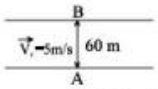
Section : (B) Relative motion in river flow & Air flow

B-1. The speed of boat is 5 km/h in still water. It crosses a river of width 1 km along shortest possible path in 15 min. The velocity of river water is

(A)1 km/h (B) 3 km/h (C) 4 km/h (D) 5 km/h

B-2. A man is crossing a river flowing with velocity of 5 m/s. He reaches a point directly across at a distance of 60 m in 5 sec. His velocity in still water should be



(A) 12 m/s (B) 13 m/s
(C) 5 m/s (D) 10 m/s

B-3. If speed of water in river is 4 m/s and speed of swimmer with respect to water is 3 m/s, then in which direction the swimmer must swim so that he will reach directly opposite end?

(A) 127° with direction of river flow
(B) 90° with direction of river flow
(C) 143° with direction of river flow
(D) Swimmer will never reach directly opposite end

B-4. A boat can go across a lake and return in time T_0 at a speed V. On a rough day there is uniform current at speed u to help the onward journey and impede the return journey. If the time taken to go across and return on the rough day be T, then T/T_0 =

(A) $1-\frac{u^2}{V^2}$ (B) $\frac{1}{1-\frac{u^2}{V^2}}$ (C) $1+\frac{u^2}{V^2}$ (D) $\frac{1}{1+\frac{u^2}{V^2}}$

B-5. To cross the river in shortest distance, a swimmer should swim making angle θ with the upstream. What is the ratio of the time taken to swim across in the shortest time to that in swimming across over shortest distance. [Assume speed of swimmer in still water is greater than the speed of river flow

(A) cosθ (B) sin θ (C) tan θ (D) cot θ

B-6. A man crosses the river perpendicular to river flow in time t seconds and travels an equal distance down the stream in T seconds. The ratio of man's speed in still water to the speed of river water will be:

(A) $\frac{t^2-T^2}{t^2+T^2}$ (B) $\frac{T^2-t^2}{T^2+t^2}$ (C) $\frac{t^2+T^2}{t^2-T^2}$ (D) $\frac{T^2+t^2}{T^2-t^2}$

C-1. When a person walks on a straight road with a speed 10 km/h, rain appears to fall vertically downward. As he stops, the rain appears to fall at an angle 30° with vertical. The speed of rain with respect to the person.

(A) 20 km/hr (B) $10\sqrt{3}$ km/hr (C) 10 km/hr (D) $20\sqrt{3}$ km/hr

C-2. An aeroplane is to go along straight line from A to B, and back again. The relative speed with respect to wind is V.. The wind blows perpendicular to line AB with speed v. The distance between A and B is ℓ. The total time for the round trip is:

(A) $\frac{2\ell}{\sqrt{V^2 - v^2}}$ (B) $\frac{2v\ell}{V^2 - v^2}$ (C) $\frac{2V\ell}{V^2 - v^2}$ (D) $\frac{2\ell}{\sqrt{V^2 + v^2}}$

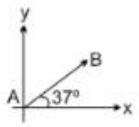
C-3. A flag is mounted on a car moving due North with velocity of 20 km/hr. Strong winds are blowing due East with velocity of 20 km/hr. The flag will point in direction

(A) East (B) North - East (C) South - East (D) South - West

C-4. Rain is falling vertically with a speed of 20 ms^{-1} relative to air. A person is running in the rain with a velocity of 5 ms^{-1} and a wind is also blowing with a speed of 15 ms^{-1} (both towards east). Find the angle with the vertical at which the person should hold his umbrella so that he may not get drenched.

(A) $\tan^{-1}\sqrt{2}$ (B) $\tan^{-1}\left(\frac{1}{2}\right)$ (C) $\tan^{-1}(2)$ (D) 45°

C-5. A butterfly is flying with velocity $10\hat{i} + 12\hat{j}$ m/s and wind is blowing along x axis with velocity u. If butterfly starts motion from A and after some time reaches point B, find the value of u.



(A) 2 m/s (B) 6 m/s (C) 4 m/s (D) 3m/s

C-6. Raindrops are falling vertically with a velocity of 10 m/s. To a cyclist moving on a straight road the raindrops appear to be coming with a velocity of 20 m/s. The velocity of cyclist is :

(A) 10 m/s (B) $10\sqrt{3}$ m/s (C) 20 m/s (D) $20\sqrt{3}$ m/s

B1 –B
B2- B
B3 –D
B4- B
B5- B
B6- C

C1- B
C2-A
C3-C
C4-B
C5- B
C6-B