CHAPTER 10

Simple and Compound Interest

Interest is the money paid by the borrower to the lender for the use of money but the interest calculated at principal borrowed known as simple interest and the interest calculated after addition of principal and interest known as compound interest.

Simple Interest

Interest is the amount paid by the borrower to the lender for using his money.

When the interest is calculated uniformly on the amount throughout the loan period, then that is simple interest. The amount on which simple interest is calculated is known as principal.

$$\mathbf{SI} = \frac{\boldsymbol{PTR}}{\mathbf{100}}$$

Here, SI → Simple Interest

$\boldsymbol{T} \rightarrow$ **Time**
$\boldsymbol{P} \rightarrow$ **Principal on which interest is calculated**
$\boldsymbol{R} \rightarrow$ **Rate**
Amount $(\boldsymbol{A}) = \boldsymbol{P} + \mathbf{SI}$

Compound Interest

It is the interest calculated on a sum of money which includes principal and interest calculated for previous year. The SI and CI for first year is same and for second and subsequent years differ by an amount which is arrived by calculating interest on interest for previous years.

-When Interest added half yearly and time, rate is given in yearly, then time becomes double and rate becomes half.

-When time and rate is given in yearly and interest added quarterly, then rate becomes $1/4$ of yearly rate and times becomes four times of yearly.

The following table will illustrate the conceptual working of simple interest and compound interest. Rate of interest per annum is 10%

For the year	Simple Interest		Compound Interest	
	Principal	SI	Principal	CI
1	1000	100	1000	100
2	1000	100	$1000 + 100 = 1100$	110
3	1000	100	$1100 + 110 = 1210$	121

On the basis of above calculation

It is clear that

(i) Simple interest for each year is constant.

(ii) Compound interest calculated for each year includes-simple interest on principal and simple interest on interest calculated for previous year.

Important Tips/Formulae

- Let principal $= ₹P$, Rate $= R\%$ per annum, Time $= nyr$

(i) When interest is compounded annually, then

$$\textbf{Amount} = \boldsymbol{P\left(1+\frac{R}{100}\right)^{n}}$$

Difference between Cl and SI for $2\text{yr} = \boldsymbol{\frac{P\times r^2}{(100)^2}}$

Difference between Cl and SI for $3\text{yr} = \boldsymbol{\frac{P\times r^2(300+r)}{(100)^3}}$

(ii) When interest is annually and rate of interest be $R_1\%$ during 1 st year, $R_2\%$ during 2 nd year, $R_3\%$ during 3 rd year

$$\textbf{Amount } = \boldsymbol{P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)}$$

(iii) When interest is half-yearly Amount $= \boldsymbol{P\times\left(1+\frac{R}{2\times100}\right)^{2n}}$

(iv) When interest is quarterly= $\textbf{Amount} = \boldsymbol{P\times\left(1+\frac{R}{4\times100}\right)^{4n}}$

Solved Examples:

1. A sum doubles in 20yr at simple interest. How much is the rate?

(a) 5% per annum
(c) 5.5% per annum
(b) 8% per annum
(d) 8.5% per annum

Sol. (a) Let sum $= P$

Then, amount $= 2P$, $\text{SI} = 2P - P = P$

$$\therefore\ R = \frac{\text{SI}\times 100}{P\times T}$$
$$= \frac{P\times 100}{P\times 20}$$

$R = 5\%$ per annum

2. Find simple interest on ₹4800 at 8% per annum for 10 months.

(a) ₹ 400
(b) ₹ 420
(c) ₹320
(d) ₹ 510

Sol. (c) $P = ₹4800, R = 8\%$ per annum,

$$T = \frac{10}{12}\text{yr} = \frac{5}{6}\text{yr}$$

$$\therefore \text{ SI} = \frac{P \times R \times T}{100} = \frac{4800 \times 8 \times 5}{6 \times 100} = ₹320$$

3. The simple interest on a certain sum of money for $2\frac{1}{3}$ yr at $8\frac{1}{3}\%$ per annum is ₹560. Then, find the sum.

