

CHAPTER 12

Time and Work

In this chapter conceptual clarity of relationship between working efficiency and time is very important to understand. Working efficiency is the work done by an individual in one day and this efficiency is inversely proportional to the number of days to complete a work. It means that a person who takes less days to complete a work is said to be more efficient than a person who takes more days to complete the same work.

Important Tips/Formulae

- If A can do a piece of work in n days, then the piece of work completed by A in one day is $\frac{1}{n}$.
- If A complete a piece of work in n days and B in m days, then they together can complete the work in $\left(\frac{nm}{n+m}\right)$ days.
- If a pipe A can fill a tank in xh and a pipe B can empty the full tank in yh (where $y > x$), then net part filled in 1 h = $\left(\frac{1}{x} - \frac{1}{y}\right)$.
- $\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$; Here M_1, M_2 = Number of men
 D_1, D_2 = Number of days, H_1, H_2 = Number of hours and W_1, W_2 = Works

Solved Examples:

1. If A and B together can finish a piece of work in 20 days, B and C in 10 days and C and A in 12 days, then A, B and C jointly can finish the same work in

- (a) $4\frac{2}{7}$ days
(b) 30 days
(c) $8\frac{4}{7}$ days
(d) $\frac{7}{60}$ days

Sol. (c) $(A + B)$'s 1 day work = $\frac{1}{20}$

$$(B + C) \text{ 's 1 day work} = \frac{1}{10}$$

$$(C + A) \text{ 's 1 day work} = \frac{1}{12}$$

$$2(A + B + C) \text{ 's 1 day work} = \frac{1}{20} + \frac{1}{10} + \frac{1}{12}$$

$$= \frac{3 + 6 + 5}{60}$$

$$= \frac{14}{60} = \frac{7}{30}$$

$$\therefore (A + B + C) \text{ 's 1 day work} = \frac{7}{30} \times \frac{1}{2}$$

$$= \frac{7}{60}$$

Hence, A, B and C can finish the work together in $\frac{60}{7}$ days or $8\frac{4}{7}$ days.

2. In a fort there was sufficient food for 200 soldiers for 31 days. After 27 days 120 soldiers left the fort. For how many extra days will the rest of the food last for the remaining soldiers?

- (a) 10
 (b) 8
 (c) 12
 (d) 9

Sol. (a) Suppose extra days = x

$$\text{Then, } 200 \times 31 = 200 \times 27 + 80 \times x$$

$$\Rightarrow 6200 = 5400 + 80x$$

$$\Rightarrow x = \frac{800}{80} = 10 \text{ days}$$

Alternate Method

Required number of days i.e., $D = \frac{200(31-27)}{200-120}$

$$= \frac{200 \times 4}{80} = 10 \text{ days}$$

3. If 10 men or 20 boys can make 260 mats in 20 days, then how many mats will be made by 8 men and 4 boys in 20 days?

- (a) 250
 (b) 280
 (c) 255
 (d) 260

Sol. (d) Let the number of mats be x .

$$10 \text{ men} \equiv 20 \text{ boys} \Rightarrow (1 \text{ man} \equiv 2 \text{ boys}) \\ \Rightarrow (8 \text{ men} + 4 \text{ boys}) \equiv (8 \times 2 + 4) \equiv 20 \text{ boys}$$

In 20 days, 20 boys make 260 mats.

4. Two pipes A and B can fill a cistern in 12 min and 16 min, respectively. Both are opened together at the end of 4 min, B is turned off. In how much time will the cistern be full?

- (a) 8 min
(b) 10 min
(c) 9 min
(d) 11 min

Sol. (c) Part filled by $(A + B)$ in 4 min

$$= \left(\frac{1}{12} + \frac{1}{16} \right) \times 4 = \frac{7}{48} \times 4 = \frac{7}{12}$$

$$\text{Remaining part} = \left(1 - \frac{7}{12} \right) = \frac{5}{12}$$

$\frac{1}{12}$ part is filled by A in 1 min.

$\frac{5}{12}$ part is filled by A in $\left(12 \times \frac{5}{12} \right) = 5$ min

\therefore Total time taken to fill the cistern = $(4 + 5) = 9$ min

Practice Questions

1. 30 men can produce 1500 units in 24 days working 6 h a day. In how many days, can 18 men produce 1800 units working 8 h a day?

