

1.2.a – Components of fitness

Learning objectives

To know and understand the components fitness.

To describe the relative importance of these components for physical activity and sport.

To understand the individual testing protocols for the components of fitness.

To be able to interpret data relating to fitness tests and analyse against normative values.

Components of fitness

Every sport requires different components of fitness depending on the demands of that event.



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



Cardiovascular Endurance/Stamina

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



Definition:



“The ability of the heart and circulatory system to meet the demands of the body for a long period of time”



Cardiovascular Endurance/Stamina – Fitness test

Multi Stage Fitness Test

This test is an indication of a performer's Cardiovascular endurance and can be used to estimate VO_2 max.

Protocol:

- 20 metre distance to be marked out with cones.
- Athlete must arrive at the cone before the beep and wait. On the beep the athlete can resume running. The level and number of shuttles are recorded.



Cardiovascular Endurance/Stamina – Fitness test

Multi Stage Fitness Test for Cardiovascular Endurance/Stamina

Here is a table of the normative data:

	Men (level/shuttle)	Women (level/shuttle)
Excellent	L12 S7 and >	L10 S9 and >
Above average	L11 S2	L9 S1
Average	L8 S9	L6 S7
Below average	L7 S1	L5 S1
Poor	< L6 S6	< L4 S7



Cardiovascular Endurance/Stamina – Fitness test

12 minute Cooper Run

This test is an indication of a performer's Cardiovascular endurance and can help to estimate of their VO_2 max.

Protocol:

- Complete the maximum distance possible in 12 minutes.



Cardiovascular Endurance/Stamina – Fitness test

12 minute Cooper Run for Cardiovascular Fitness/Stamina

Here is a table of the normative data:

	Men (m)	Women (m)
Excellent	> 2800	> 2100
Very good	2500-2800	2000-2100
Good	2300-2500	1700-2000
Average	2200-2300	1600-1700
Poor	< 2200	< 1600



Muscular Endurance

Also known as stamina means that the muscles keep working for a long time without getting tired. This component of fitness is essential for long distance events.

Definition:



“The ability to use voluntary muscles, over long periods of time without getting tired”



Muscular Endurance – Fitness test

1 Minute Sit up Test

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

Protocol:

- Athlete performs as many sit ups as possible to the point of exhaustion.
- The level of fitness reached depends on the number of repetitions completed.



Muscular Endurance – Fitness test

1 Minute Sit up Test for Muscular Endurance

Males

Here is a table of the normative data:

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 – Fitness test

1 Minute Sit up Test for Muscular Endurance

Females

Here is a table of the normative data:

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 – Fitness test

1 Minute Sit up Test

The 1 minute press-up test assesses muscular endurance of the pectoral, deltoid and bicep.

Protocol:

- Athlete performs as many press ups as possible to the point of exhaustion.
- The level of fitness reached depends on the number of repetitions completed.



Muscular Endurance – Fitness test

1 Minute Press up Test for Muscular Endurance

Males

Here is a table of the normative data:

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 – Fitness test

1 Minute Press up Test for Muscular Endurance

Females

Here is a table of the normative data:

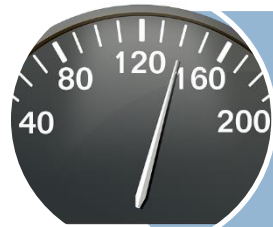
Age	17-19	20-29	30-39	40-49	50-59	60-65
Excellent	> 35	> 36	> 37	> 31	> 25	> 23
Good	27-35	30-36	30-37	25-31	21-25	19-23
Above Average	21-27	23-29	22-30	18-24	15-20	13-18
Average	11-20	12-22	10-21	8-17	7-14	5-12
Below average	6-10	7-11	5-9	4-7	3-6	2-4
Poor	2-5	2-6	1-4	1-3	1-2	1
Very Poor	0-1	0-1	0	0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



Speed

Speed is very important in many sports in a number of ways. Speed is key in a 100m sprint race or it may aid a sporting action. (i.e. a badminton player producing a quick overhead clear may be too powerful to return)

Definition:



“Time taken to cover a set distance”



Speed – Fitness test

30m Sprint Test

Protocol:

- Performers to cover a straight 30m from a standing start.
- The time taken should be accurately recorded.



Speed – Fitness test

30m Sprint Test for Speed

Here is a table of the normative data:

Time to run 30 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



Strength

Strength is required for a range of athletes.

