# BOATS AND STREAMS PROBLEMS SOLUTIONS


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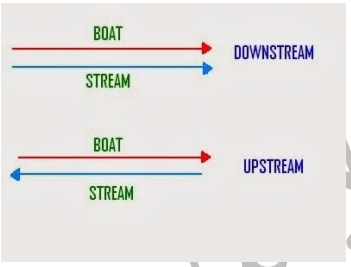
# Boats and Streams

Boats and Streams is just a logical extension of motion in a straight line. One or two questions are asked from this chapter in almost every exam. Here is discussion of some important facts and terminologies which will help you to make better understanding about this topic.

**Basic Concept**

If direction of boat is same as direction of the stream, then it is known as DOWNSTREAM and if directions are opposite, then it is known as UPSTREAM. Following figure is representing the same:




i.e. if boat is moving with stream then it is known as Downstream and if opposite to stream, then it is Downstream.

**Downstream Speed and Upstream Speed**

In case of Downstream, as you can see the direction is same, speeds of stream and boat will be added to get Down stream speed.

If Speed of boat in still water = u km/hr

Speed of stream = v km/hr, then

Downstream Speed = (u+v) km/hr

Similarly, if I talk about upstream speed, as the direction of boat and stream is opposite, speed of both will be subtracted.

i.e. Upstream Speed = (u-v) km/hr

Study the following figure, notice the directions and try to remember this i.e.

If directions are same then speeds will be added and

If directions are opposite then speeds will be subtracted

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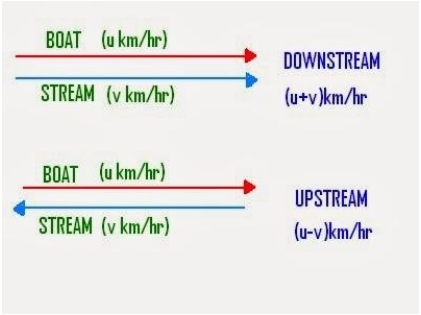


Speeds of Boat and Stream if Downstream and Upstream Speeds are given

Speed of Boat = $\frac{1}{2}$ (Downstream Speed + Upstream Speed)

Speed of Stream = $\frac{1}{2}$ (Downstream Speed - Upstream Speed)

**Problems with Solution**

**Example 1:** Speed of boat in still water is 5 km/hr and speed of stream is 1 km/hr. find the downstream speed and upstream speed.

**Solution:** Given that, u = 5 km/hr
v = 1 km/hr
Downstream speed = u+ v km/hr
⇒ 5+ 1= 6 km/hr
Upstream speed = u -v km/hr
⇒ 5- 1 = 4 km/hr

**Example 2**: A man takes 3 hours to row a boat 15 km downstream of river and 2 hours 30 min to cover a distance of 5 km upstream. Find speed of river or stream.

**Solution:** We need to find speed of stream from downstream speed and upstream speed. See how we calculate it:

As you know, Speed = Distance/ Time

So, Downstream Speed = $\frac{15}{3}$= 5 km/hr

Upstream Speed = $\frac{5}{2.5}$ = 2 km/hr

Now, as we have discussed, Speed of stream = $\frac{1}{2}$ (Downstream Speed - Upstream Speed)

⇒Speed of stream = $\frac{1}{2}$(5-2)

⇒$\frac{3}{2}$ = 1.5 km/hr

**Example 3**: A man can row 7km/hr in still water. If in a river running at 2km/hr, it takes him 50 minutes to row to his place and back, how far off is the place?

**Solution:** Given, u = 7km/hr

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v = 2km/hr
From u and v, we can calculate downstream speed and upstream speed.
Downstream Speed = (u + v) = 7+2 = 9 km/hr
Upstream Speed = (u-v) = 7-2 = 5 km/hr
Now, we need to find DISTANCE and time is given,
Time = Distance / Speed
Let required distance = x km
Time taken in downstream + Time taken in upstream = Total Time
$\Rightarrow \frac{x}{9} + \frac{x}{5} = \frac{50}{60}$ (50 minutes = $\frac{50}{60}$ hrs)
⇒Calculating the above equation: x = 2.68km

## Exercisxe

1) A boat can travel with a speed of 13 km/hr in still water. If the speed of the stream is 4 km/hr. find the time taken by the boat to go 68 km downstream?
   a) 2hours b) 3hours c) 4hours
   d) 5hours e) None of these

2) The speed of a boat in still water is 15 km/hr and the rate of current is 3 km/hr. The distance travelled downstream in 12 minutes is
   a) 1.2km b) 1.8 km c) 2.4 km
   d) 3.6km e) None of these