- (a) 18
(b) 32
(c) 36
(d) 45

2. 4 men and 6 children can complete a work in 8 days while 3 men and 7 children can complete the same work in 10 days. If 20 children only work, the work will be completed in

- (a) 20 days
(b) 22 days
(c) 15 days
(d) 18 days

3. A can do a piece of work in 10 days and B can do the same piece of work in 20 days. They start the work together, but after 5 days A leaves. B will do the remaining piece of work in
- (a) 5 days
(b) 10 days
(c) 6 days
(d) 8 days
4. A and B undertake to do a piece of work for ₹ 720. A alone can do it in 8 days and B alone can do it in 12 days. With the help of C they finish it in 4 days. Then, the share of C (in ₹) is
- (a) 120
(b) 300
(c) 360
(d) 240
5. Three pipes A , B and C can fill a tank in 30 min, 20 min and 10 min, respectively. When the tank is empty, all the three pipes are opened. If A , B and C discharge chemical solutions P , Q and R respectively, then the part of solution R in the liquid in the tank after 3 min is
- (a) $\frac{8}{11}$
(b) $\frac{5}{11}$
(c) $\frac{6}{11}$
(d) $\frac{7}{11}$
6. A , B and C can do a piece of work in 20, 24 and 30 days, respectively. They undertook to do the piece of work for ₹ 5400. They begin the work together but B left 2 days before the completion of work and C left 5 days before the completion of work. The share of A from the assured money is
- (a) ₹ 2700
(b) ₹ 540
(c) ₹ 1800
(d) ₹ 600

7. A and B can do a piece of work in 72 days, B and C can do it in 120 days, and A and C can do it in 90 days. When A , B and C work together, how much work is finished by them in 3 days?

- (a) $\frac{1}{40}$
- (b) $\frac{1}{30}$
- (c) $\frac{1}{20}$
- (d) $\frac{1}{10}$

8. A is twice as good a workman as B and together they finish a piece of work in 14 days. The number of days taken by A alone to finish the work is

- (a) 11 days
- (b) 21 days
- (c) 28 days
- (d) 42 days

9. A is thrice as good a workman as B and therefore is able to finish a job in 40 days less than B . Working together, they can do it in

- (a) 14 days
- (b) 13 days
- (c) 20 days
- (d) 15 days

10. A and B can do a piece of work in 8 days, B and C can do it in 24 days, while C and A can do it in $8\frac{4}{7}$ days. In how many days can C do it alone?

- (a) 60
- (b) 40
- (c) 30
- (d) 10

11. A coach helper repairs a coach in 12 days. His technician completes the same job in 18 days. If both of them work together, in how many days would the job be completed?

- (a) $\frac{5}{36}$
- (b) 7.3
- (c) 7.2
- (d) 7

12. 15 trackmen complete rail renewal job in 12 days. How many days would 18 trackmen take to complete the same job?

- (a) 10
- (b) 18
- (c) 15
- (d) 17

13. A man can do a work in 15 days. His father does this work in 20 days and man's son do this work in 25 days. If all do the work together, how many days will they take?

- (a) Less than 6 days
- (b) 6 days
- (c) Approximately 6.4 days
- (d) More than 10 days

14. If 6 men and 8 boys can do a piece of work in 10 days, while 26 men and 48 boys can do the same in 2 days, the time taken by 15 men and 20 boys in doing the same type of work will be

- (a) 4 days
- (b) 5 days
- (c) 6 days
- (d) 7 days

15. A can do a work in 15 days and B in 20 days. If they work on it together for 4 days, then the fraction of the work that is left is

- (a) $\frac{1}{4}$
- (b) $\frac{1}{10}$
- (c) $\frac{7}{15}$
- (d) $\frac{8}{15}$

16. 8 horses' food is equal to 6 cows' food. How many cows can eat the food meant for 20 horses?

- (a) 15
- (b) 16
- (c) 17
- (d) 18

17. X can complete a piece of work in 30 h and Y can do it in 24 h. In how many hours will it be completed if they work together?

- (a) 13.33
- (b) 14.33
- (c) 15.33
- (d) 16.33

18. A can do $\frac{3}{4}$ of a work in 12 days. In how many days can he finish $\frac{1}{8}$ of the work?

- (a) 1
- (b) 2
- (c) 3
- (d) 4

19. If 18 men and 10 boys can do in one day as much work as 10 men and 22 boys, the amount that a man should be paid per day, if a boy gets ₹ 10 per day

- (a) ₹ 7.5
- (b) ₹ 12.5
- (c) ₹ 20
- (d) ₹ 15

20. Rani and Sneha working separately can finish a job in 8 h and 12 h respectively. If they work for an hour alternately, Rani beginning at 9:00am when will the job be finished?

