Solution :

6w/d ← A — 10 days
4w/d ← B — 15 days } L.C.M.= 60 work
5w/d ← C — 12 days

Total work/day by (A+B+C) = 15 work

Total work is done by (A+B+C) = $\frac{60}{15} = 4$ days

Ex-3. **If A & B completed a work together in 6 days. If A completed the same work in 10 days alone. Then in how many days will B complete the same work alone ?**

Solution :

5w/d ← A+B — 6 days
3w/d ← A — 10 days } 30 work

The work is completed by B in

$= \frac{30}{2} = 15$ days

Ex-4. **A & B can do a piece of work in 12 days, B & C can do it in 15 days, A & C can do it in 20 days. In how many days will A, B & C finish it, working all together ?**

Solution :

5w/d ← A+B — 12 days
4w/d ← B+C — 15 days } 60 work
3w/d ← C+A — 20 days
12w/d ← 2(A+B+C)

A+B+C = 6w/d

Total work is completed by A +B+C in

$= \frac{60}{6} = 10$ days.

Ex-5. **A can complete a work in 20 days & B can complete the same work in 25 days. If they start the work together but After 5 days A left the work. In how many days the total work would be finished?**

Solution :

5w/d ← A — 20 days
4w/d ← B — 25 days } 100 work
9w/d ← A+B —

A+B → A, B → $\frac{55}{4} = 13\frac{3}{4}$ days
5 days | 5×9 = 45w | ← 55w →
← 100 w →

Total time = $5+13\frac{3}{4} = 18\frac{3}{4}$ days

Ex-6. **A can do a work in 10 days and that of B in 15 days. B starts the work alone but after 3 days he left the work & A joined the work. In how many days will the total work be finished ?**

Solution :

3w/d ← A — 10 days
2w/d ← B — 15 days } 30 work

B → B, A → $\frac{24}{3}$ 8 days
3 days | 3×2 = 6w | ← 24w →
← 30 w →

Total Time = 3+8

= 11 days

Ex-7. **A can complete a piece of work in 9 days and B in 12 days respectively. If they work for a day alternately, In how many days the work would be finished, If A begins the work?**

Solution :

4w/d ← A - 9 days
3w/d ← B - 12 days } LCM = 36 work

Now, A B — 7w — 4w 3w ←2 days→ A B 4w 3w ←2 days→

7 w → 2 days

5x [7w → 2 days] ×5

35w → 10 days

Remaining work = 36 -35 = 1 w

1w will be done by A (because A starts the work)

$\therefore$ 1w → $\frac{1}{4}$ days---------- (done by A)

$\therefore$ Total time = $\left(10+\frac{1}{4}\right)$ days = $10\frac{1}{4}$ days

Note : Work efficiency of any worker inversely proportional to time taken by him / her.

i.e, work efficiency α $\frac{1}{\text{Time}}$

eg. The work efficiency ratio of A and B - A : B = 3 : 4. Then it means if A can do 3 work in one day, then

B can do 4 work in one day and

(A+B) can do 3+4 = 7 work in one day

ie. B is more efficient to A. (B is stronger than A)

Ex-8. **The ratio of work efficiency of A & B is 2 : 5. If A can complete a work in 10 days. In how many days the work can be completed by B and when they work together, in how many days the work would be completed ?**

Solution : A : B = 2 : 5

A = 10 days B = ?

A = 10 × 2 = 20 work

B = $\frac{20}{5}$ = 4 days. Ans

Total days for complete the work A & B work together A + B

$= \frac{20}{7} = 2\frac{6}{7}$ days.

Ex-9. **The ratio of work efficiency of A & B is 2 : 5. If A & B work together and completed a piece of work in 30 days, In how many days the work is completed when A works alone ?**

Solve :A : B = 2 : 5

A + B = 30 days

A + B = 30 × 7 = 210 work

A = $\frac{210}{2}$ = 105 days .

Ex-10. **A is twice as good a work man as B & together they finish a piece of work in 18 days. In how many days will A alone finish the work ?**

Solution : A : B = 2 : 1

A + B = 18 days

A + B = 18 × 3 = 54 work

A will do alone = 27 days

Ex-11. **If the ratio of work efficiency of A & B is 6 : 5 & that of B & C is 6 : 5. If A can complete the piece of work in 2 days, In how many days the same work can be completed by B & C separately ?**

Solution : A : B = [6 : 5] × 6 = 36 : 30

B : C = [6 : 5] × 5 = 30 : 25

A : B : C = 36 : 30 : 25

A = 2 days

A = 2 × 36 = 72 work

B = $\frac{72}{30} = 2\frac{2}{5}$ days

C = $\frac{72}{25} = 2\frac{22}{25}$ days

Ex-12. **A alone can finish a piece of work in 10 days which B alone can finish in 15 days. If they work together and finish it, then out of total wages of Rs. 225 the amount in rupees that A will get.**

Solution : Ratio between A & B's wages = A's 1 day's work : B's 1 day's work

$$= \frac{1}{10} : \frac{1}{15} = 3 : 2$$

$$A's\ wages = \frac{225}{5} \times 3 = 135\ Rs.$$

Formula :

$$\frac{M_1D_1H_1}{W_1R_1} = \frac{M_2D_2H_2}{W_2R_2}$$

M = no. of person

D = no. of days

H = no. of hours

W = work

R = rate (in Rs.)

Ex-13. **If 10 men can complete a work in 12 days. In how many days can 18 men complete the same work ?**

Solution : By formula :

$m_1 d_1 = m_2 d_2$

$10 \times 12 = 18 \times d_2$

$$d_2 = \frac{10 \times 12}{18} = \frac{20}{3} = 6\frac{2}{3}\ days,$$

Ex-14. **If 10 men complete half work in 12 days when they work 8 hours per day, In how many days 18 men complete the full work when they work 6 hours/ day ?**

Solution : By formula :

$$\frac{M_1D_1H_1}{W_1} = \frac{M_2D_2H_2}{W_2}$$

$$\frac{10 \times 12 \times 8}{1/2} = \frac{18 \times D_2 \times 6}{1}$$

$10 \times 12 \times 8 \times 2 = 18 \times D_2 \times 6$

$$D_2 = \frac{160}{9} = 17\frac{7}{9}\ days.$$

Ex-15. **2 men & 3 boys can do a work in 10 days, 3 men & 2 boys can do a work in 8 days . In how many days 2 men & 1 boy can do the same work ?**

Solution : 2M + 3B = 10 days - (I)

3M + 2B = 8 days - (II)

2M + 1B = ? - (III)

from (I) & (II)

$M_1 D_1 = M_2 D_2$

$(2M + 3B) \times 10 = (3M + 2B) \times 8$

$7B = 2M$

Again from (I) & (III)

$(2M + 3B) \times 10$

$= (2M + 1B) \times D$

$(7B + 3B) \times 10 = (7B + 1B) \times D$

$100B = 8B \times D$

$$D = \frac{100}{8} = \frac{25}{2} \Rightarrow 12.5\ days.$$

Ex-16. **1 man or 2 boys or 3 girls can do a piece of work in 88 days. In how many days one man, one boy and one girl can do the same work ?**

Solution : 1m = 2b = 3g = 88 days

(1m + 1b + 1g) = ?

By formula

$m_1 d_1 = m_2 d_2$

$3g \times 88 = (1m + 1b + 1g) \times d_2$

$$3g \times 88 = (3g + \frac{3}{2}g + 1g)\ d_2$$

$$3g \times 88 = \left(\frac{6g + 3g + 2g}{2}\right) d_2$$

$$3g \times 88 = \frac{11}{2} g \times d_2$$

$d_2 = 48$ days

Ex-17. **If 100 men can do 100 jobs in 100 days, 1 man can do one job in how many days ?**

Solution :

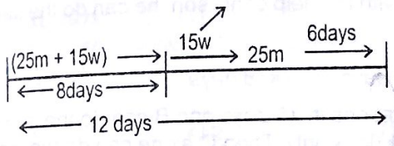
$$\frac{M_1D_1}{W_1} = \frac{M_2D_2}{W_2}$$

$$\frac{100 \times 100}{100} = \frac{1 \times d_2}{1}$$

$d_2 = 100$ days.

Ex-18. **25 men and 15 women do a piece of work in 12 days. They started the work, after 8 days women leaves off the remaining work done by 25 men in 6 days. In how many days, 15 women can do the same piece of work?**

Solution :



$m_1 d_1 = m_2 d_2$

$(25m + 15w) \times 4\ days = 25m \times 6$

$100m + 60w = 25m \times 6$

$100m + 60w = 150m$

$60\ w = 50m$

$6\ w = 5m$

Again,

$(25m + 15w) \times 12 = 15w \times d_2$

$$(25 \times \frac{6}{5} w + 15w) \times 12 = 15w \times d_2$$

$45w \times 12 = 15w \times d_2$

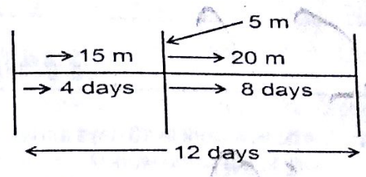
$d_2 = 36$ days

Ex-19. **15 men can complete a work in 12 days they start the work together. In how many days the total work will be finished when.**

(i) **After 4 days 5 more men join the work.**

(ii) **After 4 days 5 men left the work.**

Solution



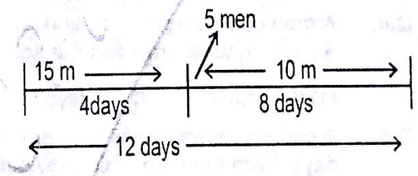
$m_1 \times d_1 = m_2 d_2$

$15 \times 8 = 20\ d_2$

$$d_2 = \frac{120}{20} = 6\ days$$

Total days = 4 + 6 = 10 days.

(ii) **Solution**



$m_1 d_1 = m_2 d_2$

$15 \times 8 = 10 \times d_2$

$d_2 = 12$ days

Total days = 4 + 12 = 16 days.

Ex-20. **3 men or 4 women can do a piece of work in 43 days. In how many days 7 men & 5 women can do the same work ?**

Solution 3m or 4w = 43 days

7m + 5w = ?

