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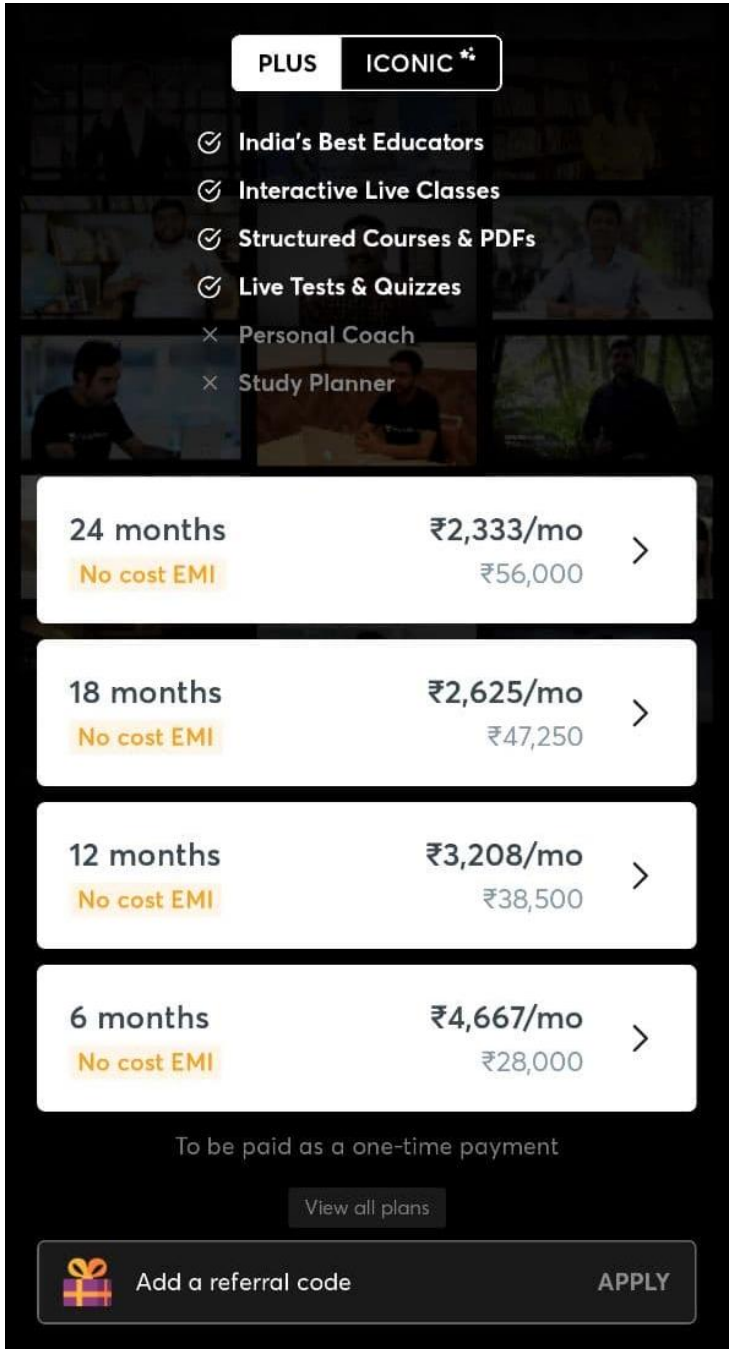

