44. During projectile motion, which flight component does gravity affect?

- *Vertical* component is influenced by acceleration due to gravity (constant downward force= 9.81m/s/s. Up is + & Down is -; thus a= -9.81m/s/s.) Gravity affects height travelled.

45. During projectile motion, which flight component does air resistance affect?

- *Horizontal* component is influenced by air resistance which affects distance travelled.

46. When ignoring air resistance, what affect does the size, shape and mass of an object have on the acceleration of that object due to gravity?

- Acceleration due to gravity is independent (not dependant) of size, shape & mass. Acceleration remains constant regardless of size, shape or weight of projectile.
- Vertical component of initial vel determines max height. As projectile gets higher its vertical vel (Vv) ↓. At max height, Vv is 0. As object falls, Vv in the – direction in negative (-) direction is ↑. Under normal conditions, air resistance can influence the vertical distance travelled.
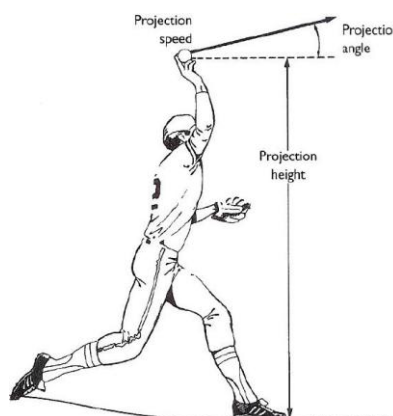
47. The flight path of a projectile that is not influenced by air resistance would follow a trajectory of which shape?

- Without air resistance, *parabola shape trajectory. Parabola* is curved with an *apex*; symmetrical.
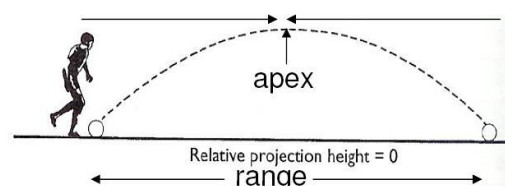
48. A projectile at the apex of its flight is represented by a vertical velocity of?

- *Vertical velocity* of 0; projectile completely stops moving for a period of time when reaching its apex.
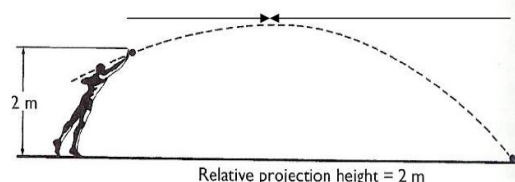
49. For a projectile that is released from and lands at the same height (ignoring air resistance), the time taken for that projectile to reach the apex of its flight is equal to what percentage of the total flight time?

- 50%; without air resistance, there should be equal time from release point to apex & consequent apex to landing point.
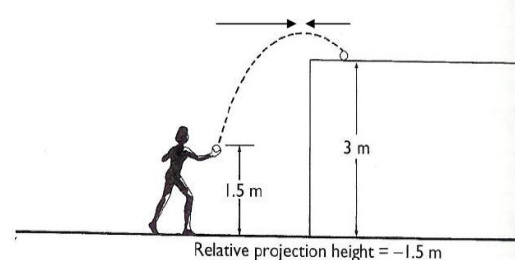
50. List three release factors that affect the trajectory of a projectile.

- *Without gravity:* object travel indefinitely with no change in vel (in space)
- *With gravity:* motion pathway changes vertically
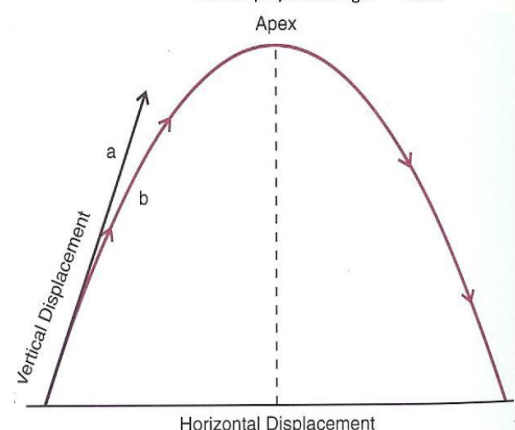
- *With air resistance:* changes horizontal velocity (& vertical). Tail wind ↑ horizontal displacement & ↓ release velocity. Head wind ↓ displacement & ↑ release velocity.
- *Angle of Projection:* relative angle of release
- *Speed of Projection:* relative speed of release
- *Height of projection:* relative height of release

51. Define **Projection Angle**.
- Angle at which a body is projected with respect to the horizontal. Influences the shape of the projectiles trajectory. In absence of air resistance, *vertical, parabolic & horizontal (half parabola)* trajectory.

