

CBSE Class 12 Physical Education

Revision Notes

UNIT-7

Test & Measurement in Sports

Key Points :

- Computation of Fat Percentage - Slaughter – Lohman Children Skinfold Formula Specification
- Measurement of Muscular strength-Kraus-Weber test
- Motor Fitness Test-AAPHER
- General Motor Fitness- Barrow three item general motor ability
- Measurement of Cardio-Vascular Fitness-Harward Step Test/Rock Port Test
- Measurement of flexibility-Sit & Reach Test
- Rikli & Jones Senior Citizen Fitness Test

Computation of Fat Percentage

The Body Fat Percentage Calculator uses the U.S. Navy fitness formula to calculate an estimation of body fat. Although the water displacement test is the most accurate way to determine body fat percent, however the Navy Body Fat test or YMCA formula is sufficiently accurate within 1-3% for most people.

Body fats include: essential body fat along with storage body fat.

The essential body fat is required in order to maintain life and reproductive organ functions. The percentage of essential body fat in women is greater than that found in men, mainly because of childbearing demands and other hormonal functions.

The percentage of essential fat is 3% to 5% in men, and 8% up to 12% in women.

Storage body fat consists of fat accumulation in the adipose tissue, which is meant to protect the internal organs (chest and abdomen). The minimum recommended total body fat percentage exceeds the essential fat percentage value mentioned above.

Slaughter – Lohman Children Skinfold Formula Specification

This description is specifically for the SKYNDEX SYSTEM I programed with the Slaughter-Lohman formula. The Slaughter-Lohman is named after the authors of the original research

study. Each formula was developed from the results of underwater weighing and skinfold data taken from several hundred individuals over a wide range of age, body structure, body composition and exercise habits. The skinfold equations shown below are used to predict body fat in children 6-17 years of age:

TRICEPS

Measure vertically on back of arm midway between top of shoulder point (Acromial Process) and elbow (Olecranon Process)



CALF

Inside (medial) of the right lower leg at the greatest calf girth.



**Dial Position 1 on Slaughter-Lohman Skyndex I Caliper
(OR 11 if multi-formula unit)**

Boys: % Body Fat = 0.735 (Triceps + Calf) + 1.0

Dial Position 2 on Slaughter-Lohman Skyndex I Caliper

(OR 12 if multi-formula unit)

Girls: % Body Fat = $0.610 (\text{Triceps} + \text{Calf}) + 5.1$

Muscular strength is the amount of force the muscle or a group of muscle can exert against resistance for short duration as in aerobic activities

Kraus Weber Test

It 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 poses muscles.

Test 2 tests the strength of the abdominal muscles.

Test 3 tests the strength of the poses 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.

AAHPER Test

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. This test was administered on school students of 17 years of age.

This test consists of the following six items :

- a. Pull ups : In case of girls, the pull-ups are to be started from a flexed arm hang. This test item judges the arm and shoulder girdle strength.
- b. Flexed Leg situps : This test is meant to judge the efficiency of abdominal and hip flexor muscles.
- c. Shuttle Run : This test item is meant for judging the speed and change of direction.
- d. Standing Long Jump : For judging the explosive power of leg muscles.

- e. 50 yard Dash or Sprint : For judging speed.
- f. 600 yard Run : For judging endurance.

Administration of Tests : these tests can be conducted in a gymnasium or out-doors. The only apparatus required in these tests is a horizontal bar having a diameter of approximately 1½ inches for pull-ups and flexed arm hang for girls. However, arrangement has to be made for the timing and recording of all scores with the help of timers and recorders.

Item No.1—Pull ups : This item has to be done from a hanging position on the bar by using the overhead grasp (with palms facing outwards). The arms and legs of a subject should be fully extended. From hanging position, the subject should raise his body with his arms until his chin is placed over the bar. Then, he should lower his body to a full hanging position. In doing so, the knees should not be bent and the pull should not be jerky or snap pull. (The number of completed pull-ups is the score of the subject.)

Item No. 1 (Girls)—Flexed-arms hung: In this test item for girls, the subject is required to hang from the bar with flexed arms and overhead grasp. She should raise her body to a position where the chin is above the bar, the elbows are flexed and the chest is close to the bar. The stopwatch is started as soon as a subject assumes such a hanging position and is stopped when the subject's chin falls below the level of the bar. (The time recorded in seconds for which a subject holds the hang position is her score)

Item No. 2—Sit-ups : For this test meant for boys and girls, the subject should lie on his or her back with knees flexed and kept not more than 12 inches from the buttocks. The hands of the subject should be placed at the back of the neck, fingers clasped and elbows touching the mat. From this position, the subject should raise his or her head and elbows forward upwards till the elbows touch the knees. This constitutes one sit-up. (The number of correctly performed sit ups in 60 seconds from the start of the first sit-up is the score of a subject).

Item No. 3—Shuttle Run : For this test item, two parallel lines are drawn at a distance of 30 feet from each other and two blocks of wood are placed behind one of the lines. The subject has to stand behind the other line and on the signal —Ready||, —Go|| should run to pick up one block, run back to the starting line and place the block behind the line. He should again turn back to pick up the second block and bring it also behind the starting line. Two such trials are given. (The better time of the two trials to the nearest 10th of a second is the score

of the subject).

Item No. 4—Standing Long Jump : In this test, a subject is required to stand behind a take-off line, with feet apart. He takes a jump forward by extending his bent knees and swinging the arms forward. The best jump recorded, out of the three trials given, is the score of the subject. (The jump should be recorded in feet and inches).

Item No. 5—50 Yard Dash : Two lines are drawn at a distance of 50 yards from each other. The subject is made to run from the start line to the finish line and his time taken is recorded in seconds (nearest to the tenth of a second.) This indicates his score.

Item No. 6—600 Yard Run : This run can be organized on a track, on a football field or an open area marked for this purpose. In this test item, a subject runs a distance of 600 yards. The subject takes a standing start from the start line. The subject may walk in between. However, the objective is to cover the distance in the shortest time. When he crosses the finish line, he is informed of his time. (The time taken to run the distance is recorded in minutes and seconds).

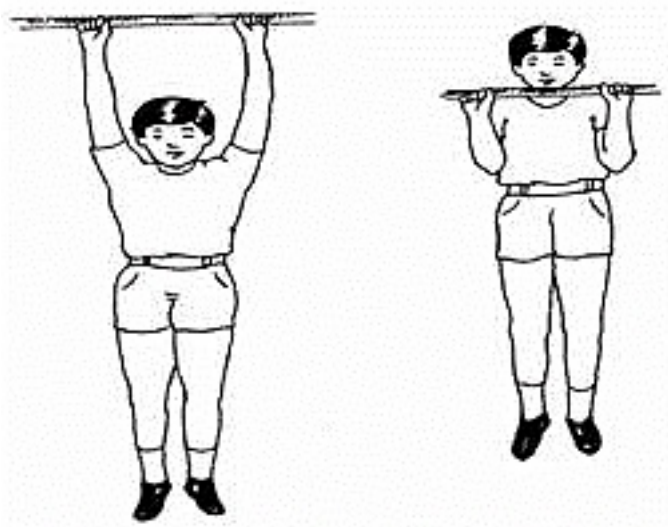
The Aapher—Youth Physical Tests were created in 1957. During the years 1957- 58 these tests were applied to 8500 School Children of classes 5 to 8 in the United States of America. On the basis of this study standard rooms were created. Studies were conducted on 2200 College level students in 1960 and percentile rooms were created, Similarly Percentile rooms were created on the basis of studies belonging to 50 institutions. New percentile rooms were created again in 1965 on the basis of age. This study included 9200 boys and girls in the 10 to 17 years age group.

1. Pull Ups Boys is an activity meant only for boys:

Equipment: A metal or wooden bar approximately 1½ inches in diameter is preferred. A doorway gym bar can be used and if no regular equipment is available, a piece of pipe or even rungs of a ladder can serve the purpose.

Description: The bar should be high enough so that the pupil can hang with his arms and legs fully extended and feet free from the floor. He should use the overhand grasp. After coming in hanging position, the pupil raises his body by his arms until his claim can be placed over the bar. Then he lowers his body to a full hang as in starting position. The

exercises is repeated as many times as possible.



Rules

- (i) Each Student will be allowed one trial.
- (ii) The body must out swing during the execution of the movement.
- (iii) The knees must not be raised and the kicking of legs is not permitted.

Scoring: Record the number of completed Pull Ups.

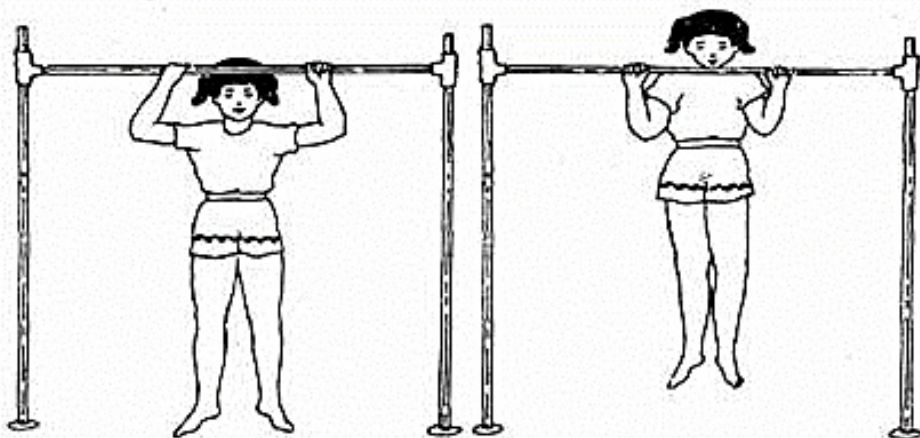
2. Flexed Arm Hang: This activity is meant only for girls.

Equipment: A horizontal bar is used. The diameter of the rod ought to be 1½ inches. A stop watch is needed to record time.