(a) ₹ 2880
(b) ₹ 2800
(c) ₹ 8880
(d) ₹ 8280

Sol. (a) Let the sum be ₹ x. Then,

$$x \times \frac{25}{3} \times \frac{1}{100} \times \frac{7}{3} = 560 \Rightarrow x \times \frac{7}{36} = 560$$

$$\Rightarrow x = \frac{560 \times 36}{7} = 2880 \Rightarrow x = ₹2880$$

4. Find the compound interest on ₹10000 in 2yr at 4% per annum (p.a.), the interest being compounded half-yearly.

(a) ₹ 836
(b) ₹ 824.32
(c) ₹ 324
(d) ₹ 868

Sol. (b) Principal = ₹10000, Rate = 2% per half-year

Time = 2yr = 4 half-year

$$\therefore \text{ Amount} = \left[10000 \times \left(1 + \frac{2}{100}\right)^4\right]$$

$$= 10000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}$$

$$= ₹10824.32$$

$$\text{CI} = ₹10824.32 - 10000 = ₹824.32$$

Practice Questions

1. If a sum of money at simple interest doubles in 5yr, it will become 4 times in how many years?

(a) 18
(b) 16
(c) 15
(d) 20

2. A certain sum of money becomes ₹2250 at the end of 2yr and becomes ₹ 2625 at the end of 5yr. If the person receives only simple interest, then the rate of interest is

(a) 6.25%
(b) 5%
(c) 8%
(d) 6.5%

3. A sum was put at simple interest at a certain rate for 4yr. Had it been put at 3% higher rate it would have fetched ₹ 1440 more. Find the sum.

(a) ₹ 14400
(b) ₹ 11000
(c) ₹ 10000
(d) ₹ 12000

4. If the compound interest on a certain sum for 2yr at 4% is ₹102, what would be the simple interest at the same rate for 2yr ?

(a) ₹ 75
(b) ₹ 100.50
(c) ₹ 100
(d) ₹ 98

5. A sum of money amounts to ₹ 2240 at 4% per annum simple interest in 3yr. The interest on the same sum for 6 months at 3.5% per annum is

(a) ₹ 30
(c) ₹ 35
(b) ₹ 50
(d) ₹ 150

6. A sum of ₹ 8448 is to be divided between *A* and *B* who are respectively 18 and 19yr old, in such a way that if their shares be invested at 6.25% per annum compound interest, they will receive equal amounts on attaining the age of 21yr. The present share of *A* is

(a) ₹ 4225
(b) ₹ 4352
(c) ₹ 4096
(d) ₹ 4000

7. On a certain sum of money, the difference between the compound interest for a year, payable half-yearly, and the simple interest for a year is ₹180. If the rate of interest in both the cases is 10%, then the sum is

(a) ₹ 60000
(b) ₹ 72000
(c) ₹ 62000
(d) ₹ 54000

8. In a certain time, the ratio of a certain principal and the simple interest obtained from it are in the ratio 10: 3 at 10% interest per annum. The number of years the money was invested is

(a) 1
(b) 3
(c) 5
(d) 7

9. Find the simple interest due after 120 days for ₹ 4800 at 10%.

(a) ₹ 157.80
(b) ₹ 157
(c) ₹ 156.01
(d) ₹ 124.93

10. Find the rate of interest at which ₹100 becomes ₹ 200 in 10yr.

(a) 10%
(b) 15%
(c) 8%
(d) 17%

11. Rina borrows a loan of ₹1200 at simple interest and the number of years is equal to the rate per cent per annum and she give ₹ 432 as interest. Find the rate of interest.

(a) 3.6%
(b) 6%
(c) 18%
(d) Cannot be determined

12. A man took loan from a bank at the rate of 12% par annum simple interest. After 3yr he had to pay ₹ 5400 interest only for the period. The principal amount borrowed by him was

(a) ₹ 2000
(b) ₹ 10000
(c) ₹ 15000
(d) ₹ 20000

13. A sum of money at simple interest amount to ₹ 815 in 3yr and to ₹ 854 in 4yr. The sum is

(a) ₹ 650
(b) ₹ 690
(c) ₹ 698
(d) ₹ 700

14. The rate of interest is 6% per annum in a bank. If an interest of ₹ 1350 is to be earned in 5yr, then the amount of money deposited is

(a) ₹ 13500
(c) ₹ 5400
(b) ₹ 4500
(d) ₹ 4800

15. A man borrows ₹50000 at 4% compound interest per annum. Then, the total amount of money he has to pay after 2yr is

(a) ₹ 54080
(b) ₹ 50480
(c) ₹ 54000
(d) ₹ 54800

16. Sudha borrowed ₹ 400 from her friend at the rate of 12% per annum for $2\frac{1}{2}$yr. The interest and the amount paid by her were