From

$M_1 D_1 = M_2 D_2$

$3\ m \times 43 = (7m + 5w) \times D_2$

$$3\ m \times 43 = (7m + \frac{15}{4} m) \times D_2$$

$$3\ m \times 43 = \frac{43m}{4} \times D_2$$

$$D_2 = \frac{516}{43}$$

= 12 days

EXERCISE

TIME AND WORK

Q.1. A does a work in 10 days and B does the same work in 15 days. In how many days they together will do the same work ?
(1) 5 days (2) 6 days (3) 8 days (4) 9 days (5) None of these

Q.2. A, B and C can complete a piece of work in 24, 6 and 12 days respectively. They will complete the same work in :
(1) $\frac{1}{24}$ days (2) $\frac{7}{24}$ days (3) $3\frac{3}{7}$ days (4) 4 days (5) None of these

Q.3. A man can do a job in 15 days. His father takes 20 days and his son finishes it in 25 days. How long will they take to complete the job if they all work together ?
(1) $5\frac{15}{47}$ days (2) $5\frac{17}{23}$ days (3) $6\frac{18}{47}$ days (4) $6\frac{12}{47}$ days (5) None of these

Q.4. A man can do a piece of work in 5 days, but with the help of his son, he can do the same work in 3 days. In what time can the son do it alone ?
(1) $6\frac{1}{2}$ days (2) 7 days (3) $7\frac{1}{2}$ days (4) 8 days (5) None of these

Q.5. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With the help of C, they did the job in 4 days only. Then C alone can do the job in :
(1) $9\frac{1}{5}$ days (2) $9\frac{2}{5}$ days (3) $9\frac{3}{5}$ days (4) 10 days (5) None of these

Q.6. A takes twice as much time as B and thrice as much time as C finish a piece of work. Working together, they can finish the work in 2 days. A can do the work alone in :
(1) 4 days (2) 6 days (3) 8 days (4) 12 days (5) None of these

Q.7. Rohan and Sohan are working on an assignment. Rohan takes 6 hours to type 32 pages on a computer, while Sohan takes 5 hours to type 40 pages. How much time will they take, working together on two different computers to type an assignment of 110 pages ?
(1) 7 hours 30 minutes (2) 8 hours (3) 8hours 15 minutes
(4) 8 hours 25 minutes (5) None of these

Q.8. Two workers A and B are engaged to do a work. A working alone takes 8 hours more to complete the job than if both worked together. If B worked alone, he would need $4\frac{1}{2}$ hours more to complete the job than they both working together. What time would they take to do the work together ?
(1) 4 hours (2) 5 hours (3) 6 hours (4) 7 hours (5) None of these

Q.9. P can complete a work in 12 days working 8 hours a day. Q can complete the same work in 8 days working 10 hours a day. If both P and Q work together, working 8 hours a day, in how many days can they complete the work ?
(1) $5\frac{5}{11}$ (2) $5\frac{6}{11}$ (3) $6\frac{5}{11}$ (4) $6\frac{6}{11}$ (5) None of these

Q.10. A and B can do a work in 12 days, B and C in 15 days, C and A in 20 days. If A, B and C work together, they will complete the work in :
(1) 5 days (2) $7\frac{5}{6}$ days (3) 10 days (4) $15\frac{2}{3}$ days (5) None of these

Q.11. A and B can do a piece of work in 72 days; B and C can do it in 120 days while A and C can do it in 90 days. In what time can A alone do it ?
(1) 80 days (2) 100 days (3) 120 days (4) 150 days (5) None of these

Q.12. A and B can do a piece of work in 5 days; B and C can do it in 7 days; A and C can do it in 4 days. Who among these will take the least time if put to do it alone ?
(1) A (2) B (3) C (4) Data inadequate (5) None of these

Q.13. A can do a piece of work in 4 hours; B and C together can do it in 3 hours, while A and C together can do it in 2 hours. How long will B alone take to do it ?
(1) 8 hours (2) 10 hours (3) 12 hours (4) 24 hours (5) None of these

Q.14. A can do a certain work in the same time in which B and C together can do it, A and B together could do it in 10 days and C alone in 50 days, then B alone could finish it in :
(1) 15 days (2) 20 days (3) 25 days (4) 30 days (5) None of these

Q.15. A works twice as fast as B. If B can complete a work in 12 days independently. The number of days in which A and B can together finish the work is :
(1) 4 days (2) 6 days (3) 8 days (4) 18 days (5) None of these

Q.16. A is 30% more efficient than B. How much time will they, working together, take complete a job which A alone could have done in 23 days ?
(1) 11 days (2) 13 days (3) $20\frac{3}{17}$ days (4) 15 days (5) None of these

Q.17. A does half as much work as B in three-fourth of the time. If together they take 18 days to complete the work, how much time shall B take to do it ?
(1) 30 days (2) 35 days (3) 40 days (4) 20 days (5) None of these

Q.18. A can finish a work in 18 days and B can do the same work in 15 days. B worked for 10 days and left the job. In how many days, A alone can finish the remaining work ?
(1) 5 (2) $5\frac{1}{2}$ (3) 6 (4) 8 (5) None of these

Q.19. Ram and Mohan can complete a work in 15 days and 10 days respectively. They started doing the work together but after 2 days Mohan had to leave and Ram alone completed the remaining work The whole work was completed in :
(1) 8 days (2) 10 days (3) 12 days (4) 15 days (5) None of these

Q.20. A can finish a work in 24 days, B in 9 days and C in 12 days. B and C start the work but are forced to leave after 3 days. The remaining work was done by A in :
(1) 5 days (2) 6 days (3) 10 days (4) $10\frac{1}{2}$ days (5) None of these

Q.21. Machine P can print one lakh books in 8 hours, machine Q can print the same number of books in 10 hours while machine R can print the same number of books in 12 hours. All the machines are started at 9 a.m. while machine P is closed at 11 a.m. and the remaining two machines complete the work. Approximately at what time will the work be finished ?
(1) 11:30 a.m. (2) 12 noon (3) 12:30 p.m. (4) 1 p.m. (5) None of these

Q.22. A and B can do a piece of work in 30 days, while B and C can do the same work in 24 days and C and A in 20 days. They all work together for 10 days Then B and C left. How many days more will A take to finish the work ?
(1) 18 days (2) 24 days (3) 30 days (4) 36 days (5) None of these

Q.23. X and Y can do a piece of work in 20 days and 12 days respectively. X started the work alone and then after 4 days Y joined him till the completion of the work. How long did the work last ?
(1) 6 days (2) 10 days (3) 15 days (4) 20 days (5) None of these

Q.24. A can do a piece of work in 40 days. He works it for 8 days and then B finished it in 16 days How long will they together take to complete the work ?
(1) $13\frac{1}{3}$ days (2) 15 days (3) 20 days (4) 56 days (5) None of these

Q.25. If 5 men or 9 women can do a piece of work in 19 days. 3 men and 6 women will do the same work in how many days ?
(1) 10 days (2) 12 days (3) 13 days (4) 15 days (5) None of these

CHAPTER-11

PIPE & CISTERN

Tips : Pipe & cistern is more similar to Time & Work, First of all we check the nature of pipes :

Suppose, pipe A can fill a tank, means nature of pipe A is positive.

and Pipe B can empty a tank, means nature of pipe B is negative.

Ex-1. **Two pipes A & B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously. How much time will be taken to fill the tank ?**

Solution :

+ 5 l/h ⟵ A — +36h
+ 4 l/h ⟵ B — +45h
} 180 l
+ 9 l/h ⟵ A+B

time taken by (A + B) = $\frac{180}{9}$ = 20 h

Ex-2. **If 'A' pipes can fill a tank in 10 hr. & pipes 'B' can empty a tank in 15hr. When both pipes are opened simultaneously, How much time will be taken to fill the tank ?**

Solution :

+ 3 l/h ⟵ A = +10h
- 2 l/h ⟵ B = -15h
} 30 l
+ 1 l/h ⟵ A+B

time taken when A & B both are opened,

A + B = $\frac{30}{1}$ = 30h.

Ex-3. **If A & B two pipes can fill a tank in 10 hr. when 'A' pipe can fill a tank in 6 hr. alone then in how much time will be taken to fill/empty the tank when pipes 'B' open alone ?**

Solution :

3 l/h ⟵ A+B = +10h
5 l/h ⟵ A = +6h
} 30 l
- 2 l/h ⟵ B

B = $\frac{30}{-2}$ = - 15 h.

i.e. B can empty the tank alone in 15h.

Ex-4. **To fill a cistern, pipes A, B & C takes 20, 15 and 12 minutes respectively. The time in minutes that the three pipes together will take to fill a cistern is ?**

Solution :

+ 3 l/m ⟵ A — +20m
+ 4 l/m ⟵ B — +15m
+ 5 l/m ⟵ C — +12m
} 60 l
+ 12 l/m ⟵ A + B + C

Time taken by A, B & C to fill the cistern

A + B + C = $\frac{60}{12}$ = 5 m

Ex-5. **Pipe 'A' & 'B' can fill a tank in 10h & 12h respectively but pipe 'C' can empty the same tank in 15h. In how much time it will take fill the tank when the three pipes are opened together ?**

Solution :

+ 6 l/h ⟵ A — +10h
+ 5 l/h ⟵ B — +12h
- 4 l/h ⟵ C — -15h
} 60 l
+ 7 l/h ⟵ A + B + C

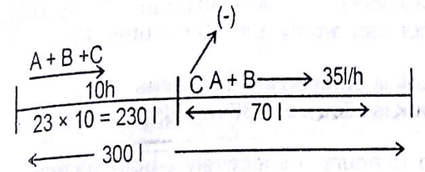
Time taken by A, B & C to fill the tank

A + B + C = $\frac{60}{7} = 8\frac{4}{7}$h.

Ex-6. **Two pipes A & B can fill a tank in 15hr. & 20hr. respectively while pipe C can empty the completly filled tank in 25hr. Three pipes are opened simultaneously. After 10hr. pipe C is closed. After what time will the tank be completely filled ?**

Solution :

+ 20 l/h ⟵ A — +15h
+ 15 l/h ⟵ B — +20h
- 12 l/h ⟵ C — -25h
} 300
+ 23 l/h ⟵ A + B + C



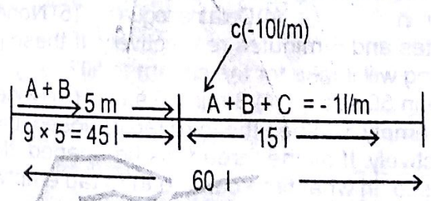
Time taken to fill the tank = $\frac{70\text{ l}}{35\text{ l/ h}}$

= 2h Ans.

