

**SOLVED
PAPER**

**C.B.S.E.
Class–XII**

**PHYSICAL
EDUCATION**

Time : 3 Hours

Max. Marks : 70

General Instructions :

- (i) The question paper consists of 34 questions.
- (ii) All questions are compulsory.
- (iii) Question no. 1 to 20 carry 1 mark each and are multiple choice questions.
- (iv) Question no. 21 to 30 carry 3 marks each and should not exceed 80 - 100 words.
- (v) Question no. 31 to 34 carry 5 marks each and should not exceed 150 - 200 words.

SECTION-A

1. The total number of matches in a knock out tournament of 34 teams are : 1
(a) 31 (b) 32
(c) 33 (d) 35
2. The primary goal of Intramural competition is 1
(a) To provide opportunity for mass participation of students
(b) To participate in inter-school competition
(c) To provide intra-school competition
(d) All of the above
3. The food component present in sugar is 1
(a) fats (b) protein
(c) vitamin (d) carbohydrate
4. The main source of Vitamin C is 1
(a) Guava (b) Egg
(c) Milk (d) Banana
5. Which asana is helpful in maintaining normal blood pressure? 1
(a) Shavasana (b) Padmasana
(c) Shalabhasana (d) Vakrasana
6. Gomukhasana, Chakrasana and Matsyasana are helpful in curing which disease? 1
(a) Diabetes (b) Backpain
(c) Asthama (d) Obesity
7. When child is not able to adjust within society or having no friends, is suffering from 1
(a) ADHD (b) ASD
(c) ODD (d) OCD

OR

Obsessive Compulsive Disorder is a/an

- (a) Argumentative disorder (b) Anxiety disorder
- (c) Receiving and responding disorder (d) All of these

8. Cognitive disability may cause difficulty in which of the following activity? 1
 (a) Reading (b) Writing
 (c) Mathematics (d) All of the above
9. Menarche is defined as the 1
 (a) Ending of menstrual period in women
 (b) Beginning of menstrual period in women
 (c) Time of pregnancy
 (d) Beginning of pregnancy
10. Scoliosis is a postural deformity related with 1
 (a) foot (b) leg
 (c) vertebral column (d) hand
11. Sit and reach test is conducted for 1
 (a) Flexibility (b) Motor fitness
 (c) Endurance (d) Speed
12. Barrow Fitness Test does not include 1
 (a) Medicine Ball Put
 (b) Zig-zag Run
 (c) 600 metres Run
 (d) Standing Broad Jump

OR

Rock Port one mile test is conducted to measure

- (a) Cardio vascular fitness
 (b) Senior citizen's fitness
 (c) Vital capacity
 (d) Muscular strength
13. Movement possible in Ball and Socket joint are 1
 (a) Rotation
 (b) Flexion
 (c) Extension
 (d) All of the above

OR

The Law of acceleration is also known as

- (a) Law of inertia
 (b) Law of action and reaction
 (c) Law of momentum
 (d) Boyle's Law
14. Match List 1 and List 2, selecting the correct option : 1

S. No	List 1	List 2
1.	Abrasion	Joint Injury
2.	Green Stick Fracture	Soft Tissue Injury
3.	Shoulder Dislocation	Cause of Sports Injury
4.	Lack of Fitness	Bone Injury

- (a) 2, 4, 1, 3
 (b) 3, 2, 4, 1
 (c) 4, 3, 1, 2
 (d) 1, 3, 2, 4
15. Bio-mechanics helps in which of the following 1
 (a) In improving techniques (b) In improving designs of sports equipment
 (c) In improving performance (d) All of these
16. The force of friction depends upon 1
 (a) Nature of surface of contact (b) Material of object in contact
 (c) Both (a) and (b) (d) None of the above

