Chapter - 13

Boat and Stream

Foundation

Solutions

1. (a); Let speed of boat in still water = x

   Then, $\dfrac{14}{x-4} = \dfrac{42}{60} \Rightarrow x = 24\ km/h$

2. (b); Let the speed of the stream is y km/h.
   Then, $y + 7 = 10 \Rightarrow y = 3\ km/h$

3. (c); Let speed of boat = x km/h
   Speed of stream = y km/h
   Then, $x + y = 10 \Rightarrow x - y = 6$
   $\Rightarrow 2x = 16 \Rightarrow x = 8\ km/h$

4. (d); Speed of the man upstream (v) = 12 − 4 = 8 km/h

5. (b); Let speed of boat in still water = x km/hr
   Speed of stream = y km/hr
   $x + y = 14, \quad x - y = 6,$
   $2x = 20, \quad x = 10\ km/h$

6. (b); Let speed of boat in still water = x
   Speed of stream = y

   $\dfrac{20}{x+y} = 5 \Rightarrow x + y = 4$ ... (i)

7. (c); $\dfrac{10}{x-y} = 5 \Rightarrow x - y = 2$ ... (ii)

   From (i) and (ii), $2x = 6 \Rightarrow x = 3$
   $y = 1\ km/h$

   Let speed of boat in still water = x

   From question, Given $y = \dfrac{1}{4}x$

   Then $\dfrac{18}{x - \dfrac{x}{4}} = 6 \Rightarrow 3 = \dfrac{3x}{4} \Rightarrow x = 4$

   Then the time it will take to cover the same

   distance downstream = $\dfrac{18}{4+1} = \dfrac{18}{5} = 3.6\ hr.$

8. (b); Let the speed of boat = x
   Speed of stream = y
   $x + y = 8\ km/h \Rightarrow x - y = 4\ km$
   $2x = 12 \Rightarrow x = 6 \Rightarrow y = 2\ km/h$

9. (c); Given x = 4 km/h y = 2 km/h
   Upstream rate = 4 − 2 = 2 km/h

10. (a); Given $x = 9, y = 6$
Then downstream speed of the swimmer
$= 9 + 6 = 15$ km/h

11. (a); Given, $x + y = 11 \Rightarrow y = 1.5$ then $x = 9.5$
∴ upstream speed of swimmer $= 9.5 - 1.5$
$= 8$ km/hr

12. (a); Let speed of boat = x, Speed of steam = y

$$\frac{1}{x+y} = \frac{5}{60} \Rightarrow x + y = 12 \qquad ...(i)$$

$$\frac{6}{x-y} = 1 \Rightarrow x - y = 6 \qquad ...(ii)$$

From (i) and (ii)
$2x = 18 \Rightarrow x = 9$
Speed of the stream $= (12 - 9) = 3$ km/h

13. (d); Let speed of boat = x, speed of current = y

$$\frac{60}{x+y} = 10 \Rightarrow x + y = 6 \qquad ...(i)$$

$$\frac{36}{x-y} = 10 \Rightarrow x - y = 3.6 \qquad ...(ii)$$

From (i) and (ii)
$2x = 9.6 \Rightarrow x = 4.8 \Rightarrow y = 1.2$ km/h

14. (b); Time taken $= \dfrac{128}{24+8} = \dfrac{128}{32} = 4$ h

15. (d); Let speed of boat = x, speed of stream = y

$$\frac{3/4}{x-y} = \frac{15}{60} \Rightarrow x - y = 3 \qquad ...(i)$$

$$\frac{3/4}{x+y} = \frac{10}{60} \Rightarrow \frac{3}{4(x+y)} = \frac{1}{6}$$

$$\Rightarrow x + y = \frac{9}{2} \qquad ...(ii)$$

From (i) and (ii)

$$2x = 3 + \frac{9}{2} \Rightarrow 2x = \frac{15}{2} \Rightarrow x = \frac{15}{4}$$

and $y = \dfrac{15}{4} - 3 \Rightarrow y = \dfrac{15-12}{4} = y = \dfrac{3}{4}$

16. (a); Let speed of boat = x, speed of stream = y

$$\frac{48}{x+y} = 20 \Rightarrow x + y = \frac{12}{5} \qquad ...(i)$$

$$\frac{48}{x-y} = 24 \Rightarrow x - y = 2 \qquad ...(ii)$$

From (i) and (ii)

$$2x = \frac{12}{5} + 2 \Rightarrow x = \frac{11}{5}$$

$x = 2.2$ km/h

$$∴ \quad \frac{x}{y} = \frac{15/4}{3/4} = \frac{15}{3} = \frac{5}{1} \Rightarrow x : y = 5 : 1$$

