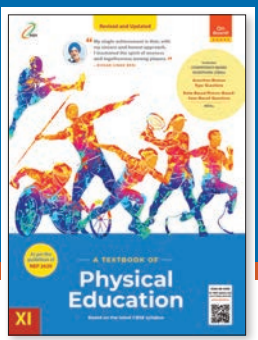
As per the guidelines of NEP 2020

— SUPPLEMENT —

A Textbook of Physical Education Class XI

Based on 2022–23 CBSE syllabus



1 Changing Trends and Career in Physical Education

CHANGING TRENDS IN SPORTS– PLAYING SURFACE, WEARABLE GEARS AND SPORTS EQUIPMENT, TECHNOLOGICAL ADVANCEMENTS

Playing Surface

Many of today's most popular sports have been around for centuries. Looking at what they did with their surfaces back then is a fantastic place to start. Sports surfaces have evolved along with the advancement of techniques, skills, and technological advancements. The use of various playing surfaces denotes the technical standard and now it dominates the nature of the game. For example, the game of tennis was started on grass court and later various surfaces like hard court, clay court and artificial grass were used. Tournaments like Australian and US Open are played on hard courts, the French Open is played on clay court, and the Wimbledon is played on grass court. Accordingly, the nature of the game is also different in these grand slam tournaments.

Various surfaces used in other sports are cemented courts and acrylic courts used in basketball, badminton, etc. which are considered as hard and all-weather outdoor surface. For indoor games like volleyball, basketball and other similar games, wooden surface is used for the construction of the courts. For games like gymnastics, karate, judo, wrestling, etc. where balance, stability and safety are prominent, rubber mattresses of various thickness are used to prepare the playing arena.

The most prominent example of playing surface dominating and impacting any game is field hockey. Till the time, hockey was played on natural turf,

Carpet Clay Hard Grass

Figure 1.1 Different types of tennis courts

India used to dominate the game with all skills. But the introduction of artificial turf in 1976 has made the game faster and fitness dominating. Since then, India is struggling to get back its lost glory in field hockey.

Wearable Gears

Sports gears are mostly worn to ensure basic safety related to the game/ sport. Sports injury is the only limitation for the players to sustain their sports performance. So, all the respective sports have their minimum requirement of wearing sports gears as laid down in their regulations. Extra safety gears can be used by the players as and when required under the jurisdiction of their respective federations/associations. The material used to manufacture the gears depends on the tentative and nature of impact during the game or practice session. Few common sports gears used are: Batting/kipping gloves, pads, helmets/ head gears used in various sports, shin/abdominal guards, caps used in various joints knee caps, etc.

There are various gears used in sports to collect data related to training, research, performance assessment, etc. These smart wearable gears assist both amateur and professional athletes in tracking their training progress and sporting successes, monitoring their health, and avoiding injuries during games and practices. Wearable electronics, such as fitness bracelets, sensors integrated into athletes' equipment or clothing, or sensors placed throughout the gym or playing field, assist in collecting a large amount of data on various categories, storing it in the cloud, and analysing it for use by team managers, coaches, advertisers, and other stakeholders.

Sports Equipment

Many of the sports we participate in have their origin around centuries back, yet they no longer look the same as they did hundreds of years ago. The sports equipment are the reflection of the technological advancements and research done in that sports. As the level of the game changes, equipment are also updated accordingly. For example, the cricket bat, tennis rackets, size of basketball and football, etc. are different according to the age group of the players. Nowadays training equipment are also different according to the level of the players. This ensures safety and fast learning and adaptation. For example, use of various coloured tennis rubber balls having different density and weight during training helps the learner to gain more confidence and technical learning. Research and technology have also helped to create, produce and test new features for hockey sticks, improved aerodynamic cycling helmets, flame-resistant F-1 racing outfits, and many more equipment. Use of advance sports equipment also ensures better performance with adequate skills. For example, steel, aluminum or aluminum alloy javelins are used by the advance athletes to ensure highest level of performance. Beginners are also seen using wooden, bamboo or even javelin made of different material to learn the basic techniques and develop interest in the event. In the international football, the players demonstrate high level of skills. So, the balls are also designed with light materials like polyurethane (PU) skin featuring micro and macro textures and a new 20-piece panel shape which has the potential of demonstrating high level of mechanics. That is why, the ball if hit with correct force, point and with perfect angle shows technical aerodynamic movements.

Technological Advancements

Technological advancements dominated the sporting extravaganza. Technology not only helps in introducing new equipment, gears, playing surface and introducing advance techniques of skills but it also makes any sport more spectacular on the field and off the field. It is technology only that has given the advance equipment and gears like: improved hockey sticks, cricket bats, rackets, improved balls in cricket, basketball, football, helmets, and guards used in various sports. The introduction of various playing surfaces is also the reflection of technological advancements.

Technological advancement has also made the officiating field very easy and non-controversial. Technologies like 'Hawk-Eye' used in tennis, cricket, badminton, etc. have given an alternate review system to the officials for giving a perfect judgement. Another example is from football wherein since the 2020 season onwards, virtual reviews system has changed the nature of the game.

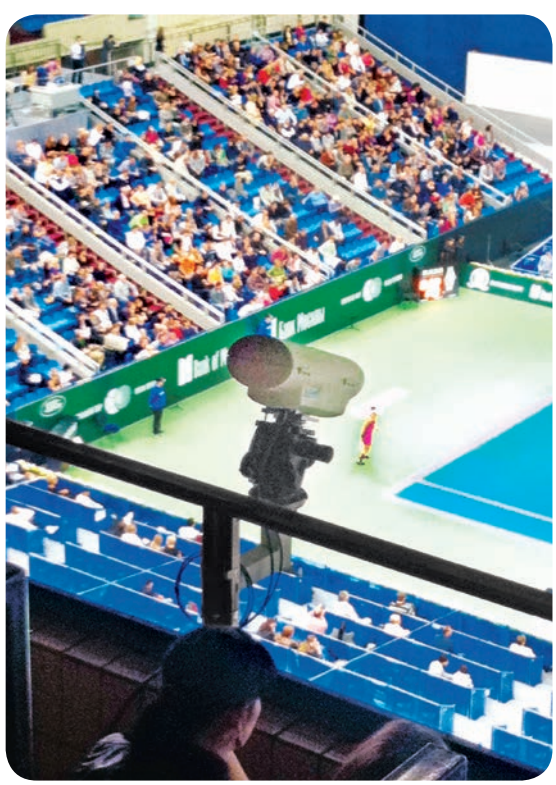
In the Premier League and at every level of the Champions League in what FIFA calls it as a 'game-changing decisions', perfection has been achieved in the legality of goals, penalties, red cards, and offsides.

At athletic events, technology has enhanced the accuracy, enjoyment, and experiences of both participants and spectators. During track race, picture finish technology takes 3,000 photographs per second. This has made it easy for officials to decide and declare the winners even during close finish.

In total, technology has made sports more technical, spectacular and precise for the sports-persons, spectators, officials, coaches, trainers, researchers and others.

DID YOU KNOW?

Hawk Eye System employs six to seven very powerful cameras which are fixed at various positions of the stadium to track and get the clear view of the ball from different angles in games like cricket, football, tennis, etc. This powerful and strong combination ensures that no shot is missed to be tracked by it. It also provides 3D animation of the path of the ball.



KHELO INDIA AND FIT INDIA PROGRAMME

For Khelo India: Refer to Pages 20–21 of the textbook.

Fit India Movement was launched by the Prime Minister of India on 29 August 2019 (National Sports Day) with the goal of making fitness a part of our everyday life. The movement's goal is to change people's habits and encourage them to adopt a more physically active lifestyle.

Figure 1.2 The Fit India Programme logo

Objectives of Fit India Programme

Fit India plans to pursue numerous projects and holds events in order to attain the following objectives:

- To promote fitness as easy, fun and free.
- To spread awareness on fitness and various physical activities that promote fitness through focused campaigns.
- To encourage indigenous sports.
- To make fitness reach every school, college/university, panchayat/village, etc.
- To create a platform for citizens of India to share information, drive awareness and encourage sharing of personal fitness stories.

The Fit India Movement aims to put the country on a fitness and wellness path. It offers a once-in-a-lifetime opportunity to contribute to a healthier India. Individuals and organisations can participate in the movement by taking efforts for their personal health and well-being, as well as the health and well-being of fellow Indians.

Fitness Pledge

"I promise to myself that I will devote time for physical activity and sports every day and I will encourage my family members and neighbours to be physically fit and make India a fit nation."

Fitness Mantra

Fit India Mission encourages people to become

part of Fit India Movement by including at least 30–60 minutes of physical activities in their day-to-day lives.

Fitness Protocols and Guidelines

Fit India has started many campaigns to promote and spread awareness on fitness. These activities can be undertaken to ensure that fitness reaches every school, college/university, panchayat/village, etc.

Fitness protocols for different age groups have been laid down keeping different parameters in mind. Age-Appropriate Fitness Protocols will enable Physical Fitness Assessments to be conducted by schools and parents to monitor and track the fitness and health indicator of each child.

EXERCISES

A. Objective Type/Multiple-Choice Questions

1 mark

I. **Multiple-Choice Questions:**

1. When was the Fit India Movement launched?

   (a) 29 August 2013 (b) 29 August 2016 (c) **29 August 2019** (d) 29 August 2021

2. Which of the following tournaments, is played on clay courts?

   (a) Australian Open (b) **French Open** (c) US Open (d) The Wimbledon

B. Short Answer Type Questions

2 marks

1. What is Hawk Eye Technology?
2. What is the goal of Fit India Programme?
3. What is the fitness pledge of Fit India Programme?

C. Short Answer Type Questions

3 marks

1. Write in brief about different wearable gears.
2. What are different objectives of Fit India Programme? Mention any three.

D. Long Answer Type Questions

5 marks

1. What are the changing trends in sports in terms of playing surfaces?
2. Describe in detail about the changing trends in sports in terms of technological advancements.
3. What is Fit India Programme? How is it important for rural players of India?

2 Olympism

OLYMPISM – CONCEPT AND OLYMPICS VALUES (EXCELLENCE, FRIENDSHIP AND RESPECT)

Olympism is a philosophy of life. The word 'Olympism' refers to the philosophy of the Olympic Games.

The Olympic Movement's purpose is to help construct a more peaceful and better world by teaching kids through sport activities, which must be done without prejudice, and inculcating the Olympic spirit, which demands mutual understanding, solidarity and fair play.

Fundamental Principles of Olympism

The following fundamental principles of Olympism are explained in the Olympic Charter.

