TIME AND WORK

9

INTRODUCTION

The concept of time and work is another important topic for aptitude exams. Over the past five years, questions based on Time and Work have been regularly asked in CAT too. Besides, questions on this chapter have been appearing regularly over the past few decades in all aptitude exams.

THEORY

The basic concepts and theory in this chapter hinge around the following concepts and thought structures:

If A does a work in a days, then in one day A does $\rightarrow \frac{1}{a}$ of the work.

If B does a work in b days, then in one day B does $\rightarrow \frac{1}{b}$ of the work.

Then, in one day, if A and B work together, then their combined work is $\frac{1}{a} + \frac{1}{b}$.

or $\frac{a+b}{ab}$

In the above case, we take the total work to be done as "1 unit of work". Hence, the work will be completed when 1 unit of work is completed.

For example, if A can do a work in 10 days and B can do the same work in 12 days, then the work will be completed in how many days.

One day's work = 1/10 + 1/12 = (12 + 10)/120

[Taking LCM of the denominators]

= 22/120

Then the number of days required to complete the work is 120/22.

Note: This is a reciprocal of the fraction of work done in one day. This is a benefit associated with solving time and work through fractions. It can be stated as—the number of time periods required to complete the full work will be the reciprocal of the fraction of the work done in one time period.

ALTERNATIVE APPROACHES

Percentage Approach:

Instead of taking the value of the total work as 1 unit of work, we can also look at the total work as 100 per cent work. In such a case, the following rule applies:

If A does a work in a days, then in one day A does $\rightarrow \frac{100}{a}\%$ of the work.

Then, in one day, if A and B work together, then their combined work is

$$\frac{100}{a}+\frac{100}{b}$$

This is often a very useful approach to look at the concept of time and work because thinking in terms of percentages gives a direct and clear picture of the actual quantum of work done.

What I mean to say is that even though we can think in either a percentage or a fractional value to solve the problem, there will be a thought process difference between the two.

Thinking about work done as a percentage value gives us a linear picture of the quantum of the work that has been done and the quantum of the work that is to be done. On the other hand, if we think of the work done as a fractional value,

the thought process will have to be slightly longer to get a full understanding of the work done.

For instance, we can think of work done as 7/9 or 77.77%. The percentage value makes it clear as to how much quantum is left – as we will be measuring the total work to be done as 100%. The percentage value can be visualised on the number line, while the fractional value requires a mental inversion to fully understand the quantum.

An additional advantage of the percentage method of solving time and work problems would be the elimination of the need to perform cumbersome fraction additions involving LCMs of denominators.

However, you should realise that this would work only if you are able to handle basic percentage calculations involving standard decimal values. If you have really internalised the techniques of percentage calculations given in the chapter of percentages, then you can reap the benefits for this chapter.

The benefit of using this concept will become abundantly clear by solving through percentages the same example that was solved above using fractions.

Example: If *A* can do a work in 10 days and *B* can do the same work in 12 days, then the work will be completed in how many days?

Solution: One day's work = 10% + 8.33% = 18.33% (**Note:** No LCMs required here)

Hence, to do 100% work, it will require: 100/18.33.

This can be solved by adding 18.33 mentally to get between 5–6 days. Then on you can go through options and mark the closest answer.

The process of solving through percentages will yield rich dividends, if and only if, you have adequate practice on adding standard percentage values. Thus, 18.33 × 5 = 91.66 should not give you any headaches and should be done while reading for the first time.

Thus, a thought process chart for this question should look like this.

If *A* can do a work in 10 days (→ means 10% work) and *B* can do the same work in 12 days (→ 8.33% work → 18.33% work in a day in 5 days, 91.66% work → leaves 8.33% work to be done → which can be done in 8.33/18.33 of a day = 5/11 of a day (which can be obtained by multiplying both the numerator and the denominator by 3 to get 8.33/18.33 = 25/55=5/11). Thus, the work will be completed in $5\frac{5}{11}$ days.

The entire process can be done mentally.

However, the percentage method has some basic limitations – firstly it requires you to be really good at handling the decimal values of the percentages and secondly it works well only with standard denominators. For instance in the above illustration, if *A* could do the work in 13 days and *B* in 17 days, and if it is asked to you to find out how many days *A* and *B* would take together to complete the work, it would not be possible to solve using percentages – as we would not be aware of the percentage values of 1/13 and of 1/17 (and even if you were somehow aware of these numbers, it would not be possible to mentally add the difficult decimals that 1/13 and 1/17 throw up). All these problems get sorted out through the third method of thinking in these situations, which I now move onto.

LCM METHOD: The Best Approach

This is by far the best method of solving Time and Work Questions. The process is best explained through an example. Suppose, *A* can do a piece of work in 10

days and *B* can do it in 12 days. In how many days can *A* and *B* together do the work?

Solution using the LCM Method

Assume the total work to be 60 (LCM of 10 and 12). Then, since *A* can do the total work in 10 days, he would do 6 units of work per day (60/10). Likewise, *B* would do 5 units of work per day (since he does the total work of 60 units in 12 days). Thus, *A* and *B*'s work in 1 day would be 6 + 5 = 11. Hence, total number of days taken to do the work = 60/11 = $5\frac{5}{11}$ days.

Concept of Negative Work

Suppose, that *A* and *B* are working to build a wall while *C* is working to break the wall. In such a case, the wall is being built by *A* and *B* while it is being broken by *C*. Here, if we consider the work as the building of the wall, we can say that *C* is doing negative work.

Example: *A* can build a wall in 10 days and *B* can build it in 5 days, while *C* can completely destroy the wall in 20 days. If they start working at the same time, in how many days will the work be completed.

Using Percentages: The net combined work per day here is:

A's work + *B*'s work – *C*'s work = 10% + 20% – 5% = 25% work in one day.

Hence, the work will get completed (100% work) in 4 days.

Using LCM

The LCM of 10, 20 and 5 is 20. Hence, we assume the total work as 20 units. *A* can do +2 units of work each day. *B* can do +4 units of work per day, while *C* can do –1 units of work each day. Thus, total work done per day = + 2 + 4 – 1 = 5 units of work per day. Thus, 20 units of work would be done in 20/5 = 4 days.

The concept of negative work commonly appears as a problem based on pipes and cisterns, where there are inlet pipes and outlet pipes/leaks which are working against each other.

If we consider the work to be filling a tank, the inlet pipe does positive work while the outlet pipe/leak does negative work.

Application of Product Constancy Table to Time and Work

The equation that applies to time and work problems is

$$\text{Work rate} \times \text{Time} = \text{Work done}$$

This equation means that if the work done is constant, then → work rate is inversely proportional to time. Hence, the product constancy table will be directly applicable to time and work questions.

> ***Note:*** The parallelism between this formula and the formula of time speed and distance, where again there is product constancy between speed and time if the distance is constant.

Time is usually in days or hours, although any standard unit of time can be used. The unit of time that has to be used in a question is usually decided by the denominator of the unit of work rate.

Here, there are two ways of defining the work rate.

1. In the context of situations where individual working efficiencies or individual time requirements are given in the problem, the work rate is defined by the unit: work done per unit time.

In this case, the total work to be done is normally considered to be 1 (if we solve through fractions) or 100% (if we solve through percentages).

Thus, in the solved problem above, when we calculated that A and B together do 18.33% work in a day, this was essentially a statement of the rate of work of A and B together.

Then the solution proceeded as:

18.33% work per day × number of days required = 100% work

Giving us: the number of days required = 100/18.33 = $5\frac{5}{11}$

2. In certain types of problems (typically those involving projects that are to be completed), where a certain category of worker has the same rate of working, the work rate will be defined as the number of workers of a particular category working on the project.

For instance, questions where all men work at a certain rate, the work rate when two men are working together will be double the work rate when one man is working alone. Similarly, the work rate when ten men are working together will be ten times the work rate when one man is working alone.

In such cases, the work to be done is taken as the number of man-days required to finish the work.

> ***Note:*** For future reference, that the work to be done can also be measured in terms of the volume of work defined in the context of day-to-day life.

For example, the volume of a wall to be built, the number of people to be interviewed, the number of chapter is to be made and so on.

WORK EQUIVALENCE METHOD(To Solve Time and Work Problems)

The work equivalence method is nothing but an application of the formula:

Work rate × Time = Work done (or work to be done)

Thus, if the work to be done is doubled, the product of *work rate* × *time* also has to be doubled. Similarly, if the work to be done increases by 20%, the product of *work rate* × *time* also has to be increased by 20% and so on.

This method is best explained by an example:

A contractor estimates that he will finish the road construction project in 100 days by employing 50 men.

However, at the end of the 50th day, when as per his estimation half the work should have been completed, he finds that only 40 per cent of his work is done.

(a) How many more days will be required to complete the work?

(b) How many more men should he employ in order to complete the work in time?

Solution:

(a) The contactor has completed 40 per cent of the work in 50 days.

If the number of men working on the project remains constant, the rate of work also remains constant. Hence, to complete 100 per cent work, he will have to complete the remaining 60 per cent of the work.

For this, he would require 75 more days. (This calculation is done using the unitary method.)

(b) In order to complete the work on time, it is obvious that he will have to increase the number of men working on the project.

This can be solved as:

50 men working for 50 days → 50 × 50 = 2500 man-days.

2500 man-days has resulted in 40 per cent work completion. Hence, the total work to be done in terms of the number of man-days is obtained by using unitary method:

$$\text{Work left} = 60\% = 2500 \times 1.5 = 3750 \text{ man-days}$$

This has to be completed in 50 days. hence, the number of men required per day is 3750/50 = 75 men.

Note: This can be done using the percentage change graphic for product change. Since, the number of days is constant at 50, the 50 per cent increase in work from 40 per cent to 60 per cent is solely to be met by increasing the number of men. Hence, the number of men to be increased is 50 per cent of the original number of men = 25 men.

Specific Case of Building a Wall (Work as volume of work)

As already mentioned, in certain cases, the unit of work can also be considered to be in terms of the volume of work. For example, building of a wall of a certain length, breadth and height.

In such cases, the following formula applies:

$$\frac{L_1 B_1 H_1}{L_2 B_2 H_2} = \frac{m_1 t_1 d_1}{m_2 t_2 d_2}$$

where L, B and H are respectively the length, breadth and height of the wall to be built, while m, t and d are respectively the number of men, the amount of time per day and the number of days. Further, the suffix 1 is for the first work situation, while the suffix 2 is for the second work situation.

Consider the following problem:

Example: Twenty men working eight hours a day can completely build a wall of length 200 metres, breadth 10 metres and height 20 metres in ten days. How many days will 25 men working 12 hours a day require to build a wall of length 400 metres, breadth 10 metres and height of 15 metres?

Solution: This question can be solved directly by using the formula above

$$\frac{L_1 B_1 H_1}{L_2 B_2 H_2} = \frac{m_1 t_1 d_1}{m_2 t_2 d_2}$$

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$$\frac{L_1 B_1 H_1}{L_2 B_2 H_2} = \frac{m_1 t_1 d_1}{m_2 t_2 d_2}$$

Here, L_1 is 200 metres L_2 is 400 metres

B_1 is 10 metres B_2 is 10 metres

H_1 is 20 metres H_2 is 15 metres

while m_1 is 20 men m_2 is 25 men

d_1 is 10 days d_2 is unknown

and t_1 is 8 hours a day t_2 is 12 hours a day

Then we get $(200 \times 10 \times 20)/(400 \times 10 \times 15) = (20 \times 8 \times 10)/(25 \times 12 \times d2)$

$\therefore$ $d_2 = 5.333/0.6666 = 8$ days

Alternatively, you can also directly write the equation as follows:

$d_2 = 10 \times (400/200) \times (10/10) \times (15/20) \times (20/25) \times (8/12)$

This can be done by thinking of the problem as follows:

The number of days have to be found out in the second case. Hence, on the LHS of the equation, write down the unknown and on the RHS of the equation, write down the corresponding knowns.

$$d_2 = 10 \times ....$$

Then, the length of the wall has to be factored in. There are only two options for doing so, viz,

multiplying by 200/400 (< 1, which will reduce the number of days) or multiplying by 400/200 (>1, which will increase the number of days).

The decision of which one of these is to be done is made on the basis of the fact that when the length of the wall is increasing, the number of days required will also increase.

Hence, we take the value of the fraction greater than 1 to get

$$d_2 = 10 \times (400/200)$$

We continue in the same way to get

No change in the breadth of the wall → hence, multiply by 10/10 (no change in d_2)

Height of the wall is decreasing → hence, multiply by 15/20 (< 1 to reduce d_2).

Number of men working is increasing → hence, multiply by 20/25 (< 1 to reduce d_2).

Number of hours per day is increasing → hence, multiply by 8/12 (< 1 to reduce the number of days).