- (a) 7:30pm
- (b) 7:00pm
- (c) 6:30pm
- (d) 6:00pm

21. After working for 8 days, Anil finds that only $\frac{1}{3}$ of the work has been done. He employs Rakesh who is 60% efficient as Anil. How many more days will Anil take to complete the job?

- (a) 5
- (b) 8
- (c) 10
- (d) 12

22. A, B and C can do a job alone in 6, 12 and 24 days respectively. In what time will they do it together?

- (a) $2\frac{3}{7}$ days
- (b) $3\frac{3}{7}$ days
- (c) $3\frac{2}{7}$ days
- (d) $3\frac{4}{7}$ days

23. A can do $\frac{1}{3}$ of the work in 5 days and B can do $\frac{2}{5}$ of the work in 10 days. In how many days both A and B together can do the work?

- (a) $7\frac{3}{4}$
- (b) $8\frac{4}{5}$
- (c) $9\frac{3}{8}$
- (d) 10

24. A is thrice as efficient as B and B is twice as efficient as C , if A, B and C work together how long would they take to complete a job that B takes 10 days to complete?

- (a) $\frac{20}{9}$ days
- (b) $\frac{11}{9}$ days
- (c) 3 days
- (d) None of these

25. 12 men can complete a work in 18 days. 6 days after they started working, 4 men joined them. How many days will all of them take to finish the remaining work?

- (a) 9
- (b) 10
- (c) 12
- (d) 15

ANSWERS

1. (c)	2. (a)	3. (a)	4. (a)	5. (c)	6. (a)	7. (b)	8. (b)	9. (d)	10. (a)
11. (c)	12. (a)	13. (a)	14. (a)	15. (d)	16. (a)	17. (a)	18. (b)	19. (d)	20. (c)
21. (c)	22. (b)	23. (c)	24. (a)	25. (a)					

Hints & Solutions

1. Here, $M_1 = 30, W_1 = 1500,$

$$D_1 = 24, T_1 = 6, M_2 = 18,$$

$$W_2 = 1800, D_2 = ?, T_2 = 8$$

Using, $M_1 T_1 D_1 W_2 = M_2 T_2 D_2 W_1$ $30 \times 6 \times 24 \times 1800$

$$= 18 \times 8 \times D_2 \times 1500$$

$$\Rightarrow D_2 = \frac{30 \times 6 \times 24 \times 1800}{18 \times 8 \times 1500}$$

$$= 36 \text{ Days}$$

2. Let 1 man's one day's work be x and 1 child's one day's work be y there,

$$4x + 6y = \frac{1}{8}$$

$$3x + 7y = \frac{1}{10}$$

Solving both the equations, $y = \frac{1}{400}$

Therefore, 1 child can complete the work in 400 days and thus, 20 children can complete the work in $\frac{400}{20}$ i.e. 20 days.

3. Let B will do the remaining work in x days.

$$\frac{5}{10} + \frac{x+5}{20} = 1$$

According of the question: $\Rightarrow \frac{10+x+5}{20} = 1$

$$\Rightarrow x + 15 = 20$$

$$\therefore x = 5 \text{ days}$$

4. C can do the work $= \frac{1}{\left(\frac{1}{4} - \frac{1}{8} - \frac{1}{12}\right)}$

$$= \frac{1}{\left(\frac{6-3-2}{24}\right)} = 24 \text{ days}$$

Ratio of one day work of A, B and C

$$= \frac{1}{8} : \frac{1}{12} : \frac{1}{24} = 3 : 2 : 1$$

$$\begin{aligned}\therefore \text{Share of } C &= \frac{1}{(3 + 2 + 1)} \times 720 \\ &= \frac{1}{6} \times 720 = ₹120\end{aligned}$$

5. Total quantity of solutions P, Q and R from A, B and C respectively, after 3 min

$$= \frac{3}{30} + \frac{3}{20} + \frac{3}{10} = \frac{3 \times 11}{60} = \frac{11}{20}$$

$$\text{Quantity of solution } R \text{ in 3 min} = \frac{3}{10}$$

$$\therefore \text{Part of solution } R = \frac{\frac{3}{10}}{\frac{11}{20}} = \frac{3 \times 20}{10 \times 11} = \frac{6}{11}$$

6. Let the number of days to complete the work be x , then

$$\begin{aligned}\frac{x}{20} + \frac{x-2}{24} + \frac{x-5}{30} &= 1 \\ \Rightarrow \frac{6x + 5(x-2) + 4(x-5)}{120} &= 1 \\ \Rightarrow 6x + 5x + 4x &= 120 + 10 + 20 \\ \Rightarrow 15x &= 150 \\ \therefore x &= 10\end{aligned}$$

$$\therefore \text{Work done by } A = \frac{10}{20} = \frac{1}{2}$$

$$\therefore \text{Share of } A \text{ from the assured money} = \frac{1}{2} \times 5400 = ₹2700$$

