric action) before a maximal muscle shortening (concentric action)

i.e. Bounding, hopping, jumping.



Strength, Endurance & Power Training

Strength gains through plyometrics usually takes about 8-10 weeks.

Plyometrics must be performed carefully because it can be physically stressful on the body.



Circuit Training

Circuit training is a series of exercises completed one after another. It is a very good way of developing strength, muscular endurance and power..



Circuit Training

Each exercise is called a station. Each station should work a different area of the body to avoid fatigue.

The intensity of a circuit can be increased by changing the time of work at each station, increasing the intensity or decreasing the rest.



Think. Pair. Share – What factors should you consider about the order of the activities and why?



Weight Training

Weight training is a form of training that uses progressive resistance against a muscle group.

Weight training can benefit a performer through

1. Increase muscular strength
2. Increase muscular endurance
3. Recover after injury.



Weight Training

Weight training can increase:

Muscular strength: High weight x low repetitions

Muscular endurance: Low weight x high repetitions



Rest and recovery time will depend on:

- Athlete's fitness
- Athlete's weight
- Sets completed

2 days is the average recovery period to mend damaged muscle fibres.



Weight Training

1 Repetition Maximum (1RM) – This is the maximum weight an individual can lift in a given exercise.

Working at 90% of an individual's 1RM intensity will improve muscular strength.

Working at 75% of an individual's 1RM intensity will improve elastic strength. This is used by gymnasts.



Weight Training

Working at 50-60% of an individual's **1RM** intensity will improve **strength endurance**.



Aerobic Endurance Training

Continuous Training:

This type of training involves a steady but regular pace at a moderate intensity which should last for at least 30 minutes.



Activities can includes running, walking, swimming, rowing or cycling.



Aerobic Endurance Training

Fartlek Training: This means **Speed Play**.

It is a combination of different intensities. i.e. 1 lap at 50% max, 1 lap walking, 1 lap at 80%



Works on both **aerobic** and **anaerobic** fitness due to the varying intensities.

Think. Pair. Share – What athletes use this method of training?



Aerobic Endurance Training

Fartlek training is used by team games performers as it suits the movements necessary for a game.



Can be completed over different **terrains** - woods/hills/roads to create a variety of intensities.



Aerobic Endurance Training

Interval training: This training involves periods of work followed by periods of rest. *i.e. Sprint for 20 metre + walk back to start.*



Think. Pair. Share – What athletes/performers would benefit from this method of training?



Aerobic Endurance Training

Lactic acid and oxygen debt builds up during interval training. The rest phase allows for recovery of these levels.

Exercise intensity can be increased through:

- Decreased rest time.
- Extended period of work.
- Use of equipment/weights to increase intensity of work.



Speed Training

Hollow Sprints: This training method involves a series of sprints separated by a 'hollow' period of jogging or walking.



This type of training is often used by sprinters.



Speed Training

Acceleration Sprints: This is where the pace is gradually increased from a standing or rolling start. Progressively the athlete will build up to a maximum sprint or intensity.



Speed Training

For **speed training** the intervals between work will be shorter and more intense. *i.e. 40 metre sprint + 15 seconds rest.*



Retrieval Practice

Which aspect of fitness is commonly improved through?

- i) continuous training
- ii) short interval training

Describe a typical Plyometrics training session.

Fitness training methods

Explain the principle behind fartlek training.

Describe the difference between active and passive stretching.



Exam Question Application

1. The photo shows athletes training on a treadmill. They have been running at a steady pace and a moderate intensity for 60 minutes.

(a) Which method of training are they undertaking? (1)

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(b) The athletes decide to alter their running intensity by changing their running speed without any rest. What is this method of training called? (1)

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Exam Question Application

2. There are many different methods of strength training. Identify **two** methods of training that would improve strength. (1)

- A Interval training
- B Circuit training
- C Flexibility training
- D Free weights
- E Fartlek training

3. Julian completes the following routine. **A standing start – Jogging – Striding – Maximum sprint.** Which of the following methods of training is Julian using?