Concept of Efficiency

The concept of efficiency is closely related to the concept of work rate.

When we make a statement saying A is twice as efficient as *B*, we mean to say that A does twice the work as *B* in the same time. In other words, we can also understand this as A will require half the time required by *B* to do the same work.

In the context of efficiency, another statement that you might come across is: A is two times more efficient than B. This is the same as: A is thrice as efficient as *B* or A does the same work as *B* in 1/3rd of the time.

Equating Men, Women and Children This is directly derived from the concept of efficiencies.

Example: Eight men can do a work in 12 days while twenty women can do it in 10 days. In how many days can 12 men and 15 women complete the same work?

Solution: Total work to be done = 8 × 12 = 96 man-days.

or total work to be done = 20 × 10 = 200 woman-days.

Since, the work is the same, we can equate 96 man-days = 200 woman-days.

Hence, 1 man-day = 2.08333 woman-days.

Now, if 12 men and 15 women are working on the work we get

12 men are equal to 12 × 2.08333 = 25 women

Hence, the work done per day is equivalent to 25 + 15 women working per day.

That is, 40 women working per day.

Hence, 40 × number of days = 200 woman days

Number of days = 5 days.

WORKED-OUT PROBLEMS

Problem 9.1 A can do a piece of work in 10 days and B in 12 days. Find how much time they will take to complete the work under the following conditions:

(a) Working together

(b) Working alternately starting with$A$

(c) Working alternately starting with B

(d) If B leaves two days before the actual completion of the work

(e) If *B* leaves two days before the scheduled completion of the work

(f) If another person *C* who does negative work (i.e. works against *A* and *B* and can completely destroy the work in 20 days) joins them and they work together all the time.

Solution:

(a) One day's work for *A* is 1/10 and one day's work for *B* is 1/12.

Then, working together, the work in one day is equal to:

$\frac{1}{10}+\frac{1}{12}=\frac{11}{60}$ of the work. Thus, working together they need 60/11 days to complete the work → 5.45 days.

Alternately, you can use percentage values to solve the above question:

A's work =10%, *B*'s work = 8.33%. Hence, *A* + *B* = 18.33% of the work in one day.

Hence, to complete 100% work, we get the number of days required = 100/18.33 → 5.55 days.

This can be calculated as

@ 18.33% per day in 5 days, they will cover 18.33 × 5 = 91.66%. (The decimal value 0.33 is not difficult to handle if you have internalised the fraction to percentage conversion table of the chapter of percentages).

Work left on the sixth day is: 8.33%, which will require: 8.33/18.33 of the sixth day.

Since, both these numbers are divisible by 1.66, we get 5/11 of the sixth day will be used → 0.45 of the sixth day is used.

Hence, 5.45 days are required to finish the work.

However, as already stated earlier, the best method is to solve this using the LCM method: Assume total work as 60 units, *A*'s work will be 6 units, *B*'s work will be 5 units. The work would be done in 60/11 = $5\frac{5}{11}$ days.

(b) Working alternately starting with *A*: When two people are working alternately, the question has to be solved by taking two days as a unit of time instead of one day.

So in (a) above, the work done in one day will be covered in two days here.

Thus, in two days the work done will be 18.33%. In ten days, it will be 91.66%. On the eleventh day, *A* works by himself.

But *A*'s work in one day is 10 per cent. Therefore, he will require 4/5 of the eleventh day to finish the work.

Using the LCM method, this question can be thought through as follows:

Total work = 60. First day: *A* works alone and does 6 units of work; Second day: *B* works alone and does 5 units of work. In two days, work done = 6 + 5 = 11 units. Using unitary method, in ten days, work done is 55 units. On the eleventh day, *A* works alone and since 5 units of work is left and *A* does 6 units of work in the whole day, it means that he would take 5/6 of the day to complete the work. Hence, total days required = $10\frac{5}{6}$ days.

(c) Working alternately starting with *B*: Here, there will be no difference in work completed by the tenth day. On the eleventh day, *B* works alone and does

8.33% of the work (which was required to complete the work). Hence, the whole of the eleventh day will get used.

Using the LCM method, this question can be thought through as follows:

Total work = 60. First day: *B* works alone and does 5 units of work; Second day: *A* works alone and does 6 units of work. In two days, work done = 5 + 6 = 11 units. Using unitary method, in ten days, work done is 55 units. On the eleventh day, *B* works alone and since 5 units of work is left and *B* does 6 units of work in the whole day, it means that he would take the whole day to complete the work. Hence, total days required = 11 days.

(d) If *B* leaves two days before the actual completion of the work: In this case, the actual completion of the work is after two days of *B*'s leaving. This means, that *A* has worked alone for the last two days to complete the work. But *A* does, 10% work in a day. Hence, *A* and *B* must have done 80% of the work together (@18.33% per day).

Then, the answer can be found by
80/18.33 + 20/10 days.

Note: For calculation of 80/18.33, we can use the fact that the decimal value is a convenient one. If they worked together, they would complete 73.33% of the work in four days and the work that they would have done on the fifth day would be 6.66%.

At the rate of 18.33% work per day while working together, they would work together for 6.66/18.33 of the fifth day. Since both the numerator and denominator are divisible by 1.66, the above ratio is converted into 4/11 = 0.3636.

Hence, they work together for 4.3636 days after which *B* leaves and then *A* completes the work in two more days. Hence, the time required to finish the work would be = 6.3636 days.

Using the LCM method would be very convenient comparatively in this question. The following thought process would be used:

Total work = 60. *A*'s work in 1 day = 6 units, *B*'s work in 1 day = 5 units. Since, *B's* leaves two days before actual completion of work the interpretation of this would be that for the last two days *A* has worked alone and finished the work alone. On the last two days, *A* would do 6 + 6 = 12 units of work. Thus, *A* and *B* together would do 60 – 12 = 48 units of work. They would take 48/11 = $4\frac{4}{11}$. Thus, the total number of days required would be $2 + 4\frac{4}{11} = 6\frac{4}{11}$ days.

(e) If *B* leaves two days before the scheduled completion of the work: Completion of the work would have been scheduled assuming that *A* and *B* both worked together for completing the work (say, this is *x* days). Then, the problem has to be viewed as: *x* – 2 days was the time for which *A* and *B* worked together. The residual amount of work left (which will be obtained by two days work of *A* and *B* together) would be done by *A* alone at his own pace of work.

Thus, we can get the solution by:

Number of days required to complete the work = $[(100/18.33) - 2] + \frac{36.66}{10}$

Using the LCM method: Total work = 60 units. *B* leaves two days before the scheduled completion of the work means that when *B* leaves, two scheduled days of work was left. Since, as per schedule *A* and *B* were working together, they would do 11 units of work per day. Hence, sched-

uled work for last 2 days = 2 × 11 = 22 units. This work would be done along by *A* (@ 6 units of work per day), while the other 38 units of work would be done by *A* and *B* together (@11 units of work per day). Total number of days required = $\frac{38}{11}+\frac{22}{6}=\frac{470}{66}=\frac{235}{33}$ days. Again as you can see, the LCM method reduces your calculations and hence, the time you take to get through the question.

(f) If *C* joins the group and does negative work, we can see that one day's work of the three together would be

A's work + *B*'s work – *C*'s work = 10% + 8.33% – 5% = 13.33%

Hence, the work will be completed in (100/13.33) days.

Note: This can be calculated by 13.33 × 7 = 13 × 7 + 0.33 × 7 = 93.33.

Then, work left = 6.66, which will require half a day more at the rate of 13.33% per day. Thus, the total time required would be 7.5 days.

Using the LCM method: Total work = 60 (LCM of 10,12 and 20). *A* = + 6, *B* = + 5, *C* = – 3. Total work done per day = + 6 + 5 – 3 = 8 units. Time required = 60/8 = 7.5 days.

Advantage of solving problems on time and work through LCM: You should realise from the above examples, that the LCM method is the best way to solve the typical questions on time and work. Once, you identify the LCM of the number of days each person requires to do the work, the LCM method reduces calculations for the solving process.

Problem 9.2 A contractor undertakes to build a wall in 50 days. He employs 50 people for the same. However, after 25 days, he finds that the work is only 40% complete. How many more men need to be employed to:

(a) complete the work in time?

Solution: In order to complete the work in time, the contractor has to finish the remaining 60% of the work in 25 days.

Now, in the first 25 days the work done = 50 × 25 =1250 man-days → 40% of the work.

Hence, work left = 60% of the work = 1875 man-days.

Since, 25 days are left to complete the task, the number of people required is 1875/25 = 75 men.

Since, 50 men are already working, 25 more men are needed to complete the work.

Thought process should go like: 1250 → 40% of work. Hence, 1875 man-days required to complete the work.

Since there are only 25 days left, we need 1875/25 = 75 men to complete the work.

(b) Complete the work ten days before time?

Solution For this purpose, we have to do 1875 man-days of work in 15 days.
Hence, men = 1875/15 = 125 men.

Hence, he would need to hire 75 more men.

Problem 9.3 For the previous problem, if the contractor continues with the same workforce:

(a) How many days behind schedule will the work be finished?

Solution He has completed 40% work in 25 days. Hence, to complete the remaining 60% of the work, he would require 50% more days (i.e. 37.5 days) (Since, 60% is 1.5 times of 40%)

Hence, the work would be done 12.5 days behind schedule.

(b) How much increase in efficiency is required from the work force to complete the work in time?

Solution: If the number of men working is kept constant, the only way to finish the work in time is by increasing the efficiency so that more work is done every man-day.

This should be mathematically looked at as follows:

Suppose, that one man-day takes care of 1 unit of work.

Then, in the first 25 days, work done = 25 (days) × 50 (men) × 1 (work unit per man-day) = 1250 units of work.

Now, this 1250 units of work is just 40% of the work.

Hence, work left = 1875 units of work.

Then, 25 (days) × 50 (men) × z (work units per man-day) = 1875 → $z = 1.5$

Thus, the work done per man-day has to rise from 1 to 1.5, that is, by 50%. Hence, the efficiency of work has to rise by 50%.

Problem 9.4 A is twice as efficient as B. If they complete a work in 30 days, find the times required by each to complete the work individually.

Solution: When we say that A is twice as efficient as B, it means that A takes half the time that B takes to complete the same work.

Thus, if we denote A's one day's work as A and B's one day's work as B, we have

$A = 2B$

Then, using the information in the problem, we have: $30A + 30B = 100\%$ work

That is, 90 B = 100% work → B = 1.11 % (is the work done by B in one day) → B requires 90 days to complete the work alone.

Since, $A = 2B$ → we have A = 2.22 % → A requires 45 days to do the work alone.

You should be able to solve this mentally with the following thought-process while reading for the first time:

$\frac{100}{30} = 3.33\%.\ \frac{3.33}{3} = 1.11\%.$ Hence, work done is 1.11% per day and 2.22% per day → 90 and 45 days.

Problem 9.5 A is two times more efficient than B. If they complete a work in 30 days, then find the times required by each to complete the work individually.

Solution: Interpret the first sentence as $A = 3B$ and solve according to the process of the previous problem to get the answers. (You should get that A takes 40 days and B takes 120 days.)

LEVEL OF DIFFICULTY (I)

1. A can do 10% of a piece of work in ten days. How many days will he take to complete the work five times?

   (a) 500 days

   (b) 450 days

   (c) 400 days

   (d) 480 days

2. Five men can do a piece of work in ten days. How many men are needed to do the work in five days?

   (a) 11 men

   (b) 10 men

(c) 9 men

(d) 12 men

3. Raman can do a piece of work in ten days and Rahul can do it in 15 days. How long will they take if both work together?

(a) 5 days

(b) 6 days

(c) 12 days

(d) 8 days

4. In question 3, if Charan, who can finish the same work in 20 days, joins them, then how long will they take to complete the work?

(a) 5.12 days

(b) 4.62 days

(c) 5.67 days

(d) 4.82 days

5. *A* and *B* can do a piece of work in eight days and *B* alone can do it in 16 days. In how many days, can *A* do it alone?

(a) 12 days

(b) 13 days

(c) 18 days

(d) 16 days

6. Suman alone can do a piece of work in 15 days. Aman alone can do it in 20 days. If the total wages for the work is ₹1400, how much should Suman be paid if they work together for the entire duration of the work?

   (a) ₹600

   (b) ₹500

   (c) ₹800

   (d) ₹700

7. Two men and three women finish a job in ten days, and six men and twelve women can do the same job in three days. How long will one man and one woman take to do the work?

   (a) 22 days

   (b) 22.5 days

   (c) 5 days

   (d) 12 days

8. If 16 boys and 24 women can do a piece of work in 50 days, in how many days can the work be done by 7 boys and 10 women working together?