17. (c); Let speed of boat = x, speed of stream = y

$$\frac{15}{x+y} = 3 \Rightarrow x + y = 5 \qquad ...(i)$$

$$\frac{5}{x-y} = \frac{5}{2} \Rightarrow x - y = 2 \qquad ...(ii)$$

From (i) and (ii)
$x = 3.5$ km/h

18. (a); Let speed of the current = y km/h

Given $\dfrac{44}{8+y} = 4 \Rightarrow y = 3$ km/h

Time taken in upstream $= \dfrac{25}{(8-3)} = 5$ h

19. (d); Speed in still water = 20 km/h

Speed of the stream = 5 m/sec $= 5 \times \dfrac{18}{5}$ km/hr

$= 18$ km/h $\Rightarrow$ Ratio $= 20 : 18 = 10 : 9$

20. (a); Given speed in still water (x) = 9.6 km/h
Let speed of stream = y km/h, distance = d

According to question $\dfrac{d}{(9.6-y)} = \dfrac{2d}{(9.6+y)}$

$2 \times 9.6 - 2y = 9.6 + y \Rightarrow 3y = 9.6$
$y = 3.2$ km/h

Moderate

1. (c); Speed of motor boat in still water = 45 km/h
Time taken to travel along the stream

$= 1$ hr 20 min $= 1\dfrac{20}{60} = 1\dfrac{1}{3} = \dfrac{4}{3}$ hr.

Let speed of current = y km/h
Then According to question,

$$\frac{80}{45+y} = \frac{4}{3} \Rightarrow 60 = 45 + y \Rightarrow y = 15 \text{ km/h}$$

Then required time $= \dfrac{80}{45-15} = \dfrac{80}{45-15}$

$= \dfrac{80}{30} \times 60$ min $= 160$ min $= 2$ hr 40 min.

2. (a); Speed of boat in still water = 5 km/h
        speed of current = 2 km/h
        Let distance = d

$$\frac{d}{5-2} = 2 + \frac{d}{5+2} \;\Rightarrow\; \frac{d}{3} = 2 + \frac{d}{7}$$

$$\frac{d}{3} - \frac{d}{7} = 2 \;\Rightarrow\; d = 10.5 \text{ km.}$$

3. (a); Speed of boat in still water = 10 km/h
        Let speed of current = y km/h

$$\frac{24}{10+y} + \frac{24}{10-y} = 5 \;\Rightarrow\; 24\left(\frac{10+y+10-y}{(10+y)(10-y)}\right) = 5$$

$$\frac{24 \times 20}{100 - y^2} = 5 \;\Rightarrow\; 100 - y^2 = 96 \;\Rightarrow\; y^2 = 4$$

        y = 2 (Neglect – ve sign)

4. (d); Speed of the stream = 2 km/h
        Let speed of the boat in still water = x km/h
        And distance b/w two boats = d km

Then $\frac{d}{x+2} = 4 \Rightarrow d - 4x = 8$ ... (i)

$\frac{d}{x-2} = 5 \Rightarrow d - 5x = -10$ ... (ii)

        From eq. (i) and (ii)
        d – 4x – d + 5x = 8 + 10 ⇒ x = 18
        From eq. (i)
        d – 18 × 4 = 8 ⇒ d = 80 km

5. (b); Let speed of boat in still water = x
        speed of current = y ⇒ distance = d

Then $\frac{d}{x-y} = \frac{2d}{x+y} \;\Rightarrow\; 2x - 2y = x + y$

$x = 3y \;\Rightarrow\; \frac{x}{y} = \frac{3}{1}$

        Required ratio = 3 : 1

6. (b); Given speed of current = 4 km/h
        Let speed of rowing in still water = x km/h

distance (d) = $\frac{42}{2}$ = 21 km

Then $\frac{21}{x-4} = 2 + \frac{21}{x+4}$

$21\left(\frac{1}{x-4} - \frac{1}{x+4}\right) = 2 \;\Rightarrow\; 21\left(\frac{8}{x^2 - 16}\right) = 2$

        21 × 8 = 2x² – 32 ⇒ 200 = 2x²
        x² = 100 ⇒ x = 10 km/h

7. (c); Let the speed of the motorboat = 36 x
        Speed of current = 5x
        let distance = d

$$\frac{d}{41x} = 5\frac{10}{60} = \frac{31}{6} \;\Rightarrow\; \frac{d}{31x} = \frac{41}{6}$$

Means, time to come back of motor boat = $\frac{41}{6}$ hr

$= \frac{41}{6} \times 60 \text{ min} = 410 \text{ min} = 6\text{ h }50\text{ min}$

8. (b); Let speed of first boat = 5a, stream = 2a
        Speed of stream = 3b, boat = 4b