Description: The height of the bar should be adjusted so it is approximately equal to the pupil's standing height. The pupil should use an overhang grasp. With the assistance of two spotters, one in front and one in back of Pupil the Pupil raises her body off the floor to a position where the Chin is above the bar, the elbows are flexed and the Chest is close to the bar. The Pupil holds this position as long as possible.

Rules:

- (1) The Stopwatch to started as soon as the Subject takes the hanging position.
- (2) The watch is stopped when:
 - (i) Pupil's Chin touches the bar
 - (ii) Pupil's head hits backward to keep Chin above the bar.
 - (iii) Pupil's Chin falls below the level of the bar.

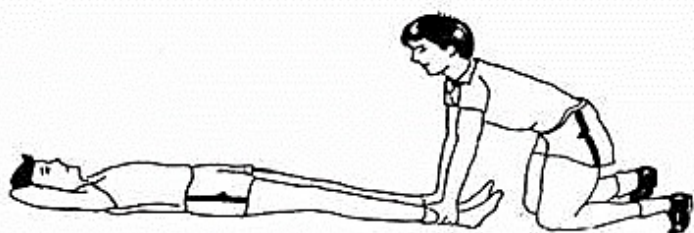


3. Sit-Ups (Flexed Leg), Boys and Girls

Scoring: The length of time the subject holds the hanging position will be recorded in seconds. Sit-ups (flexed leg)

Equipment: Clean floor, Mat or Dry Turf and Stop-Watch.

Description: The Pupil lies on his back with his knees bent, feet on the floor and heels not more than 12 inches from the buttocks. The angle at the knees should be less than 90 degrees. The Pupil puts his hands in the back of his neck with fingers clasped and places his elbows squarely on the mat, floor and turf. His feet are held by his partner to keep them in touch with surface. The Pupil heightens his abdominal muscles and brings his head to knees. This action constitutes one sit up. The number of correctly extended Sit ups performed in 60 seconds shall be the score.



Rules:

(1) No rest is permitted between sit ups.

(2) Keep the fingers clasped behind his neck.

(a) Keep the fingers clasped behind his neck.

(b) Bring both elbows forward in starting to sit up without pushing off the floor with an elbow.

(c) Return to starting position with elbows flat on the surface before sitting up again.

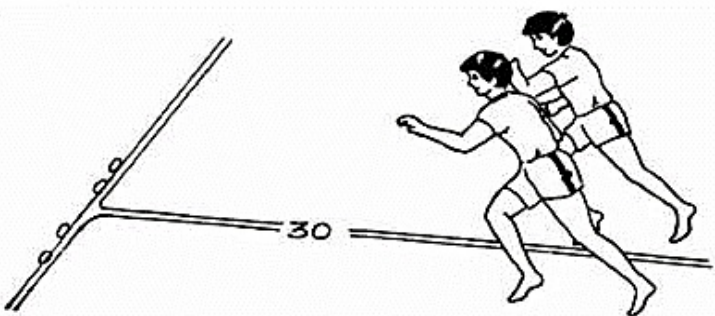
Scoring: Only the Sit ups a pupil is able to do in 60 Seconds are recorded.

4. Shuttle Run (Boys and Girls):

Equipment: Two blocks of wood, 2 inches x 2 inches x 4 inches and a stopwatch. Pupils must wear sneakers or run bare footed.

Description: Two parallel lines are marked on the floor 30 feet apart. The width of a regulation Volleyball Court serves as a suitable area. Place the blocks of wood behind one of the lines.

The pupil starts from behind one of the lines. On the signal “Ready” or “Go” the pupils runs to the blocks, picks one up runs back to the starting line and places the block behind the line. He then runs back and picks up the second block which he carries back across the Starting Line.



Rules: Allow two trials with some rest between.

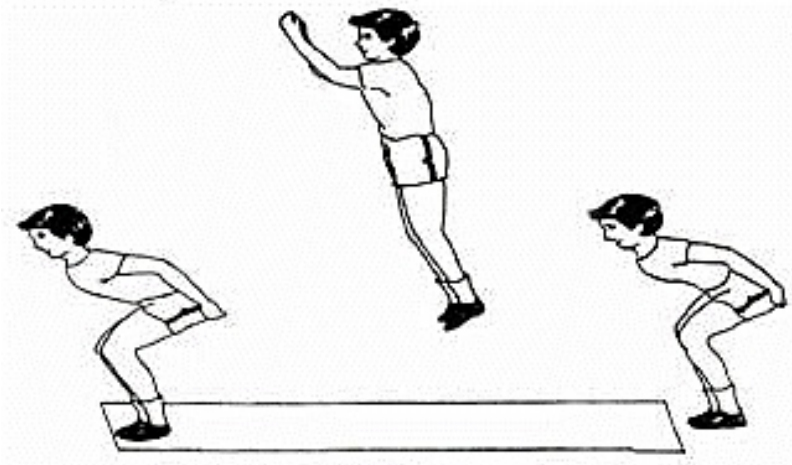
Scoring: Record the time of the better of the two trials.

5. Standing Broad (Long) Jump:

Equipment: Mat, Floor or Outdoor Jumping pit and Tape Measure.

Description: Pupil stands with the feet several inches apart and the toes just behind the take off line. Preparatory to jumping, the pupil swings the arms backward and bends the knees. The jump is accomplished by simultaneously get bending the knees and swinging forward

the arms.



Rules:

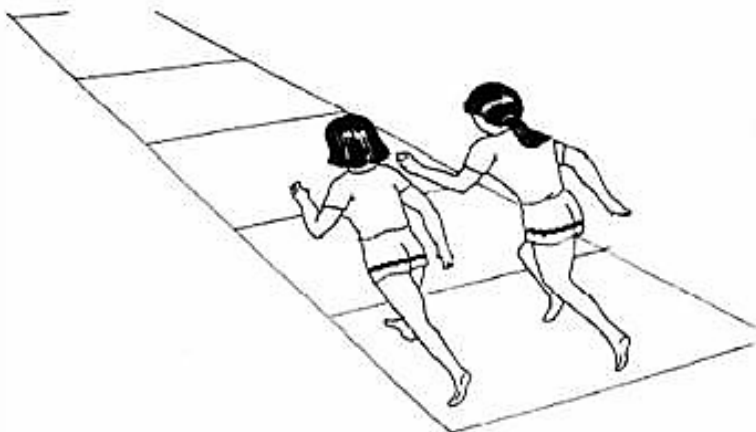
- (1) Allow three trials.
- (2) Measure from the take off line to the feet or other part of the body that touches the floor nearest the take off line.

Scoring: Record the best of the three trials.

6. 50 Yards Run (Boys and Girls):

Equipment: Two stop watches or one with a split second times.

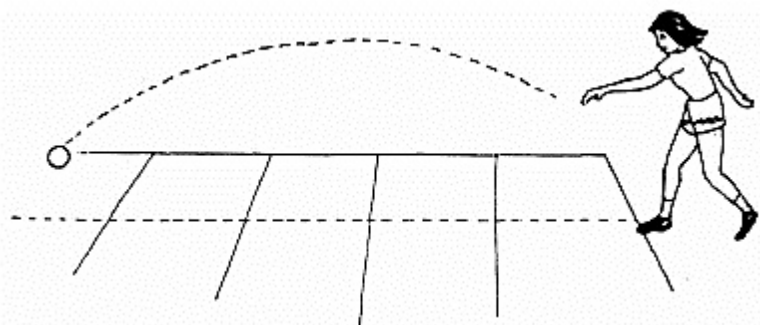
Description: It is preferable to administer this test to two pupils at a time. The starter will use the commands: “Ready” and “Go” the race comes to an end at the “Finishing Line”, Rules, the stop watch is kept on from the word “Go” to the finishing line, a time is recorded to the one tenth of a second.



7. Soft-Ball Throw (Boys and Girls):

Equipment: Soft Ball 12, Measure Tape.

Description: Game is played in a football field on a field of similar size. Lines are drawn at a distance of five yards each. The pupil who throws the ball can throw from a distance of 6 feet.



Rules:

- (1) It is necessary to have the ball in one hand.
- (2) Three chances are given to each player.

Scoring: Best of the three throws is counted.

8. 600 Yards Run or Walk (Boys and Girls)

Equipment:

1. A Track
2. A Stop Watch

Description: Pupils take their positions at the standing start. The race starts with command words: "Ready" and "Go". As many as Six Pupils can participate at a time.

Rules: Walking is permitted but the object is to cover the distance in shortest possible time.

Scoring: Record in Minutes and Seconds.

General Motor Fitness- Barrow three item general motor ability

General Motor Fitness: Barrow three items for general motor ability (Standing Broad Jump, Zig Zag Run & Medicine Ball Put- For boys: 03 KG & for Girls: 01 KG)

Harold M Barrow developed a test of motor ability for college men as well as for high school boys. The test battery comprised of three items which are explained below:

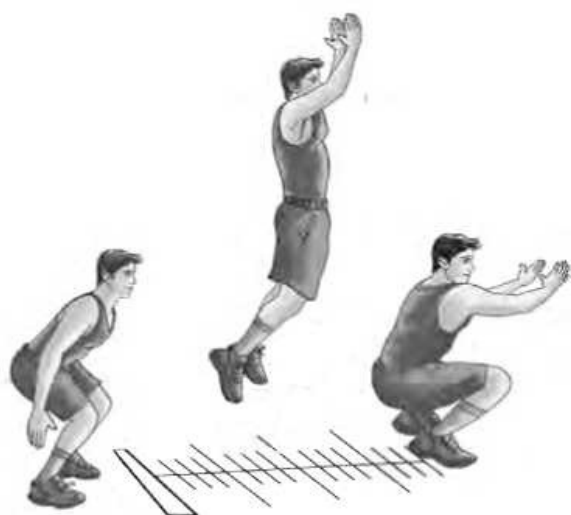
(1) Standing Broad Jump

Purpose of the Test: To measure Power mainly but also agility, speed and strength. Facilities and Equipment required: One 5 x 12 feet mat marked with take off line and parallel lines 2

inches apart as shown in the diagram.