1. Olympism is a philosophy of life, exalting and combining in a balanced whole the qualities of body, will and mind. Blending sport with culture and education, Olympism seeks to create a way of life based on the joy of effort, the educational value of good example, social responsibility and respect for universal fundamental ethical principles.
2. The goal of Olympism is to place sport at the service of the harmonious development of humankind, with a view to promote a peaceful society concerned with the preservation of human dignity.
3. The Olympic Movement is the concerted, organised, universal and permanent action, carried out under the supreme authority of the International Olympic Committee (IOC), including all individuals and entities who are inspired by the values of Olympism. It covers the five continents. So, its symbol/emblem is five interlaced rings.

   It reaches its peak with the bringing together of the world's athletes at the great sports festival, the Olympic Games.
4. The practice of sport is a human right. Every individual must have the opportunity of practising sport, without discrimination of any kind and in the Olympic spirit, which requires mutual understanding with a spirit of friendship, solidarity and fairplay.
5. Recognising that sports are played within the framework of society, sports organisations within the Olympic Movement shall apply political neutrality.

   They have the rights and obligations of autonomy, which include freely establishing and controlling the rules of sport, determining the structure and governance of their organisations, enjoying the right of elections that are free from any outside influence and the responsibility for ensuring that principles of good governance be applied.
6. The enjoyment of the rights and freedoms set forth in this Olympic Charter shall be secured without discrimination of any kind, such as race, colour, sex, sexual orientation, language, religion, political or other opinion, national or social origin, property, birth or other status.
7. Belonging to the Olympic Movement requires compliance with the Olympic Charter and recognition by the IOC.

Olympic Values

Excellence, camaraderie (friendship) and respect are the three core ideals/values of Olympism. They serve as the basis for the Olympic Movement's efforts to promote sport, culture and education in the pursuit of a better world.

According to the Olympic Charter, the initial values of Olympism were to 'promote effort,' 'preserve human dignity,' and 'build peace.'

They have changed over time and are now stated in more modern words as:

- Striving for greatness and helping others to achieve their full potential.
- Being unique and unusual, the Olympic Games celebrate friendship – an event that draws people together every few years.
- Respecting oneself, the rules, your opponents, the environment, the general public, and so forth.
- Setting your rivalries aside is the concept. We have more in common than we have differences.

The core ideals/values also include five educational values. These values have been incorporated from the three domains of learning: Mental, Emotional and Physical. They are as follows:

- Joy of effort
- Fair play
- Respect for others
- Pursuit of excellence, and
- Balance in life between body, will and mind.

Excellence

Excellence refers to doing the best one can, on the field of play or in the professional life.

The main aim is not winning, but taking part, making progress and enjoying the healthy combination of body, will and mind. It is about having a goal in life, and through determination, effort and perseverance attaining that goal. Excellence is not only on the playground; it is also in the classroom, where all students have the right to education (Article 28), and also by helping students pursue excellence by chasing their dreams of life.

Friendship

Friendship is at the core of the Olympic Movement. It motivates us to see sport as an instrument for mutual understanding among individuals, and among people all over the world. Friendship brings Olympic and Paralympic athletes and people from around the world together in sport, play and competition. It helps in breaking down the barriers down by encouraging people to look beyond the differences. By welcoming everyone's differences we are able to establish the culture of working together and supporting each other.

Respect

Respect means to show high regard for, or special attention to, someone. It lies at the heart of Olympism. It includes respect for yourself and your body, for other people, for rules and regulations, for sports and for the environment. In fact, respect is the key to strong friendships, fair play and sportsmanship.

Respect includes self-respect and respect for others. For example,

- knowing that we can offend or hurt someone by not letting them join in our game.
- listening to and asking for the ideas, opinions and beliefs of everyone – boys, girls and CWSN.
- helping others to feel safe from violence – teasing, bullying, and verbal, physical and sexual violence.
- taking care of ourselves by choosing to eat healthy food, while getting enough rest and exercise.
- being confident in ourselves to share and defend our ideas and opinions.

Olympics – Symbols, Motto, Flag, Oath and Anthem

For Olympic Symbols, Motto, Flag, Oath: Refer to Pages 28–29 of the textbook.

The Olympic Anthem or the Olympic Hymn is the oldest treasure of the modern Games, having been composed by Greek composer Spiro Samara to lines penned by his fellow countryman, poet Kosts Palamás. It is played when Olympic flag is raised in the opening ceremony of the Olympic Games.

The renowned composer was tasked with writing it to provide a musical identity to the opening ceremonies of the 1896 Olympic Games in Athens, the first modern Games, which took place two years after Pierre de Coubertin established the IOC.

At the age of 35, Samara was famous throughout Europe. His three-act opera 'Flora Mirabilis' had been performed at La Scala in Milan ten years before. His operas were well-received and were staged in all of Europe's and the Middle East's major cities. He was even compared to Giacomo Puccini, Ruggero Leoncavallo and Pietro Mascagni, the three great Italian composers.

The Olympic Anthem

"Immortal spirit of antiquity,

Father of the true, beautiful and good, Descend, appear, shed over us thy light

Upon this ground and under this sky

Which has first witnessed thy unperishable fame

Give life and animation to those noble games!
Throw wreaths of fadeless flowers to the victors in the race and in the strife!

Create in our breasts, hearts of steel!

In thy light, plains, mountains and seas

Shine in a roseate hue and form a vast temple

To which all nations throng to adore thee,
Oh immortal spirit of antiquity!"

Olympic Movement Structure – NOC, IFs, Other Members

The Olympic Movement is the concerted, organised, global, and permanent action of all persons and entities who are motivated by the principles of Olympism, carried out under the ultimate authority of the IOC. It encompasses all five continents. It achieves its pinnacle during the Olympic Games, which bring together the best athletes from around the world.

The Olympic Movement's mission is to help construct a more peaceful and better world by teaching kids through sports that are consistent with Olympism and its principles. The IOC, International Sports Federations (IFs), and National Olympic Committees (NOCs) are the three primary components of the Olympic Movement.

For more information about IOC: Refer to pages 35–36 of the textbook

National Olympic Committees

At present, there are 206 NOCs recognised by the IOC. The IOC is the sole authority to recognise an NOC. Together with the IFs, the NOCs are a constituent of the Olympic Movement under the leadership of the IOC. The mission of the NOCs is to develop, promote and protect the Olympic Movement in their respective countries, in accordance with the Olympic Charter. The Indian Olympic Association (IOA) is the National Olympic Committee of India.

For details about IOA, refer to pages 36–37 of the textbook.

International Sports Federations

The International Sports Federations are international non-governmental organisations recognised by the IOC. IFs administer one or more sports at the world level. The national federations also administer the sports that are affiliated to them.

IFs are independent sport federations recognised by the International Paralympic Committee (IPC) as the sole representative of a Paralympic Sports. There are 11 international federations recognised by the IPC.

Organising Committees for the Olympic Games

The Olympic Movement includes the Organising Committees of the Olympic Games (OCOGs), national associations, clubs, and individuals affiliated with the IFs and NOCs, particularly athletes, whose interests are central to the Olympic Movement's work, as well as judges, referees, coaches, and other sports officials and technicians. It also covers additional IOC-recognised organisations and institutes. The host city's OCOG is in charge of organising this world class event. When the IOC selects a city to host the Games, the city and the NOC of the host country create the OCOG which organises the Games. Usually, OCOG is created seven years before the Games.

EXERCISES

A. Objective Type/Multiple-Choice Questions

1 mark

I. **Multiple-Choice Questions:**

1. Who composed the Olympic Anthem?

   (a) Rabindranath Tagore
   (b) **Spiro Samara**
   (c) Kostis Palamas
   (d) George Bernard Shaw

2. At present, how many national Olympic committees are recognised by the IOC?

   (a) 192
   (b) **206**
   (c) 212
   (d) 240

B. Short Answer Type Questions

2 marks

1. What is Olympism?
2. What are the educational themes of Olympism?

C. Short Answer Type Questions

3 marks

1. What is the purpose of Olympic Movement?
2. How can you justify this statement – Respect lies in the heart of Olympism?

D. Long Answer Type Questions

5 marks

1. Write about any five fundamental principles of Olympism.
2. Describe in detail about the Olympic values – friendship and excellence?

4 Physical Education and Sports for CWSN (Children With Special Needs – *Divyang*)

CONCEPT OF DISABILITY AND DISORDER

Disability

The word disability refers to the inability or incompetency in performing any functional work by the body. It is actually the consequences of any impairment caused to the functional ability of a person. Disability can be present in a person by birth or can also be due to any unforeseen situation during her/his lifetime. Disability can be seen in the area of physical, mental, sensory, cognitive, intellect and development or may be a combination of some or few of these. It actually affects the person's life activities. In simple words, disability can be understood as a condition of a person wherein she/he is unable to perform the day-to-day common tasks due to functional disability of any body system. Disabilities can also be seen as the outcome of any disorders.

A few definitions that can help us understand the concept of disability better are given below:

"A disability is a restriction or lack (resulting from impairment) of ability to perform an activity in the manner or within the range considered normal for a human being."

– World Health Organisation

"A disability is any continuing condition that restricts everyday activities. It is attributable to an intellectual, psychiatric, cognitive, neurological, sensory or physical impairment or a combination of these impairments; is permanent or is likely to be permanent; may or not be of a chronic or episodic nature; results in substantially reduced capacity of the person for communication, social interaction, learning or mobility and a need for continuing support services."

– Government of Western Australia's Disability Services Act (1973)

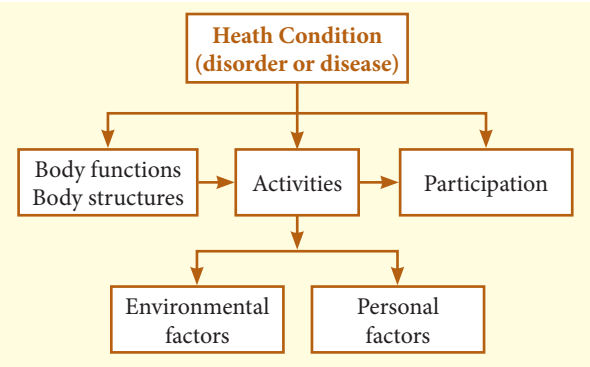
The Americans with Disabilities Act 1990 recognises a disabled person as one who:

- has a physical or mental impairment that substantially limits one or more major life activities,
- has a record of such an impairment,
- is regarded as having such an impairment.

The Government of India passed an act named as the Rights of Person with Disabilities Act 2016 (RPWD Act 2016) on 27 December 2016 to give an effect to the United Nations Convention on the Rights of Person with Disabilities. This act recognises 21 disabilities. Every year December 3 is celebrated as World Disability Day. There are nine

domains of functioning as per the International Classification of Functioning, Disability and Health (ICF). According to the ICF, medical model, social model, biopsychosocial model, etc. have been proposed to understand and explain disability and functioning.