17. Emotionally unstable, anxiety, sadness are attributes of which personality dimension? 1
(a) Extroversion (b) Neuroticism
(c) Agreeableness (d) Openness
- OR**
- Aggressive behaviour of a sportsperson is influenced by
(a) Emotional identification with the team
(b) Tactical ability
(c) Goal orientation
(d) All of the above
18. The body structure of mesomorphic people is like 1
(a) Fatty (b) Large muscles and bones
(c) Solid (d) Obese
19. Fartlek training was developed in 1
(a) Sweden (b) The USA
(c) India (d) The U.K.
20. If a muscle contracts and changes its length to produce force, the contraction type is : 1
(a) Isotonic (b) Isometric
(c) Isokinetic (d) None of these

SECTION-B

21. Explain the procedure of Harvard step test in detail. 3
- OR**
- List down the test items of Rikli and Jones fitness test and explain the procedure of any one.
22. League tournament is a better way to judge the best team of the tournament. Comment. 3
23. "Asanas can be used as a preventive measure." Comment. 3
24. Discuss in detail any one type of disorder. 3
25. Suggest physical exercises for childhood and adulthood. 3
26. What do you understand by food myths? 3
- OR**
- What are the pitfalls of dieting?
27. Discuss the preventive measure of sports injuries. 3
28. With suitable examples explain the application of Newton's law in sports. 3
29. Discuss in detail any three techniques of motivation. 3
- OR**
- Define balanced Diet. Explain any four Micro Nutrients.
30. Define flexibility and its types. 3

SECTION-C

31. What is circuit training? Draw a diagram of circuit training with 12 stations and explain its importance in sports. 5
- OR**
- Draw a knock out fixture for 25 teams with all steps involved.
32. How physical activities are helpful for children with special need? Explain strategies to make physical activities assessable for them. 5
33. Give your outlook on participation of Indian women in sports. 5
34. Which asanas will you suggest for back pain? Explain the procedure, benefits and contraindications of any two asanas recommended for back pain. 5
- OR**
- What is the effect of exercise on cardio respiratory system and muscular system?

ANSWERS

SECTION-A

1. (c) 33
 2. (a) To provide opportunity for mass participation of students.
 3. (d) carbohydrate
 4. (a) Guava
 5. (a) Shavasana
 6. (c) Asthama
 7. (b) ASD
- OR**
- (b) Anxiety disorder
 8. (d) All of the above
 9. (b) Beginning of menstrual period in women
 10. (c) vertebral column
 11. (a) Flexibility
 12. (c) 600 metres Run
- OR**
- (a) Cardio-vascular fitness
 13. (a) Rotation
- OR**
- (c) Law of momentum
 14. (a) 2, 4, 1, 3
 15. (d) All of these
 16. (c) Both (a) and (b)
 17. (b) Neuroticism
- OR**
- (d) All of the above
 18. (c) Solid
 19. (a) Sweden
 20. (a) Isotonic

SECTION-B

21. **The Harvard step test** is a cardiovascular fitness test. It is also called aerobic fitness test. It is used to measure the cardiovascular fitness or aerobic fitness by checking the recovery rate.

Equipment required : A gym bench or box of 20 inches height for man and 16 inches for woman, stopwatch and cadence tape.

Procedure : The athlete stands in front of the bench or box. On the command "Go" the athlete steps up and down on the bench or box at a rate of 30 steps per minute. Stopwatch is also started at the start of the stepping.

Calculation of the scores : Calculate with the help of following formula fitness index score = $(100 \times \text{test duration in seconds}) / (2 \times \text{sum of heartbeat in recovery})$

OR

Rikli and Jones prepared various physical fitness tests for senior citizens. Senior citizens can't do exhaustive workouts, that is why easy tests prepared for different body parts are given as:

- Chair Stand Test for lower body strength.
- Arm Curl Test for upper body strength endurance.
- Chair sit and reach test for lower body flexibility.
- Back scratch test for upper body flexibility.
- Eight foot up and go test for coordination and agility.
- Six-minute walk test for aerobic fitness and endurance.