Ex-7. **A pipe can fill a cistern in 12 min & another pipe in 15 min but a third pipe can empty it in 6min. The first two pipes are kept open for 5 min. in the beginning & then the third pipe is also opened. In what time the cistern would be empty ?**

Solution :

+ 5 l/m ⟵ A — +12m
+ 4 l/m ⟵ B — +15m
- 10 l/m ⟵ C — -6m
} 60 l
–1 l/m ⟵ A + B + C



i.e when A, B & C are opened then it takes 45 min to empty the cistern because A + B + C can empty 1l/h.

Ex-8. Two pipes A and B can fill a tank in 12 hours and 16 hours, respectively. While a third pipe C emptied the full tank in 24 hours. If all the three pipes are operate simultaneously at 7 am. In what time tank will be filled?

Solution :

+ 12 ⟵ A — +4
+ 16 ⟵ B — +3
- 24 ⟵ C — - 2
} 48
A + B + C ⟶ + 5

The tank will be fill in

$\frac{48}{5} = 9\frac{3}{5}$ hours

= 9 hr 36 minute

Time = 7 am + 9 hr 36 min.

= 4:36 pm.

Ex-9. The efficiency of pipe A is twice as good as pipe B and the efficiency of pipe B is thrice as good as C. If all the pipes are open together the tank will be fill in 10 hours. If pipe B open separately then in how many times the tank will be fill?

Solution :

Let pipe C can fill the tank in 'x' hours

B = $\frac{x}{3}$ hours

A = $\frac{x}{6}$ hours

$\therefore \frac{1}{x} + \frac{3}{x} + \frac{6}{x} = \frac{1}{10}$

$= \frac{10}{x} = \frac{1}{10}$

x = 100

Pipe B can fill the tank = $\frac{100}{3}$

= $33\frac{1}{3}$ hours

33 hours 20 minute

EXERCISE

PIPE & CISTERN

Q.1. One tap can fill a cistern in 2 hours and another can empty the cistern in 3 hours. How long will they take to fill the cistern if both the taps are opened ?
(1) 6 hours (2) 7 hours (3) 6.30 hours (4) 7.30 hours (5) None of these

Q.2. A tap can fill a tank in 25 minutes and another can empty it in 50 minutes. Find in how many minutes the tank will be filled up or emptied ?
(1) Tank is filled up in 50 minutes (2) Tank is emptied in 25 minutes
(3) Tank is filled up in 25 minutes (4) Tank is filled up in 30 minutes
(5) None of these

Q.3. Two taps A and B can fill a tank in 10 hours and 15 hours, respectively. If both the taps are opened together the tank will be filled in how many hours ?
(1) 8 hours (2) 6 hours (3) 5 hours (4) 5 hrs 30 min (5) None of these

Q.4. Two pipes A and B can separately empty a cistern in 12 hours and 15 hours respectively. In what time will the cistern be emptied, if both the pipes are opened together?
(1) 5 hours 30 minutes (2) 7 hours (3) 6 hours 40 minutes
(4) 6 hours (5) None of these

Q.5. Two pipes can fill a tank in 10 hours and 12 hours respectively. While a third pipe emptied the full tank in 20 hours. If all the three pipes operate simultaneously, in how much time the tank will be filled ?
(1) 7 hours 30 min (2) 6 hours 40 min (3) 8 hours 30 min (4) 9 hours 30 min (5) None of these

Q.6. Two pipes A and B can fill a cistern in 24 minutes and 30 minutes, respectively. There is also an outlet C. If all the three pipes are opened together, the cistern is filled in 20 minutes. How much time will be taken by *C* to empty the full cistern?
(1) 30 min (2) 40 min (3) 45 min (4) 50 min (5) None of these

Q.7. A cistern has a leak which would empty in 8 hours. A tap is turned on which admits 6 litres a minute into the cistern and it is now emptied in 12 hours. The cistern can hold
(1) 6840 litres (2) 7860 litres (3) 8640 litres (4) 1000 litres (5) None of these

Q.8. If two pipes function simultaneously, the reservoir will be filled in 12 hours. One pipe fills the reservoir 10 hours faster than the other. How many hours does the faster pipe take to fill the reservoir ?
(1) 35 hours (2) 30 hours (3) 40 hours (4) 32 hours (5) None of these

Q.9. One fill pipe *A* is 3 times faster than second fill pipe *B* and takes 32 minutes less than the fill pipe B. When will the cistern be full if both pipes are opened together?
(1) 28 min (2) 24 min (3) 30 min (4) Data inadequate (5) None of these

Q.10. Two pipes A and B can fill a cistern in 4 minutes and 6 minutes respectively. If these pipes are turned on alternately for 1 minute each how long will it take for the cistern to fill?
(1) 4 min 40 sec (2) 3 min 20 sec (3) 4 min 50 sec (4) 3 min 30 sec. (5) None of these

Q.11. There are two taps to fill a tank while a third to empty it. When the third tap is closed, they can fill the tank in 10 minutes and 12 minutes respectively. If all the three taps be opened, the tank is filled in 15 minutes. If the first two taps are closed, in what time can the third tap empty the tank when it is full?
(1) 7 min (2) 9 min and 32 sec (3) 8 min and 34 sec
(4) 6 min. (5) None of these

Q.12. A cistern is provided by two taps A and B. A can fill it in 20 minutes and B in 25 minutes. Both the taps are kept open for 5 minutes and then the second is turned off. The cistern will be completely filled in another
(1) 11 min (2) 10 min (3) 15 min (4) 12 min (5) None of these

Q.13. Two pipes *A* and *B* can separately fill a tank in 6 hours and 8 hours, respectively. Both the pipes are opened together, but $1\frac{1}{2}$ hours after the start, the pipe *A* is turned off. How much time will it take to fill the tank?

(1) 5 hours (2) 6 hours (3) $4\frac{1}{2}$ hours (4) $5\frac{1}{2}$ hours (5) None of these

Q.14. A cistern has two taps which fill it in 12 minutes and 15 minutes respectively. There is also a waste pipe in the cistern. When all the pipes are opened, the empty cistern is filled in 20 minutes. How long will the waste pipe take to empty a full cistern?
(1) 8 minutes (2) 10 minutes (3) 12 minutes (4) 16 minutes (5) None of these

Q.15. Two taps can separately fill a cistern in 10 minutes and 15 minutes respectively and when the waste pipe is opened, they can together fill it in 18 minutes. The waste pipe can empty the full cistern in
(1) 7 min (2) 9 min (3) 13 min (4) 23 min (5) None of these

Q.16. A water tank is $\frac{2}{5}$ th full. Pipe *A* can fill the tank in 10 minutes and pipe *B* can empty it in 6 minutes. If both the pipes are opened, how long will it take to empty or fill the tank completely?
(1) 6 minutes to empty (2) 6 minutes to fill (3) 9 minutes to empty
(4) 9 minutes to fill (5) None of these

Q.17. Tap 'A' can fill a water tank in 25 minutes, tap 'B' can fill the same tank in' 40 minutes and tap 'C' can empty that tank in 30 minutes. If all the three taps are opened together, in how many minutes will the tank be completely filled up or emptied?
(1) 3 (2) 9 (3) 12 (4) 24 (5) None of these

Q.18. A cistern can be filled with water by a pipe in 5 hours and it can be emptied by a second pipe in 4 hours. If both the pipes are opened when the cistern is full, the time in which it will be emptied is
(1) 9 hours (2) 18 hours (3) 20 hours (4) 25 hours (5) None of these

Q.19. A pump can fill a tank with water in 2 hours. Because of a leak in the tank it was taking $2\frac{1}{3}$ hours to fill the tank. The leak can drain all the water off the tank in
(1) 8 hours (2) 7 hours (3) $4\frac{1}{3}$ hours (4) 14 hours (5) None of these

Q.20. Two pipes A and B can separately fill a cistern in 60 minutes and 75 minutes respectively. There is a third pipe at the bottom of the cistern to empty it., If all the three pipes are simultaneously opened, then the cistern is filled in 50 minutes. In how much time can the third pipe alone empty the cistern?
(1) 110 minutes (2) 100 minutes (3) 120 minutes (4) 90 minutes (5) None of these

Q.21. A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What, is the total time taken to fill the tank completely?
(1) 4 hours (2) 4 hours 15 minutes (3) 3 hours 15 minutes
(4) 3 hours 45 minutes (5) None of these

Q.22. A pump can fill a tank with water in 2 hours. Because of a leak, it took $2\frac{1}{3}$ hours to fill the tank. The leak can drain all the water of the tank in :
(1) 4 hrs (2) 7 hrs (3) 8 hrs (4) 14 hrs (5) None of these

Q.23. Two pipes A and B can fill a tank in 6 hours and 4 hours respectively. If they are opened on alternate hours and if pipe A is opened first, in how many hours, the tank shall be full ?
(1) 4 hrs (2) $4\frac{1}{2}$ hrs (3) 5 hrs (4) $5\frac{1}{2}$ hrs (5) None of these

Q.24. Three taps A, B and C can fill a tank in 12,15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in :
(1) 6 hrs (2) $6\frac{2}{3}$ hrs (3) 5 hrs (4) $7\frac{1}{2}$ hrs (5) None of these

Q.25. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 gallons per minute. All the three pipes working together can filled the tank in 15 minutes. The capacity of the tank is :
(1) 60 gallons (2) 100 gallons (3) 120 gallons (4) 180 gallons (5) None of these

CHAPTER-12

SPEED, TIME AND DISTANCE

The formula, *Distance= Speed x Time* expresses one of the most frequently used relations in Algebra

Since an equation remains true as long as you divide through by the same non-zero element on each side, this formula can be written in different ways:

To find speed, divide through on both sides by time:

Speed = Distance / Time

Speed is equal to distance (given in units such as miles, feet, kilometres, metres, etc.) divided by time (hours, minutes, seconds, etc.). Speed can always be written as a fraction that has distance units in the numerator and time units in the denominator, e.g., 25 miles/hour.

To find time, divide through on both sides by rate:

Time = Distance / Speed

When using this equation, it's important to keep the units straight. For instance, if the rate of the problem is given in miles per hour (mph), then the time needs to be in hours, and the distance in miles. If the time is given in minutes, you will need to divide by 60 to convert it to hours before you can use the equation to find the distance in miles. Always make your units match: if the time is given in fortnights and the distance in furlongs, then the Speed should be given in furlongs per fortnight.

You can see why this is true if you look carefully at how the units are expressed.

Ex-1. A car is travelling at 30 mph and you want to figure out how far it will go in 2 hours?