The following diagram helps to understand the model of disability as per the ICF.



Disorder

Simply put, a disorder is an illness or a dysfunctional factor that affects the physiology and/or psychology of an individual. It can be structural or functional. Structural disorder is visible; some part or other of the body is observably different from what is considered physiologically normal. Or, it can be a psychological disorder, i.e. disorders of the mind. Structural disorder can alter the physical structure of the affected individual, or cause intellectual deviances.

Functional disorder is different in the sense that it is less noticeable. Rather, the inner chemistry of a system is disturbed by the malfunctioning of an organ, or hyposecretion of chemicals in the body. The consequences of such a disorder can be seen in deviations from the normal functional ability of the concerned systems of the body, may it be in speech, behaviour, understanding, responsiveness, reaction time, motor coordination, etc.

TYPES OF DISABILITY, ITS CAUSES AND NATURE (Intellectual disability, Physical disability)

According to the nature, level or type of malfunctioning in the body system, the types of disabilities are identified as follows:

Intellectual Disability

Intellectual disability usually occurs before the age of 18 years. A child with intellectual disability will have the limitations in the intellectual functioning and also in adaptive behaviour patterns. A child with intellectual disability will have limitations in the functioning of mental capacity such as learning, reasoning, problem-solving and IQ level.

Intellectual disability may be characterised as mild, moderate, severe and profound. These characteristics may be judged according to their IQ tests scores. If the IQ of a child is between 55 and 75, she/he is considered to have mild intellectual disability. If the IQ of a child is between 35 and 55, then the child is in the category of moderate intellectual disability. A child falls in the severe intellectual disability category if the IQ is between 20 and 40. If the IQ is below 25, it is profound intellectual disability. Adaptive behaviour focuses on the conceptual skills, social skills and practical skills. A child with intellectual disability will show limitations in the following areas:

- **Conceptual Skills:** Low in the concept of language, time, numbers and directions.
- **Social Skills:** Poor interpersonal relations, no social responsibility, poor self-esteem, feelings of negativity and so on.
- **Practical Skills:** Slow daily living activities, occupational skills and healthcare affected, money handling and safety affected.

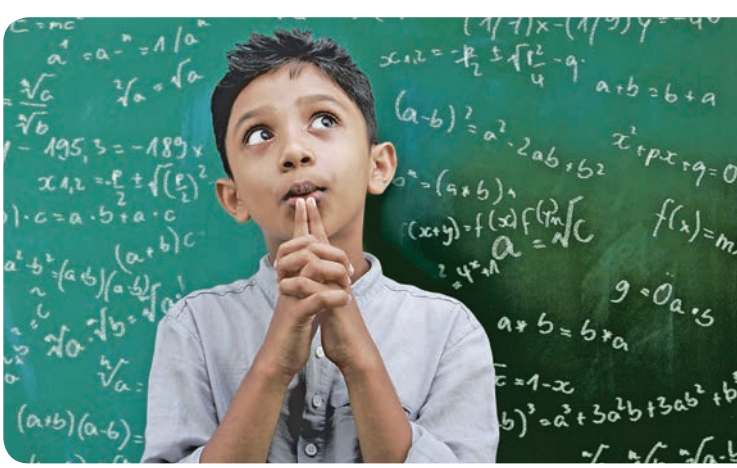


Figure 4.1 Intellectual disability involves problems with general mental abilities.

The cause of this disability maybe due to the exposure of the child in a typical community environment, interaction with peer group, cultural exposure, linguistic background and exposure, family culture to some extent and also genetic potential.

Physical Disability

The word 'physical disability' means the limitations in a person's physical functioning. This may affect the person's movement, mobility, strength, speed, posture and so on. The cause of physical disability maybe numerous. Some of them are as follows:

- Genetic disorder
- Muscle dystrophy
- Accidents
- Inadequate brain development
- Spinal injury
- Chemical imbalance in the body
- Serious illness that affects the brain, nervous system, muscular system, etc.

Physical disabilities can be diagnosed through observation of a child's development, behaviour and physical performance. Their nature can be characterised as:

- Acquired brain injury
- Spinal cord injury
- Spina bifida
- Cerebral palsy

Figure 4.2 Physical disability limits the stamina, mobility and physical functioning of the person.

DID YOU KNOW?

1. **Harry Boniface Prabhu** is an Indian quardriplegic wheelchair tennis player. Apart from this, he has represented India at international events in six disciplines, over 50 times. He was awarded the Padma Shri, the fourth highest civilian award by the Government of India in 2014.
2. **Stephen Hawking** was a very famous cosmologist. He was diagnosed with Amyotrophic Lateral Sclerosis during his college days. Despite his debilitating illness, he had done groundbreaking work in physics and cosmology.

- Cystic fibrosis
- Epilepsy
- Multiple sclerosis
- Muscular dystrophy
- Tourette syndrome
- Dwarfism

The Paralympic Movement offers sports opportunities for athletes on the basis of mobility and physical impairments, amputation, cerebral palsy (Spasticity, Athetosis, Ataxia and mixed type), muscular dystrophy, hearing and visual impairments.

Causes of Disability

A few major causes of disabilities are discussed below:

Genetics: Anomalies in genes can cause disabilities such as spinal bifida (split spine) and muscular dystrophy, and intellectual disabilities like Down syndrome and Fragile X syndrome. These are inherited at birth. However, diseases and overexposure to radiation may also bring about genetic abnormalities.

Poverty: Many families live below the poverty line and go without two square meals a day. Their living conditions are poor and they do not have access to quality healthcare, safe drinking water, proper sanitation and wholesome nutrition. As such, they fall prey to many diseases and disabilities and pass them on to their offspring.

Accidents: Accidents are unpredictable external

causes that may result in permanent disabilities, such as paralysis of the limbs, amputation and psychosomatic disorders. Those employed at dangerous workplaces, for example, mines, chemical industries, construction business, etc. should take extra care in order to avoid accidents.

Diseases: If a child is not vaccinated on time, she/he may become susceptible to diseases like polio which can cripple her/him. Infectious diseases acquired during infancy and childhood, or during pregnancy by the infected mother, may result in growth retardation, seizures, congenital toxoplasmosis, etc. Illnesses like diabetes, cancer, arthritis, etc. also result in disabilities.

Hormonal Imbalances: Disturbances in the function of the endocrine glands are also responsible for bringing about disabilities, both physical and mental.

Malnutrition: Lack of proper nutrition affects the healthy growth of a child, who might become physically weak, stunted, and malformed. Iodine deficiency, for example, retards the normal growth process. Vitamin deficiency may cause blindness (Vitamin A), osteomalacia and learning disabilities (Vitamin D), cognitive decline and functional disability (Vitamin B_{12}), etc.

Radiation: Overexposure to radiation brings about genetic mutation, as already mentioned. Accidents occurring at nuclear power plants – 1979 in USA and 1986 in Ukraine – have had long-term effects, causing disabilities in the affected population.

Toxicity: Use of pesticides and insecticides, and the presence of lead and mercury in consumed products, can also result in lasting illnesses and disabilities. The Bhopal Gas Tragedy of 1984 produced long-term health effects that included neurological disabilities like impairment of memory and motor skills and inability to grow in children.

Violence and Trauma: Injuries sustained in violent physical attacks may cause disabilities that are not only physical but also mental, such as Post Traumatic Stress Disorder (PTSD). Violence of any kind, for example, might result in loss of limbs and loss of speech, hearing, eyesight, etc.

Medical Malpractice: Poor health facilities and ill-qualified medical practitioners have been known to inadvertently cause disabilities with their lack of knowledge, unhygienic methods like not sterilising their equipment, administering the wrong medication, etc.

EXERCISES

A. Objective Type/Multiple-Choice Questions

1 mark

I. **Multiple-Choice Questions:**

1. How can physical disabilities be diagnosed?

   (a) Through observation of child's development
   (b) Behaviour and physical performance
   (c) Understanding of the mental state
   (d) **Only through (a) and (b)**

2. What is the name for the condition under which a person has difficulty in comprehending written text, spelling and writing accurately?

   (a) Spina bifida
   (b) Epilepsy
   (c) **Dyslexia**
   (d) Arthritis

3. For a child to be considered in the severe intellectual disability category, his/her IQ has to be below what value?

   (a) 70
   (b) 55
   (c) **30**
   (d) 15

II. **Case-Based Questions:** CBQ

A couple has a premature, malnourished child. They live in a small village and in severe poverty. On the basis of the case given, answer the following questions:

1. Which of the following disabilities is the child not likely to have?

   (a) Blindness (b) Osteomalacia (c) Functional disability (d) **None of these**

2. Which of the following vitamins does the child lack if he is suffering from blindness?

   (a) Vitamin B_{12} (b) **Vitamin A** (c) Vitamin D (d) Vitamin K

3. Which of the following factors may have contributed indirectly to the condition of the child?

   (a) Diseases (b) **Poverty** (c) Violence (d) Radiation

B. Short Answer Type Questions — 2 marks

1. What is disability?
2. Define a disabled person according to the Americans with Disabilities Act, 1990.

C. Short Answer Type Questions — 3 marks

1. What is intellectual disability?
2. What are the causes of physical disability?

D. Long Answer Type Questions — 5 marks

1. Elaborate the nature of intellectual disability.
2. Explain the characteristics of physical disability.

5 Physical Fitness, Health and Wellness

TRADITIONAL SPORTS AND REGIONAL GAMES FOR PROMOTING WELLNESS

The traditional sports and regional games are the reflection of the people and the society and their culture. Earlier all the games and sports were played for recreation and entertainment. Most of them were also played to improve and showcase the physical abilities of people. Slowly they took the shape of organised games and sports. Rules and regulations were also incorporated time to time to mark specificity as required. When we consider the traditional games, we notice the reflection of the culture, tradition, innovation and practice of the people of that area. These games connect all the people culturally, socially and take care of the positive aspects of health also. The traditional sports not only help in binding people together but also improve their physical ability and health in long run. When people get connected, they participate whole-heartedly and the outcome is attainment of good health and wellness. That is why, government is also putting efforts in promoting rural and traditional games and sports in our country. Traditional games and sports improve competency of the people related to that area. As a whole, it also helps in improving the wellness concept because participating in, and organising traditional game, helps people to improve their physical and mental ability, induces happiness, binds them together, and improves their habits and behavioural aspects. Sports build up discipline and traditional sports connect people.

Together they build up healthy habits, behaviour, and relations, and all these promote the concept of wellness in an individual and society in turn.

Table 5.1 Traditional sports and regional games played in different Indian states, which promote health and wellness.