Directions: The subject is advised to stand just behind the take off line with feet together. Then by giving swing of arms and bending knees a jump is taken. Landing is done keeping feet together.

Instructions: The subject must crouch before jump. Before the jump is taken the arms are swung. Three trials are given.

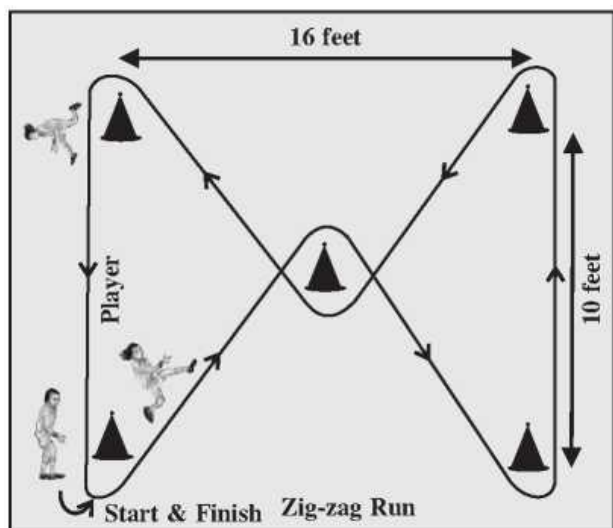


Scoring: The final score is the distance in inches from the best jump.

Table-Standing Broad Jump (T-Scores For High-School and junior High-School Boys)

Grade T-Score	7	8	9	10	11	T-Score
80	90-Up	97-Up	103-Up	105-Up	112-Up	80
75	86-89	92-96	98-102	101-104	107-111	75
70	82-85	88-91	93-97	97-100	103-106	70
65	77-81	83-87	88-92	92-96	97-102	65
60	73-76	78-82	83-87	88-91	93-96	60
55	69-72	73-77	79-82	83-87	88-92	55
50	65-68	69-72	74-78	79-82	83-87	50
45	61-64	64-68	69-73	75-78	78-82	45
40	56-60	59-63	64-68	71-74	74-77	40
35	52-55	54-58	59-63	66-70	69-73	35

30	48-51	50-53	54-58	62-65	64-68	30
25	44-47	45-49	49-53	58-61	59-63	25
20	43 Down	44 Down	48 Down	57 Down	58 Down	20



(2) Zigzag Run

Purpose of the Test: To measure agility mainly but also speed.

Facilities and Equipment required: One stop watch & 5 flags or cones as shown in the diagram given below.

Directions: First of all demonstration is given. The subject is advised to stand just behind the starting line. Then running is done in zig zag manner and three rounds are completed.

Instructions: The subject can take start from standing position. After the start running is done in a manner of figure of eight. Like this three circuits are completed.

Scoring: The final score is the time in seconds for three laps.

Table-Zigzag Run (T-Scores for High-School and Junior High-School Boys)

Grade T-Score	7	8	9	10	11	T-Score
80	20.1 Down	17.8 Down	20.2 Down	21.6 Down	21.5 Down	80
75	21.4-20.2	19.5-17.9	21.3-20.3	22.7-21.7	22.6-21.6	75
70	22.7-21.5	21.2-19.6	22.4-21.4	23.8-22.8	23.7-22.7	70
65	24.0-22.8	22.8-21.3	23.5-22.5	24.8-23.9	24.7-23.8	65

60	25.2-24.1	24.5-22.9	24.6-23.6	25.8-24.9	25.8-24.8	60
55	26.5-25.3	26.2-24.6	25.7-24.7	26.9-25.9	26.8-25.9	55
50	27.8-26.6	27.8-26.3	26.8-25.8	27.9-27.0	27.8-26.9	50
45	29.0-27.9	29.5-27.9	27.9-26.9	28.9-28.0	28.9-27.9	45
40	30.3-29.1	31.2-29.6	29.0-28.0	29.9-29.0	29.9-29.0	40
35	31.6-30.4	32.8-31.3	30.1-29.1	31.0-30.0	31.0-30.0	35
30	32.8-31.7	34.5-32.9	31.2-30.2	32.1-31.1	32.0-31.1	30
25	34.1-32.9	36.2-34.6	32.3-31.3	33.1-32.2	33.0-32.1	25
20	34.2 Up	36.3 Up	32.4 Up	33.2 Up	33.1 Up	20

(3) Six Pound Medicine Ball Put

Purpose of the Test: To measure mainly strength of arm and shoulder girdle but also to measure power of arm and shoulder girdle coordination, speed and balance.

Facilities and Equipment required: A space in the gymnasium hall with 90 x 25 feet. A 15 feet restraining line marked. One medicine ball weighing six pounds and one measuring tape.

Directions: First of all event is explained and demonstration is given. The subject is advised to put the ball but no throwing is not allowed. Three trials are given. But if the subject commits three faults then he must put until he makes a fair put.

Instructions: The subject must take the position before the restraining line. No overstepping is allowed after restraining line. The medicine ball is put not thrown.

Scoring: The final score is the distance of the best put in nearest foot.

Table-Medicine Ball Put (T-Scores for High-School and Junior High-School Boys)

Grade T-Score	7	8	9	10	11	T-Score
80	43-Up	45-Up	49-Up	50-Up	54-Up	80
75	38-42	43-44	46-48	47-49	51-53	75
70	35-37	40-42	44-45	44-46	48-50	70
65	33-34	37-39	41-43	42-43	46-47	65

65	33-34	37-39	41-43	42-43	46-47	65
60	30-32	34-36	38-40	39-41	43-45	60
55	27-29	31-33	35-37	37-38	40-42	55
50	25-26	28-30	32-34	34-36	37-39	50
45	22-24	25-27	29-31	32-33	34-36	45
40	19-21	23-24	27-28	29-31	31-33	40
35	17-18	20-22	24-26	27-28	28-30	35
30	14-16	17-19	21-23	24-26	25-27	30
25	12-13	14-16	18-20	22-23	22-24	25
20	11 Down	13 Down	17 Down	21 Down	21 Down	20

7.4 Measurement of Cardio-Vascular Fitness-Harward Step Test/Rock Port Test

Cardiovascular fitness is the ability of an individual to strengthen the heart muscles during continuous muscular activities in which numbers of muscles groups are used.

1. Harward Step Test-Aerobic Fitness (Recovery time)

100*(Total test time in seconds (the time for which the athlete was able to do the stepping up and down)

2*(the total number of heartbeats for all the three time intervals)

2. Rockport Fitness Test-One mile Walking test

$VO_{2max} = 132.853 - (0.0769 * \text{Weight}) - (0.3877 * \text{Age}) + (6.315 * \text{gender}) - (3.2649 * \text{time}) - (0.1565 * \text{Heart Rate})$

Harvard step test-This test requires the athlete to step up and down off a gym bench for 5 minutes at a rate 30 steps/minute which measures the Aerobic fitness test. The distance to be covered is 1 mile on normal track. After the workout, timing, heart rate, has to be measured. The athlete steps up and down onto a standard gym bench once every two seconds for five minutes (150 steps), The assistant stops the test after 5 minutes

The assistant measures the athlete's heart rate (bpm) one minute after finishing the test -

Pulse1 The assistant measures the athlete's heart rate (bpm) two minutes after finishing the

test - Pulse2 The assistant measures the athlete's heart rate (bpm) three minutes after finishing the test - Pulse3 b. Rock fort one mile test- Main objective to check the development of vo2 max.

Harvard step test fitness index score

Rating	Fitness Index	Rating	Fitness index
Excellent	>96	Below average	54-67
Good	83-96	Poor	<54
average	68-82		

In the **Harvard step test** for cardiovascular fitness, the physical efficiency index $PEI = (\text{Duration or exercise in seconds} \times 100) \div 2 \times \text{Sum of pulse counts in recovery}$

Rockport fitness walking test

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 (VO₂) 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

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

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.

Rikli and Jones senior citizen fitness test

The Rikli and Jones Senior Citizen Fitness Test for assessing the functional fitness of older adults describes easy to understand and effective tests to measure aerobic fitness, strength and flexibility using minimal and inexpensive equipment. The Individual fitness test items involve common activities such as getting up from a chair, walking, lifting, bending and stretching.

The tests were developed to be safe and enjoyable for older adults while still meeting scientific standards for reliability and validity. The tests are

(i) Chair Stand Test-testing lower body strength

(ii) Arm Curl Test-testing upper body strength

(iii) Chair sit and Reach Test-lower body flexibility test

(iv) Back Scratch Test-upper body flexibility test

(v) 8 Foot Up and Go Test-agility test

(vi) Walk Test (6 min) or Step in Place Test (2 min)-The Walk Test is used to assess aerobic fitness ;

however, if the person uses orthopedic devices when walking or has difficulty balancing, they do the Step in Place Test.

Fitness Index F.I.

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), the procedure is

- i. 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.
- ii. The upper arm is placed against the body so that only the lower arm is moving (the tester may assist to hold the upper arm steady).
- iii. The subject curls the arm up through a full range of motion, gradually turning the palm up (flexion with inspiration).

- iv. 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.
- v. Repeat this action as many times as possible within 30 sec.
- vi. score is the total number of controlled arm curls performed in 30 sec.

The **sit and reach test** is a common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles. This test is important as because tightness in this area is implicated in lumbar lordosis, and lower back pain. This test was first described by Wells and Dillon (1952) and is now widely used as a general test of flexibility.