You can use the formula:

Speed × Time = Distance

30 miles/hour x 2 hours = 60 miles

Important Formulae :

1. km/hr to m/sec conversion:

$$A \text{ km/hr} = \left(A \times \frac{5}{18}\right) \text{ m/sec.}$$

2. m/sec to km/hr conversion:

$$A \text{ m/sec} = \left(A \times \frac{18}{5}\right) \text{ km/hr.}$$

3. If the ratio of the speeds of A and B is a : b, then the ratio of the the time taken by them to cover the same distance is $\frac{1}{a} : \frac{1}{b}$ or b : a

4. Suppose a man covers a certain distance at x km/hr and an equal distance at *y* km/hr. Then, the average speed during the whole journey is $\left(\frac{2xy}{x+y}\right)$ km/hr.

Examples :

Ex-1. A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?

Solution:

$$\text{Speed} = \left(\frac{600}{5 \times 60}\right) \text{m/sec.} = 2\text{m/sec}$$

Converting m/sec to km/hr (see important formula's section)

$$= \left(2 \times \frac{18}{5}\right) \text{ km/hr} = 7.2 \text{ km/hr}$$

Ex-2. An aeroplane covers a certain distance at a speed of 240 kmph in 5 hours. To cover the same distance in $1\frac{2}{3}$ hours, it must travel at a speed of:

Solution:

Distance = (240 x 5) = 1200 km.

Speed = Distance/Time

Speed = 1200/(5/3) km/hr. [We can write $1\frac{2}{3}$ hours as 5/3 hours]

$$\text{Required speed} = \left(1200 \times \frac{3}{5}\right)$$

= 720km/hr.

Ex-3. If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance travelled by him is:

Solution:

Let the actual distance travelled be x km.

$$\text{Then, } \frac{x}{10} = \frac{x+20}{14}$$

$$\Rightarrow 14x = 10x + 200$$

$$\Rightarrow 4x = 200$$

$$\Rightarrow x = 50\text{km.}$$

Ex-4. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:

Solution:

Let speed of the car be x kmph.

$$\text{Then, speed of the train} = \frac{150}{100}x = \left(\frac{3x}{2}\right) \text{ kmph.}$$

$$\frac{75}{x} - \frac{75}{(3/2)x} = \frac{125}{10 \times 60}$$

$$\Rightarrow \frac{75}{x} - \frac{50}{x} = \frac{5}{24}$$

$$x = \left(\frac{25 \times 24}{5}\right) = 120 \text{ kmph.}$$

Ex-5. Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour?

Solution:

Due to stoppages, it covers 9 km less.

Time taken to cover 9 km

$$= \left(\frac{9}{54} \times 60\right) \text{min} = 10 \text{ min}$$

Ex-6. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight is increased by 30 minutes. The duration of the flight is:

Solution:

Let the duration of the flight be x hours.

Then, $\frac{600}{x} - \frac{600}{x+(1/2)} = 200$

$\frac{600}{x} - \frac{1200}{2x+1} = 200$

$\Rightarrow x(2x+1) = 3$

$\Rightarrow 2x^2 + x - 3 = 0$

$\Rightarrow (2x+3)(x-1) = 0$

$x = 1$ hr. [neglecting the -ve value of x]

Ex-7. **A man completes a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.**

Solution:

Let the total journey be x km.

$\frac{(1/2)x}{21} + \frac{(1/2)x}{24} = 10$

$\Rightarrow \frac{x}{21} + \frac{x}{24} = 20$

$\Rightarrow 15x = 168 \times 20$

$\Rightarrow x = \left(\frac{168 \times 20}{15}\right) = 224$ km.

Ex-8. **The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 kms in 4 hours, then the speed of the first train is:**

Solution:

Let the speed of two trains be 7x km/hr and 8x km/hr.

Then, $8x = \left(\frac{400}{4}\right) = 100$

$\Rightarrow x = \left(\frac{100}{8}\right) = 12.5$

$\therefore$ Speed of first train = (7 x 12.5) km/hr

= 87.5 km/hr.

Ex-9. **A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for 320 km of the tour is:**

Solution:

Total time taken = $\left(\frac{160}{64} + \frac{160}{80}\right) = \frac{9}{2}$ hrs.

$\therefore$ Average speed = $\left(320 \times \frac{2}{9}\right)$ km/hr

= 71.11 km/hr (approx.)

Ex-10. **A car travelling with $\frac{5}{7}$ of its actual speed covers 42 km in 1 hr 40 min 48 sec. Find the actual speed of the car.**

Solution:

Time taken = 1 hr 40 min 48 sec = 1 hr $40\frac{4}{5}$ min.

$= 1\frac{51}{75}$ hrs

$= \frac{126}{75}$ hrs.

Let the actual speed of the car be x km/hr.

Then, $\frac{5x}{7} \times \frac{126}{75} = 42$

$x = \left(\frac{42 \times 7 \times 75}{5 \times 126}\right) = 35$ km/hr.

EXERCISE

TIME, SPEED AND DISTANCE

Q.1. A man is walking at the rate of 5 km/hr crosses a bridge in 15 minutes. The length of the bridge (in metres) is:
(1) 600 (2) 750 (3) 1000 (4) 1250 (5) None of these

Q.2. A car is running at speed of 108 kmph. What distance will it cover in 15 seconds ?
(1) 45 meter (2) 55 meter (3) 450 meter
(4) cannot be determined (5) None of these

Q.3. One of the two buses completes a journey of 300 km in $7\frac{1}{2}$ hours and the other a journey of 450 km in 9 hours. The ratio of their average speeds is :
(1) 2 : 3 (2) 3 : 4 (3) 4 : 5 (4) 8 : 9 (5) None of these

Q.4. A truck covers a distance of 550 metres in 1 minute whereas a bus covers a distance of 33 kms in 45 minutes. The ratio of their speeds is :
(1) 3 : 4 (2) 4 :3 (3) 3 : 5 (4) 50 : 3 (5) None of these

Q.5. A train travels at an average speed of 50 miles per hour. It travels for $2\frac{1}{2}$ hours -
(1) 120 miles (2) 150 miles (3) 200 miles (4) 230 miles (5) None of these

Q.6. A man in train notices that he can count 21 telephone posts in one minute. If they are known to be 50 metres apart, then at what speed is the train travelling ?
(1) 55 km/hr (2) 57 km/hr (3) 60 km/hr (4) 63 km/hr (5) None of these

Q.7. Sound is said to travel in air at about 1100 feet per second. A man hears the axe striking the tree, $\frac{11}{5}$ seconds after he sees it strike the tree. How far is the man from the wood chopper ?
(1) 2197 ft (2) 2420 ft (3) 2500 ft (4) 2629 ft (5) None of these

Q.8. An express train travelled at an average speed of 100 km/hr, stopping for 3 minutes after every 75 km. How long it take to reach its destination 600 km from the starting point ?
(1) 6 hrs 21 min (2) 6 hrs 24 min. (3) 6 hrs 27 min (4) 6 hrs 30 min (5) None of these

Q.9. The speed of a car increases by 2 kms/hr. after every one hour. If the distance covered in the first one hour was 35 kms, what was the total distance travelled in 12 hours ?
(1) 456 kms (2) 482 kms (3) 552 kms (4) 556 kms (5) None of these

Q.10. A train covers a distance of 10 km in 12 minutes. If its speed is decreased by 5 km/hr the time taken by it to cover the same distance will be :
(1) 10 min (2) 11 min 20 sec (3) 13 min (4) 13 min 20 sec (5) None of these

Q.11. A is faster than B. A and B each walk 24 km. The sum of their speeds is 7 km and the sum of times taken by them is 14 hours. Then, A's speed is equal to:
(1) 3 km/ hr (2) 4 km/ hr (3) 5 km/ hr (4) 6 km/ hr (5) None of these

Q.12. A person travels from P to Q at a speed of 40 kmph and returns by increasing his speed by 50%. What is his average speed for both the trips ?
(1) 36 kmph (2) 45 kmph (3) 48 kmph (4) 50 kmph (5) None of these

Q.13. Mac travels from A to B a distance of 250 miles in $5\frac{1}{2}$ hours. He returns to A in 4 hours 30 minutes. His average speed is :
(1) 44 mph (2) 46 mph (3) 48 mph
(4) 50 mph (5) None of these

Q.14. A boy goes to his school from his house at a speed of 3 km/hr and returns at a speed of 2 km / hr . If he takes 5 hours in going and coming, the distance between his house and school is :
(1) 5 km (2) 5.5 km (3) 6 km (4) 6.5 km (5) None of these

Q.15. The average speed of a train in the onward journey is 25 % more than that in the return journey. The train halts for one hour on reaching the destination. The total time taken for the complete to and fro journey is 17 hours covering a distance of 800 km. The speed of the train in the onward journey is :
(1) 45 km/hr (2) 47.5 km/hr (3) 52 km/hr (4) 56.25 km/hr (5) None of these

Q.16. I started on my bicycle at 7 a.m. to reach a certain place. After going a certain distance, by bicycle went out of order. Consequently, I rested for 35 minutes and came back to my house walking all the way. I reached my house at 1 p.m. If my cycling speed is 10 kmph and my walking speed is 1 kmph, then on my bicycle I covered a distance of :
(1) $4\frac{61}{66}$ km (2) $13\frac{4}{9}$ km (3) $14\frac{3}{8}$ km (4) $15\frac{10}{21}$ km (5) None of these

Q.17. A,B and C are on a trip by car.A drives during the first hour at an average speed 50 km/hr. B drives during the next 2 hours at an average speed of 48 km/hr. A and C drives during the next 3 hours at an average speed of 52 km./hr. and they reached the destination in 6 hours. Their mean speed is :
(1) 50 km/hr (2) $50\frac{1}{3}$ km/hr (3) 51 km/hr $\frac{1}{3}$ (4) 52 km/hr (5) None of these

Q.18. A boy rides his bicycle 10 km at an average speed of 12 km/hr and again travels 12 km at an average speed of 10 km/hr. His average speed for the entire trip is approximately.
(1) 10.4 km/hr (2) 10.8 km/hr (3) 11 km/hr (4) 12.2 km/hr (5) None of these

Q.19. A man travels 600 km by train at 80 km/hr, 800 km by ship at 40 km/hr, 500 km by aeroplane at 400 km/hr. and 100 km by car at 50 km/hr. What is the average speed for the entire distance ?
(1) 60 km/hr (2) $60\frac{5}{12}$ km/hr (3) 62 km/hr (4) $66\frac{5}{12}$ km/hr (5) None of these

