

Chapter-10

Biomechanics and Sports Important Questions

VERY SHORT ANSWER TYPE QUESTION (1 MARK EACH)

Q1. Define trajectory?

Ans. The flight path followed by a projectile is called it's trajectory.

Q2. What do you mean by sport biomechanics?

Ans. Sport biomechanics is the study of forces and stresses of human movements & their effects, athletics performance and safety.

Q3. What is power?

Ans. The rate of doing work or using energy is called Power.

$$Power = \frac{\text{work done}}{\text{time taken to do work}}$$

Q4. Define Work?

Ans. Work refers to an activity involving a force and the movement in the direction of the force. It can also be defined as the work done by a constant force as the product of force and the distance moved in the direction of the force.

Work Done = Constant force × Distance moved in the direction of the force

Q5. Explain Gravity?

Ans. Gravity is the force of attraction exerted by the earth towards it's centre on a body or an object.



Q6. What is Air-resistance?

Ans. When a projectile moves through the air, it is slow down by air-resistance.

Q7. Define velocity?

Ans. The distance covered by an object per unit time is called velocity.



Chapter-10

Biomechanics and Sports

Important Questions

SHORT ANSWER TYPE QUESTION (80 TO 90 WORDS) -

(3 MARKS EACH)

Q1. What is Energy? Explain about Kinetic & Potential Energy?

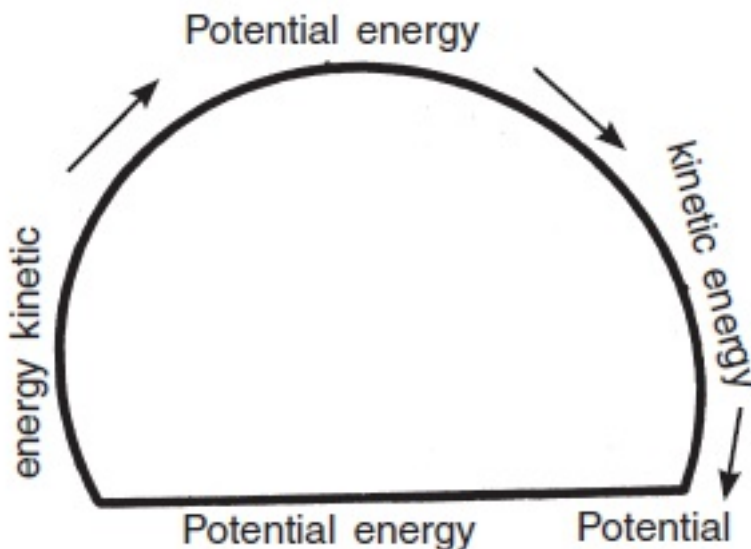
Ans. The Energy is the capacity to do work. There are various forms of energy.

Kinetic Energy:- It is defined as energy possessed by a body as a result of motion. It is called

as—Kinetic energy = $\frac{1}{2} \text{ mass} \times \text{velocity}^2 \left(\frac{1}{2}mv^2 \right)$

Potential Energy:- It is energy which is stored up in a body because of its position.

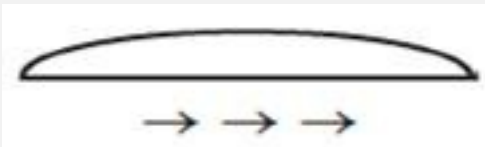
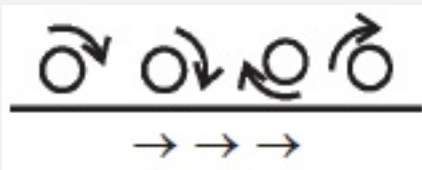
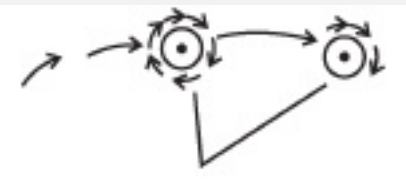
Potential Energy = mass × gravitational force × height of the body from ground (mgh)



Q2. Differentiate between Linear and Angular Motion?

Ans. Motions(Momentum) means a Change of position of a body and consists of the upsetting the equilibrium of a body.



LINEAR MOTION	ANGULAR MOTION
When a body moves in a straight line, one point to other in the same linear motion	When a body rotates it turns about from an axis, this rotation of the body in direction, is called angular motion.
	
