WEEKLY TEST TYM TEST - 13 BALLIWALA SOLUTION Date 14-07-2019

[PHYSICS]

1.
2.
3. In return journey the angle made by the projectile with the horizontal is $-\theta$. Hence,

$$\overrightarrow{\Delta p} = [\hat{i}\, p\cos\theta + \hat{j}\, p\sin\theta]$$

$$-[\hat{i}\, p\cos(-\theta) + \hat{j}\, p\sin(-\theta)] = \hat{j}\, 2p\sin\theta$$

or $|\overrightarrow{\Delta P}| = 2p\sin\theta$

4. $$\frac{h_2}{h_1} = \frac{u^2\sin^2\theta_2}{2g} \times \frac{2g}{u^2\sin^2\theta_1}$$

$$= \frac{\sin^2\theta_2}{\sin^2\theta_1} = \frac{\sin^2\pi/6}{\sin^2\pi/3} = \frac{1}{3}$$

$\therefore$ $h_2 = h_1/3$

5. Time taken by bullet to reach the target $= \frac{\text{distance}}{\text{velocity}} = \frac{\text{distance}}{u\cos\theta}$

As θ is very small, $\cos\theta = 1$

$$\text{Time} = \frac{\text{distance}}{u} = \frac{400}{400} = 1\text{ sec}$$

Vertical deflection of bullet

$$= \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times (1)^2 = 5\text{ metre}$$

6. $R_{max.} = \frac{u^2}{g} = 1000\text{ m}$ (R is maximum where $\theta = 45^o$)

$$H = \frac{u^2\sin^2\theta}{2g} = \frac{u^2}{2g} \times \sin^2 45^o = \frac{u^2}{4g}$$

$$= \frac{1000}{4} = 250\text{ m}$$

7. Kinetic energy is minimum at the higest point and highest point is attained after covering distance equal to 0.5 R
8. When the horizontal range is maximum, the maximum height attained is R/4. Hence, co-ordinates of the point = (400, 100).
9. R is same for both θ and $(90^o - \theta)$,
If angle w.r.t. vertical is 40^o, then w.r.t. horizontal direction in will be $90^o - 40^o = 50^o$.

10. $\frac{R}{T^2} = \frac{u^2 \sin 2\theta \times g^2}{g.4u^2 \sin^2 \theta} = \frac{g}{2}\cot\theta$

i.e., $gT^2 = 2R \tan\theta$

If T is doubled, then R becomes 4 times

11. The shooter has to direct slightly upward as the path followed by a projectile is a parabola trajectory.

12. $H_{max.} = \frac{u^2 \sin^2 \theta}{2g}$

$T = \frac{2u\sin\theta}{g}$

$\frac{H_{max.}}{T^2} = \frac{u^2 \sin\theta}{2g} \times \frac{g^2}{4u^2 \sin^2 \theta}$

$= \frac{g}{8} = \frac{10}{8} = \frac{5}{4}$

13. $H = \frac{u^2 \sin^2 \theta}{2g}$

or $80 = \frac{u^2 \sin^2 \theta}{2 \times 10}$

or $u^2 \sin^2\theta = 1600$

or $u \sin\theta = 40 \text{ ms}^{-1}$.

Horizontal velocity = $u \cos\theta$ = at

$= 3 \times 30 = 90 \text{ ms}^{-1}$

$\frac{u\sin\theta}{u\cos\theta} = \frac{40}{90}$

or $\tan\theta = \frac{4}{9}$ or $\theta = \tan^{-1}\left(\frac{4}{9}\right)$

14. $\theta_1 = 30^o$, $\theta_2 = 60^o$

$H = \frac{u^2 \sin^2 \theta}{2g}$, i.e., $H \propto \sin^2\theta$

$\therefore \frac{H_1}{H_2} = \frac{\sin^2 \theta_1}{\sin^2 \theta_2} = \frac{\sin^2 30^o}{\sin^2 60^o}$

$= \frac{(1/2)^2}{(\sqrt{3}/2)^2} = \frac{1}{3}$

15. Component of velocity $\perp$ to plane remains the same (in opposite direction),

i.e., $u \sin\theta = 20 \sin 30^o = 10$ m/s.