

# 3

## Let us maintain correct posture

We engage in different activities in our daily life. Standing, sitting and lying down are known as static postures. Walking, running and jumping are referred to as dynamic postures. If these postures are not maintained properly we may have to face many ailments and diseases. To avoid this let us have a proper understanding on how to maintain correct posture in our daily activities. By maintaining correct posture, we can be more efficient in our activities. It also helps us in reducing pressure on the joints, muscles and other parts of the body and maintaining a pleasant appearance. To maintain an effective posture we should apply our knowledge on bio mechanics.

In the previous classes we learnt about correct posture that helps maintain a healthy life. In this chapter we learn the principles of bio mechanics and its effects on posture.

### Bio mechanical factors related to posture

There are two main bio mechanical factors that are related to posture in our daily activities

1. Centre of gravity
2. Balance

#### 1. Centre of gravity

Any object, as well as the human body is made up of tiny particles. All these tiny particles have a weight. The weight of these objects act around a single point. This point is called centre of gravity.

The centre of gravity of an object or human body, is a point where the whole weight of an object/body is concentrated.

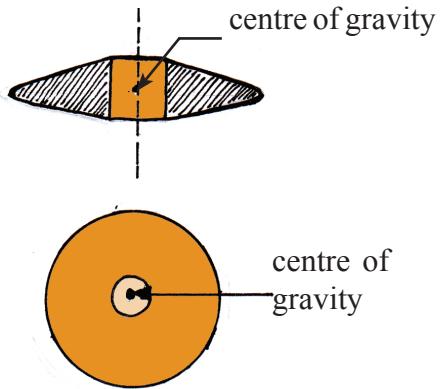


Figure 3.1

In any posture, we adopt the weight of the body acts around a single point and that point becomes the centre of gravity.

According to a person's posture, the centre of gravity changes temporarily.

A person standing straight with hands by the side will have his/her centre of gravity at a distance of about 56% of the total height measured from the ground (figure 3.2). Although the centre of gravity normally appears as described above, it could change temporarily according to the posture of the body.

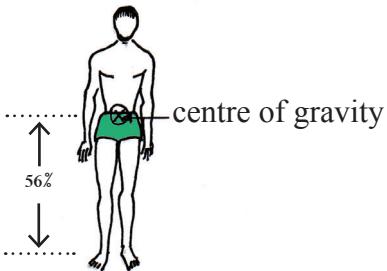


Figure 3.2

This happens as the weight spreads in different directions. When a person stands with both arms by the side and then raises the arms up the weight is spread to the upper part of the body. So the position of the centre of gravity goes higher (figure 3.3c). Study the changes in the centre of gravity that occur when both arms are stretched out on either sides of the body, only when the right hand is stretched out, both arms are raised, the body is bending forward and at the start of a race (figure 3.3).

