

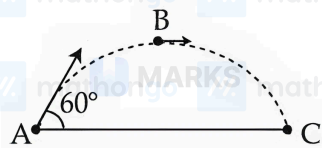
Q1. JEE Main 2026 (21 January Shift 2)

A river of width 200 m is flowing from west to east with a speed of 18 km/h. A boat, moving with speed of 36 km/h in still water, is made to travel one-round trip (bank to bank of the river). Minimum time taken by the boat for this journey and also the displacement along the river bank are _____ and _____ respectively.

- (1) 20 s and 100 m (2) 40 s and 0 m
(3) 40 s and 200 m (4) 40 s and 100 m

Q2. JEE Main 2026 (23 January Shift 1)

An object is projected with kinetic energy K from a point A at an angle 60° with the horizontal. The ratio of the difference in kinetic energies at points B and C to that at point A (see figure), in the absence of air friction is :



- (1) 1 : 4 (2) 2 : 3 (3) 3 : 4 (4) 1 : 2

Q3. JEE Main 2026 (22 January Shift 1)

A projectile is thrown upward at an angle 60° with the horizontal. The speed of the projectile is 20 m/s when its direction of motion is 45° with the horizontal. The initial speed of the projectile is _____ m/s.

- (1) $20\sqrt{2}$ (2) 40 (3) $40\sqrt{2}$ (4) $20\sqrt{3}$

Q4. JEE Main 2026 (24 January Shift 1)

A boy throws a ball into air at 45° from the horizontal to land it on a roof of a building of height H . If the ball attains maximum height in 2 s and lands on the building in 3 s after launch, then value of H is _____ m.

($g = 10 \text{ m/s}^2$)

- (1) 15 (2) 20 (3) 25 (4) 10

ANSWERS AND SOLUTIONS

1. (3)

2. (3)

3. (1)

4. (1)

1. (3) Width of the river $d = 200$ m.

Speed of river $v_r = 18$ km/h $= 18 \times \frac{5}{18} = 5$ m/s.

Speed of boat in still water $v_b = 36$ km/h $= 36 \times \frac{5}{18} = 10$ m/s.

For minimum time to cross the river, the boat must head perpendicular to the river flow (at 90° to the bank).

Time taken to cross once $t = \frac{d}{v_b} = \frac{200}{10} = 20$ s.

For a round trip (bank to bank and back), the total minimum time is $T = 2t = 2 \times 20 = 40$ s.

During the first crossing, the drift (displacement along the bank) is $x_1 = v_r \times t = 5 \times 20 = 100$ m.

During the return trip, to minimize time, the boat again heads perpendicular to the flow relative to the water. The river continues to flow in the same direction, so the drift is again in the same direction as the first trip.

Return drift $x_2 = v_r \times t = 5 \times 20 = 100$ m.

Total displacement along the river bank $= x_1 + x_2 = 100 + 100 = 200$ m.

Thus, minimum time is 40 s and displacement is 200 m.

2. (3) At A: $KE_A = K$, $v_A = v$, angle $= 60^\circ$.

At B (highest point): $v_B = v \cos 60^\circ = v/2$, so $KE_B = K/4$.

At C (same level as A): by energy conservation, $KE_C = K$.

$|KE_B - KE_C| = |K/4 - K| = 3K/4$.

Ratio $= \frac{3K/4}{K} = \frac{3}{4}$, i.e., 3 : 4.

3. (1) Horizontal velocity is constant: $v_x = u \cos 60^\circ = \frac{u}{2}$.

When direction is 45° with horizontal and speed is 20 m/s:

$v_x = 20 \cos 45^\circ = \frac{20}{\sqrt{2}}$.

$\frac{u}{2} = \frac{20}{\sqrt{2}} \Rightarrow u = \frac{40}{\sqrt{2}} = 20\sqrt{2}$ m/s.

4. (1) For projectile motion at 45° , vertical component of initial velocity:

$v_{0y} = v_0 \sin 45^\circ = \frac{v_0}{\sqrt{2}}$

Maximum height occurs at $t = 2$ s when $v_y = 0$:

$0 = v_{0y} - gt$

$\Rightarrow v_{0y} = 10 \times 2 = 20$ m/s

Thus $\frac{v_0}{\sqrt{2}} = 20$, so $v_0 = 20\sqrt{2}$ m/s

Height at landing time $t = 3$ s:

$H = v_{0y}t - \frac{1}{2}gt^2 = 20 \times 3 - \frac{1}{2} \times 10 \times 9$

$= 60 - 45 = 15$ m