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- Forms of motion
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Forms of motion:

- Translation: linear motion (when a body moves so it travels the same distance in the same direction at the same time)
Rectilinear-straight line, curvilinear-curved line, non linear. Two points maintain a uniform distance in straight line. Curved motion, no rotation.
- Rotation: through the same angle, rotation about an internal or external axis. Depends on what you are examining, i.e. drinking water, glass is curvilinear, arm rotates around elbow.
- General motion: combination of linear and angular. I.e. ball spinning while in a curved projectile.
- System: thing whose motion is being examined.
- Frames of reference: motion explained relative to frame of reference prevents ambiguity.
- Measuring motion: needed for standardisation & to measure performance, Kinematics what you see vs kinetics why a body moves what causes it.
- Measurement quantities:
 - scalar magnitude without direction distance,
 - vector magnitude with direction displacement.
- Linear speed = distance/time m.s^{-1} or speed = stride length x stride rate. Increase stride length first, then to get fast increase rate and slightly decrease stride length.
- Linear velocity = displacement/time m.s^{-1} N with direction
- Linear acceleration = final velocity-initial velocity/elapsed time. M.s^{-2}
- Uniformly accelerated motion:
 - u-initial velocity
 - v-final velocity
 - t-time
 - a-acceleration
 - s-displacement
- Equations: $v = u + at$
 $S = ut + \frac{1}{2}(at^2)$
 $S = \frac{1}{2}(ut + vt)$
 $V^2 + u^2 + 2as$
- Angular distance: angle between initial and final positions of a rotating body.
- Angular displacement: the smaller of the two angles between a body's initial and final positions. Actual change start to finish.
- Angular speed: rate of covering a distance in degrees,
- Angular velocity: rate at which a body moves from one location to another.
- Angular acceleration: with direction rate of changes in angular velocity.

- Angular kinematics units: revolutions, degrees ($1/360^{\text{th}}$ rev) radian (57°)
- Angular motion vectors: represented by an arrow drawn so that if the curled fingers of a person's right hand point in the direction of the rotation, the direction of the arrow coincides with the direction indicated by the external thumb.
- Linear and angular motion: Increase linear velocity at impact = increase angular velocity of implement \times increase of radius of rotation. How fast racquet/golf stick hits the ball. swing faster, or use longer implement/ more of body.

Stability:

- Mass the quantity of matter of which a body is composed (kg). Weight a measure of the force which the earth pulls on a body's mass (N).
- Centre of Gravity: point of a body through which the force of gravity acts. The point where all a body's weight seems concentrated, the balance point.
- Also the centre of mass, each body segment has its own mass, weight and centre of gravity (usually closer to more massive end, proximal) does not need to be within the physical substance of a body.
- Location of centre of gravity depends on: position of body segments, arrangement of the body segments at any given time. ROM is roughly 12 cm. each change in position changes the total body centre.
- Effects of segments on CoG location. More massive segments have a greater influence on CoG location than smaller segments. The bigger the segments you move the more impact it has. Symmetrical movements decrease the change of cog. Men 57% of height, women 55% of height.
- Line of CoG. The line of action of the force of gravity. Where the line of gravity is will affect your balance. When moving try to keep line of gravity within base of support to maintain balance and stability.
- Torque: a turning or rotary force, the turning effect is caused by an off centre or eccentric force acting on the body. Also known as a moment. Principle of torque=principle of moments.
- Net torque. Manipulate where weight sits to manipulate that balance. Larger is closer to fulcrum and smaller is further away to ensure balance.
- Torque=force \times perpendicular distance.
- Calculating the CoG:
 - Suspension method: Line of gravity falls under the pivot point, if not in line of gravity continue swinging.
 - Segmentation method: measure all limbs and trunk then use values to determine where the cog of each segment is

relative to that section. Add together on x and y axis to find cog.

- Balance board method: lay on board until balanced, shifting weight up and down distance between feet and pivot point is cog. As if the force acting through your centre of gravity doesn't tip the board it must be over the pivot point.
- Reaction board method: assume feet at pivot point, the weight difference between the two top scales divided by your height gives your cog. Bottom scales are used to ensure no issues with scales should add to give your weight.
- Base of support: area defined by straight lines connecting the most peripheral points of the body parts contacting the supporting surface. All area inside is included in the base of support.
- Equilibrium, balance & stability:
 - Equilibrium = zero acceleration
 - Balance = ability to control equilibrium
 - Stability = resistance to a disturbance of equilibrium
- Equilibrium: state of a system that is not being accelerated. I.e. not changing its state of motion in terms of speed and direction. Constant velocity, static and dynamic equilibrium.
 - Static equilibrium: when a body is at rest, not translating or rotating
 - Dynamic equilibrium: when a body is moving with constant speed and direction.



- Stable equilibrium is reluctant to change the state of motion. Unstable equilibrium easy to change the state of motion.
- Balance: process where the body's state of equilibrium is controlled for a given purpose movement control.