Q.20. A car travels the first one-third of a certain distance with a speed of 10 km/hr, the one third distance with speed of 20 km/hr. and the last one third distance with speed of 60 km/hr the average speed of the car for the whole journey is:
(1) 18 km/hr (2) 24 km/hr (3) 30 km/hr
(4) 36 km/hr (5) None of these

Q.21. A train when moves at an average speed of 40 kmph, reaches its destination. When its average speed becomes 35 kmph, then it reaches its destination 15 late. Find the distance of journey.
(1) 30 km (2) 40 km (3) 70 km
(4) 80 km (5) None of these

Q.22. If a train runs at 40 kmph, it reaches its destination late by 11 minutes but if it runs at 50 kmph, it is late by 5 minutes only. The correct time for the train to its journey is :
(1) 13 min. (2) 15 min. (3) 19 min.
(4) 21 min. (5) None of these

Q.23. A man covered a certain distance at some speed . Had he moved 3 kmph faster would have taken 40 minutes less. If he had moved 2 kmph slower, he would taken 40 minutes more.The distance (in km) is :
(1) 35 (2) $36\frac{2}{3}$ (3) $37\frac{1}{2}$ (4) 40 (5) None of these

Q.24. A car covers a distance of 715 km at a constant speed. If the speed of the car would have been 10 km/hr more, then it would have taken 2 hours less to cover the same distance.What is the original speed of the car ?
(1) 45 km/hr (2) 50 km/hr (3) 55 km/hr (4) 65 km/hr (5) None of these

Q.25. In covering a certain distance, the speeds of A and B are in the ratio of 3 : 4. A takes 30 minutes more than B to reach the destination. The time taken by A to reach the destination is:
(1) 1 hour (2) $1\frac{1}{2}$ hours (3) 2 hours (4) $2\frac{1}{2}$ hours (5) None of these

CHAPTER-13

PROBLEM ON TRAINS

Formula : Speed = $\frac{\text{Distance}}{\text{Time}}$

Some useful things :

I. To change k/h in m/s we multiply by $\frac{5}{18}$

eg. 72 k/h means

$72 \times \frac{5}{18} = 4 \times 5 = 20$ m/s

II. To change m/sec. in k/h we multiply by $\frac{18}{5}$

eg. 45 m/s means

$45 \times \frac{18}{5} = (9 \times 18)$ k/h

= 162 k/h

III. In the concept of train, there are two objects. First object train & second is that which is crossed by the train.

Tips :

Case I- When a moving train crosses a man, the first object is train and second one is man.

Case II- When a moving train crosses a platform, the train is first object and 2nd one is platform.

Case III- When a moving train crosses a man who is standing on a railway platform, first object is train and 2nd one is man.

Case IV- When a moving train crosses another moving train (same or opposite direction); the first object is first train and 2nd one is 2nd train.

Case V- When a moving train crosses a man who is standing in another moving train, the first object is first train and 2nd one is man (not 2nd train)

Case-I : When a train crosses a man/pole/tree (In stationary form)

Let a train having speed is s and length L, crosses a pole in T time then,

$s = \frac{L}{T}$ (Here the breadth of man, tree, pole is negligible with respect to the train)

Case-II : When a train crosses a platform

Let a train having speed of S and length L_1, crosses a platform whose length is L_2 in time T, then

$s = \frac{L_1 + L_2}{T}$

Case-III : When a train crosses another running train

Let a train having speed s_1 and length L_1 crosses another train which is travelling in opposite direction at a speed of s_2 and length L_2 in T time. Then-

$s_1 + s_2 = \frac{L_1 + L_2}{T}$ (both object having length and speed)

Note :

(i) If both object having length (L_1 and L_2) then The length is always sum (i.e. $L_1 + L_2$).

(ii) If both object having speed s_1 and s_2 then the speed are added (When direction is opposite) and subtracted (When direction is same)

Case- IV : When a moving train crosses a man who is running

Let a train having speed s_1 and length L_1 crosses a man, who is running at a speed of s_2 in the same direction in T time. Then

$$(s_1 - s_2) = \frac{L_1}{T}$$

(Since man has negligible breadth)

Case V : When a moving train crosses a man who is sitting into a moving train

Let a train having speed s_1 and length L_1

Crosses a man who is sitting in another train which is travelling in opposite directions at speed of s_2 and length L_2 in time T-

$$s_1 + s_2 = \frac{L_1}{T}$$

Ex-1. **Find the time taken by a train 180m long, running at 72 km/h in crossing an electrical pole.**

Solution :

$$S = \frac{L}{T} \text{ (because pole has no breadth)}$$

$$T = \frac{L}{S} = \frac{180m}{\frac{72 \times 5}{18} m/s} = \frac{180}{20}$$

= 9 sec

Ex-2. **A train 140 m long is running at 60 km/h. In how much time will it pass a platform 260m long?**

Solution :

$$S = \frac{L_1 + L_2}{t} \qquad t = \frac{L_1 + L_2}{s}$$

$$= \frac{140 + 260}{60 \times \frac{5}{18}}$$

$$= \frac{400 \times 18}{300} = 24 \text{ sec}$$

Ex-3. **A train 100m long is running at a speed of 70 km/h. In what time will it pass a man who is running at a speed of 10 km/h in the same direction ?**

Solution :

$$S_1 - S_2 = \frac{L_1}{T}$$

$$T = \frac{L_1}{S_1 - S_2} = \frac{100}{(70 - 10) km/h}$$

$$= \frac{100}{60 \times \frac{5}{18} m/s}$$

$$= \frac{100 \times 18}{60 \times 5}$$

= 6 sec

Ex-4. **A train 160 m long taken 30 sec. in crossing a tunnel 440 m long. The speed of the train is -**

Solution :

$$S = \frac{L_1 + L_2}{t} = \frac{160 + 440}{30} = \frac{600}{30}$$

= 20 m/s

Ex-5. **A man is standing on a railway bridge which is 50m long. He finds that a train crossed the bridge in $4\frac{1}{2}$ sec but himself in 2sec. Find the length & speed of train.**

Solution :

$$S = \frac{L + 50}{4.5} \quad \text{—(I)}$$

$$S = \frac{L}{2} \quad \text{—(II)}$$

From (I) & (II)

$$\frac{L}{2} = \frac{L + 50}{4.5}$$

$$4.5\,L = 2\,L + 100$$

$$2.5\,L = 100$$

$$\Rightarrow L = 40 \text{ m}$$

$$S = \frac{40}{2}$$

= 20 m/s

Ex-6. **A train running at a speed of 25 km/h takes 18 sec to pass a railway platform and it takes 13.5 sec to pass a man who is running at a speed of 5 km/h in the same direction. Find the Length of the train & length of the platform.**

Solution :

Let the length of the train is L.

and the length of the platform is P.

$$S_1 = \frac{L + P}{t}$$

$$\frac{5}{18} \times 25 = \frac{L + P}{18}$$

$$L + P = 125 \quad \text{—(I)}$$

Again

$$S_1 - S_2 = \frac{L}{T}$$

$$\frac{5}{18} \times (25 - 5) = \frac{L}{13.5}$$

$$L = \frac{5 \times 20 \times 13.5}{18}$$

Length of train L = 75 m

Length of platform = 125 - 75

= 50 m.

Ex-7. **A goods train of 50m. long is moving with speed 54 km/h. A man is sitting in a passanger train which is moving with 18 km/hr. with same direction. In how many second the goods train crosses the man sitting in a passanger train ?**

Solution :

Let the length of the goods train is L.

$$S_1 - S_2 = \frac{L}{t} \text{ (because man has no breadth)}$$

$$\frac{5}{18}(54 - 18) = \frac{50m}{t}$$

$$\frac{5}{18} \times 36 = \frac{50}{t}$$

t = 5 sec

Ex-8. **Two trains A and B started to move from Patna to Delhi 6am and 6 : 30 am at the speed of 60 km/h and 90 km/h. How far away from Patna will they meet each other ?**

Solution :

Distance travelled by A in 30 min

$$= 60 \times \frac{1}{2} h$$

= 30 km

Relative speed = 90 - 60 = 30 Km/h

Time taken to cover 30 km = $\frac{30}{30}$ = 1h

Required distance = 90 × 1 = 90 km

EXERCISE

PROBLEM ON TRAINS

Q.1. A speed of $33\frac{1}{3}$ metres/second is the same as :
(1) 100 km./hr. (2) 80 km/hr. (3) 120 km/hr. (4) 75 km/hr (5) None of these

Q.2. If a man running at the rate of 15 km/hr. crosses a bridge in 5 minutes. The length of the bridge (in metres) is :
(1) $1333\frac{1}{3}$ (2) 1000 (3) 7500 (4) 1250 (5) None of these

Q.3. A train 200 metres long, running with a speed of 30km/hr. will pass a standing man in :
(1) 18 seconds (2) 45 seconds (3) 12 seconds (4) 5 seconds (5) None of these

Q.4. A train 280 metres long is moving at a speed of 60 km/hr.The time taken by the train to cross a platform 220 metres long is:
(1) 20 seconds (2) 25 seconds (3) 40 seconds (4) 35 seconds (5) None of these

Q.5. A train 50 metres long passes a platform 100 metres long in 10 seconds. The speed of the train in metres/second is:
(1) 150 (2) 50 (3) 10 (4) 15 (5) None of these

Q.6. A train running at the rate of 36 km/hr. passes a standing man in 8 seconds. The length of the train is.
(1) 45 metres (2) 28 metres (3) 80 metres (4) 48 metres (5) None of these

Q.7. A train 120 metres long travels at 60 km/hr. A man is running at 6 km/h. in the same direction in which the train is going. The train will cross man in:
(1) 6 seconds (2) 7 seconds (3) $6\frac{2}{3}$ seconds (4) 8 seconds (5) None of these

Q.8. A train 270 metres long is moving at a speed of 25 km/hr. It will cross a man coming from the opposite direction at a speed of 2 km./hr. in:
(1) 36 seconds (2) 32 seconds (3) 28 seconds (4) 24 seconds (5) None of these

Q.9. A train 150 metres long crosses a man walking at a speed of 6 km/hr. in the opposite direction in 6 seconds. The speed of the train is :
(1) 96 km/hr. (2) 84 km/hr. (3) 106 km/hr. (4) 66 km/hr. (5) None of these

Q.10. A train 150 metres long passes a standing man in 5 seconds. How long will it take to cross a bridge 180 metres long ?
(1) $3\frac{1}{3}$ seconds (2) $12\frac{1}{2}$ seconds (3) $7\frac{1}{2}$ seconds (4) 10 seconds (5) None of these

