

# PHYSICAL EDUCATION

## CHAPTER 5: TEST & MESUREMENT IN SPORTS



## TEST & MEASUREMENT IN SPORTS

### Test And Measurement

Test and measurement is the instrument for getting essential details regarding the needs, capacities, abilities and attitudes of students or sportspersons.

Every task and work needs to be evaluated. Evaluation is based upon test and measurement. This is very important to check the progress of an individual.

Test provides data or scores which can be measured and evaluated. A test helps to collect data which can be evaluated for further improvement.

In Physical Education Tests are used to collect information or data about a specific skill, strength, endurance, knowledge and attitude. And Measurement is related to measuring size, height, weight, vital capacity, achievement, etc.

### Motor Fitness Test And Measurement

Motor fitness refers to the capacity of an athlete to take part effectively in particular sports. It can also be said that the fitness is a person's ability to do physical activity

Motor fitness is the ability to perform physical activities effectively and efficiently. There are 5 motor fitness components which measures' fitness level of an athlete.



These components are Strength, Endurance, Flexibility, Speed, Coordination/agility.

Test to check these components are as follows.

### Test Items

- 50 M Standing Start - For speed
- 600 M Run/Walk - For Endurance
- Sit & Reach - For flexibility
- Partial Curl Up- For abdomen strength
- Push Ups (Boys) - For arm strength
- Modified Push Ups (Girls) - For arm Strength
- Standing Broad Jump - For leg explosive strength
- 4 × 10 M Shuttle Run - For agility

### 50 M Standing Start



50m race is administered to test the athlete's speed. This test includes running 50 meters as fast as possible.

### Procedure

Stand behind the starting line without touching the ground. One foot in front of the other.

Once the subject is ready, the starter gives the instructions "set" then "go". The athlete starts and crosses the end line as fast as possible.

## 600m run/walk



This test is to measure the endurance level.

### Procedure

Stands behind the starting line. At the signal Ready and Go, The athlete starts running. In between, he can run or walk. Time is recorded.

## Sit and Reach Test



This test is conducted to measures the flexibility of the lower back and hamstring muscles.

### Procedure

Sit on the floor without shoes, legs stretched, knee straight, palm facing downward.

The subject tries to reach forward along the measure line as far as possible without giving any jerks

### Partial Curl Up



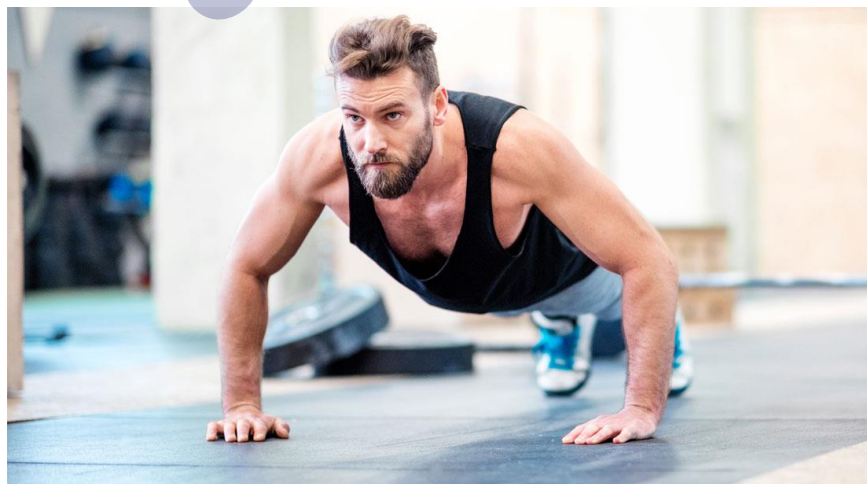
The partial curl-up test is to test abdomen strength. The subjects perform as many sit-ups as possible at the rate of one every three seconds.

#### Procedure

Lie down on the back with the knees flexed. The subject curls up, until the shoulders come off the mat two inches, then go back again.

A total number of repetition of sit-ups is recorded in one minute.

### Push Ups For Boys



This push-up test is to measure upper body strength and endurance.