7. Work done by A and B together in 1 day = $\frac{1}{72}$

$$\text{Work done by } B \text{ and } C \text{ together in 1 day} = \frac{1}{120}$$

and work done by C and A

$$\text{together in 1 day} = \frac{1}{90}$$

$$\Rightarrow 2(A + B + C) \text{ 's 1 day's work} = \left(\frac{1}{72} + \frac{1}{120} + \frac{1}{90}\right)$$

$$\Rightarrow (A + B + C) \text{ 's 1 day's work} = \frac{1}{2} \left(\frac{1}{72} + \frac{1}{120} + \frac{1}{90}\right)$$

$$\therefore (A + B + C) \text{ 's 2 day's work} = 2 \times \frac{1}{2} \left(\frac{5+3+4}{360}\right) = \frac{1}{30}$$

8. Let A completes the work in x days, then B completes the work in $2x$ days.

A and B together completes the work in = 14 days

$$\frac{x + 2x}{x + 2x} = 14$$

$$\Rightarrow x = \frac{3}{2} \times 14$$

$$= 21 \text{ days}$$

9. Ratio in work efficiency of

A and $B = 3:1$ and then ratio in time taken by A and $B = 1:3$

According to question,

$$3x - x = 40$$

$$2x = 40 \Rightarrow x = 20$$

$\therefore A$ takes 20 days and B takes 30 days.

\therefore If they work together, the time taken by A and $B = \frac{20 \times 60}{20 + 60} = 15$ days

10. According to question, $(A + B)$'s 1 day's work = $\frac{1}{8}$

$$(B + C) \text{ 's 1 day's work} = \frac{1}{24}$$

$$(C + A) \text{ 's 1 day's work} = \frac{7}{60}$$

$$\therefore 2(A + B + C) \text{ 's 1 day's work} = \frac{1}{8} + \frac{1}{24} + \frac{7}{60} = \frac{17}{60}$$

$$(A + B + C) \text{ 's 1 day's work} = \frac{17}{120}$$

$$C \text{ 's 1 day's work} = \frac{17}{120} - \frac{1}{8} = \frac{1}{60}$$

$\therefore C$ can complete the work in 60 days.

11. If they work together

$$\begin{aligned} &= \frac{x \times y}{x + y} = \frac{12 \times 18}{12 + 18} = \frac{12 \times 18}{30} \\ &= 7.2 \text{ days} \end{aligned}$$

12. $T_1 = 15$ trackmen, $D_1 = 12$ days

$T_2 = 18$ trackmen, $D_2 = ?$

According to the question,

$$\begin{aligned} T_1 D_1 &= T_2 D_2 \\ \Rightarrow 15 \times 12 &= 18 \times D_2 \\ \Rightarrow D_2 &= \frac{15 \times 12}{18} = 10 \text{ days} \end{aligned}$$

13. A man 1 day's work = $\frac{1}{15}$

Man's father 1 day's work = $\frac{1}{20}$

Man's son 1 day's work = $\frac{1}{25}$

If three do together, then 1 day's work:

$$\begin{aligned} &= \frac{1}{15} + \frac{1}{20} + \frac{1}{25} \\ &= \frac{30 + 15 + 12}{300} = \frac{57}{300} \end{aligned}$$

Hence, they do the work together in $\frac{300}{57}$ days or 5.26 days.

14. 6 men and 8 boys can do a work = 10 days

60 men and 80 boys can do a work = 1 day

Similarly, 26 men and 48 boys can do a work = 2 days

60 men + 80 boys = 52 men + 96 boys

8 men = 16 boys

1 man = 2 boys

6 men + 8 boys (4 men) can do a work = 10 days

10 men can do a work = 10 days

15 men + 20 boys (10 men) will complete the work = x days

25 men will complete the work = x days

$$M_1 D_1 = M_2 D_2$$
$$10 \times 10 = 25 \times x$$
$$\therefore x = \frac{100}{25}$$

