Boats & Stream

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The concept is easy to understand, and is related to the topic of Time, Speed and Distance. Let us start the topic with basic definitions.

1. A boat is said to go downstream if it is moving along the direction of the stream. The net speed of the boat in this case is called downstream speed.

2. A boat is said to go upstream if it is moving in the direction opposite to the direction of the stream. The net speed of the boat in this case is called upstream speed.

3. Let the speed of the boat in still water is 'b' km/hr and the speed of the stream is 'w' km/hr. When the boat goes downstream then the relative speed will be (b + w) km/hr as in this case the water will take the boat along with it.

When the boat goes upstream then the relative speed will be (b - w) km/hr as in this case the water will offer resistance to the boat.

Let the downstream speed = d = (b + w) ……. (i)

Then the upstream speed = u = (b – w) ……(ii)

Adding the two equations, we get

2b = d + u ⇒ b = $\frac{d+u}{2}$ which gives **the speed of the boat** in terms of downstream and upstream speed.

Subtracting the equation (i) and (ii),

we get **2w = d - u ⇒ w =** $\frac{d-u}{2}$ which gives **the speed of the stream** in terms of downstream and upstream speed.

4. If a man can row at the speed of a km/hr in still water and he rows the same distance up and down in a stream flowing at a rate of b km/hr. Then average speed of man throughout the whole journey:

$$\frac{\textbf{Upstream Speed} \times \textbf{Downstream Speed}}{\textbf{Speedof man in still water}} = \frac{(a-b)\times(a+b)}{a}$$

5. Let the speed of a man in still water be 'a' km/hr and the speed of a stream be 'b' km/hr. If he takes 't' hours more in upstream than to go downstream for the same distance, the distance:

$$\frac{(a^2-b^2)t}{2b}\ \text{km}$$

6. A man rows a certain distance downstream in t_1 hours and returns the same distance upstream in t_2 hours. If the speed of the stream is 'b' km/hr, then the speed of the man in still water:

$$b\left(\frac{t2+t1}{t2-t1}\right)\ \text{km/hr}$$

7. A man rows a boat in still water at 'a' km/hr in a stream flowing at 'b' km/hr. If it takes him 't' hours to row a particular point and come back to the same spot, then the distance between the two points:

$$\frac{t(a^2-b^2)}{2a}\ \text{km}$$

8. A man takes 't' times as long to row upstream as to row downstream the river. If the speed of the man is 'a' km/hr and the speed of the stream is 'b' km/hr, then:

$$a = b\left(\frac{t+1}{t-1}\right)$$