## Procedure

From prone position push whole body up, hands and toes touch the floor, the body and legs in a straight line, feet slightly apart, keep the back and knees straight, Lowers the body to a 90-degree angle at the elbows, then returns to position, continue till exhaustion,

## Modified Push Ups For Girls



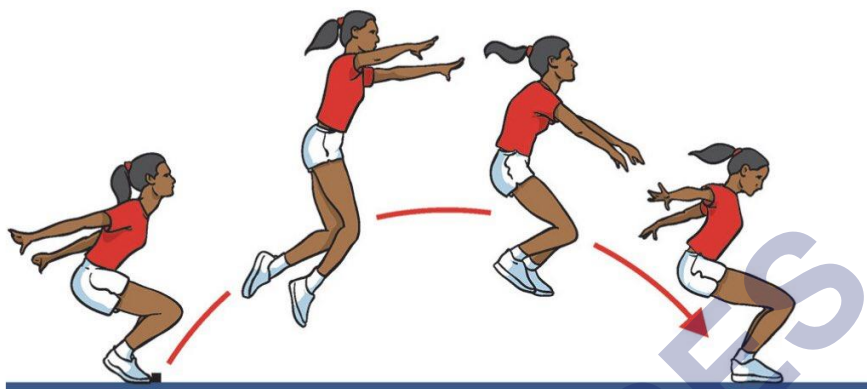
The Modified Push-Up test is used to measure upper body strength, endurance and trunk stability

## Procedure

Get down on your hands and knees with your hands just outside the shoulder. Now bend your elbows and lower your chest till 90° at the elbows.

Push your body up so that your arms are straight, the test will continue until exhaustion

## Standing Broad Jump



The purpose of this test is to measure the explosive power of the legs.

### Procedure

Stand behind a line marked on the ground with feet slightly apart. Now jump as far as possible, landing on both feet without falling backwards.

### 4 × 10 M Shuttle Run



This test measures agility and speed

### Procedure

Stand behind the starting line. On the signal, go, sprint to the opposite line, which is marked 10 m away. Pick up one block of wood (two wood block kept behind the line beforehand), run back to starting position, place the block on or beyond the line.

Take turn without a rest, run back to get the second block and carry it back across the finish line. A total of 40 metre is covered.

## Measurement of Cardiovascular Fitness

### Harvard Step Test

Harvard step test was developed by Lucien Brouha and his associates in 1943.

This test is to measure the cardiovascular or Aerobic fitness of an athlete, by checking the recovery rate.

#### Requirements:

- One gym bench of 20 inches high for men and 16 inches for women.
- Stopwatch.

#### Test Administration

In this test, Athlete step-ups and step-down on the gym bench for five minutes or until exhaustion, at a rate of 30 steps per minute.

On the command 'go' an athlete starts doing steps, stopwatch is switched on simultaneously. After completing athlete sits down immediately.

**Pulse 1:** The assistant measures the total number of heartbeat counted for 30 sec after 1 min of completion.

**Pulse 2:** The assistant measures heartbeat again after 2 min for 30 sec.

**Pulse 3:** The assistant measures pulse again after 3 minutes for 30 sec.

#### Calculation:

$100 \times \text{Test duration in seconds} / 2 \times \text{Sum of pulses}$

For male excellent score is above 90, and for women it is above 86

## Rockport Walking Test

This test is to measure the Cardiorespiratory fitness of the athlete by measuring VO<sub>2</sub> Max ( Maximum Cardiovascular Ability )

#### Requirements:

Running track (200 – 400m)

Stopwatch

Weighing machine

Assistant



### Test Administration

- Record body weight in pounds.
- Walk or run one mile (1609m) as fast as possible.
- Record the time to complete the one-mile walk.
- Immediately on finishing the walk measure heart rate.

### Calculation

The formula to calculate VO<sub>2</sub> max is:

$$132.853 - (0.0769 \times \text{Weight}) - (0.3877 \times \text{Age}) + (6.315 \times \text{Gender}) - (3.2649 \times \text{Time}) - (0.1565 \times \text{Heart rate})$$

(Weight is in pounds (lbs))

**Gender:** Male = 1 and Female = 0

Time is expressed in minutes

Heart rate is in beats/minute (Age is in years)

### Rikli & Jones – Senior Citizen Fitness Test & Measurement:

Senior citizen fitness test was developed by Roberta Rikli and Dr. Jessie Jones. This test consists of six easy and simple tests that assess the functional fitness of senior citizens.