   (a) 15 days

   (b) 10 days

   (c) 12 days

   (d) Cannot be determined

9. Anil can do a piece of work in eight days and Bimal can do the same work in twelve days. With the help of Charan, they finish the work in four days. How long will it take for Charan alone to finish the work?

   (a) 24 days

   (b) 25 days

   (c) 23 days

   (d) 28 days

10. Ashok can do a piece of work in ten days. He works at it for 5 days and then Saheb finishes it in ten more days. In how many days will Saheb alone finish the whole work?

    (a) 8 days

    (b) 10 days

    (c) 12 days

    (d) 20 days

11. In the previous question in how much time will Ashok and Saheb finish the whole work together?

    (a) 6 days

    (b) 6.66 days

    (c) 5.33 days

    (d) 1.66 days

12. *A* and *B* undertake to do a piece of work for ₹1000. *A* can do it in ten days and *B* can do it in twenty days. With the help of *C*, they finish it in five days. How much should *C* be paid for his contribution?

    (a) ₹400

    (b) ₹250

    (c) ₹150

    (d) ₹350

13. Thirty workers can finish a piece of work in 20 days. After how many days should 10 workers leave the job so that the work is completed in 25 days?

    (a) 12 days

    (b) 10 days

    (c) 15 days

    (d) 5 days

14. Anuj and Binod together can do a piece of work in 21 days. If Anuj does twice as much work as Binod in a given time, how long will Anuj alone take to do the work?

    (a) 31.33 days

    (b) 31.5 days

    (c) 31 days

    (d) 32 days

15. Sashi can type 500 pages in 10 hours; Sashi and Rishi together can type 3000 pages in 40 hours. In how much time can Rishi type 300 pages?

    (a) 13 h

    (b) 12 h

    (c) 11 h

    (d) 9 h

16. '*x*' number of men can finish a piece of work in ten days. If there were five men more, the work could be finished in five days. What is the original number of men?

    (a) 5

    (b) 10

    (c) 7

    (d) 15

17. Aman can do a piece of work in 20 days and Baman can do it in 25 days. They work for 5 days and then Baman goes away. In how many more days will Aman finish the work?

    (a) 10 days

    (b) 12 days

    (c) 14 days

    (d) 11 days

18. Fifteen men and sixteen women together can complete a job in six days. If twelve women can complete the same project in 32 days, in how many days will ten men complete the same project?

    (a) 12

    (b) 20

    (c) 16

    (d) 8

19. Twenty Eight men can complete a piece of work in 15 days and 15 women can complete the same work in 24 days. What is the respective ratio between the amount of work done by 30 men in 1 day and the amount of work done by 18 women in 1 day?

    (a) 10:7

    (b) 3:5

    (c) 5:4

    (d) 9:5

20. If 36 persons are engaged on a piece of work the work is supposed to be completed in 40 days. After 32 days, only 3/4th of the work was completed. How many more persons are required to complete the work on time?

    (a) 10

    (b) 8

    (c) 9

    (d) 12

21. If 12 boys or 15 girls can do a work in 48 days, in what time will 24 boys and 6 girls do twice of the work?

(a) 42 days

(b) 40 days

(c) 45 days

(d) 30 days

22. Seven boys and two men working together can do three times as much work per hour as a boy and a man together, what will be the respective ratio of work done by a boy and a man for the given time?

(a) 3:1

(b) 1:2

(c) 1:3

(d) 1:4

23. *A* and *B* together can complete a task in 20 days. *B* and *C* together can complete the same work in 30 days. *A* and *C* together can complete the same task in 40 days. What is the respective ratio of the number of days taken *A* when completing the same task alone to the number of days taken by *C* when completing the same task alone?

(a) 2:5

(b) 2:7

(c) 3:7

(d) 1:5

24. If *A* and *B* together can complete a piece of work in 15 days and *B* alone in 20 days, in how many days can *A* alone complete the work?

    (a) 60

    (b) 45

    (c) 40

    (d) 30

25. A piece of work can be done by Ram and Shyam in 12 days, by Shyam and Hari in 15 days, and Hari and Ram in 20 days. Ram alone will complete the work in

    (a) 30 days

    (b) 32 days

    (c) 36 days

    (d) 42 days

26. *A* and *B* can separately complete a piece of work in 20 days and 30 days respectively. They worked together for some time, then *B* left the work. If *A* completed the rest of the work in ten days, then *B* worked for

    (a) 6 days

    (b) 8 days

    (c) 12 days

    (d) 16 days

27. *A* can complete a piece of work in 18 days, *B* in 20 days and *C* in 30 days. *B* and *C* together start the work and are forced to leave after two days. The time taken by A alone to complete the remaining work is

(a) 10 days

(b) 12 days

(c) 15 days

(d) 16 days

28. *A* and *B* working separately can do a piece of work in 9 and 12 days respectively. If they work for a day alternately with *A* beginning, the work would be complete in

(a) $10\frac{2}{3}$ days

(b) $10\frac{1}{2}$ days

(c) $10\frac{1}{4}$ days

(d) $10\frac{1}{3}$ days

29. *A* can finish a work in 18 days and *B* can do the same work in 15 days. *B* worked for ten days and left the job. In how many days, *A* alone can finish the remaining work?

(a) 8

(b) $5\frac{1}{2}$

(c) 5

(d) 6

30. *A* can do a piece of work in 20 days and *B* in 30 days. They work together for seven days and then both leave the work. Then *C* alone finishes the remaining work in ten days. In how many days will *C* finish the full work?

(a) 25 days

(b) 30 days

(c) 24 days

(d) 20 days

31. Four men and six women can complete a work in eight days, while three men and seven women can complete it in ten days. In how many days will ten women complete it?

(a) 50

(b) 45

(c) 40

(d) 35

32. Three men and four boys can complete a piece of work in 12 days. Four men and three boys can do the same work in 10 days. Then two men and three boys can finish the work in (number of days)

(a) $17\frac{1}{2}$

(b) $5\frac{5}{11}$

(c) 8

(d) 22

33. *A* can do certain work in 120 days and *B* can finish in 150 days. They together worked for 20 days. Then *B* leaves and *A* continues for 20 days. Thereafter, *C* joins and the work is completed in 32 days. The work can be done by *C* alone in

    (a) 83 days

    (b) 103 days

    (c) 93 days

    (d) None of these

34. A piece of work can be done by *A* and *B* in 12 days, by *A* and *C* in 15 days, and *C* and *B* in 20 days. *A* alone will complete the work in

    (a) 20 days

    (b) 30 days

    (c) 36 days

    (d) 42 days

35. Sunil estimates that he will finish the road construction project in 200 days by employing 100 men. However, at the end of 100th day, when as per his estimation half the work should have been completed, he finds that only 40% of the work is done. How many more men should he hire so that he can complete the work in time?

    (a) 50

    (b) 40

    (c) 60

(d) 25

36. 20 men working 10 hours a day can build a wall of length 20 meters, breadth 10 meters and height 20 meters in 20 days. How many days will 40 men working 5 hours a day require to build the same wall?

    (a) 10 days

    (b) 15 days

    (c) 20 days

    (d) 25 days

37. Ajay can do a piece of work in 20 days and Bijay in 30 days. They work together for 7 days and then both leave the work. Then Chinmay alone finishes the remaining work in 5 days. In how many days will Chinmay finish the full work?

    (a) 25 days

    (b) 30 days

    (c) 24 days

    (d) 20 days

38. In Mindworkzz, a certain number of developers can design a product in 20 days. If there were five more developers, it could be finished in five days less. How many developers were there in the beginning?

    (a) 12

    (b) 20

    (c) 10

    (d) 15

39. If two boys *P* and *Q* working together can do a job in six hours and boy *Q* takes five hours more to do the job alone, then what is the time taken by *P* and *Q* respectively to complete the job working individually?

(a) 15 hours, 20 hours

(b) 10 hours, 15 hours

(c) 5 hours, 10 hours

(d) 15 hours, 10 hours

40. There are three workers *A*, *B* and *C* in a company. They can do a job in 5, 10 and 15 hours respectively. In starting, all three are working. Then after 1 hour, *C* stopped working whereas *A* and *B* continued their work. After another 1 hour, *B* stopped working. The remaining work is done by *A* alone. Find the percentage of the work done by *A*.

(a) 75.33%

(b) 72%

(c) 73.33%

(d) None of these

41. *A* can do a piece of work in 30 days, *B* can do the same in 15 days whereas *C* in 5 days. *A* and *B* start working together and after two days *C* joins them. How many more days will they take to complete the job?

(a) 3.33

(b) 3.66

(c) 2.66

(d) 2.33

42. Amit, Bipul and Charan can together build a chair in four days. If Amit can do it alone in 12 days and Bipul in 15 days, in how many days will Charan alone build the chair?

(a) 10 days

(b) 15 days

(c) 12 days

(d) 6 days

43. 20 men working 6 hours a day can build a wall of length 20 meters, breadth 10 meters and height 20 meters in 20 days. How many days will 40 men working 5 hours a day require to build a wall of length 40 meters, breadth 20 meters, height 10 meters?

(a) 12 days

(b) 18 days

(c) 24 days

(d) 30 days

44. Three men and four boys can complete a piece of work in 12 days. Four men and three boys can do the same work in ten days. Then two men and three boys can finish the work in number of days is

(a) $17\frac{1}{2}$

(b) $5\frac{5}{11}$

(c) 8

(d) 22

45. If 10 men or 20 women or 40 children can do a piece of work in 7 months, then 5 men, 5 women and 5 children together can do half of the work in

    (a) 6 months

    (b) 4 months

    (c) 5 months

    (d) 8 months

46. Aliya and Deepika can complete a job in 8 and 12 hours, each working alone. If Deepika starts working on the same job and then each one works in alternate hours, how many hours will it take to complete the job?

    (a) $9\frac{2}{3}$

    (b) 9.5

    (c) 9.33

    (d) None of these

47. In the previous question, if instead of Deepika, Aliya starts the job, what will be the difference in the number of days in the two cases?

    (a) 1/6

    (b) 1/8

    (c) 4/5

    (d) None of these

48. Company *A*, *B* and *C* each working alone take 10, 20 and 25 hours respectively to manufacture 200 boxes. The defect in their production is 10%, 20% and 12.5% respectively. How many hours will it take to produce 660 non-defective boxes if they work together?

(a) 23

(b) 20

(c) 24

(d) 28

49. *A*, *B* and *C* can do a task in 10, 20 and 25 days respectively. They started the work together and *A* stops doing the task after two days. After three more days *B* and *C* left too but then A completes the task. What portion of work is done by *C*?

(a) 1/14

(b) 1/5

(c) 1/4

(d) 3/10

50. If ₹5000 was given to them as remuneration, then what amount (in ₹) of share will *A* get?

(a) 2750

(b) 2300

(c) 2400

(d) 2600

51. If 3 men and 4 boys can do a piece of work in 12 days while 4 men and 3 boys can do the same in 10 days, the time taken by 1 man and 2 boys in doing the same type of work will be

(a) $38\frac{2}{11}$ days

(b) $38\frac{3}{11}$ days

(c) $36\frac{3}{11}$ days

(d) $37\frac{2}{11}$ days

52. *A*, *B*, *C* and *D* can do a piece of work in 10, 20, 40 and 80 hours respectively. *A* starts the work, *B* joins after 1/4th of the work is done, *C* after half of the work and *D* after 3/4th of the work. Find the time (approximately in hours) after which work gets completed.

(a) 6.75

(b) 7.5

(c) 7

(d) 8.5

53. Aman, Bhuvan and Charan started doing a job. All three of them together take two hours to complete the job. Charan individually takes four times the time taken by Aman and Bhuvan together. Also the time taken by Aman is half the time taken by the other two together. Find the fraction of work which Bhuvan complete one hour?

(a) 1/14

(b) 1/15

(c) 1/5

(d) None of these.

54. A man, a woman, a boy and a girl can do a piece of work in 4, 6, 12 and 24 days respectively. How many girls are required to work with one man, one woman and one boy to complete the work in one day?

55. *A* and *B* can do a task alone in 25 and 40 days respectively. Now according to a new method, they work on alternate days with *A* starting the work and after every two days of work, they take one day holiday and after holiday the person who worked on the last day before holiday resumes the work. With this method, how many days will they take to complete the job?

56. A 100 × 70 m fishing pond was dug by 500 workers in 36 days. What is the number of days in which a 140m × 80 m pond having the same depth can be dug by 600 workers?

57. The wages of 7 men and 3 women amount to ₹11900 per week and the wages of 4 men and 3 women to ₹7700 per week . Find the daily wages of a man.

58. Five women can paint a building in 30 working hours. After 16 hours of work, 2 women decided to leave. How many hours will it take for the work to be finished?