- A Hollow sprints
- B Acceleration sprints
- C Sprint intervals



Exam Question Application

4. Max's BTEC group all participate in different sports. Each week Max's teacher takes them for a circuit training session. Explain the advantages and disadvantages of the group using circuit training to improve their fitness. (6)

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Exam Question Application

Marks Scheme:

1. (a) Continuous training

(b) Fartlek training

2. B & D

3. B



Exam Question Application

Marks Scheme:

4. Advantages of circuit training

- It can be tailored to develop any component of fitness (1) so each member of the group could focus on what was relevant to their sport (1)
- You can include a variety of exercises (1) which will maintain the groups interest and maintain their motivation for training (1)

Disadvantages of circuit training

- The session will need careful planning and organisation (1) as the group all want to improve different components of fitness (1)
- Too much activity time can be lost during the session (1) because the teacher will need to explain the correct techniques for all the different exercises to make sure the session is safe (1)



Fitness Testing

Fitness testing is vital for athletes to monitor and assess improvements in performance. This is important for goal setting and motivation.



The results should be used to design a specific training programme that works on the performers area of weakness.



Fitness Testing

A coach should consider the following points when setting up and carrying out fitness tests on a athlete:

- Consent
- Calibration of equipment
- Accurate recording of the results
- The purpose of the test. Does it measure what you what to find out?



Fitness Testing

Once results are collected they will need interpreting against a set of published standardised readings.

Evaluating the testing procedure is also important.



Think. Pair. Share – What do the following terms mean; Reliability, Validity and Practicality?



Fitness Testing

Validity relates to whether the test actually measures what it sets out to measure.

Reliability is a question of whether the test is accurate. It is important to ensure that the procedure is correctly maintained for **all** individuals.



Think. Pair. Share – How might you improve validity and reliability?



Fitness Testing

Validity, reliability & practicality can be improved by:

- The tester should be experienced.
- Equipment should be standardised.
- Different performers might have differing motivation to complete the test to the best of their ability.
- Tests should be repeated to avoid human error.



Fitness Testing

Flexibility – Sit and Reach Test

Measures the range of movement at the hips/torso.

Rules:

- Legs straight with feet touching the box.
- Push marker as far as possible without bending your knees.





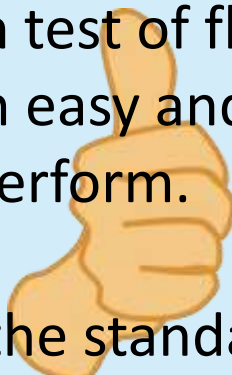
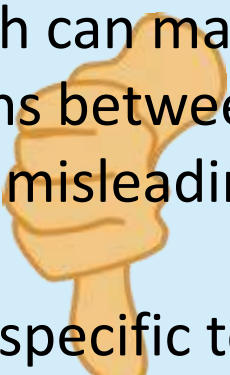
Here is a table of the published data for a sit and reach test:

Gender	Excellent	Above average	Average	Below average	Poor
Male	>14	11 - 14	7 - 10	4 - 6	<4
Female	>15	12 - 15	7 - 11	4 - 6	<4



Flexibility – Sit and Reach Test

Consider the **advantages** and **disadvantage** of this test.

Advantages	Disadvantages
<p>The sit and reach test is a common test of flexibility, and is an easy and quick test to perform.</p>  <p>If using the standard testing procedure, there is a lot of published data to use for comparison.</p>	<p>Variations in arm, leg and trunk length can make comparisons between individuals misleading.</p>  <p>This test is specific to flexibility of muscles and joints of the lower back and hamstrings, and may not be relevant to other parts of the body.</p>



Fitness Testing

Strength – Hand Grip Dynamometer

Measures the strength of the performer hand grip strength in one action.

Rules:

- No swinging your hand
- Start with your hand up and bring down to side while pulling in handle





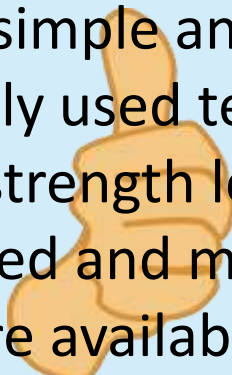
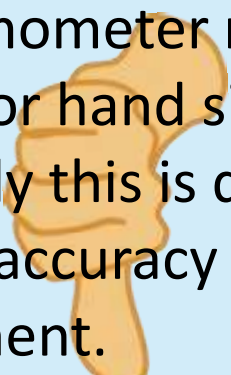
Here is a table of the published data:

Gender	Excellent	Good	Average	Fair	Poor
Male	>56	51-56	45-50	39-44	<39
Female	>36	31-36	25-30	19-24	<19



Strength – Hand Grip Dynamometer

Consider the **advantages** and **disadvantage** of this test.