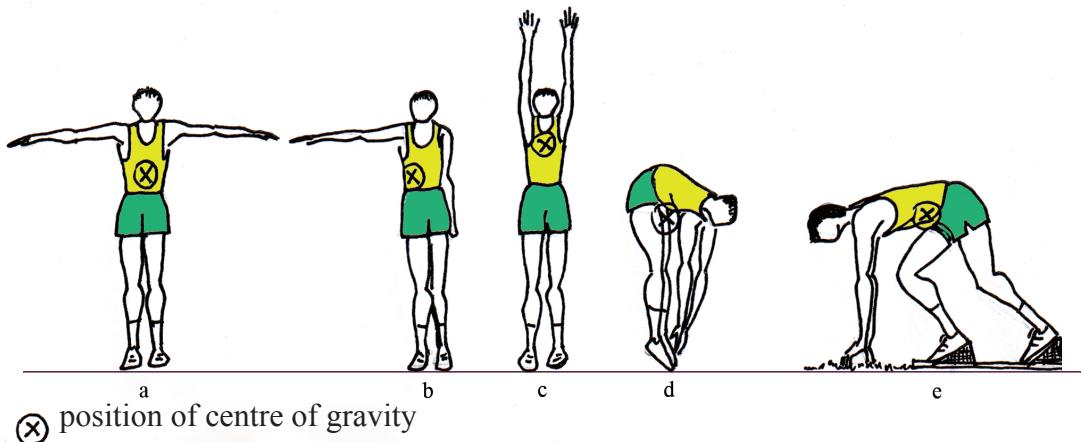


Figure 3.3

## 2. Balance

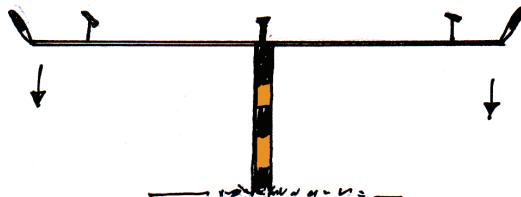


Figure 3.4

The state of a body or physical system that is at rest or in constant and unchanging motion is called balance. When an equal force is applied on either side of it, it will maintain its balance.

e.g: a see-saw shown in figure 3.4 is in a

balanced position. This is because the forces that act on either side of the centre of gravity is equal and is in a balanced position. If a weight is put only to one side of the see-saw, it will lose its balance and there will be a movement around the centre of gravity.

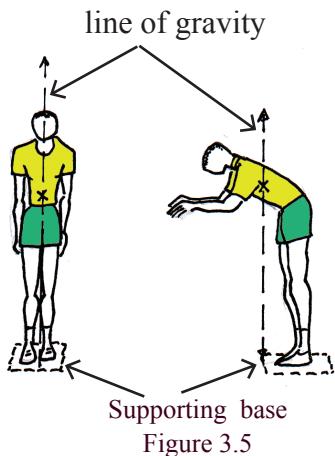
Factors that help maintain the balance at different body postures are given below.

- Keeping the line of gravity within the supporting base - vertical line passing through the centre of gravity is called the line of gravity.
- Having the centre of gravity at a lower position (closer to the ground)
- Maintaining a wider supporting base
- Movement of the body in the opposite direction when loss of posture is imminent
- Bending the body towards an external force

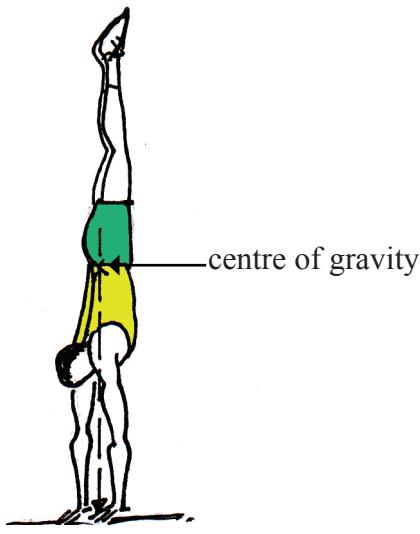
## Let us see how the above factors affect different postures

### i. Keeping the line of gravity within the supporting base

A person standing with both legs together, bends his body forward without bending the knees and waist at one point will tend to lose his balance and fall forward (figure 3.5).



Standing with both legs together, the centre of gravity is vertically above the feet. That is to say, the line of gravity stays within the supporting base. When bending forward, the vertical line on the centre of gravity goes away from the base of the feet. As it passes the peripheral margin of the base, the body loses its balance and falls.



In gymnastics, the player's centre of gravity should be positioned above the supporting base (figure 3.6). When the body bends in a certain direction, the centre of gravity moves in that direction to prevent falling, maintaining the line of gravity within the supporting base. By moving the centre of gravity towards it, the player balances his body.