Games/Sports	Brief Description
Kushti Akhara or *Pehelwani*	Like many traditional sports, wrestling (Kushti) remains very popular in small towns and villages. It evokes nostalgia, notions of bravery and machismo, and can be traced back to mythology and the much-celebrated tradition of *akharas* and *pehelwans*. There are many instances of wrestling in the Indian epics. In the Mahabharata, Duryodhana and Bhima were accomplished wrestlers. It is popular in Uttar Pradesh, Punjab, Bihar, Haryana and many other states.
Thang-Ta	Thang means sword and Ta means armour. This is an indigenous sport of Manipur.
Kalaripayattu	Kalaripayattu is derived from the Malayalam words 'kalari' meaning gymnasium and 'payattu' meaning fighting/exercising. This martial art is said to have been born out of a long-drawn-out period of conflict between the Cheras of Kerala and the Cholas of Tamil Nadu in the 11th century. Legend traces this art form to Sage Parasurama, who was the master of all martial art forms, and is credited to being the reclaimer of Kerala from the Arabian Sea. Kalaripayattu is one of the oldest fighting arts in the world, practised in Kerala, Tamil Nadu and Karnataka, as well as in Sri Lanka and Malaysia.
Kho-Kho	Kho-Kho is probably the most ancient game known to Indians. It pre-dates the Mahabharata. In ancient times, it was played on '*raths*' or chariots and it was known as Rathera. Many historians believe that the game is a modified form of 'Run Chase' which involves chasing and touching a person. Kho-Kho demands great agility, alertness and speed, with a lot of weaving around, dodging and body feints. Just like Kabaddi, the aim of the players is to touch the opponents so that they are considered to be 'out' of the game. At the Gymkhana Poona (modern Pune), a Committee was formed in 1914 to frame the rules. The first ever rules of the game were published by the Gymkhana Baroda, in 1924. The first ever national Kho-Kho championship was organised in Vijayawada, Andhra Pradesh, in 1959–60. This game is now played all across India.
Tug of War (*Rassakasi*)	Tug of war is related to the 12th century. Carvings in the Surya Temple of Odisha prove that this was a famous game in 12th century. These days, this game is played all across India.
Mallakhamb	The word Mallakhamb is formed from two words – 'malla', meaning a man of strength and 'khamb' meaning a pole. This ancient sport was invented to train wrestlers. An impressive Mallakhamb performance requires suppleness of the body, great strength and skill. It is a wonderful way to stay fit and flexible. In recent years there has been a major resurgence in the popularity of Mallakhamb, especially in Maharashtra. Fifteen Indian states regularly participate in the National Mallakhamb Championship.

Contd...

Hekko	Hekko means daring the tiger. This game is played in Nagaland.
Sqay	Sqay is a martial art form of sword-fighting. It originated in Kashmir. It is governed by the Sqay Federation of India. It is a practical fighting technique.
Chhau and Paika Akhada	Chhau dance is a famous tribal dance which uses martial arts movements to a great extent. This is famous is West Bengal, Jharkhand and Odisha. Odisha's Paika Akhada, like Chhau, mixes martial arts and dance forms. In this sport, weapons are used along with rythmic movements.
Kabaddi	In India, Kabaddi is known as Chedugudu in the south and Hu-Tu-Tu in the west. According to one theory, the game was born in Karnataka and the name is derived from the Kannada words 'Kai' (hand) and 'hidi' (catch), thus meaning 'catching hands'. For millions, Kabaddi is more than a game – it is a source of fun, frolic and recreation. This game is now played all across India.
Shooting Ball	Since shooting ball requires a lot of power, stamina, agility and flexibility, people consider this game very good for fitness and wellness. The rectangular shape of shooting ball court has a dimension of 33 × 66 feet. The first national championship of shooting ball was organised in 1976 in Delhi.
Lagori and Langadi	Lagori and Langadi are two very popular sports of Goa since old times. Lagori is played with other names like *Pitho garam*, *pitto* and seven stones in other parts of the country. Seeker and hitter are two teams. Nowadays this sport is played in about 30 countries. In langadi, players touch their opponent by running on a single leg. This game is useful for the practice of volleyball, kho-kho and gymnastics. This game is popular in western Maharashtra and Konkan region. This sport is known as Kukurazu, Aroni or Gamosa in North-east; *Langda Sher* in Punjab, *Langdi Tang* in Delhi, *Chuta Gudo* in Odisha and *Kuntata* in South India.
Gatka	Gatka is an ancient martial art associated with Sikhs of Punjab and other ethnic groups. Sikh warriors kept this art alive and achieved efficiency in it and used in many wars.
Roll Ball	Roll ball is a game played between two teams and is a unique combination of roller skates, basketball, handball and throwball. It is played on 'roller shoes' with each team consisting of 12 players, six on the field and six in reserve. The main objective of the game is to score maximum goals within a stipulated time. The main feature of roll ball is that the ball is held in one or both hands, when passing to the other players, with the ball repeatedly bounced on the ground. In 2003, Sports Authority of India launched roll ball for the first time.
Dhoop Khel and Cowrie Khel	Dhoop Khel and Cowrie Khel are games that originated in Assam. It is traditionally played with a ball. The game is played between two teams of 11 on a 125 m × 80 m field bounded by four flags. The players take turns, throwing the ball at the opponent to knock them out of the game, while seeking to catch the ball and evade other players. It is a test of speed, stamina and acrobatic skills.
Silambam	Silam means bamboo. It is a martial art. It is an indigenous game of Puducherry.
Sikkim Archery	In Sikkim archery, bows and arrows made up of bamboo are used. This is also known as bamboo archery.

Contd...

Gilli Danda	Gilli Danda was played in villages across the length and breadth of our country. The game is similar to cricket in many ways. It requires a sharp eye, dextrous hands and quick feet. Many versions of Gilli Danda are played across the world. In neighbouring Nepal, it is called Dandi Biyo. English children know it as Tipcat, and the Iranians call it Alak-Dolak.
Inbuan Wrestling	Inbuan is a form of wrestling, native to the people of Mizoram in India. Inbuan is said to have originated in the village of Dungtlang in 1750. It was recognised as a sport after the Mizo people migrated from Burma to the Lushai Hills.
Stapu	Every little child in India has played Stapu or *Ekhat-Dukhat* or as it is commonly known, *Kith-Kith*. It remains a part of their memories of childhood. Kith-Kith, called Hopscotch in English, requires physical agility and nimbleness. It needs very little space to play and can be played both outdoors and indoors. Kith-Kith is played all over India. It is known as Kunte Bille in Karnataka, Paandi in Tamil Nadu, Tokkudu Billa in Andhra Pradesh, and Khané in Kashmir.
Boat Race	Boat races are held during the harvest festival of Onam in autumn. Chundan Vallams are paddled longboats. They are the biggest and longest boats used in a sport in the world. The races are held on the fifth day of the Onam celebrations at places such as Aranmula, Kollam, Kottayam and Kumarakom. The snake boats of Kerala have over four hundred years of history associated with them.

For more information on traditional/indigenous/regional games of India, please refer to the free poster with the textbook– "Traditional Games of India".

EXERCISES

A. Objective Type/Multiple-Choice Questions

1 mark

I. **Multiple-Choice Questions:**

1. Gilli Danda is a traditional sport of India. What is the name of this game in Nepal?

   (a) Atayu Patayu (b) Mallakhamb (c) **Dandi Biyo** (d) Alak-Dolak

2. In which state of India the game Thang-Ta is practised?

   (a) Assam (b) **Manipur** (c) Mizoram (d) Karnataka

B. Short Answer Type Questions

2 marks

1. Name any four traditional games of India.
2. What is Inbuan wrestling?
3. How is Sikkim Archery different from mainstream archery?

C. Short Answer Type Questions

3 marks

1. Write about Dhoop Khel and Cowrie Khel.
2. Explain briefly about Kalaripayattu.

D. Long Answer Type Questions

5 marks

1. What is the importance of traditional and regional games of India?
2. Briefly describe about the following traditional and regional games of India.
   (a) Boat Races (b) Akhara Kushti (c) Roll Ball (d) Mallakhamb

6 Test, Measurement and Evaluation

CONCEPT OF TEST, MEASUREMENT AND EVALUATION IN PHYSICAL EDUCATION AND SPORTS

The concepts of test, measurement and evaluation are interrelated. Any idea or thought cannot take productive or practical shape without evaluation. It is not possible to evaluate the collected data without measurement. You need a tool to start measuring and that tool is an appropriate test. So, a test is a tool for gathering data to identify an individual's unique features or attributes in terms of knowledge, physical abilities, skill abilities, and so on. Unit tests, yearly checkups, physical fitness, and body measurements are examples (height, weight).

Concept of test

Test is the process of assessment of a content. This content can be academics, skills, knowledge, concept, quality, quantity, vocabulary, etc. In education, tests are done to assess the progress of learning, significance of learning and also attainment of the learning outcome. Tests are important to ascertain the reliability and validity of the objects to attain the goal of learning. Test helps us to know the present status and also justify reasons to modify the ways of attainment. In brief, tests can be used as a tool to measure and justify learning.

Concept of Measurement

Measurement is a process of associating academics, skills, knowledge, concept, quality, quantity, etc. objectively or subjectively. In measurement, we should have two aspects, i.e. initial and final, pre or post and so on. In physical education, measurement is done to assess growth, development, performance, academics, skills, fitness parameters, physical and psychological parameters, etc. Measurement techniques are used to assess the pattern of development, effects of a training programme on any parameters and so on. Measurements are always done based on tests conducted and it can also be understood as an outcome of a test.

Quantitative, qualitative, or both types of measurement might be used. It is a numerical/grading value score or data that indicates an individual's capacity or aptitude and is produced by the use of a test. Measurement refers to how well students do in tests and exams, whether on the field or in the classroom.

Concept of Evaluation

Evaluation is a process of analysing the measurements acquired based on test conducted. Evaluation helps in grading the parameters and put them to various standards. It is the outcome of test and measurement and helps in interpreting and analysing the results obtained through various testing process and measurement techniques. The test results can only be justified through a proper evaluation process. So, we can conclude by saying that in physical education if we want to assess a learning process, performance, etc. test is used as a tool, measurement is used as a technique of assessment and evaluation is used as a criteria to analyse and appraise the final outcome.

It is the process of evaluating data in order to quantify and make a professional value or worth judgement. Everyone wants to know the feedback or efficacy of the measures after the test, which may be obtained through assessment. The evaluation process can be formative or summative, and it involves three steps: process education, objectives, learning experiences, and behaviour modification.

These steps must be followed in order. Teachers, students, and parents in the field of health and physical education can utilise the Measurement and Evaluation software to monitor academics as well as fitness levels. The TME procedure is beneficial for achievement, diagnosis, prescription, improvement, categorisation, grading, motivating purposes, and performance prediction.