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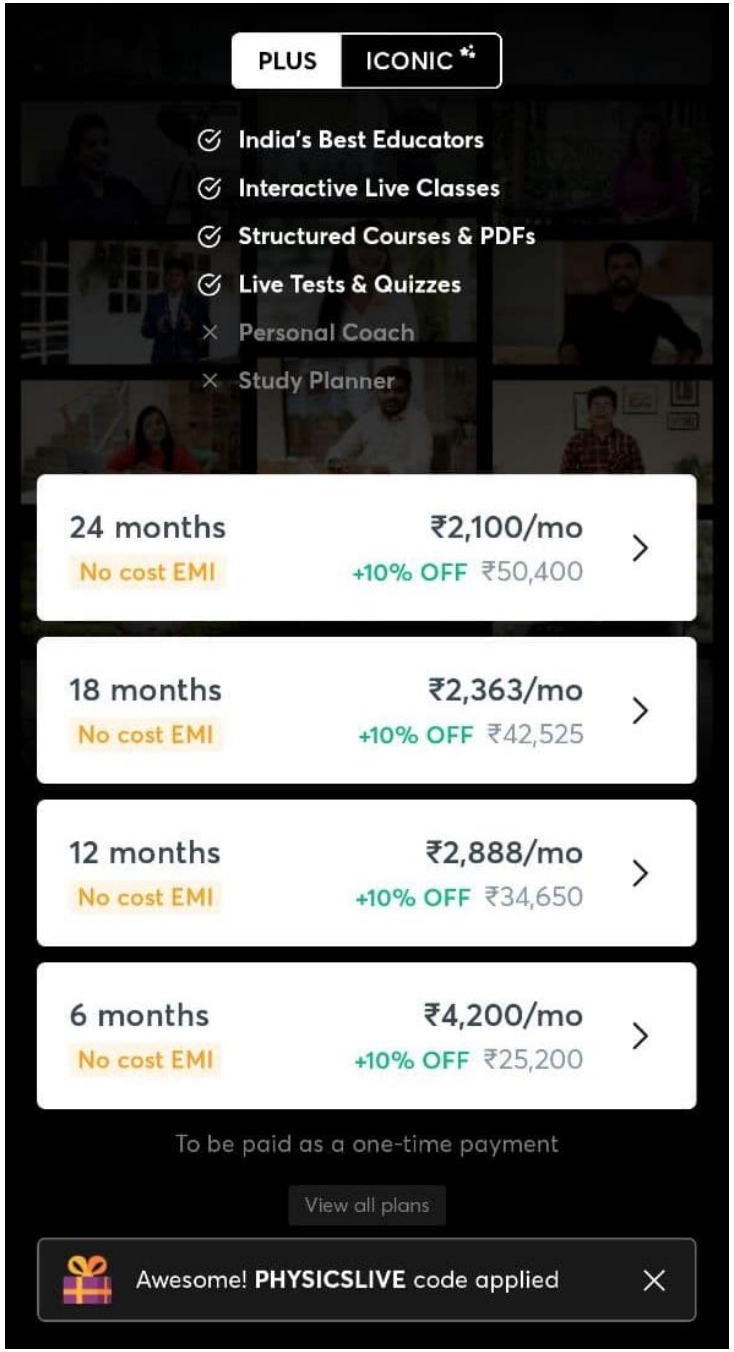

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Physics DPP

DPP-5 Projectile Motion

By Physicsaholics Team

Q) A projectile fired with initial velocity u at some angle θ has a range R. If the initial velocity be doubled at the same angle of projection, then the range will be:

(a) 2R
(b) R/2
(c) R
(d) 4R

Ans. d

$$R = \frac{u^2 \sin 2\theta}{g}$$

$$R \propto u^2$$

If $u \rightarrow 2u$

$$\frac{R'}{R} = \frac{(2u)^2}{u^2} = 4$$

$$\boxed{R' = 4R}$$

Q) A ball is thrown with an initial velocity of 100m/s at an angle of 30^0 above the horizontal. How far from the throwing point will the ball attain its original level? $(g = 10\ m/s^2)$

(a) $50\sqrt{3}$ m

(b) 486 m

(c) 866 m

(d) 746 m

Ans. c

$$R = \frac{u^2 \sin 2\theta}{g}$$

$$= \frac{(100)^2 \times \sin(2 \times 30^\circ)}{10}$$

$$= 1000 \frac{\sqrt{3}}{2}$$

$$\boxed{R = 500\sqrt{3}\ m}$$

or

$$\boxed{R = 866\ m}$$

Q) The greatest height to which a man can throw a stone is h. The greatest distance to which he can throw it, will be?