Q.11. A train travelling at 36 km/hr. takes 10 seconds to pass a telegraph pole. How long would it take to cross a platform 55 metres long ?
(1) 12 seconds (2) $5\frac{1}{2}$ seconds (3) $16\frac{1}{2}$ seconds (4) $15\frac{1}{2}$ seconds (5) None of these

Q.12. A train 100 metres long completely crosses a bridge 300 metres long in 30 seconds. How many seconds will it take to pass a telegraph pole ?
(1) 10 seconds (2) $7\frac{1}{2}$ seconds (3) 9 seconds (4) 3 seconds (5) None of these

Q.13. A train crosses a platform in 60 seconds at a speed of 45 km/hr. How much time will it take to cross an electric pole if the length of the platform is 100 metres ?
(1) 8 seconds (2) 1 minute (3) 52 seconds (4) 40 seconds (5) None of these

Q.14. Two trains 90 metres and 120 metres long are running in opposite directions, one at the rate of 30 km/hr. and another one at the rate of 60 km/hr. From the moment they meet, they will cross each other in :
(1) 6 seconds (2) 7 seconds (3) 8.4 seconds
(4) 9 seconds (5) None of these

Q.15. A train of length 150 metres, takes 10 seconds to pass over another train 100 metres long coming from the opposite direction. If the speed of the first train be 30 km/hr., the speed of the second train is:
(1) 54 km/hr. (2) 60 km/hr. (3) 72 km/hr. (4) 36 km/hr. (5) None of these

Q.16. A train 300 metres long is running at a speed of 90 km/hr. How many seconds will it take to cross a 200 m long train running in the opposite direction at a speed of 60 km/hr. ?
(1) 60 second (2) $7\frac{1}{5}$ second (3) 12 second (4) 20 second (5) None of these

Q.17. Two trains are running on parallel lines in the same direction at a speed of 50 km. and 30 m per hour respectively. The faster train crosses a man in slower train in 18 seconds. The length of the faster train is:
(1) 98 metres (2) 170 metres (3) 100 metres (4) 85 metres (5) None of these

Q.18. Two trains X and Y start from stations A and B towards B and A respectively. After passing each other, they take 4 hours 48 minutes and 3 hours 20 minutes to reach B and A respectively. If train X is moving at 40 km/hr., the speed of train Y is :-
(1) 60km/hr. (2) 54km/hr. (3) 64.8 km/hr. (4) 48 km/hr. (5) None of these

Q.19. Two trains travelling in the same direction at 40 km/hr. and 22 km/hr. completely pass one another in 1 minute. If the length of the first train is 125 metres, the length of the second train is:
(1) 125 metres (2) 150 metres (3) 178 metres (4) 200 metres (5) None of these

Q.20. A train travelling at 36 km/hr. completely crosses another train having half its length and travelling in the opposite direction at 54 km/hr. in 12 seconds. If it also passes a railway plat form in $1\frac{1}{2}$ minutes, the length of the platform is:
(1) 750 metres (2) 700 metres (3) 620 metres (4) 560 metres (5) None of these

Q.21. Two stations A and B are 110 kms apart on a straight line. One train starts fromA at 7A.M. and travels towards B at 20 km/hr. speed. Another train starts from B at 8 A.M. and travels towards A at 25 km/hr. speed. At what time will they meet ?
(1) 9 A.M. (2) 10 A.M. (3) 11A.M.
(4) 12 A.M. (5) None of these

Q.22. Two trains are running in opposite directions with the same speed. If the length of each train is 135 metres and they cross each other in 18 seconds, the speed of each train is :
(1) 104 km/hr. (2) 27 km/hr. (3) 54 km/hr.
(4) 100 km/hr. (5) None of these

Q.23. A train travels a certain distance with out stoppages with an average speed of 90 km/hr. but with stoppages at an average speed of 80 km/hr. The number of minutes per hour that the train stops is :
(1) $13\frac{1}{3}$ min (2) 12 min (3) 8 min (4) $6\frac{2}{3}$ min (5) None of these

Q.24. Two trains are moving in the opposite directions on parallel tracks at the speeds of 63 km/hr and 94.50 km/hr respectively. The first train passes a pole in 6 seconds whereas the second train passes a pole in 4 seconds.Find the time taken by the trains to cross each other completely?
(1) 4.80 sec. (2) 4.40 sec. (3) 3.80 sec.
(4) Can't be determined (5) None of these

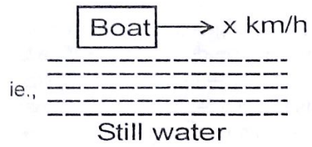
Q.25. Two trains running at the speed of 60 km/h and 75 km/h leaves Hydrabad to New Delhi at 8.45 and 9.15 respectively at the same day. At what distance from New Delhi will the letter meet the former?
(1) 75 km. (2) 50 km. (3) 1175 km.
(4) Can't be determined (5) None of these

CHAPTER-14

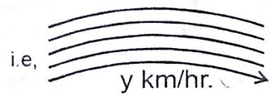
BOAT & STREAM

There are four types of speed :

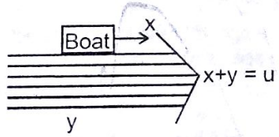
Type-1. Speed of the boat/boatman in still water, denoted by x km/hr.



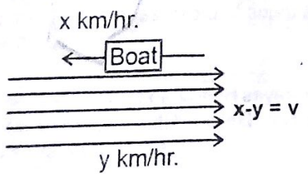
Type-2. Speed of the water, denoted by y km/hr.



Type-3. Speed of the boatman or boat in along the stream (water) is called downstream speed of boatman or boat and denoted by u km/hr.



Type-4. Speed of the boatman or boat against the stream is called upstream, speed by boatman, denoted by v km/hr.



Ex-1. **If the speed of the boatman in still water is 8 k/h and speed of the water (stream) is 2 km/h then speed of the boatman in downstream direction is**

Solution :

$u = x + y$

$u = 8 + 2 = 10$ km/hr.

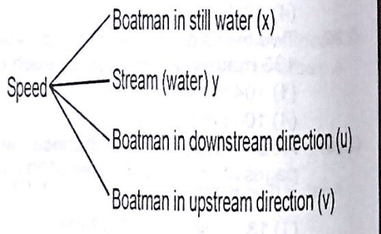
Ex-2. **If the speed of the boatman in still water is 8k/h and speed of the water (stream) is 2 km/hr.Then speed of the boatman in upstream direction is -**

Solution :

$\overline{V} = x - y$

ie. $v = 8-2 = 6$ km/h

Conclusion There are four speeds -



Formula :

Downstream Speed $u = x + y$ .....(I)

Upstream Speed $v = x - y$ .....(II)

When x is original speed of boat in still water, y is speed of water or stream

and from I & II we get-

(x is speed of stream)

Speed of boatman $x = \frac{u+v}{2}$ and

Speed of water stream $y = \frac{u-v}{2}$

Ex-3. **A man can go 30km/hr upstream & 34 km/h downstream. Find the speed of current & speed of man in still water.**

Solution :

Speed of current y

$= \frac{U-V}{2} = \frac{34-30}{2} = \frac{4}{2}$

$= 2$ km/h

Speed of man in still water x

$= \frac{U+V}{2} = \frac{30+34}{2}$

$= 32$ km/h

Ex-4. **The speed of boat in still water is 8 km/h. The boat goes 6km & back to the starting point in 2 hours. Find the speed of the stream.**

Solution :

According to question,

$\frac{6}{8+x} + \frac{6}{8-x} = 2$

$\frac{6(8-x)+6(8+x)}{8^2-x^2} = 2$

$\frac{48-6x+48+6x}{64-x^2} = 2$

$96 = 128 - 2x^2$

$32 = 2x^2$

$x^2 = 16$

$x = 4$ km/h

Ex-5. **A boat running in down stream covers a distance of 30 km in 2 hr. while coming back the boat takes 6 hr. to cover the same distance. What is the speed of boat in km/hr. ?**

Solution :

Let speed of the boat be x km/h & that of current is y km/h.

$\frac{30}{x+y} = 2 \Rightarrow x + y = 15$ (i)

$\frac{30}{x-y} = 6 \Rightarrow x - y = 5$ (ii)

from (i) & (ii)

$2x = 20$

$x = 10$ km/h.

EXERCISE

BOAT & STREAM

Q.1. In one hour, a boat goes 11 km along the stream and 5 km against the stream. Then speed of the boat in still water (in km/hr) is :
(1) 3 (2) 5 (3) 8 (4) 9 (5) None of these

Q.2. A boat running downstream covers a distance of 16 km in 2 hours while for covering the same distance upstream, it takes 4 hours. What is the speed of the boat in still water ?
(1) 4 km/hr (2) 6 km/hr (3) 8 km/hr (4) Data inadequate (5) None of these

Q.3. A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in still water ?
(1) 40 minutes (2) 1 hour (3) 1 hr 15 min (4) 1 hr 30 min (5) None of these

Q.4. A man can row three-quarters of a kilometre against the stream in $11\frac{1}{4}$ minutes. The speed (in km/hr) of the man in still water is :
(1) 2 (2) 3 (3) 4 (4) 5 (5) None of these

Q.5. A man takes twice as long to row a distance against the stream as to row the same distance in favour of the stream. The ratio of the speed of the boat (in still water) and the stream is :
(1) 2 : 1 (2) 3 : 1 (3) 3 : 2 (4) 4 : 3 (5) None of these

Q.6. A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current respectively ?
(1) 2 : 1 (2) 3 : 2 (3) 8 : 3
(4) Can not be determined (5) None of these

Q.7. If a boat goes 7 km upstream in 42 minutes and the speed of the stream is 3 kmph, the speed of the boat in still water is :
(1) 9 km/hr (2) 13 km/hr (3) 8 km/hr (4) 21 km/hr (5) None of these

Q.8. The speed of boat in downstream is 15 km / hr and the speed of the current is 2.5 km / hr. The speed of boat against the current is :
(1) 8.5 km/hr (2) 9 km/hr (3) 10 km/hr (4) 12.5 km/hr (5) None of these

Q.9. A man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate against the current is :
(1) 4.25 kmph (2) 6 kmph (3) 6.5 kmph (4) 8.5 kmph (5) None of these

Q.10. Boat can travel with a speed of 13 km / hr in still water. If the speed of the stream is 4 km/hr, find the time taken by the boat to go 68 km downstream.
(1) 2 hours (2) 3 hours (3) 4 hours (4) 5 hours (5) None of these