(a) ₹ 140, ₹ 540
(b) ₹ 130, ₹ 530
(c) ₹ 125, ₹ 525
(d) ₹ 120, ₹ 520

17. The compound interest on a sum at the rate of 5% for 2yr is ₹ 512.50. The sum is

(a) ₹ 5200
(b) ₹ 4800
(c) ₹ 5000
(d) ₹ 5500

18. At what rate per cent compound interest, will ₹ 400 amount to ₹ 441 in 2yr?

(a) 4%
(b) 5%
(c) 6%
(d) 3%

19. Find the simple interest on ₹1600 at 6% per annum for 146 days.

(a) ₹ 42.50
(b) ₹ 30.60
(c) ₹ 38.40
(d) ₹ 40

20. Arun invests ₹10250 at 4% per annum simple interest to obtain a total amount of ₹ 12710. For how many years did he invest the sum?

(a) 6
(b) 8
(c) 5
(d) 4

21. The simple interest on ₹2000 for 7 months at 5 paise per rupee per month is

(a) ₹ 700
(b) ₹ 70
(c) ₹ 350
(d) ₹ 305

22. A certain sum is invested at simple interest. If it trebles in 10yr, what is the rate of interest?

(a) 18% per annum
(b) 20% per annum
(c) 22% per annum
(d) 25% per annum

23. A certain sum of money at simple interest amounts to ₹ 4320 in $2\frac{1}{2}$yr and to ₹ 4752 in 4yr. The rate of interest per annum is

(a) 8%
(b) $8\frac{1}{2}\%$
(c) $7\frac{1}{2}\%$
(d) 9%

24. A lent be ₹ 5000 to B for 2yr and ₹ 3000 to C for 4yr on simple interest at the same rate of interest and received ₹ 2200 in all from both as interest. The rate of interest per annum is

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

25. The simple interest on ₹7380 from 11 May, 1987 to 11 September, 1987 at 5% per annum.

(a) ₹ 123
(b) ₹ 103
(c) ₹ 200
(d) ₹ 223

26. A man invested $\frac{1}{3}$ of his capital at 8%, $\frac{1}{4}$ at 9% and the remainder at 10%. If his annual income is ₹ 1180, the whole capital is

(a) ₹ 9000
(b) ₹ 12000
(c) ₹ 15000
(d) ₹ 13500

ANSWERS

1.	(c)	**2.**	(a)	**3.**	(d)	**4.**	(c)	**5.**	(c)	**6.**	(b)	**7.**	(b)	**8.**	(b	**9.**	(a)	**10.**	(a)
11.	(b)	**12.**	(c)	**13.**	(c)	**14.**	(b)	**15.**	(a)	**16.**	(d)	**17.**	(c)	**18.**	(b)	**19.**	(c)	**20.**	(a)
21.	(a)	**22.**	(b)	**23.**	(a)	**24.**	(c)	**25.**	(a)	**26.**	(b)								

Hints & Solutions

1. Here, $n_1 = 2, t_1 = 5, n_2 = 4, t_2 = ?$

Using, $\frac{t_1}{t_2} = \frac{n_1 - 1}{n_2 - 1} \Rightarrow \frac{5}{t_2} = \frac{1}{3}$

