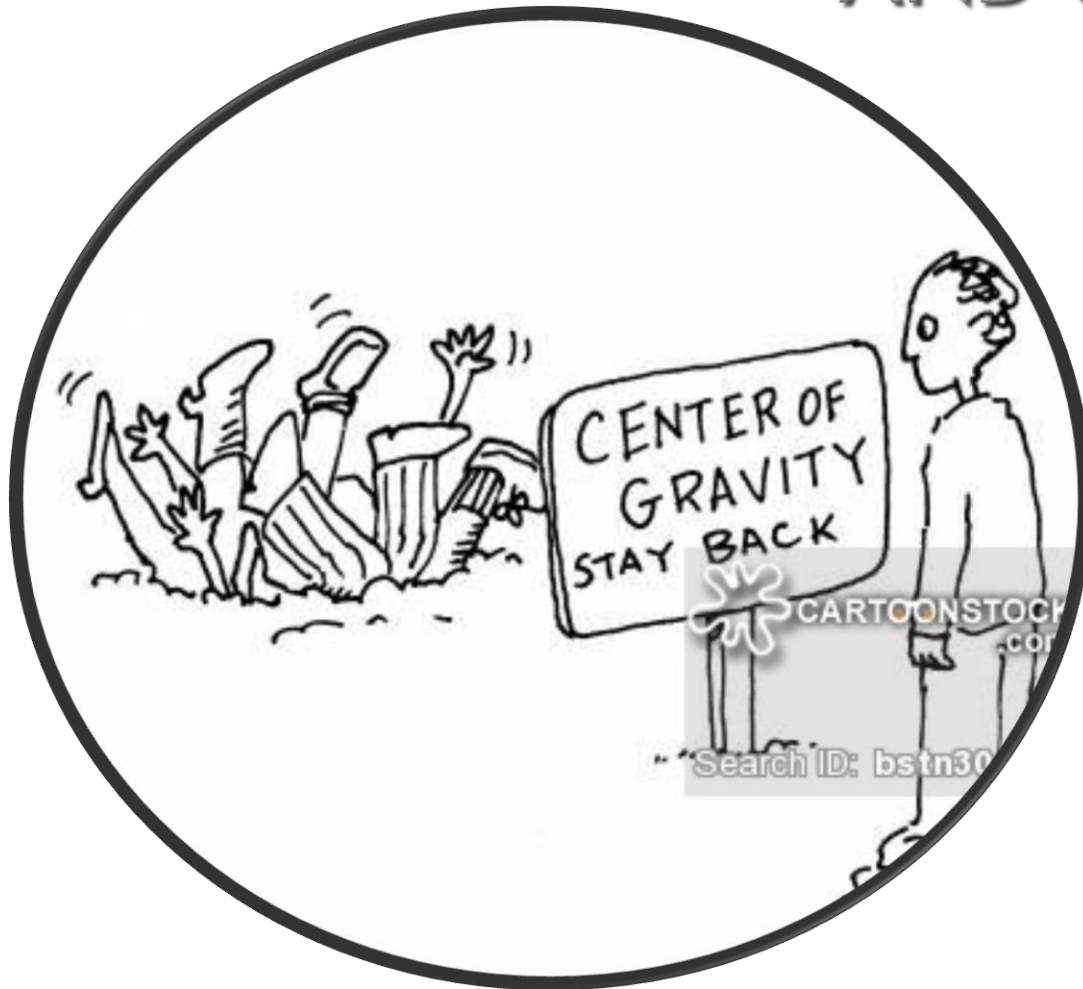
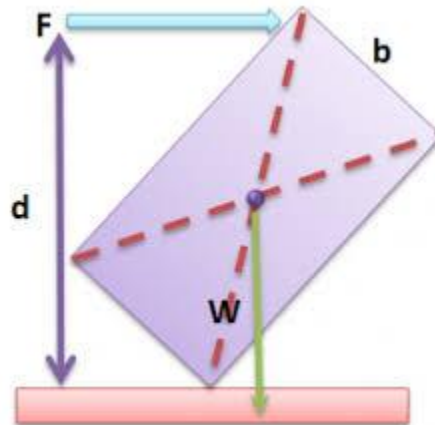


THE CENTER OF GRAVITY AND STABILITY



FOR CLASS 9
BY
UZMA AMER
THE CITY SCHOOL
NORTH NAZIMABAD
BOYS CAMPUS



Objectives

14-3

- Define center of gravity, and explain the basis for its location in the human body.
2. Estimate the location of the center of gravity of individuals in any position.
3. State the principles of equilibrium, and explain and demonstrate applications of each.
4. Discuss the factors that affect the stability and energy cost of the erect posture.
5. Explain the effects that the postural adaptations have on static and dynamic postures.
6. Explain the value of both anticipatory and compensatory postural adjustments.