Q.11. A boatman can row 2 km against the stream in 20 minutes and return in 18 minutes. Find the rate of current.
(1) 1/3 km/hr (2) 2/3 km/hr (3) 5/3 km/hr (4) 3 km/hr (5) None of these

Q.12. A boatman can row 48 km downstream in 4 hr. If the speed of the current is 5 km/hr, then find in what time will he be able to cover 8 km upstream ?
(1) 6 hr (2) 4 hr (3) 8 hr (4) 10 hr (5) None of these

Q.13. A man can row at a speed of 10 km/hr in still water to a certain upstream point and back to the starting point in a river which flows at 4 km/hr. Find his average speed for total journey.
(1) $9\frac{2}{5}$ km/hr (2) $8\frac{2}{5}$ km/hr (3) $11\frac{2}{5}$ km/hr (4) $12\frac{1}{5}$ km/hr (5) None of these

Q.14. A boat travels upstream from B to A and downstream from A to B in 3 hrs. If the speed of the boat in still water is 9 km/hr and the speed of the current is 3 km/hr, the distance between A and B is:
(1) 8km (2) 16km (3) 12km (4) 10 km (5) None of these

Q.15. A boat travels 2 km upstream in a stream flowing at 3 km/hr and then returns downstream to the starting point in 30 minutes. The speed of the boat in still water is:
(1) 17 km/hr (2) 9 km/hr (3) 13 km/hr (4) 15 km/hr (5) None of these

Q.16. A man swimming in a stream which flows $1\frac{1}{2}$ km/hr finds that in a given time he can swim twice as far with the stream as he can against it. At what rate does he swim?
(1) $4\frac{1}{2}$ km/h (2) $5\frac{1}{2}$ km/h (3) $7\frac{1}{2}$ km/h (4) $8\frac{1}{2}$ km/h (5) None of these

Q.17. A boat travels upstream from B to A and downstream from A to B in 3 hours. If the speed of the boat in still water is 9 km/hour and the speed of the current is 3 km/hour, the distance between A and B is:
(1) 4 km (2) 6 km (3) 8km (4) 12km (5) None of these

Q.18. A man rows upstream 12 km and downstream 28 km taking 5 hours each time. The velocity of water current is :
(1) $2\frac{1}{5}$ km/h (2) $2\frac{1}{2}$ km/h (3) 3 km/h (4) $1\frac{3}{5}$ km/h (5) None of these

Q.19. Twice the speed downstream is equal to the thrice the speed upstream, the ratio of speed in still water to the speed of the current is:
(1) 1 : 5 (2) 5 : 1 (3) 1 : 3 (4) 2 : 3 20 (5) None of these

Q.20. A man can swim 3 km/hr in still water. If the velocity 5 of the stream be 2 km/hr, the time taken by him to swim to a place 10km upstream and back is :
(1) $8\frac{1}{3}$ hr (2) $9\frac{1}{2}$ hr (3) 10hr (4) 12hr (5) None of these

Q.21. A boat covers 24 km upstream and 36 km downstream in 6 hr, while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hrs. The velocity of the current is:
(1) 1.5 km/hr (2) 1 km/hr (3) 2 km/hr (4) 2.5 km/hr (5) None of these

Q.22. A boatman goes 2 km against the current of the stream in 1 hr and goes 1 km along the current in 10 min. How long will he take to go 5km in still water?
(1) 1 hr. (2) 1 hr 15 min (3) $1\frac{1}{2}$ hr (4) 40 min (5) None of these

Q.23. The speed of a boat in still water is 8 kmph. The boat goes 6 km. and back to the starting point in 2 hours. Find the speed of the stream ?
(1) 4 kmph. (2) 6 kmph. (3) 4.4 kmph. (4) 5 kmph. (5) None of these

Q.24. A boat travels 40 km. up stream and 55 km. down stream in 13 hours. It takes 10 hours to travel 30 km. up stream and 44 km. down stream. Find the speed of boat in still water ?
(1) 6 km./h. (2) 8 km./h. (3) 10 km./h.
(4) 3 km./h (5) None of these

Q.25. A boat covers 24 km. upstream and 36 km. down stream in 24 hours. While it covers 36 km. upstream and 24 km. downstream in 21 hours. What is the difference between the speed of boate and that of current.
(1) 1 km./h. (2) 2 km./h. (3) 3 km./h.
(4) 4 km./h. (5) None of these

CHAPTER-15

MIXTURE AND ALLIGATION

GENERAL RULES:

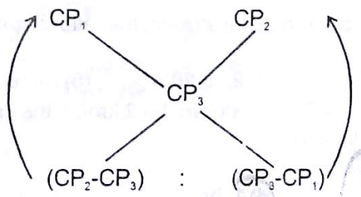
I. ***Alligation :*** It enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

II. ***Mean price :*** The cost price of a unit quantity of the mixture is called the mean price.

III. ***Rule of alligation :*** If two ingredients are mixed, then

$$\frac{\text{(Quantity of cheaper)}}{\text{(Quantity of dearer)}} = \frac{\text{(CP of dearer – Mean Price)}}{\text{(Mean Price – CP of Cheaper)}}$$

We present as :



Summary :

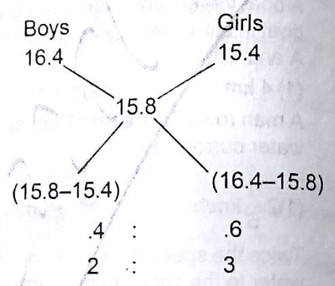
1. $CP_1 \rightarrow$ represent cost price of first ingredient.
   $CP_2 \rightarrow$ represent cost price of second ingredient.
   $CP_3 \rightarrow$ represent cost price of mixture.
2. Remember that-if CP_3 is greater than CP_1, then less than CP_2 and if CP_3 is less than CP_1 then more than CP_2
3. In the above ratio $(CP_2 \sim CP_3) : (CP_3 \sim CP_1)$
   $\rightarrow (CP_2 \sim CP_3)$ represent the quantity of first ingredient and $(CP_3 \sim CP_1)$ represent the quantity of second ingredient.

IV. Suppose a container contains x - units of liquid from which y -units are taken out and replaced by water- after n-operations,

the quantity of pure liquid = $\left[x\left(1-\frac{y}{x}\right)^n\right]$ units.

Ex-1. **If the average age of students in a class is 15.8 years the average age of boys is 16.4 years that of girls is 15.4 years. What is the ratio of the no. of boys to the girls ?**

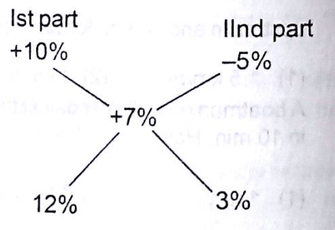
Solution :



The ratio of Boys & Girls is 2 : 3

Ex-2. **A man has 50 kg of rice. A part of which he sells at 10% profit & remaining at 5% loss. He gain 7% on whole. Find the quantity sold at 10% profit.**

Solution :

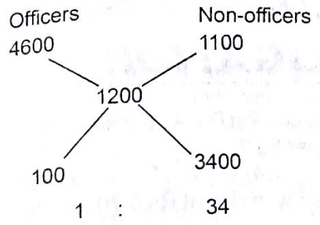


Quantity sold at 10% profit = $50 \times \frac{4}{5}$

= 40 kg

Ex-3. **The average salary of staff of company is Rs. 1200. If the average salary of officers is Rs. 4600 & that of non-officers is Rs. 1100 .If the no. of officers are 15. Find the no. of non-officers .**

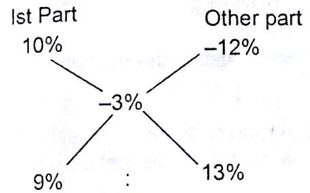
Solution :



No . of non-officers = 15×34/1 = 510

Ex-4. **A merchant has 88 kg of sugar. A part of this he sells at a gain of 10% & the remaining at a loss of 12% on the total he loses 3%. What is the quantity sold at a loss of 12% ?**

Solution :



ratio = 9 : 13

Quantity of sugar sold at 12% loss is,

$= \frac{88}{22} \times 13 = 52$ kg.

Ex-5. **In what ratio water be mixed with milk so as to gain 20% by selling at c.p. ?**

Solution :

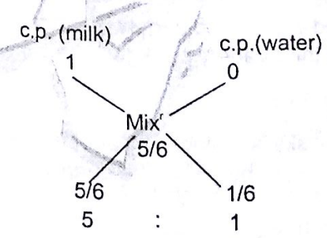
Let c.p. of pure milk =1

then s.p. of mixture =1

% profit = 20%

$(c.p.)_{mix} = \frac{1}{120} \times 100 = \frac{5}{6}$

By alligation :



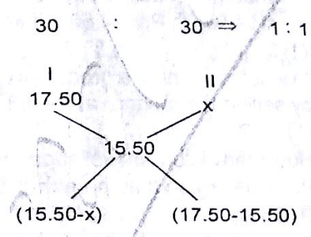
Ratio between milk & water to gain 20% profit, = 5 : 1

Ex-6. **Rachana purchased 30 kg of Rice at the rate of Rs. 17.50/kg & another 30 kg Rice at a certain rate. She mixed the two & sold the entire quantity at the rate of Rs. 18.60/kg & made 20% overall profit. At what price / kg did she purchase the another 30 kg rice ?**

Solution : c.p. of mix

$= \frac{18.60}{120} \times 100 = 15.50$ Rs.

