

**Question 1 :** What is the difference between axis and plane?

**Answer :** An axis is an imaginary line about which the body or limb rotates. A plane is an imaginary flat surface along which a movement takes place.

**Question 2 :** Elucidate projectile motion.

**Answer :** It refers to the motion of an object projected into the air at an angle.

**Question 3 :** An object thrown into the space either horizontally or at an acute angle under the action of gravity is called a projectile. Name the two forces which act on a projectile.

**Answer :** The two forces that act on a projectile are propelling force and force of gravity.

**Question 4 :** What is the first law of Newton?

**Answer :** This law states that a body at rest will remain at rest and a body in motion will remain in motion at the same speed and in the same direction till any external force is applied on it to change state.

**Question 5 :** Explain, what is 'dynamic friction'?

**Answer :** Dynamic friction is the opposing force that comes into play when one body is actually over the surface of another body. Dynamic friction may be of two types, i.e. sliding friction and rolling friction.

**Question 6 :** Enlist the methods of reducing friction.

**Answer :** Methods of reducing friction are:

- i) Polishing
- ii) Lubrication
- iii) Use of ball bearings
- iv) Streamlining

### **3 Marks Questions**

**Question 7 :** What is axis? What are its types?

**Answer :** An axis is an imaginary line about which the body (or limb) rotates. It can be divided in three parts.

- i) **Frontal Horizontal Axis :** Axis of the body that passes horizontally from side to side at right angles to the sagittal plane.

ii) **Vertical Axis** : Axis of the body that passes from head to foot at right angles to the transverse plane.

iii) **Sagittal Horizontal Axis** : Axis of the body that passes from front to rear lying at right angles to the frontal plane.

**Question 8** : What do you mean by plane? Explain its types.

**Answer** : A plane is an imaginary flat surface along which a movement takes place. It can be divided into three parts as follows:

i) **Sagittal Plane** : A vertical plane of the body which passes from front to rear dividing the body into two symmetrical halves.

ii) **Transverse Plane** : Any horizontal plane of the body which is parallel to the diaphragm, also called the horizontal plane.

iii) **Frontal Plane** : Plane of the body which passes from side to side at right angles to the sagittal plane; also called the coronal plane.

**Question 9** : Enumerate the laws of motion.

**Answer** : The three laws of motion are:

i) **Newton's First Law of Motion** : This law is also known as the law of inertia. This law states that a body at rest will remain at rest and a body in motion will remain in motion at the same speed and in the same direction till any external force is applied on it to change its state.

ii) **Newton's Second Law of Motion** : This law states that the acceleration of an object is directly proportional to the force producing it and inversely proportional to its mass.

$$a = F/m$$

iii) **Newton's Third Law of Motion** : This law states that to every action, there is always an equal and opposite reaction. This law describes what happens to a body when it exerts a force on another body.

**Question 10** : How Newton's second law and third law of motion can be applied in sports.

**Answer : Second Law** : If a baseball player hits a ball with double the force, the rate at which the ball will accelerate (speed up) will be doubled. Football players can slow down, stop, or reverse the direction of other players depending upon how much force they can generate and in which direction.

**Third Law** : A swimmer propels herself through the water because the water offers enough counter force to oppose the action of her hands pushing, allowing her to move. An athlete can jump higher off a solid surface because it opposes his body with as much force as he is able to generate, in contrast to sand or other unstable surface.

**Question 11:** “Friction is a necessary evil.” Justify your answer with suitable examples from sport.

**Answer :** Friction is usually called a necessary evil. It means that it is essential in games and sports. Without friction, we cannot give a better performance in the field of sports.

Examples are spikes used by athletes for running and studs used in football boots of the players. However, friction has disadvantages also. In cycling, there should not be more friction between road and the tyres of the cycle.

## 5 Marks Questions

Question 12 : Describe different types of movements.

Answer : Physical activity is made possible by movements and motions. Every movement takes place in one plane and around one axis.