Chair Stand Test for Lower Body strength :

- **Purpose :** This test assesses leg strength and endurance of senior citizens.
- **Equipment Required :** A straight or folding chair without arm rests (seat 17 inches or 44 cm high) and a stopwatch.
- **Procedure :** Put a chair against a wall to keep it from moving or causing accidental fall. The subject is to sit on the chair with both feet away from each other at a length of own shoulder. The wrists are held in a crossed position and held close to the chest. At the signal of the person taking the test, the subject stands up completely and then sit back completely. The process is repeated for 30 seconds. One complete cycle means standing up completely and sitting back. The number of completed cycles in 30 seconds are awarded as final score.

Norms for Men

Age	Below average	Average	Above average
60-64	< 14	14 to 19	> 19
65-69	< 12	12 to 18	> 18
70-74	< 12	12 to 17	> 17
75-79	< 11	11 to 17	> 17
80-84	< 10	10 to 15	> 15
85-89	< 8	8 to 14	> 14
90-94	< 7	7 to 12	> 12

Norms for Women

Age	Below average	Average	Above average
60-64	< 12	12 to 17	> 17
65-69	< 11	11 to 16	> 16
70-74	< 10	10 to 15	> 15
75-79	< 10	10 to 15	> 15
80-84	< 9	9 to 14	> 14
85-89	< 8	8 to 13	> 13
90-94	< 4	4 to 11	> 11

22. League tournament is surely a better way to judge the best team of the tournament. Only real team having best potential will be the winner of the league tournament. The charm of the tournament is maintained throughout the tournament. The good team will continue throughout the tournament so the chance of selection of good players remains alive during the entire tournament.
23. Asanas play a vital role as being a preventive measure for many body related diseases and problems. There are many asanas which lead to avoid many problems. Some of the important preventive asanas are:
- (A) **Asanas for health:**
- Surya Namaskar** : It penetrates and rejuvenate most of the vital organs of the human system.
 - Naukasana (Boat Posture)** : It stimulates digestive system and gives relief in gastric problems.
 - Padmasana** : It is good for concentration and memory and brings calmness and peace.
- (B) **Asanas improving physical fitness/ flexibility:**
- Hastottasana** : It is beneficial for increasing height for growing children.
 - Katichakrasana (Lumber Twist Posture)** : It strengthens shoulders, neck, arms, abdomen, back and thigh region.
 - Dhanurasana (Bow Posture)** : It is good for joint of the shoulders, knees, ankles and entire backbone. It also stimulates and regulates the functioning of glands.
- (C) **Asanas for concentration:**
- Garudasana** : It enhances concentration, stabilizes mind and develops body balance.
 - Baddhapadmasana** : It creates an inner peace, improves concentration and memory.
24. Oppositional Defiant Disorder (ODD) is a behavioural condition, usually diagnosed in childhood, which consists of strongly embedded pattern of negative reactions to authority, irritable mood and negative attention seeking behaviour. ODD symptoms can be extremely disruptive in nature and they often coincide with other childhood problems such as ADHD and anxiety and mood related conditions. ODD related problems not only negatively affect the child's daily functioning, but also interfere with relationship with peers, family members, teachers, and others caregivers.
25. Physical exercises for childhood can be classified into three categories:
- Physical exercises for infancy (1 to 2 years) – These include throwing, catching and kicking a ball.
 - Physical exercises for early childhood (3 to 7 years) – These include throwing, jumping, catching, kicking a ball and running.
 - Physical exercises for later childhood (8 to 12 years) – These include stunts, throwing, jumping, catching, running, swimming, cycling, rapid movement exercises and resistance exercises.
- Physical exercises for adulthood : These include brisk walking, bike riding, dancing, swimming, running, weight training, push-ups, sit-ups, rope exercises, etc.
26. Numerous food myths exist not only in India but also all over the world as they sound like they could be true. The most common food myths which are still widespread in our modern society are:
- Potatoes make you fat.
 - Eggs increase cholesterol levels, so avoid them.
 - Drinking while eating makes you fat.
 - Starve yourself if you want to lose weight.
 - Fat-free products help you in losing weight.
 - There are some magical foods that cause weight loss.
 - Exercises make you eat more.
 - Do not drink milk immediately after eating fish.
 - Skipping breakfast is a good way to lose weight
 - No treats
 - No eating past 8 PM
 - Vegetarians cannot build muscles
 - Low fat milk has less calcium than full fat milk
- OR**
- Some pitfalls of dieting are:**
- Hair loss:** The most common side effect is that you start to lose your hair. Lack of required amount of proteins and fats result in hair loss.
 - Depression:** Dieting is one of the depressions in life. When your body is not able to handle loads of activities, you feel pressure in mind which causes stress, which worsen the physical health of a person.
 - Organs damage:** If you continue dieting for long time it can damage your internal organs and body systems. Its working efficiency decreases than the normal. Your blood circulation becomes passive. You are less energetic, lazy, lethargic and become weak.
 - Sudden weight gain:** Weight loss through exercises is a good thing but weight loss through dieting is very harmful. It makes your physique worse because after dieting when you come to original eating pattern your body starts gaining fat.
 - Dieting deficiency:** When you cut short your diet, some of the major nutrients such as carbohydrates and proteins do not meet the adequate amount. This can lead to many deficiencies. e.g. dark circles below the eyes.
27. There are preventive aspects of some sports injuries:
- Athlete's Medical Check-Up** : Prior to the start of the activity or seasonal practice, a pre-participation physical and medical check-up should be done of all athletes, which must comprise:
 - A meticulous medical history.
 - Few major lab tests should be done.
 - Medical check of circulo-respiratory components, abdominal, pelvis check etc.
 - Body Measurement such as height, weight and blood pressure etc. should be checked.