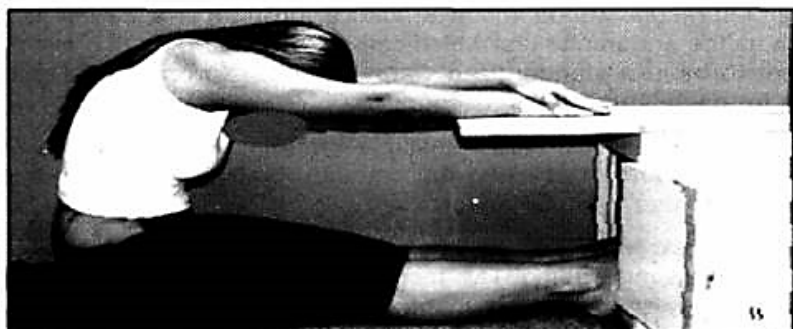
7.5 Measurement of flexibility-Sit & Reach Test

1. Test for absolute flexibility
2. Test of Relative flexibility
 - a. Measure of linear flexibility test
 - b. Rotary (Angular measure flexibility test)

I. Sit and Reach Test: This test is used to measure the flexibility of the back and leg (hamstring muscle) It is a kind of absolute and linear test of flexibility.

Equipment: A testing box or a flexomeasure and a yardstick.

Procedure: The subject is asked to remove shoes and place his/her feet against the testing box while sitting on the floor with straight knees. Now the subject is asked to place one hand on top of the other so that the middle finger of both hands are together at the same length. The subject is instructed to lean forwards and place his/her hands over the measuring scale lying on the top of the box with its 10 inch mark coinciding with the front edge of the testing box. Then, the subject is asked to slide his/her hands along the measuring scale as far as possible without bouncing and to hold the farthest position for at least one second.



Score: Each subject is given three trials and the highest score nearest to an inch is recorded

and 10 inches are subtracted from the recorded reading to obtain the flexibility score which is compared with the standards given in.

Table source: Based on personal experience.

Validity: This test only measures the flexibility of the lower back and hamstrings, and is a valid measure of this.

Reliability: The reliability of this test will depend on the amount of warm-up that is allowed, and whether the same procedures are followed each time the test is conducted. Most sit and reach testing norms are based on no previous warm-up, though the best results will be achieved after a warm up or if the test is preceded by a test such as the endurance test which can act as a warm up. If a warm up is used, it is important to have a standardized warm up and test order and repeat the same conditions for each time the test is conducted.

Advantages: The sit and reach test is a common test of flexibility, and is an easy and quick test to perform. If using the standard testing procedure, there is a lot of published data to use for comparison.

Disadvantages: Variations in arm, leg and trunk length can make comparisons between individuals misleading. This test is specific to the range of motion and muscle and joints of the lower back and hamstrings, and may not be relevant to other parts of the body.

Back scratch test

This test is performed in standing position. Keep one hand behind the head and back over the shoulder and reach as far as possible down middle of your back. Your palm should touch your body and the fingers should be downwards. Then carry other arm behind your back palm facing outward and fingers upward and reach up as far as possible trying to touch or overlap the middle fingers of both hands. Fingers should be aligned. Measure the distance between the tips of fingers. If the finger tips touch then score is zero, if they do not touch measure the distance between finger tips (negative), if they overlap then by how much (+ score).

Eight foot up and go test

This test is a coordination and agility test for senior citizens.

Purpose: To assess speed, agility and balance while moving.

Equipments required: A chair with straight back (about 44 cms high) a stopwatch, cone marker, measuring tape, and area without hinderance.

Procedure: Keep chair next to the wall and the marker, 8 feet in front of the chair. The

participant starts completely seated, with hands resting on the knees and feet flat on the ground. On the command 'go' stopwatch is started and the participant stands and walk (on running at all) as quickly as possible to and around cone and returns to the chair to sit down. Time is noted as he sits down on the chair. Two trials are given to the participant.

Scoring: The best trial is recorded to the nearest 1/10th second.

7.6 Rikli Jones-Senior Citizen Fitness Test

Test Item	Parts of Body-Physical fitness Components
1. Chair stand test for lower body	1. Lower body strength, leg strength & strength Endurance
2. Arm curl test for upper body flexibility	2. The upper body strength, arm flexor, strength & endurance
3. Chair sit & reach test for lower body flexibility	3. The hemi string and lower back flexibility
4. Back-scratch test for lower body	4. The upper body flexibility of the body & Flexibility range of motion of the shoulders
5. Eight foot up & Go test for agility	5. The motor agility, speed & balance
6. Six minute walk test for aerobic endurance	6. Cardio-vascular endurance & recovery

(a) Chair Stand test for lower body strength

Purpose and Daily Benefit: The purpose of the Chair-Stand is to measure the strength of lower body of adults over 60 years of age. Lower body strength is important for activities such as getting out of a chair, on the bus, out of the car, and rising up from a kneeling position in the house or garden. The, strength of your lower body can directly affect the ease with which you perform the activities you do every day.

Equipment: Chair without arms, Stopwatch.

Procedure: Place the chair against a wall where it will be stable. Sit in the middle of the

chair with your feet flat on the floor, shoulder width apart, back straight. Cross your arms at the wrist and place them against your chest. The test partner will tell you when to begin and will time you for 30 seconds, using the stopwatch. You will rise up to a full stand and sit again as many times as you can during the 30 second interval.

- (a) Each time you stand during the test be sure you come to a full stand.
- (b) When you sit, make sure you sit all the way down. Do not just touch your backside to the chair. You must fully sit between each stand.
- (c) Do not push off your thighs, or off the seat of the chair with your hands to help you stand unless you have to.
- (d) Keep your arms against your chest crossed and do not allow the arms to swing up as you rise.
- (e) If you are on your way up to stand when time is called you will be given credit for that stand.



Scoring: The score is the number of completing correct chair stands in 30 minutes.

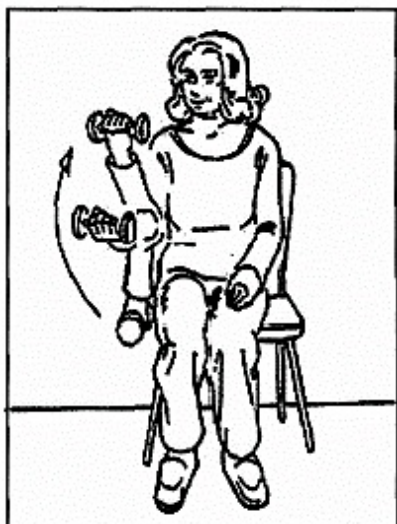
(b) Arm Curl test for upper body strength

Purpose: This test measures upper body strength and endurance.

Equipments Required: 4 pound weight (women, AAHPERD), 5 pound weight (women, SFT), 8 pound weight (for men). A chair without armrests, stopwatch.

Procedure: The aim of this test is to do as many arm curls as possible in 30 seconds. This test is conducted on the dominant arm side (or strongest side). The subject sits on the chair, holding the weight in the hand using a suitcase grip (palm facing towards the body) with the arm in a vertically down position beside the chair. Brace the upper arm against the body so that only the lower arm is moving (tester may assist to hold the upper arm steady). Curl the

arm up through a full range of motion, gradually turning the palm up (flexion with supination). As 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. The protocol for the AAHPERD test describes the administrator's hand being placed on the biceps, and the lower arm must touch the tester's hand for a full bicep curl to be counted. Repeat this action as many times as possible within 30 seconds.



Scoring: The score is given for the total number of controlled arm curls performed in 30 seconds.

(c) Chair Sit and Reach test for Lower Body Flexibility

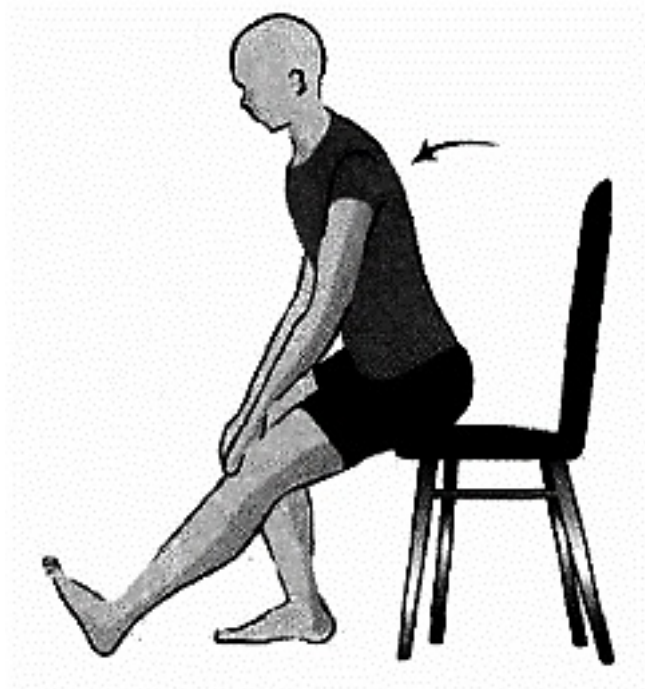
The Chair Sit and Reach test is a part of the Senior Fitness Test Protocol, and is designed to test the functional fitness of seniors. It is a variation of the traditional sit and reach flexibility test.

Purpose: This test measures flexibility of lower body.

Equipments Required: Ruler, straight back or folding chair, (about 17 inches/44 cm high)

Procedure: The subject sits on the edge of a chair (placed against a wall for safety). One foot must remain flat on the floor. The other leg is extended forward with the knee straight, heel on the floor, the ankle bent at 90°. Place one hand on top of the other with tips of the middle fingers even. Instruct the subject to inhale, and then as they exhale, reach forward towards the toes by bending at the hip. Keep the back straight and head up. Avoid bouncing or quick movements, and never stretch to the point of pain. Keep the knee straight, and hold the

reach for seconds. The distance is measured between the tip of the *Chair sit & reach test for lower body flexibility* fingertips and the toes. If the finger tips touch the toes then the score is zero. If they do not touch, measure the distance between the fingers and the toes (a negative score), if they overlap, measure by how much (a positive score).



