BCM SCHOOL, BASANT AVENUE, DUGRI, LDH.

ANSWER KEY

XI – PHYSICS

① $P.E. = mgH$

$= \frac{mg(u^2\sin^2\theta)}{2g}$

$= \left(\frac{1}{2}mu^2\right)\sin^2\theta$

$= E\sin^2\theta$.

② $u_x = x$; $u_y = y$

$R = 2H$

$\frac{u^2\sin 2\theta}{g} = 2\left(\frac{u^2\sin^2\theta}{2g}\right)$

$2\sin\theta\cos\theta = \sin^2\theta$

$2\cos\theta = \sin\theta$

$2 = \tan\theta$

$2 = \frac{u_y}{u_x}$

$\boxed{\frac{y}{x} = 2}$.

3. $\frac{u^2\sin 2\theta}{g} = 50$ (i)

$\frac{u^2\sin^2\theta}{2g} = 10$ (ii)

Divide (i) by (ii):

$\frac{u^2 \cdot 2\sin\theta\cos\theta}{g} \times \frac{2g}{u^2\sin^2\theta} = \frac{50}{10}$

$\frac{4\cos\theta}{\sin\theta} = 5$

$\frac{4}{5} = \tan\theta$

$\boxed{\theta = \tan^{-1}(0.8)}$.

4. 1st ball.

$u = 20\ m/s$; $t = 1\ s$

$a = -9.8\ m/s^2$

$y_1 = ut + \frac{1}{2}at^2$

$= 20(1) + \frac{1}{2}\times(-9.8)\times(1)^2$

$= 15.1\ m$

2nd ball.

$y_2 = u_y t + \frac{1}{2}a_y t^2$

$= (u\sin\theta)t + \frac{1}{2}\times(-9.8)\times(1)^2$

$= (20\sin 30^\circ)(1) - 4.9$

$= 10 - 4.9$

$= 5.1\ m$.

Separation $15.1 - 5.1$

$= 10\ m$

5. $u = 100\ m/s$.

$x = u_x t + \frac{1}{2}a_x t^2$

$= (u\cos\theta)T \quad (\because a_x = 0)$

$v_y = u_y + a_y t$

$0 = (u\sin\theta) - gt$

$t = \frac{u\sin\theta}{g} = \frac{100\times\sin 30^\circ}{9.8}$

$= \frac{100\times\frac{1}{2}}{9.8} = 5.1$

$T = 2t = 10.2\ s$

$x = (u\cos\theta)T$

$= 100\times\frac{\sqrt{3}}{2}\times 10.2$

$= 883.3\ m$.

6. $v = \sqrt{u^2 + g^2t^2 - 2ugt\sin\theta}$

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

$$v' = \sqrt{u^2 + g^2 \cdot \frac{4u^2\sin^2\theta}{g^2} - 2ug\left(\frac{2u\sin\theta}{g}\right)\sin\theta}$$

$$= \sqrt{u^2} = u$$

Also, $\tan\beta = \dfrac{u\sin\theta - g\left(\frac{2u\sin\theta}{g}\right)}{u\cos\theta}$

$$\tan\beta = -\frac{u\sin\theta}{u\cos\theta}$$

$$\tan\beta = -\tan\theta$$

$$\tan\beta = \tan(-\theta)$$

$$\boxed{\beta = -\theta}$$

7. $R_{max} = \dfrac{2}{\sqrt{3}} R$

$$\frac{u^2}{g} = \left(\frac{2}{\sqrt{3}}\right)\frac{u^2\sin 2\theta}{g}$$

$$\frac{\sqrt{3}}{2} = 2\sin\theta\cos\theta$$

$$\frac{\sqrt{3}}{2} = \sin 2\theta$$

$$\sin 60^\circ = \sin 2\theta$$

$$60^\circ = 2\theta$$

$$\boxed{\theta = 30^\circ}$$

$$y = \sqrt{3}x - \frac{g}{2}x^2$$

$$= (\tan\theta)x - \frac{g}{2u^2\cos^2\theta}x^2$$

$$\tan\theta = \sqrt{3}$$

$$\boxed{\theta = 60^\circ}$$

9. $R_P = R_Q$

$$\frac{(\sqrt{2}v)^2\sin 2(16^\circ)}{g} = \frac{v^2\sin 2\theta}{g}$$

$$2v^2 \cdot \sin 30^\circ = v^2 \cdot \sin 2\theta$$

$$1 = \sin 2\theta$$

$$\sin 90^\circ = \sin 2\theta$$

$$\boxed{\theta = 45^\circ}.$$

10.

m	$u_1 = 60$ km/h	h	$R_1 = 400$ m
$2m$	$u_2 = 30$ km/h	$4h$	$R_2 = ?$

$$R = u\sqrt{\frac{2h}{g}}$$

$$\frac{R_2}{R_1} = \frac{u_2}{u_1}\sqrt{\frac{h_2}{h_1}}$$

$$\frac{R_2}{400} = \frac{30}{60}\sqrt{\frac{4h}{h}}$$

$$\frac{R_2}{400} = \frac{1}{2} \times 2$$

$$\boxed{R_2 = 400\text{ m}}.$$

$u^2\cos^2\theta = 1$

$u^2 \cdot \cos^2 60^\circ = 1$

$u^2\left(\frac{1}{4}\right) = 1$

$u^2 = 4$

$\boxed{u = 2}$ m/s.