$$\Rightarrow x = 4 \text{ days}$$

15. One day work of A = $\frac{1}{15}$

One day work of B = $\frac{1}{20}$

One day work of both

$$= \frac{1}{15} + \frac{1}{20}$$
$$= \frac{4+3}{60} = \frac{7}{60}$$

$$4 \text{ days work of both} = \frac{7}{60} \times 4 = \frac{7}{15}$$

$$\therefore \text{Remaining work} = 1 - \frac{7}{15} = \frac{8}{15}$$

16. Food of 8 horse's = Food of 6 cow's

Food of 1 horse = Food of $\frac{6}{8}$ cow

$$\text{Food of 20 horses} = \frac{6}{8} \times 20 = 15 \text{ cows}$$

17. 1 h work of X = $\frac{1}{30}$

1 h work of Y = $\frac{1}{24}$

$$1 \text{ h work of both} = \frac{1}{30} + \frac{1}{24} = \frac{4+5}{120} = \frac{9}{120} = \frac{3}{40}$$

$$\text{Both complete the work} = \frac{40}{3} = 13.33 \text{ h}$$

18. Using formula,

$$\begin{aligned}\frac{M_1 D_1 H_1}{W_1} &= \frac{M_2 D_2 H_2}{W_2} \\ \Rightarrow \frac{12}{3} &= \frac{D_2}{1} \\ D_2 &= 12 \times \frac{1}{8} \times \frac{4}{3} \\ D_2 &= 2\end{aligned}$$

∴ He can finish in 2 days.

19. 18 men + 10 boys

$$\Rightarrow \frac{\text{Man}}{\text{Boy}} = \frac{3}{2} = 10 \text{ men} + 22 \text{ boys}$$

⇒ Their wages paid will be in the ratio 3: 2.

Hence, if a boy gets ₹ 10 per day a men get ₹ 15.

20. Capacity of Rani and Sneha per hour = $\frac{1}{8}$ and $\frac{1}{12}$ respectively.

$$\text{Total work done by them in 1 h} = \frac{1}{8} + \frac{1}{12} = \frac{5}{24} \text{ per hour}$$

∴ Full work = $1 \times \frac{48}{5} = 9 \text{ h}$, then $\frac{1}{6}$ of work will be left and now turn is of Sneha. Sneha will do the remaining work in 30 min.

Total time taken = 9 h and 30 min

Time = 9 + 9 h and 30 min = 18: 30 h

Rani finished the job in 6: 30pm.

21. If efficiency of Anil is taken as 1, then efficiency of Rakesh = 0.6

∴ After employing Rakesh, total effective man;

$$\begin{aligned}\text{man} \times \text{efficiency} &= 1 \times 1 + 0.6 \times 1 \\ &= 1 + 0.6 = 1.06\end{aligned}$$

Using the formula:

$$\begin{aligned} & \frac{\text{Man}_1 \times \text{Efficiency}_1 \times \text{Days}_1}{\text{Work}_1} \\ &= \frac{\text{Man}_2 \times \text{Efficiency}_2 \times \text{Days}_2}{\text{Work}_2} \\ &\Rightarrow \frac{1 \times 1 \times 8}{\frac{1}{3}} = \frac{1.6 \times x}{\left(1 - \frac{1}{3}\right)} \\ &\Rightarrow \frac{1}{3} \times 1.6x = \frac{2}{3} \times 8 \\ &\Rightarrow x = 10 \text{ days} \end{aligned}$$

\therefore 10 days more to complete the job.

22. Taken time = $\frac{1}{\frac{1}{6} + \frac{1}{12} + \frac{1}{24}}$

$$\begin{aligned} &= \frac{1}{\frac{1}{6} + \frac{1}{12} + \frac{1}{24}} \\ &= \frac{1}{\frac{4 + 2 + 1}{24}} \\ &= \frac{1 \cdot 24}{7} = \frac{24}{7} \\ &= 3\frac{3}{7} \text{ days} \end{aligned}$$

23. A does one work in 15 days B does one work in 25 days \therefore (A + B) 's one day work

$$\begin{aligned} &= \frac{1}{25} + \frac{1}{25} \\ &= \frac{5 + 3}{75} = \frac{8}{75} \end{aligned}$$

Hence, (A + B) will complete one work in $9\frac{3}{8}$ days.

24. Since, $A = 3B$ and $B = 2C$

$\therefore B$ takes 10 days

$\Rightarrow C$ takes 20 days and A takes $\frac{10}{3}$ days.

\therefore If they all work together, then $\frac{3}{10} + \frac{1}{10} + \frac{1}{20} = \frac{9}{20}$

Hence, time taken is $\frac{20}{9}$ days.

25. 12 men's 6 days work = $\frac{1}{3}$

Remaining work = $\frac{2}{3}$

$$m_1 \times d_1 \times w_2 = m_2 \times d_2 \times w_1$$

$$12 \times 1 \times \frac{2}{3} = 16 \times d_2 \times \frac{1}{18}$$

$$d_2 = \frac{12 \times 2 \times 18}{3 \times 16} = 9 \text{ days}$$

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