

Simple and Compound Interest

INTEREST

Interest is the fixed amount paid on borrowed money.

The sum lent is called the **principal**.

The sum of the principal and interest is called the **amount**.

Interest is of two kinds :

- (i) Simple interest
- (ii) Compound interest

Simple Interest

When interest is calculated on the original principal for any length of time, it is called simple interest.

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

i.e. $S.I. = \frac{P \times R \times T}{100}$

- Principal (P) = $\frac{100 \times S.I.}{R \times T}$

- Rate (R) = $\frac{100 \times S.I.}{T \times P}$

- Time (T) = $\frac{100 \times S.I.}{P \times R}$

- If rate of simple interest differs from year to year, then

$$S.I. = P \times \frac{(R_1 + R_2 + R_3 + \dots)}{100}$$

- Amount = Principal + Interest

i.e. $A = P + I = P + \frac{PRT}{100} = P \left(1 + \frac{RT}{100} \right)$

Compound Interest

Money is said to be lent at compound interest when at the end of a year or other fixed period for which the borrower and the lender agree (called conversion period), the interest that has become due is not paid to the lender, but is added to the sum lent, and the amount thus obtained becomes the principal in the next year or period. The process is repeated until the amount for the last period has been given to the lender by the borrower. Hence, when the interest charged after a certain specified time period is added to just previous principal to form new principal for the next time period, the interest is said to be compounded and the total interest occurred is compound interest.

Note

The main difference between the simple interest and the compound interest is that the principal in the case of simple interest remains constant throughout the loan period where as in the case of compound interest, the principal changes periodically (i.e. after each conversion period) throughout the loan period.

(i) **Computation of Amount when Interest is Compounded Annually :**

- Amount (A) = $P \left(1 + \frac{r}{100} \right)^n$

Where A is the amount, P is the principle, r is the rate of interest in percent per conversion period, (Here conversion period = 1 years) and n is the number of conversion periods in the whose loan period.

When conversion period is one year, then in whole loan period, number of conversion periods equal to number of years in whole loan period.

i.e., $n = t$, where t is the whole loan period in years.

- $C.I. = A - P = P \left[\left(1 + \frac{r}{100} \right)^n - 1 \right]$

- If rate of compound interest differs from year to year, then

$$\text{Amount} = P \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right) \left(1 + \frac{r_3}{100} \right) \dots$$

(ii) **Amount When Interest is Compounded Half-yearly**

Rate per cent half-yearly = $\frac{r}{2}\%$ and $n = 2 \times t$ in years

Hence, $A = P \left(1 + \frac{r}{2 \times 100} \right)^n = P \left(1 + \frac{r}{200} \right)^{2t}$

(iii) **Amount When Interest is Compounded Quarterly**

Since 1 year has 4 quarters, therefore quarterly rate of interest = $\frac{1}{4}r$ and $n = 4t$

$$A = P \left(1 + \frac{r/4}{100} \right)^n = P \left(1 + \frac{r}{400} \right)^n$$