Definition:



“The ability to exert a large amount of force in a single maximum effort”



Discuss what sporting events would benefit from a high level of muscular strength.



Strength

A sports person uses different types of strength depending on the type of action required.

Dynamic Strength:

This type of strength is used in events that take a long period of time to complete. i.e. *Rowing action*

Maximal strength:

The greatest force that is possible in a single maximum contraction



Strength

Explosive Strength:

This type of strength comes about when a burst of maximum effort is required.

e.g. Kicking a ball or striking a tennis ball during a groundstroke

Static Strength:

Static strength takes place when the muscle length stays the same. It is used to stabilise the body.

e.g. A rugby scrum



Strength – Fitness test

One Rep Max Test

This test measures the maximum strength of various muscle groups.

Protocol:

- Athlete should attempt to perform one full repetition of the stated exercise at the highest possible weight.
- The weight should be recorded.



Strength – Fitness test

Hand Grip Dynamometer

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

Protocol:

- Start with your hand up and bring down to side while pulling in handle.
- Do not swing your hand.



Strength – Fitness test

Hand Grip Dynamometer for Strength



Here is a table of the normative 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



Power

Power is a combination of **strength** and **speed**.

Power is important in explosive events like throwing and sprinting.

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



Definition:



“Speed x Strength”



Power - Fitness Test

Vertical Jump Test

Protocol:

- Performers to reach up to highest point without going onto tiptoes.
- Jump vertically and touch highest point on the wall/board.
- The score is the difference between the 2 measurements



Power - Fitness Test

Vertical Jump Test for Power



Here is a table of the normative data:

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 - Fitness Test

Standing Jump

Protocol:

- Athlete to jump horizontally as far as possible landing with both feet together.
- Measure and records the distance from the start line to the nearest impression made by the athlete.
- The distance should be accurately recorded.



Power - Fitness Test

Standing Jump for Power



Here is a table of the normative data:

Gender	Excellent	Above average	Average	Below average	Poor
Male	>2.11m	2.11 - 1.96m	1.95 - 1.85m	1.84 - 1.68m	<1.68m
Female	>1.91m	1.91 - 1.73m	1.72 - 1.60m	1.59 - 1.47m	<1.47m



Flexibility

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.

Definition:



“The range of movement at a joint”



Flexibility - Fitness Test

Sit and Reach Test

Measures the range of movement at the hips/torso.

Protocol:

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



Flexibility - Fitness Test

Sit and Reach Test



Here is a table of the normative 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

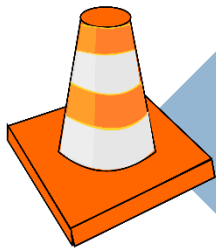


Agility

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*



Definition:



“is the ability to change direction with speed”



Agility - Fitness Test

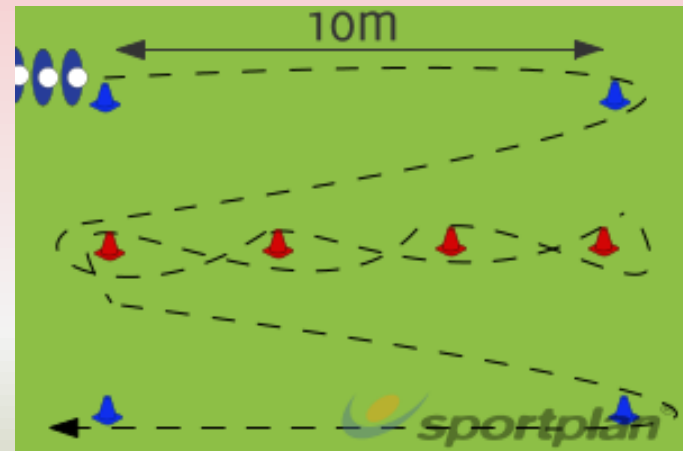
Illinois Agility Test

Measures the agility of the performer as well as speed.

Protocol:

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.