- (e) Orthopaedic examination comprising of body structure, posture, flexibility, fat percentage and maturation should be collected.
- (ii) **Stay Hydrated** : When we are active and exercising, water is essential to keep the body going. It is especially important to keep hydrated if we are exercising in heat or sunny weather, as dehydration can considerably decrease mental and physical fitness.
- (iii) **Balanced Diet** : Balanced diet is also essential to prevent sports injuries because the lack of essential minerals and vitamins such as calcium, phosphorus and vitamin 'D' etc. makes bones weak. Weak bones usually lead to sports injuries.
- (iv) **Obeying the Rules** : During practice or competition, if the athletes obey the rules of games/sports properly, sports injuries such as tendinitis and stress fractures could be prevented.
- (v) **Use of Protective Equipment** : It is an easy and the best way to prevent sports injuries. The protective equipment protect the sports person from getting injured. It is only due to this reason the protective equipment are essential in sports.
- (vi) **Proper cooling down** : Cooling down is basically lowering down the pace of workout by performing stretching exercise and deep breathing relaxation exercise. Cooling down exercises prevent the post soreness and stiffness which make exchange of blood easier.
- (vii) **Avoid Overtraining** : Doing overtraining i.e. allowing body to work more than its normal resisting capacity, which may lead to over stretching of muscles and sprains in the muscles.

28. The laws of Newton and their application in sports are as under:

- (i) **Law of inertia** : "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 on by a non-zero external force".

There are large number of examples of this law in the field of sports and grasses, such as starting in rowing, starting on roman rings, starting in sprinting, etc. 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 the playing field, a defensive player or the breaking player causing the sports person's body to stop.

- (ii) **Law of acceleration**: "A change in acceleration of an object is directly proportional to the force producing it and inversely proportional to its mass."

This Law is applied in various sports, such as in hammer throw, the thrower who is stronger (who

has more force) will throw the 12 lbs hammer farther than a thrower who has less force or strength.

- (iii) **Law of Reaction**: " For every action there is an equal and opposite reaction."

Application of law of reaction in different sports:

- (a) **Shooting**: In shooting, when a gun or pistol is fired the bullet moves forward (action). The gun or pistol jerks backward (reaction).
- (b) **Walking**: When a person walks, he presses the ground in backward direction (action) by his feet . The ground pushes him in forward direction with an equal force (reaction).
- (c) **Swimming**: A swimmer pushes the water backwards (action). The water pushes the swimmer forward (reaction) with the same force.
- (d) **High jump** : A high jumper can jump higher on a solid surface because the surface opposes his body with as much force as he is able to generate in sand or any other unstable surface.
- (e) **Dribbling in basketball** : When a basketball player dribbles, he exerts force on the ball and the ball strikes on the floor with a force (action). Then the ball comes up with an equal force from the floor (reaction).