CLASSIFICATION OF TEST IN PHYSICAL EDUCATION AND SPORTS

In physical education, tests are classified as oral test, written test, and practical test. Further classifications are given in Figure 6.1.

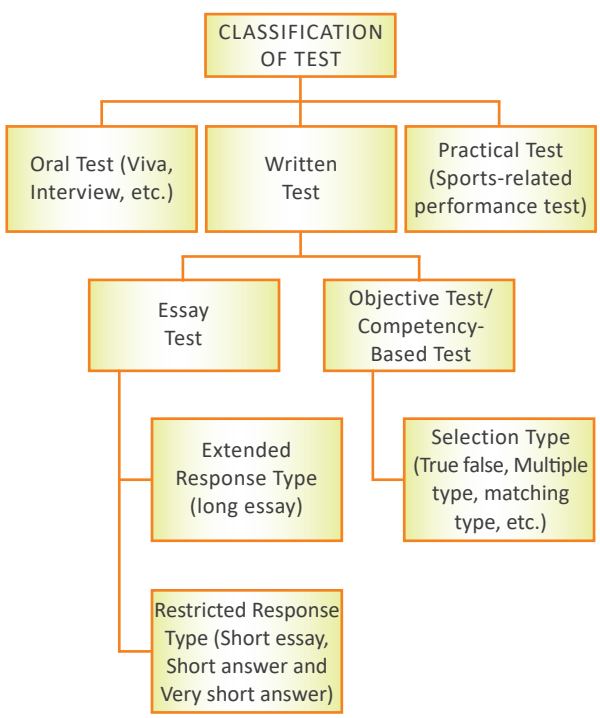


Figure 6.1 Classification of test

There could be a number of tests in physical education and sports. The classification of practical test (sports related performance tests) may include motor ability tests, physical fitness tests, physical capacity tests, physical efficiency test, physical intelligence tests, strength tests, proficiency tests, achievement tests, knowledge tests, technique tests, decathlon tests, skill tests, practice tests, age norms tests, tests of physiological condition, anthropometric tests and badge tests. This list can have more tests.

While making a classification of tests, the first move should probably be the selection of a satisfactory basis of classification. Tests could be classified according to the type of activity measured, according to the method of constructing the tests, according to the purpose for which the test is designed, or according to the actual function that the test performs. For example, tests might be classified as written tests or as performance tests. If classified according to the method of construction, tests might be classified as judgement tests or achievement tests. If classified according to the purpose for which designed, they might be classified as posture tests, strength tests, swimming tests, motor ability tests, etc. If classified as to the actual function performed, tests might be called any of the above names accordingly, as they really measure those factors.

The plan proposed is to classify tests in accordance with the function which they actually perform. Thus, if a test measures fundamental motor ability, it may be called a motor ability test. If it measures practice improvement in executing basketball skills, it may be called an achievement test in basketball technique.

On the basis of function, certain general classification of test can be recommended. This classification of tests in physical education and sports is as follows:

1. Intelligence tests
2. Anthropometric test
3. Health Tests
4. Physical Fitness Test

In 2019, Fit India Mission developed Physical Fitness Test battery for Indian school children in the age group of 9–18. These health-related fitness components include body composition (BMI), cardiorespiratory endurance (600 m Run/walk), muscular strength and endurance (Partial curl-up and Push-up) and flexibility (Sit and Reach).

TEST ADMINISTRATION GUIDELINES IN PHYSICAL EDUCATION AND SPORTS

The age-appropriate protocols and guidelines developed by Fit India Mission, Ministry of Youth Affairs and Sports are comprehensive and aim to promote physical activity in multiple settings. These guidelines are a step forward to create active people and societies by encouraging physical activity among people of all ages and abilities. Before conducting any test battery, test administration guidelines and safety of the students/players are important. Though, sometimes a test requires a specific guideline. These test administration guidelines in physical education and sports are as follows:

Environmental Consideration

1. Adequate precautionary measures related to adequate hydration and proper clothing should be taken before undertaking physical exercises in hot, humid, cold and high altitude areas.
2. Adequate rest, quality sleep, nutrition and hydration status be ensured before undertaking exercise protocol as an essential safety prerequisite.
3. Sustained and heavy exercises are to be avoided in hot and humid environment.
4. Appropriate modification should be carried out in exercise protocols, keeping in view the prevailing local environmental conditions (extreme weather conditions).

Warm-up

1. Warm-up for a duration of 5-10 minutes will be an integral part of the exercise protocol.
2. Light stretching be undertaken as a part of the warm-up phase of exercise protocol which has a role in injury prevention.

Hydration

1. Appropriate measures should be undertaken during the duration of exercise to maintain adequate hydration to make up for the loss of water and salt during exercise.

Cool Down

1. Cooling down by undertaking light aerobic exercises and stretching of major joints for a duration of 5–10 minutes be undertaken after the end of the exercise.

Other Considerations

1. Participants across the age group having a BMI more than 30 are advised to start the exercise protocol in a gradual manner with relatively lesser time duration, lower intensity and lesser frequency. They should be encouraged to gradually increase the frequency, time and intensity till it is tolerated well.
2. Children with known medical history should exercise under supervision, after due clearance from concerned medical practitioners.

   Participants are encouraged to be vigilant about the possible development / occurrence of symptoms with regard to adverse medical conditions and immediately stop the exercise and seek medical help.

Responsibilities of Test Administrators

Test administrators must be trained in the administration of the test batteries. This training will ensure consistency and accuracy in administration of testing procedures and maximise efficiency.

It will help test administrators to prepare for the testing sessions properly.

The test administrators should plan for the following:

Pre Testing

- Arrange for assistants / volunteers, facility use and other special scheduling as needed.
- Arrange all standard test equipment, check calibrations and measurements to ensure consistency and accuracy.
- Practice with any equipment that will be used (for example, audiotape, metronome, stopwatches). Must have back-up equipment.
- Take print out of all important sheets / forms. These days Khelo India app is recommended to record the data of students.

- Record students' ages, based on how old they are when they begin the battery of tests.
- Prepare students with adequate instruction and practice time in the techniques to properly perform the test items.

During Testing

- It is the sole responsibility of test administrators to organise and administer the testing sessions.
- Select clean and safe area to conduct tests. Consideration should be given to ensure safety and fairness in testing.
- Though it is impossible to avoid all variables (for example, wind, running surfaces, etc.), it is expected that PE teachers/coaches will work to achieve accurate and consistent data.
- Test items may be administered in any order. More than one test item may be administered in any one session. All students need not be tested on the same item in any one session.
- Students are not allowed to repeat test items in order to achieve better scores.

Post Testing

- The test administrator must summarise/upload the data of each student/ player in the score sheet / on app.

Table 6.1 Test administration guidelines in physical education and sports in a nutshell

Pre Testing	During Testing	Post Testing
• Selection of venue • Preparation of time table • Arrangement of evaluators/ assistants/volunteers • Marking of grounds or testing areas • Arrangement of equipment • Arrangement of score sheets/ mobile app	• Directing the test • Supplying the essential items to test area • Ensuring proper participation • Ensuring safety of the participants	• Ensuring that everyone has completed the test • Collecting score sheet/ uploading data on app • Rearranging equipment

EXERCISES

A. Objective Type/Multiple-Choice Questions — 1 mark

I. **Multiple-Choice Questions:**

1. ..... refers to how well students do in tests and exams, whether on the field or in the classroom.
   (a) Test (b) **Measurement**
   (c) Evaluation (d) None of these
2. Which one of the following developed Physical Fitness Test battery for Indian school children between the age group of 9 and 18 in 2019?
   (a) Ministry of Education, India (b) **Fit India Mission**
   (c) Indian Olympic Association (d) BCCI

B. Short Answer Type Questions — 2 marks

1. Define the term 'test'.
2. Write the names of any two physical education and sports tests.
3. What is the benefit of TME procedure?

C. Short Answer Type Questions

3 marks

1. How can you say that test, measurement and evaluation are interrelated?
2. What are different health-related fitness components? Write about any three.

D. Long Answer Type Questions

5 marks

1. What are the responsibilities of test administrators before testing?
2. What are the responsibilities of test administrators during testing?
3. What are various test administration guidelines in physical education and sports? Explain in detail.

8 Fundamentals of Kinesiology and Biomechanics in Sports

DEFINITION AND IMPORTANCE OF KINESIOLOGY AND BIOMECHANICS IN SPORTS

Meaning of Kinesiology

Kinesiology is the study of movements, whether of the human body or of non-human animals. The word is a combination of the Greek word for 'movement' (*kinesis*) and 'study' (*logos*). It is a multifaceted subject which covers an array of sub-disciplines, such as psychology of physical activity, biomechanics, exercise physiology, history of physical activity, measurement of physical activity, motor development, motor learning and control, philosophy of physical activity, physical activity and public health, physical education pedagogy, etc.

"Kinesiology encompasses holistic health disciplines which use the gentle art of muscle monitoring to access information about a person's well-being. Originating in the 1970's, it combines Western techniques and Eastern wisdom to promote physical, emotional, mental and spiritual health. Kinesiology identifies the elements which inhibit the body's natural internal energies and accesses the life enhancing potential within the individual."

– Australian Kinesiology Association

"Kinesiology is the academic discipline which involves the study of physical activity and its impact on health, society, and quality of life."

– American Kinesiology Association

Kinesiology is applied in strength training, sports conditioning, physical and occupational therapy and occupational health and safety. It should not be confused with Applied Kinesiology, which is a separate method of therapy wherein muscle testing is used to diagnose a condition and treatment is done through dietary changes and/or manual manipulation.

According to the Canadian Kinesiology Alliance (CKA), there are three main scopes for practice of kinesiology:

1. **Adaptation through Exercise:** Use of exercises to improve overall health and physical fitness of individuals.
2. **Neuroplasticity:** Neuroplasticity is the physiological change in the brain which occurs as per our changing interactions with our environment. The neural network of the brain

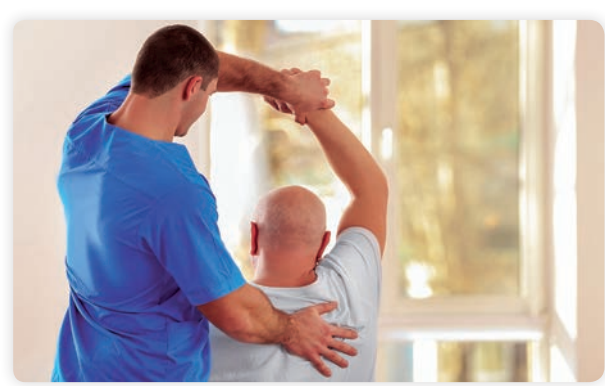


Figure 8.1 Kinesiology is the study of body movements.

expands with the addition of new experiences. This aspect of brain function is a salient part of kinesiology, since we not only learn but also need to remember and adjust our motor skills.