#### Chair Stand Test



This test is to check leg strength and muscle endurance.

### Requirements

Straight back chair without arms 45 cm high, stopwatch.

### Test Administration

- Place the chair against the wall
- The person sits on the chair with feet apart
- Arms crossed at the wrist and held close to chest
- From sitting position stand completely
- Repeats for 30 seconds
- The number of complete chair stand is scored.

### Arm Curl Test:



This test measures upper body strength and endurance. The aim is to do as many arm curls in 30 sec.

### Requirements:

- 4 pound dumbbell for women and 8 pound for men.
- A chair without any armrest.
- Stopwatch.

### Test Administration

- The person sits on the chair holding the dumbbell, arms vertically downward.

- Curl forearm up through a full range of motion.
- The number of complete Curl actions is the score.

### Sit and Reach Test.



The purpose of this test is to measure the lower body flexibility.

#### Requirements:

Ruler, Straight back chair 45 cm high

#### Test Administration:

- The person sits on the edge of the chair.
- One foot on the floor and other foot extended with knee straight.
- Exhale and reach towards the toe.
- Keep the back straight and head up.
- Hold the reach for 2 sec.
- Perform the test twice and consider the best.

### Back Scratch Test:



This test measures the general range of motion of the Shoulder. It requires a ruler

#### Test Administration:

- The test is done in a standing position.
- One hand is kept behind the head over the shoulder.
- Place the other hand behind the back. Fingers up.
- Try to touch both arms finger.
- Try the test twice and consider the best.

#### 8- Feet Up and Go Test



This test is designed to measure speed, agility and balance while moving

#### Requirements

- Stopwatch

- Straight back chair
- Cone markers
- Measuring tape

**Test Administration:**

- Place a chair against the wall
- Keep a cone eight feet away in front of chair
- The person sits on the chair and hands resting on knees
- On the command GO person stand up and walk around the cone as quickly as possible and sit down on the chair
- Scoring is counted based on time taken to perform

**6 Minute Walk Test**

This test is to measure Aerobic fitness.

**Requirements:**

- Measuring tape to mark track distance.
- Stopwatch.
- Chair for rest.

**Test Administration:**

- The walking track is laid in rectangle area with cone marking
- Person walk as quickly as possible for six minutes to cover maximum distance
- Person can set their own pace and can stop to take rest.

- Measure in metres the distance covered by a person in six minutes.

## Important Questions

### ➤ Multiple Choice Questions:

Question 1: AAHPERD stands for

- Australian Alliance for Health, Physical education , Recreation and Dance
- Australian Alliance for Health, Physical education , Recreation and Dance
- American Alliance for Health, Physical Education, Recreation and Dance
- None of the above

Question 2: Which one of the following is not included in AAHPERD young fitness test 1975?

- 50 yard dash
- Flexed leg sit ups
- 600 yard run walk
- Medicine ball put

Question 3: The test used to measure fitness of senior citizens is \_\_\_\_.

- Harvard step test
- Rikli and Jones fitness test
- General motor fitness test
- Borrow motor fitness test

Question 4: Which one of the following is not considered a part of Rikli and Jones senior citizen fitness test?

- Chair stand test
- Arm curl test
- 1 mile walk test
- Back scratch test

Question 5: What should be the height of chair required in chair sit and reach test ?

- 40 cm
- 44 cm
- 42 cm
- None of the above

Question 6: The purpose of which of the following test is to measure explosive power of legs?

- 4 × 10 m shuttle run
- Modified push ups for girls
- Standing broad jump
- Partial curl ups

Question 7: Which among the following test is widely used as a normal test to assess

flexibility?

