## BOAT AND STREAM

## INTRODUCTION:

Still water: When water is not moving, it is called still water.

Stream: When the water is moving, it is called stream.

Downstream: If the boat is moving in the same direction of the stream or moving with the stream of the river is called downstream.

Upstream: If the boat is moving in the opposite direction of the stream or moving against the stream of the river is called Upstream.

If speed of boat in still water is ' $x$ ' $\mathrm{km} / \mathrm{hr}$ and speed of stream is ' y ' $\mathrm{km} / \mathrm{hr}$,
Speed of boat downstream $=(x+y) k m / h r$,
Speed of boat upstream $=(b-s) k m / h r$,
Distance ( D ) $=$ Speed $(\mathrm{S}) \times$ Time $(T)$
Speed of boat $=\frac{\text { Downstream }+ \text { upstream }}{2}$
Speed of Steam $=\frac{\text { Downstream }- \text { upstream }}{2}$
Example 1:
If a man rows 12 km downstream in 3 hours and 12 km upstream in 6 hours then find the speed of boat in (still) water and speed of stream?
Solutions:
Downstream Speed $=\frac{12}{3}=4 \mathrm{~km} / \mathrm{h}$
Upstream Speed $=\frac{12}{6}=2 \mathrm{~km} / \mathrm{h}$
Speed of boat $=\frac{4+2}{2}=3 \mathrm{~km} / \mathrm{h}$
Speed of Stream $=\frac{4-2}{2}=1 \mathrm{~km} / \mathrm{h}$
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 $y \mathrm{~km} / \mathrm{h}$, then the speed of the boat in still water is:
Short Trick:
Speed of Boat $=y\left[\left(t_{2}+t_{1}\right) /\left(t_{2}-t_{1}\right)\right]$

## Example 2:

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 $1.5 \mathrm{~km} / \mathrm{h}$, then the speed of man in still water is

## Solution:

By using above formulae
$=1.5[(6+2) /(6-2)]=1.5 *(8 / 4)=1.5 * 2=3 \mathrm{~km} / \mathrm{h}$

## Questions for Practice

1. The speed of a motor-boat is that of the current of water as 31:9. The boat goes against the current in 12 hours. Find the time taken by motor-boat to come back with the stream.
(A) 6 hours
(B) 6 hours 20 min
(C) 6 hours 36 min
(D) 7 hours 20 min
(E) 9 hours
2. A boat travels a distance of 8 Km downstream in a stream flowing at $3 \mathrm{~km} / \mathrm{h}$ and, then returns upstream the starting point in 1 Hour 40 minutes. The speed of the boat in still water is:
(A) $17 \mathrm{Km} / \mathrm{h}$
(B) $9 \mathrm{Km} / \mathrm{h}$
(C) $13 \mathrm{~km} / \mathrm{h}$
(D) $15 \mathrm{Km} / \mathrm{h}$
(E) None of these
3. A man goes downstream with a boat to a certain point and returns upstream to his original place in 7 hours. If the speed of boat in still water and that of stream are $14 \mathrm{~km} / \mathrm{hr}$. and $4 \mathrm{~km} / \mathrm{hr}$. respectively, then find the distance of destination from his original place?
(A) 45 Km
(B) 50 Km
(C) 54 Km
(D) 60 Km
(E) None of these
4. Two boats $P$ and $Q$ start towards each other from two places, 135 km apart. Speed of the boats $P$ and $Q$ in still water are $15 \mathrm{~km} / \mathrm{h}$ and 21 $\mathrm{km} / \mathrm{h}$ respectively. If P proceeds down and Q upstream, then after how much time will they meet?
(A) 3 hours
(B) 3 hours 15 min
(C) 3 hours 30 min
(D) 3 hours 45 min
(E) None of These
5. A Boat can travel a certain distance with $15 \mathrm{~km} / \mathrm{hr}$ in still water. It takes 6 hr and 9 hr to cover the same distance in downstream and upstream respectively. What will be the distance travelled in 5.5 hours in downstream?
(A) 88 Km
(B) 92 Km
(C) 99 Km
(D) 105 Km
(E) None of these

## Solutions

## 1. Answer is option C

## Explanation:

Speed of boat $=31 x$
Speed of current $=9 x$
Downstream $=31 x+9 x=40 x$
Let Downstream time $=T$
Upstream $=31 x-9 x=22 x$
Upstream time $=12$ hours
Distance travelled is same.
$22 \mathrm{x} \times 12=40 \mathrm{x} \times \top$
$\mathrm{T}=\frac{33}{5}$ Hours
Upstream time $=6$ hours 36 min