29. Three techniques of motivation are:

- (i) **Healthy Sports Environment** : Healthy sports environment plays a very vital role in motivating the sportsperson. Healthy sports environment consists of good climate, proper weather, proper humidity, proper temperature, smooth and clean sports fields, good quality of sports equipment and other facilities.
- (ii) **Positive Attitude** : For proper motivation, the coaches should try to encourage positive attitude among the sportspersons. Players must think they can do it positively.
- (iii) **Cash Prizes, Certificates and Trophies** : Indeed, it is a good incentive to the sportspersons. Governments offer cash prizes to the sportsperson who win for the pride of their countries. The sportsmen are affected by the lure of cash prizes, certificates and honour rolls.

OR

A balanced diet refers to an intake of edibles which can provide all the essential constituents necessary for growth and maintenance of the body in definite amount as required by the body. A balanced diet means eating the right amount of food from all food groups. 'A diet which consists of all the essential food constituents viz., proteins, carbohydrates, fats, vitamins, minerals and water in correct proportion is called a 'balanced diet.'

Some important micro-nutrients are:

- **Vitamin 'A':** Keeps eyes and skin healthy.
 - **Vitamin 'B':** This is good for muscles and nerves.
 - **Vitamin 'C':** Makes strong gums and heals our wounds faster.
 - **Vitamin 'D':** Makes teeth and bones strong.
30. Flexibility is the ability to perform a joint action through a range of movement.

Types of flexibility:

- (i) **Passive Flexibility:** Passive flexibility is the base of active flexibility. Passive flexibility is the ability to do movement with greater amplitude by means of external assistance e.g., helping partner doing stretching exercises .
- (ii) **Active flexibility:** Active flexibility is the ability to perform movement with greater range without external help e.g. : the sportsman stretches a joint with external help.

There are two types of active flexibility:

- (a) **Static flexibility:** While the sportsman is lying, standing or sitting, static flexibility is essential for movements done.
- (b) **Dynamic flexibility:** Dynamic flexibility is vital for performing movements when the sportsman is moving with superior amplitude.

SECTION-C

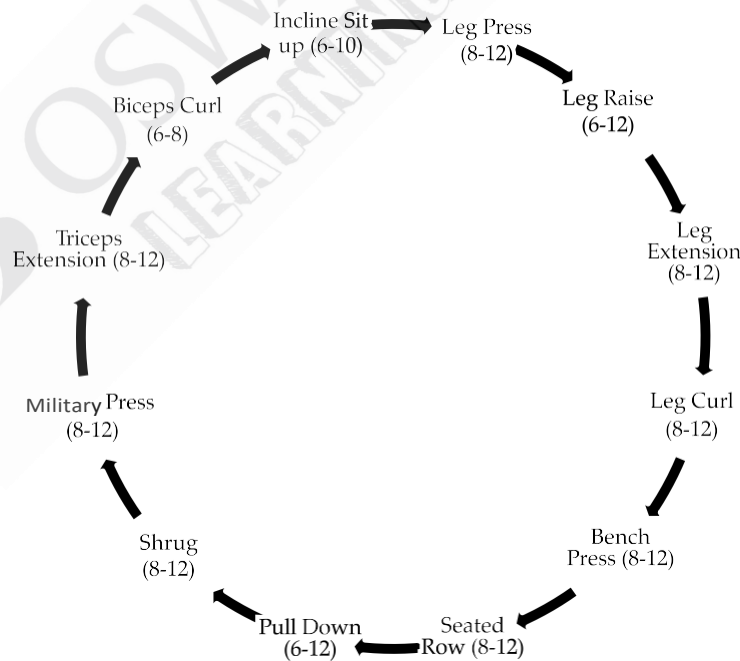
31. Circuit training is an excellent way to impose mobility, strength and stamina. The training

comprises of 6 to 10 strength exercises that are completed one exercise after another. Each exercise is performed for a specified number of repetitions or for a set time before moving on to next exercise. The exercises within each circuit are separated by a short rest period and circuit is separated by a longer rest period.