3) A boat takes 19 hours for travelling downstream from point A to point B and coming back to a point C midway between A and B. If the velocity of the stream is 4 kmph and the speed of the boat in still water is 14 kmph, what is the distance between A and B?
   a) 160 km b) 180 km c) 200 km
   d) 220 km e) None of these

4) A boat running downstream covers a distance of 16 km in 2 hours while for covering the same distance upstream, it takes 4 hours. What is the speed of the boat in still water?
   a) 4 km/hr b) 6 km/hr c) 8 km/hr
   d) Data inadequate e) None of these

5) A man can row upstream at 8 kmph and downstream at 13 kmph. The speed of the stream is
   a) 2.5 km/hr b) 4.2 km/hr c) 5 km/hr
   d) 10.5 km/hr e) None of these

6) A boat covers a certain distance downstream in I hour, while it comes back in 1½ hours. If the speed of the stream be 3 kmph. What is the speed of the boat in still

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Water?

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a) 12 kmph b) 13 kmph c) 15 kmph
d) 16 kmph e) None of these

7) A man's speed with the current is 15 km/hr and the speed of the current is 2.5 km/hr The man's speed against the current is
a) 8.5 km/hr b) 9 km/hr c) 10 km/hr
d) 12.5 km/hr e) None of these

8) A man can row upstream at 7 kmph and downstream at 10 kmph. Find man's rate in still water and the rate of current?
a) 6.5, 1.2 km/hr b) 8.5, 1.5 km/hr c) 1.5, 1.6 km/hr
d) 7.5, 1.8 km/hr e) None of these

9) A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water?
a) 40 minutes b) 1 hour c) 1 hour 15 min
d) 1 hour 30 min e) None of these

10) There is a road beside a river. Two friends started from a place A, moved to a temple situated at another place B and then returned to A again. One of them moves on a cycle at a speed of 12 km/hr, while the other sails on a boat at a speed of 10 km/hr. If the river flows at the speed of 4 km/hr, which of the two friends will return to place A first ?
a) 5.4 km /hr, boat b) 12 km /hr, cycle c) 8.4 km/hr, boat
d) 9.6 km /hr, cycle e) None of these

11) In one hour, a boat goes 11 km along the stream and 5 km against the stream. The speed of the boat in still water in ( km/hr) is
a) 3 b) 5 c) 8
d) 9 e) None of these

12) If a man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is
a) 4.25 kmnph b) 6 kmph c) 6.5 kmph
d) 8.5 kmph e) None of these

13) Speed of a boat in standing water is 9 kmph and the speed of the stream is 1. 5 kmph. A man rows to a place at a distance of 105 km and comes back to the starting point. The total time taken by him is
a)16 hours b) 18 hours c) 20 hours
d) 24 hours e) None of these

14) A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 mph, the speed of the stream is
a) 2 mph b) 2.5 mph c) 3 mph

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d) 4mph e) None of these

15) A man takes 3 hours 45 minutes to row a boat 15 km downstream of a river and 2 hours 30 minutes to cover a distance of 5 km upstream. Find the speed of the river current in km/hr.
a) 1 km/hr b) 2 km/hr c) 3 km/hr
d) 4 km/hr e) None of these

16) A man can row $\frac{\square}{\square}$ kmph in still water. If in a river running at 1.5 km an hour, it takes him 50 minutes to row to a place and back, how far off in the place?
a) 3 km b) 7 km c) 8 km
d) 6 km e) None of these

17) A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water?
a) 40 minutes b) 1 hour c) 1 hr 15 min
d) 1 hr 30 min e) None of these

18) If a man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is :
a) 4.25 kmph b) 6 kmph c) 6.5 kmph
d) 8.5 kmph e) None of these

19) A man rows to a place 48 km distant and back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the strem. The rate of the stream is :
a) 1 km/hr b) 1.5 km/hr c) 1.8 km/hr
d) 3.5 km/hr e) None of these

20) A man can row 9 km/h in Still water. It takes him twice as long as to row up as to row down. Find the rate of stream of the river.
a) 3 km/h b) 9 km/h c) 5 km/h
d) 6 km/h e) None of these

21) A man can row 5 km/h in still water. If the rate of current is 1 km/h , it takes $\frac{\square}{\square}$ hours to row to a place and back. How far is the place?
a) 2 km b) 2.5 km c) 3 km
d) 4 km e) None of these

22) A boat which sails at 10 km/h in still water starts chasing from 10 km behind, another one which sails at 4 km/h in the upstream direction. After how long will it catch up if the stream is flowing at 2 km/h