59. Ajay, Vijay and Sanjay are employed to do a piece of work for ₹529. Ajay and Vijay together are supposed to do 19/23 of the work and Vijay and Sanjay together 8/23 of the work. How much should Ajay be paid?

    (a) ₹245

    (b) ₹295

    (c) ₹300

    (d) ₹345

60. Anmol is thrice as good a workman as Vinay and therefore, is able to finish the job in 60 days less than Vinay. In how many days will they finish the job working together?

(a) 22.5 days

(b) 12.5 days

(c) 15 days

(d) 20 days

61. 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) 12 days

(b) 10 days

(c) 8 days

(d) 6 days

62. A takes 5 days more than B to do a certain job and 9 days more than C; A and B together can do the job in the same time as C. How many days A would take to do it?

(a) 16 days

(b) 10 days

(c) 15 days

(d) 20 days

63. A, B and C can do some work in 36 days. A and B together do twice as much work as C alone and A and C together can do thrice as much work as B alone. Find the time taken by C to do the whole work.

(a) 72 days

(b) 96 days

(c) 108 days

(d) 120 days

64. Two taps are running continuously to fill a tank. The first tap could have filled it in five hours by itself and the second one by itself could have filled it in 20 hours. But the operator failed to realise that there was a leak in the tank from the beginning which caused a delay of one hour in the filling of the tank. Find the time in which the leak would empty a filled tank.

(a) 15 hours

(b) 20 hours

(c) 25 hours

(d) 40 hours

65. *A* alone can complete a job in four days. He is twice as fast as *B* while *B* is twice as fast as *C*. If all of them work together, in how many days would the job get completed?

LEVEL OF DIFFICULTY (II)

1. Two t-shirt manufacturing companies in their respective plants were involved in the manufacturing of *shirts*. One company had an average output of 21 shirts from a plant and the other company, which had 12 plants less than the first company manufactured 25 shirts per plant. As a result, the second company manufactured 300 shirts more than the first company. How many *shirts* did the first company manufacture?

(a) 3150

(b) 3450

(c) 3500

(d) 3600

2. According to a plan, a construction team has to build a 2700 metres long wall. For the first three days, the team built the wall as per the plan. However, subsequently finding that their resources were getting under-utilised according to the plan, it started to make 80 metres more than the plan every day. Therefore, a day before the planned date they had built to a length of 2800 metres. How many metres of wall was the plan for each day?

   (a) 380 metres

   (b) 300 metres

   (c) 270 metres

   (d) 280 metres

3. A pipe can fill a tank in a hours and another can empty it in b hours. If the tank is 1/4th full initially, then the number of hours in which they will together fill in the tank

   (a) $\frac{3ab}{5(b-a)}$

   (b) $\frac{3ab}{4(b-a)}$

   (c) $\frac{4ab}{3(b-a)}$

(d) $\frac{4ab}{3(b-a)}$

4. A and B can do a piece of work in 15 and 20 days respectively. They began the work together, but B leaves after some days and A finished the remaining work in 8 days. After how many days did B leave?

   (a) 3 days

   (b) 8 days

   (c) 5 days

   (d) 4 days

5. Anil finishes 4/7th of the work in 4 hours, Bimal works twice as fast and finishes the remaining work. For how long did Bimal work (in hours) ?

   (a) 2/3

   (b) 1/4

   (c) 3/5

   (d) 3/2

Directions for Questions 6 to 10: Read the following and answer the questions that follow.

A set of 5 pipes (set A) can fill 40% of a tank in 4 hours. Another set of 10 pipes (set B) fills 30% of the tank in 10 hours. A third set of 12 pipes (set C) can empty 50% of the tank in 10 hours.

6. How many minutes will it take to fill the tank if all the 27 pipes are opened at the same time?

   (a) 8 hours

(b) 12.5 hours

(c) 6 hours

(d) 10 hours

7. If 60% pipes of set *A* are closed and 50% pipes of set *B* are open and all other pipes are open, how long will it take to fill 10% of the tank?

(a) 11 hours

(b) 13 hours

(c) 12 hours

(d) 20 hours

8. If 6 pipes are closed in set *C*, and all others remain open, how long will it take to fill 21% of the tank?

(a) 1 hour

(b) 2 hours

(c) 3 hours

(d) 1.5 hours

9. If the tank is half full and set *A* and set *B* are closed, how many hours will it take for set *C* to empty the tank if alternate taps of set *C* are closed?

(a) 22 hours

(b) 30 hours

(c) 20 hours

(d) 26 hours

10. If one pipe is added for set *A* and set *B* and set *C*'s capacity is increased by 20% on its original value and all the taps are opened at 12.08 P.M., then at what time would 93% of the tank get filled? (If it is initially empty.)

    (a) 7.08 P.M.

    (b) 11.08 P.M.

    (c) 10.10 P.M.

    (d) 10.08 P.M.

11. Aman can do as much work in 12 days as Balbir can do in 24 days and Balbir can do as much in 4 days as Dilbeer in 5 days. A piece of work takes 10 days if all work together. How long would Balbir take to do all the work by himself?

    (a) 38 days

    (b) 24 days

    (c) 36 days

    (d) 40 days

12. Two pipes can fill a cistern in 12 and 18 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom of the cistern, it takes 48 minutes extra for the cistern to be filled up. When the cistern is full, in what time will the leak empty it?

    (a) 110 hours

    (b) 72 hours

    (c) 90 hours

    (d) 80 hours

13. A tank holds 80 gallons of water. Its inlet is 4 inches in diameter and fills the tank at 10 gallons/min. The outlet of the tank is thrice the diameter of the inlet. How many minutes will it take to empty the tank if the inlet is shut off, when the tank is full and the outlet is opened? (*Hint:* Rate of filling or emptying is directly proportional to the diameter.)

    (a) 2.67 min

    (b) 2.0 min

    (c) 0.8 min

    (d) 3.0 min

14. A tank of capacity 1000 litres has an inlet and an outlet tap. If both are opened simultaneously, the tank is filled in 25 minutes. But if the outlet flow rate is tripled and taps opened the tank never gets filled up while it also never gets emptied. Which of the following can be outlet flow rate in litres/min?

    (a) 20

    (b) 60

    (c) 10

    (d) 30

15. *X* takes 3 days to complete 50% of a job, *Y* takes 1 day to complete 1/4th of the same work and *Z* takes 2 days to complete 66.67% of the job. If all of them work together for 1 day and *X* and *Z* quit, how long will it take for *Y* to complete the remaining work done?

    (a) 0.5 days

(b) 1.25 days

(c) 5/3 days

(d) 1 day

16. *A* completes 1/3 of a certain job in 2 days. *B* can complete 1/2 of the same job in 2.5 days and *C* can complete 3/4 of the work in 3 days. All of them work together for day and then *A* and *C* quit. How long will it take for *B* to complete the remaining work alone?

    (a) 27/12 days

    (b) 33/12 days

    (c) 15/12 days

    (d) 23/12 days

17. Three workers dug a ditch of 150m deep in five days working simultaneously. During one shift, the third worker digs as many metres more than the second as the second digs more than the first. The third worker's work in 10 days is equal to the first worker's work in 30 days. How many metres does the first worker dig per shift?

    (a) 5 m

    (b) 15 m

    (c) 10 m

    (d) 25 m

18. Aman, Baman and Chaman need a certain unique time to do a certain work. Chaman needs one hour less than Aman to complete the work. Working together, they require 60 minutes to complete the job. The work also gets completed if Aman and Baman start working together and Aman leaves after one hour and Baman works for a further three hours. How much work does Charan do per hour?

    (a) 16.66%

    (b) 33.33%

    (c) 50%

    (d) 66.66%

19. Ashu and Ben completed a work together in ten days. Had Ashu worked at 2/3 of his speed and Ben at 1.5 times of his speed, it would have taken them ten days to complete the job. How much time would it take for Ashu alone to do the work, if he works at his normal pace?

    (a) 30 days

    (b) 20 days

    (c) 25 days

    (d) 50/3days

20. Two boys and a girl are assigned a job. The second boy needs three hours more to cope with the job than the first boy and the girl would need working together. The first boy, working alone, would need as much time as the second boy and the girl working together. The first boy, working

alone, would spend eight hours less than the double period of time the second boy would spend working alone. How much time would the two boys and the girl need to complete the task if they all worked together?

(a) 2 hours

(b) 3 hours

(c) 4 hours

(d) 5 hours

21. Two persons can do a typing job in 7.5 minutes if they work together. If the first person typed alone for nine minutes and then the second person typed alone for five minutes, they would be left with 3/4 of the whole work. How many minutes would it take the first person to complete the job working alone?

(a) 30 minutes

(b) 48 minutes

(c) 36 minutes

(d) 40 minutes

22. Three potters have to make 320 pitchers. They are known to make 80 pitchers every day working together. The first potter began working alone and made 20 pitchers having worked for sometime more than three days. The remaining part of the work was done by the second and the third potter working together. It took a total of 8 days to complete the 320 pitchers. How many days would it take the first potter alone to make 640 pitchers?

(a) 32 days

(b) 64 days

(c) 128 days

(d) 256 days

23. It takes ten days for four men and three women working together to complete a work. Two men would do the same work twenty-five days sooner than three women. How many times does the output of a man exceed that of a woman?

(a) 3 times

(b) 4 times

(c) 5 times

(d) 6 times

24. *A* and *B* are working on a project. If *A* worked alone, he would need nine hours more to complete the project than if they both worked together. Now if *B* worked alone, he would need four hours more to complete the project than they both working together. What time would it take *A* alone to complete the project?

(a) 15 hours

(b) 12 hours

(c) 14 hours

(d) 18 hours

25. Alok, Biru and Charan working together completed a job in eleven days. However, Charan only worked for the first three days when 44% of the job was done. Also, the work done by Alok in three days is equal to the

work done by Biru in two days. How many days would be required by the fastest worker to complete the entire work?

(a) 20 days

(b) 280/17 days

(c) 300/23 days

(d) None of these

26. *A* and *B* are quiz masters preparing for a quiz. In five hours, *A* makes 30 questions more than *B*. If both of them make two questions less per hour each, then in ten hours they would make 140 questions overall. How many questions does *A* make in five hours?

(a) 60

(b) 30

(c) 45

(d) 50

27. A tank of 2700-litre capacity is being filled with water. The delivery of the pump discharging the tank is 50% more than the delivery of the pump filling the same tank. As a result, thirty minutes more time is needed to fill the tank than to discharge it. Determine the delivery of the pump discharging the tank.

(a) 45 litres

(b) 55 litres

(c) 65 litres

(d) 85 litres

28. Two pipes *A* and *B* can fill up a half full tank in 1.2 hours. The tank was initially empty. Pipe *B* was kept open for half of the time required by pipe *A* to fill the empty tank by itself. Then, pipe *A* was kept open for as much time as was required by pipe *B* to fill up 1/3 of the empty tank by itself. It was then found that the tank was5/6 full. The least time in which any of the pipes can fill the tank fully is

(a) 4.8 hours

(b) 4 hours

(c) 3.6 hours

(d) 6 hours

29. A tank of 425 litres capacity has been filled with water through two pipes, the first pipe having been opened five hours longer than the second. If the first pipe were open as long as the second, and the second pipe was open as long as the first pipe was open, then the first pipe would deliver half the amount of water delivered by the second pipe; if the two pipes were open simultaneously, the tank would be filled up in 17 hours. How long was the second pipe open?

(a) 10 hours

(b) 12 hours

(c) 15 hours

(d) 18 hours

30. A tank has four inlets. Through the first three inlets, the tank can be filled in six hours; through the second, the third and the fourth inlet, it can be filled in eight hours; and through the first and the fourth inlet, in 12 hours. How much time will it take all the four inlets to fill up the dam?

    (a) 5 hours 20 minutes

    (b) 5 hours 10 minutes

    (c) 5 hours

    (d) None of these

Directions for Questions 31 and 32: An overhead tank has three taps attached to it. While the first tap can fill the tank in 24 hours, the second one takes 1.5 times the first one to fill it completely. A third tap is attached to the tank, which empties it in 72 hours. Now, one day, in order to fill the tank, Alok opens the first tap and after 2 hours opens the second tap as well. However, at the end of the sixth hour, he realises that the third tap has been kept open right from the beginning and promptly closes it.

31. What is the ratio of volume occupied by water to volume of remaining part of the tank after six hours?

32. What will be the total time required to fill the tank (in hours)?

Directions for Questions 33 and 34:

33. An overhead tank that is filled by two pumps — *X* and *Y*. *X* can fill the tank in 10 hours while *Y* can fill the tank in 12 hours. There is a pipe *Z* which can empty the tank in 8 hours. Both the pumps are opened simultaneously. The supervisor of the tank, before going out on a work, asks his assistant to open *Z* when the tank is exactly 55% filled so that the tank is exactly filled up by the time he is back. If he starts *X* and *Y* at exactly

11:00 AM and he comes back at a time represented in hours and minutes as $A:B$. Then find the value of $A + B$ (Take the closest approximation of B).