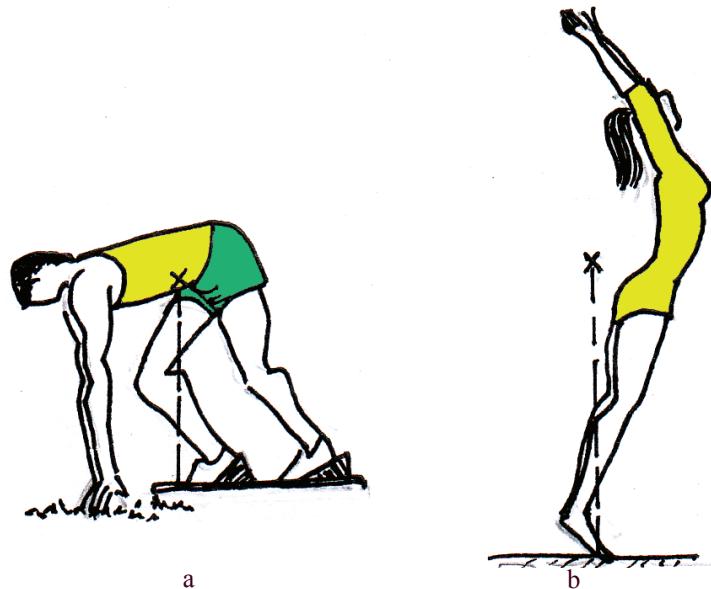


Figure 3.7

The above two figures in 3.7, show the start of the short distance race and a gymnastics movement. In both situations the centre of gravity of the player's body is placed above the supporting base. Therefore in both situations the body is well balanced.

## ii. The centre of gravity at a lower level

When the centre of gravity is placed at a lower level it helps to maintain the balance of the object. The centre of gravity of the object in figure 3.8 a is at a lower level than the object shown in figure 3.8 b. The beaker in 3.8 a is in a more balanced position. If it were to lose its balance and fall, the centre of gravity of that object has to move a considerable distance but with a slight push the line of gravity of the object shown in figure 3.8 b can be moved away from the supporting base and topple easily.

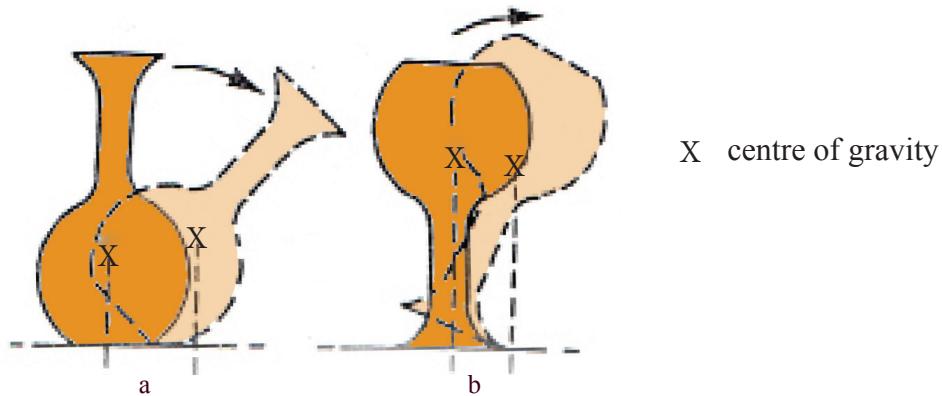


Figure 3.8

When a basketball player bends his knees, his centre of gravity is at a lower position than the centre of gravity of a player who is standing vertically and the first player is better balanced. (3.9 a and b)

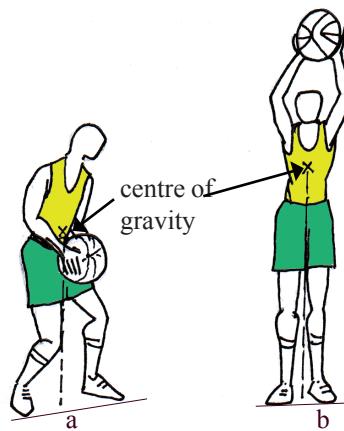


Figure 3.9

After an athlete has released the put, he always moves his body forward and downwards. This helps the player to balance his body by keeping the centre of gravity in a lower position (3.10 a). Figure 3.10 b shows how a gymnast carries the centre of gravity to a lower position to maintain balance.

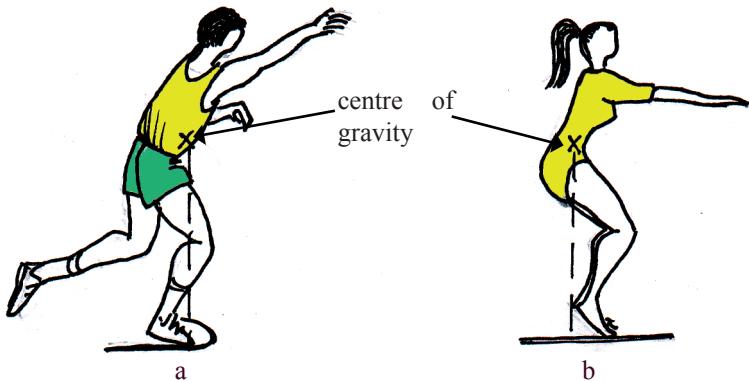


Figure 3.10

### iii. Wider supporting base

When the supporting base of an object is wider it's balance also increases. We can see a better balance in a person who is standing, with feet wide apart than the person who is standing keeping the feet close together. The reason for this is the wider supporting base. (figure 3.11)

