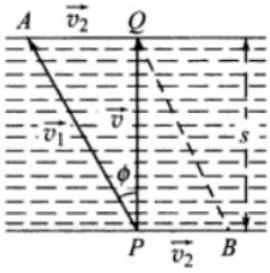
Answer on Question #47390 – Physics – Other

to cross a river across to the lowest distance,why the river has to run the boat creating an angle with the stream.as the question says that the boat has to cross it across the lowest distance which is the width of the river.so why not the angle between the boat and stream is not 90 degree?and here if it creates another angle then why not the total distance is more than the width?

Solution:
A boat in a river always moves in the direction of resultant velocity of the velocity of the boar and the velocity of the river flow.



When a boat crosses the river along a shortest path (s −width of the river), it should be rowed up the stream making the angle ϕ with the PQ. Here, let $\overrightarrow{\mathrm{PA}}$ is the direction of the boat, moving with velocity $\overrightarrow{\mathrm{v_1}}$ and $\overrightarrow{\mathrm{PB}}$ (or $\overrightarrow{\mathrm{AQ}}$) is the direction of the flow of the river having velocity $\overrightarrow{\mathrm{v_2}}$, then $\overrightarrow{\mathrm{PQ}}$ gives the direction of resultant velocity $\vec{\mathrm{v}}$.

$$In\ \Delta\mathrm{APQ},\ \sin\phi = \frac{\mathrm{AQ}}{\mathrm{AP}} = \frac{\overrightarrow{\mathrm{v_1}}}{\overrightarrow{\mathrm{v_2}}}$$

And the resultant velocity $|\vec{\mathrm{v}}| = \sqrt{\mathrm{v_1^2 - v_2^2}}$

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