34. Due to a miscalculation by the assistant, he opens Z when the tank is 27.5% filled. If the supervisor comes back as per the plan, what percent of the tank is still empty?

35. Three students Alok, Baman and Charu were working on a project. Alok is 25% more efficient than Baman, who is 20% more efficient than Charu. Alok takes 10 days less than Baman to complete the project. Alok starts the project and works for 10 days and then Baman takes over. Baman works on the project for the next 14 days and then stops the work, handing it over to Charu to complete it. In how many days, would Charu complete the remaining project?

Directions for Questions 36 and 37: Three water pipes, X, Y and Z are all used to fill a container. These pipes can fill the container individually in 10 minutes, 15 minutes and 20 minutes, respectively. All the three pipes were opened simultaneously. However, it was observed that pipes X and Y were supplying water at 1/2 of their normal rates for the first minute after which they supplied water at the normal rate. Pipe Z supplied water at 1/3 of its normal rate for first 3 minutes, after which it supplied water at its normal rate. Now answer the following questions:

36. What fraction of the tank is empty after four minutes?
37. In how much time (in minutes), would the container be filled?

38. A project is to be completed in 60 days and 90 men are set to work, each working 6 hours a day. After 20 days, only 1/5th of the work is finished. How many additional men need to be employed so that the work may be completed on time. (If each man is now working 8 hours per day)?

39. *A*, *B* and *C* can complete a work in 6, 8 and 12 hours, respectively. At the most, only one person can work in each hour and nobody can work for two consecutive hours. Find the minimum number of hours that they will take to finish the work.

40. The rate at which tap *X* fills a tank is 50% more than that of tap *Y*. If both the taps are opened simultaneously, they take 40 hours to fill the tank. The time taken by *Y* alone to fill the tank is (in hours)

LEVEL OF DIFFICULTY (III)

Directions for Questions 1 to 10: Study the following tables and answers the questions that follow.

Darbar toy company has to go through the following stages for the launch of a new toy:

		Expert man-days required	*Non-expert man-days required*
1.	Design and development	30	60
2.	Prototype creation	15	20
3.	Market survey	30	40
4.	Manufacturing setup	15	30
5.	Marketing and launch	15	20

The profile of the company's manpower is

Worker name	*Expert at*	*Non-expert at*	*Refusal to work on*
A	Design and development	All others	Market survey
B	Prototype creation	All others	Market survey
C	Market survey and marketing and launch	All others	Design and development
D	Manufacturing	All others	Market survey
E	Market survey	All others	Manufacturing

1. Given this situation, the minimum number of days in which the company can launch a new toy going through all the stages is

   (a) 40 days

   (b) 40.5 days

   (c) 45 days

   (d) 44 days

2. If A and *C* refuse to have anything to do with the manufacturing set up. the number of days by which the project will get delayed will be

   (a) 5 days

   (b) 4 days

   (c) 3 days

   (d) 6 days

3. If each of the five works is equally valued at ₹10,000, the maximum amount will be received by

   (a) *A*

   (b) *C*

   (c) *D*

   (d) *E*

4. For question 3, the second highest amount will be received by

   (a) *A*

   (b) *C*

   (c) *D*

(d) *E*

5. If *C* works at 90.909% of his efficiency during marketing and launch, who will be highest paid amongst the five of them?

   (a) *A*

   (b) *C*

   (c) *D*

   (d) *E*

6. If the company decides that the first four works can be started simultaneously and the experts will be allocated to their respective work areas only and a work will be done by a non-expert only if the work in his area of expertise is completed, then the expert who will first be assisted in his work will be (assume that marketing and launch can only be done after the first four are fully completed)

   (a) *A*

   (b) *B*

   (c) *C*

   (d) *D*

7. For the question above, the minimum number of days in which the whole project will get completed (assume everything is utilised efficiently all the time, and nobody is utilised in a work that he refuses to work upon), will be

   (a) 22.5 days

(b) 15 days

(c) 24.75 days

(d) 25.25 days

8. For the situation in question 6, the highest earning will be for

(a) *A*

(b) both *B* and *D*

(c) *C*

(d) Cannot be determined

9. If each work has an equal payment of ₹10,000, the lowest earning for the above situation will be for

(a) *A*

(b) *E*

(c) *C*

(d) *B*

10. The value of the earning for the highest earning person, (if the data for questions 6–9 are accurate) will be

(a) 19,312.5

(b) 13,250

(c) 12,875

(d) B

Directions for Questions 11 to 20: Read the following and answer the questions that follow.

A fort contains a granary, that has 1000 tons of grain. The fort is under a siege from an enemy army that has blocked off all the supply routes.

The army in the fort has three kinds of soldiers:

Sepoys → 2,00,000

Mantris → 1,00,000

Footies → 1,00,000

100 sepoys can hold 5% of the enemy for one month.

100 mantris can hold 10% of the enemy for 15 days.

50 footies can hold 5% of the enemy for one month.

A sepoy eats 1 kg of food per month, a mantri eats 0.5 kg of food per month and a footie eats 3 kg of food. (Assume 1 ton = 1000 kg).

The king has to make some decisions based on the longest possible resistance that can be offered to the enemy.

If a king selects a soldier, he will have to feed him for the entire period of the resistance. The king is not obliged to feed a soldier not selected for the resistance.

(Assume that the entire food allocated to a particular soldier for the estimated length of the resistance is redistributed into the king's palace in case a soldier dies and is not available for the other soldiers.)

11. If the king wants to maximise the time for which his resistance holds up, he should

    (a) select all mantris

    (b) select all footies

    (c) select all sepoys

    (d) none of these

12. Based on existing resources, the maximum number of months for which the fort's resistance can last is

(a) 5 months

(b) 20 months

(c) 7.5 months

(d) cannot be determined

13. If the king makes a decision error, the maximum reduction in the time of resistance could be

(a) 15 months

(b) 12.5 months

(c) 16.66 months

(d) cannot be determined

14. If the king estimates that the attackers can last for only 50 months, what should the king do to ensure victory?

(a) select all mantris

(b) Select the mantris and the sepoys

(c) select the footies

(d) the king cannot achieve this

15. If a reduction in the ration allocation by 10% reduces the capacity of any soldier to hold off the enemy by 10%, the number of whole months by which the king can increase the life of the resistance by reducing the ration allocation by 10% is

(a) 4 months

(b) 2 months

(c) no change

(d) This will reduce the time

16. The minimum amount of grain that should be available in the granary to ensure that the fort is not lost (assuming the estimate of the king of 50 months being the duration for which the enemy can last is correct) is

    (a) 2000 tons

    (b) 2500 tons

    (c) 5000 tons

    (d) cannot be determined

17. If the king made the worst possible selection of his soldiers to offer the resistance, the percentage increase in the minimum amount of grain that should be available in the granary to ensure that the fort is not lost is

    (a) 100%

    (b) 500%

    (c) 600%

    (d) cannot be determined

18. The difference in the minimum grain required for the second worst choice and the worst choice to ensure that the resistance lasts for 50 months is

    (a) 5000 tons

    (b) 7500 tons

    (c) 10000 tons

    (d) cannot be determined

19. If the king strategically attacks the feeder line on the first day of the resistance so that the grain is no longer a constraint, the maximum time for which the resistance can last is

(a) 100 months

(b) 150 months

(c) 250 months

(d) cannot be determined

20. If the feeder line is opened after six months and prior to that the king had made decisions based on food availability being a constraint then the number of months (maximum) for which the resistance could last is

(a) 100 months

(b) 150 months

(c) 5 months

(d) cannot be determined

Directions for Questions 21 to 25: Study the following and answer the questions that follow.

A gas cylinder can discharge gas at the rate of 1 cc/minute from burner A and at the rate of 2 cc/minute from burner *B* (maximum rates of discharge). The capacity of the gas cylinder is 1000 cc of gas.

The amount of heat generated is equal to 1 kcal per cc of gas.

However, there is wastage of the heat as per follows:

Gas discharge@	*Loss of heat*
0–0.5 cc/minute	10%
0.5–1 cc/minute	20%
1–1.5 cc/minute	25%
1.5 + cc/minute	30%

@(Include higher extremes)

21. If both burners are opened simultaneously such that the first is opened to 90% of its capacity and the second is opened to 80% of its capacity, the amount of time in which the gas cylinder will be empty (if it was half full at the start) will be

    (a) 250 minutes

    (b) 400 minutes

    (c) 200 minutes

    (d) None of these

22. The maximum amount of heat with the fastest speed of cooking that can be utilised for cooking will be when

    (a) The first burner is opened upto 50% of its aperture

    (b) The second burner is opened up to 25% of its aperture

    (c) Either (a) or (b)

    (d) None of these

23. The amount of heat utilised for cooking if a full gas cylinder is burnt by opening the aperture of burner A 100% and that of burner *B* 50% is

    (a) 900 kcal

    (b) 800 kcal

    (c) 750 kcal

    (d) cannot be determined

24. For Question 23, if burner A had been opened only 25% and burner *B* had been opened 50%, the amount of heat available for cooking would be

    (a) 820 kcal

    (b) 800 kcal

    (c) 750 kcal

    (d) cannot be determined

25. For Question 24, the amount of time required to finish a full gas cylinder will be

    (a) 900 minutes

    (b) 833.33 minutes

    (c) 800 minutes

    (d) none of these

ANSWER KEY

Level of Difficulty (I)

1. (a)
2. (b)
3. (b)
4. (b)
5. (d)
6. (c)
7. (b)
8. (d)
9. (a)

10. (d)
11. (b)
12. (b)
13. (b)
14. (b)
15. (b)
16. (a)
17. (d)
18. (a)
19. (a)
20. (d)
21. (b)
22. (d)
23. (d)
24. (a)
25. (a)
26. (a)
27. (c)
28. (c)
29. (d)
30. (c)
31. (c)
32. (a)
33. (d)
34. (a)
35. (a)

36. (c)
37. (c)
38. (d)
39. (b)
40. (c)
41. (c)
42. (a)
43. (c)
44. (a)
45. (b)
46. (a)
47. (a)
48. (b)
49. (b)
50. (a)
51. (a)
52. (a)
53. (b)
54. 12
55. 45 5/8days
56. 48 days
57. ₹20
58. 39.33
59. (d)
60. (a)
61. (d)

62. (c)

63. (c)

64. (b)

65. 16/7 days

Level of Difficulty (II)

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

21. (b)
22. (c)
23. (c)
24. (a)
25. (c)
26. (a)
27. (a)
28. (b)
29. (c)
30. (a)
31. 5/13
32. 16.4 hours
33. 52
34. 18.75%
35. 28.20
36. 19/60
37. 5.15
38. 45
39. 6.75
40. 100

Level of Difficulty (III)

1. (b)
2. (b)
3. (b)
4. (d)
5. (b)
6. (a)

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

Solutions and Shortcuts

Level of Difficulty (I)

1. He will complete the work in 100 days. Hence, he will complete five times the work in 500 days.
2. Five men for 10 days means 50 man-days. This would be equal to 10 men for 5 days.

3. Raman's one day work will be 10%, while Rahul will do 6.66 % of the work in one day. Hence, their total work will be 16.66% in a day.

   In six days, they will complete → 16.66 × 6 = 100%

   Alternately: Total work = 30 units. Raman's work = 3 units, Rahul's work = 2 units per day. Together, total work per day is 5 units. Hence, to complete 30 units of the work, they would take 30/5 = 6 days.

4. Total work = LCM of 10,15 and 20 = 60 Units. Raman does 6 units per day, Rahul does 4 units per day while Charan does 3 units of work per day. Total work together per day = 6 + 4 + 3 = 13 units of work. Total time required = $\frac{60}{13}$ = 4.62 days.

5. $A + B$ = 100/8%

   B = 100/16%

   Hence, A = 100/16% → 16 days.

   Alternately, let the total work be 16. A and B's one day work would be 16/8 = 2 units of work. B's 1 day work would be 16/16 = 1 unit per day. Thus, A would do (2 – 1 = 1 unit of work) per day. He would take 16/1 = 16 days.

6. The ratio of the wages will be the inverse of the ratio of the number of days required by each to do the work. Hence, the correct answer will be 4:3 → ₹800.

7. 20 man days + 30 women days = 18 man days + 36 women days

   → 2 man days = 6 woman days

   → 1 man day = 3 woman days

Total work = 20 man days + 30 woman days = 60 woman days + 30 woman days = 90 woman days.