Linear motion is measure in feet, Meters, KM etc.	It is measure in degrees. 
Linear motion is of two types:	Angular motion is of two types:-
Curvy linear motion- It is used When body travel on a curve path.  Rotary motion is the movement which occurs when the axis of the body fixed, to the move around that particular point when the force is applied to it. 	Visible Axis- It is that type which can See for example- hands of a clock.  Invisible- An imaginary axis is that which cannot be seen. The axis is the causing centre of the gravity of the body. Example- A ball rotated in the air. 

Q3. What is Friction ? Discuss various types of Friction.

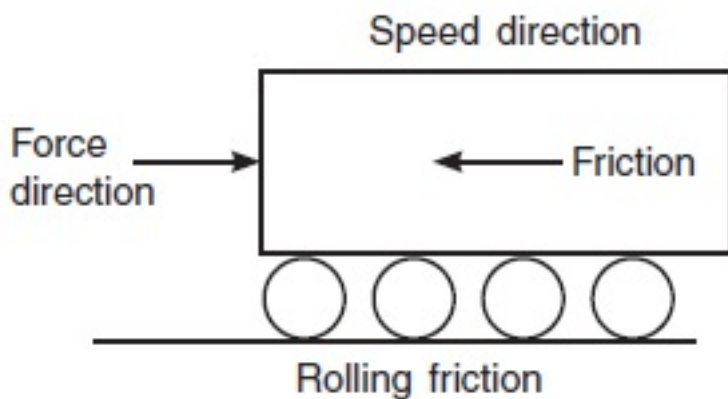
Ans. Friction is the force that combats relative motion between the two surfaces that come in contact. Friction always acts in the opposite direction of the applied force. Friction can be of following types:-

Static friction:-the opposite force that comes into play when one body tends to move over

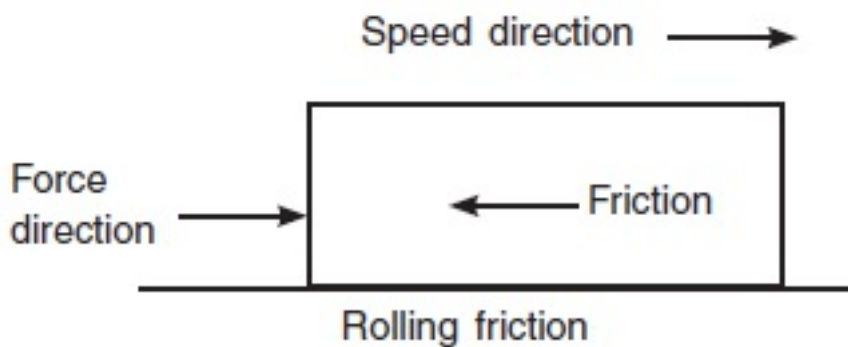
the surface of another, but the actual motion has not yet started.

Dynamic friction:-the opposing force that comes into play when one body is actually moving over the surface of another body. Dynamic friction may be of two types.

Rolling friction:-the opposing force that comes into play when body is actually rolling over the surface of another body. For example, hockey/ cricket ball is hit.



Sliding friction:- The opposing force that comes into play when one body is actually sliding over the surface of the other body. For example- Ice skating.



Q4. Difference between Running and walking?

Ans.-

Running	Walking
Running is a process, in which both feet are off the ground.	-Walking is a process, in which least one part of body (foot) remains in contact with the ground.

There is double swing phase and whereas swing phase is longer.	-There is longer stance phase the swing phase is shorter.
-The linear and angular velocity lower limbs is faster.	-The linear and angular velocity of lower of limbs is slower.
-Running require greater range of motion.	-Walking requires lesser range of motion.

Q5. Is friction advantageous or disadvantageous in the field of games and sports? Give your comments with examples.

Ans. Friction is usually called necessary evil. It means it is essential in the life and we cannot do any work without it.