3. **Motor Redundancy:** According to this concept, any physical task which can be performed by the human body can be done so in unlimited number of ways.

Importance of Kinesiology in Sports and Physical Education

Kinesiology is very important in sports and physical education. The following points illustrate the importance of kinesiology.

1. Kinesiology is an inclusive subject that covers personal, public and environmental health. A lot can be learned about the nature of motor functions through familiarisation with this subject.
2. Kinesiology involves application of bio-mechanics, anatomy, physiology and psychology to examine how the human body responds to physical activity.
3. It focuses on the acquisition and development of motor skills. Therefore, it can provide a scientific study of the motor aspects of every kind of sports and enable us to identify the best possible techniques.

Figure 8.2 Kinesiology is the branch of physiology that studies the mechanics and anatomy in relation to human movement.

4. Kinesiology improves the area of rehabilitation due to sport-related injuries as well as therapeutic application of physical exercises.
5. With the use of kinesiology, exercise methods can be evaluated and altered for better performance and safety.
6. It can be applied to regulate our sleeping habits, reinforce our immune system, and enhance body functions, and thus brings an overall positive change to our well-being.

Meaning of Biomechanics

The word 'biomechanics' is an amalgamation of two Greek words: '*bio*' for 'life' or 'living things', and '*mechane*' for 'machine'. It has been defined as the science that deals with the study of the effects produced by internal and external forces when they act on a biological system. In simpler terms, biomechanics looks at the study of forces acting on bodies. Experts have defined it as follows:

"Biomechanics is the study of the structure and function of biological systems by means of the methods of mechanics."

– H Hatze

"The study and analysis of human movement patterns in sports is called biomechanics."

– Watson

"(Biomechanics is) the science and action of forces, internal or external, on the living body."

– Stedman's Medical Dictionary

In sports, biomechanics has a crucial role both in injury prevention and enhancement of performance. The laws of mechanics are applied to understand the activities and techniques of the players and the implications that mechanics have for human movements. Sports biomechanics use quantitative data for its analyses, obtained through mathematical modelling, measurement, computer simulation, etc. The broad aims of biomechanics in sports are:

- Finding and perfecting new techniques for athletes through quantification of motor abilities.
- Establishing techniques and strategies that allow the athletes to give maximum results with minimum physical exertion.

Figure 8.3 Biomechanics helps to describe, explain and predict the mechanical aspects of human exercise, sport and play.

- Evaluating existing trends and assessing their pros and cons.
- Minimising and preventing injury.

Importance of Biomechanics in Sports and Physical Education

A common mistake made by coaches and trainers is the failure to examine the underlying causes of wrong techniques. They correct and train the athletes as needed, but do not attempt to ascertain why the latter are unable to perform well in the first place. This is where biomechanics comes in. With detailed analysis of physical movements in sports biomechanics, the flaw can be rooted out from within the source itself.

The importance of biomechanics in sports can be outlined as follows:

Improvement of the Sports Technique: Sports biomechanics constantly tries to upgrade and refine sporting trends and techniques for all types of sports. A coach with a good knowledge of the subject is able to guide an athlete achieve a correct mechanical technique to execute in two ways:

1. Corrections of the athlete's performance for better delivery through qualitative biomechanical analysis.
2. Discovery of new and more effective methods through quantitative biomechanical analysis.

Improvement of Equipment and Facilities: Biomechanics has also proved useful in the development of better equipment and facilities with its valuable design inputs. For example, running shoes tailored for races help the athlete reduce injuries and use their energy optimally. Equipment can be personal (shoes, clothings, gears, helmets, etc.), technical (bats, balls, rackets, wickets, bikes, racing cars and cycles, etc.), facilities (gymnasiums, swimming pools, tennis courts, etc.) and instruments (heart rate monitors, accelerometer, stopwatch, etc.).

Minimisation of Injury: With the application of biomechanics, it is easier to find scientific rehabilitation of injuries and how they can be prevented in future. It therefore focuses on the safety and well-being of the athletes. Needless to say, physical education teachers, sports trainers and coaches have a duty, which is both professional and moral, to have a thorough grasp of the subject.

Development of New Methods: There are various ways in which data is gathered for a fruitful application of biomechanics in sports: recording videos with Polaroid sequence cameras, taking photographs, etc. They are studied to locate faults in movement patterns and correct them, standardise exercise methods and gauge the physical and motor fitness of the athletes.

Improvement of Training: An important function of the application of biomechanics in sports is the identification of training for specific athletes. Different sports require different techniques and muscular activities. A physical education teacher or sports coach can map out training rules for their athletes according to their particular requirements.

Understanding of the Human Body: Anyone engaged in sports ought to be aware of how their bodies function, from the working of the central nervous system to the capacities and limitations of the bones and muscles. Without a background in biomechanics, knowledge will be incomplete and consequently, the training will be insufficient.

PRINCIPLES OF BIOMECHANICS

There are seven main principles of biomechanics. They are as follows:

1. **Stability:** If the base of the support increases, stability increases and vice versa. The heavier the object, the more is the stability.
2. **Maximum Effort:** The production of maximum force requires the use of all possible joint movements that contribute to the objective of given task.
3. **Maximum Velocity:** The production of maximum velocity needs the use of joints in the order from the largest to the smallest.
4. **Impulse:** It is a force or movement of energy that causes a reaction. Applied impulse is directly proportional to velocity.
5. **Reaction:** It is the resistance or opposition to a force, influence, or movement. Movement usually occurs in the direction opposite to that of the applied force.
6. **Torque:** Torque is the measure of the capacity of a force to turn a body. So, angular motion is produced by application of force acting at some distance from an axis by torque.
7. **Angular Momentum:** The quantity of rotation of a body, which is the product of its moment of inertia and its angular velocity is called angular momentum. When an athlete or an object is free in the air, the angular momentum is constant.

TYPES OF BODY MOVEMENTS (FLEXION, EXTENSION, ABDUCTION, ADDUCTION, ROTATION, CIRCUMDUCTION, SUPINATION AND PRONATION)

Movement is a change of place or location. We observe a variety of movements in our body. They are as follows:

Flexion

Flexion is a movement that decreases the angle between two body parts. For example, when the elbow flexes, the angle between the ulna and the humerus decreases. Similarly, the angle between the femur and the tibia decreases when the knee flexes. Flexion normally occurs in a sagittal plane on a frontal axis. The only exception is flexion of the thumb, which occurs in a frontal plane about a sagittal axis.

Extension

Unlike flexion, extension increases the angle between two body parts. When the elbow extends, the angle between the ulna and the humerus increases until an angle of 180° is reached and the arm becomes straight. Like flexion, extension also occurs in a sagittal plane on a frontal axis, save for extension of the thumb in which the reverse is true.

Figure 8.4 Flexion and extension

Abduction

Abduction is a movement in the frontal plane that takes the body part away from the midline or towards an imaginary centre line. Abduction of the forefinger and ring finger takes them away from the midline, which is the middle finger, to opposite sides.

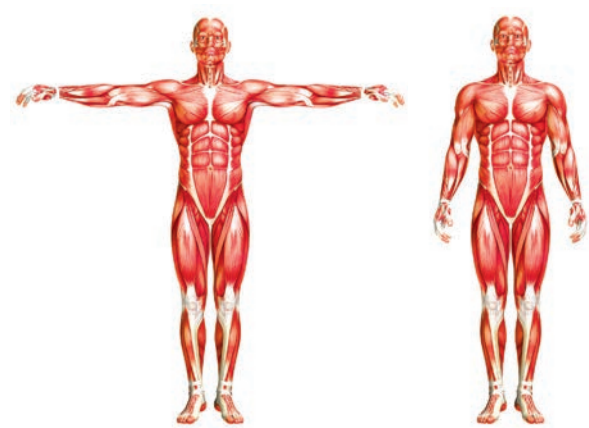


Figure 8.5 Abduction and adduction

Adduction

Adduction is a movement in the frontal plane that returns the body part to the midline or takes it away from the imaginary centre line. Adducting the fingers brings them together. Refer to Figure 8.5.

Though for biomechanics, it is simpler to explain gross movements in terms of single planes, in reality the motion is tri-planar or three-dimensional. For instance, walking is biomechanically described to occur in a sagittal plane. What actually happens during walking is flexion/extension of the hip in the sagittal plane, abduction/adduction of the hip in the frontal plane and internal/external rotation of the hip in the transverse plane. For the sake of convenience and simplicity, we usually describe gross movements in relation to the plane which dominates it.

Rotation

Rotation of body parts may be internal or external. Body parts can be rotated towards or away from the centre of the body. Internal rotation (or medial rotation) is the rotation towards the axis of the body. External rotation (or lateral rotation) is the rotation away from the centre of the body.

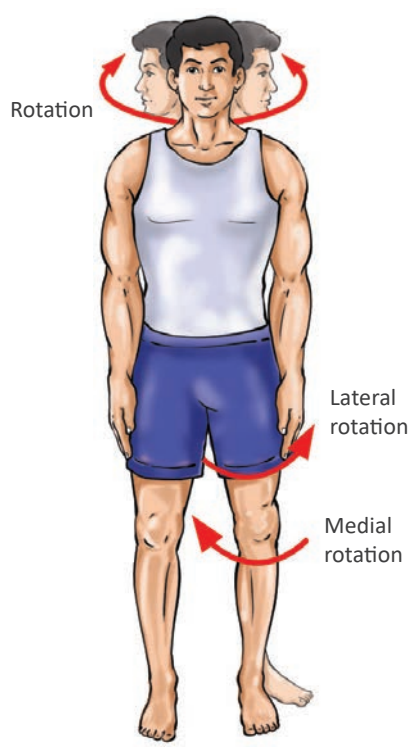


Figure 8.6 Rotation of the head, neck and lower limb

Circumduction

Circumduction is a conical movement of a body part, such as a ball and socket joint or the eye. This body movement is a combination of flexion, extension, adduction and abduction. Circumduction can be best performed at ball and socket joints, such as the hip and shoulder, but may also be performed by other parts of the body such as fingers, hands, feet and head.

