CH 4 BOATS AND STREAMS

ANSWERS AND EXPLANATIONS

EXERCISE 1

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

$\therefore$ 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.

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

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

Given 20 + S = 25

$\Rightarrow$ S = 5 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.

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

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

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

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

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 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 × Time

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

and time = 9 hr (given)

$\therefore$ distance upstream = (x – y). 9

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

Now, distance downstream = distance upstream (given)

$\therefore$ (x– y) 9 = (x + y). T

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

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

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

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

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

Speed of stream = 8 – 6 = 2 km/h

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

Hence, required distance = 10 × 10 = 100 km

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

Let speed of stream = S km/h

Here, $T_u = 2T_d$

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

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

$\Rightarrow 3S = 4.5 \Rightarrow S = 1.5$ km/h

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

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

$= \frac{x+x}{\frac{x}{16}+\frac{x}{28}} = \frac{2}{\frac{28+16}{28\times16}}$

$= \frac{2\times28\times16}{44} = 20.36\,\text{km/h}$

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

$= \frac{15}{60} = \frac{1}{4}$ 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.

$X - 2 = \frac{9}{3}$ 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

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

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

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

or $100 - x^2 = 48x$

or $x^2 + 48x - 100 = 0$

or $x = 2$ 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) km/hr

Speed of the boat upstream = (x – 2) 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) km/hr and speed of the boat upstream = (x – y) 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

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

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

Now, we solve for v_m.

(1) $\Rightarrow v_m - v_s$

$= \frac{3}{4} \times \frac{4 \times 60}{45} = \frac{3 \times 60}{45} = 4$

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

= 1km (in 10 min)

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

= 6 km (in 1 hr)

$\therefore$ Speed in stationary water = 6 – 2 = 4 km

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

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

$\therefore$ Time taken to cover the distance 5 km

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

= 60 min + 15 min = 1 hour 15 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.

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

and t_2 time taken to travel 200 m with the current

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

Given : $t_1 - t_2 = 10$ min

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

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

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

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

Hence, speed of the current

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

7. (a) Here, Distance for downstream

= 2(Distance for upstream)

Let speed of stream = S km/h.