Advantages of friction	Disadvantages of friction
a. Keeps the object at position: By objects can be placed at position and shaped.	a. Wear and tear of object:- Due to friction the there is wear and tear of object. Lubrication is used to allow the parts to move easier, moreover, prevents wear and tear.
b. Helps to move:- Frictional forces extra energy thus energy is It helps and running, walking. With Friction of feet/shoes on the surface helps to speed. Frictional force helps to move the object in the speed. For example:- Spikes are used by the athletes to run fast.	b. Wastage of Energy:- Excess of means friction, helps to move the object being wasted.
c. Hold and grip of an object:-with the help of friction the ridges of skin of our	c. Slower down the speed:- In the roller



fingers and palm enable us to grab and hold objects. For example:- in badminton the players use grip to hold it.	sketting, Rolling shoes and smooth surface are used to minimize friction.
d. Produce heat:- The law of conservation of energy states that the amount of energy remains constant. Thus, the energy is lost due to friction in trying to move and object is really turned into energy.	d. Makes movement difficult:- Friction can makes the job more difficult when one has to move the object. Excess friction can make it difficult to slide a box across the heat floor, walk through deep snow.



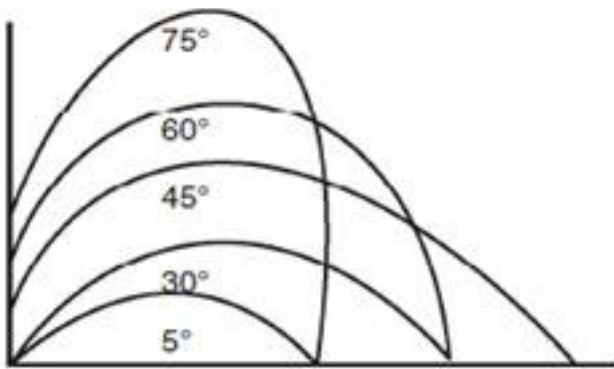
LONG ANSWER TYPE QUESTION (5 MARKS EACH)

Q1. What is Projectile? Explain the factors affecting projectile trajectory?

Ans. Projectile:- An object thrown into the space either horizontally or an acute angle under the action of gravity is called a projectile. There are forces which act on a projectile gravitational force and air resistance.

Air resistance of an object varies greatly and it depends on the object's particular shape and the atmospheric conditions in which the object is released.

The factors affecting Projectile



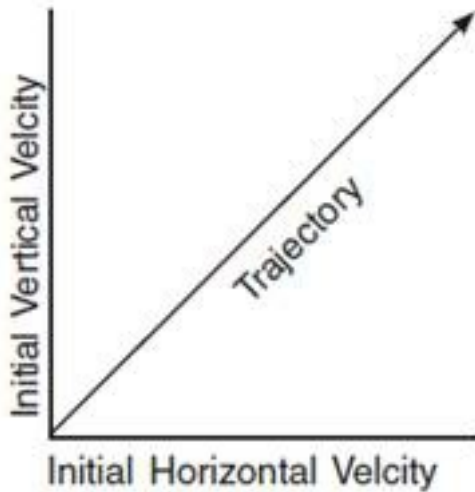
Trajectory are mentioned below.

a. **Angle of projection:-** An object which is projected at different angles covers different distances. When it is projected or released at angle of 30, making it a parabolic path and covers lesser distance. When it is projected at 60, it covers a distance less than 30. When it is released at an angle of 45, makes a parabolic path and covers maximum distance. So the distance covered by an object (short-put, hammer, javeline, discus etc. depends on the angle of release of projectile)

b. **Height of release:-** The higher the level of release, the greater distance is covered in flight,

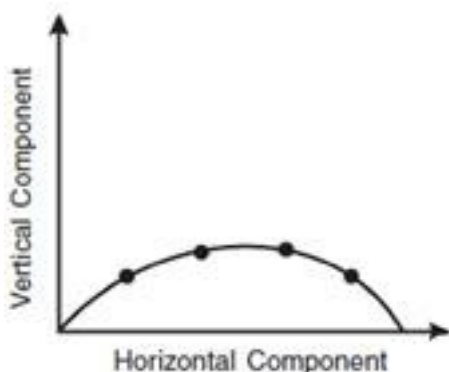
this is because the higher projectile is released. The longer it will be in the air. The horizontal component will be acting on the projectile for longer.

c. **Speed of release (initial velocity):-** The speed or velocity is directly related to the distance covered in flight. The speed of release depends on initial vertical



velocity and initial horizontal velocity. Having higher horizontal velocity will increase the length of flight time and therefore the distance covered. This would be an advantage in sports which primarily requires good distance in long jump, sky jump etc.