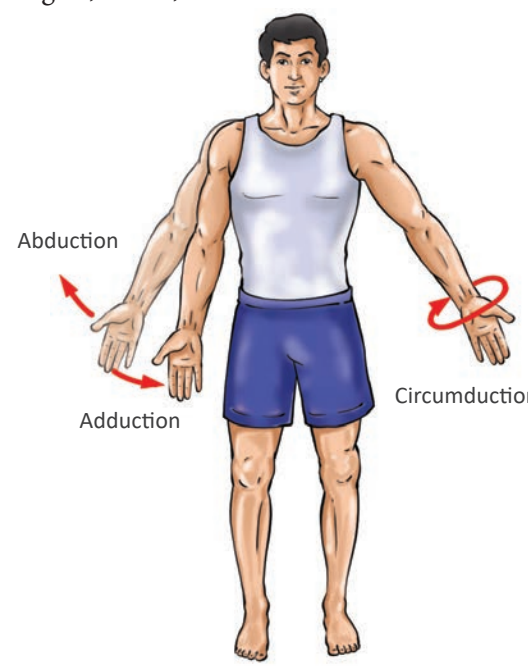


Figure 8.7 Angular movements: abduction, adduction and circumduction of the upper limb at the shoulder

Pronation and Supination

When a person is laying face-down on a surface, it is pronation. When a person is laying face-up on a surface, it is supination.

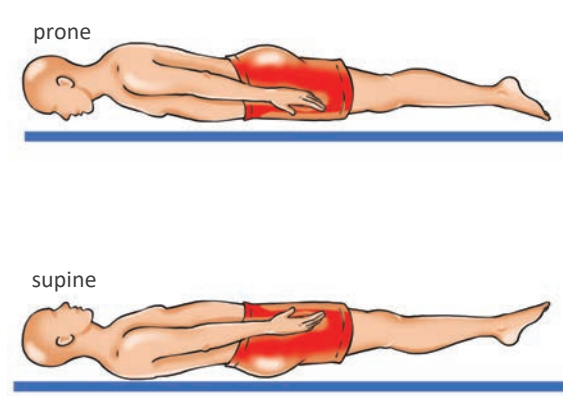


Figure 8.8 Pronation and supination

We generally use these two positions during yoga poses that involve lying. These two terms are also used in a specific sense referring to rotation of the forearm or foot so that in the standard anatomical position, the palm or sole is facing anteriorly (supination) or posteriorly (pronation). Pronation at the forearm is a rotational movement wherein the hand and upper arm are turned inwards. Pronation of the foot refers to turning of the sole outwards, so that the weight is borne on the medial part of the foot. Supination of the forearm occurs when the forearm or palm is rotated outwards. Supination of the foot refers to turning of the sole of the foot inwards, shifting weight to the lateral edge.

Positioning the hand in space is essential for grip, hand movement, and everyday functioning of the upper limb. The upper limb of the human being has developed and evolved immensely, and in addition to the elongated and opposable thumb, the ability to supinate and pronate gives the humans enormous mechanical advantage and enhanced functionality.

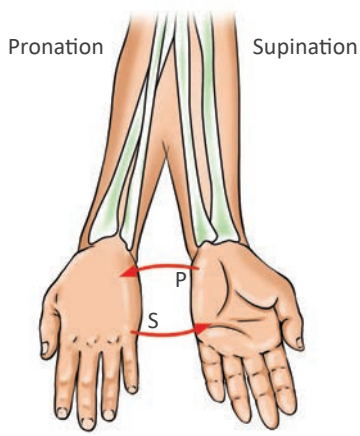


Figure 8.9 Hand position during pronation and supination

AXIS AND PLANE – CONCEPT AND ITS APPLICATION IN BODY MOVEMENTS

Now, we will learn about different axes and planes.

Axis

An axis is an imaginary straight line about which a body rotates. Movement at the joint takes place in a plane about an axis. There are three kinds of axis:

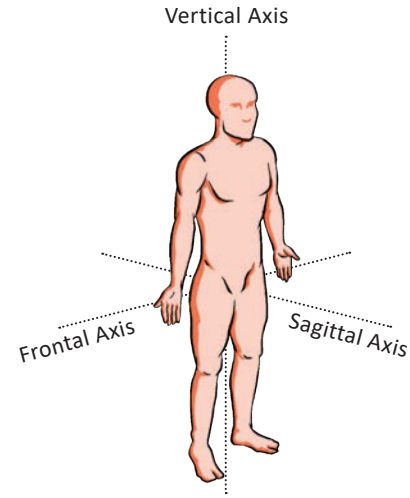


Figure 8.10 Various axes of human body

1. **Sagittal or Anteroposterior Axis:** It runs from the back to the front horizontally, and is formed by the intersection of the sagittal and transverse planes. It is perpendicular to the coronal plane.
2. **Frontal or Medio-lateral Axis:** It runs from the left to the right horizontally and is formed by the intersection of the frontal and transverse planes. It is perpendicular to the sagittal plane.
3. **Vertical or Longitudinal Axis:** It runs from the upper to the lower half vertically and is formed by the intersection of the sagittal and frontal planes. It is perpendicular to the transverse plane.

Plane

It shows the human body in its erect form, the hands slightly spread to the sides, palms facing forward (when the visual is frontal), legs together with the knees straight and feet resting on the ground with the toes pointed straight. This pose is also referred to as anatomical neutral, and the description of movements begins from it.

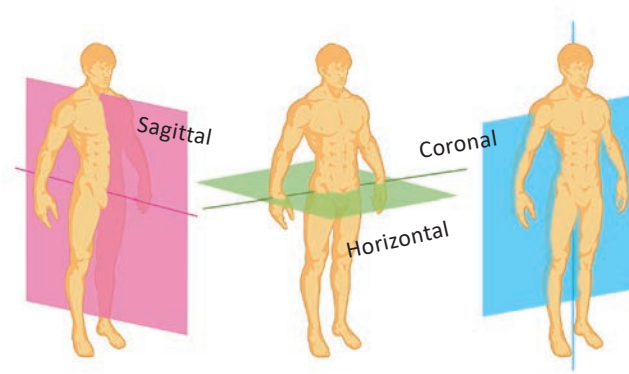


Figure 8.11 Various planes of human body

There are three planes that pass through the human body.

Sagittal Plane: This is a vertical plane that divides the body into two parts: a left part and a right part.

Coronal/Frontal Plane: This plane also runs vertically and separates the body into two halves: back half and front half.

Transverse or Horizontal Plane: This is a horizontal plane that divides the body into the superior and inferior halves.

EXERCISES

A. Objective Type/Multiple-Choice Questions

1 mark

I. Multiple-Choice Questions:

1. Which of the following outlines the importance of biomechanics in sports?
   (a) Improvement of training (b) Understanding of the human body
   (c) Development of new methods (d) **All of these**
2. Biomechanics helps in which of the following?
   (a) In improving technique (b) In improving designs of sports equipment
   (c) In improving performance (d) **All of these** **(CBSE 2020)**
3. Which one of the following is a correct term for flexion?
   (a) Turning (b) Twisting (c) **Bending** (d) Straightening
4. A decrease in the angle between the femur and the tibia because of the movement of the knee is an example of which type of movement?
   (a) **Flexion** (b) Extension (c) Abduction (d) Adduction
5. Circumduction is a ..... movement of a body part
   (a) vertical (b) **conical** (c) horizontal (d) none of these
6. What is the name of the plane which divides the body into left and right parts?
   (a) Vertical plane (b) Coronal plane (c) **Sagittal plane** (d) Transverse plane
7. Which of the following planes passes through the human body?
   (a) Sagittal (b) Coronal/frontal
   (c) Transverse or horizontal (d) **All of these**

II. Assertion-Reason Type Questions: CBQ

Given below are the two statements labelled Assertion (A) and Reason (R).

A: In sports, biomechanics has a crucial role both in injury prevention and enhancement of performance.

R: The laws of mechanics are applied to understand the activities and techniques of the players and the implications that mechanics have for human movements using quantitative data for its analysis, obtained through mathematical modelling, measurement, computer simulation, etc.

In the context of the two statements given above, which one of the following is correct?

(a) **Both (A) and (R) are true and (R) is the correct explanation of (A).**

(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

III. Match the following:

Match list – I with list – II and select the correct answer from the code given below:

List I – Motion	List II – Gross Movements
(a) Flexion	(1) Throwing
(b) Abduction	(2) Star jump
(c) Internal Rotation	(3) Walking
(d) Horizontal flexion	(4) Baseball swing

Select the correct set of options:

Code				
	(i)	(ii)	(iii)	**(iv)**
(a)	3	2	1	**3**
(b)	4	1	3	**2**
(c)	2	3	4	**1**
(d)	1	4	2	**4**

IV. Case-Based Questions: CBQ

Every sportsperson does at least one of the six types of body movements at a time when she/he engages in a game.

On the basis of the situation given, answer the following questions:

1. Which body part falls in the exception zone of flexion?

   (a) **Thumb** (b) Wrist (c) Knee (d) Elbow

2. When the sportsperson squats, which of the following movements will she/he be performing?

   (a) Internal rotation (b) **Extension** (c) Side flexion (d) Adduction

3. If a sportsperson flaps her/his arms to warm up, what sort of movement(s) is she/he performing?

   (a) Extension and Flexion (b) Extension and Adduction

   (c) Flexion and Abduction (d) **Abduction and Adduction**

B. Short Answer Type Questions — 2 marks

1. Define kinesiology.
2. Define biomechanics.
3. What is supination?

C. Short Answer Type Questions — 3 marks

1. What is the importance of kinesiology in physical education and sports? Write any three.
2. Differentiate between pronation and supination.

D. Long Answer Type Questions — 5 marks

1. Discuss the concept and application of kinesiology.
2. Discuss in detail the importance of biomechanics in sports.
3. Discuss any four major movements accomplished by the human body.

9 Psychology and Sports

TEAM COHESION AND SPORTS

Team cohesion may be defined as the degree to which players are driven to practise, compete as a team, and 'hang out' as part of a sports team.

Experts define team cohesion in the following manner:

"Team cohesion is a dynamic process of the tendency for a group to stick together and remain united to pursue instrumental objectives and satisfaction of member affective needs."

– Carron, Brawley and Widmeyer

"Not all are blessed with great ability, but with teamwork and perseverance, all can accomplish great things."

– M D Boyer

Team cohesiveness is linked to team performance, while team performance is linked to team cohesion. To put it another way, a more cohesive team is more likely to perform well, which leads to a more cohesive team. This idea is particularly essential for young athletes, since it is linked to sport enjoyment, continued participation and youth development.

It has two main aspects, including:

- **Task Cohesion:** It refers to a team's ability to work together to complete a task (for example, teamwork and task completion in sports, such as working together to win a championship).
- **Social Cohesion:** Social cohesiveness is a measure of a team's social cohesion (for example, social support and friendships outside of the sports).

Task cohesion is when a coach or a manager shares a set goal/objective with their team with a success criteria. On the other hand, social cohesion is how well a team interacts. Both operate independently of each other and it is important for sports coaches to be aware that these can vary.

