

Answer on Question #62045-Physics – Mechanics | Relativity

A swimmer sets out across a 300-meter wide river maintaining a speed of 2.0 m/s relative to the water.

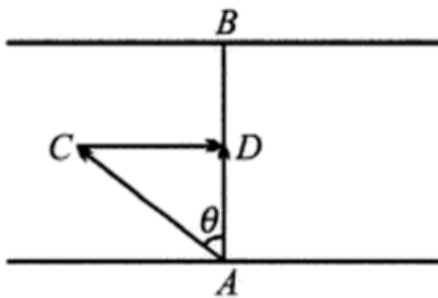
a) If he starts from the West Bank of the river, which flows south of 1.0 m/s, in what direction should he head to reach the other bank at a point just opposite to his starting point?

b) How long will it take him to make the trip?

c) Can he reach the opposite side faster if he heads in some other direction? Explain.

Solution

a)



AC represents the velocity of swimmer, CD represents the velocity of water, AD represents the resultant velocity of man in river.

$$\overrightarrow{AD} = \overrightarrow{AC} + \overrightarrow{CD}$$

$$\sin \theta = \frac{CD}{AC} = \frac{1}{2} \rightarrow \theta = 30^\circ$$

AC makes $30^\circ + 90^\circ = 120^\circ$ with the velocity of water.

b)

$$t = \frac{d}{v \cos 30^\circ} = \frac{300}{2 \cos 30^\circ} = 173.2 \text{ s} = 2.9 \text{ min}$$

c) He need to swim at 90° to the direction of flow. So, $\cos \theta = 1$:

$$t = \frac{d}{v} = \frac{300}{2} = 150 \text{ s} = 2.5 \text{ min}$$

120° up the stream.

\vec{AC} represents the velocity of man, \vec{CD} represents the velocity of water.

\vec{AD} represents the resultant velocity of man in water. $\vec{AD} = \vec{AC} + \vec{CD}$

$$\therefore \sin \theta = \frac{CD}{AC} = \frac{1}{2} \qquad \therefore \theta = 30^\circ$$

$\therefore AC$ makes 120° with the velocity of water.

In which direction should the swimmer head if he wants to cross in