Advantages	Disadvantages
<p>This is a simple and commonly used test of general strength level, well researched and many norms are available.</p> 	<p>The dynamometer must be adjusted for hand size, how successfully this is done will affect the accuracy of the measurement.</p> 



Fitness Testing

Methods of evaluating stamina or aerobic endurance (cardio-respiratory endurance) include:

- The multi-stage fitness test
- Forestry step test

The Multi Stage Fitness Test:

The athlete performs a 20m progressive shuttle run in time with a beep, to the point of exhaustion. The level reached depends on the number of shuttle runs completed and is ascertained from a standard results table.



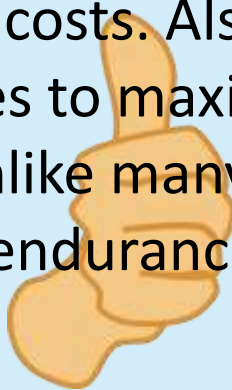
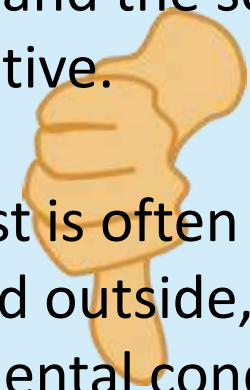
Here is a table of the published data:

	Men	Women
Excellent	> 13	> 12
Very good	11 - 13	10 - 12
Good	9 - 11	8 - 10
Average	7 - 9	6 - 8
Poor	5 - 7	4 - 6
Very poor	< 5	< 4



Aerobic Endurance – The Multi Stage Fitness Test

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>Large groups can perform this test all at once for minimal costs. Also, the test continues to maximum effort unlike many other tests of endurance capacity.</p> 	<p>Practice and motivation levels can influence the score attained, and the scoring can be subjective.</p> <p>As the test is often conducted outside, the environmental conditions can affect the results.</p> 



VO2 Max

Athletes need a constant supply of oxygen to muscles. This is known as oxygen uptake (VO₂) The maximum oxygen uptake in a minute refers to high intensity exercise.

VO₂ max can
be measured
in a
laboratory
(ml/kg/min)



Aerobic Endurance

Forestry Step Test:

Performers step onto and off the bench/step continuously for 5 minutes. (steady pace). Recovery heart rate is then measured.



Forestry Step Test

1 minute after exercise = take pulse

2 minute after exercise = take pulse

3 minute after exercise = take pulse

Add 3 scores together and use the following formula:

$$\frac{30,000}{3 \text{ pulse score added together}}$$

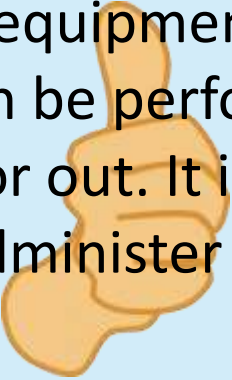

Here is a table of the 'norms':

Gender	Excellent	Above Average	Average	Below Average	Poor
Male	>90	80-90	65-79	55-64	<55
Female	>86	76-86	61-75	50-60	<50



Aerobic Endurance – Forestry Step Test

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>This simple test requires minimal equipment and costs, can be performed indoors or out. It is possible to self-administer this test.</p> 	<p>Some subjects may not have the fitness or coordination to maintain the required stepping rate.</p> 



Speed testing

Speed – 35m Sprint Test

Performers to cover a straight 35 m from a standing start. The time taken should be accurately recorded.



