

# TSD & Mixtures

## Mixture & allegations

1 Ans: - Let the initial quantity =  $x$  litres

$$\text{Milk} = \frac{7}{10}x, \text{ Water} = \frac{3}{10}x$$

When 10l of mixture is removed:

- Milk removed =  $\frac{7}{10} \times 10 = 7$

- Water removed =  $\frac{3}{10} \times 10 = 3$

Remaining: Milk =  $\frac{7}{10}x - 7$

Water =  $\frac{3}{10}x - 3 + 10$

New ratio:  $\frac{\frac{7}{10}x - 7}{\frac{3}{10}x - 3 + 10} = \frac{5}{4}$

$$4 \left( \frac{7}{10}x - 7 \right) = 5 \left( \frac{3}{10}x + 7 \right)$$

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$$2.8x - 28 = 1.5x + 35$$

$$2.8x - 1.5x = 35 + 28$$

$$1.3x = 63 \Rightarrow x = 48.46$$

2 Ans: - Using allegation:

$$\frac{90 - 75}{75 - 60} = \frac{15}{15} = 1:1 //$$

3Ans:- Let the quantity drawn out =  $x$  L  
 Milk: water initially = 4:1  
 Milk left =  $\frac{4}{5}(60-x)$   
 Water left =  $\frac{1}{5}(60-x) + x$

New ratio:

$$\frac{4/5(60-x)}{1/5(60-x)+x} = \frac{2}{3}$$

Simplify:

$$\frac{4(60-x)}{(60-x)+5x} = \frac{2}{3}$$

$$\frac{240-4x}{60+4x} = \frac{2}{3}$$

$$\Rightarrow 3(240-4x) = 2(60+4x)$$

$$720-12x = 120+8x$$

$$720-120 = 8x+12x$$

$$\boxed{x=30}$$

4Ans:- Initial: Milk =  $\frac{2}{3} \times 60 = 40$  L, Water = 20 L

Water added = 15 L - New water = 35 L

New ratio = 40:35 = 8:7

5Ans:- Milk =  $\frac{5}{8} \times 80 = 50$  L, Water = 30 L

20 L removed:

Milk removed =  $\frac{5}{8} \times 20 = 12.5$  L

Water removed = 7.5 L

Remaining: Milk =  $50 - 12.5 = 37.5$  L

Remaining: Water =  $30 - 7.5 + 20 = 42.5$  L



$$\text{New ratio} = 37.5 : 42.5 = 75 : 85 = 15 : 17$$

6 Ans: Let  $x$  l of 25% solution, then  $(30-x)$  l of 40% solution

$$\frac{25x + 40(30-x)}{30} = 30$$

$$25x + 1200 - 40x = 900$$

$$-15x = -300 \Rightarrow x = 20 \text{ l}$$

7 Ans: - Let initial quantity =  $x$  l

$$\text{Alcohol} = 7/12x, \text{Water} = 5/12x$$

$$\text{Alcohol removed} = 7/12 \times 24 = 14 \text{ l}$$

$$\text{Water removed} = 5/12 \times 24 = 10 \text{ l}$$

$$\text{Remaining: Alcohol} = 7/12x - 14$$

$$\text{Water} = 5/12x - 10 + 24$$

$$\text{New ratio} = 1:1 \rightarrow \text{Alcohol} = \text{Water}$$

$$\frac{7}{12}x - 14 = \frac{5}{12}x - 10 + 24$$

$$2/12x = 28 \Rightarrow x = 168 \text{ l}$$

8 Ans: - Milk = 120 l

$$\text{Water added} = 20\% \text{ of } 120 = 24 \text{ l} \rightarrow \text{Total} = 144 \text{ l}$$

$$\text{Cost price per l} = \text{Pure milk price}$$

$$\text{Selling price} = 144 \text{ l at C.P. of } 120 \text{ l}$$

$$\Rightarrow \text{Gain} = (24/120) \times 100 = 20\% \text{ gain}$$

Ans: Let the ratio be  $1:x$  (Syrup: Water)

$$\text{Cost price per liter} = \frac{20 \times 1 + 0 \times x}{1+x} = \frac{20}{1+x}$$