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a) 4 h b) 2.5 h c) 2 h
d) 3.5 h e) None of these

23) A boat sails 15 km of a river towards upstream in 5 hours. How long will it take to cover the same distance downstream, if the speed of current is one-fourth the speed of the boat in still water :
a) 1.8 h b) 3 h c) 4 h
d) 5 h e) None of these

24) A man can row upstream at 8 kmph and downstream at 13 kmph. The speed of the stream is :
a) 2.5 km/hr b) 4.2 km/hr c) 5 km/hr
d) 10.5 km/hr e) None of these

25) A boat can travel with a speed of 13 km/hr in still water. If the speed of the stream is 4 km/hr, find the time taken by the boat to go 68 km downstream.
a) 2 hours b) 3 hours c) 4 hours
d) 5 hours e) None of these

26) If a boat goes 7 km upstream in 42 minutes and the speed of the stream is 3 kmph, then the speed of the boat in still water is :
a) 4.2 km/hr b) 9 km/hr c) 13 km/hr
d) 21 km/hr e) None of these

27) A motor boat whose speed is 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. The speed of the stream (in km/hr) is :
a) 4 b) 5 c) 6
d) 10 e) None of these

**Solutions:**

1. Option C

Speed Downstream = (13 + 4) km./hr.
= 17 km./hr.

Time taken to travel 68 km. downstream $= \left[\frac{68}{17}\right]$ hrs.
= 4 hrs.

2. Option D

Speed Downstream = (15 + 3) km./hr.
= 18 km./hr.

Distance travelled $= \left[18 \times \frac{12}{60}\right]$ hrs.
= 3.6 km.

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3. Option B

Speed Downstream = (14 + 4) km./hr.
= 18 km./hr.
Speed upstream = (14 - 4) km./hr.
= 10 km./hr.

Let the distance b/w A and B be xkm. Then $= \left[\frac{\square}{18} + \square\right]$

$= 19 \quad \frac{\square}{10}$

$= \frac{19\square}{180} = 19$

x = 180

4. Option B

Rate Downstream $= \left[\frac{16}{2}\right]$ kmph
= 8 kmph

Rate upstream $= \left[\frac{16}{4}\right]$ kmph
= 4 kmph

Speed in still water $= \frac{1}{2}(8 + 4)$ kmph
$= \frac{1}{2} \times 12$
= 6 kmph

5. Option A

Speed of stream $= \frac{1}{2}(13 - 8)$ kmph
$= \frac{1}{2} \times 5$
$= \frac{5}{2}$
= 2.5

6. Option C

Let the speed of the boat in still water be x kmph.
Then, speed downstream = (x + 3) kmph
Speed upstream = (x - 3) kmph
= (x + 3) × 1
= (x - 3) × 3/2 kmph
= 2x + 6 = 3x - 9
x = 15 kmph

7. Option C

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Man's rate in still water = (15 - 2.5) km./hr.

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= 12.5 km./hr.

Man's rate against the current = (12.5 - 2.5) km./hr.

= 10 km./hr.

8. Option B

Rate in still water $= \frac{1}{2}(10 + 7)$ km./hr.

= 8.5 km./hr.

Rate of current $= \frac{1}{2}(10 - 7)$ km./hr.

= 1.5 km./hr.

9. Option C

Rate downstream $= \left[\frac{1}{10} \times 60\right]$ km./hr.

= 6 km./hr.

Rate upstream = 2 km./hr.

Speed in still water $= \frac{1}{2}(6 + 2)$ km./hr.

= 4 km.

Required time $= \frac{5}{4}$ km./hr.

$= 1 \times \frac{1}{4}$ km./hr.

= 1 hr. 15 min.

10. Option C

Clearly, the cyclist moves both ways at a speed of 12 km./hr.

So, average speed of the cyclist = 12 km./hr.

Average speed $= (2 \times 14 \times \frac{6}{14} + 6)$ km./hr.

$= \frac{42}{5}$ kmph

= 8.4 kmph

Since the average speed of the cyclist is greater, he will return to A first.

11. Option C

Speed in still water $= \frac{1}{2}(11 + 5)$ km./hr.

= 8 km./hr.

12. Option C

Let the rate along the current be x kmph. $= \left[\frac{1}{2}(x + 3.5)\right] = 5$

Then, x = 6.5 kmph.

13. Option D

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Speed upstream = 7.5 kmph
Speed downstream = 10.5 kmph

Total time taken $= \left[ \frac{10.5}{7.5} + \frac{105}{10.5} \right]$ hours
= 24 hours

14. Option A

Speed downstreams = (10 + x) mph.
Speed upstreams = (10 - x) mph.
= 18 kmph.

