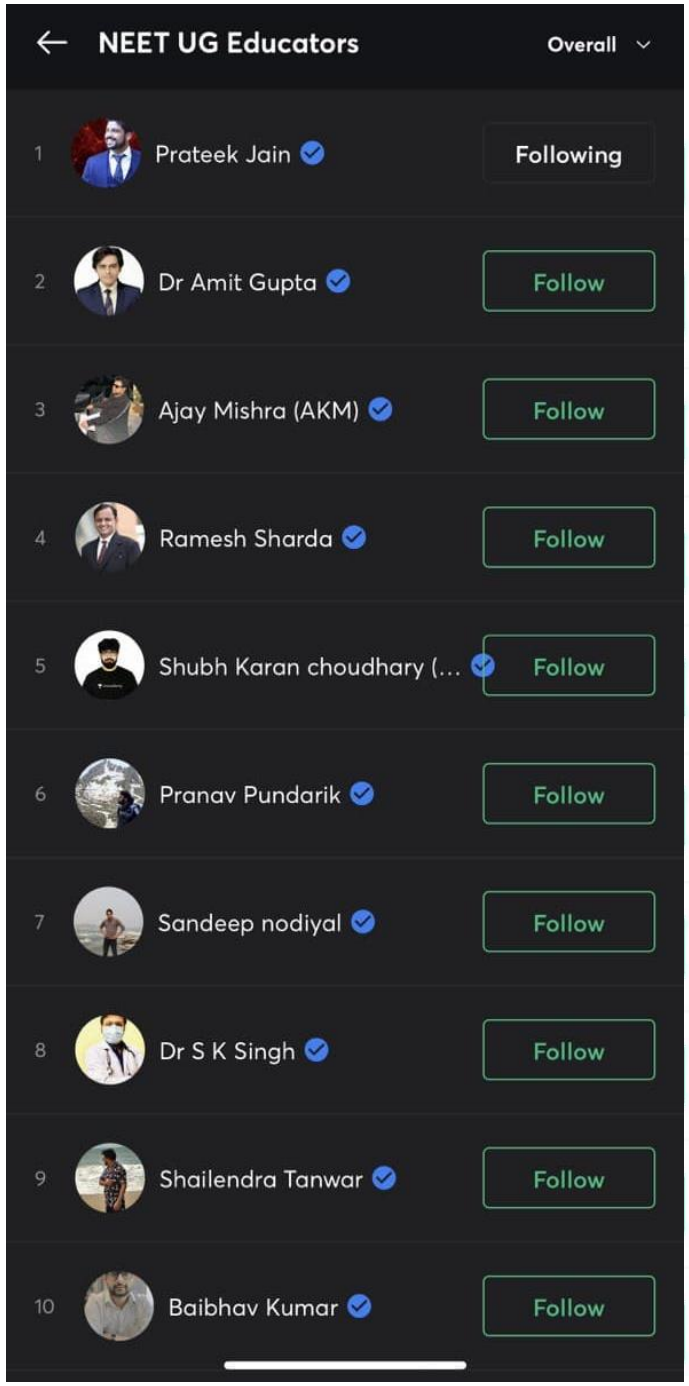
SIR PRATEEK JAIN

. Founder @Physicsaholics
. Top Physics Faculty on Unacademy (IIT JEE & NEET)
. 8+ years of teaching experience in top institutes like FIITJEE (Delhi, Indore) , CP (KOTA) etc.
. Produced multiple Top ranks.
. Research work with HC Verma sir at IIT Kanpur
. Interviewed by International media.