Center of Gravity (C of G)

14-4

- The “balance point” of the body.
- The point where the weight of the body acts.
- The point where all forces acting on the body equal zero:
 - ▣ Linear forces must be balanced.
 - ▣ Torques must be balanced.

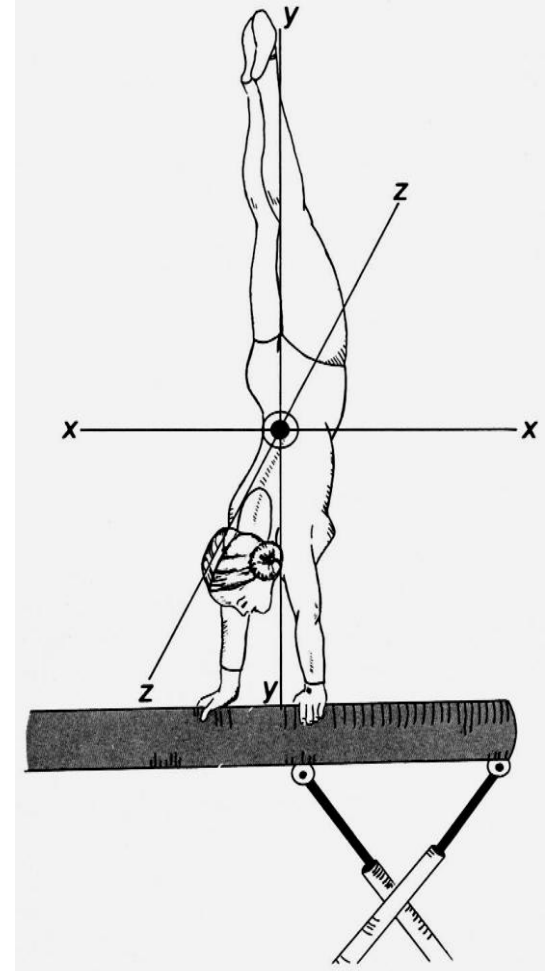


Fig 14.1

CENTER OF GRAVITY

14-5

- The location of the C of G remains fixed as long as the body does not change shape.
- If an object's shape or position changes, the location of the C of G changes.

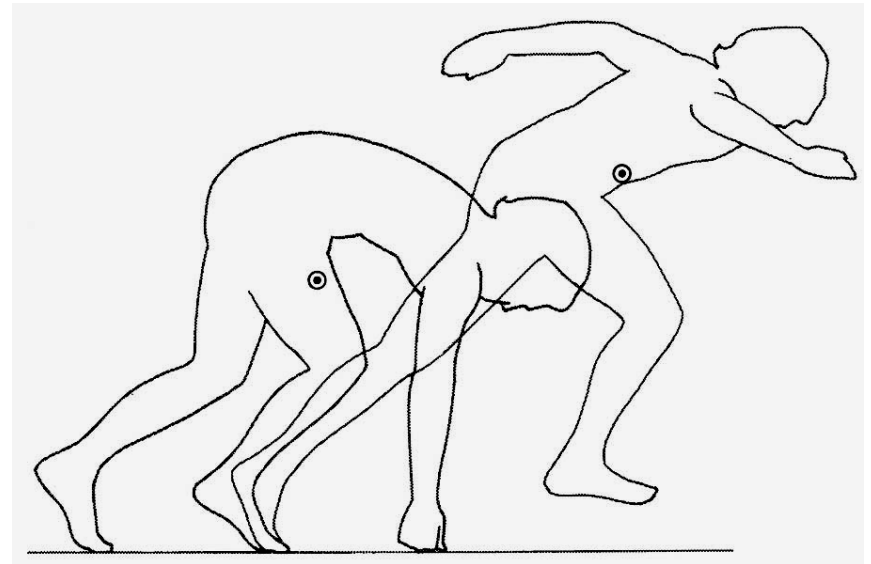


Fig 14.3

CENTER OF GRAVITY

14-6

- As one changes the relationship of the body segments to each other, the C of G may even be located outside the body.