Scoring: Perform two trials. A score is recorded to the nearest inch or 1 cm as the distance reached, either a negative or positive score. Record with leg was used for measurement.

(d) Back Stretch for Upper Body Flexibility

Aim: The Back Scratch Test measure flexibility of your upper body. Upper body's flexibility affects your ability to reach for items that may be high on a shelf, change a light bulb, or do any activity that requires arm and/or shoulder movement. Maintaining flexibility in your upper body will assist you in continuing to live independently.

Equipment: Ruler

Procedure: Place your left arm straight up in the air above your left shoulder. Bend your left arm at the elbow to reach toward your back, with your fingers extended. Your elbow pointed toward the ceiling. Place your right hand behind your back with your palm out and your fingers extended up. Reach up as far as possible and attempt to touch the fingers of your two hands together. Some people are not able to touch at all, while other's fingers may overlap.

Take two practice stretches with each arm, determining which side is more flexible. You will be measuring and recording only your most flexible side. You are now ready to be measured. Perform the stretch as outlined above. Without shifting your hands your test partner will position your fingers so that they are pointing toward each other.



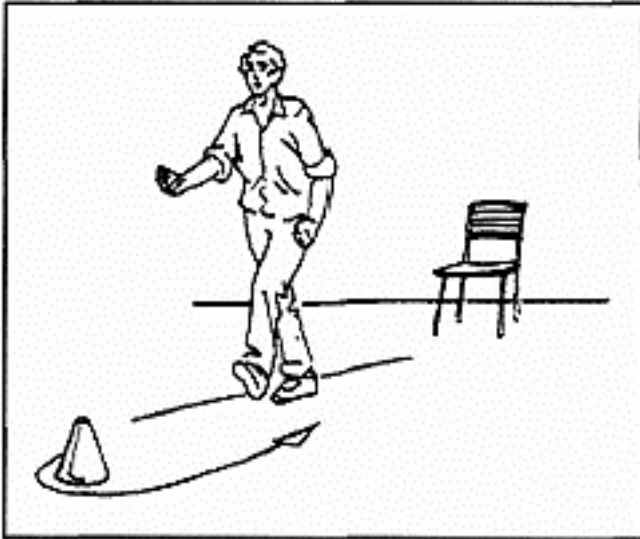
Scoring: The distance between the finger tips of one hand and the other is measured to the nearest half inch or centimeters. If your fingers overlap, the amount of the overlap will be measured. Fingertips just touching receive a score of “0”. If your fingers do not touch, you receive a negative score of the distance between your fingers, measured to the nearest half inch or centimeters.

(e) Eight Foot Up and Go Test for Agility

Aim: The ‘8 Foot Up and Go’ is a coordination and agility test for the elderly, which is a part of the Senior Fitness Test. This test measures speed, agility and balance while moving.

Equipments required: Stopwatch, straight back or folding chair (about 17 inches/44 cm high), one marker, measuring tape, area clear of obstacles.

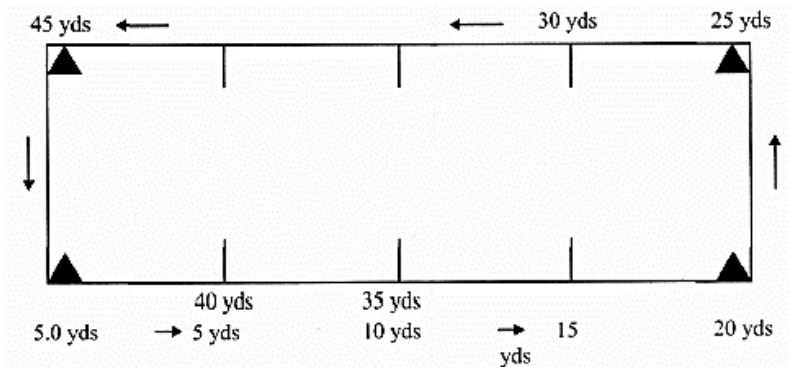
Procedure: Place the chair next to a wall (for safety) and the marker 8 feet of the chair. Clear the path between the chair and the marker. The subject starts fully seated, hands resting on the knees and feet flat on the ground. On the command, “Go,” timing is started and the subject stands and walks (no running) as quickly as possible (and safely) to and around the cone, returning to the chair to sit down. Timing stops as they sit down.



Purpose: To assess aerobic fitness or aerobic endurance which is important for walking distances, stair climbing, shopping and sightseeing etc.

Equipment: Stop watch. *

Rectangular ground measuring 20 x 5 yds.



CBSE Class 12 Physical Education

Revision Notes

Unit 8

PHYSIOLOGY AND SPORTS

key points

- gender differences on physical and physiological parameters
- Physiological factors for deteming components of Physical Fitness
- Effects of exercise on Cardivascular, Respiratory and muscular system
- Physiological changes due to ageing
- Role of exercise in slowing ageing process

Gender differences between physical and physiological parameters

There are following physical differences between males and females:

Body size: there is a lot of difference in body size of males and females. The size of body of males is larger in comparison to females.

Body shape: In males 'V' Shaped body is considered the best whereas in females slim constitution of body is considered the best.

Vertebrae, legs and knees: The vertebrae in females is long in comparison to hands and legs whereas in males the vertebra is small in comparison to hands and legs .

Centre of gravity: The height of female is usually found is less in comparison to males. The centre of gravity of females is less high and the height of centre of gravity of males if high. This is the reason why the stability in females is more than males.

Abdomen: females have larger abdominal cavity than males. This is due to the fact that females have additional organs of reproduction.

Bones of shoulders: The shoulder bones of females are found to be weak in comparion to shoulder bones of males. Due to this reason, females are provided low weight equipments in

throwing events.

The physiological difference in females and males are follows:

Muscular strength: The muscular strength of females is less than males. The contraction and extension of muscles of females is less forceful whereas males have more forceful contraction and extension of muscles.

Blood circulation: The size of heart in females is smaller in comparison to males and also there is less amount of blood in females than males. Generally the heart rate of females remain more than males.

Respiratory organs: Lungs of females are smaller in comparison to males. That's why, females have less endurance than males. In fact, lung capacity of normal healthy female is 10% less in comparison to male of similar shape and size.

Menstrual cycle: Females should not perform strenuous and vigorous works during menstrual cycle whereas in males there is no such type of cycle.

Physiological factors for determining strength.

The following are the factors for determining strength:

- **Muscle composition:** There are two types of fibres in muscles i.e. fast twitch fibres and slow twitch fibres. The muscles which consist of more percentage of fast twitch fibres will produce more strength.
- **Size of the muscle:** The strength of an individual depends on the size of muscle. As larger and bigger muscle produce more force and with the help of different methods of strength training, the size of the muscle can be increased.
- **Body weight:** there is a positive relation between body weight and strength. The individuals who are heavier are stronger than the individuals who are lighter in weight.
- **Intensity of nerve impulse:** A muscle is composed of no. of motor units. The total force of muscle depends upon the number of contracting motor units. Whenever, a stronger nerve impulse from central nervous system excite more number of motor units, the muscle will contract more strongly or it can be said that the muscle will produce more force or strength.

Physiological factors for determining speed.

The following are the factors for determining speed:

- **Muscle composition:** The muscles which consist of more percentage of fast twitch fibres contract with more speed and produce a greater speed. Different muscles of the body have different percentage of fast twitch fibres.
- **Explosive strength:** it depends on the shape, size and coordination of muscles. For very quick and explosive movement, explosive strength is required. The related proportion of fast twitch fibres and slow twitch fibres determines the maximum possible speed with which the muscle can contract.
- **Flexibility:** It also determines the speed. Good flexibility allows maximum range of movements and also enables complete utilization of explosive strength.
- **Biochemical reserves and metabolic power:** muscles require more amount of energy and high rate of consumption for maximum speed performance. For this purpose the stores of ATP & CP in the muscles should be enough. If the store is less, the working process of the muscles slows down after short time.

Physiological factors for determining flexibility.

The physiological factors for determining flexibility are:

- **Muscle strength:** Flexibility depends on the level of strength. Weak muscles can become a limiting factor for achieving higher range of movement. Muscle strength is highly trainable therefore, it can enhance flexibility.
- **Joint structure:** There are several different types of joints in human body. Some of the joints intrinsically have a greater range of motion. eg. the ball and socket joint of the shoulder has the greatest range of motion.
- **Age and gender:** flexibility decreases with the advancement of age. It can be enhanced with the help of training. Gender also determines the flexibility as females tend to be more flexible than males.
- **Internal environment:** The internal environment of an athlete influences the flexibility. If internal temperature increases flexibility increases; if it decreases flexibility decreases.

Previous injury: Injuries to connective tissues and muscles ultimately lead to reduced

flexibility

Physiological factors determining endurance.

Aerobic capacity:-

(1) oxygen intake

(ii) oxygen transport

(iii) oxygen uptake

(a) Energy reserves,

(b) Lactic acid tolerance,

(c) Movement economy,

(d) Muscle composition

Oxygen Uptake:- It is highest rate at which oxygen can be taken up and consumed by the heart per minute.

Cardiac Output:- The cardiac output is simply the amount of blood pumped by the heart per minute.

Hydration and Endurance Exercise: - Sweating is normal physiological response to prolonged exercise, required for the dissipation of heat produced during energy metabolism

Effect of exercise on the cardiovascular system

(i) Cardiac output is the amount of blood pumped by the heart in 1 min. This increases directly with increasing exercise intensity.

(ii) The heart rate increases from a resting rate of 72 beats / min to 150 beats / min or even more.

(iii) The stroke volume, meaning the amount of blood pumped into the Aorta with every heartbeat, increases from a resting volume of 70-90 mL to 100-120 mL per beat.

(iv) Exercise increases the plasma volume of blood by 12% ; but total blood volume may

reduce slightly.

(V) Blood flow is redistributed with more blood going to the muscles, heart and skin, while blood in the kidneys and abdomen is reduced.