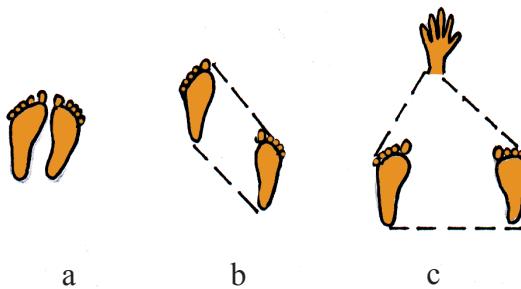


Figure 3.11

It is very clearly shown in figure 3.11 that when the ground area of the supporting base increases the equilibrium also increases. Figure 3.11a shows the player's feet kept close to each other. Here the size of the supporting base is small. In a situation like this, the player's position is not stable. Even a small external push can make him lose his balance. If the player's feet are kept as shown in 3.11b, his stability is more. As shown in 3.11c, apart from keeping the feet wide apart, keeping one hand on the ground, will increase the size of the supporting base. Furthermore, it brings the position of the centre of gravity to a lower level making it a more stable position.

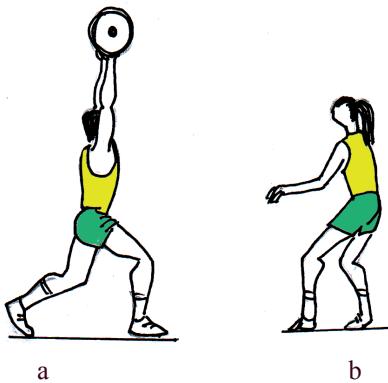


Figure 3.12

Figure 3.12 shows a netball player and a weight lifter keeping their feet apart. Due to a wider supporting base they have more stability in their stance.

#### **iv. Movement of the body in the opposite directions.**

When a part of the body moves far from the line of gravity the body may lose its balance. Moving another part of the body in the opposite direction, the former position can be balanced. The player in diagram 3.13, while stretching his left hand forward has his left leg and hand stretched backward. By doing this he balances his body.

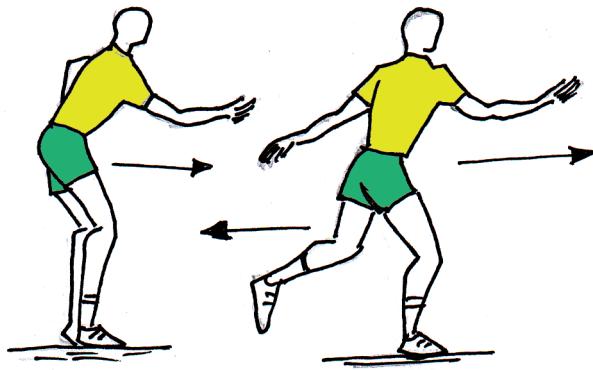


Figure 3.13

#### **v. Bending the body towards an external force.**

When an external force is coming towards you by leaning forward, you can have a better balance. If you bend your body backwards to an external force then the centre of gravity will be pushed backwards away from the base of your body and balance

will be lost. This is explained by the two positions shown in figure 3.14

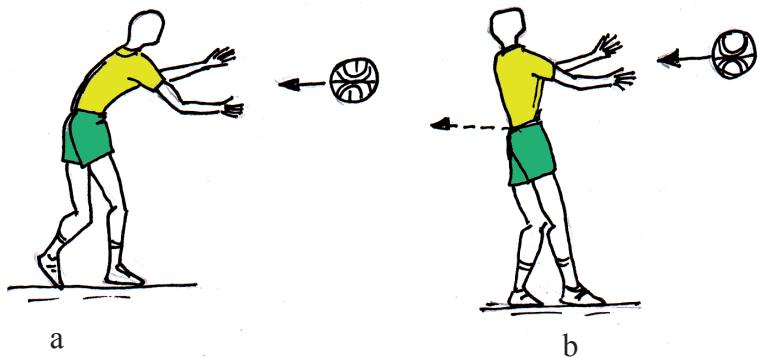


Figure 3.14

## Maintaining posture according to bio mechanical factors

When we engage in static postures in our day-to-day life the centre of gravity and balance are very important and attention should be paid to it. Let us study some situations where the centre of gravity and balance are applied.