Stream should be same ⇒ 2a = 3b ⇒ a = $\frac{3}{2}$b

Required Ratio = $\frac{5a}{4b} = \frac{5 \times 3}{2 \times 4} = \frac{15}{8}$

9. (b); x = 3.5 km/h Let speed of current = y

$$\frac{d}{x-y} = \frac{5}{2} \times \frac{d}{x+y} \;\Rightarrow\; 5x - 5y = 2x + 2y$$

        3x = 7y ⇒ 3 × 3.5 = 7y ⇒ y = 1.5 km/h

10. (d); Given x = 4 km/h. Let speed of current = y

$$\frac{d}{x-y} = \frac{3d}{x+y} \;\Rightarrow\; 3x - 3y = x + y$$

        2x = 4y ⇒ 8 = 4y ⇒ y = 2 km/h

11. (b); Given y = 1.5 km/h
        Let speed of swimmer in still water = x

$$\frac{d}{x-y} = \frac{2d}{x+y} \;\Rightarrow\; x + y = 2x - 2y$$

        x = 3y ⇒ x = 3 × 1.5 ⇒ x = 4.5 km/hr

12. (d); x = 8 km/h, Let speed of current = y

$$\frac{36}{x-y} = 6 \Rightarrow \frac{36}{8-y} = 6 \;\Rightarrow\; 36 = 48 - 6y$$

6y = 12 ⇒ y = 2 ⇒ $\frac{d}{8+2} = 10 \Rightarrow d = 100$ km.

13. (d); x = 4 km/h, y = 2 km/h

$\frac{d}{4-2} = 9 \Rightarrow d = 18$ km $\Rightarrow \frac{18}{4+2} = t \Rightarrow t = 3$ hr

14. (a); x = 4 km/h y = 2 km/hr

$\frac{6}{4-2} = t \;\Rightarrow\; t = 3$ hr

15. (a); x = 4.5 km/hr y = 1.5 km/hr
        upstream speed (u) = 4.5 – 1.5 = 3 km/h
        downstream = (v) = 4.5 + 1.5 = 6 km/h

Average speed = $\frac{2uv}{u+v} = \frac{2 \times 3 \times 6}{9} = 4$ km/hr

16. (d); x = 15 km/h, y = 3 km/hr
u = 12 km/ v = 18 km/h

Average speed $= \dfrac{2uv}{u+v} = \dfrac{2 \times 18 \times 12}{30}$

= 14.4 km/hr

17. (d); x = 7 km/hr, y = 3 km/hr

$\dfrac{d}{7-3} = 6 + \dfrac{d}{10} \Rightarrow \dfrac{d}{4} = 6 + \dfrac{d}{10} \Rightarrow \dfrac{3d}{20} = 6$

d = 40 km

18. (b); x = 9, y = 3

$\dfrac{d}{9-3} = 3 + \dfrac{d}{9+3} \Rightarrow \dfrac{d}{6} = 3 + \dfrac{d}{12} \Rightarrow d = 36 \text{ km}$

19. (d); x = 4 km/h

$\dfrac{d}{4+y} + \dfrac{d}{4-y} = 3$

We can't solve this question.

20. (a); $\dfrac{d}{x+y} + \dfrac{d}{x-y} = 10$ ... (i)

$\dfrac{2d}{x+y} = 4 \Rightarrow d = 2(x+y)$ ... (ii)

From equation (i)

$d\left(\dfrac{x-y+x+y}{(x+y)(x-y)}\right) = 10 \Rightarrow 2xd = 10(x+y)(x-y)$

xd = 5 (x + y) (x – y)

From equation (ii) put $(x+y) = \dfrac{d}{2}$

$xd = 5 \times \dfrac{d}{2}(x-y) \Rightarrow 2x = 5x - 5y \Rightarrow 3x = 5y$

$3x = 5y \Rightarrow \dfrac{x}{y} = \dfrac{5}{3}$

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Boats and Streams Quick Maths Formulas

→ **If the speed of the boat is x and if the speed of the stream is y while upstream then the effective speed of the boat is = x - y**

→ **And if downstream then the speed of the boat = x + y**

→ **If x km/hr be the man's rate in still water and y km/hr is the rate of the current. Then**

   Man's rate with current = x + y
   Man's rate against current = x – y

→ **A man can row x km/hr in still water. If in a stream which is flowing at y km/hr, it takes him z hrs to row to a place and back, the distance between the two places is = z * (x2 – y2) / 2x**

→ **A man rows a certain distance downstream in x hours and returns the same distance in y hours. If the stream flows at the rate of z km/hr, then the speed of the man in still water is given by – z* (x + y) / (y - x) km/hr.**

→ **Man's rate against current = Man's rate with current – 2 * rate of current**

→ **Distance = Total Time * [(Speed in still water)2 – (Speed of current)2] / 2 * (Speed in still water)**

→ **Speed in Still Water = [(Rate of Stream) * (Sum of upstream and downstream time)] / (Diff of upstream and downstream time)**

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