They are categorised by movement type as follows:

- i) **Flexion** : It takes place when the angle decreases between the two bones attached to a joint.
- ii) **Extension** : It takes place when the angle between the two bones attached to a joint increases. Both flexion and extension occur in the sagittal plane about the frontal axis.
- iii) **Adduction** : It is a movement laterally toward the middle of the body.
- iv) **Abduction** : It is a movement laterally away from the middle of the body.

Both adduction and abduction occur in the frontal plane about the sagittal axis.

**Question 13 :** What are the major muscles that we use while we run?

**Answer :** Following are the four muscles that we use while we run:

i) **Quads (Quadriceps Femoris) :** Quads are muscle groups of four basic muscles located on our front thighs. They are:

- The rectus femoris
- The vastus medialis
- The vastus lateralis
- The vastus intermedius

Our quads are responsible for moving two of the joints used in running, our knee joint and our hip joint. They work together to straighten our knees and bend our hips.

ii) **Quads (Quadriceps Femoris) :** Our hamstrings are made up of four muscle-parts on the back of your thighs. These are known as:

- The semitendinosus
- The semimembranosus
- The biceps femoris

These four parts of our hamstrings allow us to flex our knees. The semitendinosus, semimembranosus and the long head biceps femoris work together to extend the hips.

iii) **Hip Flexors (Iliopsoas)** : Our hip flexors (or iliopsoas), like our quads, is comprised of a muscle group of two muscles:

- The iliacus
- The psoas major

To our right, the shorter muscle, the iliacus, begins on our pelvic crest (the iliac fossa) and stretches over to our thigh bone (femur). The larger of the muscles, the psoas major, stretches from our T-12 spinal vertebrae to our L-5 spinal vertebrae and there attaches to the femur. These two muscles work together to help our hips flex.

iv) **Calf Muscles** : Our calf muscles are located on the back of our leg, below our knee. Though many anatomists see the calf muscle to be single muscle (triceps surae), most say that it is a muscle group, like our quads and hip flexors. This group consists of two main muscles:

- The gastrocnemius
- The soleus

Our calf muscles will allow us to flex our knee and plantar flex our ankle. Like our quads, our calf muscles can be strengthened by doing squats. Other good strength-building exercises would include calf muscle raises and skipping!

**Question 14** : Which muscles are used in jumping?

**Answer** : Following muscles are used in jumping:

i) **Quadriceps** : The quadriceps rest on the front of the thighs and they have four components: the vastus medialis, vastus lateralis, rectus femoris and vastus intermedius. During a jump, you perform hip flexion and knee extension, which both activate the quadriceps. Hip flexion takes place when you move your thigh toward your stomach; knee extension takes place when you straighten your leg. A squat is a specific exercise that can help you gain more strength in the quads.

ii) **Hamstrings** : The hamstrings are opposing muscles to the quadriceps and have an opposite function. You activate your hamstrings through hip extension and knee flexion. Hip extension takes place when you bend your knee and move your heel toward your butt. Hip extension also causes you to work the glutes. From an anatomical standpoint, the hamstrings have three parts: the biceps, femoris, semimembranosus. All parts get activated during the lowering phase and the explosive phase of a jump. A squat works the hamstrings, but you can place more emphasis on them by doing a lunge.

iii) **Hip Flexors** : The hip flexors run from the lower stomach to the top of the thighs. They consist of the psoas major and iliacus, and because of this, they are often referred to as the iliopsoas. As the name implies, these muscles get activated when you flex your hip, in similar fashion to the quads. Although these muscles are small, they are important for explosive motions like sprinting a jumping. A lying leg raise is a good exercise to strengthen the hip flexors.

iv) **Calves** : The calves have two parts the gastrocnemius and soleus. The gastrocnemius has a lateral head and medial head and it is easily seen on the back of the leg right below the knee. The soleus sits anterior, or in front of the gastrocnemius. Both parts function to plantar-flex the foot. This motion occurs when you jump off the ground and point your toes downward.

Jumping rope is a good cardiovascular exercise to train these muscles because of the repetitive hopping you do on your toes. A tuck jump is a good exercise to work your calves because it is specific to jumping.