195. Define **Angular Power**, *and provide its unit of measurement.*
- The product of torque & angular velocity; watts or Nm/s. Used to describe mechanical muscle power.
- Angular Power = T ω
- *POSITIVE muscle power:* POSITIVE work or net concentric action
- *NEGATIVE muscle power:* NEGATIVE work of net eccentric action

Linear	Angular
• Mass (m)	• Moment of inertia (I)
• Force (F)	• Torque (T)
• Momentum (M or p)	• Ang momentum (H)
• Impulse (Ft)	• Ang impulse (Tt)
• Acc (a)	• Ang acc (α)

196. The **Analogue of Newton's 1st Law** *of Motion states that …....*
- An object will continue spinning with constant angular momentum unless acted on by an external torque.

### 197. *Give an example of the analogue of Newton's 1st law of motion.*
- Divers & gymnasts able to achieve aerial manoeuvres by manipulation of *moment of inertia* & *angular velocity* due to constant angular momentum (remains constant due to absence of external torque)

198. The **Analogue of Newton's 2nd Law** *of Motion states that …....*
- A net torque produces angular acceleration in direct proportion to the magnitude of the torque & in the same direction as the torque & angular acceleration is inversely proportional to the body's moment of inertia. T (External Torque) = I α (moment of inertia x angular acceleration)

199. *Give an example of the analogue of Newton's 2nd law of motion.*
- If person abducts arm from body to horizontal position; torque at shoulder results in angular acceleration of arm greater moment of inertia of moment arm about axis through shoulder & less angular acceleration of segment.
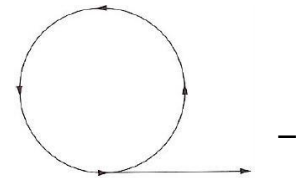
200. The **Analogue of Newton's 3rd Law** *of Motion states that …....*
- For every torque exerted by 1 body on another, there is an equal & opposite torque exerted by the 2nd body on the 1st; torque produced by 1 body part to rotate that part results in counter torque by another body part
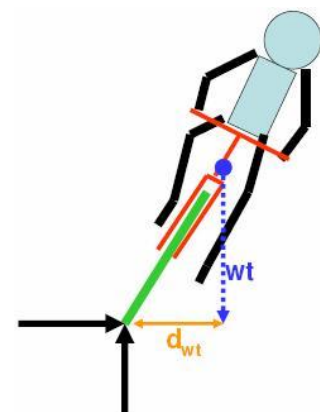
$$F_C = m\ \omega^2 r$$
or
$$F_C = m\ v_t^2 / r$$

where F_C = centripetal force
m = mass
ω = ang vel
  r = radius of rot
v = tangential vel of segment

201. *Give an example of the analogue of Newton's 3rd law of motion.*
- *Counter-Rotation Effect:* Rotation can be initiated in the air when angular momentum = 0, **e.g. m/ment of hitting arm with high angular velocity, there is a compensatory rotation of lower body producing an equal angular momentum in opposite direction.**

CENTRIPETAL AND CENTRIFUGAL FORCES:

202. Define **Centripetal Force**.

- Force directed toward the centre of rotation for a body in rotational motion; force which prevents a whirling object from leaving its circular path.

203. Centripetal forces always act in which direction?

- Always directed towards centre or rotation of the rotating object.

204. What is an alternative name given to centripetal force?

- *Centre Seeking Force*

205. Centripetal forces are associated with which acceleration?

- *Radial component of angular acceleration of body travelling around a curved path.*