

PHYSICAL EDUCATION



BIOMECHANICS & SPORTS

Meaning

Biomechanics is the science concerned with the analysis of the mechanics of human movement. It explains how and why the human body moves.

It is the study of the function and motion of the mechanical aspects of biological systems.

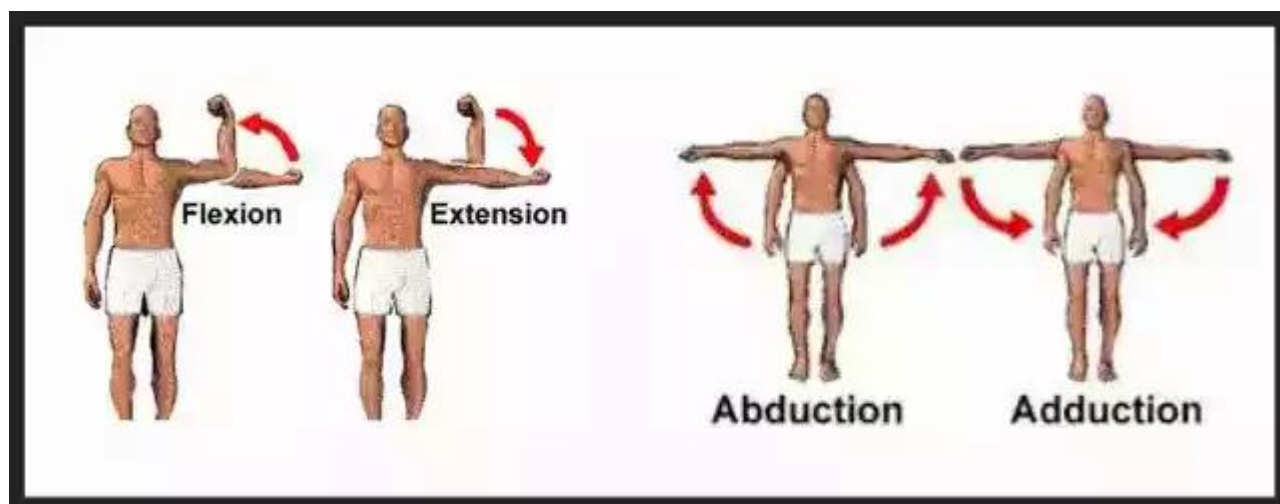
Biomechanics tells us how our muscles, bones, tendons, and ligaments work together to produce movement.

It gives us a detailed analysis of any sport movements, which helps to minimise the risk of injury and improve sports performance.

Importance Of Biomechanics In Sports:

- **Improves sports performance:** Biomechanics tell us the right techniques for effective and efficient results by using minimum muscular force and gets maximum results.
- **Improvement in technique:** Biomechanics helps to improve new techniques, which helps us to get more results.
- **Helps to develop best sports equipment:** Biomechanics helps us to make correct and scientifically proven equipment.
- **Improvement in training:** Coaches can give best training to athletes on the basis of scientific knowledge. He can analyse the player's movement in a better way.
- **Prevents injuries:** It helps us to know the forces that can lead to the injuries during the game situation.
- **Knowledge of safety principles:** Biomechanics gives the understanding to analyse different safety movements.
- **Helps in research work:** It helps to impart scientific teaching and learning processes.
- **Creates confidence in players:** Players come to know correct techniques to execute the movement. Thus, it improves the confidence of the player.

Types Of Movements



Flexion

It describes a bending movement that decreases the angle between two body parts, that is bones of the limb at a joint. Flexion refers to movement in the anterior direction.

It happens when muscles contract and move your bones and joints.

Example: Elbow flexion is decreasing the angle between the radius and the humerus. Knee flexion is decreasing the angle between the femur and tibia.

Flexion of the shoulder or hips refers to movement of arm or leg forward.

Extension

It is the opposite of flexion; it is a movement that increases the angle between two body parts.

Extension refers to movement in the posterior direction.

Extension at the elbow is to increase the angle between the ulna and the humerus. Extension of the knee is to increase the angle between the tibia and the femur.

Abduction

Abduction is a movement that pulls a structure or part away from the midline of the body. The muscles which create this type of motion is known as abductor.

Abduction of the wrist is also known as radial deviation.

Swinging the arms laterally from the side of the body up to the shoulder or moving the legs away from midline is abduction are some examples.

Adduction

It refers to the movement that pulls a part towards the midline. When the arms straight out at the shoulders brings down to their sides is adduction.