For example, if a team is winning trophies then it has good task cohesion. However, if the players of the same team argue and do not like each other, then they have low social cohesion.

Figure 9.1 The ratio of We's to I's is the best indicator of the development of a team.

Why is Team Cohesion Useful?

Team cohesion is useful. It can improve performance and motivation of a team. If a team works together, it improves their team cohesion, thus, improves team's performance. This leads to personal satisfaction. So, improvement in team cohesion drives a team in an upward direction.

How to Develop Team Cohesion?

Team cohesion or group development usually follows a specific process. The most common model for explaining how individuals perform as a team was developed by B W Tuckman in 1965. According to this model, when forming a team/ group, individuals go through four main stages of team cohesion: They are as follows:

1. **Forming:** During the forming stage, the team members usually come together for the first time for the season. This is a learning period for old and new members, acquainting and reacquainting themselves with how the team functions, their roles within the team and the team goals.

   In order to facilitate this stage, coaches/ PE Teacher often set up time outside of practice for social activities such as movies, picnics and outings to other sporting events to allow the team members to get to know each other better.

This is also the time when coaches go over team rules, responsibilities, and roles within the team.

For example, for a swimming team, it is common for coaches to provide each athlete with a few guidelines/manual that outline(s) expectations and procedures. Additionally, activities such as participating in a ropes course or hosting a tea party are typical early-season functions. All of these strategies serve to facilitate the forming of a team.

2. **Storming:** The storming phase usually occurs a few weeks into the season. The happy days are over and now it is time to get down to work. This phase is characterised by conflict over who has control and infighting for status positions and the coach's attention.

   It is during the storming phase that those athletes with a poor work ethics and/or bad attitude emerge; personality and goal conflicts among team members also become apparent. While it seems like a counterproductive stage, keep in mind that the storming phase is inevitable and if channeled correctly can lead to effective team building. Coach's need to be watchful in identifying conflicts when they emerge and open up communication paths to resolve the conflict in a timely manner. Successful resolution can lead to increase in team member's self-esteem, respect for their teammates' similarities and differences, overall trust, and effectiveness in communication skill.

   Again, take the example of swimming. Storming on a swimming team is when Akash, a new swimmer, joins the team and immediately moves to the front of the lane. John, who led his lane all last season becomes frustrated and his attitude begins to affect the atmosphere in the lane. Covert infighting is bound to happen as John struggles to retain his status and control the lane. If approached carefully, this presents a perfect opportunity to teach John and Akash life skills and help them to develop more effective goals together.

3. **Norming:** This is the calm after the storm. Norming is the period after storming where the team has come to a consensus about what is acceptable and what is not acceptable. Goals, objectives and expectations have been clearly defined by the coach/PE teacher and the athletes. The respect they gain for their teammate's unique contribution to the team is the most important realisation the athletes come to during the norming phase.

   Apply it to swimming. During the norming phase, John gains respect for Akash's abilities and now realises that Akash helps push him in practice, which will only make him a better swimmer.

4. **Performing:** The performing stage is similar to the peak at the end of the season. During this stage, there is a close bond among the team members and a general want for one another to succeed. The team members begin to truly value each individual's contribution and the relationships are secure within the team. The group is finally acting as a confident cohesive unit. In this final stage, the team should be able to combine efforts towards the team goals.

   Again in swimming, we often see the performing stage in action at regional or national level competitions. A team goal may be to have 75 per cent of the athletes' swim as personal best. In support of this goal, whenever a team member is on the blocks, the team supports her/him with a cheer. This is a great motivation for the team member to swim fast.

How to Improve Team Cohesion?

The coach or the team manager is responsible for developing and improving her/his team's cohesion.

Below are a few recommendations on how to improve the cohesion of a team.

1. The coach or the team manager should set clear goals for the team to achieve. For example, this could be to reach mid-table by the end of the season or to concede no more than 20 goals in a season.
2. The coach or the team manager should set goals for each individual in her/his team. To ensure all team members feel valued, it is recommended to meet all the team first to decide the team goals. This improves the internal motivation of the team and individuals within the team.

3. The coach or the team manager should provide feedback to the players as well as to the team as a whole. She/he should regularly ask for opinions of the players and listen to any suggestions from them. This will again make them feel valued. However, she/he should give any critical feedback to any player privately.

EXERCISES

A. Objective Type/Multiple-Choice Questions

1 mark

I. **Multiple-Choice Questions:**

1. Which of the following is/ are an area/s of team cohesion?

   I. Logical cohesion II. Task cohesion III. Social cohesion

   Now choose the correct answer:

   (a) Only I (b) Only II (c) I and II (d) **II and III**

2. During which stage of team cohesion, there is a close bond among the team members and a general want for one another to succeed?

   (a) Forming (b) Storming (c) Norming (d) **Performing**

B. Short Answer Type Questions

2 marks

1. What is team cohesion?
2. What is task cohesion?
3. What is social cohesion?

C. Short Answer Type Questions

3 marks

1. How is team cohesion useful for a team?
2. What is storming stage in team cohesion?

D. Long Answer Type Questions

5 marks

1. What are the ways to improve team cohesion?
2. Describe the various stages of team cohesion?

10 Training and Doping in Sports

TRAINING LOAD: OVERLOAD, ADAPTATION AND RECOVERY

Training Load

Load is a key consideration in sports training. Efforts should be made to complete job with the least amount of effort feasible. The term 'load' is defined as the amount of work that a person's body does. It is also known as training load. It is the physiological and psychological pressure placed on individuals by subjecting them to exercise in order to enhance and elevate their capabilities during performance.

Overload

Load is distributed to athletes according to their capabilities during training. When this burden

exceeds an individual's capabilities, physiological and psychological systems are disrupted. Though the additional load has no immediate effect on the athlete, if the overload is applied for an extended length of time, the athlete's performance will suffer.

The symptoms of overload include:

Psychological Symptoms

1. Increased irritability and a tendency to lash out at others.
2. Tendency to withdraw into oneself and avoid the company of coaches and fellow trainees.
3. Oversensitivity to criticism.
4. Laziness towards learning and working.
5. Hallucination, anxiety, depression, melancholia, insecurity.
6. Decreased self-esteem and motivation.
7. Inability to focus.

Symptoms Manifesting in Performance

1. **Movement Coordination:** Lack of rhythm and flow in movement, slowness in correction and differentiation, inability to focus, tense movements, re-occurrence of previously corrected error, and tendency to make technical errors.
2. **Competitive Qualities:** A new-found fear of competitions and subsequent decrease in preparation, lack of interest in wanting to perform well and win.
3. **Physiological Systems:** Decreased appetite, insomnia, poor digestion, loss of weight, dizziness, night sweats, increased rate of respiration, weakening of muscular strength and joint aches.

Adaptation

The adjustment of physical and psychological functioning systems to the training load is referred to as adaptation. Adapting to a load leads to an increase in performance capacity. As a result of the adaptation process, a sportsperson might improve her/his performance. The adaptation process necessitates that a sportsperson trains consistently. The adaptation process will be accelerated if a sportsperson is exposed to new and unfamiliar load in a systematic and organised manner. It usually requires 4–6 weeks for adaptation to take place. Adaptation happens after the completion of the training session during the recovery period.

Recovery

Simply said, it is the time to recover body damage induced by training or competition. This entails restoring the following:

- Enzymes that produce energy within muscle fibres.
- Muscle cell carbohydrate storage.
- Immunological and endocrine systems.

Muscles should increase protein content in their general structure during recovery to improve strength, refill and increase energy stores, and raise enzyme amounts to improve lactate threshold.

Process of Stimulus – Recovery and Adaptation

Our body goes through various changes. To catch up with these changes, the body adapts itself. This happens frequently during our lifetime. Living cells are capable of accomplishing these adaptations. We all know that every living organism is made up of tiny living cells and each type of cell or a group of cells functions differently. Adaptation also occurs in sports training. Training load plays an important role in sports training because it boosts performance. It should be raised after every adaptation if we wish to improve our performance. Otherwise, the performance will remain the same.

When the body is stimulated with a new load, it will react by adapting itself to the new load. At first, there will be exhaustion but when the loading ceases, it will recover and adapt to that load. Consequently, the body not only resumes its former health status, but also becomes more enhanced. Thus, a sportsperson can improve her/his abilities and performance through overloading because the body puts extra effort to adjust to the new load. If the training load is very small, there will be little or no adaptation at all. If it is exceedingly hard, the body will have difficulty in recovering and cannot regain its former self over training health status. This is termed as overtraining.

DOPING AND ITS DISADVANTAGES

The use of forbidden chemicals in competitive sports is referred to as 'doping'. Another word for

medications used by athletes to increase their sports performance is performance enhancing drugs (PEDs). Due to their performance-enhancing qualities, certain substances are prohibited both in and out of competition, while others are prohibited solely during competition. Another argument for drug prohibition is their capacity to hide the presence of another forbidden substance during testing.

Each organisation has its own list of chemicals that are prohibited. WADA is the world's largest anti-doping agency. WADA has created a global anti-doping programme that applies to all sports that have made a promise to follow the WADA Code. "Anti-doping policies, rules, and regulations among sport organisations and among public authorities across the world" are outlined in the WADA Code.

Disadvantages of Doping

The fact that many of these drugs can have dangerous and long-lasting negative effects is the most crucial reason why doping is such a major deal:

- Cardiovascular: arrhythmia, high blood pressure, heart attack, and sudden death, etc.
- Insomnia, anxiety, sadness, aggressive behaviour, headache, addiction with withdrawal, psychosis, tremor, dizziness, and stroke are all symptoms of the central nervous system.
- Sinusitis, nosebleeds, and other respiratory issues
- Infertility, gynecomastia (enlarged breasts), decreased testicular size, acromegaly (coarse bones in the face, hands and feet), and cancer are all hormonal issues.

EXERCISES

A. Objective Type/Multiple-Choice Questions — 1 mark

I. **Multiple-Choice Questions:**

1. Which of the following is not a symptom of overload?
   (a) **Increase in the interest in sports** (b) Loss of concentration
   (c) Lack of desire (d) Sleep disturbance
2. How much time does it usually take for adaptation during sports training?
   (a) 24 hours (b) One week
   (c) **Four to six weeks** (d) Six months

B. Short Answer Type Questions — 2 marks

1. What do you mean by training load?
2. Define adaptation.
3. Define recovery.

C. Short Answer Type Questions — 3 marks

1. What is the meaning of overload?
2. List the performance related symptoms of overload.

D. Long Answer Type Questions — 5 marks

1. Briefly discuss the relationship between recovery and adaptation.
2. What is doping? What are its disadvantages?

Note: Answers of all MCQs are highlighted in **bold**.