$\frac{36}{10 - \square} - \frac{36}{10 + \square}$ $= \frac{90}{60}$
$= 72x \times 60$
$= 90 (100 - x^2)$
$= x^2 + 48x + 100 = 0$
$x = 2$ mph.

15. Option A

Rate downstream $= \left[ \frac{15}{3\frac{3}{4}} \right]$ km/hr $= \left[ 15 \times \frac{4}{15} \right]$ km/hr = 4 km/hr

Rate upstream $= \left[ \frac{5}{2\frac{1}{2}} \right]$ km/hr $= \left[ 5 \times \frac{2}{5} \right]$ km/hr = 2 km/hr

So, speed of current $= \frac{1}{2}$ (4 - 2) km/hr = 1 km/hr

16. Option A

Speed downstream = (7.5 + 1.5) kmph = 9 kmph
Speed upstream = (7.5 - 1.5) kmph = 6 kmph
Let the required distance be x km. Then,

$\frac{\square}{9} + \frac{\square}{6} = \frac{50}{60}$

$2x + 3x = \left[ \frac{5}{6} \times 18 \right]$

$5x = 15$
$x = 3$
Hence, the required distance is 3 km

17. Option C

Rate downstream $= \left[ \frac{1}{10} \times 60 \right]$ km/hr = 6 km/hr, Rate upstream = 2 km/hr

Speed in still water $= \frac{1}{2}$ (6 + 2) km/hr = 4 km/hr

So, required time $= \left[ \frac{5}{4} \right]$ hrs $= 1\frac{1}{4}$ hrs = 1 hr 15 min

18. Option C

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Let the rate along the current be x kmph. Then, $\frac{1}{2}(x + 3.5) = 5$ or $x = 6.5$ kmph

19. Option A

Suppose he moves 4 km downstream in x hours. Then,
Speed downstream = $\left[\frac{4}{\square}\right]$ km/hr, speed upstream = $\left[\frac{3}{\square}\right]$ km/hr

So, $\frac{48}{4/\square} + \frac{48}{3/\square} = 14$ or $x = \frac{1}{2}$

So, speed downstream = 8 km/hr, Speed upstream = 6 km/hr
Rate of the stream = $\frac{1}{2}(8 - 6)$ km/hr = 1 km/hr

20. Option A

$\frac{\square\square\square\square\ \square\square\square\square\square\ \square\square\ \square\square\square\ \square\square\square\square}{\square\square\square\square\ \square\square\square\square\square\ \square\square\ \square\square\square\square\square\square\square\square\square\square\square} = \frac{2}{1}$

$\frac{\square\square\square\square\square\square\square\square\square\square\square}{\square\square\square\square\square\ \square\square\square\square\square\square\square\square\square} = \frac{2}{1}$ where $\frac{\square + \square}{\square - \square} = \frac{2}{1}$

B □ Speed of boat in still water
R □ speed of current

$\frac{\square}{\square} = \frac{3}{1}$ (By componendo and dividend)

$\frac{9}{\square} = \frac{3}{1}$

R = 3 km/h

21. Option C

Let the required distance be D km, then

$\frac{\square}{6} + \frac{\square}{4} = \frac{5}{4}$

$D\left[\frac{10}{24}\right] = \frac{5}{4}$

D = 3 km

22. Option B

Upstream speed of first boat = 8 km/h
Upstream speed of second boat = 4 km/h
So, relative speed = 4 km/h (8 - 4)
So, required time = $\frac{10}{4} = 2.5$ h

23. Option B

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Upstream speed = B - S
Downstream speed = B + S

$B - S = \frac{15}{5} = 3$ km/h

Again $B = 4S$

So, $B - S = 3 = 3S$

$S = 1$ and $B = 4$ (km/h)

So, $B + S = 5$ km/h

So, time during downstream $= \frac{15}{5} = 3$ h

24. Option A

Speed of stream $= \frac{1}{2}(13 - 8)$ kmph = 2.5 kmph

25. Option C

Speed downstream = (13 + 4) km/hr = 17 km/hr

Time taken to travel 68 km downstream $= \left[\frac{68}{17}\right]$ hrs. = 4 hrs.

26. Option C

Rate upstream $= \left[\frac{7}{42} \times 60\right]$ kmph = 10 kmph

Speed of stream = 3 kmph

Let speed in still water be x km/hr. Then, speed upstream = (x - 3) km/hr

So, x - 3 = 10 or x = 13 km/hr

27. Option B

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