Horizontal Projectile Motion

1. (b) $R_{max} = \frac{u^2}{g} \Rightarrow u = 400 m/s$

2. (c) Due to constant velocity along horizontal and vertical downward force of gravity stone will hit the ground following parabolic path.

3. (b) Because the vertical components of velocities of both the bullets are same and equal to zero and $t = \sqrt{\frac{2h}{g}}$.

4. (c) The pilot will see the ball falling in straight line because the reference frame is moving with the same horizontal velocity but the observer at rest will see the ball falling in parabolic path.

5. (b) Due to air resistance, it's horizontal velocity will decrease so it will fall behind the aeroplane.

6. (c) Because horizontal velocity is same for coin and the observer. So relative horizontal displacement will be zero.

7. (c) Horizontal displacement of the bomb

AB = Horizontal velocity × time available

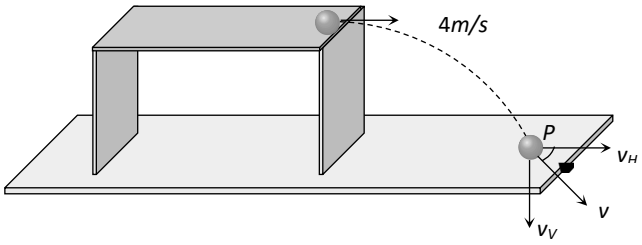
$$AB = u \times \sqrt{\frac{2h}{g}} = 600 \times \frac{5}{18} \times \sqrt{\frac{2\times1960}{9.8}} = 3.33 Km.$$

8. (a,c) Vertical component of velocity of ball at point *P*

$v_V = 0 + gt = 10 \times 0.4 = 4 m/s$

Horizontal component of velocity = initial velocity

$\Rightarrow v_H = 4 m/s$



So the speed with which it hits the ground

$v = \sqrt{v_H^2 + v_V^2} = 4\sqrt{2}m/s$

and $tan\,\theta = \frac{v_V}{v_H} = \frac{4}{4} = 1 \Rightarrow \theta = 45°$

It means the ball hits the ground at an angle of $45°$ to the horizontal.

Height of the table $h = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times (0.4)^2 = 0.8m$

Horizontal distance travelled by the ball from the edge of table $h = ut = 4 \times 0.4 = 1.6m$

9. (b) $S = u \times \sqrt{\frac{2h}{g}} = 100 \times \sqrt{\frac{2\times490}{9.8}} = 1000m = 1km$

10. (c) $S = u \times \sqrt{\frac{2h}{g}} \Rightarrow 10 = u\sqrt{2 \times \frac{5}{10}} \Rightarrow u = 10m/s$

11. (d)$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times396.9}{9.8}} \simeq 9sec$ and $u = 720km/hr = 200m/s$

$\therefore R = u \times t = 200 \times 9 = 1800m$

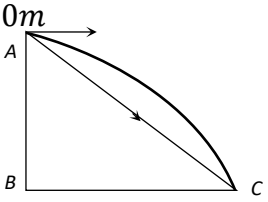
12. (a) For both cases $t = \sqrt{\frac{2h}{g}}$ =constant.

Because vertical downward component of velocity will be zero for both the particles.

13. (c)

14. (a) The horizontal distance covered by bomb,

$$BC = v_H \times \sqrt{\frac{2h}{g}} = 150\sqrt{\frac{2\times80}{10}} = 660m$$

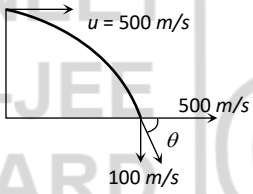


$\therefore$ The distance of target from dropping point of bomb,

$$AC = \sqrt{AB^2 + BC^2} = \sqrt{(80)^2 + (600)^2} = 605.3m$$

15. (a) Horizontal component of velocity v_x= 500 *m/s*

and vertical components of velocity while striking the ground.



$$v_y = 0 + 10 \times 10 = 100m/s$$

$\therefore$ Angle with which it strikes the ground.

$$\theta = tan^{-1}\left(\frac{v_y}{v_x}\right) = tan^{-1}\left(\frac{100}{500}\right) = tan^{-1}\left(\frac{1}{5}\right)$$

16. (b) Area in which bullet will spread = πr^2

For maximum area, $r = R\frac{v^2}{g}$ when $_{max}$

Maximum area $\pi\ R_{max}^{2\left(\frac{v^2}{g}\right)^2}\frac{\pi v^4}{g^2}$