$\Rightarrow\ t_2 = 15\text{yr}$

3. Let the principal be ₹P and rate of interest r% per annum. Then, according to question,

$$\frac{P \times (r+3) \times 4}{100} - \frac{P \times r \times 4}{100} = 1440$$

$\Rightarrow\ 4P + 12P - 4\text{Pr} = 1440 \times 100$

$\Rightarrow\ 12P = 1440 \times 100$

$\Rightarrow\ P = 120 \times 100$

$\Rightarrow\ P = ₹12000$

4. Let the principal be ₹ P.

According to question,

$$102 + P = P\left(1 + \frac{4}{100}\right)^2$$

$$\Rightarrow \quad 102 + P = P\left(\frac{26}{25}\right)^2$$

$$\Rightarrow \quad 102 + P = \frac{P \times 676}{625}$$

$$\Rightarrow \quad 102 = \frac{676P - 625P}{625}$$

$$\Rightarrow \quad 51P = 108 \times 625$$

$$P = ₹1250$$

Required single interest $= \frac{1250 \times 4 \times 2}{100} = ₹100$

5. If the sum be ₹ P, then

$$2240 - P = \frac{P \times 4 \times 3}{100}$$

$$\Rightarrow \quad 2240 = \frac{12P}{100} + P$$

$$\Rightarrow \quad 2240 = \frac{112}{100}P$$

$$\therefore \quad P = \frac{2240 \times 100}{112} = ₹2000$$

Now, required interest,

$$\text{SI} = \frac{Prt}{100} = 2000 \times \frac{7}{2} \times \frac{1}{2} \times \frac{1}{100} = ₹35$$

6. Let shares of A and B are ₹x and ₹ $(8448 - x)$, respectively.

Amount got by A after 3 yr

= Amount got by B after 2yr

$$x\left(1 + \frac{6.25}{100}\right)^3$$

$$= (8448 - x)\left(1 + \frac{6.25}{100}\right)^4$$

$$\Rightarrow \frac{x}{8448 - x} = 1 + \frac{6.25}{100}$$

$$\Rightarrow \quad \frac{x}{8448 - x} = 1 + \frac{1}{16} = \frac{17}{16}$$

$$\Rightarrow \quad 16x = 17(8448 - x)$$

$$\Rightarrow \quad 16x = 143616 - 17x$$

$$\Rightarrow \quad 33x = 143616$$

$$\therefore \quad x = ₹4352$$

7. Let the sum be ₹ P.

Compound interest

$$= P\left[\left(1+\frac{5}{100}\right)^2 - 1\right] = \frac{41}{400} \times P$$

and simple interest $= \frac{P \times 10 \times 1}{100} = \frac{1}{10} \times P$

Given, CI − SI = ₹180

$$\frac{41}{100} \times P - \frac{1}{10} \times P = 180$$

$$P = 180 \times 400 =$$

$$= ₹72000$$

8. Let time $= t$ yr

$\therefore$ $P = 10x$ and SI $= 3x$

$\because$ $\text{SI} = \frac{\text{Pr}\, t}{100}$

$$3x = \frac{10x \times 10 \times t}{100}$$

$t = 3$yr

9. Given, principal = ₹4800

Rate = 10%, Time = 120 days

$$\text{Simple interest} = \frac{P \times R \times T}{100}$$

$$= \frac{4800 \times 10 \times 120}{100 \times 365}$$

$$= ₹157.8$$

10. Principal = ₹100, Time = 10yr

Amount = ₹200,

Simple interest = 200 − 100 = ₹100

$$\text{Rate} = \frac{\text{SI} \times 100}{P \times T} = \frac{100 \times 100}{100 \times 10} = 10\%$$

11. Given, time = rate of interest = r

Then, $432 = \frac{1200 \times r \times r}{100}$

$\Rightarrow r^2 = \frac{432 \times 100}{1200}$

$\Rightarrow r^2 = 36$

$\Rightarrow r = \sqrt{36}$

$\therefore r = 6\%$

12. Let amount of loan = ₹x

Simple interest = $\frac{\text{Amount} \times \text{Rate} \times \text{Time}}{100}$

$5400 = \frac{x \times 12 \times 3}{100}$

$x = \frac{5400 \times 100}{36}$

$x =$ ₹15000

13. Let amount = ₹x

Let interest rate = $r\%$

Simple interest in 3yr,

$\Rightarrow 815 - x = \frac{x \times r \times 3}{100}$

Simple interest in 4yr

$\Rightarrow 854 - x = \frac{x \times r \times 4}{100}$

On dividing Eq. (i) by Eq. (ii),

$\Rightarrow \frac{815 - x}{854 - x} = \frac{3}{4}$

$\Rightarrow 3260 - 4x = 2562 - 3x$

$\therefore x =$ ₹ 698

14. Given, Rate = 6% per annum,

Time = 5yr

Interest = ₹1350

Let amount = ₹x

Then, Simple Interest

$$= \frac{\text{Amount} \times \text{Rate} \times \text{Time}}{100}$$

$$\Rightarrow 1350 = \frac{x \times 6 \times 5}{100}$$

$$\Rightarrow \frac{1350 \times 100}{30} = x$$

$$\Rightarrow x = 45 \times 100 = ₹4500$$

15. Given, Rate = 4%

Amount = ₹50000

Time = 2yr

Then, the total amount of money

$$= 50000\left(1 + \frac{4}{100}\right)^2$$
$$= 50000 \times \frac{26}{25} \times \frac{26}{25}$$
$$= 80 \times 676$$
$$= ₹54080$$