$$\text{Given S.p} = 2641$$

$$\text{Profit} = 20\%$$

$$\text{C.P} = \frac{64}{1.2} = 53.33$$

$$\frac{20}{1+x} = 53.33 \Rightarrow 20 = 53.33(1+x)$$

$$20 = 53.33 + 53.33x$$

$$\Rightarrow 53.33x = 26.67$$

$$\text{Ratio} = 1:0.5 = 2:1$$

10Ans: Initial: Alcohol =  $3/5 \times 30$   
 $= 18$  L Water =  $12$  L

10L removed: Alcohol =  $3/5 \times 10 = 6$  L  
 Water =  $4$  L

Remaining: Alcohol =  $18 - 6 = 12$  L

Remaining: Water =  $12 - 4 = 8$  L

Alcohol added =  $10$  L, New alcohol =  $22$  L

New ratio =  $22:8 = 11:4$

11Ans: Initial: Acid =  $2/3 \times 60 = 40$  L, Water =  $20$  L

$1/3$  removed  $\rightarrow 20$  L removed: Acid =  $2/3 \times 20 = 13.33$  L, Water =  $6.67$  L

Remaining: Acid =  $40 - 13.33 = 26.67$  L

$$\text{Water} = 20 - 6.67 + 20 = 33.33$$

$$\text{New ratio} = 26.67 : 33.33 = 4 : 5$$

12 Ans: Using allegation;

$\frac{5}{8}$  and  $\frac{3}{8}$  to get  $\frac{1}{2}$

$$5/8 - 1/2 = 1/8, 1/2 - 3/8 = 1/8$$

$$\text{Ratio} = 1:1 //$$

13 Ans: Red: Blue = 12:1  $\rightarrow$  Red = 20 l, Blue = 10 l

Let  $x$  l of red added:

$$\frac{20+x}{10} = 4 \Rightarrow 20+x = 40$$

$$x = 20 //$$

14 Ans: Remaining Milk = Initial Quantity

$$x \left(1 - \frac{x}{V}\right)^n$$

where,  $V = 36$  l

$x$  = quantity replaced each time

$n = 3$

Final milk = 16 l

$$16 = 36 \left(1 - \frac{x}{36}\right)^3$$

$$4/9 = \left(1 - \frac{x}{36}\right)^3$$

$$\left(4/9\right)^{1/3} = 1 - \frac{x}{36}$$

Take cube root on both sides



$$(4/9)^{1/3} = 1.5874 \approx 0.763$$

$$0.763 = \frac{1-x}{36}$$

$$\Rightarrow \frac{x}{36} = 1 - 0.763 = 0.237 //$$

Quantity replaced each time = 8.5L //

15Ans: Milk =  $3/5 \times 20 = 12$

Water =  $2/5 \times 20 = 8$

Let  $x$  liters of water be added.

New ratio:  $\frac{12}{8+x} = \frac{1}{2}$

$$2 \times 12 = 8 + x \Rightarrow 24 = 8 + x$$

$$\Rightarrow x = 16 //$$

\* Time Speed & Distance

16Ans: Given, Distance = Length of train =  $L$   
 Speed =  $\frac{L}{20}$  m/s (passing a pole)

When passing a platform,

Distance =  $L + 200$  m

Time = 35 seconds

Speed =  $\frac{L+200}{35}$  m/s

$$\frac{1}{20} = \frac{L+200}{35} \Rightarrow 35L = 20(L+200)$$

$$85L = 20L + 4000$$

$$15L = 4000 \Rightarrow L = 266.67 \text{ m}$$

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COMPASS

Date: \_\_\_\_\_

17Ans: - Relative Speed:

$$54 + 72 = 126 \text{ km/h} = \frac{126 \times 1000}{3600}$$

$$= 35 \text{ m/s}$$

$$\text{Total distance: } 150 + 200 = 350 \text{ m}$$

$$\text{Time: } t = \frac{350}{35} = 10 \text{ seconds}$$

18Ans: - Speed of Stream =  $\frac{\text{Down stream} - \text{Up stream}}{2}$

$$= \frac{42 - 6}{2} = 18 \text{ km/h}$$

19Ans: - Let total distance =  $3d$

$$\text{Total time: } t = \frac{d}{30} + \frac{d}{20} + \frac{d}{10} + \frac{d}{30} + \frac{d}{20} + \frac{d}{10}$$