Speed testing

Speed – 35m Sprint Test

Here is a table of the average scores:

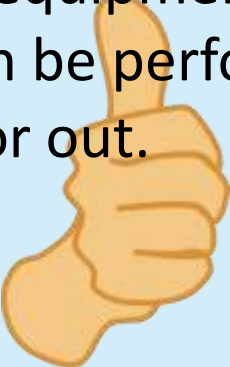

Time to run 35 meters (in seconds)

Rating	Men	Women
Very good	< 4.80	< 5.30
Good	4.80 - 5.09	5.30 - 5.59
Average	5.10 - 5.29	5.60 - 5.89
Fair	5.30 - 5.60	5.90 - 6.20
Poor	> 5.60	> 6.20



Speed – 35m Sprint Test

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>This simple test requires minimal equipment and costs, can be performed indoors or out.</p> 	<p>Problems with accuracy of timing and false starting.</p> 



Speed & Agility testing

Agility – Illinois Agility Run

Performers start at the first cone. On the whistle pupils should follow the course in the diagram and finish at the end cone.



Performers are timed from start to finish.






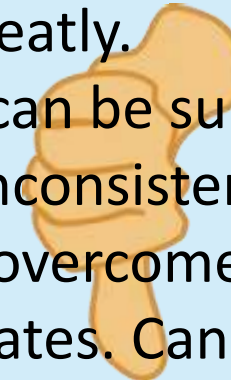
Here is a table of the average scores:

Gender	Excellent	Above Average	Average	Below Average	Poor
Male	<15.2 secs	15.2 - 16.1 secs	16.2 - 18.1 secs	18.2 - 19.3 secs	>19.3 secs
Female	<17.0 secs	17.0 - 17.9 secs	18.0 - 21.7 secs	21.8 - 23.0 secs	>23.0 secs



Agility – Illinois Agility Run

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>This is a simple test to administer, requiring little equipment.</p>  <p>Also, the players ability to turn in different directions and different angles is tested.</p>	<p>Choice of footwear and surface of area can effect times greatly.</p>  <p>Results can be subject to timing inconsistencies, which may be overcome by using timing gates. Cannot distinguish between left and right turning ability</p>



Speed & Agility testing

Power – Vertical Jump Test

Performers to reach up to highest point without going onto tiptoes. They then jump vertically and touch highest point on the wall/board.

The score is the difference between the 2 measurements



Power – Vertical Jump Test




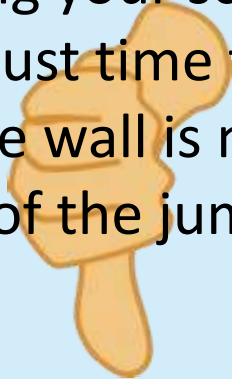
Here is a table of the average scores:

Gender	Excellent	Above average	Average	Below average	Poor
Male	>65cm	50 - 65cm	40 - 49cm	30 - 39cm	<30cm
Female	>58cm	47 - 58cm	36 - 46cm	26 - 35cm	<26cm



Power – Vertical Jump Test

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>This test is simple and quick to perform.</p> 	<p>Technique plays a part in maximising your score, as the subject must time the jump so that the wall is marked at the peak of the jump.</p> 



Muscular Endurance

The sit-up or press up test assesses muscular endurance of the abdominals.

The athlete performs sit ups or press ups to the point of exhaustion. The level of fitness reached depends on the number of repetitions completed.



Muscular Endurance

Here is a table of the average scores for **Press Up Test**:

Males

Age	17-19	20-29	30-39	40-49	50-59	60-65
Excellent	> 56	> 47	> 41	> 34	> 31	> 30
Good	47-56	39-47	34-41	28-34	25-31	24-30
Above average	35-46	30-39	25-33	21-28	18-24	17-23
Average	19-34	17-29	13-24	11-20	9-17	6-16
Below average	11-18	10-16	8-12	6-10	5-8	3-5
Poor	4-10	4-9	2-7	1-5	1-4	1-2
Very Poor	< 4	< 4	< 2	0	0	0



Muscular Endurance

Here is a table of the average scores for **Press Up Test**:

Females

Age	17-19	20-29	30-39	40-49	50-59	60-65
Excellent	> 35	> 36	> 37	> 31	> 25	> 23
Good	27-35	30-36	30-37	25-31	21-25	19-23
Above Average	21-27	23-29	22-30	18-24	15-20	13-18
Average	11-20	12-22	10-21	8-17	7-14	5-12
Below average	6-10	7-11	5-9	4-7	3-6	2-4
Poor	2-5	2-6	1-4	1-3	1-2	1
Very Poor	0-1	0-1	0	0	0	0