EXERCISE

- Anil invested an amount for three years at a simple interest rate of 9% p.a. He got an amount of ₹ 19,050 at the end of three years. What principal amount did he invest?
(a) ₹14,500 (b) ₹11,050
(c) ₹1,440 (d) ₹10,950
(e) None of these
- What will be the compound interest on an amount of ₹ 5,000 for a period of 2 years at 8% p.a?
(a) ₹ 840 (b) ₹ 400
(c) ₹ 823 (d) ₹ 416
(e) None of these
- What is the interest received on a principal of ₹ 450 for 2 years if the interest received on ₹ 1 after four years at the same rate of simple interest is ₹ 0.40?
(a) ₹ 90 (b) ₹ 180
(c) ₹ 36 (d) Cannot be determined
(e) None of these
- Ms. Sandhya deposits an amount of ₹ 31,400 to obtain a simple interest at the rate of 12 per cent per annum for 8 years. What total amount will Ms. Sandhya get at the end of 8 years?
(a) ₹ 31,444 (b) ₹ 61,544
(c) ₹ 41,544 (d) ₹ 31,144
(e) None of these
- What amount of compound interest can be obtained on the principal amount of ₹ 15800 at the rate of 6 per cent per annum at the end of 2 year ?
(a) ₹ 1,986 (b) ₹ 2,012.48
(c) ₹ 1,952.88 (d) ₹ 1,956
(e) None of these
- Sudhanshu invested ₹ 15,000 at interest @ 10% p.a for one year. If the interest is compounded every six months what amount will Sudhanshu get at the end of the year?
(a) ₹ 16,537.50 (b) ₹ 16,5000
(c) ₹ 16,525.50 (d) ₹ 18,150
(e) None of these
- Ms Suchi deposits an amount of ₹ 24,000 to obtain a simple interest at the rate of 14% p.a. for 8 years. What total amount will Ms Suchi get at the end of 8 years?
(a) ₹52080 (b) ₹28000
(c) ₹50880 (d) ₹26880
(e) None of these
- The simple interest accrued on an amount of ₹ 84,000 at the end of three year is ₹ 30,240. What would be the compound interest accrued on the same amount at the same rate in the same period?
(a) ₹ 30,013.95 (b) ₹ 31,013.95
(c) ₹ 32,013.95 (d) ₹ 33,013.95
(e) ₹ 34,013.95
- What will be the difference between the compound interest and simple interest at the rate of 5% p.a. on an amount of ₹ 4,000 at the end of two years?
(a) ₹ 10 (b) ₹ 20
(c) ₹ 30 (d) Data inadequate
(e) None of these
- If the compound interest accrued on an amount of ₹14,500 in two years is ₹ 4676.25, what is the rate of interest % p.a. ?
(a) 11 (b) 9 (c) 15 (d) 18
(e) None of these
- The compound interest accrued on an amount of ₹ 25,500 at the end of three year is ₹ 8,440.5. What would be the simple interest accrued on the same amount at the same rate in the same period?
(a) ₹ 4,650 (b) ₹ 5,650
(c) ₹ 6,650 (d) ₹ 7,650
(e) None of these
- The simple interest obtained on an amount of ₹ 45,000 at the end of 4 year is ₹ 15,300. What would be the approximate compound interest obtained on the same amount at the same rate of interest in the same period ?
(a) ₹ 18,244 (b) ₹ 18,544
(c) ₹ 16,285 (d) ₹ 18,566
(e) ₹ 17,364
- The simple interest accrued on a sum of certain principal is ₹ 1,200 in four year at the rate of 8% p.a. What would be the simple interest accrued on thrice of that principal at the rate of 6% p.a in 3 year?
(a) ₹ 2,025 (b) ₹ 3,025
(c) ₹ 2,250 (d) ₹ 2,150
(e) None of these
- A sum of money at compound interest doubles itself in 15 years. It will become eight times of itself in
(a) 45 years (b) 48 years
(c) 54 years (d) 60 years
- What annual payment will discharge a debt of ₹6,450 due in 4 years at 5% per annum simple interest ?
(a) ₹1,400 (b) ₹1,500
(c) ₹1,550 (d) ₹1,600
- In how many years will a sum of ₹ 800 at 10% per annum compound interest, compounded semi-annually becomes ₹ 926.10 ?
(a) $1\frac{1}{2}$ (b) $1\frac{2}{3}$ (c) $2\frac{1}{3}$ (d) $2\frac{1}{2}$
- In how many years will a sum of money double itself at $6\frac{1}{4}\%$ simple interest per annum?
(a) 24 years (b) 20 years
(c) 16 years (d) 12 years
- A sum of ₹ 12,000, deposited at compound interest becomes double after 5 years. How much will it be after 20 years ?
(a) ₹ 1,44,000 (b) ₹ 1,20,000
(c) ₹ 1,50,000 (d) ₹ 1,92,000
- The simple interest on a sum for 5 years is one fourth of the sum. The rate of interest per annum is
(a) 5% (b) 6% (c) 4% (d) 8%