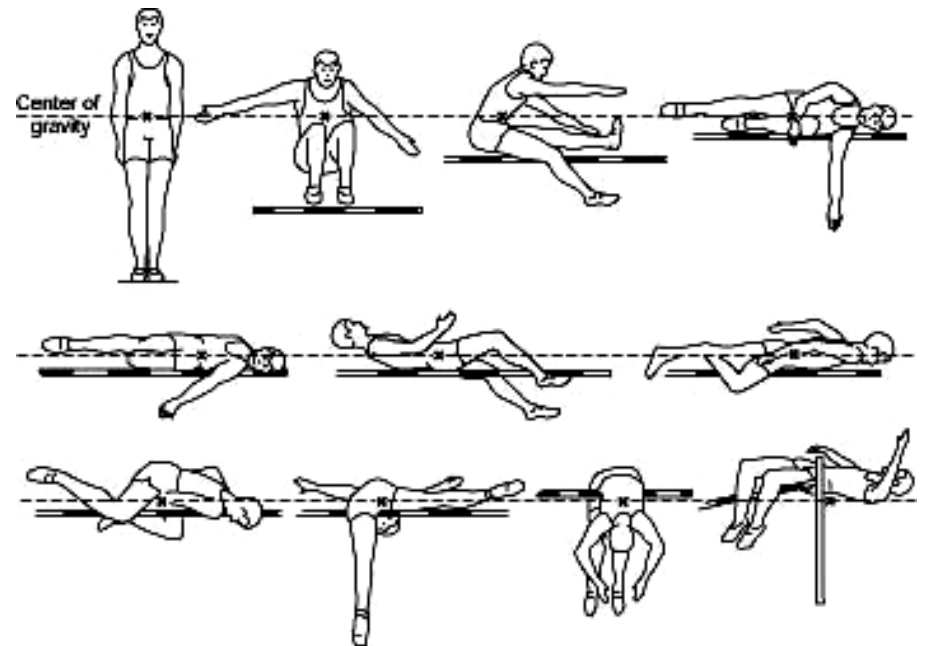


Fig 14.4

Placement of the Center of Gravity

14-7

in Humans

- The location of the C of G of a human in standing position varies with body build, age, and sex.
- Female's CG is $\sim 55\%$ of standing height
- Male's CG is $\sim 57\%$ of standing height
- In quiet standing, the C of G can be considered almost directly over center of pressure.
- Center of pressure - point at which the force vector for ground reaction force is applied.

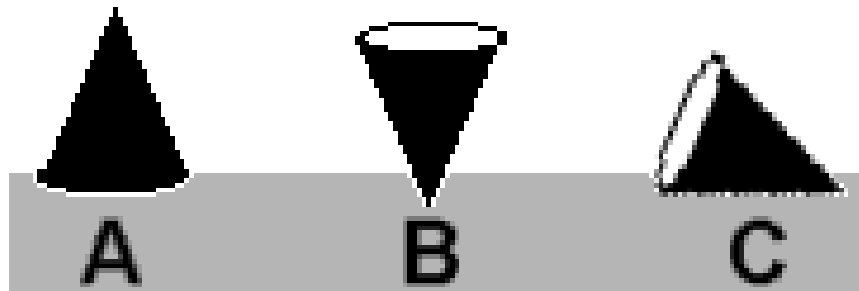
Stability and Equilibrium

14-8

- All objects at rest are in equilibrium.
- All forces acting on them are balanced.
- The sum of all linear forces equals zero.
- The sum of all torques equals zero.
- However, all objects at rest are not equally stable.