### Standing

At the beginning of this chapter you studied that the centre of gravity of a person in standing posture is at a distance of about 56% of height above the level of the ground (figure 3.2).

In general a female's centre of gravity is below that of a male's. This is an advantage for females to maintain balance. A child's centre of gravity is situated at a higher level than of an adult.

When standing if the hands are moved, the centre of gravity changes. When standing for a long time, having a wider support of base, helps to maintain good balance.

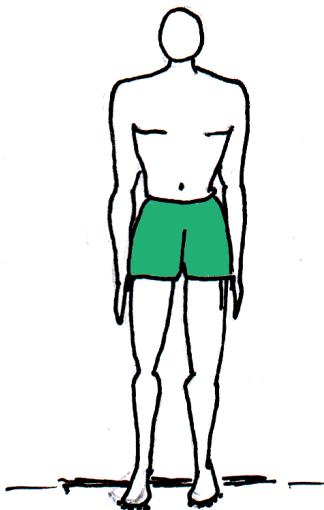


Figure 3.15

Therefore when we stand the following points should be considered:

- Body is kept in a vertical stance
- Hands are kept on either side of the body
- Keep the feet apart, at an equal distance of the shoulder and direct the body weight to spread equally to both feet

When standing and attending to any work remember to:

- keep the body in a vertical stance
- keep feet apart at an equal distance of the shoulder maintaining the balance
- adjust the working surface to the level of the elbow (e.g: ironing)



Not keeping the back straight, being hunched, leaning forward and working for a long time will result in injury to the muscles and ligaments of the vertebral column. A long term problem is kyphosis that can arise due to the spine bending forward.

Figure 3.16

## Sitting

This is a common posture that we adopt in our daily life. When sitting the position of our centre of gravity is as shown below (3.17).

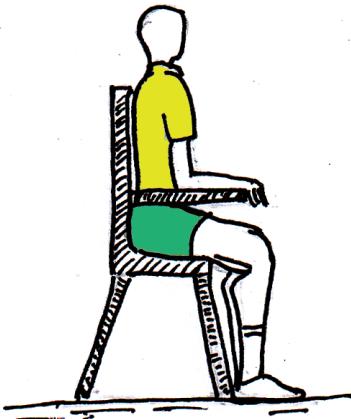


Figure 3.17

When sitting, the centre of gravity is placed at a lower position than standing. The body weight acts on the pelvis and because the centre of gravity lies at a lower level the body is balanced well. For studying purposes and resting purposes we sit in our day to day posture.

### Points to consider when sitting :

- Keep the spine vertically
- Waist, knees and ankles should be bent at 90 degrees
- The soles of the feet should be touching the floor
- Use a properly designed chair with
  - a back rest to lean
  - the height of the chair equal to the height of knee from its feet
  - sitting surface not soft or too hard
  - handrests to rest the elbow.

Let us learn more on the position of sitting, in which we engage a lot in daily life.

## Sitting and working at a table

- Sit closer to the table.  
If the chair is higher than the normal height, we need to bend forward. So the chair should be in a position where the feet are touching the floor. The table surface should be at the level of your elbows. The distance between the table and the seat should be at least 20 cm.
- Keep the spine vertical.
- Feet should touch the ground.
- Hip and knee joints should be bent at 90 degrees
- If sitting for a long time, it is important to get up and walk from time to time. This will prevent undue pressure on the spinal cord.

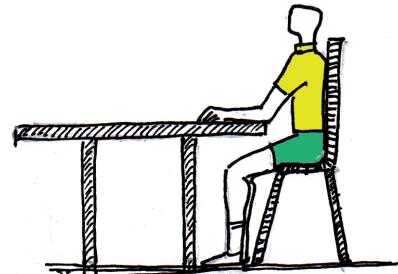


Figure 3.18

## Driving a vehicle

- Sit on the driver's seat with a relaxed body.
- Hands bent slightly at the elbows.
- Keep back straight and rest completely against the backrest.
- Legs should be in a relaxed position when using brakes.