(a) h/2
(b) h
(c) 2h
(d) 3h

Ans. c

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

for max value of H

$\sin\theta = 1$

$\theta = 90^\circ$

so) $h = \frac{u^2}{2g}$

$$\boxed{u = \sqrt{2gh}}$$

for max Range;

$\theta = 45^\circ$

$$R = \frac{u^2 \sin 2\theta}{g}$$

$$R = \frac{(2gh)(\sin 90^\circ)}{g}$$

$$\boxed{R = 2h}$$

Q) The range of a projectile for a given initial velocity is maximum when the angle of projection is 45^0. The range will be minimum, if the angle of projection is:

(a) 90^0

(b) 180^0

(c) 60^0

(d) 75^0

Ans. a

Range; $R = \frac{u^2 \sin 2\theta}{g}$

minimum Range; $R = 0$

at $\theta = 90$

(in vertical up ward projection; Range is zero)

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Q) A stone is projected from the ground with velocity 25 m/s. Two seconds later, it just clears a wall 5 m high. The angle of projection of the stone is: $(g = 10\ m/s^2)$

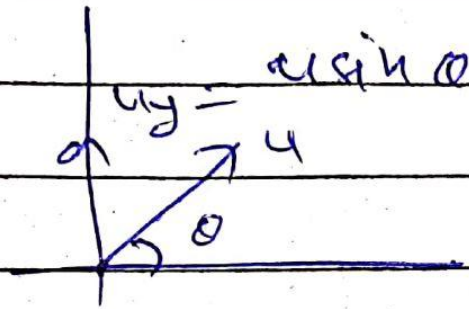
(a) 30^0

(b) 45^0

(c) 50.2^0

(d) 60^0

Ans. a



$$h = u_y t - \frac{1}{2} a_y t^2$$

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

$$5 = 50\sin\theta - 20$$

$$25 = 50\sin\theta$$

$$\sin\theta = \frac{1}{2}$$

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

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Q) Galileo writes that for angles of projection of a projectile at angles $(45^0 + \theta)$ and $(45^0 - \theta)$, the horizontal ranges described by the projectile are in the ratio of: $(\theta < 45^0)$

(a) 2:1
(b) 1:2
(c) 1:1
(d) 2:3

Ans. c

$\theta_1 = 45^\circ + \theta$; $\theta_2 = 45^\circ - \theta$

$\theta_1 + \theta_2 = (45^\circ + \theta) + (45^\circ - \theta)$

$$\theta_1 + \theta_2 = 90^\circ$$

∴ Range will be same for both.

$$\frac{R_1}{R_2} = \frac{1}{1}$$

Q) The equation of trajectory of a projectile is $y = 10x - \left(\frac{5}{9}\right)x^2$ If we assume g = $10\ m/s^2$, the range of projectile (in meters) is:

(a) 36
(b) 18
(c) 24
(d) 9

Ans. b

$$y = x + \tan\theta\left(1 - \frac{y}{R}\right) \quad \text{— (1)}$$

$$y = 10x\left(1 - \frac{5}{9} \times \frac{1}{10}x\right)$$

$$y = 10x\left(1 - \frac{x}{18}\right) \quad \text{— (2)}$$

by comparing eq^{n} (1) & (2)

$$\boxed{R = 18\ m}$$

Q) A projectile can have the same range R for, two angles of projection at a given speed. If T_1 and T_2 be the times of flight in two cases, then find out relation between T_1, T_2 and R:

(a) $R = T_1 T_2 \frac{g}{2}$

(b) $R = T_1 T_2 \frac{2}{g}$

(c) $T_1 T_2 = \frac{R}{g}$

(d) $R = \frac{T_1 T_2}{g}$

Ans. a

for same Range:

if $\theta_1 = \theta$

then $\theta_2 = 90 - \theta$

$$R = \frac{u^2 \sin 2\theta}{g} \quad - (1)$$

$$T_1 = \frac{2u \sin\theta}{g} \quad - (2)$$

$$T_2 = \frac{2u \sin(90-\theta)}{g} \quad -$$

$$T_2 = \frac{2u \cos\theta}{g} \quad - (3)$$

$$T_1 \cdot T_2 = \frac{+u^2 \sin\theta \cos\theta}{g^2}$$

$$T_1 T_2 = \frac{2u^2 \sin 2\theta}{g^2}$$

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

$$T_1 T_2 = \frac{2}{g} R$$

$$\boxed{R = \frac{T_1 T_2 g}{2}}$$

Q) A body is projected with initial velocity of $(8\hat{\imath} + 6\hat{\jmath})\ m/s$. The horizontal range is? $(g = 9.8\ m/s^2)$

(a) $9.6\ m$

(b) $14\ m$

(c) $50\ m$

(d) $19.2\ m$

Ans. a

$$\vec{V} = 8\hat{i} + 6\hat{j}$$

$$u_x = 8 \text{ m/s}$$

$$u_y = 6 \text{ m/s}$$

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

$$R = \frac{2 (8)(6)}{9.8}$$

$$\boxed{R = 9.6 \text{ m}}$$

Q) If time of flight of a projectile is 10 seconds. Range is 500 m. The maximum height attained by it will be:

(a) $50\ m$

(b) $100\ m$

(c) $125\ m$

(d) $150\ m$

Ans. c

$$T = \frac{2u\sin\theta}{g} = 10$$

$$\Rightarrow u\sin\theta = \frac{10 \times 10}{2} = 50$$

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

$$= \frac{(50)^2}{2\times 10} = \frac{2500}{2\times 10}$$

$$\boxed{H_{max} = 125\ m}$$

Q) An aeroplane is flying horizontally with a velocity of 600 km/h at a height of 1960 m. When it is vertically at a point A on the ground, a bomb is released from it. The bomb strikes the ground at point B. The distance AB is:

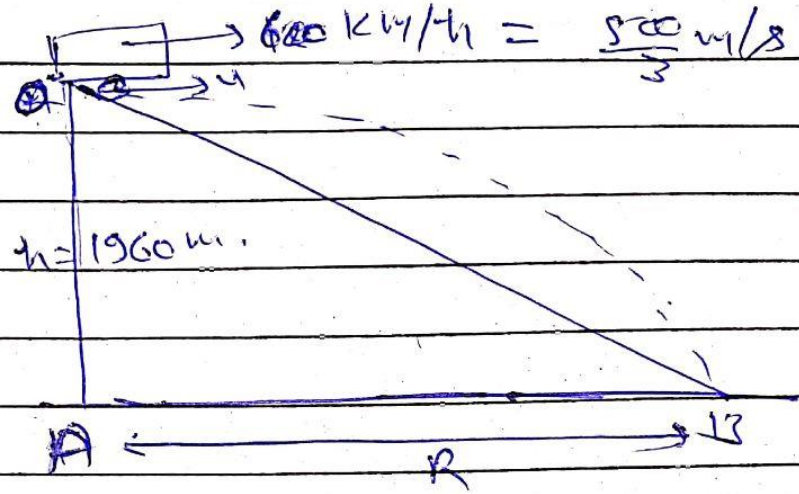
(a) $1200\ m$

(b) $0.33\ km$

(c) $3.33\ km$

(d) $33\ km$

Ans. c



$$T = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 1960}{9.8}}$$

$$T = \sqrt{400}$$

$$T = 20 \text{ Sec.}$$

$$AB = R = u \times T$$

$$= \frac{500}{3} \times 20 = \frac{10,000}{3} \text{ m}$$

$$AB = 3333.3 \text{ m.}$$

$$\boxed{AB = 3.33 \text{ km}}$$

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Chalo Niklo