Agility - Fitness Test



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



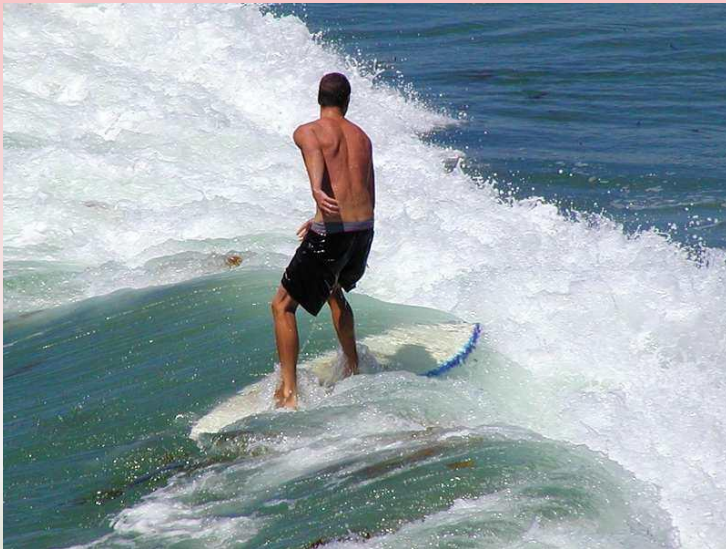
Balance

Balance can be **static** (*i.e. handstand*) or **dynamic** (*i.e. keeping your balance on a skateboard or while surfing*)

Definition:



“is the ability of the performer to retain their centre of mass over their base of support without falling”



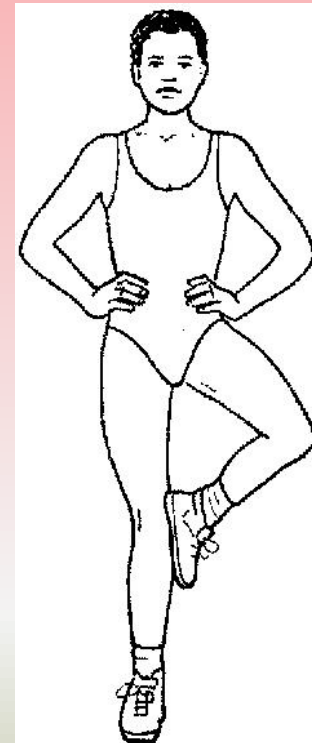
Balance - Fitness Test

Stork Balance Test

Measures the development of the athlete's ability to maintain a state of equilibrium (balance) in a static position.

Protocol:

- Athlete lifts the right leg, places the sole of the right foot against the side of the left kneecap. The athlete raises the heel of the left foot to stand on their toes.
- The athlete is timed holding this position for as long as possible.



Balance - Fitness Test

Here is a table of the average scores:

Rating	Males (seconds)	Females (seconds)
Excellent	>50	>30
Above Average	41-50	23-30
Average	31-40	16-22
Below Average	20-30	10-15
Poor	<20	<10



Coordination

Coordination may be advantageous to tennis player in producing an effective tennis stroke, coordinating footwork and arm action.

Definition:



“is the ability to move two or more body parts at the same time”



Discuss other sporting events that require coordination.



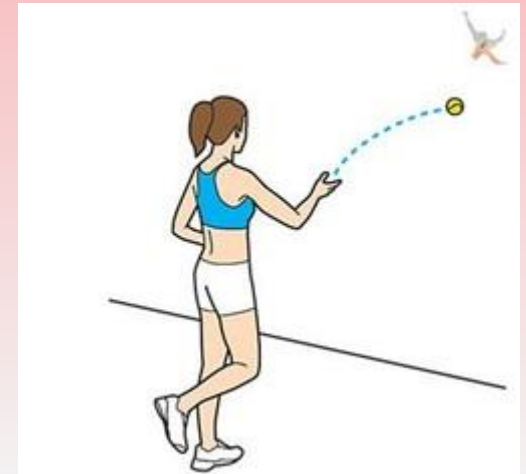
Coordination - Fitness Test

Wall throw test

The test is designed to monitor the ability of the athlete's vision system to coordinate the information received.

Protocol:

- Athlete is to stand 2 metres from a wall.
- A tennis ball is thrown with their right hand against the wall and caught with the left hand. The ball is then thrown with the left hand and caught with the right hand.
- This cycle of throwing and catching is repeated for 30 seconds. The number of catches is recorded.



Coordination - Fitness Test

Wall throw test for Coordination

Here is a table of the normative data:

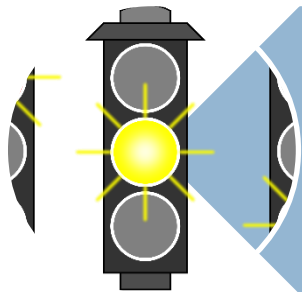
Age	Excellent	Above Average	Average	Below Average	Poor
15-16 years	>35	30 - 35	25 - 29	20 - 24	<20



Reaction Time

Reaction time is a response to a **stimulus**. This could be anything from a starting gun to a sudden side-step by an opponent.

