

## SIMPLE INTEREST

## 11.1 TERMS USED

1. **Simple Interest :**

It is the money, which the lender gets from the borrower, in consideration of the sum (money borrowed) used by the borrower.

The **simple interest** (S.I.) and the **interest** (I) mean the same.

2. **Principal (P) :**

It is the sum (money) which the lender gives to the borrower.

3. **Rate or Rate of Interest (R) :**

It is the interest for a fixed period on every ₹ 100.

e.g. (i) Rate of interest is 18% per year means, on ₹ 100 the interest in one year is ₹ 18.

(ii) Rate is 1.5% per month means, the interest of one month on ₹ 100 is ₹ 1.5, i.e., ₹ 1.50.

4. **Time Period (T) :**

It is the time for which the sum (principal) is borrowed or lent.

1. Questions on interest involve four quantities : the Principal (P), the Rate of Interest (R), the Period (T) and the Interest (I) of that period.

And, all these are related to each other as :

$$\text{Interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} \quad \text{i.e.,} \quad I = \frac{P \times R \times T}{100}$$

2. The formula  $I = \frac{P \times R \times T}{100}$  can also be expressed as :

$$(i) \quad P = \frac{I \times 100}{R \times T}$$

$$(ii) \quad R = \frac{I \times 100}{P \times T}$$

$$(iii) \quad T = \frac{I \times 100}{P \times R}$$

5. **Amount (A) :**

It is the sum of the Principal and the Interest on it.

∴ Amount = Principal + Interest i.e.,  $A = P + I$

**Example 1 :**

Find the amount of a loan of ₹ 3,000 at 4% per year and for 5 years.

**Solution :**

Given; P = ₹ 3,000, R = 4% and T = 5 years.

$$\therefore \text{Interest, } I = \frac{P \times R \times T}{100} = ₹ \frac{3,000 \times 4 \times 5}{100} = ₹ 600.$$

$$\text{And, Amount} = P + I = ₹ 3,000 + ₹ 600 = ₹ 3,600$$

(Ans.)

**Example 2 :**

Find the interest on ₹ 800 at 6 percent per month for 9 months.

**Solution :**

**Note :** Time is always taken according to the percentage rate, *i.e.*, if the rate is given per annum, *i.e.*, per year, the time must be taken in years and if the rate is per month, the time must be taken in months.

Since, in this example, Rate = 6% per month.

∴ Time should be taken in months.

Now, P = ₹ 800, R = 6% per month and T = 9 months.

$$\Rightarrow I = \frac{P \times R \times T}{100} = ₹ \frac{800 \times 6 \times 9}{100} = ₹ 432 \quad (\text{Ans.})$$

**Example 3 :**

Find the S.I. on ₹ 900 lent on August 10 and received back on October 22 of the same year, the rate being  $8\frac{3}{4}\%$  p.a. (per annum).

**Solution :**

$$\text{Given : } P = ₹ 900, R = 8\frac{3}{4}\% \text{ p.a.} = \frac{35}{4}\% \text{ p.a.}$$

$$T = \begin{array}{ccc} \text{August} & & \text{September} & & \text{October} \\ 21 & + & 30 & + & 22 \\ (31 - 10) & & & & \end{array}$$

$$= 73 \text{ days} = \frac{73}{365} \text{ years} = \frac{1}{5} \text{ years} \quad [\text{As rate is p.a.}]$$

$$\therefore \text{S.I.} = \frac{P \times R \times T}{100} = ₹ \frac{900 \times 35 \times 1}{100 \times 4 \times 5} = ₹ 15.75 \quad (\text{Ans.})$$

For finding time, the starting date is not included.

In example 2, given above, the starting date is 10th August. Therefore, from total number of days in August, 10 days are subtracted. But the last date, *i.e.*, October 22 is included.

**Example 4 :**

- (i) What sum will earn an interest of ₹ 480 in 3 years, at 16% per year ?
- (ii) In what time will ₹ 2,100 fetch an interest of ₹ 525 at 5% p.a. ?
- (iii) At what rate percent per year will a sum of money double itself in 10 years ?

**Solution :**

(i) Given : I = ₹ 480, T = 3 years and R = 16%

$$\therefore \text{Sum (P)} = \frac{I \times 100}{R \times T} = ₹ \frac{480 \times 100}{16 \times 3} = ₹ 1,000 \quad (\text{Ans.})$$

(ii) Given : P = ₹ 2,100, I = ₹ 525 and R = 5%

$$\therefore \text{Time (T)} = \frac{I \times 100}{P \times R} = \frac{525 \times 100}{2,100 \times 5} \text{ years} = 5 \text{ years} \quad (\text{Ans.})$$

(iii) Given :  $P = ₹ 100, A = ₹ 200$

Then,  $I = ₹ 200 - ₹ 100 = ₹ 100$

$$\therefore \text{Rate\% (R)} = \frac{I \times 100}{P \times T} = \frac{100 \times 100}{100 \times 10} = 10\% \quad (\text{Ans})$$

**Example 5 :**

What sum of money will amount to ₹ 992 at 4% in 6 years ?