## 2. Answer is option $B$

Explanation:
Distance $=8 \mathrm{~km}$
Stream $=3 \mathrm{~km} / \mathrm{h}$
Let speed of boat $=x$
Time $=1$ hour 40 min
$\Rightarrow \frac{5}{3}$ Hours
$\Rightarrow \frac{8}{x-3}+\frac{8}{x+3}=\frac{5}{3}$
$\Rightarrow x^{2}-8 x-9=0$
$\Rightarrow x^{2}-9 x+x-9=0$
$\Rightarrow x=9$

## 3. Answer is option $A$

Explanation:
Let the distance of destination from starting point
= D km.
$\Rightarrow$ Speed of man downstream $=(14+4)=18 \mathrm{~km} / \mathrm{h}$
$\Rightarrow$ Speed of man upstream $=(14-4) \mathrm{km} / \mathrm{h}=6$ km/h.
According to question,
$\Rightarrow \frac{D}{18}+\frac{D}{10}=7$
$\Rightarrow \frac{14 D}{90}=7$
$\Rightarrow D=45 \mathrm{~km}$.

## 4. Answer is option D Explanation:

Distance $=135 \mathrm{~km}$
Speed of Boat $\mathrm{P}=15$
Speed of Boat $Q=21$
Let the meeting time $=T$

Speed of the stream is same.
$(15+x) \times T+(21-x) \times T=135$
$15 \mathrm{~T}-\mathrm{xT}+21 \mathrm{~T}-\mathrm{xT}=135$
$36 \mathrm{~T}=135$
$\mathrm{T}=\frac{135}{36}=\frac{15}{4}$
$\Rightarrow 3$ Hours 45 min

## 5. Answer is option C

Explanation:
Speed of boat in still water $=15$
Let speed of current $=x$
$\Rightarrow(15+x) \times 6=(15-x) \times 9$
$\Rightarrow 90+6 x=135-9 x$
$\Rightarrow 15 x=45$
$\Rightarrow x=3$
Downstream =15+3 = 18
Time $=5.5$ hours
Distance $=18 \times 5.5=99 \mathrm{~km}$

## 6. Answer is option D

Explanation:
Let distance = D
Speed of boat in still water $=16 \mathrm{~km} / \mathrm{h}$
Let Speed of stream $=x$
$\frac{D}{16-x}=\frac{D}{16+x} \times 3$
$16+x=48-3 x$
$4 x=32$
$x=8 \mathrm{~km} / \mathrm{h}$

## 7. Answer is option C <br> Explanation:

Let the distance From $X$ to $Y=D$
And $Y$ to $Z=\frac{D}{2}$
Time = 11 hours
Speed of boat $=12 \mathrm{~km} / \mathrm{h}$
Speed of stream $=3 \mathrm{~km} / \mathrm{h}$
Downstream $=12+3=15 \mathrm{~km} / \mathrm{h}$
Upstream $=12-3=9 \mathrm{~km} / \mathrm{h}$
As per question,
$\frac{D}{15}+\frac{D}{2 \times 9}=11$
$\frac{6 D+5 D}{90}=11$
$\frac{11 D}{90}=11$
D $=90 \mathrm{~km}$

## 8. Answer is option D

## Explanation:

Let Speed of boat $=x$
Let Speed of current $=y$
Downstream $=x+y$
Upstream $=x-y$
$3 x(x-y)=2 x(x+y)$
$3 x-3 y=2 x+2 y$
$x=5 y$
$x: y$
5:1

## 9. Answer is option D

Explanation:
Time $=3$ hours
Upstream distance $=30 \mathrm{~km}$
Downstream distance $=54 \mathrm{~km}$
Upstream speed $=\frac{30}{3}=10 \mathrm{~km} / \mathrm{h}$
Downstream speed $=\frac{54}{3}=18 \mathrm{~km} / \mathrm{h}$
Speed of current $=\frac{18-10}{2}=\frac{8}{2}$
$=4 \mathrm{~km} / \mathrm{h}$
10. Answer is option $A$

Explanation:
Distance $=2 \mathrm{~km}$
Downstream $=\frac{2}{20} \times 60=6 \mathrm{~km} / \mathrm{h}$
Upstream $=\frac{2}{40} \times 60=3 \mathrm{~km} / \mathrm{h}$
Speed of boat $=\frac{6+3}{2}=4.5$
Speed of Current $=\frac{6-3}{2}=1.5$
Ratio
Speed of boat : current
4.5 : 1.5

3:1

