(1) $D = 3\ km$ $\quad T = 30\ min = 0.5\ hour$

$S = D/T = 3/0.5 = 6\ km/hr$

(2) $S = D/T = 60/2 = 30\ km/hr$

(3) $D = S \times T$

$= 50 \times 3 = 150\ km$

(4) $T = 1hr\ 30\ min = 1.5\ hr$

$S = 20/1.5 = 13.33\ km/hr$

(5) $S = 10/1 = 10\ km/hr$

(6) upstream S = Boat S − Stream S

$= 15 - 5$

$= 10\ km/hr$

(7) $S = 4/2 = 2\ km/hr$

(8) Down stream $S = 24/2 = 12\ km/hr$

Stream $S = DS - BS$

$= 12 - 10$

$= 2\ km/hr$

(9) $S = 60/3 = 40\ km/hr$

(9) $S = 300/5 = 60$ km/hr

(10) $S = 60/3 = 20$ km/hr

(11) $T = D/S = 240/60 = 4$ hr

(12) $US = 30/3 = 10$ km/hr

$DS = 30/2 = 15$ km/hr

$BS = (15+10)/2 = 12.5$ km/hr

Stream $S = (15-10)/2 = 2.5$ km/hr

(13) Down Stream $= 20+5 = 25$ km/hr

Upstream $= 20-5 = 15$ km/hr

(14) $D = 120$ m, $T = 9$ sec

S in m/s $= 120/9 = 13.33$ m/s

Convert to km/hr $= 13.33 \times 18/5 = 48$ km/hr

(15) Relative speed $= (120+140)/10 = 260/10 = 26$ m/s

First Train Speed in m/s $= 54 \times 5/18 = 15$ m/s

So, $26 = 15 + x$

$x = 11$ m/s $\rightarrow$ in km/hr $= 11 \times 18/5 = 39.6$ km/hr

(16) Up S = 20/4 = 5 km/hr
Ds S = 20/3 = 6.67 km/hr

Boat S = (5 + 6.67)/2 = 5.83 km/hr
Stream S = (6.67 − 5)/2 = 0.83 km/hr

(17) Down stream speed = 5 + 2 = 7 km/hr

Time = 10/7 = 1.43 hr

(18)

$$\text{Avg speed} = \frac{2xxy}{x+y}$$

$x = 40$, $y = 60$

$$= \frac{2 \times 40 \times 60}{40+60}$$

$$= \frac{4800}{100} = 48 \text{ km/hr}$$

(19) Ds S = 48/3 = 16 km/hr
Up S = 48/4 = 12 km/hr

Boat Speed = (16 + 12)/2 = 14 km/hr

Stream S = (16 − 12)/2 = 2 km/hr

(20) Total distance = 100 + 200 = 300 m

Speed in m/s = 60 × 5/18 = 16.67 m/s

Time = 300 / 16.67 = 18 sec

(21) let boat Speed in still water = x km/hr

Then

D.S = x + 2

U.S = x − 2

$$\frac{30}{x+2} + \frac{20}{x-2} = 5$$

LCM

Multiply Through by $(x+2)(x-2)$:

$$30(x-2) + 20(x+2) = 5(x^2-4)$$

$$30x - 60 + 20x + 40 = 5x^2 - 20$$

$$50x - 20 = 5x^2 - 20$$

$$50x = 5x^4$$

$$x^2 = \frac{50}{5}$$

$$x^2 = 10 \text{ km/hr}$$

(22) Total length = 150 + 250 = 400 m

Relative Speed = 60 + 40 = 100 km/hr = 100 × 5/18

= 27.78 m/s

T = 400 / 27.78 = 14.4 s

(23) DS $s = x+2$

UP $s = x-2$

$$\frac{20}{x+2} - \frac{20}{x+2} = 2$$

Take LCM

$$\frac{20(x+2) - 20(x-2)}{(x^2-4)} = 2$$

$$\frac{20x + 40 - 20x + 40}{x^2-4} = 2$$

$$\frac{80}{x^2-4} = 2$$

$$80 = 2(x^2-4)$$

$$80 = 2x^2 - 8$$

$$2x^2 = 88$$

$$x^2 = 88/4$$

$$x^2 = 44$$

$$x = \sqrt{44}$$

$$x = 6.63 \text{ km/hr}$$

(24) $s = 72 \times 5/18 = 20 \text{ m/s}$

Length of Train $= 20 \times 12 = 240 \text{ m}$

Total platform + Train $= 20 \times 18 = 360 \text{ m}$

Platform length $= 360 - 240 = 120 \text{ m}$

Train = 240 m, platform = 120 m

(25) Sp = x km/hr.

DS = 20+x

US = 20-x

$$\frac{40}{20-x} - \frac{40}{20+x} = 1$$

LCM

$$\frac{40(20+x) - 40(20-x)}{400-x^2} = 1$$

$$\frac{800+40x-800+40x}{400-x^2} = 1$$

$$\frac{80x}{400-x^2} = 1$$

$$80x = 400 - x^2$$

$$x^2 + 80x - 400 = 0$$

Solve using quadratic formula:

$$x = \frac{-8 \pm \sqrt{80^2 + 4 \times 400}}{2}$$

$$= \frac{-8 \pm \sqrt{6400+1600}}{2}$$

$$= \frac{-8 \pm \sqrt{8000}}{2}$$

$$= \frac{-8 \pm 89.44}{2}$$

$$= 4.72 \text{ km/hr}$$