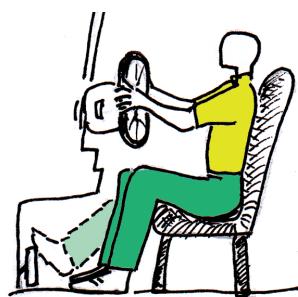


Figure 3.19

## While working at the computer

- Chair should be one inch higher than the usual height.
- Spine should be vertical.
- Head should not be swayed forward or backward unnecessarily.
- Feet should touch the floor.
- Shoulder should be parallel to the hip bone.
- Change your posture every half an hour. Standing, walking, stretching hands should be done.



Figure 3.20

In all the situations mentioned above, the seat should be a well-balanced one and it is compulsory to sit in a balanced position in order to prevent neck pains, wrist aches, stress to the eyes and pain in the hands.

## Lying down

Lying down is done in many ways in our day-to-day life. It is a natural static position. According to the need, place and facilities available the posture changes. Therefore the posture of lying down when asleep, when sick, after an accident and at rest would differ.

When we lie down, we usually stay in a straight position facing up, facing down or turning to the left or to the right side. The correct position to lie down is to be straight and face up or turn to left or right side. If we follow this method, the centre of gravity lies closer to the body as well as to the surface of the lying area. As a result of this the balance of the body increases.

Pay attention to the following points when you are lying down.

- The air way should not be obstructed when lying.
- The circulatory process should not be obstructed.
- Lying down in such a way that it does not give any aches and pains to the body.
- A horizontal, flat and medium soft surface should be used in order to avoid muscle related problems.
- Lying down should not affect the curves of the spine or muscles of the back.

It is important to follow the correct posture of sitting, standing and lying down in our daily life.



### For extra knowledge

#### Dynamic Postures

The centre of gravity and the body balance are very important aspects in dynamic postures such as walking, running, jumping and throwing.

While running or walking, the body balance is maintained by moving the hands and legs in the opposite directions.

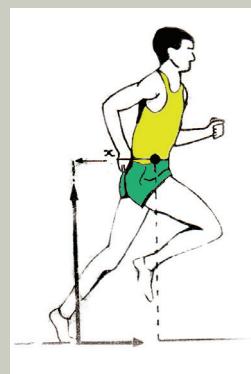


Figure 3.21

The path a jumper takes in his flight indicates the path of the centre of gravity of his body.

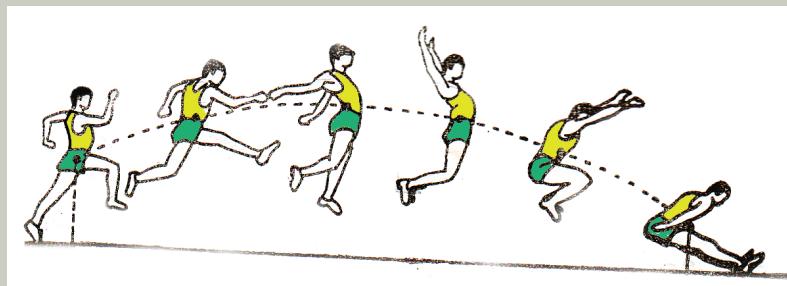


Figure 3.22

At the landing stage, when a jumper is about to land, he raises his legs forward and upwards while bending the upper body forward and downwards. The equal and opposite movements made during the flight are important in maintaining the body balance of the jumper. Such movements do not cause any change in the path that the centre of gravity of the body of the jumper takes.

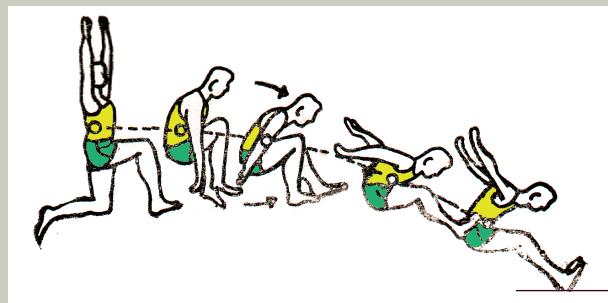


Figure 3.23

After clearing the hurdle, a hurdler drives his foot towards the ground while in flight. Then the upper body of the jumper is raised. These actions prevent the centre of gravity from moving above or below the path that the body of the hurdler takes.