Hence, 1 man + 1 woman = 4 women can do it in 90/4 = 22.5 days.

8. The data is insufficient, since we only know that the work gets completed in 800 boy days and 1200 women days.

9. Let the total work be 24 units. Efficiency of Anil = 24/8 = 3, efficiency of Bimal = 24/12 = 2 units.

   Combined efficiency of Anil, Bimal and Charan = 24/4 = 6 units.

   Charan's efficiency = – 6 – (2 + 3) = 1. Hence, Charan will complete the whole work in 24/1 = 24 days.

10. In 5 days, Ashok would do 50% of the work. Since, Saheb finishes the remaining 50% work in 10 days, Saheb would complete the 100% work in 20 days. Hence, option (d) is correct.

11. Let the total work be 20 units. Efficiency of Ashok = 20/10 = 2 units. Efficiency of Saheb = 20/20 = 1 unit per day.

    Hence, the required time = 20/(2 + 1) = 6.66 days. Hence, option (b) is correct.

12. Let the total work be 20 units. Efficiency of A = 2 units per day.

    Efficiency of B = 1 unit per day

    Combined efficiency of A, B and C = 20/5 = 4 units.

    Efficiency of C = 4 – (1 + 2) = 1 unit per day.

Hence, the required answer = $1000 \times \frac{1}{1+2+1}$ = ₹250.

13. Total man days required = 600 man-days. If 10 workers leave the job after 'n' days, the total work would be done in 25 days. We have to find the value of 'n' to satisfy:

    $600 = 30 \times n + 20 \times (25 - n)$

    On solving, we get n = 10 days. Hence, option (b) is correct.

14. Let the time taken by Anuj be 't' days. Then, time taken by Binod = $2t$ days.

    $1/t + 1/2t = 1/21 \rightarrow t = 31.5$ days

15. Sashi's efficiency = 50 pages per hour

    Sashi + Rishi's efficiency = 75 pages per hour

    Rishi's efficiency = 75 – 50 = 25 pages per hour

    Required time = 300/25 = 12 hours

16. $10x = (x + 5)5$

    $10x = 5x + 25$ or $x = 5$

17. Aman = 5%, Baman = 4%. In five days, they do a total of 45% work. Aman will finish the remaining 55% work in 55/5 = 11 more days.

18. Let the efficiency of 1 man and 1 woman is m and w respectively.

    Total work = $12w \times 32 = (15m + 16w)\,6$

    $90m = 288w$

    Or $10m = 32w$

    Required time = total work/10m = $12w \times 32/10m = 12w \times \frac{32}{32w}$ = 12 days

19. Let the efficiency of 1 man and 1 woman is m and w respectively.

According to the problem:

$28m \times 15 = 15w \times 24$

$7m = 6w$

$\frac{m}{w} = \frac{6}{7}$

Required ratio = $\frac{30m}{18w} = \frac{30}{18} \times \frac{6}{7} = 10:7$

20. In 32 days, 3/4 of the total work is done = 32 × 36 man days = 1152 man days

Total work = $1152 \times \frac{4}{3}$ = 1536 man days.

Remaining work = 1536 – 1152 = 384 man days.

Total persons required to complete the remaining work in 8 days = $\frac{384}{8} = 48$

Therefore, we need 48 – 36 = 12 more men.

21. According to the problem: Total work = $12b \times 48 = 15w \times 48$

$4b = 5w$

24 boys and 6 girls = $24b + 6w = 30w + 6w = 36w$

Twice of the total work = $2 \times 15w \times 48$

Required time = $2 \times 15w \times \frac{48}{36w} = 40$ days

22. $7b + 2m = 3(b + m)$

$$4b = m \text{ or } \frac{b}{m} = \frac{1}{4}$$

23. Let the total work be LCM of 20, 30, 40 = 120

Combined efficiency of A and B OR $A + B = 120/20 = 6$ (1)

Combined efficiency of B and C OR $C + B = 120/30 = 4$ (2)

Combined efficiency of A and C OR $A + C = 120/40 = 3$ (3)

By solving the above three equations we get: $A = 2.5, B = 3.5, C = 0.5$

$A:C = 2.5: 0.5 = 5:1$

The above ratio is the ratio of efficiencies of A and C. The time taken by them to complete the work = inverse of the above ratio = 1:5.

24. Let the total work be LCM of 15 and 20 = 60

Let the efficiencies of A and B be a and b respectively.

$a + b = 60/15 = 4$ (1)

$b = 60/20 = 3$ (2)

By solving equation 1 and 2, we get:

$a = 1$

Hence, A alone can complete the total work in 60/1 = 60 days.

25. Let the efficiencies of Ram, Shyam and Hari be R, S and H respectively.

Let the total work be LCM of 12, 20 and 15 = 60.

$R + S = 60/12 = 5$ (1)

$S + H = 60/15 = 4$ (2)

$R + H = 60/20 = 3$ (3)

By solving the above three equations we get $R = 2$.

Hence, Ram alone can complete the work in $\frac{60}{2} = 30$ days.

26. Let the total work be LCM of 30 and 20 = 60.

The efficiencies of A and B would be 3 units per day and 2 units per day respectively.

Work done by A in 10 days = $10 \times 3 = 30$.

Rest of the work was done by A and B together. Hence, the B worked for $\frac{60-30}{(2+3)} = \frac{30}{5} = 6$ days.

27. Let the total work be LCM of 18, 20, 30 = 180.

Efficiencies of A, B and C are $\frac{180}{18}, \frac{180}{20}$ and $\frac{180}{30}$ or 10, 9 and 6, respectively.

Total work done by B and C in 2 days = $2 \times (9 + 6) = 30$

Time taken B to complete the remaining work = $\frac{180-30}{10} = 15$ days.

28. Let the total work be LCM of 9, 12 = 36.

Efficiencies of A and B are $\frac{36}{9}$ and $\frac{36}{12}$ or 4 and 3 respectively.

Total work done by A and B in 2 days = 4 + 3 = 7

In 10 days, total work done by them = $7 \times 5 = 35$.

On 11th day the rest of the work will get finished by A. Hence. total time taken by them to complete the work = $10 + \frac{1}{4} = 10\frac{1}{4}$ days.

29. Let the total work be LCM of 18 and 15 = 90.

The efficiencies of A and B would be 5 and 6 respectively.

Work done by B in 10 days = $10 \times 6 = 60$.

Rest of the work was done by A. Hence, to complete the remaining work, A worked for $\frac{90-60}{5} = \frac{30}{5} = 6$ days.

30. Let the total work be LCM of 30 and 20 = 60.

The efficiencies of A and B will be 3 and 2 respectively.

Work done by A and B in 7 days = $7 \times 5 = 35$.

Rest of the work was done by C alone. Hence, the efficiency of C $= \frac{60-35}{10} = 2.5$

C alone can finish the whole work in $\frac{60}{2.5} = 24$ days.

31. According to the question: $8 \times (4m + 6w) = 10 \times (3m + 7w)$

$32m + 48w = 30m + 70w$

$2m = 22w$

$m = 11w$

Required time = $\frac{32m+48w}{10w} = \frac{32\times11w+48w}{10w} = 40$ days.

32. According to the question: $12 \times (3m + 4b) = 10 \times (4m + 3b)$

$36m + 48b = 40m + 30b$

$4m = 18b$

$m = 4.5b$

Required time = $\frac{36m+48b}{2m+3b} = \frac{(36\times4.5b)+48b}{(2\times4.5b)+3b} = 17\frac{1}{2}$ days.

33. Let total work = 600 units.

A's one day work = (600/120) = 5 units.

B's one day work = (600/150) = 4 units.

They work for 20 days, so work done = 20 × (5 + 4) = 180 units. Now, *A* alone works for 20 days so work done by him = 20 × 5 = 100 units.

Let *C* do '*c*' units of work in a day, so remaining work = (5 + *c*) × 32.

This should be equal to 600 – 180 – 100 = 320 units.

On equating, we get *c* = 5 units.

So, *C* alone can do the work in (600/5) = 120 days.

34. Let the total work be 60. *A* + *B* = 5 units of work. *A* and *C* = 4 units of work and *B* and *C* = 3 units of work. Solving from here, we will get: *C* = 1, *B* = 2 and *A* = 3. A will complete the work in 60/3 = 20 days.

35. 40% of the total work = 100×100

Remaining work = $(100 \times 100) \times \frac{60}{60}$ = 15000 men-days

Required number of people to finish the work on time = $\frac{15000}{100}$ = 150 men.

However, since 100 men are already working on the project, he would need to hire an additional 50 men.

36. Total work = 20 × 10 × 20 man-hours

Let 40 men working 5 hours a day require '*d*' days to finish the work.

20 × 10 × 20 = 40 × 5 × *d*

d = 20 days.

37. Work done by Ajay and Bijay in seven days

$$= \frac{7}{20} + \frac{7}{30} = \frac{21+14}{60} = \frac{35}{60} = \frac{7}{12}$$

Work left = $1 - \frac{7}{12} = \frac{5}{12}$

$\therefore$ Time taken by Chinmay to complete the work = $\frac{12}{5} \times 5$ = 12 days.

Task for student: Try to apply the LCM method here.

38. Let the number of developers be x.

New number of developers = $(5 + x)$

Equating man-days, $20x = 15\ (5 + x)$. This gives $x = 15$.

39. Let time taken by $P = t$ hours, time taken by $Q = (t + 5)$ hours.

Work done by P in 1 hour = $(1/t)$, work done by Q in one hour = $1/(t + 5)$.

Work done by both of them working together = 1/6 this is equal to $\frac{1}{t} + \frac{1}{t+5} = \frac{1}{6}$.

On solving, we get t = 10 hours. Therefore, P takes 10 hrs and Q takes (10 + 5) = 15 hours.

40. Let the total work = 30 units.

Work done by A, B and C in one hour is respectively 6 units, 3 units and 2 units.

In the first hour, all three workers are working. Hence, total work done in first hour = 6 + 3 + 2 = 11 units. In the next hour, C does not work, so total work done in the next hour = 6 + 3 = 9 units.

In the first hour, all three workers are working. Hence, total work done in first hour = 6 + 3 + 2 = 11 units. In the next hour, *C* does not work, so total work done in the next hour = 6 + 3 = 9 units.

So work left to be done = 30 – 11 – 9 = 10 units, which is done by *A* working alone. So work done by *A* = (10 + 6 + 6) = 22 units. So percentage of work done by *A* = (22/30) × 100 = 73.33%.

41. Let the work = 30 units.

A does one unit per day, *B* does two units in one day whereas *C* does six units per day.

Work done by *A* and *B* in two days @ three units per day = 6 units.

Eight left work = 30 – 6 = 24 units.

Now all of them work together so work will be complete in $\frac{24}{2+1+6} = \frac{24}{9} =$ 2.66 days.

42. Let us represent Amit, Bipul and Charan by *A*, *B* and *C* respectively.

Let the total work = 60 units

Work done by *A*, *B* and *C* in one day = (60/4) = 15 units.

Work done by *A* in one day = (60/12) = 5 units.

Work done by *B* in one day = (60/15) = 4 units.

So work done by *C* in one day = (15 – 4 – 5) = 6 units.

Number of days taken by *C* to do the work = (60/6) = 10 days.

43. According to the question:

20 × 6 × 20 man-days = 20 × 10 × 20 (1)

Let 40 men working 5 hours a day require 'd' days to build a wall of length 40 meters, breadth 20 meters, height 10 meters.

$40 \times 5 \times d$ men-days = $40 \times 10 \times 20$ (2)

Equation (1)/Equation (2):

$\frac{20\times6\times20}{40\times5\times d} = \frac{20\times10\times20}{40\times10\times20}$ = 24 days.

44. If the efficiencies of one man and one boy be m and b respectively then according to the question: $12 \times (3m + 4b) = 10 \times (4m + 3b)$

$\Rightarrow 36m + 48b = 40m + 30b$

$\Rightarrow 4m = 18b$

$\Rightarrow 2m = 9b$

$\therefore 4m + 3b = 18b + 3b = 21b$

Total work = $210b$.

Two men and three boys = 9 boys and 3 boys = 12 boys. Hence, total days required = 210/12 = $17\frac{1}{2}$ days.

45. $10m = 20w = 40c$

$1m = 2w = 4c$

$1w = 2c$

$\therefore 5m + 5w + 5c = 20c + 10c + 5c = 35c$

Let five men, five women and five children can do the work in 'd' days.

$\Rightarrow 40 \times 7 = 35 \times d$

$\Rightarrow d = \frac{40 \times 7}{35}$ = 8 months. But, this is the time for the total work.

To do, half the work, the required time = 4 months.

46. Let total work be 24 units.

Aliya = 24/8 = 3 units per hour and Deepika = 24/12 = 2 units per hour.