d. **Gravity:-** gravity acts on a body or object to give it mass. The greater the weight of an object, the greater the influence of gravity upon it. Gravity will effect a projectile as well as it will decrease the height, the projectile can obtain. For example:-a cricket ball can be thrown at greater distance in comparison to shotput.



e. **Air Resistance:-** When a projectile moves through the air, it is slow down by an air resistance. Air resistance decreases the horizontal component of a projectile. The effect of air resistance is very small but it need to be taken into consideration if you want to increase the

horizontal components of a projectile. The factors are related to the amount of air resistance acting on a projectile-mass, surface of the object, surface of the volume ratio. Trajectory
Initial Horizontal Velocity Vertical Component Initial Vertical Velocity Horizontal Component

f. **Spin**:- The amount and direction of spin acting on a projectile will directly effect the distance while travel.

The main reason behind this fact is the air pressure acting on the object.

Q2. Discuss the mechanical analysis of walking in details?

Ans. Mechanical analysis of walking can be studied in two fields

Stance phaser:- Stance phase is the time, when the foot is on the ground. It is considered that it consists of maximum percentage of walking cycle. For the part of stance phase, both the feet have a contact with the ground for a period of time. The stance phase of walking is divided into five stages.

·**Heel Strike** - This stage begins when the feet first touches the ground and continuous until the complete foot is on the ground i.e. early flat foot stage.

·**Early Flat Foot** - The starting of this stage is that movement when the complete foot is on the ground and early flat foot stage occurs when the body's centre of gravity passes over the top of the foot. The centre of gravity of the body is located approx. In the palvic area of the lower spine while walking. The main purpose of this stage is to allow the foot to act as a shock absorber.

·**Late Flat Foot** - An athlete comes into late flat foot stage when his body's centre of gravity passes in front of ' neutral position. This stage lasts when the heel lifts off the ground. During this stage the foot needs to go from being a shock absorber to being a rigid lever which can help to prople the body in forward direction.

·**Heel Rise** - This stage starts when the heel begins to leave the ground. The foot functions are a rigid lever to move the body in forward direction. During this stage of walking, the ground forces that go through the foot are very efficient. -Toe off-this stage begins when the toes leave the ground completely. This stage continues until the beginning of swing phase.



Swing Phase:-It occurs when one foot is on the ground and other one is in the air. Swing phase in walking is shorter than The stance phase. It is divided into three phases

Initial swings:- This phase sees the hip extended to 10o and then going onto flexion and knee flexed to 40-60o and the Ankle changing it's position from the flexion to neutral.

Mid swing:- This phase sees the hip extended to 30o, the knee flexion till 60o and extended approx to 30o and ankle become dorsiflexed.

Terminal Swing:-This phase is the hip flexed till 30o and the knee is locked extension and foot changes its position from Dorsiflexed to neutral.

Q3. What are the different phases of running cycle?

Ans. Running is an essential part of living beings. Running is important in sports also. A good runner will not only be able to defeat it's opponents in running, but would also be able to gain very good takeoff velocity that would help to take a higher or longer jump.

Different phases of running are mentioned below.

Running style/ Phases	Sprinting	Fast Running	Jogging
Initial Contact	This phase sees the front Of the foot of the sprinter making contact with the ground. Their heel might or might not touch the ground later depending on their personal running Technique.	This phase sees the Middle of the foot or Heel of the fast Runner make contact with the ground.	This phase the full foot or the heel of the jogger make contact with the ground.
	This phase is very quick and the sprinter's foot is	This phase is very Quick and the fast Runner will spend	In comparison to sprinters and the fast runners who use their feet and

Mid-Stance	usually in the same position as in the phase of the initial contact.	This phase in mid-Stance as he pushes through with this foot.	ankle to move into the next phase, Joggers tend to move their Centre of gravity forward to do the same.
Proplulsion	This phase see the hips of The sprinter extending Back ready to propel him Forward to take-off. His Arms simultaneously swing at full power to help him.	The fast runner Receives propulsion Through the big toe With his hips extended back and knee Slightly bent.	The jogger will receive Propulsion through the big toe. But if the hips of the jogger are not fully extended back, then the Propulsion is received from the other toes. The Arms of the jogger only move a small amount.
Swing	The non-supporting leg of The sprinter swings high With the knee at almost At an angle of 90° .	The knee of the Supporting leg of The fast runner will Be lifted, although Not not as high as That of a sprinter.	The knee of your non-supporting leg of the jogger remains low and only slightly bent.

