# Word Problems Based on Mathematics

# **NOTES**

In this chapter we will learn life problems related to mathematics.

# **Problems Based on Time and Work**

Time and work are always indirectly proportional.

:. A person can take a time to do any work  $\alpha \frac{1}{capability \ of \ person \ to \ do \ that \ work}$ 

Thus, we know that if a person have lot of capability to do a work, then he takes less time to do that work and if a person have less capability to do a work, then he takes more time to do that work.

Note: It is assumed that the person works at uniform rate until and unless specified.

# **Problems Based on Time and Distance**

Length of the path covered by an object is called distance. Speed is the distance travelled by an object in unit time.

$$\therefore \text{ Speed} = \frac{\text{distance}}{\text{time}}$$

Average speed is the ratio of the total distance and the total time taken by an object to cover that distance.

 $\therefore \text{ Average speed} = \frac{\text{total distance covered}}{\text{total time taken}}$ 

#### Note:

(a) When two trains are moving with velocities a km/hr and b km/hr respectively, then relative speed will be (where a > b)

- i. (a b) km/hr, if they are moving in same direction.
- ii. (a + b) km/hr, if they are moving in opposite direction.

(b) When the speed of boat in still water is a km/hr and speed of stream is b km/hr then

- i. speed in downstream = (a + b) km/hr.
- ii. speed in upstream = (a b) km/hr.

#### **Problems Based on Pipes and Cisterns**

Suppose three pipes A, B and C takes a, b and c hour respectively to fill/empty the cistern, then

(a) The part of the cistern filled/emptied by pipe A in  $1h = \frac{1}{2}$  similar for pipe B and C.

(b) The part of the cistern filled/emptied by A, B and C in  $1hr = \left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)part$ 

#### **Problems Based on Profit, Loss and Discount**

For these types of problems, formulas related to profit, loss and discount are given below:

- $\blacktriangleright \quad \text{Profit} = \text{S.P} \text{C.P.}$
- $\blacktriangleright$  Loss = C.P S.P.
- ➢ Profit/Loss % =  $\left(\frac{\text{Amount of profit/loss}}{\text{C.P.}} \times 100\right)$ %

► If profit is x%, then 
$$S.P. = \left(\frac{100 + x}{100}\right) \times C.P.$$

- ➤ If loss is y% then S.P. =  $\left(\frac{100 y}{100}\right) \times C.P$ .
- > If a person buys two articles at total cost of Rs. R and sells one at a loss of y% and other at a profit of x%, then

cost of one article = 
$$\frac{\text{C.P. of both} \times y}{x + y}$$
, cost of second article =  $\frac{\text{C.P. of both} \times x}{x + y}$   
**Note:** Resultant profit on getting two successive profits of  $x_1$ % and  $x_2$ % is  $\left(x_1 + x_2 + \frac{x_1x_2}{100}\right)$ %

#### **Problems Based on Alligation or Mixture**

When two or types of quantities of things are mixed, a mixture is produced. Alligation is a rule that helps us to find the proportion in which two or more ingredient of the given price must be mixed to produce a mixture at a given price.

# **Rule of Alligation**

 $\frac{\text{Quantity of cheaper ingredient}}{\text{Quantity of dearer ingredient}} = \frac{\text{CP of dearer - Mean price}}{\text{Mean price - CP of dearer}}$ 

**Note:** A vessel contains x litre of liquid A. From this vessel, y litre are withdrawn and replaced by y litre another liquid B. Next y litre of this mixture is withdrawn and replaced by y litre of liquid B. This operation is repeated times.

Then, 
$$\frac{\text{Quantity of liquid A left after } n^{\text{th}} \text{ operation}}{\text{Quantity of liquid A initially present}} = \left(\frac{x-y}{x}\right)^{n}$$

#### > Example:

Six women or four men can complete a piece of work in 24 days. 5n days will 3 women and 10 men together complete the same piece of work?

**Solution:** :: Six women = four men

$$\Rightarrow 4 \text{ men} = 6 \text{ women} \Rightarrow 10 \text{ men} = \frac{6}{4} \times 10 = 15 \text{ women}$$

 $\therefore$  10 men + 3 women = (15 + 3) women

$$\therefore$$
 Required number of days =  $\frac{6 \times 24}{18} = 8 \text{ days}$ .

# > Example:

A train covered a distance of 1235 KM in 19 hours. Also, the average speed of a car is six-fifth the average speed of the train. How much distance will the car cover in 24 hours?

**Solution:** Average speed of the train 
$$=\frac{1235}{19} = 65 \text{ km}/\text{hr}$$
  
Speed of the car  $=\frac{6}{5} \times 65 = 78 \text{ km}/\text{hr}$ 

Required distance =  $78 \times 24 = 1872 \ km$ .

# > Example:

Mr. Smith purchased 100 of an article at the rate of Rs. 480 per piece. He then listed the price so as to gain a profit of 25%. While the articles, he a discount of 5%. Find the percentage of profit in the deal.

(a) 16.85%	(b) 18.75%
(c) 20.25%	(c) 25%

(e) None of these

**Ans.** (b)

**Explanation:** Profit percent = 
$$\left(x + y + \frac{xy}{100}\right)\%$$

$$= \left(25 - 5 - \frac{25 \times 5}{100}\right)\% = 18.75\%$$