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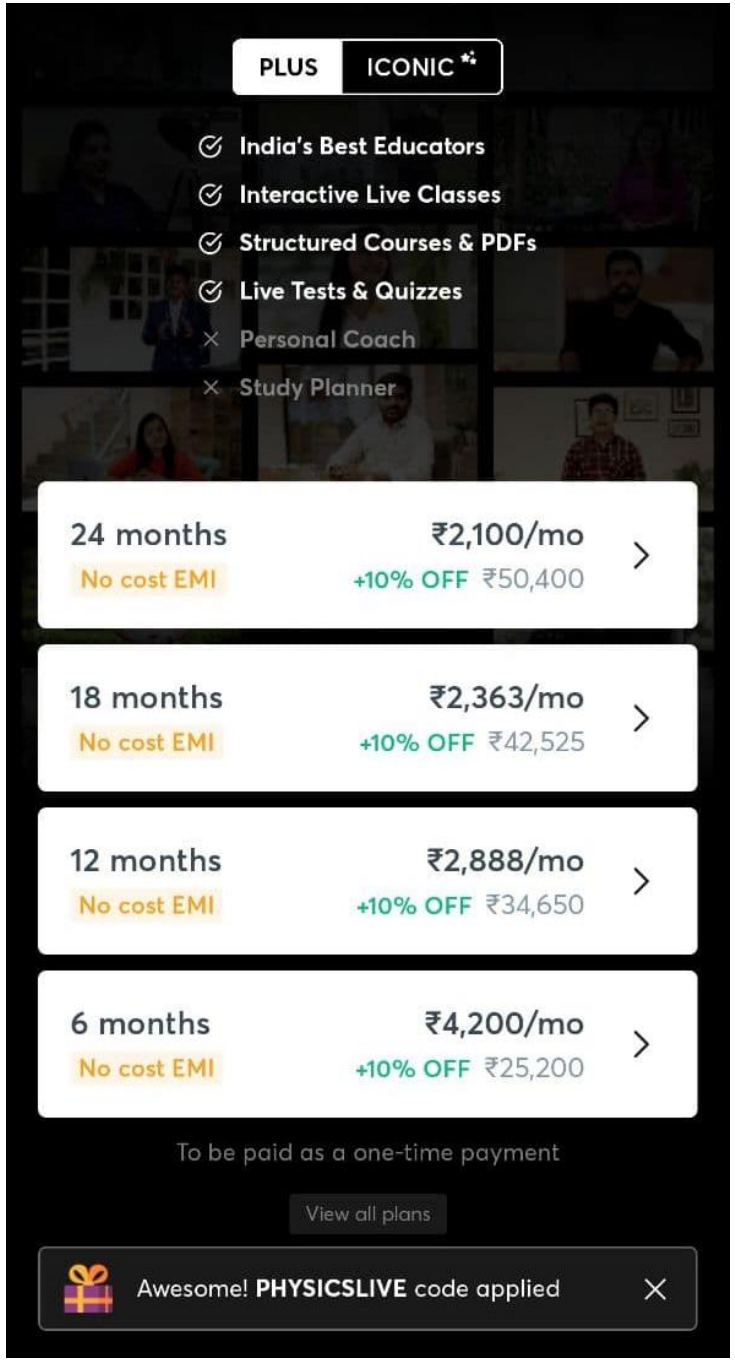

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Solution
NEET & AIIMS PYQs

Kinematics (3/3) :2D

By Physicsaholics Team

PYQs on Following Subtopic:

Equation of Projectile

A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} at angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) is (given, $g = 9.8\ ms^{-2}$)

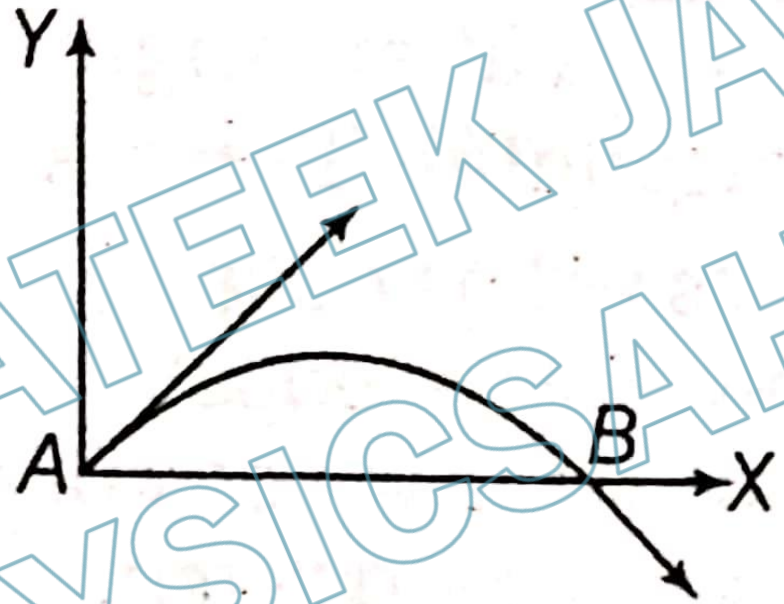
[CBSE AIPMT 2014]