Importance of circuit training :

- (i) **Improves muscular strength:** Circuit training improves muscular strength or in other words, your ability to produce force. For example strength determines how many groceries you can carry at one time or the heaviest amount of weight you could lift up during a bench press exercise.
- (ii) **Improves muscular endurance:** Weekly circuit training enhances muscular endurance, or your ability to perform muscular activity at any time. At first muscular endurance dictates how many push ups you can perform consecutively. Performing up to 20 repetitions at your workout stations, with little rest throughout your workout, forces your muscles to work through fatigue and build endurance.
- (iii) **Body composition:** Circuit training can improve your body composition, or the percentage of your total body weight comprised of fat, by burning calories and building muscles. Additionally increased muscles mass boosts the number of calories burned during test and exercise.

Circuit diagram with 12 stations is:



OR

- Number of teams in the tournament = 25
 ⇒ Number of teams in the upper half

$$= \frac{n+1}{2} = \frac{25+1}{2} = \frac{26}{2} = 13$$

⇒ Number of teams in the lower half

$$= \frac{n-1}{2} = \frac{25-1}{2} = \frac{24}{2} = 12$$

Number of byes in the tournament (nb)

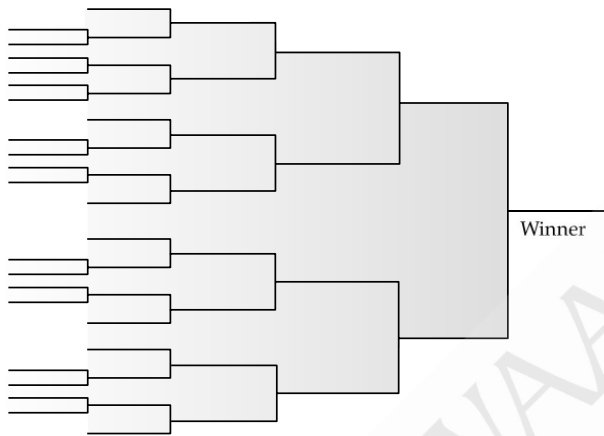
$$= (2 \times 2 \times 2 \times 2 \times 2) - n = 2^5 - 25 = 32 - 25 = 7$$

⇒ Number of byes in the upper half

$$= \frac{nb-1}{2} = \frac{7-1}{2} = \frac{6}{2} = 3$$

⇒ Number of byes in the lower half

$$= \frac{nb+1}{2} = \frac{7+1}{2} = \frac{8}{2} = 4$$



32. All individuals benefit from regular physical activity and children with special needs specially. They could gain from these physical, mental, and social benefits by being active.

Their helpfulness is as under:

- (i) See improvements in muscle strength, coordination, and flexibility.
- (ii) Improve exercise endurance, cardiovascular efficiency, and possibly increased life expectancy.
- (iii) Experience better balance, motor skills, and body awareness.
- (iv) Will show improvement in behaviour, academics, self-confidence, and building friendships.
- (v) Will have positive changes in their health, quality of life, and boost their self-esteem.
- (vi) Gets to experience a sense of accomplishment and possibly the taste of winning or personal satisfaction.
- (vii) Experience increases in attention span on task behaviour, and level of correct responding.
- (viii) Will increase appetite and quality of sleep.
- (ix) Will find an outlet for their physical energy, will help them cope with stress, anxiety and depression.

Strategies to make physical activities assessable for children with special needs :

- (i) **Sensory Integration:** The first two things we always notice about physical education classes are the loud

music and fluorescent lights in the gym. These are major barriers to students with some type of neurological differences. Many students are also sensitive to light like bright sunlight outdoors and the sound of squeaking sneakers on the gym floor. Sound proof headphones may also be used indoors and sunglasses can be used outdoors.