By alligation



Ratio between Ist & IInd part = 1 : 1

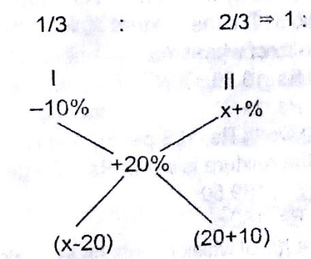
then

$$\frac{17.50 - 15.50}{15.50 - x} = \frac{1}{1}$$

$$\frac{2}{15.50 - x} = \frac{1}{1}, \qquad x = 13.50 \text{ Rs.}$$

Ex-7. **If goods be purchased for Rupees 450 & $\frac{1}{3}$ part of goods be sold at the loss of 10%. What % of profit should be taken on the remaining goods so as to gain 20% on whole ?**

Solution :



then $\frac{x - 20}{20 + 10} = \frac{1}{2}$

2x–40 = 30

x = 35%

EXERCISE

MIXTURE OR ALLIGATION

Q.1. In what ratio must a grocer mix two varieties of pulses costing Rs. 15 per kg. and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 per kg ?
(1) 3 : 7 (2) 5 : 7 (3) 7 : 3 (4) 7 : 5 (5) None of these

Q.2. Find the ratio in which rice at. Rs. 7.20 a kg be mixed with rice at Rs.5.70 a kg to produce a mixture worth Rs. 6.30 a kg.
(1) 1 : 3 (2) 2 : 3 (3) 3 : 4 (4) 4 : 5 (5) None of these

Q.3. In what ratio must. tea at Rs. 62 per kg be mixed with tea at Rs. 72 per kg so that the mixture must be worth Rs. 64.50 per kg ?
(1) 3 : 1 (2) 3 : 2 (3) 4 : 3 (4) 5 :3 (5) None of these

Q.4. In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg and Rs. 65 a kg so that by selling the mixture at Rs. 68.20 a kg he may gain 10% ?
(1) 3 : 2 (2) 3 : 4 (3) 3 : 5 (4) 4 : 5 (5) None of these

Q.5. How many kilograms of sugar costing Rs. 9 per kg must be mixed with 27 kg of sugar costing Rs. 7 per kg so that there may be a gain of 10% by selling the mixture at Rs. 9.24 per kg ?
(1) 36 kg (2) 42 kg (3) 54 kg (4) 63 kg (5) None of these

Q.6. In what ratio must water be mixed with milk to gain $16\frac{2}{3}\%$ on selling the mixture at cost price ?
(1) 1 : 6 (2) 6 : 1 (3) 2 : 3 (4) 4 : 3 (5) None of these

Q.7. Two vessels A and B contain spirit and water mixed in the ratio 5 : 2 and 7 : 6 respectively. Find the ratio in which these mixture be mixed to obtain a new mixture in vessel C containing spirit and water in the ratio 8 : 5 ?
(1) 4 : 3 (2) 3 : 4 (3) 5 : 6 (4) 7 : 9 (5) None of these

Q.8. Two vessels A and B contain milk and water mixed in the ratio 8 : 5 and 5 : 2 respectively. The ratio in which these two mixtures be mixed to get a new mixture containing $69\frac{3}{13}\%$ milk, is :
(1) 2 : 7 (2) 3 : 5 (3) 5 : 2 (4) 5 : 7 (5) None of these

Q.9. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk, the second contains 50% water. How much milk should be mixed from each of the containers so as to get 12 litres of milk such that the ratio of water to milk is 3 : 5 ?
(1) 4 litres, 4 litres (2) 6 litres, 6 litres (3) 5 litres, 7 litres
(4) 7 litres, 5 litres (5) None of these

Q.10. One quality of wheat at Rs. 9.30 per kg is mixed with another quality at a certain rate in the ratio 8 : 7. If the mixture so formed be worth Rs. 10 per kg, what is the rate per kg of the second quality of wheat ?
(1) Rs. 10.30 (2) Rs. 10.60 (3) Rs. 10.80
(4) Rs. 11 (5) None of these

Q.11. Tea worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety of the ratio 1 :1 : 2 If the mixture is worth Rs. 153 per kg, the price of the third variety per kg will be :
(1) Rs. 169.50 (2) Rs. 170 (3) Rs.175.50
(4) Rs. 180 (5) None of these

Q.12. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is :
(1) $\frac{1}{3}$ (2) $\frac{2}{3}$ (3) $\frac{2}{5}$ (4) $\frac{3}{5}$ (5) None of these

Q.13. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of the water is 16 :81. How much wine did the cask hold originally ?
(1) 18 litres (2) 24 litres (3) 32 litres (4) 42 litres (5) None of these

Q.14. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially ?
(1) 10 (2) 20 (3) 21 (4) 25 (5) None of these

Q.15. A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup ?
(1) $\frac{1}{3}$ (2) $\frac{1}{4}$ (3) $\frac{1}{5}$ (4) $\frac{1}{7}$ (5) None of these

Q.16. Rs. 1000 is lent out in two parts, one at 6% simple interest and the other at 8% simple interest. The yearly income is Rs. 75. The sum lent at 8% is :
(1) Rs. 250 (2) Rs. 500 (3) Rs. 750 (4) Rs. 600 (5) None of these

Q.17. A marchant has 50 kg. of sugar, part of which he sells at 8% profit and the rest at 18% profit, He gains 14% on the whole. The quantity sold at 18% profit is :
(1) 20 kg. (2) 30 kg (3) 15 kg. (4) 35 kg (5) None of these

Q.18. A mixture of 20 kg. of spirit and water contains 10% water. How much water must be added to this mixture to raise the percentage of water to 25% ?
(1) 4 kg (2) 5 kg (3) 8 kg (4) 30 kg (5) None of these

Q.19. Kantilal mixes 80 kg. of sugar worth of Rs. 6.75 per kg. with 120 kg. worth of Rs. 8 per kg.At what rate should be sell the mixture to gain 20%?
(1) Rs. 7.50 (2) Rs. 9 (3) Rs. 8.20 (4) Rs. 8.85 (5) None of these

Q.20. A jar full of whisky contains 40% of alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26. The quantity of whisky replaced is :
(1) $\frac{2}{5}$ (2) $\frac{1}{3}$ (3) $\frac{2}{3}$ (4) $\frac{3}{5}$ (5) None of these

Q.21. A man lent out Rs. 9600 partly at 12% and partly at 14% simple interest. His total income after 1.5 years was Rs. 1800. Find the ratio of the sum lent at 12% and 14% simple interest respectively?
(1) 5 : 1 (2) 4 : 1 (3) 3 : 1 (4) Data inadequate (5) None of these

Q.22. A grocer buys mustard oil at the rate of Rs. 34 a litre and repeseed oil at the rate of Rs. 30 a litre. He mixes the two in the ratio of 2 : 1 and sells the mixture at the rate of Rs. 36 a litre. What approximate profit percentage does he earn ?
(1) 10% (2) 8% (3) 12% (4) 16% (5) 14%

Q.23. Madhulika deposited two parts of a sum of Rs. 25,000 in different banks at the rates of 15% per annum and 18% per annum respectively. In one year she got Rs. 4050 as the total interest. What was the amount deposited at the rate of 15% per annum ?
(1) Rs. 10,000 (2) Rs. 15,000 (3) Rs. 9,000
(4) Data inadequate (5) None of these

Q.24. A mixture of 45 litres of spirit and water, contains 20% water in it. How much water must be added to it to make water 25% in the new mixture ?
(1) 5 liter (2) 4 liter (3) 6 liter (4) 3 liter (5) None of these

Q.25. By mixing two varieties of tea casting Rs. 65 and Rs. 115 per kg. and selling the mixture at the rate of Rs. 100 kg., a seller made a profit of 15%. In what ratio did he mix the two varieties ?
(1) 101 : 129 (2) 100 : 113 (3) 129 : 101
(4) 129:100 (5) None of these

CHAPTER-16
INEQUALITY

Helping Hands:

1. **Variables :** variables are those figure which numeric value we want to find in any equation and represented by x, y, z.,.....etc.

   eg. In the equation 4x + 3 = 8, x is a variable.

2. **Constant :** Constants are those figure which numeric value are given in any equation and represented by a, b, c etc.

   eg. In equation-

   (4x + 3 = 8), 4, 3, 8 are constant.

3. **Equation :**

   Where, a, b, c are constant and x is unknown variable.

   eg. $x^2 + 7x + 12 = 0$

Kinds of equation

[A] Linear equations :

An equation, in which the maximum power of unknown variable is one, is known as linear equation.

(i) One variable linear equation

eg. 4x +5 = 13,

(ii) More than one variable linear equation

eg. 4x + 3y = 10,

3x + 2y = 15

[B] Quadratic equation :

An equation, in which the maximum power of unknown variable is two, is known as Quadratic equation.

In general $\Rightarrow ax^2 + bx + c = 0$

How to solve one-variable linear equation.

Ex-1. **Solution :**

I. Solution $\Rightarrow$ **4x + 3 = 15**

$\Rightarrow$ **4x = 15 - 3 = 12** $\Rightarrow$ **x = 3**

II. Solution $\Rightarrow$ **5 y - 3 = 22**

5y = 22 + 3

y = 25/5

y = 5

How to solve two variable linear equations

Ex-2. **I.** **2x + 3y = 8**

II. **3x + 2y = 7**

Solution :

Apply (I) × 3 and (II) × 2, we get-

$3 \times (2x + 3y) = 8 \times 3 \Rightarrow 6x + 9y = 24$

$2 \times (3x + 2y) = 7 \times 2 \Rightarrow 6x + 4y = 14$

– – –

5y = 10

y = 10/5

y = 2

Put the value of y in (I), we get

2x + 3× 2 = 8 $\Rightarrow$ 2x = 8-6

2x = 2

x = 1

How to solve quadratic equation-

Ex-3. **$8x^2 + 10x + 3 = 0$**

Solution :

In this question + 8 is cofficient of x^2

+ 10 is cofficient of x

+ 3 is constant term.

Step I : We multiply, (+8) × (+3) = +24

Step II : We break + 24 in two factors such that addition between them is 10 and the product of both factors is 24.

ie. +24 = +6 × +4 (Sum of is + 10)

Step III : Change the sign of both factors

ie. +6 → -6

+4 → -4

and divided by cofficient of x^2, i.e. 8, we get

divided by 8

-6 ⟶ -6/8

divided by 8

-4 ⟶ -4/8

Step IV : We get ans. i.e.

x = -6/8, -4/8

x = -3/4, - 1/2

In the following example two equations are given. You have to solve both equations and-

Give the answer-

(i) x >y
(ii) x ≥ y
(iii) x < y
(iv) x ≤ y
(v) x = y or the relation can't be established.

Ex-4. **I. $6x^2 + x - 1 = 0$,**

II. $8y^2 + 10y + 3 = 0$

Solution : For x

$(+6) \times (-1) = -6$ < +3/6 ⇒ -1/2, -2/6 ⇒ 1/3

$x = -\frac{1}{2}, \frac{1}{3}$

For y

$3 \times 8 = +24$ < -6/8 ⇒ -3/4, -4/8 ⇒ -1/2

$y = -\frac{3}{4}, -\frac{1}{2}$

i. e. $x \geq y$

Ex-5. **I. $18x^2 - 9x + 1 = 0$,**

II. $12y^2 - y - 1 = 0$

Solution :

$18 \times 1 = +18$ < -6/18 = +1/3, -3/18 = +1/6

$x = \frac{1}{3}, \frac{1}{6}$

$12 \times -1 = -12$ < -4/12 = +1/3, 3/12 = -1/4

$y = \frac{1}{3}, -\frac{1}{4}$