$$= \frac{11d}{60}$$

$$\text{Average Speed} \Rightarrow V_{\text{avg}} = \frac{3d}{\frac{11d}{60}} = \frac{180}{11}$$

$$\approx 16.36 \text{ km/h}$$

$$\begin{aligned} 20\text{Ans: - Distance} &= \text{Speed} \times \text{Time} \\ &= 25 \times 60 = 1500 \text{ m} \end{aligned}$$

$$\text{Length of bridge} = 1500 - 400 = 1100 \text{ m}$$

21Ans: - Average speed ( $V_{\text{avg}}$ )

$$= \frac{2 \times 60 + 40}{60 + 40} = \frac{160}{100} = 1.6 \text{ km/h}$$

22 Ans: -  $\frac{300}{x-10} - \frac{300}{x} = 2$

$\Rightarrow \frac{300x - 300(x-10)}{x(x-10)} = 2$

$\Rightarrow \frac{3000}{x(x-10)} = 2$

Solve:-

$3000 = 2x(x-10)$

$\Rightarrow 2x^2 - 20x - 3000 = 0$

$\Rightarrow x = \frac{10 \pm \sqrt{100 + 6000}}{2} = \frac{10 + 80}{2} = 45 \text{ km/h}$

23 Ans: - Relative Speed =  $\frac{120}{12} = 10 \text{ m/s}$

Where Train Speed =  $60 \text{ km/h} = 16.67 \text{ m/s}$

Train length =  $120 \text{ m}$

Time =  $12 \text{ s}$

Man's Speed =  $16.67 - 10 = 6.67 \text{ m/s}$   
 $= 24 \text{ km/h}$

24 Ans: - Average Speed:

$V_{\text{avg}} = \frac{300 + 240}{3 + 4} = \frac{540}{7} \approx 77.14 \text{ km/h}$

25 Ans: - Speed of boat in still water:

$S = \frac{5 + 2}{2} = 3.5 \text{ km/h}$

26 Ans: - Train Speed:

$V = \frac{240}{20} = 12 \text{ m/s}$



Distance covered in 36 seconds = 12/36  
= 432m,

Platform length = 432 - 240 = 192m,

27Ans: Let the distance be  $d$  km

Difference in time = 15 min + 15 min = 30 min  
= 0.5 hrs,

$$d/6 - d/10 = 0.5$$

$$10d - 6d/60 = 0.5$$

$$4d/60 = 0.5 \Rightarrow 4d = 30$$

$$d = 7.5 \text{ km}$$

28Ans: Time at Speed  $x = \frac{180}{x}$

Time at Speed  $x+10 = \frac{180}{x+10}$

Difference = 1 hr:

$$\frac{180}{x} - \frac{180}{x+10} = 1$$

$$180(x+10) - 180x = x(x+10)$$

$$180x + 1800 - 180x = x^2 + 10x$$

$$1800 = x^2 + 10x$$

$$x^2 + 10x - 1800 = 0$$

$$\Rightarrow x = \frac{-10 \pm \sqrt{100 + 7200}}{2} = \frac{-10 \pm 85}{2} = 37.5 \text{ km/h}$$

29Ans - Let the train's length =  $L$  m

$$\text{Speed} = 4/3 \text{ m/s}$$

Time to pass platform;

$$\frac{L+300}{3} = \frac{1}{3}$$

$$3(L+300) = 331$$

$$3L + 900 = 331$$

$$900 - 301 = 3L \Rightarrow L = 30 \text{ m}$$

30Ans - Speed increased uniformly

$$\text{Final Speed} = \text{Initial Speed} + (\text{Rate} \times \text{Time})$$

Rate of increase =  $10 \text{ km/h per min}$

Time = 6 minutes

Final Speed =  $100 \text{ km/h}$

$$100 = x + 10 \times 6$$

$$100 = x + 60$$

$$x = 40 \text{ km/h}$$