PHYC10005: Physics 1 Fundamentals Notes

Topic 1 – Kinematics

LECTURE 1 – DISPLACEMENT & VELOCITY

- **Δx**: change in position
- **Distance**: length of path taken
- $s = d/t$
- $v_{av} = \Delta x/t$
- $v = dx/dt$

LECTURE 2 – ACCELERATION

- $a_{av} = \Delta v/t$
- $a = dv/dt$
- Acceleration due to gravity = 9.8 m/s^2

LECTURE 3 – CONSTANT ACCELERATION FORMULAS & VECTORS

- $v = u + at$
- $\Delta x = ut + ½ at^2$
- $\Delta x = ½ (u + v) t$
- $v^2 = u^2 + 2a\Delta x$
- Vectors have units and directions

LECTURE 4 – VECTORS

- $A_x = A \cos(\alpha)$
- $A_y = A \sin(\alpha)$
- $A = (A_x^2 + A_y^2)^{½}$
- $A_y/A_x = \tan(\alpha)$
- A (unit) = A/|A|

LECTURE 5 – 2D KINEMATICS

- **Projectiles**:
  - Horizontal and vertical motions are INDEPENDENT

- $a_{vertical} = g$
- $a_{horizontal} = 0$
- Parabolic trajectory
- If more time in air (higher), takes longer

LECTURE 6 – CIRCULAR MOTION

- $f = 1/T$
- Acceleration towards CENTRE of circle
- $|\Delta v| = v\theta$
- $v = r\theta/t$
- $a = v^2/r$

LECTURE 7 – NEWTON'S LAWS OF MOTION & FORCES

- 1: **Law of inertia** = an object will continue with constant velocity (even if v = 0) unless a net force causes its velocity to change
- 2: **F = ma** = an object subject to a net force will accelerate in direction of net force at rate proportional to F and inversely proportional to m
- 3: **Action-reaction** = for every force on an object, there is a force of equal magnitude and opposite direction on some OTHER object
- Forces are VECTORS
- Action-reaction pairs must involve two different objects

LECTURE 8 – SPRINGS

- **Hookes' law**: $F = -k\Delta x$
- **Normal force**: compression and extension of bonds results in reaction forces pushing upwards, acting perpendicular to surface
- **Tension force**: combined effect of molecular spring forces, k(rope) >> k(string) => **inextensible string approximation** (doesn't stretch rope)
  - Tension is equal throughout rope/string => **massless string approximation**
- For inclined planes:
  - $T = mg \sin(\theta)$