Oblique Projectile Motion

1. (d) $R = \frac{u^2 \sin 2\theta}{g} \therefore R \propto u^2$. If initial velocity be doubled then range will become four times.

2. (c) $H = \frac{u^2 \sin^2 \theta}{2g} \therefore H \propto u^2$. If initial velocity be doubled then maximum height reached by the projectile will quadrupled.

3. (a) An external force by gravity is present throughout the motion so momentum will not be conserved.

4. (a) Range $= \frac{u^2 \sin 2\theta}{g}$; when $\theta = 90°$, $R = 0$ *i.e.* the body will fall at the point of projection after completing one dimensional motion under gravity.

5. (c) $R = 4H \cot \theta$.
When $R = H$ then $\cot \theta = 1 \rightleftarrows / \rightleftarrows 4 \Rightarrow \theta = \tan^{-1}(4)$

6. (c) Because there is no accelerating or retarding force available in horizontal motion.

7. (a) Direction of velocity is always tangent to the path so at the top of trajectory, it is in horizontal direction and acceleration due to gravity is always in vertically downward direction. It means angle between $\vec{v}$ and $\vec{g}$ are perpendicular to each other.

8. (d) $R = 4H \cot \theta$ if $\theta = 45°$ then $R = 4H \cot(45°) = 4H$

9. (c) $v_y = \frac{dy}{dt} = 8 - 10t$, $v_x = \frac{dx}{dt} = 6$

at the time of projection *i.e.* $v_y = \frac{dy}{dt} = 8$and $v_x = 6$

$$\therefore v = \sqrt{v_x^2 + v_y^2} = \sqrt{6^2 + 8^2} = 10\ m/s$$

10. (b) The angle of projection is given by $\theta = tan^{-1}\left(\frac{v_y}{v_x}\right) = tan^{-1}\left(\frac{4}{3}\right)$

11. (a) $a_x = \frac{d}{dt}(v_x) = 0,\ a_y = \frac{d}{dt}(v_y) = -10\ m \rightleftarrows/\rightleftarrows s^2$

$\therefore$ Net acceleration $a = \sqrt{a_x^2 + a_y^2} = \sqrt{0^2 + 10^2} = 10 m/s^2$

12. (b) $R_{15^\circ} = \frac{u^2 \sin(2\times15^\circ)}{g} = \frac{u^2}{2g} = 1.5km$

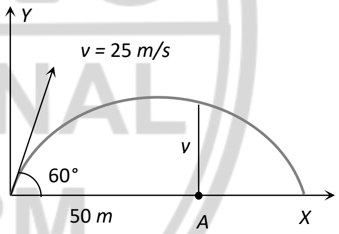
$$R_{45^\circ} = \frac{u^2 \sin(2\times45^\circ)}{g} = \frac{u^2}{g} = 1.5 \times 2 = 3km$$

13. (a) Horizontal component of velocity

$v_x = 25\cos 60^\circ = 12.5 m/s$

Vertical component of velocity

$v_y = 25\sin 60^\circ = 12.5\sqrt{3} m/s$



Time to cover 50 m distance $t = \frac{50}{12.5} = 4sec$

The vertical height y is given by

$y = v_y t - \frac{1}{2}gt^2 = 12.5\sqrt{3} \times 4 - \frac{1}{2} \times 9.8 \times 16 = 8.2m$

14. (a) For vertical upward motion $h = ut - \frac{1}{2}gt^2$

$5 = (25\sin\theta) \times 2 - \frac{1}{2} \times 10 \times (2)^2$

$\Rightarrow 25 = 50 \sin\theta \Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30^\circ$

15. (c) For angle$(45° - \theta)$, $R = \frac{u^2 \sin(90° - 2\theta)}{g} = \frac{u^2 \cos 2\theta}{g}$

For angle$(45° + \theta)$, $R = \frac{u^2 \sin(90° + 2\theta)}{g} = \frac{u^2 \cos 2\theta}{g}$

16. (b) Range is given by $R = \frac{u^2 \sin 2\theta}{g}$

On moon $g_m = \frac{g}{6}$. Hence $R_m = 6R$

17. (c) For greatest height θ = 90°

$H \frac{u^2 \sin^2(90°)}{2g} \frac{u^2}{2g}_{max}$ (given)

$R \frac{u^2 \sin^2 2(45°)}{g} \frac{u^2}{g}_{max}$

18. (c) $R = 4H \cot\theta$, if $R = 4H$ then $\cot\theta = 1 \Rightarrow \theta = 45°$

19. (b) $E' = E \cos^2\theta = E \cos^2(45°) = \frac{E}{2}$

20. (b)