- a) Sit and Reach test
- b) Partial curl up test
- c) 50 m dash test
- d) None of the above

Question 8: Partial Curl up test is used

- a) To measure the explosive power of legs
- b) The upper body strength and endurance is measured by this test
- c) To determine or measure speed
- d) The strength and endurance of abdominal muscles is measured with the help of this test

Question 9: Which one of the following is used to measure cardiovascular fitness?

- a) Chair stand test
- b) Harvard Step test
- c) Rockport one mile test
- d) Both B and C

Question 10: Modified push ups is measured for

- a) Boys
- b) Volleyball players
- c) Girls
- d) Cricket players

Question 11: Which one of the following is not linked accurately ?

- a) Arm Curl Test – A test to measure the upper body strength
- b) Chair sit and reach test – A test to assess the upper body flexibility
- c) Chair stand test – A test to measure the lower body strength
- d) Eight foot up and go test – A test to evaluate speed and agility

Question 12: In which year Rikli and Jones senior citizen test was discovered ?

- a) 1990
- b) 2000
- c) 2001
- d) 2002

Question 13: Harvard Step test is also called as

- a) Rockport fitness walking test
- b) Chair stand test
- c) Jump up and down test
- d) Aerobic fitness test

Question 14: In the back scratch test if the finger tips touch each other then the score will be

- a) Negative
- b) Zero
- c) Positive
- d) None of the above

Question 15: The process of collecting the data about a specific skill , strength , endurance , knowledge and behaviour is generally known as

- a) Capacity
- b) Measure
- c) Test
- d) Evaluation

### ➤ Very Short Question:

Que 1. What is test?

Que 2. What is measurement?

Que 3. What do you understand by muscular strength?

Que 4. What is Kraus-Weber test?

Que 5. What is motor fitness?

Que 6. What do you understand by cardiovascular fitness?

Que 7. What do you understand by Harward step test?

Que 8. What is Rockport one mile test?

Que 9. What do you understand by flexibility?

Que 10. What do you understand by senior citizen fitness test?

### ➤ Short Questions:

Que 1. What do you understand by AAHPER test? Describe any two items of the test.

Que 2. Describe any three tests in Kraus-Weber test.

Que 3. Explain administration of Rockport one mile test.

Que 4. Describe in short Harvard step test.

Que 5. Discuss the back scratch Test for upper body flexibility.

Que 6. Discuss in short sit and reach test.

### ➤ Long Questions:

Que 1. Explain the AAHPER physical fitness test.

Que 2. Describe the Kraus Weber Test in detail.



Que 3. Explain the measurement of cardiovascular fitness Harvard Step Test.

Que 4. Explain the Arm Curl Test for upper body strength for senior citizens.

Que 5. What are the six test items of the Kraus Weber muscular strength test?

### ➤ Assertion & Reason Questions:

1. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

**Assertion (A)** Push-ups helps in building muscular strength

**Reason (R)** Push-ups are isokinetic muscular movements that provide strength to the joints

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true and but R is not a correct explanation of A
- (c) A is true but R is false
- (d) A is false, but R is true.

2. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

**Assertion (A)** Chair stand test is designed to test the fitness of the senior citizens.

**Reason (R)** This test is safe enjoyable and meet the scientific standard of reliability and validity.

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true and but R is not a correct explanation of A
- (c) A is true but R is false
- (d) A is false, but R is true.

✓ **Answer Key-**

### ➤ Multiple Choice Answers:

1. Answer: American Alliance for Health, Physical Education, Recreation and Dance
2. Answer: Medicine ball put
3. Answer: Rikli and Jones fitness test
4. Answer: 1 mile walk test

5. Answer: 44 cm
6. Answer: Standing broad jump
7. Answer: Sit and Reach test
8. Answer: The strength and endurance of abdominal muscles is measured with the help of this test
9. Answer: Both B and C
10. Answer: Girls
11. Answer: Chair sit and reach test – A test to assess the upper body flexibility
12. Answer: 2001
13. Answer: Aerobic fitness test
14. Answer: Zero
15. Answer: Test