Definition:



“The time between the presentation of a stimulus and movement”



Discuss how a table tennis player requires reaction time to succeed.



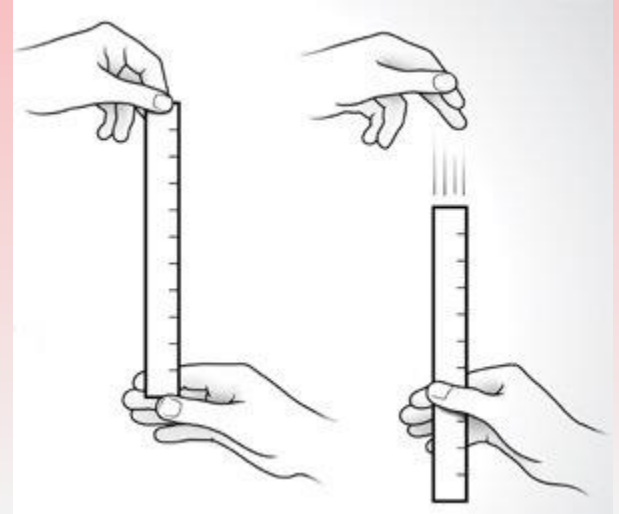
Reaction Time - Fitness Test

Ruler Drop Test

The ruler drop test monitors an athlete's reaction time to a stimulus.

Protocol:

- A ruler is held by the assistant between the outstretched index finger and thumb of the athlete's dominant hand.
- Ensure the top of the thumb is level with the zero centimetre line on the ruler.
- Ruler is released and measurement (cm) is taken from the point caught on the ruler.



Reaction Time - Fitness Test

Ruler Drop Test for Reaction Time

Here is a table of the normative data:

Excellent	Above Average	Average	Below Average	Poor
<7.5cm	7.5 - 15.9cm	15.9 - 20.4cm	20.4 - 28cm	>28cm



Fitness Testing

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

Evaluating the testing procedure is also important. Consider the terms below. What do they mean?



Reliability, Validity, 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.



How might you improve validity and reliability?



Fitness Testing

Validity, reliability & practicality can be improved by:

- Being undertaken by experienced testers
- Equipment being calibrated
- Ensuring performers have the same level of motivation to complete the test to the best of their ability.
- Testing repeatedly to avoid human error.



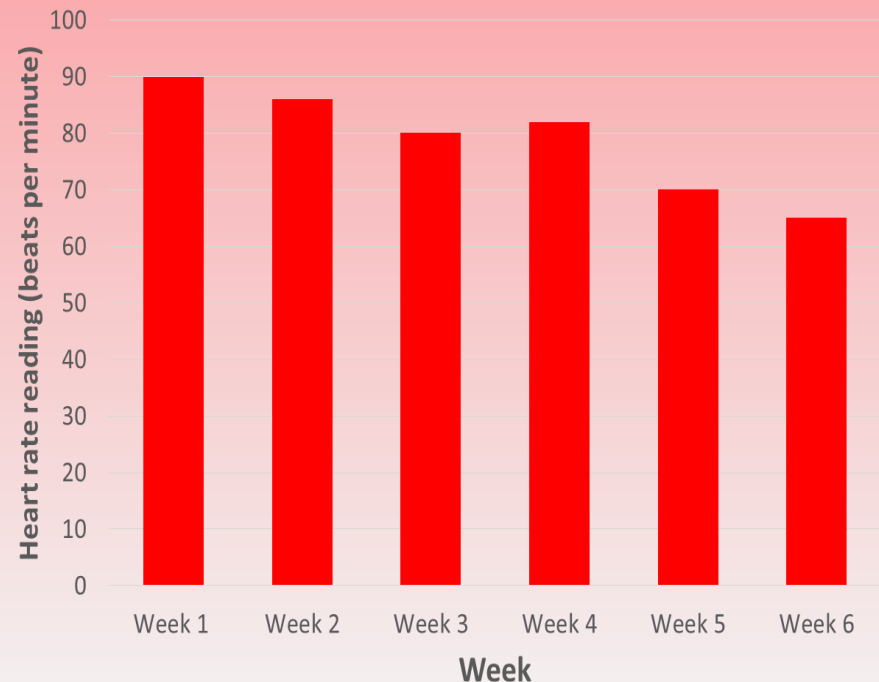
Presentation of data and recording units

Data can be presented in a variety of formats; pie chart, bar chart, line graph or in a data table.