(a) 3.5 (b) 5.9 (c) 16.3 (d) 110.8

Ans. a

The velocity of a projectile at the initial point A is $(2\hat{i} + 3\hat{j})$ m/s. Its velocity (in m/s) at point B is

[NEET 2013]



(a) $-2\hat{i} - 3\hat{j}$

(b) $-2\hat{i} + 3\hat{j}$

(c) $2\hat{i} - 3\hat{j}$

(d) $2\hat{i} + 3\hat{j}$

Ans. c

The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is

[CBSE AIPMT 2012]

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

(b) $\theta = \tan^{-1}(4)$

(c) $\theta = \tan^{-1}(2)$

(d) $\theta = 45°$

Ans. b

A missile is fired for maximum range with an initial velocity of 20 m/s. If $g = 10\ m/s^2$, the range of the missile is *[CBSE AIPMT 2011]*

(a) 50 m
(b) 60 m
(c) 20 m
(d) 40 m

Ans. d

A particle of mass m is projected with velocity v making an angle of 45° with the horizontal. When the particle lands on the level ground, the magnitude of the change in its momentum will be *[CBSE AIPMT 2008]*

(a) $2mv$ (b) $\frac{mv}{\sqrt{2}}$ (c) $mv\sqrt{2}$ (d) zero

Ans. c

For angles of projection of a projectile at angles $(45° - \theta)$ and $(45° + \theta)$, the horizontal ranges described by the projectile are in the ratio of *[CBSE AIPMT 2006]*

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

Ans. a

. Two particles are projected with same initial velocities at an angle 30° and 60° with the horizontal. Then, *[CBSE AIPMT 2000]*

(a) their heights will be equal
(b) their ranges will be equal
(c) their time of flights will be equal
(d) their ranges will be different

Ans. b

A bullet is fired from a gun with a speed of 1000 m/s in order to hit a target 100 m away. At what height above the target should the gun be aimed? (The resistance of air is negligible and $g = 10\ m/s^2$)

[CBSE AIPMT 1995]

(a) 5 cm (b) 10 cm (c) 15 cm (d) 20 cm

Ans. a

Two bodies of same mass are projected with the same velocity at an angle 30° and 60° respectively. The ratio of their horizontal ranges will be *[CBSE AIPMT 1990]*

(a) 1 : 1 (b) 1 : 2 (c) 1 : 3 (d) 2 : $\sqrt{2}$

Ans. a

The maximum range of a gun of horizontal terrain is 16 km. If $g = 10\ ms^{-2}$, then muzzle velocity of a shell must be

[CBSE AIPMT 1990]

(a) $160\ ms^{-1}$ (b) $200\sqrt{2}\ ms^{-1}$

(c) $400\ ms^{-1}$ (d) $800\ ms^{-1}$

Ans. c

Assertion : For a projectile the time of flight of a body becomes n times the original value if its speed is made n times.

Reason : For a projectile, this is due to the range of the projectile which becomes n times.

(2018)

AIIMS

Ans. c

Assertion : For angular projection, when angle of projection $\theta = \tan^{-1}(1)$, the horizontal range is four times the maximum height.

Reason : The horizontal range of projectile is directly proportional to square of velocity and inversely proportional to acceleration due to gravity.