**Question 15** : Which muscles do we use in throwing?

**Answer** : Following are the muscles which are used while throwing any thing like ball, football etc.

i) **Shoulder Muscles** : The deltoids are the muscles of your shoulder, which play a crucial role in rotating your arm. Always warm up adequately by performing arm circles to avoid injuring your rotator cuff while performing shoulder exercises.

ii) **Triceps** : Your triceps are located on the back of your upper arm and aid in the process of extending your arm at the elbow. This action helps you release the ball with force and push it in the desired direction. To strengthen your triceps efficiently, perform exercises such as triceps pushdowns with a rope or pulley and close-grip bench presses.

iii) **Latissimus Dorsi** : Your latissimus dorsi, often referred to as your lats, are located on either side of your spine. These large muscles help produce force for throwing and help transfer energy from your legs to your upper body. Among the best exercises for strengthening your lats are pull ups, seated cable rows, and bent-over barbell rows.

iv) **Abdominals** : While many people exercise their abdominal muscles in hopes of attaining a six-pack, this muscle group is highly functional as well. A strong core facilitates the transfer of power from your lower body to your upper body , enabling your throws to benefit from the strength of your legs. Among the best exercises for your abs are hanging leg raises and Swiss ball crunch.

v) **Quadriceps** : The quadriceps is the major muscle group located on the front of your thigh. This large group of muscle tissue helps you power the ball toward your intended target as you step into your throw. Among the most effective exercises for the quadriceps are the barbell step-up, barbell lunge and barbell squats, which also work your abdominal muscles.

**Question 16** : Define trajectory. Describe the factors affecting the trajectory of a projectile.

**Answer :** Trajectory is the path described by a moving object, or the path followed by a projectile. Examples are kicking a soccer ball, a throw in cricket, throwing a hammer etc.

Factors affecting projectile trajectory are:

i) **Propelling Force :** The propelling force produces certain effects depending upon its point and direction of application. If the application is directly through the projectile's centre of gravity, only linear motion results from the force.

As the projectile force is moved further from the centre of gravity, rotatory motion of the object increases at the expense of linear motion.

If the force is below the object's centre of gravity, backspin results. Forward spin results when the force is above the centre of gravity. When the force is off centre to the left, clockwise spin results and when it is off centre to right, counter clockwise spin occurs.

ii) **Force of Gravity :** As soon as contact is broken with a projectile object, the force of gravity begins to diminish the upward velocity of the object. Finally, gravity overcomes the effects of the upward component of the projectile's motion and the object begins to descend. The factor that determine how soon gravity will cause the object to descend are:

a) Weight (mass) of the object.

b) Amount of force driving it upward.

c) The effects of air resistance on the object.

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

**Question 17 :** Elucidate the types of friction.

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

Two types of friction are:

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

ii) **Dynamic Friction :** It is the friction between two surfaces that are in relative motion with respect with respect to each other. It is 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, i.e. sliding friction and rolling friction.

**Question 18 :** What is friction? Is it advantageous or disadvantageous in the field of games and sports?

**Answer :** Friction is the force acting along two surfaces in contact which opposes the motion of one body over the other. It has a lot of importance in sports. For example, when a cricket ball or hockey ball is hit, it moves very fast in the direction of force in the ground. After sometime its motion becomes less and ultimately it comes in static position.

**Advantages :** Friction has a great significance in the field of sports. Many sports require more friction and other need lesser friction. In some sports we can not give a better performance without friction. For example, in athletics, the shoes are designed to increase friction so that better speed can be generated.

The spikes have small nails to cease the friction. Gymnasts sometimes use lime on their palms to perform on horizontal bar, uneven bars to increase friction. In these sports friction is necessary thus regarded as advantageous.

**Disadvantages :** On the other hand, some games do not require friction. For example, the games like snow skiing, the skiis are designed to have minimum friction. In cycling there should not be more friction between road and tyres of the cycle. Thus the tyre should be fully inflated to reduce the force of friction. If there is more friction, it will be more wastage of energy of the cyclist. Moreover, the cyclist use pointed helmets, silk body fitted costume and bend their bodies while cycling to reduce air friction. Swimmers use goggles, cap and full body swimsuit to reduce the force of friction caused by water. In roller skating, less friction is also needed for better performance. Thus in these games friction is regarded as disadvantageous.