In addition, the units used for a recording may differ.

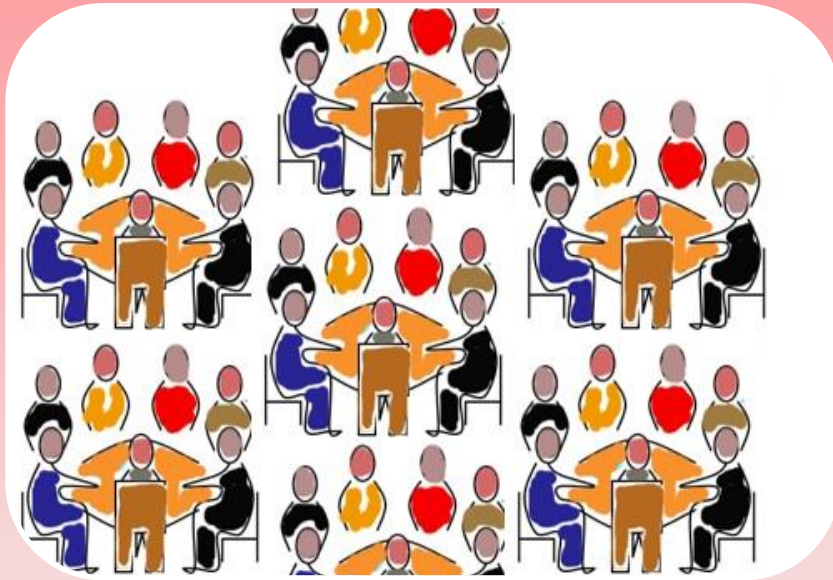
Units may be:

- Seconds
- Minutes
- cm
- Numbers
- Levels



How data is collected in sporting activities

Data in sport can be obtained using both **qualitative** and **quantitative** methods.



Quantitative data collection – This refers to actual values and readings which in turn are compared to national averages. *i.e. heart rate readings*



Qualitative data collection – This refers to open-ended testing procedures and less structured protocols. *i.e. interviews/observations*

Think. Pair. Share.

1. Which one of the above is more important to focus on?



Apply it!

What has stuck with you?



Discuss the most appropriate components of fitness for the athlete shown and why?



Apply it!

What has stuck with you?

Describe most appropriate test for measuring strength and power.

Explain the test for Speed and how to complete it.

Components of fitness and measurements

Discuss the most important components of fitness to a boxer. Why?

Discuss the importance of speed and power to a high jumper?



Practice it!

Exam questions

1. (i) 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

(ii) Which one of these describes flexibility? **(1)**

- A Changing direction at speed with control
- B Combination of strength and speed
- C Range of movement possible at a joint
- D Supplying oxygen to the working muscles



Practice it!

Exam questions

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

(i) Strength (2)

(ii) Coordination (2)



Practice it!

Exam questions

3. (i) Usman has a short stride length. To improve his range of movement he works on his

..... a

component of fitness. (1)

(ii) Name a fitness test that Usman could use to monitor improvement in this component of fitness. (1)

4. The vertical jump test measures leg power.
Discuss the suitability of this test for a football player. (3)

5. Identify a suitable test that can be used to assess the stamina of a marathon runner. (1)



Practice it!

Marks Scheme:

1. (i) D

(ii) C

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

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

3. i) flexibility

ii) sit and reach test



Practice it!

Marks Scheme:

4. Agree (sub-max 2 marks)

- Leg power is a component of fitness needed by football players to perform specific skills
- The test measures the ability to jump up so appropriate for jumping to head the ball / a goalkeeper to launch into a save / other equivalent example

Disagree (sub-max 2 marks)

- The test is not sport-specific as would not test power needed to kick a ball / start a sprint towards the ball / other equivalent example
- Does not test many aspects of playing football, eg dribbling / marking / other equivalent example
- Can be argued that other aspects of fitness are more important, eg cardiovascular endurance to last 90 minutes.



Practice it!

Marks Scheme:

5.

Multi-stage fitness test/bleep/beep test

OR

(Cooper)12 minute run/walk