1st hour = 2 units, 2nd hour = 3 units. i.e. in 2 hours 5 units are completed.

In 8 hours, 20 units are completed.

In 9 hours, 22 units get completed (Since, Deepika would be working in the 9th hour). In the 10th hour, Aliya would complete the work in 2/3 hours.

Total work gets completed in $9\frac{2}{3}$ hours. Hence, option (a) is correct.

47. If Aliya starts the job, in 9 hours work completed will be 23 units.

So total time taken in this case will be = $9\frac{1}{2}$ hours Required difference = 2/3 – 1/2 = 1/6 hours.

48. Efficiencies of *A*, *B* and *C* be 200/10, 200/20, 200/25 or 20, 10, 8 boxes per hour.

The defect in their production is 10%, 20% and 12.5% respectively.
Hence, usable boxes production are 18, 8, 7 boxes per hour.
Total boxes per hour = 18+ 8+ 7= 33 boxes per hour.Hours required = 660/33 = 20 Hours

49. Let the total units be 100.

A = 10 units/day

B = 5 units/day

C = 4 units/day

Combined efficiency = 10 + 5 + 4 = 19 units per day.

After two days, 38 units work get completed.

In the next three days, 27 units get completed. Thus, after five days, 38 + 27 = 65 units of the work is completed. This leaves 35 units of work to be done. This is done by A alone. He would take 35/10 = 3.5 days.

So A did = 35 + 20 = 55 units of the task

C = 20 units, B = 25 units.

Portion of work done by C = 20/100 = 1/5

50. A will get 55% of the amount = 55% of 5000 = ₹2750.

51. Let the efficiencies of 1 man and 1 boy are 'm' and 'b' respectively.

Total work = $12 \times (3m + 4b) = 10 \times (4m + 3b)$
$18b = 4m$ or $1m = 4.5b$

Total work = $12 \times (3m + 4b) = 12 \times (13.5b + 4b) = 210b$. This work has to be done by 1 man and 1 boy = 4.5 boys and 1 boy = 5.5 boys. Time required = $\frac{210}{5.5} = \frac{420}{11} = 38\frac{2}{11}$

52. Let the total units of work be 80 (LCM of 10, 20, 40, 80) units.

Efficiencies: A = 80/10 = 8, B = 80/20 = 4, C = 80/40 = 2, D = 80/80 = 1

According to the question:

Work done by *B* in 1 hour = 40/3 units.

Required fraction = (40/3)/200 = 1/15

54. Let the total work be 24 units (LCM of 4, 6, 12, 24).

Efficiencies of: man = 24/4 = 6 units a day, woman = 24 /6 = 4 units a day, boy = 24/12 = 2 units a day and girl = 24/24 = 1 units a day.

In one day, a man, a woman and a boy can do 12 units.The remaining 12 units can be done by 12 girls in that same day.

55. Let total work be 200 (LCM of 25 and 40).Efficiency of *A* = 200/25 = 8 and *B* = 200/40 = 5

Total work done in first three days = 8 + 5 = 13 units. In 45 days, 13 × 15 = 195 units were done.

On 46th day, *A* works and he would take 5/8 of the 46th day to complete the work. Hence, the work gets done in $45\frac{5}{8}$ days.

56. Let the efficiency of one worker be '*w*'. Let the number of days in which 600 men will dig 140 × 80m pond be '*d*'.

$100 \times 70 = 500 \times 36 \times w$ (1)

$140 \times 80 = 600 \times d \times w$ (2)

$$\frac{\text{Equation 1}}{\text{Equation 2}}:$$

$$\frac{100\times 70}{140\times 80}=\frac{500\times 36\times w}{600\times d\times w} \text{ or } \frac{5}{8}=\frac{30}{d} \text{ or } d = 48 \text{ days}$$

57. Let the wages of one man and one woman are ₹m and ₹w respectively, per day.

$7 \times (7m + 3w) = 11900$ (1)

$7 \times (4m + 3w) = 7700$ (2)

On solving the above two equations, we get: m = ₹20, w = ₹10.

Daily wage of man = ₹20

58. Let the efficiency of one woman be 'w' units of work per hour.

Total work = $30 \times 5 \times w = 150w$

Total work done by five women in 16 hours

$= 16 \times 5w = 80w$

Remaining work = $150w - 80w = 70w$

Required time to finish the remaining work = $70w/3 = 23.33$

Total time taken to finish the work = 23.33 + 16 = 39.33 hours.

59. $A + V + S = 1$ (1)

$A + V = 19/23$

$V + S = 8/23$

$\rightarrow A + 2V + S = 27/23$ (2)

(2)–(1) gives us: $V = 4/23$

60. Interpret the starting statement as: Anmol takes 30 days and Vinay takes 90 days. Hence, the answer will be obtained by:

$(1/30 + 1/90) * n = 1$

Alternatively, you can also solve using percentages as: 3.33 + 1.11 = 4.44% is the daily work. Hence, the number of days required is 100/4.44 = 22.5 days.

61. After 27 days, food left = 4 × 200 = 800 soldier days worth of food. Since, now there are only 80 soldiers, this food would last for 800/80 = 10 days. Number of extra days for which the food lasts = 10 – 4 = 6 days.

62. $(A + B)$'s work = C's work.

Also if A takes 'a' days

B would take '$a - 5$' days

and C would take '$a - 9$' days

Solving through options, option 'c' fits.

A (15 days) → A's work = 6.66%

B (10 days) → B's work = 10%

C (6 days) → C's work = 16.66%

63. $(A + B) = 2C$

Also, $(A + C) = 3B$

$36(A + B + C) = 1$

Solving for C, we get:

$36\ (2C + C) = 1 \rightarrow 108C = 1$

$C = 1/108$

Hence, C takes 108 days.

64. Without the leak:

Rate of work = 20% + 5% = 25%. Thus, it would have taken four hours to complete the work.

Due to the leak the filling gets delayed by one hour. Thus, the tank, gets filled in 5 hours. This means that the effective rate of filling would be 20% per hour. This means that the rate at which the leak empties the tank is 5% per hour and hence, it would have taken 20 hours to empty a filled tank.

65. *A* is twice fast as *B*, therefore, *B* can complete the job in eight days. Similarly, *C* can complete the job in 16 days. Therefore, together they can complete the job in $\frac{1}{\frac{1}{4}+\frac{1}{8}+\frac{1}{16}}=\frac{16}{7}=2.29$ days.

Alternately, you could have solved this using percentages. *A*'s work for one day = 25%, *B*'s work for one day = 12.5%, while *C*'s work for one day would be = 6.25%. Thus, the total work of *A*, *B* and *C* for one day would be = (25 + 12.5 + 6.25)% = 43.75%. Hence, they would complete the work in 100/43.75 = 400/175 = 16/7 days = 2.29 days.

Level of Difficulty (II)

1. $25(n-12) = 21n + 300$. Solving this equation, $n = 150$. Hence, the first company manufactured $21 \times 150 = 3150$ shirts.

2. Start from the options to find the number of planned days. Suppose we check for 300 metres per day, the work would have been completed in 9 days as per the original plan. In the new scenario:

$300 \times 3 + 380 \times 5 = 2800$. Hence, this option is correct.

3. Time required to fill the tank = $\frac{3/4}{\frac{1}{a}-\frac{1}{b}} = \frac{3ab}{4(b-a)}$

4. $n\left(\frac{1}{15}+\frac{1}{20}\right)+\frac{8}{15}=1$

5. Let the total work be seven units. Anil does 4 units of work in four hours. His efficiency would be one unit per hour. Bimal's efficiency is double the efficiency of Anil and hence, his efficiency would be two units per hour. Work left for Bimal to do after Anil completes four units of work = 3 units. Time taken = 3/2=1.5 hours.

Solutions for Questions 6 to 10:

Set *A* can fill 10% in an hour. Hence, every pipe of set *A* can do 2% work per hour. Set *B* has a filling capacity of 3% per hour (or 0.3% per hour for each pipe in set *B*). Set *C* has a capacity of emptying the tank at the rate of 5% per hour and each tap of set *C* can empty at the rate of 5/12% per hour.

6. If all the 27 pipes are opened per hour, rate will be:

   5 × 2 + 10 × 0.3 – 12 × 5/12 = 8% per hour. So the tank will be filled in 100/8 = 12.5 hours. Option (b) is correct.

7. Per hour rate = 4 + 1.5 – 5 = 0.5% per hour.

   Hence, required time to fill 10% of the tank would be 10/0.5 = 20 hours. Hence, Option (d) is correct.

8. Per hour rate = 10 + 3 – 2.5 = 10.5% per hour.

   Hence, required time to fill 21% of the tank would be 21/10.5 = 2 hours. Hence, Option (b) is correct.

9. Per hour rate = – 2.5% per hour.

   Hence, required time to empty 50% of the tank would be 50/2.5 = 20 hours. Hence, Option (c) is correct.

10. Per hour rate = (10 + 2) + (3 + 0.3) – 5 × 1.2 = 9.3% per hour

    Required time to finish the remaining 93% of the work = 93/9.3 = 10 hours. Hence, the tank would be 93% filled by 10.08 PM.

11. Let the efficiency of Dilbeer = 100 units per day. In five days, Dilbeer would do 500 units of work. Balbir takes four days to do the same work. Hence, the efficiency of Balbir = 500/4 = 125 units per day. Also, efficiency of Aman is twice the efficiency of Balbir = 125 × 2 = 250.

    Total work = 10 × (100 + 125 + 250) = 4750 units of work.

    Time taken by Balbir to do all the work himself = 4750/125 = 38 days. Hence, option (a) is correct.

12. Let the total work by equal to 72 units. The pipes do 6 and 4 units of work per hour respectively. Thus, the pipes would do 10 units of work per hour and should complete the work in 7.2 hours or 7 hours 12 minutes. However, due to the leak the time taken is 8 hours. In 8 hours, the pipes would fill 10 × 8 = 80 units and therefore the leak would take out 8 units.

    Thus, the leak is operating at 1 unit leakage per hour. It will take 72 hours to empty a full tank.

13. The outlet pipe will empty the tank at a rate, which is triple the rate of filling (Hence, 30 gallons per minute). If the inlet is shut off, the tank will get emptied of 80 gallons of water in 80/30 = 2.67 minutes.

14. If the outlet flow rate is tripled and taps opened the tank never gets filled up or emptied: it means that if we triple the outlet flow rate, it would be equal to the inlet flow rate. Thus, the outlet tap flow rate is 1/3 of the inlet flow rate.

    By checking the options, we get that for outlet flow rate 20 litres per minute and inlet flow rate of 60 litres per minute, the tank of 1000 litres capacity will be filled within 25 minutes.

15. *X* completes the task in six days. *Y* takes four days to complete the task, *Z* takes three days to complete the task. Let the total work be 12 units. Then, their respective efficiencies are: *X* = 2 units per day; *Y* = 3 units per day and *Z* = 4 units per day. In one hour, they would do 9 units of work (2 + 3 + 4). The remaining work would be 3 units. *Y*, at his rate of working would take one day to complete the work.

16. *A* takes six days to complete the work

    B takes five days to complete the work

    C takes four days to complete the work. Assume the total work to be 60 units. The respective work rates for *A*, *B* and *C* would be 10, 12 and 15 units per day. In one day, they would complete 10 + 12 + 15 = 37 units of work. Work left = 60 – 37 = 23 units of work. This has to be done by *B* alone. He would take: 23/12 days.

17. The per day digging of all three combined is 30 metres. Hence, their average should be 10. This means that the first should be 10 – *x*, the second, 10 and the third 10 + *x*.

The required conditions are met if we take the values as 5, 10 and 15 metres for the first, second and third diggers, respectively. Hence, (a) is the correct answer.

18. Let the efficiencies of Aman, Baman and Chaman be A, B and C respectively.

$(A + B + C)$ = Total work

From this point, it is better to solve through options. Option (c) gives the correct answer based on the following thought-process.

If c = 50% work per hour, it means C takes two hours to complete the work.

Consequently, A would take three hours and hence, do 33.33% work per hour.

Since, $A + B + C$ = 100%, this gives us B's hourly work rate = 16.66%.

For this option to be correct, these numbers should match the second instance and the information given there.

According to the second condition:

$A + 4B$ should be equal to 100%. Putting A = 33.33% and B = 16.66%, we see that the condition is satisfied. Hence, this option is correct.

19. Let the efficiencies of Ashu and Ben be A and B respectively.

As there is no change in time taken to finish the job after changing the efficiencies, so: It means that when Ashu starts working slower (at 2/3 of his normal rate), the reduction in his output over ten days, is compensated by Ben working faster (at 1.5 times his normal rate). This means that:

$$\frac{A}{3} = 0.5 \times B \rightarrow B = \frac{2A}{3}$$

(**Note:** When Ashu works at 2/3rd of his rate, it means that he does 1/3rd work less than his normal rate, while when Ben works at 1.5 times his rate, he would be doing half his original work as extra work.)

