# 12.Boat and Stream

**Upstream:** When the boat moves against the current of the river (i.e. in opposite direction), then the relative speed of the boat is the difference of the speed of the boat and stream. It is known as upstream speed.

Remember it with **UP** as going up the hill means against the direction of the force (speed) of the river.

**If speed of boat or swimmer is x km/h and the speed of stream is y km/h then,**

- **Speed of boat upstream =** (x – y) km/h

**Downstream:** When the boat moves with the current of the river (i.e. in same direction), then the relative speed of the boat is the sum of the speed of the boat and stream. It is known as downstream speed.

Remember it with **DOWN** as going down the hill means towards the direction of the force (speed) of the river.

**If speed of boat or swimmer is x km/h and the speed of stream is y km/h then,**

- **Speed of boat downstream** = (x + y) km/h

**Important Points**

- When speed of boat is given then it means speed in the still water, unless it is stated otherwise.

**Some Basic Formulas**

- **Speed of boat in still water is**
  = ½ (Downstream Speed + Upstream Speed)

- **Speed of stream is**
  = ½ (Downstream Speed – Upstream Speed)

## Types of Questions asked in Previous Exam By SSC

**Type 1**: When the distance covered by boat in downstream is same as the distance covered by boat upstream. The speed of boat in still water is x and speed of stream is y then ratio of time taken in going upstream and downstream is,

Short Trick:

**Time taken in upstream** : **Time taken in Downstream** = (x+y)/(x-y)

**Example:**

A man can row 9km/h in still water. It takes him twice as long as to row up as to row down. Find the rate of the stream of the river.

**Solution:**

Time taken in upstream : Time taken in Downstream = 2 : 1

Downstream speed : Upstream speed = 2 : 1

Let the speed of man = B, & speed of stream = S

B + S : B – S = 2/1

By using Componendo & Dividendo

B/R = 3/1, R = B/3

R = 9/3 = 3km/h

**Type 2:** A boat cover certain distance downstream in $t_1$ hours and returns the same distance upstream in $t_2$ hours. If the speed of stream is y km/h, then the speed of the boat in still water is:

Short Trick:

Speed of Boat = $y\,[(t_2 + t_1) / (t_2 – t_1)]$

**Example**

A man can row certain distance downstream in 2 hours and returns the same distance upstream in 6 hours. If the speed of stream is 1.5 km/h, then the speed of man in still water is

**Solution:**

By using above formulae

= 1.5 [(6+2) / (6-2)] = 1.5 * (8/4) = 1.5 * 2 = 3km/h

**Type 3:** A boat's speed in still water at x km/h. In a stream flowing at y km/h, if it takes it t hours to row to a place and come back, then the distance between two places is

Short Trick: **Distance** = $[t*(x^2 – y^2)]/2x$

**Example**

A motor boat can move with the speed 7 km/h. If the river is flowing at 3 km/h, it takes him 14 hours for a round trip. Find the total distance covered?

**Solution:** By using above formulae

$= [14 * (7^2 – 3^2)]/2* 7 = [14 * (49-9)]/2*7$

$= 14*40/2*7 = 40$km

**Type 4:** A boat's speed in still water at x km/h. In a stream flowing at y km/h, if it takes t hours more in upstream than to go downstream for the same distance, then the distance is

Short Trick: **Distance** = $[t*(x^2 – y^2)]/2y$

**Example**

A professional swimmer challenged himself to cross a small river and back. His speed in swimming pool is 3km/h. He calculated the speed of the river that day was 1km/h. If it took him 15 mins more to cover the distance upstream than downstream, then find the width of the river?

**Solution:** By using the above formulae

Distance = $[t*(x^2 – y^2)]/2y$

$= [(15/60) (3^2 – 1^2)]/2*1$

$= [(1/4) * 8] / 2$

$= 2/2 = 1$ km.

**Type 5:** A boat's speed in still water at x km/h. In a stream flowing at y km/h, if it cover the same distance up and down the stream, then its average speed is

Short Trick: **Average speed** = upstream * downstream / man's speed in still water

**Note:** The average speed is independent of the distance between the places.

**Example**

Find the average speed of a boat in a round trip between two places 18 km apart. If the speed of the boat in still water is 9km/h and the speed of the river is 3km/h?

**Solution:** Average speed = upstream * downstream / man's speed in still water

Average speed = 6 * 12 / 9 = 8km/h

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