unit - IV

BOATS AND STREAMS

(1) 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:

Speed in still water $= \frac{1}{2}(11+5)$ kmph

$= \frac{16}{2}$ kmph

$= 8$ kmph.

(2) A man can row upstream at 8 kmph and downstream at 13 kmph. The speed of the stream is:

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

$= \frac{5}{2}$ kmph

$= 2.5$ kmph.

(3) A man rows downstreams 32 km and 14 km ~~upstream at 13 kmph~~ If he takes 6 hours to cover each distance. then the velocity (in kmph) of the current is:

Rate downstream $= \left(\frac{32}{6}\right)$ kmph

Rate upstream $= \left(\frac{14}{6}\right)$ kmph

Velocity of current $= \frac{1}{2}\left(\frac{32}{6} - \frac{14}{6}\right)$ kmph

$= \frac{1}{2}\left(\frac{32-14}{6}\right)$ kmph

$= \frac{1}{2}\left(\frac{18}{6}\right)$ kmph

$= \frac{3}{2}$ kmph

$= 1.5$ kmph

(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?

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

$= \frac{12}{2}$ kmph

$= 6$ kmph

⑤ A boat man goes 2km against the current of the stream in 1hour and goes 1km along the current in 10minutes. How long will it take to go 5km in stationary water?

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

$= \frac{8}{2}$ km/hr

$= 4$ km/hr

required time $= \left(\frac{5}{4}\right)$ hrs $= 1\frac{1}{4}$ hrs

$= 1$ hr 15 min.

⑥ A man can row three-quarters of a kilometers against the stream in $11\frac{1}{4}$ minutes. The speed (in km/hr) of the man in still water is:

Rate upstream $= \left(\frac{750}{675}\right)$ m/sec

$= \frac{10}{9}$ m/sec

Rate downstream $= \left(\frac{750}{450}\right)$ m/sec

$= \frac{5}{3}$ m/sec

Rate in still water $= \frac{1}{2}\left(\frac{10}{9} + \frac{5}{3}\right)$ m/sec

$= \left(\frac{25}{18} \times \frac{18}{5}\right)$ km/hr

$= 5$ km/hr

(7) A man takes twice as long to row a distance against the stream as to row the same distance in favour of the stream. The ratio of the speed of the boat (in still water) and the stream is:

Let man's rate upstream be x kmph.

Then, his rate downstream $= 2x$ kmph

$$\left.\begin{matrix}\text{(speed in still water)}\\ \text{(speed of stream)}\end{matrix}\right\} = \left(\frac{2x+x}{2}\right) : \left(\frac{2x-x}{2}\right)$$

$$= \frac{3x}{2} : \frac{x}{2}$$

$$= 3 : 1$$

(8) A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current respectively?

Let the man's rate upstream be x kmph and that downstream by y kmph. Then, Distance covered upstream in 8hrs 48min = Distance covered downstream in 4 hrs.

$$\Rightarrow \left(x \times 8\ \frac{4}{5}\right) = (y \times 4)$$

$$\Rightarrow \frac{44}{5}x = 4y$$

$$\Rightarrow y = \frac{11}{5}x$$

$$\therefore \text{Required Ratio} = \left(\frac{y+x}{2}\right) : \left(\frac{y-x}{2}\right)$$

$$= \left(\frac{16x}{5} \times \frac{1}{2}\right) : \left(\frac{6x}{5} \times \frac{1}{2}\right)$$

$$= \frac{8}{5} : \frac{3}{5}$$

$$= 8 : 3$$

(9) If a boat goes 7km upstream in 42 minutes and the speed of the stream is 3kmph, then the speed of the boat in still water is

$$\text{Rate upstream} = \left(\frac{7}{42} \times 60\right) \text{kmph}$$

$$= 10 \text{ kmph}$$

Speed of stream = 3 kmph

Let speed in still water be x km/hr

Then, speed upstream = $(x-3)$ km/hr

$\therefore x - 3 = 10$ (or)

$x = 13$ km/hr.