### ➤ Very Short Answers:

1. Test, may be called as tool, a question, set of question, an examination which use to measure a particular characteristic of an individual or a group of individuals.
2. According to R.N. Patel  
“Measurement is an act or process that involves the assignment of numerical values to whatever is being tested. So it involves the quantity of something.”
3. It is the amount of force the muscle or a group of muscles can exert against resistance for short duration as in anaerobic activities.
4. It is mean to test minimum general fitness required by an individual by testing the strength and flexibility of big muscles and joints.
5. Motor fitness is a person’s ability to perform physical activities.
6. Cardiovascular fitness is the ability of the heart and lungs to supply oxygen rich blood to the working muscle tissues and the ability of the muscles to use oxygen to produce energy for movement.
7. It is a cardiovascular fitness test. It is good for measurement of fitness and the ability to recover after a strenuous exercise.
8. It is cardio respiratory test used to determine VO<sub>2</sub> max. (volume of oxygen) VO<sub>2</sub>max is the maximum capacity of the person’s body to move and use oxygen during exercise.
9. Flexibility is the range of motion in a joint or group of joints, or, the ability to move joints effectively. Flexibility is related to muscle strength.
10. Senior citizen fitness test are easy to understand and effective tests to measure aerobic fitness, strength and flexibility using minimum and inexpensive equipments.

### ➤ Short Answer:

1. The AAHPER youth fitness test was formed in 1965 in United States. This test administered on school student of 17 year age. This test was designed to help the physical education

teachers and other recreation leaders in the field to find out the performance levels of their students, compare them with national norms.

#### Administration of test:-

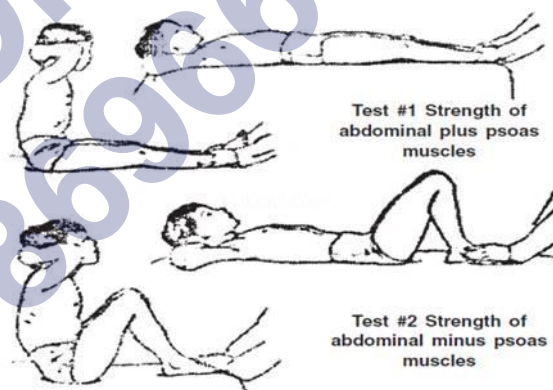
i. **(a) Pull-ups(boys):** This test measures the total number of repetitions performed without taking rest on a horizontal bar. The total number of pull-ups noted. In this test, the chin must reach above the bar while doing pull-ups.

**(b) Flexed-arm hangs (girls):** This is test is administered on an adjusted on an adjustable horizontal bar. The height of the bar should be adjusted so that it is approximately equal to the standing height of the student. With the help of two girls the student's body is lifted off the ground until her chin is positioned above the bar.

The student holds this position as long as possible. Her time is noted in seconds. She may be allowed for one trial.

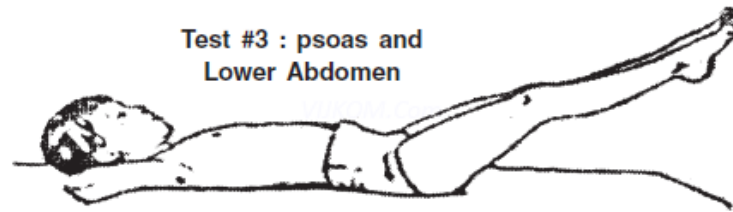
ii. **Flexed-leg sit-ups:** The student is advised to lie on floor on his/her back keeping knees bent. The angle of knee: around 90 degree. The feet are held by partner. The student should put fingers locked and put behind the head curls up and touches the elbows to knees the score is counted as maximum number of sit-ups in 60 seconds.

2. This very test of fitness was firstly used to investigate about the progress of the treatment given for back pain problems. More than eighty who take this test failed to pass it in the first attempt.



The first test of the six Kraus-Weber tests series is used to evaluate general fitness of a person. In this test one has to keep the feet on the ground: do sit ups while keeping both hands folded on the back and lying body on the ground.

The second part of Kraus-Weber 'Test series is similar to first in posture but only change is that in this test knees of person are folded and the ankles are as close to buttocks as possible; while doing sit ups.



### Lower Abdomen

The third part of Kraug-Weber Test series requires the person to lie flat on the back and keeps hands behind the neck and legs remain straight and lifted up for about ten seconds in a stretch.

