Boats and Streams

All the basic concepts of Time speed and Distance apply to this chapter Boats and streams. We have to adjust the speeds according to the point whether the boat is moving against the stream or with the stream.

There are two parameters in these problems.

1. **Speed of the Stream (S):** This is the speed with which the river flows.
2. **Speed of the boat in still water (B):** If the river is still, this is the speed at which the boat would be moving.

The effective speed of a boat in upstream = B – S

The effective speed of a boat in downstream = B + S

3. The speed of the boat in still water is given as $B = \frac{1}{2}(d + u)$, and the speed of the Stream $S = \frac{1}{2}(d + u)$, where d and u are the downstream and upstream speeds, respectively.

Solved Examples

1. A girl can swim 3 km/hr in still water. If the velocity of the stream be 2 km/hr the time taken by her to swim to a place 10 km upstream and back is :

a. $8\frac{1}{3}$ hrs

b. $9\frac{1}{5}$ hr

c. 10 hrs

d. 12 hrs

Correct Option: D

Explanation:

Speed of upstream = (3-2)km/hr = 1 km/hr

Speed of downstream (3+2) km/hr = 5 km/hr

Total time taken = $(\frac{10}{1} + \frac{10}{5})$ hrs = 12 hrs

2. A girl can row three quarters of a kilometer against the stream in $11\frac{1}{4}$ minutes and return in $7\frac{1}{2}$ minutes.The speed of the girl in still water is :

a. 2 km/hr

b. 3 km/hr

c. 4 km/hr

d. 5 km/hr

Correct Option: D

Explanation:

Speed of upstream $= \frac{(3/4)}{(\frac{45/4}{60})} = (\frac{3}{4} \times \frac{4}{45} \times 60)$ km/hr = 4km/hr

Speed of downstream $= \frac{(3/4)}{(\frac{15/2}{60})} = (\frac{3}{4} \times \frac{2}{15} \times 60)$ km/hr=6 km/hr

Speed in still water $= \frac{1}{2}(4+6)$ km/hr=5km/hr

3. A girl can row $9\frac{1}{3}$ km/hr in still water and she finds that it takes her thrice as much time to row up than as to row down the same distance in river. The speed of the current is :

a. $3\frac{1}{3}$ km/hr

b. $3\frac{1}{9}$ km/hr

c. $1\frac{1}{4}$ km/hr

d. $4\frac{2}{3}$ km/hr

Correct Option: D

Explanation:

Let speed of upstream = x km/hr

Then, speed of downstream = 3x km/hr

Speed in still water $= \frac{1}{2}(x+3x)$ km/hr = 2x km/hr

Speed of the current $= \frac{1}{2}(3x-x)$ km/hr = x km/hr

$2x = \frac{28}{3}$ or $x = \frac{14}{3} = 4\frac{2}{3}$ km/hr

4. The current of a stream runs at 1km/hr. A motor boat goes 35 km. upstream and back again to the starting point in 12 hours. The speed of motor boat in still water is :

a. 6 km/hr

b. 7 km/hr

c. 8.5 km/hr

d. 8 km/hr

Correct Option: A

Explanation:

Let the speed in still water be x km/hr.

$\frac{35}{x-1} + \frac{35}{x+1} = 12$

or $35(2x)=12(x^2-1)$

or $12x^2-70x=12=0$

or $12x^2-72x+2x-12=0$

or $12x(x-6)+2(x-6)=0$

or $(x-6)(12x+2)=0$

$x = 6$ km/hr

5. A motor covers 24 km upstream and 36 km downstream in 6 hours, while it covers 36 km upstream and 24km downstream in $6\frac{1}{2}$ hours. The velocity of the stream is :

a. 1.5 km/hr

b. 1 km/hr

c. 2 km/hr

d. 2.5 km/hr

Correct Option: C

Explanation:

Let the speed of upstream be x km/hr and the speed of downstream be y km/hr. Then,

$\frac{24}{x}+\frac{36}{y}=6 \Rightarrow 24u+36v=6$, where u=1/x, v=1/y

And, $\frac{24}{x}+\frac{36}{y}=\frac{13}{2} \Rightarrow 36u+24v=\frac{13}{2}$

Adding these equations, we get $60(u+v)=\frac{25}{2}$ or $u+v=\frac{5}{24}$

Subtracting, we get $12(u-v)=\frac{1}{2}$ or $u-v=\frac{1}{24}$

Solving $u+v=\frac{5}{24}$ and $u-v=\frac{1}{24}$ we get $u=\frac{1}{8}$ and $v=\frac{1}{12}$

$x = 8$ km/hr or $y = 12$ km/hr

Velocity of current $=\frac{1}{2}(12-8)$km/hr $=2$ km/hr

6. The current of stream runs at the rate of 4 km an hour. A boat goes 6 km and back to the starting point in 2 hours. The speed of the boat in still water is :

a. 6 km/hr

b. 7.5 km/hr

c. 8 km/hr

d. 6.8 km/hr

Correct Option: C

Explanation:

Let the speed in still water be x km/hr

Then, $\frac{6}{x+4}+\frac{6}{x-4}=2$

$\Rightarrow 6(x-4+x+4)=2(x^2-16)$

or (x-8)(x+2)=0. So, x = 8 km/hr

7. 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 stream. The rate of the stream is :

a. 0.5 km/hr

b. 1 km/hr

c. 3.5 km/hr

d. 1.8 km/hr

Correct Option: B

Explanation:

Suppose he moves 4 km downstream in x hours

Then, speed of downstream = $(\frac{4}{x})$ km/hr

Speed of upstream = $(\frac{3}{x})$ km/hr

$\frac{48}{\frac{4}{x}}+\frac{48}{\frac{3}{x}}14 \Rightarrow 12x+16x=14 \quad \Rightarrow x=\frac{1}{2}$

Speed of downstream = 8km/hr

Speed of upstream = 6 km/hr

Rate of stream = $\frac{1}{2}(8-6)$ km/hr= 1 km/hr

8. A boat moves upstream at the rate of 1 km in 10 minutes and down stream at the rate of 1 km in 6 minutes. The speed of the current is :

a. 1 km/hr

b. 1.5 km/hr

c. 2 km/hr

d. 2.5 km/hr

Correct Option: C

Explanation:

Speed of upstream = 6 km/hr

Speed of downstream = 10 km/hr

Speed of the current = $\frac{1}{2}(10-6)$ km/hr=2 km/hr

9. A girl rows upstream 16 km and downstream 28 km, taking 5 hours each time. The velocity of the current is :

a. 2.4 km/hr

b. 1.2 km/hr

c. 3.6 km/hr

d. 1.8 km/hr

Correct Option: B

Explanation:

Speed of downstream = $(\frac{28}{5})$ km/hr = 5.6 km/hr

Speed of upstream = $(\frac{16}{5})$ km/hr = 3.2 km/hr

Velocity of current = $\frac{1}{2}(5.6-3.2)$ km/hr

= 1.2 km/hr

10. Speed of a boat in standing water is 6 km/hr and the speed of the stream is 1.5 km/hr. A man rows to a place at a distance of 22.5 km and comes back to the starting point. The total time taken by him, is :

a. 6 hrs 30 min

b. 8 hrs 24 min

c. 8 hrs

d. 4 hrs 12 min

Correct Option: C

Explanation:

Speed of upstream = (6-1.5) km/hr = 4.5 km/hr

Speed of downstream = = (6+1.5)km/hr = 7.5 km/hr

Total time taken = $(\frac{22.5}{4.5}+\frac{22.5}{7.5})$ hrs = 8 hrs.

11. A man can row at 5 km/hr in still water and the velocity of current is 1 km/hr. It takes him 1 hour to row to a place and back. How far is the place ?

a. 2.5 km

b. 2.4 km

c. 3 km

d. 3.6 km

Correct Option: B

Explanation:

Speed of downstream = (5+1) km/hr = 6 km/hr

Speed of upstream = (5-1)km/hr = 4 km/hr

Let the required distance be x km.

Then, $\frac{x}{6}+\frac{x}{4}=1 \Rightarrow 2x+3x=12$

or x = 2.4 km

12. A boat travels upstream from Q to P and downstream from P to Q in 3 hours. If the speed of the boat in still water is 9 km/hr and the speed of the current is 3 km/hr, the distance between P and Q is :

a. 4 km

b. 6 km

c. 8 km

d. 12 km

Correct Option: D

Explanation:

Speed of downstream = (9+3) km/hr = 12 km/hr

Speed of upstream = (9-3)km/hr = 6 km/hr

Let the distance AB = x km

Then, $\frac{x}{6} + \frac{x}{12} = 3 \Rightarrow$

2x + x = 36 \Rightarrow x = 12$

Distance AB = 12 km.

13. A motor goes 40 km upstream in 8 hours and 36 km downstream in 6 hours. The speed of the boat in standing water is :

a. 6.5 km/hr

b. 6 km/hr

c. 5.5 km/hr

d. 5 km/hr

Correct Option: C

Explanation:

Speed of upstream = $(\frac{40}{8})$ km/hr=5 km/hr

Speed of downstream = $(\frac{36}{6})$ km/hr = 6 km/hr

Speed of boat in still water

$= \frac{1}{2}(5+6)$ km/hr = 5.5 km/hr

14. If a man's moving rate with the current is 12 km/hr and the rate of the current is 1.5 km/hr, then man's moving rate against the stream is :

a. 9 km/hr

b. 6.75 km/hr

c. 5.25 km/hr

d. 7.5 km/hr

Correct Option: A

Explanation:

Let the rate against the current be x km/hr Then,

$\frac{12-x}{2} = 1.5 \Rightarrow 12-x = 3 \Rightarrow x = 9$ km/hr

15. If a man rows at 5 km/hr in still water and 3.5 km/hr against the current, his rate along the current is :

a. 8.5 km/hr

b. 6.5 km/hr

c. 6 km/hr

d. 4.25 km/hr

Correct Option: B

Explanation:

Let the rate along the current be x km/hr

Then, $\frac{x+3.5}{2} = 5 \Rightarrow x = (10-3.5)$ = 6.5 km/hr

16. The speed of a boat downstream is 15 km/hr and the speed of the stream is 1.5 km/hr. The speed of the boat upstream is :

a. 13.5 km/hr

b. 16.5 km/hr

c. 12 km/hr

d. 8.25 km/hr

Correct Option: C

Explanation:

Let the speed of boat in still water be x km/hr

Then, x+1.5 = 15⇒ x = 13.5

Speed of upstream = (13.5-1.5) km/hr = 12 km/hr

17. The speed of a boat in still water is 2 km/hr. If its speed upstream be 1 km/hr. then speed of the stream is :

a. 1.5 km/hr

b. 3 km/hr

c. 1 km/hr

d. None of these

Correct Option: C

Explanation:

Let the speed of stream be x km/hr

Then, speed of upstream = (2-x) km/hr

2-x=1⇒x=1 km/hr

18. A man can row downstream at 14 km/hr upstream at 9 km/hr. Man's rate in still water is

a. 5 km/hr

b. 23 km/hr

c. 11.5 km/hr

d. None of these

Correct Option: C

Explanation:

Man's rate in still water = $\frac{1}{2}(14+9)$ km/hr =

11.5 km/hr

19. A girl can row with the stream at 11 km/hr and against the stream at 8 km/hr. The speed of the stream is :

a. 3 km/hr

b. 9.5 km/hr

c. 1.5 km/hr

d. 6 km/hr

Correct Option: C

Explanation:

Speed of stream = $\frac{1}{2}(11-8)$ km/hr = 1.5 km/hr

20. 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 with current is :

a. 4.25 kmph

b. 6 kmph

c. 6.5 kmph

d. 8.5 kmph

Correct Option: C

Explanation:

Let the rate along the current be x kmph

Then, $\frac{1}{2}(x+3.5)$ = 5 or x = 6.5 KMPH.

Additional Questions:

21. A man rows 27 km downstream and 18 km upstream taking 3 hr each time. What is the velocity of the current?

Rate downstream = $\frac{27}{3}$ = 9 km/hr

Rate upstream = $\frac{18}{3}$ = 6 km/hr

Velocity of current = $\frac{1}{2}$ (9 – 6) = 1.5 km/hr.

22. A man can row upstream at 7 km/hr and downstream at 10 km/hr. Find his rate in still water and the rate of the current.

Rate in still water = $\frac{1}{2}(d + u)$ = 0.5 (10 + 7) = 8.5 km/hr

Rate of current = $\frac{1}{2}(d - u)$ 0.5 (10 – 7) = 1.5 km/hr

23. A man rows a boat from point A against current for 10 minutes and then come back with the current for next 10 minutes and reaches to a point B. If distance between A and B is 1 km, find the speed of the current.

Going with current and against current for the same time means speed of the boat in still water

is neutralized.

Speed of current only moves the boat.

Boat is moved 1 km by the current in (10 + 10) minutes = 20 minute = $\frac{1}{3}$ hour.

Therefore, Speed of current = 1 x 3 = 3 km/h.

24. A man can row a boat at 6 km/h in still water and speed of the current is 2 km/h. If he takes 45 minutes to row the boat to a place and back. Find the distance between the two places.

Speed of the boat downstream = 6 + 2 = 8 km/h

Sped of the boat upstream = 6 - 2 = 4 km/h

Therefore, Average speed = $\frac{2 \times 8 \times 4}{8+4} = \frac{2 \times 8 \times 4}{12}$ km/h

Time taken = 45 minute = $\frac{45}{60}$ hour = $\frac{3}{4}$ hour

25. A man rows boat to a place covering 72 km distance and back in 15 hours. He finds that he can row 3 km with the stream in the same time as 2 km against the stream. Find the speed of the stream.

Speed downstream : Speed upstream = 3 : 2

Therefore, Time taken to row downstream : Time taken to row upstream = 2 : 3

But, total time taken = 15 hours.

Therefore, Time taken to row downstream = $\frac{2}{5}$ x 15 hours = 6 hours

And, time taken to row upstream = 15 - 6 = 9 hours

Therefore, Speed downstream = $\frac{72}{6}$ = 12 km/h

And, speed upstream = $\frac{72}{9}$ = 8 km/h

Therefore, Speed of the stream = $\frac{12-8}{2}$ = 2 km/h

Alternative Method:

Let, downstream and upstream speeds are 3 km/h and 2 km/h respectively.

Then, distance covered in 15 hours = $\frac{2 \times 3 \times 2}{5} \times 15$ = 36 km

But, actual distance covered = 2 x 72 km = 144 km (i.e. 4 times 36 km)

Therefore, Speeds are 4 x 3 = and 4 x 2, i.e. 12 and 18 km/h

Therefore, Speed of the stream = $\frac{12-8}{2}$ = 2 km/h