Muscular Endurance

Here is a table of the average scores for **Sit Up Test**:

Males

Age	18-25	26-35	36-45	46-55	56-65	65+
Excellent	>49	>45	>41	>35	>31	>28
Good	44-49	40-45	35-41	29-35	25-31	22-28
Above average	39-43	35-39	30-34	25-28	21-24	19-21
Average	35-38	31-34	27-29	22-24	17-20	15-18
Below Average	31-34	29-30	23-26	18-21	13-16	11-14
Poor	25-30	22-28	17-22	13-17	9-12	7-10
Very Poor	<25	<22	<17	<13	<9	<7



Muscular Endurance

Here is a table of the average scores for **Sit Up Test**:


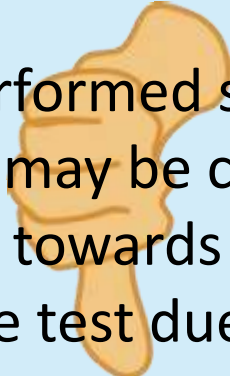
Females

Age	18-25	26-35	36-45	46-55	56-65	65+
Excellent	>43	>39	>33	>27	>24	>23
Good	37-43	33-39	27-33	22-27	18-24	17-23
Above average	33-36	29-32	23-26	18-21	13-17	14-16
Average	29-32	25-28	19-22	14-17	10-12	11-13
Below Average	25-28	21-24	15-18	10-13	7-9	5-10
Poor	18-24	13-20	7-14	5-9	3-6	2-4
Very Poor	<18	<13	<7	<5	<3	<2



Muscular Endurance – Sit up/Press up Test

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>This test is simple and quick to perform.</p> 	<p>Technique plays a part in maximising your score.</p> <p>Poorly performed sit up or press ups may be counted especially towards the later part of the test due to fatigue.</p> 



Body Composition

To assess suitability for a particular sport you can measure the ratio of the body. Fat levels vary depending on age and gender. Measuring fat levels can be done with skin fold calipers.



Measuring fat during a skin fold test should be done at the **chest, abdominals & thigh.**



Body Composition

Here is a table of the average scores:

		Excellent	Good	Average	Below average	Poor
Normal	Male	60-80	81-90	91-110	111-150	150+
	Female	70-90	91-100	101-120	121-150	150+
Athletic	Male	40-60	61-80	81-100	101-130	130+
	Female	50-70	71-85	86-110	111-130	130+



Body Composition - Body mass index (BMI)

BMI is a general way of working out whether a person is the right weight for their height.

Use the following formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)} \times \text{Height (m)}}$$

TASK: Calculate your BMI.



Body Mass Index (BMI)

WEIGHT lbs	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215
kgs	45.5	47.7	50.0	52.3	54.5	56.8	59.1	61.4	63.6	65.9	68.2	70.5	72.7	75.0	77.3	79.5	81.8	84.1	86.4	88.6	90.9	93.2	95.5	97.7
HEIGHT in/cm	Underweight				Healthy				Overweight				Obese				Extremely obese							
5'0" - 152.4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
5'1" - 154.9	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	36	37	38	39	40
5'2" - 157.4	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	33	33	34	35	36	37	38	39
5'3" - 160.0	17	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	32	32	33	34	35	36	37	38
5'4" - 162.5	17	18	18	19	20	21	22	23	24	24	25	26	27	28	29	30	31	31	32	33	34	35	36	37
5'5" - 165.1	16	17	18	19	20	20	21	22	23	24	25	25	26	27	28	29	30	30	31	32	33	34	35	35
5'6" - 167.6	16	17	17	18	19	20	21	21	22	23	24	25	25	26	27	28	29	29	30	31	32	33	34	34
5'7" - 170.1	15	16	17	18	18	19	20	21	22	22	23	24	25	25	26	27	28	29	29	30	31	32	33	33
5'8" - 172.7	15	16	16	17	18	19	19	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	32	32
5'9" - 175.2	14	15	16	17	17	18	19	20	20	21	22	22	23	24	25	25	26	27	28	28	29	30	31	31
5'10" - 177.8	14	15	15	16	17	18	18	19	20	20	21	22	23	23	24	25	25	26	27	28	28	29	30	30
5'11" - 180.3	14	14	15	16	16	17	18	18	19	20	21	21	22	23	23	24	25	25	26	27	28	28	29	30
6'0" - 182.8	13	14	14	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29
6'1" - 185.4	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28
6'2" - 187.9	12	13	14	14	15	16	16	17	18	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27
6'3" - 190.5	12	13	13	14	15	15	16	16	17	18	18	19	20	20	21	21	22	23	23	24	25	25	26	26
6'4" - 193.0	12	12	13	14	14	15	15	16	17	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26