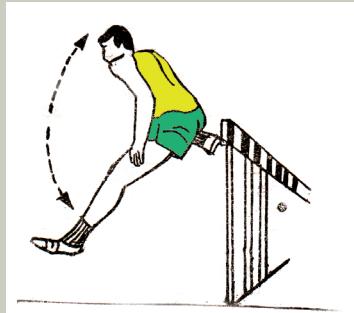


Figure 3.24

After a high jumper has taken off, he turns his body while in the air. This turning takes place around an axis which lies through the centre of gravity of the jumper's body.

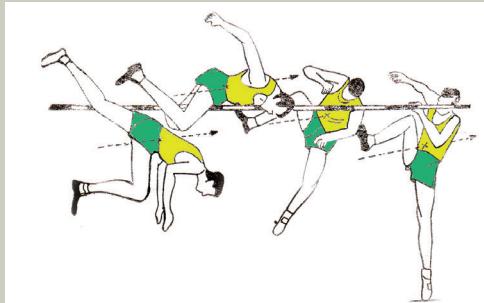


Figure 3.25

In discus throw, the centre of gravity of the body of the thrower has to move in a linear path from the beginning of the circular motion till the throw in order to exert force in the right direction.

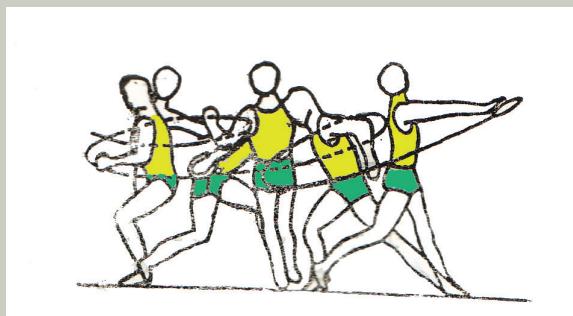


Figure 3.26

At the beginning of this lesson we learnt how a shot putter maintains his body balance by bringing the centre of gravity of his body down to a lower level by directing his body forward and downwards after the shot put has been released from his hand.

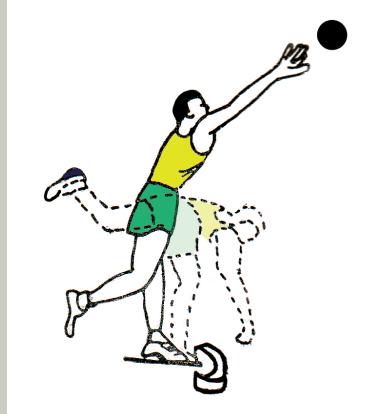


Figure 3.27

When maintaining an incorrect posture the muscles, bones and the other components of the body will be put to extra and unnecessary effort. This increases the risk of injuring joints, muscles, spine and getting disabilities in the long term. Therefore always remember to maintain the centre of gravity and a good balance by adopting correct postures.

## **Summary**

In our daily life we adopt static and dynamic postures. Centre of gravity and balance are two important bio mechanical principles that determine the state of the posture. Centre of gravity is a point in which the weight of body acts while balance is the ability to balance the body when we engage in different types of postures. The position of centre of gravity changes according to the posture. Maintaining the line of gravity within the supporting base, maintaining the centre of gravity at a lower level, having a wider supporting base, keeping parts of the body moved in opposite directions, bending the body towards the external force are some of the important factors that will help to maintain balance. In our daily life we engage in static postures such as standing, sitting and lying down. It is important to maintain a correct posture in order to maintain the centre of gravity at a suitable point in order to balance the body. Adopting wrong postures will result in many injuries to the body and disabilities later in life.



### **Exercises;**

1. Name the two principles of bio mechanics that affect posture
2. Write five factors that help to maintain balance in physical activities
3. Write three points that we should be mindful of when in standing position.
4. Write three points that we should be mindful of when in a correct sitting position
5. Write three points that we should be mindful of when lying down
6. Explain the position of the centre of gravity using diagrams, in jumping and throwing.