16. $\text{SI} = \frac{400 \times 5 \times 12}{2 \times 100} = ₹120$

$A = P + \text{SI}$

$= (400 + 120) = ₹\ 520$

17. $\text{CI} = P\left[\left(1 + \frac{R}{100}\right)^2 - 1\right]$

$$\Rightarrow 12.50 = P\left[\left(1 + \frac{5}{100}\right)^2 - 1\right]$$

$$\therefore P = \frac{512.50 \times 400}{41}$$

$= ₹5000$

18. $P = ₹400, A = ₹441, n = 2\text{yr}$

$R = ?$

$A = ?$ $\quad \left(1 + \frac{R}{100}\right)^n$

$$\Rightarrow \quad 441 = 400\left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \quad \frac{441}{400} = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \quad \left(\frac{21}{20}\right)^2 = \left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \quad \frac{21}{20} = \left(1 + \frac{R}{100}\right)$$

$$\Rightarrow \quad \frac{R}{100} = \frac{21}{20} - 1$$

$$\Rightarrow \quad \frac{R}{100} = \frac{1}{20}$$

$$\Rightarrow \quad R = 5\%$$

19. Here, $P = ₹1600, R = 6\%$ per annum and $T = \frac{146}{365}\text{yr}$

$$\therefore \text{SI} = \frac{P \times R \times T}{100}$$

$$= \left(1600 \times \frac{6}{100} \times \frac{146}{365}\right)$$

$$= \frac{192}{5}$$

$$= ₹38.40$$

20. $P = ₹10250, R = 4\%$ per annum, $\text{SI} = ₹(12710 - 10250) = ₹2460$

Now, $T = \frac{100 \times \text{SI}}{P \times R}$

$$= \frac{100 \times 2460}{10250 \times 4}$$

$$= 6\text{yr}$$

$$\therefore \ T = 6\text{yr}$$

21. SI on ₹ 1 for 1yr $= (5 \times 12)$ paise

SI on ₹ 100 for 1yr

$$= 60 \text{ paise}$$

$$= \left(\frac{60}{100} \times 100\right)$$

$$= ₹60$$

Now, $P = ₹2000$,

$R = 60\%$

and $T = \frac{7}{12}$ yr

$\therefore$ SI $= \left(\frac{2000 \times 60 \times 7}{100 \times 12}\right)$
$= ₹700$

22. Let the sum be $₹x$. Then,

SI $= ₹(3x - x) = ₹2x$

$\therefore \quad 2x = \frac{x \times R \times 10}{100}$

$\therefore \quad R = 20\%$ per annum

24. Suppose rate of interest per annum $= r\%$

According to the question, $\frac{5000\times2\times r}{100} + \frac{3000\times4\times r}{100} = 2200$

$\Rightarrow 100r + 120r = 2200$

$\Rightarrow 220r = 2200$

$\Rightarrow r = \frac{2200}{220}$

$= 10\%$

25. SI $= \frac{7380\times5\times1}{100\times3} = ₹123$

$\left(T = 4 \text{ months} = \frac{4}{12} = \frac{1}{3} \text{yr}\right)$

26. Let the capital be $₹x$.

Then, First capital $= ₹\frac{x}{3}$

Second capital $= ₹\frac{x}{4}$

Third capital $= ₹\left[x - \left(\frac{x}{3} + \frac{x}{4}\right)\right] = ₹\frac{5x}{12}$

$\therefore \left(\frac{x}{3} \times \frac{8}{100} \times 1\right) + \left(\frac{x}{3} \times \frac{9}{100} \times 1\right)$

$+ \left(\frac{5x}{12} \times \frac{10}{100} \times 1\right) = 1180$

$\Rightarrow \frac{2x}{75} + \frac{3x}{100} + \frac{x}{24} = 1180$

$\Rightarrow\ 16x + 18x + 25x = 600 \times 1180$

$\Rightarrow 59x = 600 \times 1180$

$\Rightarrow\ x = \dfrac{600 \times 1180}{59}$

$= 12000$

$\therefore$ Capital $= ₹12000$