

CH 4 BOATS AND STREAMS

ANSWERS AND EXPLANATIONS

EXERCISE 1

1. (b) Downstream speed = $15 + 5 = 20$ km/h.

$$\therefore \text{Required distance} = 20 \times \frac{24}{60} = 8 \text{ km.}$$

2. (d) Let x be the speed of the boat.
and y the speed of the current.

$$\therefore \frac{20}{x-y} + \frac{20}{x+y} = \frac{25}{36}$$

In this equation there are two variables, but only one equation, so, the value of ' x ' cannot be determined.

3. (c) Here downstream speed = 15 km/hr and upstream speed = 5 km/hr

\therefore Speed of the boat

$$= \frac{15+5}{2} = 10 \text{ km/h}$$

4. (c) Let the rate of stream = S km/h

$$\text{Given } 20 + S = 25$$

$$\Rightarrow S = 5 \text{ km/h}$$

5. (a) Let the rate against the current be x km/hr. Then,

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

6. (a) Man's speed in upstream = $4 - 2 = 2$ km/h.

$$\therefore \text{Required time} = \frac{6}{2} = 3 \text{ km/h}$$

7. (a) Let the speed of rowing be X . Then the equation

$$\text{formed is } \frac{9}{X-2} + \frac{9}{X+2} = 6.$$

On solving, we get the value of X as 4.

8. (c) Speed with the stream = 10.56 km. an hour.

Speed against the stream

$$= \frac{352}{4} \times \frac{60}{1000} = 5.28 \text{ km an hour}$$

\Rightarrow Speed in still water

$$= \frac{1}{2}(10.56 + 5.28) = 7.92 \text{ kmph}$$

9. (d) Required distance between A and B

$$= \frac{3((9)^2 - (3)^2)}{2(9)} = \frac{3(81-9)}{18}$$

$$= \frac{72}{6} = 12 \text{ km.}$$

10. (a) If the rate of the stream is x , then

$$2(4.5 - x) = 4.5 + x$$

$$\Rightarrow 9 - 2x = 4.5 + x$$

$$\Rightarrow 3x = 4.5$$

$$\Rightarrow x = 1.5 \text{ km/hr}$$

11. (d) Given, time taken by the boat to place and back = 3 hrs. and given speed of boat in still water = 4 km/hr

There is no speed of the stream given and also no down stream and upstream speed is given.

\therefore Can't calculate the distance.

12. (d) Given speed of boat in water = 4 km/hr = x (say)

and speed of current = 2 km/hr = y (say)

As we know, Distance = Speed \times Time

\therefore Upstream speed = $(x - y)$ km/hr

and time = 9 hr (given)

\therefore distance upstream = $(x - y) \cdot 9$

and downstream speed = $(x + y)$ km/hr

Now, distance downstream = distance upstream (given)

$\therefore (x - y) 9 = (x + y) \cdot 9$



$$\Rightarrow T = \left(\frac{x-y}{x+y} \right) 9 = \left(\frac{4-2}{4+2} \right) 9 = 3 \text{ hrs.}$$

13. (b) Rate downstream = $\left(\frac{16}{2} \right)$ kmph = 8 kmph;

Rate upstream = $\left(\frac{16}{4} \right)$ kmph = 4 kmph.

$$\therefore \text{Speed in still water} = \frac{1}{2} (8 + 4) = 6 \text{ km/h.}$$

14. (a) Man's upstream speed = $\frac{36}{6} = 6 \text{ km/hr}$

Speed of stream = $8 - 6 = 2 \text{ km/h}$

$$\therefore \text{Man's downstream speed} = 8 + 2 = 10 \text{ km/h}$$

Hence, required distance = $10 \times 10 = 100 \text{ km}$

15. (d) Man's speed in still water = 4.5 km/h

Let speed of stream = S km/h

Here, $T_u = 2T_d$

$$\therefore \frac{\text{Distance}}{4.5 - S} = 2 \left(\frac{\text{Distance}}{S + 4.5} \right)$$

$$\Rightarrow 4.5 + S = 9 - 2S$$

$$\Rightarrow 3S = 4.5 \Rightarrow S = 1.5 \text{ km/h}$$

16. (c) Let the distance travelled during both upward and downward journey be x km.

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{x+x}{\frac{x}{16} + \frac{x}{28}} = \frac{2}{\frac{28+16}{28 \times 16}}$$

$$= \frac{2 \times 28 \times 16}{44} = 20.36 \text{ km/h}$$

17. (c) Relative speed of the boats = 15 km/ hour

$$= \frac{15}{60} = \frac{1}{4} \text{ km/min}$$

i.e., they cover $\left(\frac{1}{4} \right)$ km in the last one minute

before collision

18. (a) If X be the speed of man in still water, Y the speed of stream, then $Y = 2$.

$$X - 2 = \frac{9}{3} \text{ or } X = 5.$$

Now, $X + 2 = 7$, hence time required = $9/7$ hours..