Generally the higher the BMI the more % body fat, but elite athletes with have a high % body mass due to muscle weighing more than fat.



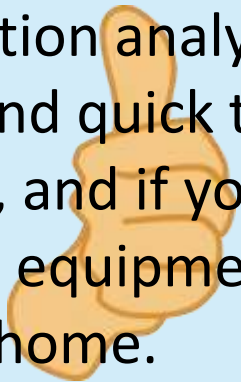

Body Composition – Bioelectrical Impedance Analysis (BIA)

BIA is another way to measure percentage of body fat using a Bioelectric Impedance Analyser.



Body Composition – Bioelectrical Impedance Analysis (BIA)

Consider the **advantages** and **disadvantages** of this test.

Advantages	Disadvantages
<p>This method of body composition analysis is very simple and quick to perform, and if you have the right equipment can be done at home.</p> 	<p>The equipment is relatively expensive.</p> 



Retrieval Practice

Describe the protocol and advantages and disadvantages of the Illinois Agility Test

Explain the type of fitness tests used to measure body composition.

Fitness testing to determine fitness levels

How might a gymnast measure flexibility?

Describe the difference between reliability and validity.



Exam Question Application

1. A basketball team take part in a multi-stage fitness test. Explain **two** factors which could affect the reliability of the test results. (4)

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Exam Question Application

2. Malcolm is 17 years old, his height is 1.74m and weight is 82 kg.

(a) Calculate Malcolm's Body Mass Index (BMI) (3)

(b) Using the information in the table below, interpret Malcolm's BMI result. (1)

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Rating	BMI
Underweight	≤19
Desirable	20-25
Overweight	26-30
Obese	31+



Exam Question Application

4. Fitness tests are used to determine baseline fitness levels and set realistic goals for improvement. The step test is a popular fitness test used by coaches and performers. Discuss the use of the step test in determining the level of fitness of a performer. (9)

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Exam Question Application

Marks Scheme:

1. If the lines are further than 20 metres apart (1) the players run further than they should making the test more difficult resulting in a lower VO₂ max result (1)

If players fail to turn in-time with the bleeps (1) this will give them more time to complete the shuttle resulting in a higher VO₂ max result (1)

If players drop out before they reach their maximal exertion (1) their VO₂ max result will be incorrect (1)

2. (a) $BMI = W / H^2$ (1) $H^2 = (1.74 \times 1.74) = 3.0276$ $W / 3.0276$ (1) = 27.08 (1)

(b) (Malcolm's result suggests he is) overweight.



Exam Question Application

Marks Scheme:

3. Advantages: ● Minimal cost involved to administer the test ● Can test large numbers of participants at once ● Test doesn't require calibration of equipment ● Specificity of the step test favours sports performers who make endurance demands of the leg muscle groups (eg cyclists/runners) ● easy test method to administer.

Disadvantages: ● Accuracy of the test results depends on correct stepping technique, which can be difficult to maintain, and can be affected by: - length of participants legs - using a standard bench height for the method for all participants (leading to inefficient hip angles for stepping) - not achieving correct leg extension (as participant steps up onto the bench) ● Participant might not keep up with the set stepping rate (dictated by a metronome) ● Participant might have difficulty in taking their own pulse ● The step test is not suitable for all populations, eg elderly ● Specificity of the step test favours sports performers who make endurance demands of the leg muscle groups (eg cyclists/runners).