AIIMS *(2018)*

Ans. b

A body is projected at such angle that the horizontal range is three times the greatest height. The angle of projection is *[1998]*

(a) $42^\circ 8'$ (b) $53^\circ 7'$

(c) $33^\circ 7'$ (d) $25^\circ 8'$

AIIMS

Ans. b

Two projectiles are projected with the same velocity. If one is projected at an angle of 30° and the other at 60° to the horizontal, the ratio of maximum heights reached, is **AIIMS** ***[2001]***

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

(c) 3 : 1 (d) 1 : 4

Ans. a

At the uppermost point of a projectile, its velocity and acceleration are at an angle of

(a) 180° (b) 90° *[2002]*

(c) 60° (d) 45° AIIMS

Ans. b

A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flights in the two cases, then the product of the two time of flights is proportional to ***[2006]***

AIIMS

(a) $\frac{1}{R^2}$ (b) R^2

(c) R (d) $\frac{1}{R}$

Ans. c

If R and H represent the horizontal range and the maximum height achieved by a projectile then which of the relation exists? ***[2009]***

(a) $\frac{H}{R} = 4\cot\theta$ (b) $\frac{R}{H} = 4\cot\theta$ **AIIMS**

(c) $\frac{H}{R} = 4\tan\theta$ (d) $\frac{R}{H} = 4\tan\theta$

Ans. b

For a given angle of the projectile if the initial velocity is doubled the range of the projectile becomes AIIMS *[2011]*

(a) Half (b) One-fourth

(c) Two times (d) Four times

Ans. d

If we can throw a ball upto a maximum height H, the maximum horizontal distance to which we can throw it is *[2011]*

(a) $2H$

(b) $\sqrt{2}H$

(c) H

(d) $\frac{H}{2}$

AIIMS

Ans. a

A projectile can have the same range for two angles of projection. If h_1 and h_2 are maximum heights when the range in the two cases is R, then the relation between R, h_1 and h_2 is *[2013]*

AIIMS

(a) $R = 4\sqrt{h_1 h_2}$ (b) $R = 2\sqrt{h_1 h_2}$

(c) $R = \sqrt{h_1 h_2}$ (d) None of these

Ans. a

A projectile thrown with velocity v making angle θ with vertical gains maximum height H in the time for which the projectile remains in air, the time period is

AIIMS *[2013]*

(a) $\sqrt{H\cos\theta/g}$ (b) $\sqrt{2H\cos\theta/g}$

(c) $\sqrt{4H/g}$ (d) $\sqrt{8H/g}$

Ans. d

A bomb is released from a horizontal flying aeroplane. The trajectory of bomb is *[2013]*

AIIMS

(a) a parabola

(b) a straight line

(c) a circle

(d) a hyperbola

Ans. a

Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true? **AIIMS** ***[2014]***

(a) Their maximum height will be same

(b) Their range will be same

(c) Their landing velocity will be same

(d) Their time of flight will be same

Ans. b

A boy playing on the roof of a 10 m high building throws a ball with a speed of 10m/s at an angle of 30^o with the horizontal. How far from the throwing point will the ball be at the height of 10 m from the ground? **AIIMS** ***[2017]***

$[\, g = 10 m/s^2,\ \sin 30^o = \frac{1}{2},\ \cos 30^o = \frac{\sqrt{3}}{2}\,]$

(a) $5\sqrt{5}$

(b) 6

(c) 3

(d) $5\sqrt{3}$

Ans. d

PYQs on Following Subtopic:

Relative Velocity

A bus is moving with a speed of $10\ ms^{-1}$ on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus? *[CBSE AIPMT 2009]*

(a) $20\ ms^{-1}$
(b) $40\ ms^{-1}$
(c) $25\ ms^{-1}$
(d) $10\ ms^{-1}$

Ans. a

A train of 150 m length is going towards North direction at a speed of 10 m/s. A parrot flies at the speed of 5 m/s towards South direction parallel to the railways track. The time taken by the parrot to cross the train is *[CBSE AIPMT 1992]*

(a) 12 s (b) 8 s (c) 15 s (d) 10 s

Ans. d

wrong

Assertion : The relative velocity between any two bodies may be equal to sum of the velocities of two bodies.

Reason : Sometimes, relative velocity between two bodies may be equal to difference in velocities of the two.