Total work = 10(A + B) OR $10 \times (A + \frac{2A}{3}) = 50A/3$

Total time taken by Ashu to finish the work alone = (50A/3)/A = 50/3 days

20. If the time taken by the first boy and the girl is 1 hour (100% work per hour), the time taken by the second boy would be four hours (25% work per hour). In such a case, the total time taken by all three to complete the task would be 100/125 = 0.8 hours. But this value is not there in the options. Hence, we reject this set of values.

    If the time taken by the first boy and the girl is two hours (50% work per hour), the time taken by the second boy would be five hours (20% work per hour). In such a case, the total time taken by all three to complete the task would be 100/70 = 10/7 hours. But this value is not there in the options. Hence, we reject this set of values.

    If the time taken by the first boy and the girl is three hours (33.33% work per hour), the time taken by the second boy would be six hours (16.66% work per hour). In such a case, the total time taken by all three to complete the task would be 100/50 = 2 hours. Since this value is there in the options, we should try to see whether this set of values meets the other conditions in the question.

In this case, it is given that the first boy working alone takes as much time as the second boy and the girl. Since, the work of all three is 50%, this means that the work of the first boy is 25%. Consequently, the work of the girl is 8.33%.

Looking at the third condition given in the problem – the time taken by the first boy to do the work alone (at 25% per hour he would take four hours) should be 8 hours less than double the time taken by the second boy. This condition can be seen to be fulfilled here because the second boy would take six hours to complete his work (at 16.66% per hour) and hence, double his time would be 12 hours— which satisfies the difference of eight hours.

Thus, the total time taken is two hours.

21. Let the efficiency of first person be 'x' pages per minute and the efficiency of the second person be 'y' pages per minute.

$7.5 \times (x + y)$ = Total work

$9x + 5y = \frac{3}{4} \times 7.5 \times (x + y) \rightarrow 13.5 \times x = 2.5 \times y \rightarrow y = 5.4 \times x$

Total work = $7.5 \times (x + y) = 7.5 \times (x + 5.4x) = 7.5 \times 6.4x = 48x$. At x pages per minute, the first person can do the entire project of typing in $48x/x$ = 48 minutes.

22. From the condition of the problem and a little bit of trial-and-error we can see that the first potter worked for four days and the second and third potters also worked for four days. As $4(A) + 4(B + C) = 4(A + B + C)$ and we know that $A + B + C = 80$ pitchers per day.

Thus, the first potter makes 20 pitchers in 4 days. To make 640 pitchers, he would take 128 days.

23. Let the efficiencies of one man and one woman be 'm' and 'w'.

Total work = $10 \times (4m + 3m)$

Let two men take 't' days. Then, we have $2 \times m \times t = 3w \times (t + 25) = 10 \times (4m + 3w)$

Now solve using options: If we try option (c), then we get that for m= 3w for which the above equation is true. Hence, Option (c) is correct.

24. Let the efficiencies of 'A' and 'B' are 'a' and 'b' respectively and the total work = W.

$$\frac{W}{a} - \frac{W}{a+b} = 9 \qquad (1)$$

$$\frac{W}{b} - \frac{W}{a+b} = 4 \qquad (2)$$

On solving equation 1 and 2, we get $b = 1.5a$.

Now check the options: For option (a): If A completed the work in 15 hours then $W = 15a$.

Put $W = 15a$ and $b = 1.5a$ in equations (1) and (2) that $W = 15a$ satisfies both equations (1) and (2). Hence, option (a) is correct.

25. Let the efficiencies of Alok, Biru and Charan be A, B and C respectively. According to the question, the three of them do 44% of the work in the first three days. This means, that in the remaining eight days A and B do 56% of the work. Thus, $A + B = 56/8 = 7\%$ work per day. On the first 3 days, C would do $44 - 7 \times 3 = 23\%$ of the work alone. This would be faster than the work done by A and B. Hence, C is the fastest worker and his

work rate is 23/3 = 7.66% of the work per day. Hence, he would complete 100% of the work in 100/7.66 = 300/23 days.

26. Let *A* make '*x*' questions per hour and *B* make '*y*' questions per hour. Then, according to the question:

$5x - 5y = 30$ or $x - y = 6$. From the second condition in the question, we have that:

$10 \times (x - 2) + 10 \times (y - 2) = 140$ (1)

On solving the above two equations we get: $x = 12$ and $y = 6$ questions per hour.

A makes a total of $5 \times 12 = 60$ questions in 5 hours.

27. Let the efficiency of the pump which is being used to fill the tank be '*x*' litres per hour and the other pump which is being used to empty the tank be '1.5*x*' litres per hour

$x \times t = 1.5x\,(t - 30)$

On solving the above equation, we get $t = 90$ minutes

$x \times t = 2700$ or $x = 30$ litres per minute. Hence, the delivery of the discharge pump would be $30 \times 1.5 = 45$ litres per minute.

Alternately, use options for this question as follows:

If the discharge pump delivers 45 litres per minute, then the filling pump delivers 45/1.5 = 30 litres per minute. Time taken for discharge = 2700/45 = 60 minutes, while time taken for filling = 2700/30 = 90 minutes. The required difference of 30 minutes can be seen happening here and hence, this option is correct.

28. The interpretation of the first statement is that A and B do 41.66 percent of the work per hour. From this point if we go through the options, Option (b) fits the situation as four hours per pipe means 25% percent work per hour. Consequently, this means that the other pipe did 16.66 percent work per hour. Suppose pipe A does 25% work per hour and pipe B does 16.66. Then, pipe A requires four hours to fill the tank by itself and pipe B requires six hours to do the same. According to the question, pipe B was kept open for two hours and pipe A was also kept open for two hours. In this situation, the total work-done would be 16.66 + 16.66 + 25 + 25 = 83.33%, which corresponds to 5/6 of the tank getting filled. Hence, this option is correct.

29. From the last statement, we know that since both the pipes would require 17 hours to fill the tank together, they would discharge 425/17 = 25 litres per hour together.

    From this point, try to fit the values from the options in order to see which one satisfies all the conditions.

    In the case of option (a): Second pipe open for 10 hours, first pipe open for 15 hours.

    When the interchange occurs: Second pipe open for 15 hours, first pipe open for 10 hours → gives us that the respective rates of the two pipes would be 3:4 (as the first pipe delivers half the amount of the second pipe — if it delivers 3 litres per minute, the second pipe would need to deliver 4 litres per minute).

    Thus, if the delivery of the first pipe is $3n$ litres per minute, the delivery of the second pipe would be $4n$ litres per minute. Then, in 10 hours of the second pipe and 15 hours of the first pipe, the total water would be

$85n$, which should be equal to the total water of the two pipes in 17 hours each. But in 17 hours each, the two pipes would discharge $17 \times 7n = 119n$. Thus, we reject this option.

In the case of option (c): Second pipe open for 15 hours, first pipe open for 20 hours.

When the interchange occurs: Second pipe open for 20 hours, first pipe open for 15 hours → gives us that the respective rates of the two pipes would be 2:3 (as the first pipe delivers half the amount of the second pipe- if it delivers 2 litre per minute the second pipe would need to deliver 3 litres per minute).

Thus, if the delivery of the first pipe is $2n$ litres per minute, the delivery of the second pipe would be $3n$ litres per minute. Then, in 15 hours of the second pipe and 20 hours of the first pipe, the total water would be $85n$, which should be equal to the total water of the two pipes in 17 hours each. In 17 hours each, the two pipes would discharge $17 \times 5n = 85n$. Thus, we realise that this is the correct option.

30. Let the capacity of the tank be LCM of (6, 8, 12) = 24 litres.

Let the inlets be A, B, C and D.

$A + B + C = 24/6 = 4$

$B + C + D = 3$

$A + D = 2$

Thus, $2A + 2B + 2C + 2D = 9$

and $A + B + C + D = 4.5$

→ 24/4.5 = 5 hours 20 minutes would be required to fill the tank completely.

31. Let the capacity of the tank be LCM of (24, 36, 72) = 72 litres.

    Efficiency of first tap = 72/24 = 3 litres per minute.

    Efficiency of second tap = 72/36 = 2 litres per minute.

    Efficiency of third tap = 72/72 = 1 litre per minute.

    Tank filled in the first two hours = 4 litres.

    Tank filled in the next four hours = 4 × (3 + 2 – 1) = 16 litres.

    Total tank filled after six hours = 4 + 16 = 20 litres. Volume unoccupied = 72 – 20 = 52 litres.

    Ratio of required volumes = 20/52 = 5/13

32. After six hours the remaining volume of the tank = 72 – 20 = 52 litres.

    Total time required to fill the remaining part of the tank = 52/(3 + 2) = 10.4 hours.

    Hence, total time required to fill the tank = 6 + 10.4 = 16.4 hours.

33. Let the total capacity of the tank be 120 litres:

    Efficiency of *X* = 12 litres/hr

    Efficiency of *Y* = 10 litres/hr

    Efficiency of *Z* = 15 litres/hr

    Time taken to fill the tank to 55% of its capacity (i.e. 66 litres) = 66/(10 + 12) = 3 hours.

    Remaining capacity of tank = 120 – 66 = 54 litres.

Time taken to fill the remaining tank = 54/(12 + 10 – 15) = 54/7 = $7\frac{5}{7}$ hours or 7 hours 43 minutes approximately.

Hence, the tank is filled up at 9:43 PM. A + B = 9 + 43 = 52.

34. The supervisor is expected to be back at 9:43 PM (approx). The assistant will open Z when 27.5% of the tank is filled (33 liters)

This would occur in 33/22 = 1.5 hours i.e. 12:30 PM. Time for which all three of X,Y and Z are open = 54/7 + 3/2 = 129/14 hours.

At a filling rate of 7 liters per hour when all three are open, it would fill 129 × 7/14 = 64.5 liters more. Total part of the tank filled when the supervisor comes back = 33 + 64.5 = 97.5 liters. On a total of 120 liters that would be 81.25%. So 18.75% of the tank is empty.

35. Let the efficiency of Charu be 100. Baman's efficiency = 120, Alok's efficieny = 150

Let Baman takes '*t*' days to finish the job. Alok will take '*t*-10' days to finish the work.

$120 \times t = 150 \times (t - 10)$

On solving, we get: $t = 50$.

Hence, total work = 120 × 50 = 6000

Work done by Alok in 10 days = 1500 units

Work done by Baman in 14 days = 1680 unit

Remaining work = 6000 – 1500 – 1680 = 2820 units.

Charu will finish the remaining work in 2820/100 = 28.20 days.

36. Let the capacity of the tank be 60 litres (LCM of 10, 15, 20).

Efficiency of X = 60/10 = 6 litres per minute

Efficiency of Y = 60/15 = 4 litres per minute

Efficiency of Z = 60/20 = 3 litres per minute

Reduced capacity of pipe X for first minute = 6/2 = 3 litres per minute

Reduced capacity of pipe Y for first minute = 4/2 = 2 litres per minute

Reduced capacity of pipe Z in first three minutes = 3/3 = 1 litre per minute

Total tank which is filled after four minutes = 1 × (3 + 2) + 3 × (6 + 4) + 3 × 1 + 1 × 3 = 41 litres.

Required fraction = (60 – 41)/60 = 19/60 of the tank is empty after 4 minutes.

37. After 4 minutes, 19 litres of the tank is empty, which can be filled in 15/(6 + 4 + 3) = 1.15 minutes.

Hence, the required time = 4 + 1.15 = 5.15 minutes.

38. Using the work equivalence method, we know that 1/5th of the work = 20 × 90 × 6 man hours.

Thus, the remaining work = 4 × 20 × 90 × 6. Since, this work has to be done in the remaining 40 days by working at 8 hours per day, the number of men required would be given by: (4 × 20× 90 × 6) ÷ (40 × 8) = 135 men. This means that we would need to hire 45 additional men.

39. Let the total work be 24, therefore efficiencies of A, B, C are 4, 3 and 2, respectively. To complete the work in minimum time, the most efficient

should start the work. So, A will start the work and B will follow him.

After two hours, total work done = 4 + 3 = 7 units.

After six hours, total work done = 3 × 7 = 21 units.

Remaining work = 24 – 21 = 3 units.

A will complete the remaining work in 3/4 hours.

Total time required to finish the work = 6 + 3/4 = 6.75 hours.

40. Let the efficiency of tap Y is 'a', then the efficiency of tap X must be '1.5a'.

Capacity of the tank = 40 (a + 1.5a) = 100a

Time taken by tap Y to fill the tank = 100a/a = 100 hours.