(vi) Blood pressure increases due to exercise because there is more blood flowing in the blood vessels.

Effects of exercise on muscular system.

- Size and shape of muscle changes: Regular exercise changes the shape and size of the muscle. Cells of the muscles are enlarged which change the shape and size of the muscle.
- Correct body posture; regular exercise keeps the correct posture of the body by strengthening the muscles. The postural deformities do not occur. If there is any physical deformity, then it is removed.
- Food storage increases: the capacity of food storage in body can be enhanced by doing regular exercises. This stored food can be utilized immediately when required.
- Toned muscles: regular exercise helps in keeping the muscles in toned position. Muscles become firm and maintain a slight, a steady pull on the attachments.
- Efficient movement of muscles: The movement of muscles becomes efficient and smooth. The movements during different activities become attractive.
- Change in connective tissues: the connective tissues become powerful. These tissues can bear the stress of strenuous activity.

Effects of exercise on respiratory system.

- Increase in Tidal air capacity: by doing regular exercise it has been noted that there is an increase in the amount of tidal air capacity of an individual.
- Decrease in rate of respiration: When a beginner starts exercising his rate of respiration increases. But when the same individual perform exercise daily, his rate of respiration decreases in comparison to the beginner at rest.
- Strong will power: regular exercise increases the will power of an individual. As pranayama, the specific exercise for lungs increases the will power of the doer.
- Unused alveolus becomes active : Regular exercise activates the unused alveolus because much amount of oxygen is required in vigorous activities of daily routine.

The passive alveolus become active.

- Increase in vital air capacity: The capacity of vital air capacity varies from 3500cc to 4500cc in a normal adult. Due to regular exercise its capacity increases upto 5500cc.

Ageing is the process of becoming older. It represents the accumulation of changes in a person over time. Ageing in humans refers to a multidimensional process of physical, psychological, and social change.

Role of regular exercise on ageing process,

Regular exercise keeps the human body livelier, fitter and In better condition, thus delaying the ageing processes. As Given below :

(I) exercise reduces the loss of elasticity from the lungs and chest wall agencies increase muscle strength and hypertrophy by increasing the cross-sectional area of the Slow Twitch Fibers (sm and Fast Twitch Fibers (FTF). This slows down ageing · The body composition changes due to exercise by reducing the fat content of the body, thus slowing down the ageing process. fu Exercise impel flexibility by strengthening the musculoskeletal systems, thereby preventing the bickering of joints. This also slows the ageing process.

CBSE Class 12 Physical Education

Revision Notes

UNIT 10

KINESIOLOGY, BIOMECHANICS & SPORTS

Key Points:

- Projectile & factors affecting projectile trajectory
- Newton's laws of motion and their application in sports
- Aerodynamics principles
- Friction & Sports
- Introduction to Axes And Plane
- Types of movements(Flexion, Extension, Abduction, Adduction)
- Major muscle involved in Running , Jumping And Throwing

Projectile

Projectile: an object thrown into the space either horizontally or at acute angle under the action of gravity is called a projectile. In the field of games and sport there are many examples of projectiles such as putting the shot, throwing a hammer, discus and javelin in athletics.

Factors affecting projectile trajectory

Propelling Force : The propelling force produces certain effects depending upon its point and direction of application. If the application is directly through the projectile's centre of gravity, only linear motion results from the force. As the projecting force is moved further from the centre of gravity, rotator motion of the object increases at the expense of linear motion. If the force is below the object's centre of gravity, back spin is results. Forward spin results when the force is above the centre of gravity. When the force is off centre to the left, clockwise spin results and when it is off centre to right, counter clockwise spin occurs.

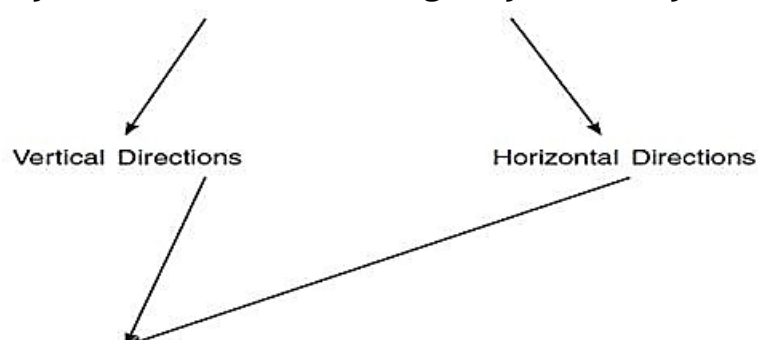
Force of Gravity: As soon as contact is broken with a projected object, the force of gravity begins to diminish the upward velocity of the object. Finally, gravity overcomes the

effects of the upward component of the projectile's motion and the object begins to descend. The factors that determine how soon gravity will cause the object to descend are -

- (a) Weight (mass) of the object
- (b) amount of force driving it upward
- (C) the effect of air resistance on the object.

(iii) Effect of Air Resistance As the speed of an object increases, air resistance has a greater retarding effect. The more surface area an object presents in the direction of movement, the greater will be the effect of air resistance.

Projectile & factors affecting Projectile Trajectory



- Speed of Release
- Angle of Release(Trajectory of Relax)
- Height of Release

Newton's laws of motion and their application in the field of sports.

The three laws of motion formulated by Newton are described below

1.Law of inertia: According to this law a body at rest will remain at rest and a body in motion will remain in motion at the same speed and in the same direction unless acted upon by an external force. There are great examples of this law in sports such as starting in rowing, starting in sprinting, starting in throwing the hammer. Basically if an object is in motion, it remains in motion unless something or some external force stops it. The external force may be gravitational force, the surface of playing field or a defensive player etc.For Ex: Starting in sprinting, starting in rowing, starting in hammer throw.

2.Law of acceleration: According to this law, A change in motion is directly proportional to the force producing it and inversely proportional to its mass. If two unequal forces are

applied to objects of equal mass, the object that has greater force applied will move faster. Conversely, if two equal forces are applied to objects of different masses, the lighter mass will travel at a faster speed. eg. in hammer throw, a thrower who is stronger will throw the hammer farther than a thrower who is less stronger.

3. Law of reaction: According to this law 'For every action there is an equal and opposite reaction.' There are so many examples in sports where this law is applied. e.g., In swimming a swimmer pushes the water backwards (action) and the water pushes the swimmer forward (reaction) with the same force. In swimming, a swimmer pushes the water backwards (action). The water pushes the swimmer forward (reaction) with the same force.

Aerodynamics is the study of properties of moving air and the interaction between the air and solid bodies moving between it.

The basic forces of aerodynamics are stated below:

Lift: lift is the force that pushes the object to move upward. It is the force that is the opposite of weight.

Weight: Weight is the force generated by the gravitational force of the earth. The weight of an object controls how strong the push has to be. A shot of 16 pounds requires more force (push) than a javelin.

Drag: Drag is a force that tries to slow the object down. It makes hard for an object to move. It is harder to walk through the water than through the air. It is because water causes more drag than air.

Thrust: Thrust is a force that is the opposite of drag. Thrust is the push that moves some objects forward.

Friction and its types

The force acting along two surfaces in contact which oppose the motion of one body over the other is called the force of friction. It is very important in sports. That is, the larger the area of contact between the surfaces, the greater is the force of friction. When both the surfaces are smooth, the force of friction reduces to almost zero.

Three types of friction are

(i) **Static Friction** The opposing force that comes into play when one body tends to move over the another surface but the actual motion has not yet started

(ii) **Limiting Friction** Limiting friction is the maximum of friction force that comes into play when one body is just on the verge of moving over the surface of another body.

(iii) **Kinetic Friction** Kinetic friction is the opposing force that comes into play when one body is actually moving over the surface of another body.

Axes & Plane

Plane is an imaginary, flat surface passing through the body or plane is the surface on which the movement occurs.

There are following types of planes:

a) **Sagittal or Medial plane:** The sagittal plane is a vertical plane passing from the rear to the front, dividing the body into left and right halves. It is also known as anteroposterior plane. Most of the sports and exercise movements that are two dimensional, such as running, long jumping and somersault take place in this plane.

b) **Frontal or Coronal plane:** the frontal plane is also vertical and passes from left to right dividing the body into posterior to anterior halves. It is also known as coronal plane. Frontal plane cuts the body into front and back. Movements along the frontal plane can include cartwheel and star jumps.

c) **Transverse or Horizontal plane:** The transverse plane divides the body into top and bottom halves. In fact, it divides the body into upper and lower sections. This plane lies horizontally that why it is also called horizontal plane. Movements along this plane can include an ice-skating spin or rotation to play a tennis shot.

An axis is a straight line around which an object rotates. Movements at the joints of human musculoskeletal system are mainly rotational and take place about a line perpendicular to the plane in which they occur. This line is known as axis of rotation.

There are following types of axes of rotation:

a) **Sagittal axis:** The sagittal axis passes horizontally from posterior to anterior. It is formed by the intersection of the sagittal and transverse plane. Sagittal axis passes from front to back.

b) **Frontal axis:** The frontal axis passes horizontally from left to right. It is formed by the

intersection of frontal and horizontal plane. Frontal axis passes from side to side.

c) **Vertical axis:** The vertical axis passes vertically from inferior to superior. It passes straight through the top of the head down between feet. It is formed by the intersection of sagittal and frontal plane. It is also known as longitudinal axis. It is the longest axis.

Types of movements

There are various types of movement in body parts which can be divided in four types i.e. gliding & angular movements, circumduction & rotation and few other movements.

Gliding movements: Gliding movements is the simplest kind of movement that can take place in a joint, one surface gliding or moving over another without any angular or rotator movement.