AIIMS 2019

Ans. b

A student is standing at a distance of 50 metre from the bus. As soon as the bus begins its motion with an acceleration of 1 ms^{-2}, the student starts running towards the bus with a uniform velocity u. Assuming the motion to be along a straight road, the minimum value of u, so that the student is able to catch the bus is

(a) 8 ms^{-1} (b) 5 ms^{-1} ***[2010]***

(c) 12 ms^{-1} (d) 10 ms^{-1} **AIIMS**

Ans. d

PYQs on Following Subtopic:

Velocity of Approach

Two particles A and B, move with constant velocities $\mathbf{v}_1$ and $\mathbf{v}_2$. At the initial moment, their position vectors are $\mathbf{r}_1$ and $\mathbf{r}_2$ respectively. The condition for particles A and B for their collision is *[CBSE AIPMT 2015]*

(a) $\dfrac{\mathbf{r}_1 - \mathbf{r}_2}{|\mathbf{r}_1 - \mathbf{r}_2|} = \dfrac{\mathbf{v}_2 - \mathbf{v}_1}{|\mathbf{v}_2 - \mathbf{v}_1|}$ (b) $\mathbf{r}_1 \cdot \mathbf{v}_1 = \mathbf{r}_2 \cdot \mathbf{v}_2$

(c) $\mathbf{r}_1 \times \mathbf{v}_1 = \mathbf{r}_2 \times \mathbf{v}_2$ (d) $\mathbf{r}_1 - \mathbf{r}_2 = \mathbf{v}_1 - \mathbf{v}_2$

Ans. a

PYQs on Following Subtopic:

Distance of closest approach

A ship A is moving Westwards with a speed of 10 km h^{-1} and a ship B 100 km South of A, is moving Northwards with a speed of 10 km h^{-1}. The time after which the distance between them becomes shortest is

[CBSE AIPMT 2015]

(a) 0 h (b) 5 h (c) $5\sqrt{2}$ h (d) $10\sqrt{2}$ h

Ans. b

A ball is thrown from a point with a speed 'v_0' at an elevation angle of θ . From the same point and at the same instant, a person starts running with a constant speed $\frac{'v_0'}{2}$ to catch the ball.

Will the person be able to catch the ball? If yes, what should be the angle of projection θ ?

[2016] **AIIMS**

(a) No

(b) Yes, 30°

(c) Yes, 60°

(d) Yes, 45°

Ans. c

PYQs on Following Subtopic:

River swimmer problem

A person swims in a river aiming to reach exactly opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle 120° with the direction of flow of water. The speed of water in stream is

[CBSE AIPMT 1999]

(a) 1.0 m/s (b) 0.5 m/s (c) 0.25 m/s (d) 0.43 m/s

Ans. c

The speed of a boat is 5 km/h in still water. It crosses a river of width 1.0 km along the shortest possible path in 15 min. The velocity of the river water is (in km/h)

(a) 5 (b) 1 *[CBSE AIPMT 1998]*

(c) 3 (d) 4

Ans. c

A boat is sent across a river with a velocity of 8 km h^{-1}. If the resultant velocity of boat is 10 km h^{-1}, then velocity of river is

wrong

[CBSE AIPMT 1993]

(a) 12.8 km h^{-1}

(b) 6 km h^{-1}

(c) 8 km h^{-1}

(d) 10 km h^{-1}

Ans. b (for shortest time)

The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path the angle at which he should make his strokes w.r.t. north is given by

(a) 0°
(b) 60° west
(c) 45° west
(d) 30° west

NEET 2019

Ans. d

Assertion : The magnitude of velocity of two boats relative to river is same. Both boats start simultaneously from same point on one bank may reach opposite bank simultaneously moving along different paths.

Reason : For boats to cross the river in same time. The component of their velocity relative to river in direction normal to flow should be same.

AIIMS *[2015]*

Ans. a

PYQs on Following Subtopic:

Rain-man problem

1. Rain is falling vertically downwards with a velocity of 3 km/hr. A man walks in the rain with a velocity of 4 km/hr. The rain drop will fall on the man with a velocity of *[1997]*

AIIMS

(a) 5 km/hr (b) 4 km/hr

(c) 1 km/hr (d) 3 km/hr

Ans. a

PYQs on Following Subtopic:

Relative motion

Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be

[NEET 2017]

(a) $\frac{t_1 + t_2}{2}$ (b) $\frac{t_1 t_2}{t_2 - t_1}$ (c) $\frac{t_1 t_2}{t_2 + t_1}$ (d) $t_1 - t_2$

Ans. c

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