(10) 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:

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

$= 12.5$ km/hr

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

$= 10$ km/hr

(11) If the man rows at the rate 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is:

Let the ratio along the current be x kmph

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

$= 6.5$ kmph

(12) 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.

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

$= 17$ km/hr

Time taken to travel 68 km downstream $= \left(\frac{68}{17}\right)$ hrs

$= 4$ hrs

(13) Speed of boat in standing water is 9 kmph and the speed of the stream is 1.5 km ph. 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:

Speed upstream $= 7.5$ kmph

Speed downstream $= 10.5$ kmph

Total time taken $= \left(\frac{105}{7.5} + \frac{105}{10.5}\right)$ hours

$= (14 + 10)$ hours

$= 24$ hours

(14) 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?

Speed downstream $= (15+3)$ kmph

$= 18$ kmph

Distance travelled $= \left(18 \times \frac{12}{60}\right)$ km

$= \frac{18}{5}$ km

$= 3.6$ km //

(15) A man can row at 5 kmph in still water. If the velocity of current is 1 kmph and it takes him 1 hour to row to a place and come back, how far is the place?

Speed downstream $= (5+1)$ kmph

$= 6$ kmph

Speed upstream $= (5-1)$ kmph

$= 4$ kmph

Let the required distance be x km.

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

$\Rightarrow 5x = 12$

$x = \frac{12}{5}$

$x = 2.4$ km

(16) 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?

Speed downstream = (14+4) km/hr

= 18 km/hr

Speed upstream = (14−4) km/hr

= 10 km/hr

Let distance between A and B be x km.

Then, $\frac{x}{18} + \frac{(x/2)}{10} = 19$

$\Rightarrow \frac{x}{18} + \frac{x}{20} = 19$

$\Rightarrow \frac{19x}{180} = 19$

$x = \frac{19 \times 180}{19}$

$x = 180$ km

(17) A man can row $9\frac{1}{3}$ kmph in still water finds that it takes him thrice as much time to row up than as to row down the same distance in the river The speed of the current is.

Let the speed upstream be x kmph.

Speed downstream = $3x$ kmph

Speed still water = $\frac{1}{2}(3x+x)$ kmph

$= 2x$ kmph

$\therefore 2x = \frac{28}{3} \Rightarrow x = \frac{14}{3}$

So, Speed upstream $= \frac{14}{3}$ km/hr

Speed downstream $= 14$ km/hr

Hence,

Speed of the current $= \frac{1}{2}\left(14 - \frac{14}{3}\right)$ km/hr

$= 4\frac{2}{3}$ km/hr

(18) A boat covers a certain distance downstream in 1 hour, while it comes back in $1\frac{1}{2}$ hours. If the speed of the stream be 3 kmph, what is the speed of the boat in still water?

Let the speed of the boat in still water be x kmph. Then,

Speed downstream $= (x+3)$ kmph.

Speed upstream $= (x-3)$ kmph

$\therefore (x+3) \times 1 = (x-3) \times \frac{3}{2}$

$\Rightarrow 2x + 6 = 3x - 9$

$\Rightarrow x = 15$ kmph.

(19) 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?

Let the speed of the stream be x km/hr. Then,

Speed downstream $= (15+x)$ km/hr

speed upstream $= (15 - x)$ km/hr

$$\therefore \frac{30}{(15+x)} + \frac{30}{(15-x)} = 4\frac{1}{2}$$

$$\Rightarrow \frac{900}{225 - x^2} = \frac{9}{2}$$

$$\Rightarrow 9x^2 = 225$$

$$x^2 = 25$$

$$x = 5 \text{ km/hr}$$

(20) The speed of the boat in still water is 10 km/hr. If it can travel 26 km downstream and 14 km upstream in the same time, the speed of the stream is?

Let the speed of the stream be x km/hr.

Then, speed downstream $= (10 + x)$ km/hr

speed upstream $= (10 - x)$ km/hr

$$\therefore \frac{26}{(10+x)} = \frac{14}{(10-x)}$$

$$\Rightarrow 260 - 26x = 140 + 14x$$

$$\Rightarrow 40x = 120$$

$$x = \frac{120}{40}$$

$$x = 3 \text{ km/hr}$$