### 3. Administration of Test:

- (i) Choose a windless day to conduct the test,
- (ii) Record your weight in pounds (lbs)
- (iii) Walk one mile (1609 mt) as fast as possible,
- (iv) Record the time to complete the one mile walk,
- (v) Immediately on finishing the walk record your heart rate (beats per minute),
- (vi) Determine your maximum cardio-respiratory ability ( $VO_2$ ) from the calculation given below.

**Calculation procedure:** Analysis of the result is done by comparing it with the result of previous test. It is expected that, appropriate training between each test should be done to show improvement.

The formula used to calculate  $VO_2$  Max is :  $132.853 - (0.0769 \times \text{weight}) - (0.3877 \times \text{Age}) + (6.315 \times \text{Gender}) - (3.2649 \times \text{Time}) - (0.1565 \times \text{Heart rate})$

### Where:-

- (a) Weight is in pounds (lbs),
- (b) Gender: Male – 1 and Female = 0
- (c) Time is expressed in minutes and seconds,
- (d) Heart rate is in beats/minute
- (e) Age in years.



4. The Harvard Step Test is a method used to assess cardio-respiratory fitness, which was developed by Brouhaetal. (1943) in the Harvard Fatigue Laboratories during World War II. It is based on heart rate recovery following a given work load of 5 minutes or until exhaustion.

#### What do we need?

- A gym bench or box. 20inches high.
- A stopwatch
- Cadence
- An assistant

#### SCORING THE TEST

There are two versions of the Harvard Step Test, the short form and the long form.

- **Short Form Equation:** Fitness Index =  $(100 \times \text{test duration in seconds})$  divided by  $(5.5 \times \text{pulse count between 1 and 1.5 minutes})$ .
  - **Long form Equation:** Fitness Index =  $(100 \times \text{test duration in seconds})$  divided by  $(2 \times \text{sum of heart beats in the recovery periods})$ .
5. You'll need a ruler or a yardstick. Place your hand over your shoulder, and reach as far as possible down the middle of your back, your palm touching your body. Place your other arm behind your back, palm facing outward and reach up as far as possible attempting to touch or overlap the middle fingers of both hands. Practice two times, and then test two times. Your partner measures the distance between the tips of the middle fingers to the nearest half-inch. If the fingertips touch, score zero. if they do not touch, score a negative distance. such as 2 incites: If they overlap score a positive distance, such as – 1 inch. Take your best score. For women the goal is to have your fingertips no more than 5 inches apart and for men no more that 8 inches apart. If you're unable to reach this goal. You may be at risk for losing the ability to form some activities that require upper body flexibility. Stop the test if you experience pain.
6. The sit and reach test is a common measure of flexibility, and specifically measures the

flexibility of the lower back and hamstring muscles.

### Equipment

Ruler, step (optional, you could make your own sit and reach box if keen too) After a brief warm up the subject sits on floor with shoes off. Subject places bottom of feet (10 to 12 inches apart) against side of box (approximately 12" or 30 cm high) with knees straight. Tester places measuring stick on box parallel to subjects legs; 15" or 38 cm at edge of box closest to subject and end of measuring stick ("o") toward subject. Subject places hand over hand and reaches as far as possible over measuring stick without bending knees. Best of three tries is recorded.

### ➤ Long Answer:

1. The AAHPER (American Alliance for Health, Physical Education and Recreation) youth fitness test was formed in 1965 in United States, but was revised in 1976.

Later, dance was also added and it was known as AAHPERD.

The students are advised to warm up before they participate in the test. All the students must be medically fit.

#### **This test has the following six items:**

- a) Pull-ups (for boys) / Flexed arm hang (for girls) to measure arm and shoulder strength.
  - b) Flexed leg sit-ups to measure abdominal strength and endurance.
  - c) Shuttle runs to measure speed and agility.
  - d) Standing long jump to measure power.
  - e) 50-yard dash to measure speed.
  - f) 600-yard run-walk to measure endurance.
2. The Kraus Weber Test is a test of minimum muscular fitness of the various muscles of the body. The test consists of six items which indicate the level of muscular strength and flexibility of key muscle groups. Usually, the scoring of each item is graded either on pass/fail basis or a range of scoring from zero to ten. A subject's grade of zero means that the subject has failed in a particular test item; score ranges from one to ten are for subjects who pass these test items.