Angular movement: Angular movement occurs between long bones. By angular movement the angle between the two bones increased or decreased. The various movements which fall under angular movements are described below:

- a) **Flexion:** Bending parts at a joint so that the angle between them decreases and parts come closer together (bending the lower limb at the knee).
- b) **Extensions:** Straightening parts so that the angle between them increases and parts moves farther apart (straightening the lower limb at the knee).
- c) **Abduction** means moving a part away from the midline (lifting the upper limb horizontally to form a right angle with the side of the body))
- d) **Adduction** means moving a part towards the midline (returning the upper limb from the horizontal position to the side of the body).

Circumduction: Circumduction is that movement which takes place between the head of a bone and its articular cavity. This kind of motion is best seen in the shoulder and hip joints.

Rotation: Rotation is a form of movement in which a bone moves around a central axis without undergoing any displacement from the axis. Moving a part around an axis is called rotation.eg. Twisting the head from side to side.

Major muscles involved in running

The major muscles involved in running are described below:

Glutes: these muscles stabilize your hips and legs. These muscles work with hamstring muscles and help in hip flexors.

Quads: Quads propel you forward and help straighten out the leg in front so that it can make a good contact with the surface of ground.

Calves: these muscles give you spring in your step and at the same time these muscles act as shock absorbers.

Hamstrings: As you move forward, the action switches to your hamstrings, the muscles at the back of your thigh muscles. These muscles help you in pulling the leg back behind and give you strength to propel your body forward.

Core muscles: Strong abs and back are really important because they keep your posture upright and overall form good. These muscles play a significant role in running.

Biceps: biceps also play a vital role in running. Biceps maintain a bent arm and help in swinging your arms back and forth while running.

Major muscles involved in jumping & throwing

The leg, feet and gluteus muscle groups are used in jumping. Specific muscles which are involved in jumping are gluteus maximus, hamstrings, quadriceps and soleus. In fact, jumping occurs in three stages. The first stage is the preparatory stage where ankle muscles, calf muscles and soleus tense to prepare launching. The second phase is the launch phase, where hip extensors, the hamstrings and gluteus maximus combine and the knee extensors extend the knees to allow the body to launch into the air. In the last stage is the landing phase where all the muscles embrace impact and allow the body to return to a resting position.

The major muscles are pectorialis major, latissimus dorsi, anterior deltoid and teres major are involved in throwing. These muscles are comparatively responsible for velocity during the throw. The pectorialis major is the large muscle in the chest and latissimus dorsi are the large muscles on each side of the back. Deltoid, biceps, triceps are also involved in throwing a javelin in athletics.

CBSE Class 12 Physical Education

Revision Notes

Unit 8

PHYSIOLOGY AND SPORTS

key points

- gender differences on physical and physiological parameters
- Physiological factors for deteming components of Physical Fitness
- Effects of exercise on Cardivascular, Respiratory and muscular system
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- Role of exercise in slowing ageing process

Gender differences between physical and physiological parameters

There are following physical differences between males and females:

Body size: there is a lot of difference in body size of males and females. The size of body of males is larger in comparison to females.

Body shape: In males ‘V’ Shaped body is considered the best whereas in females slim constitution of body is considered the best.

Vertebrae, legs and knees: The vertebrae in females is long in comparison to hands and legs whereas in males the vertebra is small in comparison to hands and legs .

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- **Biochemical reserves and metabolic power:** muscles require more amount of energy and high rate of consumption for maximum speed performance. For this purpose the stores of ATP & CP in the muscles should be enough. If the store is less, the working process of the muscles slows down after short time.

Physiological factors for determining flexibility.

The physiological factors for determining flexibility are:

- **Muscle strength:** Flexibility depends on the level of strength. Weak muscles can become a limiting factor for achieving higher range of movement. Muscle strength is highly trainable therefore, it can enhance flexibility.
- **Joint structure:** There are several different types of joints in human body. Some of the joints intrinsically have a greater range of motion. eg. the ball and socket joint of the shoulder has the greatest range of motion.
- **Age and gender:** flexibility decreases with the advancement of age. It can be enhanced with the help of training. Gender also determines the flexibility as females tend to be more flexible than males.
- **Internal environment:** The internal environment of an athlete influences the flexibility. If internal temperature increases flexibility increases; if it decreases flexibility decreases.

Previous injury: Injuries to connective tissues and muscles ultimately lead to reduced

flexibility

Physiological factors determining endurance.

Aerobic capacity:-

(1) oxygen intake

(ii) oxygen transport

(iii) oxygen uptake

(a) Energy reserves,

(b) Lactic acid tolerance,

(c) Movement economy,

(d) Muscle composition

Oxygen Uptake:- It is highest rate at which oxygen can be taken up and consumed by the heart per minute.

Cardiac Output:- The cardiac output is simply the amount of blood pumped by the heart per minute.

Hydration and Endurance Exercise: - Sweating is normal physiological response to prolonged exercise, required for the dissipation of heat produced during energy metabolism

Effect of exercise on the cardiovascular system

(i) Cardiac output is the amount of blood pumped by the heart in 1 min. This increases directly with increasing exercise intensity.

(ii) The heart rate increases from a resting rate of 72 beats / min to 150 beats / min or even more.

(iii) The stroke volume, meaning the amount of blood pumped into the Aorta with every heartbeat, increases from a resting volume of 70-90 mL to 100-120 mL per beat.

(iv) Exercise increases the plasma volume of blood by 12% ; but total blood volume may

reduce slightly.

(V) Blood flow is redistributed with more blood going to the muscles, heart and skin, while blood in the kidneys and abdomen is reduced.

(vi) Blood pressure increases due to exercise because there is more blood flowing in the blood vessels.

Effects of exercise on muscular system.

- Size and shape of muscle changes: Regular exercise changes the shape and size of the muscle. Cells of the muscles are enlarged which change the shape and size of the muscle.
- Correct body posture; regular exercise keeps the correct posture of the body by strengthening the muscles. The postural deformities do not occur. If there is any physical deformity, then it is removed.
- Food storage increases: the capacity of food storage in body can be enhanced by doing regular exercises. This stored food can be utilized immediately when required.
- Toned muscles: regular exercise helps in keeping the muscles in toned position. Muscles become firm and maintain a slight, a steady pull on the attachments.
- Efficient movement of muscles: The movement of muscles becomes efficient and smooth. The movements during different activities become attractive.
- Change in connective tissues: the connective tissues become powerful. These tissues can bear the stress of strenuous activity.

Effects of exercise on respiratory system.

- Increase in Tidal air capacity: by doing regular exercise it has been noted that there is an increase in the amount of tidal air capacity of an individual.
- Decrease in rate of respiration: When a beginner starts exercising his rate of respiration increases. But when the same individual perform exercise daily, his rate of respiration decreases in comparison to the beginner at rest.
- Strong will power: regular exercise increases the will power of an individual. As pranayama, the specific exercise for lungs increases the will power of the doer.
- Unused alveolus becomes active : Regular exercise activates the unused alveolus because much amount of oxygen is required in vigorous activities of daily routine.

The passive alveolus become active.

- Increase in vital air capacity: The capacity of vital air capacity varies from 3500cc to 4500cc in a normal adult. Due to regular exercise its capacity increases upto 5500cc.

Ageing is the process of becoming older. It represents the accumulation of changes in a person over time. Ageing in humans refers to a multidimensional process of physical, psychological, and social change.

Role of regular exercise on ageing process,

Regular exercise keeps the human body livelier, fitter and In better condition, thus delaying the ageing processes. As Given below :

(I) exercise reduces the loss of elasticity from the lungs and chest wall agencies increase muscle strength and hypertrophy by increasing the cross-sectional area of the Slow Twitch Fibers (sm and Fast Twitch Fibers (FTF). This slows down ageing · The body composition changes due to exercise by reducing the fat content of the body, thus slowing down the ageing process. fu Exercise impel flexibility by strengthening the musculoskeletal systems, thereby preventing the bickering of joints. This also slows the ageing process.

CBSE Class 12 Physical Education

Revision Notes

UNIT 12

TRAINING IN SPORTS

Key Points :

- Strength—Definition, Types and Methods of Improving Strength—Isometric, Isotonic and isokinetic.
- Endurance—Definition, Types and Methods of Develop Endurance— Continuous Training, Interval Training and Fartlek Training.
- Speed—Definition, Types and Methods of Develop Speed—Acceleration Run and Pace Run.
- Flexibility—Definition, Types and Methods to Improve Flexibility.
- Coordinative Abilities—Definition and Types.

Strength , its types and method of development

Strength is the ability to overcome resistance or to act against resistance.

a) Maximum Strength:- It is the ability to overcome or to act against resistance. It is the maximum force which is applied by the muscles to perform any certain activity. For developing maximum strength intensity is high and repetitions are less.

b) Explosive Strength: It is a combination of strength and speed abilities. It is the ability to overcome resistance with high speed. For developing explosive strength, intensity is sub maximum and repetitions are performed as fast as possible.

c) Strength Endurance: It is the ability to overcome resistance or to act against resistance under conditions of fatigue.

Method of development

ISOMETRIC EXERCISE –

Isometric exercises are those exercises, which are not visible. In fact there are no direct movements, hence they can't be observed. In these exercises, work is performed but is not

seen directly. In these exercises, a group of muscles carry out tension against the other group of muscles. For example, pushing against a sturdy wall.

ISOTONIC EXERCISE

The literal meaning of the word isotonic is constant tension i.e., iso means constant and tonic means tension. In this exercise the length of muscles changes (shortens or lengthens) during action along with tension in them. Isotonic exercise is a form of active exercise in which muscles contract and cause movement. There is no significant change in resistance throughout the movement, so the force of contraction remains constant. Such exercise greatly enhances joint mobility and helps improve muscle strength and tone.

Isokinetic exercise

These exercise are performed on specially designed machines. These exercises are developed by Perrine in 1968. In these exercise, contraction of muscles applies maximum force only at a particular angle of its range of movement, whereas, in isokinetic exercise contraction of force throughout the complete range of movement. These exercise involve a specific type of muscle contraction which is not involved in games and sports like rowing and swimming.