EXERCISE 2

1. (d) Speed of the boat in still water = 10 mph

Let the speed of the stream = x mph

Then, speed of boat with downward stream = $(10 + x)$ mph

Speed of boat with upward stream = $(10 - x)$ mph

$$\text{Now, } \frac{36}{(10+x)} + \frac{90}{60} = \frac{36}{(10-x)}$$

$$\text{or } \frac{1}{4} = 6 \left(\frac{1}{10-x} - \frac{1}{10+x} \right)$$

$$\text{or } \frac{1}{4} = 6 \left(\frac{2x}{100-x^2} \right)$$

$$\text{or } 100 - x^2 = 48x$$

$$\text{or } x^2 + 48x - 100 = 0$$

$$\text{or } x = 2 \text{ mph} \quad [x \neq -50]$$

2. (b) Let the speed of the boat in still water be x km/hr

Speed of the stream = 2 km/hr

\therefore Speed of the boat downstream

$$= (x + 2) \text{ km/hr}$$

Speed of the boat upstream

$$= (x - 2) \text{ km/hr}$$

$$\therefore \frac{8}{x+2} + \frac{8}{x-2} = 1 \frac{2}{3} = \frac{5}{3}$$

$$\Rightarrow 24x - 48 + 24x + 48 = 5(x^2 - 4)$$

$$\Rightarrow 5x^2 - 48x - 20 = 0$$

$$\Rightarrow x = \frac{48 \pm \sqrt{2304 + 400}}{10}$$



$$= \frac{48 \pm 52}{10} = 10, -0.4$$

\therefore Speed of the boat in still water = 10 km/hr.

3. (c) Let x be the speed of boat in still water and y be the speed in current.

\therefore Speed of the boat downstream

$$= (x + y) \text{ km/hr and speed of the boat upstream} \\ = (x - y) \text{ km/hr.}$$

According to the question :

$$2(x + y) = 3(x - y)$$

$$\Rightarrow 2x + 2y = 3x - 3y \Rightarrow 5y = x$$

$$\Rightarrow \frac{5}{1} = \frac{x}{y}$$

Hence, the ratio of speed in still water to speed in current is 5:1

4. (c) Let the speed of man in still water be v_m and the speed of stream be v_s . Then

$$(v_m - v_s) \times \left(\frac{45}{4 \times 60} \text{ hr} \right) = \frac{3}{4} \text{ km} \quad \dots(1)$$

$$\text{Also, } (v_m + v_s) \times \left(\frac{29}{4 \times 60} \text{ hr} \right) = \frac{3}{4} \text{ km} \quad \dots(2)$$

Now, we solve for v_m .

$$(1) \Rightarrow v_m - v_s \\ = \frac{3}{4} \times \frac{4 \times 60}{45} = \frac{3 \times 60}{45} = 4$$

$$\text{and } (2) \Rightarrow v_m + v_s$$

$$= \frac{3}{4} \times \frac{4 \times 60}{29} = \frac{3 \times 60}{29} = \frac{180}{29}$$

By adding (1) and (2), we get

$$2v_m = 4 + \frac{180}{29} \Rightarrow v_m = 5$$

Hence, the speed of the man in still water = 5 km/hr.

5. (c) The speed against the current of the stream = 2 km (in 1 hr)

The speed along the current of the stream

$$= 1 \text{ km (in 10 min)}$$

$$= \frac{1 \times 60}{10} \text{ (in 1 hr)}$$

$$= 6 \text{ km (in 1 hr)}$$

\therefore Speed in stationary water = 6 - 2 = 4 km

Thus, speed in stationary water = 4 km and distance = 5 km

$$\text{As, we know, Time} = \frac{\text{Distance}}{\text{Speed}}$$

\therefore Time taken to cover the distance 5 km

$$= \frac{5}{4} \text{ hour} = 75 \text{ min}$$

$$= 60 \text{ min} + 15 \text{ min} = 1 \text{ hour } 15 \text{ minutes}$$

6. (d) Let v_m = velocity of man = 48 m/min

Let v_c = velocity of current

then t_1 = time taken to travel 200 m against the current.

$$\text{i.e., } t_1 = \frac{200}{v_m - v_c} \quad \dots(1)$$

and t_2 time taken to travel 200 m with the current

$$\text{i.e., } t_2 = \frac{200}{v_m + v_c} \quad \dots(2)$$

Given : $t_1 - t_2 = 10 \text{ min}$

$$\therefore \frac{200}{v_m - v_c} - \frac{200}{v_m + v_c} = 10$$

$$\Rightarrow v_m^2 - v_c^2 = 40v_c$$

$$\Rightarrow v_c^2 + 40v_c - (48)^2 = 0$$

$$\Rightarrow v_c = 32, -72$$

Hence, speed of the current

$$= 32 \text{ } (\because v_c \neq -72).$$

7. (a) Here, Distance for downstream

$$= 2(\text{Distance for upstream})$$

Let speed of stream = S km/h.