#### **The six tests are:**

- Test 1 tests the strength of the abdominal and psoas muscles.
- Test 2 tests the strength of the abdominal muscles.
- Test 3 tests the strength of the psoas muscles.

- Test 4 tests the strength of the upper back.
  - Test 5 tests the strength of the lower back.
  - Test 6 tests the strength of the back and hamstring muscles.
3. The Harvard Step Test is a test that measures cardiovascular fitness. The equipment required to perform the test are bench 20 inches high, stopwatch and metronome. The procedure is that the performer steps up and down 30 times a minute on the bench. Each time the subject should step all the way up on the bench with the body erect. The stepping exercise continues for exactly 5 minutes unless the performer is forced to stop sooner due to exhaustion.

As soon as he stops exercising, the performer sits on a chair quietly while pulse rates are counted at 1 to 1' A, 2 to 2' /i and 3 to VA minutes after the exercise. The Physical Fitness Index (PFI) is computed using the formula.

4. The Arm Curl Test is a test of upper body strength. The purpose of this test is to measure upper body strength and endurance. The subject has to do as many arm curls as possible in 30 sec. This test is conducted on the dominant arm side (or stronger side).

**Its procedure is:-**

- a) The subject sits on the chair holding the weight (8 pounds for men / 5 pounds for women) in the hand using a suitcase grip (palm facing towards the body) with the arm in a vertically down position beside the chair.
  - b) The upper arm is held close to the body so that only the lower arm is moving.
  - c) The subject curls the arm up through a full range of motion, gradually turning the palm up (flexion with supination)
  - d) Then the arm is lowered through the full range of motion, gradually return to the starting position. The arm must be fully bent and then fully straightened at the elbow.
  - e) Repeat this action as many times as possible within 30 sec.
  - f) The score is the total number of controlled arm curls performed in 30 sec.
5. The six test items of the Kraus Weber muscular strength test are given below:
- a) **Abdominals Plus Psoas (hip flexing):-** Muscles The subject lies supine with hands behind the neck. The feet are held by the examiner. On command, the subject rolls up into a sitting position. This is a test of the strength of abdominal and psoas muscles. If the subject performs one sit-up then passes otherwise score remains zero.
  - b) **Abdominals Minus Psoas:-** The subject lies supine, hands behind neck and knees bent. On command, the subject tries to roll up into a sitting position. This is a further test of abdominal muscles without psoas. Scoring is like test 1.
  - c) **Psoas or P:-** The subject lies supine with hands behind the neck and legs extended. On

command, the feet are lifted 25 cms (10 inches) above the ground and maintained for ten seconds. This is a test for the strength of psoas and lower abdominal muscles. Scoring depends on the number of seconds the exact position is held.

- d) **Upper Back or UB:-** The subject lies prone with a pillow under the abdomen but far enough down to give a see-saw effect. He holds his hands behind the neck. The examiner holds down the feet and asks the subject to raise up his chest, head and shoulders and maintain the position for ten seconds. This test is for the strength of the upper back muscles. Scoring is like test 3.
- e) **Lower Back or LB:-** The subject lies prone over the pillow and places his hands in front and rests his head on them. The examiner holds the chest down and asks the subject to lift his legs up without bending the knees and maintain the position for ten seconds. This is a test for the strength of the lower back muscles. Scoring is like test 3.
- f) **Back and Hamstring or BH:-** The subject stands erect with his hands at sides and feet together. On command, he leans down slowly to touch the floor with his fingertips. The knees are kept straight and the leaning down position is maintained for ten seconds. No bouncing is allowed to touch. This tests the length of back and hamstring muscles and is a test of flexibility. Scoring is like the above tests.

➤ **Assertion and Reason Answers:**

1. (c) A is true but R is false.
2. (a) Both A and R are true and R is the correct explanation of A.