**Solution :**

Let the sum (principal) be ₹ 100.

$$\therefore \text{Interest} = \frac{P \times R \times T}{100} = ₹ \frac{100 \times 4 \times 6}{100} = ₹ 24$$

And, amount (A) =  $P + I = ₹ 100 + ₹ 24 = ₹ 124$

$$\therefore \text{When } A = ₹ 124; \quad P = ₹ 100 \quad [\text{Applying Unitary method}]$$

$$\Rightarrow \text{When } A = ₹ 992; \quad P = ₹ \frac{100}{124} \times 992 = ₹ 800 \quad (\text{Ans.})$$

**Alternative Method :**

$$A = P + I \Rightarrow A = P + \frac{P \times R \times T}{100} \quad \text{i.e.} \quad ₹ 992 = P + \frac{P \times 4 \times 6}{100}$$

$$\Rightarrow ₹ 992 = \frac{100P + 24P}{100} \quad \text{i.e.} \quad ₹ 992 \times 100 = 124P$$

$$\Rightarrow P = ₹ \frac{992 \times 100}{124} = ₹ 800 \quad (\text{Ans.})$$

**Example 6 :**

How long will it take ₹ 1,500 to become ₹ 2,040 at 8% per annum simple interest ?

**Solution :**

Given :  $P = ₹ 1,500; A = ₹ 2,040$  and  $R = 8\%$

$$\therefore I = A - P = ₹ 2,040 - ₹ 1,500 = ₹ 540$$

And, so,  $\text{Time (T)} = \frac{I \times 100}{P \times R}$

$$= \frac{540 \times 100}{1,500 \times 8} \text{ years} = \frac{9}{2} \text{ years} = 4 \frac{1}{2} \text{ years} \quad (\text{Ans.})$$

$$\begin{aligned} 4 \frac{1}{2} \text{ years} &= 4 \text{ years} + \frac{1}{2} \text{ year} \\ &= 4 \text{ years} + \frac{1}{2} \times 12 \text{ months} \\ &= 4 \text{ years} + 6 \text{ months} \\ &\text{or } 4 \text{ years and } 6 \text{ months} \end{aligned}$$

**Example 7 :**

A invests ₹ 8,000 and B invests ₹ 11,000 at the same rate of interest per annum. If at the end of 3 years, B gets ₹ 720 more interest than A; find the rate of interest.

**Solution :**

Let the rate of interest = R% per annum.

**For A :** P = ₹ 8,000 and T = 3 years

$$\begin{aligned}\therefore I &= \frac{P \times R \times T}{100} \\ &= \frac{\text{₹ } 8,000 \times R \times 3}{100} = \text{₹ } 240 R\end{aligned}$$

**For B :** P = ₹ 11,000 and T = 3 Years

$$\therefore I = \frac{\text{₹ } 11,000 \times R \times 3}{100} = \text{₹ } 330 R$$

Since, B gets ₹ 720 more interest than A

$$\therefore 330 R - 240 R = 720$$

$$\Rightarrow 90 R = 720 \text{ and } R = \frac{720}{90} = 8$$

$$\Rightarrow \text{Rate of interest} = 8\%$$

**(Ans.)****Alternative method :**

Since, A invests ₹ 8,000 and B invests ₹ 11,000

$\therefore$  B invests ₹ (11,000 – 8,000) = ₹ 3,000 more than A

$\Rightarrow$  Interest of 3 years on ₹ 3,000 = ₹ 720

$$\therefore \frac{3000 \times R \times 3}{100} = 720$$

$$\left[ \because \frac{P \times R \times T}{100} = I \right]$$

$$\Rightarrow 90 R = 720 \text{ and } R = \frac{720}{90} = 8$$

$$\therefore \text{Rate of interest} = 8\%$$

**(Ans.)****EXERCISE 11**

1. Find the S.I. and the amount on :

- (i) ₹ 150 for 4 years at 5% per year.
- (ii) ₹ 350 for  $3\frac{1}{2}$  years at 8% p.a.
- (iii) ₹ 620 for 4 months at 8 p per rupee per month.
- (iv) ₹ 3,380 for 30 months at  $4\frac{1}{2}$  % p.a.
- (v) ₹ 600 from July 12 to Dec. 5 at 10% p.a.
- (vi) ₹ 850 from 10th March to 3rd August at  $2\frac{1}{2}$  % p.a.
- (vii) ₹ 225 for 3 years 9 months at 16% p.a.

2. On what sum of money does the S.I. for 10 years at 5% become ₹ 1,600 ?
  3. Find the time in which ₹ 2,000 will amount to ₹ 2,330 at 11% p.a. ?
  4. In what time will a sum of money double itself at 8% p.a.
  5. In how many years will ₹ 870 amount to ₹ 1,044, the rate of interest being  $2\frac{1}{2}$  % p.a. ?
  6. Find the rate percent, if the S.I. on ₹ 275 in 2 years is ₹ 22.
  7. Find the sum which will amount to ₹ 700 in 5 years at 8% p.a.
  8. What is the rate of interest, if ₹ 3,750 amounts to ₹ 4,650 in 4 years ?
  9. In 4 years, ₹ 6,000 amounts to ₹ 8,000. In what time will ₹ 525 amount to ₹ 700 at the same rate ?
  10. The interest on a sum of money at the end of  $2\frac{1}{2}$  years is  $\frac{4}{5}$  of the sum. What is the rate percent ?
  11. What sum of money lent out at 5% for 3 years will produce the same interest as ₹ 900 lent out at 4% for 5 years ?
  12. A sum of ₹ 1,780 becomes ₹ 2,136 in 4 years.  
Find : (i) the rate of interest.  
(ii) the sum that will become ₹ 810 in 7 years at the same rate of interest ?
  13. A sum amounts to ₹ 2,652 in 6 years at 5% p.a. simple interest.  
Find : (i) the sum  
(ii) the time in which the same sum will double itself at the same rate of interest.
  14. P and Q invest ₹ 36,000 and ₹ 25,000 respectively at the same rate of interest per year. If at the end of 4 years, P gets ₹ 3,080 more interest than Q; find the rate of interest.
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