Speed, its types and method of development

Speed is the rate of motion, or the rate of change of position. It is expressed as distance moved per unit of time. Speed is measured in the same physical units of measurement as velocity. Speed is defined as the ability of an individual to perform similar movements consecutively at Fastest rate, e.g., short distance races like 100 metres and 200 metres. Speed as the capacity of an individual to perform successive movement of the same pattern at a fast rate.

Types of Speed:

- 1) Movement speed: It is the ability to do a movement in minimum time. It depends upon technique, explosive strength, flexibility and coordinative abilities.
- 2) Locomotor ability: It is the ability to maintain maximum speed for a maximum time or distance. Events like 100mt, 200 mt, 400mt requires this ability.
- 3) Speed Endurance: Speed endurance is the ability to perform movements with high speed under conditions of fatigue. This depends upon technique, local muscular endurance and

lactic acid tolerance ability.

Methods for improving speed.

1) Acceleration runs- It is the ability to increase speed from jogging to running and finally sprinting. It depends on explosive strength, frequency of movement & technique. To attain maximum speed from a stationary position this is practised after learning proper technique.

2) pace run or races- A competitive pace race is a timed race in which the objective is not to finish in the least time, but to finish within the prescribed time and in the best physical condition. In some races, the prescribed time is very narrowly defined and the winner is the competitor who finishes closest to the prescribed time. Complete recovery is ensured between two repetitions. This means to running the whole distance of a race at a constant speed. In this the athlete runs the race with uniform speed.

Flexibility, its types and method of development

Following are the stretching ways for flexibility development:

Active stretching is where you are taking the muscle beyond its normal range of motion with assistance (PNF or with the help of a partner)

Passive stretching allows the muscles and tendons to stretch naturally without the use of additional forces acting on the muscle/tendon. The flexibility gains are not as great with passive stretching as it is with active stretching.

1. **Static stretching** is a technique where the muscle is slowly stretched and then held in the stretched position for several seconds. This type of stretching allows the muscle to be relaxed so that a greater length can be achieved. It is the most frequently.
2. Used and most recommended type of stretching. There is a low risk of injury with this technique.
3. **PNF stretching** is much longer stretching session when compared to the other types. It requires a partner's help to utilize this technique. The use of a partner is so that there can be a contraction and relaxation phase. This type of stretching is actually the most effective form of stretching, but it is also considered the most painful type of stretching,

4. **Dynamic stretching** is a technique that many athletes should be accustomed to. This type of stretching can be in the form of leg swing walks or carioca just to name a few. This is a great way for teens to work on their flexibility in a fun way. It allows them to be active and it can be done with groups and teas. This type of stretching goes for more than two seconds and is done without stopping the movement.

5. **Ballistic stretching** is a type of stretching, but it is not recommended for improving flexibility. This type of stretching could lead to muscle soreness and injury because it is possible that this technique could cause small tears in soft tissue due to the bouncing movements that force the muscle to lengthen. Ballistic stretching due to the bouncing, could stretch ligaments too far if the movement is not controlled.

Endurance its types and method of development

Endurance- Endurance (also called Stamina, or Durability) is the ability of an organism to exert itself and remain active for a long period of time, as well as its ability to resist, withstand, recover from, and have immunity to wounds, or fatigue. In humans, it is usually used in aerobic or anaerobic exercise. endurance. Endurance training which is designed to improve stamina, endurance, and overall performance. Athletes use it while they prepare for both long and short events. People who are not athletes may utilize endurance training as a method to get fit. It is the ability to withstand fatigue.

Types of Endurance:

1. **Basic Endurance:** Basis endurance is the ability to perform movements in which large number of body muscles are involved and the activity is performed at slow pace for long duration such as jogging, walking, slow running and swimming.
2. **Speed Endurance:** It is the ability to resist fatigue in activities lasting up to 45 seconds. The event of 400 mts sprint is the most suitable example of speed endurance. This is mainly dependent upon the power and capacity of energy production.
3. **General Endurance:** It is the ability to resist fatigue satisfactorily cause by different types of activities. Activities may be aerobic or anaerobic in nature. These activities may be low or high intensity but for longer duration.

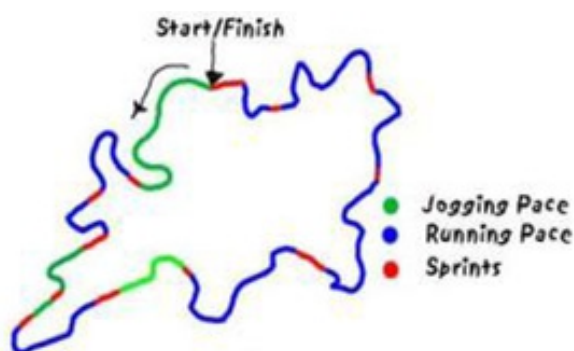
Various methods to develop Endurance ability-

a) Continuous method- The load administered for a prolonged period of time. As the loads are continued for a long time the intensity of running is low. It may be slow continuous, fast continuous and varied pace method.

b) Interval type of training involves repeated efforts at are relatively faster pace, separated by measured intervals of incomplete recovery. It is based on the principle of effort & recovery. It can be classified into short time interval, middle time interval and long time interval.

c) Fartlek training- Fartlek, developed in the 1930,s which means "speed play" in Swedish, is a training method that blends continuous training with interval training. The variable intensity and continuous nature of the exercise places stress on both the aerobic and anaerobic systems .Intensity and speed can be varied whenever the athlete wishes. Fartlek training allows the athlete to run freely over varying distances and at varying speeds. Fartlek allows the athlete to run at varying intensity levels over distances of their choice. This type of training stresses both the aerobic and anaerobic energy pathways.

Diagram- 1. Warm up with a steady jog for approximately 7-10 minutes, 2. High intensity sprint, for aproximately 60-75 seconds, 3. Light Jog for approximately 130-150 seconds, 4. Cool down with a steady jog for 7-10 minutes, 5. Run hill or stairs, 6. Vertical jump from crouch position, 15-20 times, 7. Push-ups, 8. Sit-ups, 9. Lunges



Coordinative abilities and its types

Coordination is the ability to repeatedly execute a sequence of movements smoothly and accurately. This may involve the senses, muscular contractions and joint movements.

Everything that we participate in requires the ability to coordinate our limbs to achieve a

successful outcome – from walking to the more complex movements of athletic events like the pole vault.

Basic coordination abilities:

Adaptive ability enables modifications of motor activity on the basis of comparison or anticipation of new or changing conditions during performing motor activity.

Balance ability is understood as an ability to keep body or its parts in a relatively stable position.

Combinatory ability is understood as an ability to simultaneously put partial movements together into more complex movement structures.

Orientation ability is an ability to realize position of the body or its parts in space and time.

Rhythm ability enables to grasp and meteorically express rhythm which is externally determined or contained in the motor activity it self.

Circuit training

In this training method in which certain exercise of various kind are performed with or without apparatus with given dosage. It was developed by —Adamson and Morgon|| in 1957. This is considered for the development of —strength & Endurance. Circuit training method is a scientific method which is based on over coming various exercises at once. It is meant for to develop strength & endurance. It is an off-season training method. It is a form of body conditioning or resistance training using high-intensity aerobics. It targets strength building and muscular endurance. An exercise "circuit" is one completion of all prescribed exercises in the program. When one circuit is complete, one begins the first exercise again for the next circuit.

DIAGRAM OF STATIONS Benefits of circuit training.

- 1) It is easy and interesting method.
- 2) It requires short duration
- 3) It can be performed indoor and as well as outdoor
- 4) It involves the all organs of body
- 5) It can be easily supervised by the coach.
- 6) It provides an interesting atmosphere.

Importance:

1. It is the best method for beginners as it develops strength and endurance. Maximum functioning of muscles can be gained in a single circuit.
2. It gives relief from any kind of tension. The trainee gains good result in a short period. It doesn't create boredom as lot variety of exercise can be included etc.
3. It is a workout routine that combines cardiovascular fitness and resistance training.
4. The initial routines were arranged in a circle, alternating between different muscle groups.
5. Circuit training plays an integral role in the offseason workouts of many professional athletes.

Beneficial & negative impacts of high altitude training.

Running or exercising at high altitudes in the beginning decreases the amount of oxygen getting to the muscles. At low atmospheric pressure in the thin air makes the blood less oxygen rich as it passes to the muscles. A number of physiological changes that occur with acclimatization enhance the supply of oxygen to muscles and the more amount of oxygen definitely help in improving the sports performance.

At high altitudes body produces a hormone known as erythropoietin which stimulates the production of red blood cells which carry oxygen to the muscles of the body. If you have more red blood cells, more amount of oxygen can be supplied to your muscles. Many other changes occur in the body during acclimatization which help in enhancing sports performance.

Negative impacts

The acclimatisation to the high altitudes is not easy. The increase in red blood cells, makes the blood thicker which can make the blood flow slow. It makes difficult for the heart to pump blood flow throughout the body and can actually reduce the amount of oxygen getting to where it is required. If we perform weight training at high altitude, we cannot avoid weight loss. Our body will consume our muscles in order to provide energy for training that will weak body's immune system, it may lead to further infections which lead to decrease sports performance.

12.1 A. Sports performance are to be achieved in sports competition.

B. When we take part in games and sports we try to perform our best and our performance

directly depends upon many factors.

C. Basically, the performance of the sportsman depends upon strength, endurance, speed flexibility and coordination abilities.

D. Sports training is done for improving these factors and ultimately our performance.

12.2 When an individual exerts muscular force against resistance in games and sports, it is called his or her strength.

12.3 When an individual perform under the condition of fatigue for a long time, it is called his or her endurance.

12.4 In games and sports, when an individual performs a movements quickly, it is called his or her speed.

12.5 Flexibility is the range of movement of the joints of a sports person.

12.6 The ability of an individual to do various related activities smoothly and efficiently is known as coordinative ability.

