Q.1 A police man in a jeep is chasing a terrorist on a straight road with a constant speed \( V \). The terrorist is riding a motor cycle and when the jeep is at a distance 50 m away, the terrorist starts with a constant acceleration \( 1 \text{ m/s}^2 \). The terrorist will be caught if

(A) \( V \geq 10 \text{ m/s} \)  \( (B) V \geq \sqrt{10} \text{ m/s} \)  \( (C) V \geq 1 \text{ m/s} \)  \( (D) V \geq \sqrt{3} \text{ m/s} \)

Q.2 A man is travelling in east direction with a velocity of 6 m/s. Rain is falling down vertically with a speed of 4 m/s. Find the velocity of rain with respect to man and its angle with the vertical using the concept that relative velocity of B with respect to A = \( \mathbf{v}_B - \mathbf{v}_A \).

Q.3 A girl wishes to swim across a river to a point directly opposite as shown. She can swim at 2 m/s in still water and the river is flowing at 1 m/s. At what angle \( \theta \) with respect to the line joining the starting and finishing points should she swim?

(A) 30°  \( (B) 45° \)  \( (C) 60° \)  \( (D) 63° \)

Q.4 A boat being rowed in a river. Air is also blowing. Direction of velocity vectors of boat, water and air in ground frame are as shown in diagram

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>Direction in which boat is being steered</td>
</tr>
<tr>
<td>(B)</td>
<td>Direction in which a flag on the boat may flutter</td>
</tr>
<tr>
<td>(C)</td>
<td>Direction of velocity of water relative to boat</td>
</tr>
<tr>
<td>(D)</td>
<td>Direction of velocity of air relative to a piece of wood floating on river.</td>
</tr>
</tbody>
</table>

Q.5 Two guns are mounted (fixed) on two vertical cliffs that are very high from the ground as shown in figure. The muzzle speed of the shell from \( G_1 \) is \( u_1 \) and that from \( G_2 \) is \( u_2 \). The guns aim exactly towards each other. The tuns are fired simultaneously. What is the ratio \( u_1 : u_2 \) such that the shells collide with each other in air? (Assume that there is no resistance of air).

(A) 1:2  \( (B) 1:4 \)  \( (C) \) they will collide for any ratio  \( (D) \) they will not collide for any ratio.
Q.6 To man running at a speed of 5 m/sec, the rain drops appear to be falling at an angle of 45° from the vertical. If the rain drops are actually falling vertically downwards, then velocity in m/sec is
(A) 5 (B) 5\sqrt{2} (C) 5\sqrt{3} (D) 4

Q.7 Two transparent elevator cars A and B are moving in front of each other. Car A is moving up and retarding at a_1, while car B is moving down and retarding at a_2. Person in car A drops a coin inside the car. What is the acceleration observed by person in car B.
(A) g – a_1 – a_2 downward (B) g + a_1 downward
(C) g – a_1 + a_2 downward (D) None of these

Q.8 A boat is able to move through still water at 20 m/s. It makes a round trip to a town 3.0 km upstream. If the river flows at 5 m/s, the time required for this round trip is:
(A) 120 s (B) 150 s (C) 200 s (D) 320 s

Q.9 Two particles, one with constant velocity 50 m/s and the other with uniform acceleration 10 m/s^2, start moving simultaneously from the same place in the same direction. They will be at a distance of 125m from each other after.
(A) 5 sec. (B) 5(1 + \sqrt{2}) sec. (C) 10 sec (D) 10 (\sqrt{2} + ) sec

Q.10 A boat is traveling upstream at 14 km/h with respect to a river that is flowing at 6 km/h (with respect to the ground). A man runs directly across the boat, from one side to the other, at 6 km/h (with respect to the boat). The speed of the man with respect to the ground is
(A) 10 km/h (B) 14 km/h (C) 18.5 km/h (D) 21 km/h

ANSWER KEY

Q.1 A Q.2 |\vec{v}| = \sqrt{52} m/s, angle with vertical = \tan^{-1}(3/2) towards west
Q.3 A Q.4 (A) P ; (B) Q, S ; (C) S ; (D) P,R
Q.5 C Q.6 A Q.7 A Q.8 D Q.9 AB Q.10 A