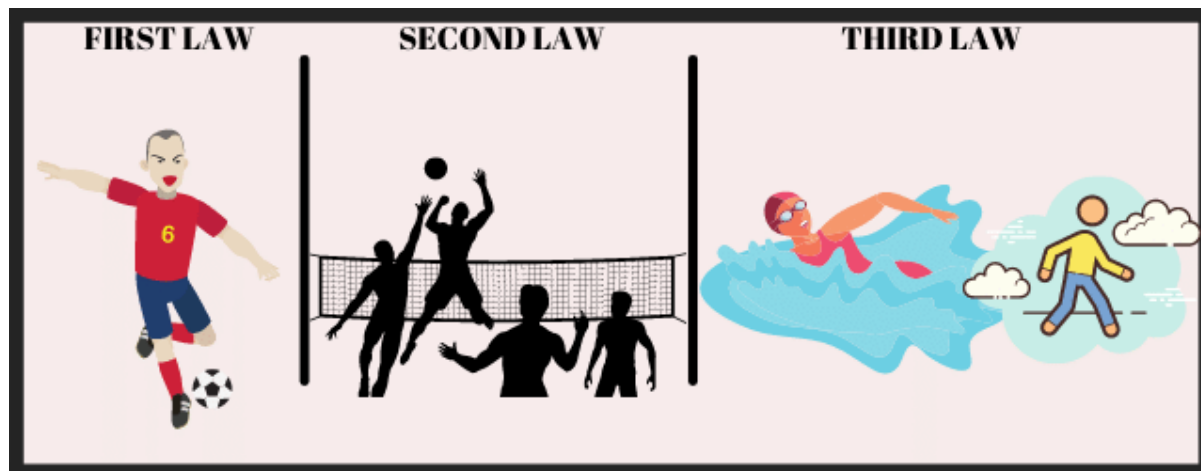
Arms closing towards the chest, bringing the knees together, bringing all the fingers or toes together, thumb back to the normal position are some of the examples of adduction.

Newton's Law of Motion

Application In Sports

Man is said to be the man of action. So, movements are involved everywhere. For every moment there is motion. Therefore, everything that moves is governed by the 'Laws of motion'.

These laws of motion formulated by Sir Isaac Newton in 1687. He explained and investigated that every motion is under the impact of following laws of motion



Less expensive.

First Law of motion

First law is also named as Law of Inertia. This law states that an object at rest will remain at rest or an object in motion will remain at motion at constant velocity unless acted upon by external force.

In other word an object will remain in stationary position or remain in movement unless external force is applied to move or stop.

Application in Sports

A football placed at penalty point will remain at rest unless a player kicks the ball to score a goal, Or that same football will continue to move at a constant velocity unless a force acts on it to slow it down (e.g. wind resistance) or change its direction (e.g. gravity).

Second Law of Motion

Second Law of motion is also named as the 'Law of Acceleration'. According to this law the rate of change in velocity of an object is directly proportional to the force applied and inversely proportional to the mass of the body.

The greater the force applied the faster is the velocity and more is displacement. If less force is applied than the displacement and acceleration is also less

If unequal forces are applied to objects of equal mass the greater force will cause more acceleration. If equal forces are applied to objects on unequal mass, the object with mass, have less acceleration

Application in Sports

A Volleyball player pushes the ball slowly for a drop, whereas hits the ball hard for a smash.

Thus, drop is slow because there is less force applied, whereas smash is very fast as there is great force applied.

In the shot-put event a player who exerts more force and tosses the shot put at the correct angle has greater displacement.

Third Law of Motion

This law is also known as 'Law of Action and Reaction'

This law states that for every action there is an equal and opposite reaction.

Application in Sports:

In swimming if a swimmer pushes the water backward, in return he is pushed forward by the water.

When a person walks, he presses the ground in the backward direction and the ground pushes him in the forward direction with an equal force.

Friction & Sports

Friction is a force resisting the relative motion of solid surface, fluid layers and material elements sliding against each other. It generally creates obstruction to moving object.

It is created whenever two surfaces move or try to move across each other. It opposes the motion of one surface across another surface.

Friction depends on the texture of both surfaces and on the amount of contact force pushing the two surface together.

Types of Friction

There are two types of friction:

- i. **Static Friction:** It occurs when a body is forced to move along a surface but movement does not start. This friction is present between two or more solid objects that are not moving relative to each other.

Without static friction your feet would sleep out and it makes it difficult to walk.

- ii. **Dynamic/kinetic friction:** It occurs when two objects are moving relative to each other and work together. Further it is of two types
- iii. **Sliding Friction:** It is a kind of friction which acts on the object when it slides or rub over the surface. It is weaker than static friction. Sliding friction causes wear and tear
- iv. **Rolling friction:** It is a force that slows down the motion of a rolling object. It acts on objects when they are rolling over a surface.

Advantages of friction:

- **It helps to move:** Frictional force helps to move the object, e.g. running, walking with friction of feet and surface.
- **Stop the moving object:** It helps to stop the moving object by friction
- **Hold or grip object:** With the help of friction our fingers and palm enable us to grasp and hold objects.
- **Keep the objects at its position:** Friction can hold the object at its position.
- Disadvantages of friction
- **Makes movement difficult:** Friction can make the movement difficult. For example, excess friction can make a box difficult to slide on the floor.
- **Waste of energy:** Excess friction means extra energy, so extra energy is wasted because of friction.