20. Simple interest on a certain sum for 6 years is $\frac{9}{25}$ of the sum. The rate of interest is
 (a) 6% (b) $6\frac{1}{2}\%$ (c) 8% (d) $8\frac{1}{2}\%$
21. The sum invested in scheme B is twice the sum invested in scheme A. Investment in scheme A is made for 3 years at 8% p.a. simple interest and in Scheme B for 2 years at 9% p.a. simple interest. The total interest earned from both the schemes is ₹ 1800. How much was invested in Scheme A?
 (a) ₹ 4000 (b) ₹ 3500 (c) ₹ 3000 (d) ₹ 2500
 (e) ₹ 4500
22. The interest earned when ₹ 'P' is invested for four years in a scheme offering 9% p.a. simple interest is more than the interest earned when the same sum (₹ P) is invested for two years in another scheme offering 12% p.a. simple interest, by ₹ 360. What is the value of P?
 (a) 2000 (b) 3500 (c) 2500 (d) 4000
 (e) 3000
23. Srinivasan invests two equal amounts in two banks giving 10% and 12% rate of interest respectively. At the end of year the interest earned is ₹ 1650/-. Find the sum invested in each.
 (a) ₹ 8,500/- (b) ₹ 15,000/-
 (c) ₹ 7,500/- (d) ₹ 17,000/-
 (e) None of these
24. Radha invests certain sums in scheme A (for 6 years) and B (for 5 years) both offering simple interest. The sum invested in scheme B was 25% less than that in scheme A. The interests received from both the schemes are equal. If the interest offered by scheme A is 10% per annum what is the rate of interest (per annum) offered by scheme B?
 (a) 12% (b) 20% (c) 16% (d) 15%
 (e) 18%
25. A sum of money lent out at compound interest increases in value by 50% in 5 years. A person wants to lend three different sum x, y and z for 10, 15 and 20 years respectively at the above rate in such a way that he gets back equal sum at the end of their respective periods. The ratio x : y : z is
 (a) 6 : 9 : 4 (b) 9 : 4 : 6 (c) 9 : 6 : 4 (d) 6 : 4 : 9
26. Mohan lent some amount of money at 9% simple interest and an equal amount of money at 10% simple interest each for two years. If his total interest was ₹ 760, what amount was lent in each case?
 (a) ₹ 1700 (b) ₹ 1800 (c) ₹ 1900 (d) ₹ 2000
27. A person invests money in three different schemes for 6 years, 10 years and 12 years at 10 percent, 12 percent and 15 percent simple interest respectively. At the completion of each scheme. He gets the same interest. The ratio of his investment is
 (a) 6 : 3 : 2 (b) 2 : 3 : 4 (c) 3 : 4 : 6 (d) 3 : 4 : 2
28. With a given rate of simple interest, the ratio of principal and amount for a certain period of time is 4 : 5. After 3 years, with the same rate of interest, the ratio of the principal and amount becomes 5 : 7. The rate of interest is :
 (a) 4% (b) 6% (c) 5% (d) 7%
29. Out of ₹ 50,000, that a man has, he lends ₹ 8000 at $5\frac{1}{2}\%$ per annum simple interest and ₹ 24,000 at 6% per annum simple interest. He lends the remaining money at a certain rate of interest so that he gets total annual interest of ₹ 3680. The rate of interest per annum, at which the remaining money is lent, is:
 (a) 5% (b) 7% (c) 10% (d) 12%
30. Ram deposited a certain sum of money in a company at 12% per annum simple interest for 4 years and deposited equal amount in fixed deposit in a bank for 5 years at 15% per annum simple interest. If the difference in the interest from two sources is ₹ 1350 then the sum deposited in each case is :
 (a) ₹ 3000 (b) ₹ 4000
 (c) ₹ 6500 (d) ₹ 5000

Hints & Solutions

1. (e) Let the principal be = ₹x.
 \therefore Interest = (19050 - x)
 Now,

$$\text{Principal} = \frac{\text{Interest} \times 100}{\text{Time} \times \text{Rate}}$$

$$\Rightarrow x = \frac{(19050 - x) \times 100}{3 \times 9}$$

$$\Rightarrow 27x = 1905000 - 100x$$

$$\Rightarrow x = \frac{1905000}{127} = ₹15000$$

2. (e) Amount = Principal $\left(1 + \frac{\text{Rate}}{100}\right)^{\text{Time}}$

$$= 5000 \left(1 + \frac{8}{100}\right)^2 = 5000 \left(1 + \frac{2}{25}\right)^2$$

$$= 5000 \times \frac{27}{25} \times \frac{27}{25} = ₹5832$$

$$\therefore \text{CI} = ₹(5832 - 5000) = ₹832$$
3. (a) Interest on ₹ 1 in 4 years = ₹ 0.4
 \therefore Interest on ₹ 100 in 4 years = ₹ 40
 \therefore Interest on ₹ 100 in 1 year = ₹ 10