- (ii) **Behaviour:** Behaviour is always a concern in physical education classes. Positive Behaviour Interventions or Support (PBIS) is a systematically proven method to prevent negative behaviours and increase healthy interactions.
- (iii) **Team building:** Physical Education is the perfect opportunity for team building exercises. Instead of competitive games, the class can focus on creative games that only succeed when a whole team works together.
- (iv) **Accessibility:** Hard surfaces such as concrete and asphalt may be dangerous for individuals with dyspraxia and softer such as sand or wood chips make it difficult to manoeuvre a wheelchair. Gym surfaces and outdoors mats make physical activity more accessible for the use with special needs

33. Sports participation of women means women's participation in the field of sports. In the first modern Olympics held at Athens in 1896, there was no participation of women. Women started to participate in sports from the year 1900 onwards. They participated in two events only. Carrying-on in 2000, Sydney Olympics the number of women's participation reached to around 5,000 which was a huge change in the time of 100 years. In, the Olympics held in 2012 at London, number of participants were around 11,000 out of which around 5,600 were women. Saina Nehwal, M.C Mary Kom secured Bronze medal for India. Now, there are many women from our country having a good name at the higher levels. Some of the examples are: Sania Mirza, Mithali Raj, Saina Nehwal and many more.

Reasons for less participation of Women in Sports :

- (i) **Time Constraints :** Women find less time for sports due to their domestic duties.
- (ii) **Social Constraints :** The attitude of society towards participation of women in sports is negative.
- (iii) **Lack of Sports infrastructure :** There is particularly no infrastructure exclusively for women.
- (iv) **Absence of skill :** There are very few coaches available to develop the skills of women.
- (v) **Lack of fitness**
- (vi) **Lack of legislation**
- (vii) **Lack of interest among spectators**
- (viii) **Male dominated culture**
- (ix) **Lack of personal safety**

Males are considered to be stronger, possess greater muscular and cardiovascular endurance and more proficient in almost all motor skills. The number of anatomical, physiological and mechanical reasons are the reasons for low performance in females.

34. The asanas recommended for backpain are Tadasana, Ardhamatsyendrasana, Vakrasana, Shalabhasana, and Bhujangasana.

Vakrasana :

Procedure :

- (i) Sit down stretching your legs forward on the ground. Keep your hands beside your thighs or buttock.
- (ii) Bend your right leg straight and stretched, keep the left foot beside the right knee raised upward.
- (iii) Inhale and raise the arms shoulder high, keeping the elbows straight.
- (iv) Exhaling twist to the left, place the right arm by the outer side of the left knee and hold the left ankle with the right hand.
- (v) Look backward towards left side, hold on this final position.

Benefits :

- (i) It increases elasticity of spine
- (ii) It stretches the muscles
- (iii) It reduces belly fat.
- (iv) It loosens the hip joint
- (v) It massages the abdominal organs.

Contraindications :

- (i) Avoid the asana if suffering from severe back pain.
- (ii) This asana is also not recommended for people suffering from ulcer and hernia.

Shalabhasana :

Procedure :

- (i) Lie flat on the stomach, legs together, hands by the side of the thighs palm facing downwards.
- (ii) Stretch both the arms and place the hands under the thighs.
- (iii) Inhaling, raise both the legs upwards as high as possible. Maintain the position for 5 – 10 seconds.

Benefits :

- (i) It reduces lower back pain.
- (ii) It enhances concentration
- (iii) Waist becomes elastic and flexible

Contraindications : Person suffering from ulcer in stomach, high B. P, cardiac complaints should not practice this asana.

OR

Effects of Exercise on Cardio Vascular System

Immediate Effects of Exercises:

- (i) **Heart Rate Increases:** Heart rate increases in the direct amount to intensity of the exercise. Maximum heart rate is calculated with method of deducting age from the beats at the time of birth (220 - Age). The only direct method is to exercise at increasing intensities for determining maximum heart rate until a plateau in heart rate is found inspite of the increasing rate of work.
- (ii) **Cardiac Output Increases:** Cardiac output increases if either heart rate or stroke volume increases. With the response of heart rate and stroke volume to

activity, cardiac output increases proportionately with intensity of exercise as well.