STABILITY

There are 3 types of equilibrium an object can be in

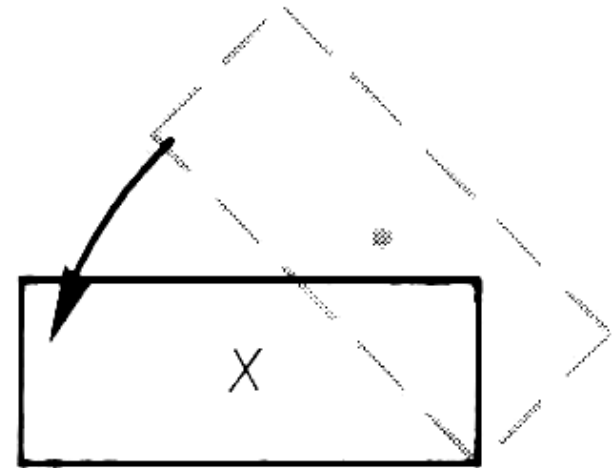


- **A** Stable equilibrium -Returns to equilibrium position when slightly displaced.
- **B** Unstable equilibrium- Neither returns to same equilibrium or stays in place when displaced slightly.
- **C** Neutral equilibrium- Remains in displaced position when disturbed.

Stable Equilibrium

14-10

- Occurs when an object is placed in such a fashion that an effort to disturb it would require its C of G to be raised.



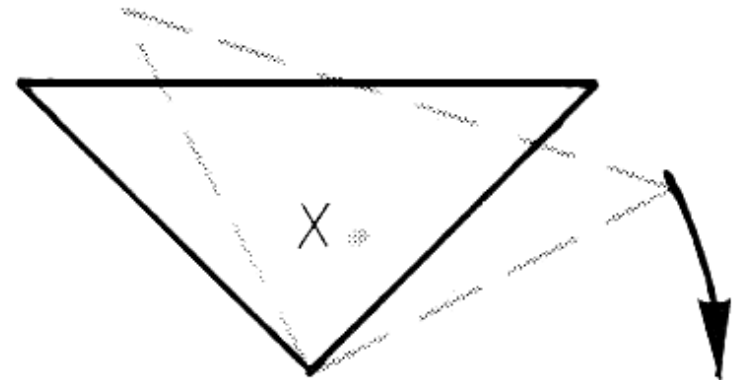
Stable

Fig 14.5a

Unstable Equilibrium

14-11

- When a slight disturbance will drop the objects' C of G to a lower point.



Unstable

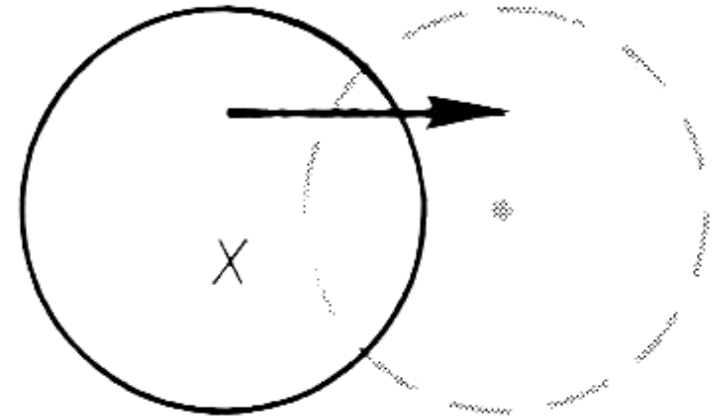
Fig 14.5b

Neutral Equilibrium

14-12

- When an object's C of G is neither raised nor lowered when it is disturbed.

Humans spend most of their time adjusting body positions for the type of equilibrium best suited to the task.



Neutral

Fig
14.5c

Mobility

14-13

- Often in sport, it is necessary to alter stability intentionally to become mobile.
- Ability to start, stop, or change direction quickly depends on manipulating the stability of the body.

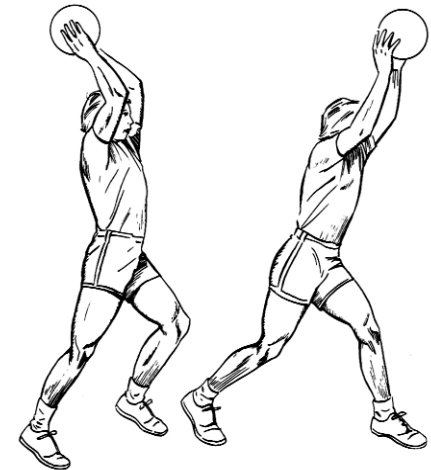


Fig 14.14