- (iii) **Blood Flow Increases:** During rest, skeletal muscles are supplied with 15-20% of the circulating blood. Through dynamic or vigorous exercise it increases up to 80-85% of cardiac output. Blood is carried away from major organs i.e. kidneys, liver, stomach and intestines.
- (iv) **Stroke Volume Increases:** With exercise intensity there is proportionate increase in the stroke volume. At rest, stroke volume in untrained individuals ranges from 50-70 ml/beat rising up to 110-130 ml/beat in intense physical activity.

Long term Effects of Exercises:

- (i) **Heart Size Increases:** The size of the heart and the strength of the cardiac muscle increases due to regular exercises as to the maximum extent the left ventricle adapts. The walls of the heart become stronger and thicker.
- (ii) **Resting Heart Rate Decreases:** The resting heart rate decreases due to regular exercises. After duration of 10 week training programme, the resting heart rate may reduce upto 10 beats per minute from the normal of 72 beats per minute.
- (iii) **Blood Flow Increases:** The body increases its number of capillaries to the requirement of supplying more oxygen during exercise to the muscles. The existing capillaries open wider as well.
- (iv) **Cardiac Output Increases:** The cardiac output tends to increase as a result of regular exercise. At resting conditions in untrained individuals the cardiac output can possibly be 14 to 20 litres/minute, in trained individuals 25 to 35 litres/minute and cardiac output can be as high as 40 liters/minute in elite athletes.
- (v) **Risk of Heart Disease Reduces:** Stress related hormones progressively get reduced from circulating in the blood due to regular exercises. Therefore, the risk of heart diseases reduces due to exercises.
- (vi) **Blood Volume Increases:** The blood volume increases due to the regular exercise. Actually, as the blood volume enhances, there is an increase in plasma volume.

OR

Effect of Exercise on Respiratory System

- (i) **Lungs Volume:** The lungs' volume and capacity increase with endurance training. After endurance training, vital capacity is increased i.e. maximal volume of air forcefully expired out subsequent to a maximal inspiration.
- (ii) **Breathing frequency:** Breathing rate is the number of breaths per minute. Breathing frequency decreases after training. In resting condition, normal untrained individual's breathing frequency is about 12-20 breaths/minute.
- (iii) **Maximum minute ventilation:** The amount of air which is inspired or expired in one minute is called minute ventilation. Maximum minute ventilation increases subsequent to training.

- (iv) **Pulmonary Diffusion:** The exchange of gases that takes place in small air sacks of lungs (alveoli) is called pulmonary diffusion. For diffusion, more alveoli become active at the time of maximal level of exercise.
- (v) **Ventilatory Efficiency:** The trained person gets the similar amount of oxygen (O_2) from less amount of air. Generally, 15 litres of air is required to obtain one litre of oxygen, however, trained individual gets the similar quantity of oxygen from 12 litres of air.

Effect of Exercise on Muscular System

(i) Alteration in Aerobic Capacity:

- (a) Amount of mitochondria increases consequently producing more muscular energy.
- (b) Breakdown of carbohydrates and fat increases.
- (c) Oxygen binding compound called Myoglobin content found in muscle tissue increases.
- (d) Quantity of glycogen store increases consequently because of training which is vital for energy production in the muscles.

(ii) Alterations in Anaerobic Capacity:

- (a) ATP + CP System capacity increases in a way releasing more energy.
- (b) As a result of training, glycolytic capacity increases as well.

(iii) Body Composition Changes:

- (a) The body composition changes significantly whereas in case of majority of individual weight training produces little or no change in the total body weight.
- (b) The muscle mass increases.
- (c) Alteration in muscle and joint motion occurs.
- (d) Flexibility increases subsequent to training, enhancing the performance and preventing serious muscle injury.
- (e) There can be noteworthy loss of relative and absolute body fat.

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