Hence, Rate = 10%

$$\begin{aligned} \therefore \text{Interest} &= \frac{\text{Principal} \times \text{Time} \times \text{Rate}}{100} \\ &= \frac{450 \times 2 \times 10}{100} = ₹ 90 \end{aligned}$$

4. (b) Simple Interest = $\frac{P \times R \times T}{100}$
 $\frac{31400 \times 8 \times 12}{100} = ₹ 30144$

$$\begin{aligned} \therefore \text{Required amount} &= ₹ (31400 + 30144) \\ &= ₹ 61544 \end{aligned}$$

5. (c) Compound Interest = $P \left[\left(1 + \frac{R}{100} \right)^T - 1 \right]$
 $= 15800 \left[\left(1 + \frac{6}{100} \right)^2 - 1 \right]$
 $= 15800 \times [(1.06)^2 - 1] = 15800 \times [1.1236 - 1]$
 $= 15800 \times 0.1236 = ₹ 1952.88$

6. (a) Required Amount

$$= 15000 \left(1 + \frac{5}{100} \right)^2 = ₹ 16537.50$$

7. (c) Required Amount = $24000 \left(1 + \frac{14 \times 8}{100} \right)$
 $= 24000 \times \frac{212}{100} = ₹ 50880$

8. (e) Rate = $\frac{30240 \times 100}{84000 \times 3} = 12\%$

$$\begin{aligned} \text{Compound interest} &= 84000 \left(1 + \frac{12}{100} \right)^3 - 84000 \\ &= 118013.95 - 84000 = ₹ 34013.95 \end{aligned}$$

9. (a) Simple interest = $\frac{4000 \times 5 \times 2}{100} = ₹ 400$

$$\begin{aligned} \text{Compound interest} &= 4000 \left(1 + \frac{5}{100} \right)^2 - 4000 \\ &= \frac{4000 \times 105 \times 105}{100 \times 100} - 4000 \\ &= 4410 - 4000 = ₹ 410 \end{aligned}$$

$$\therefore \text{Difference} = 410 - 400 = ₹ 10$$

 **Shortcut Approach**

$$D = \frac{4000 \times 5 \times 5}{100 \times 100} = 10$$

10. (c) $14500 \left(1 + \frac{r}{100} \right)^2 = 14500 + 4676.25$

$$\Rightarrow \left(1 + \frac{r}{100} \right)^2 = \frac{19176.25}{14500} = \frac{529}{400}$$

$$\Rightarrow \left(1 + \frac{r}{100} \right)^2 = \left(\frac{23}{20} \right)^2$$

$$\Rightarrow 1 + \frac{r}{100} = \frac{23}{20} \Rightarrow r = \frac{100 \times 3}{20} = 15\%$$

11. (d) $25500 \left(1 + \frac{r}{100} \right)^3 - 25500 = 8440.5$

$$\Rightarrow 25500 \left(1 + \frac{r}{100} \right)^3 = 8440.5 + 25500$$

$$\Rightarrow \left(1 + \frac{r}{100} \right)^3 = \frac{33940.5}{25500} = \frac{1331}{1000} = \left(\frac{11}{10} \right)^3$$

$$\Rightarrow \left(1 + \frac{r}{100} \right) = \left(\frac{11}{10} \right)$$

$$\Rightarrow r = \frac{100}{10} = 10\%$$

$$\therefore \text{S.I.} = \frac{25500 \times 10 \times 3}{100} = ₹ 7650$$

12. (e) Rate = $\frac{15300 \times 100}{45000 \times 4} = 8.5\%$

$$\therefore \text{Compound interest} = 45000 \left(1 + \frac{8.5}{100} \right)^4 - 45000$$

$$= 45000 \left\{ \left(\frac{108.5}{100} \right)^4 - 1 \right\}$$

$$= 45000 \times 0.3858 = ₹ 17364 \text{ (approx)}$$

13. (a) Principal = $\frac{1200 \times 100}{4 \times 8} = ₹ 3750$

Simple interest on thrice of that principal

$$= \frac{3750 \times 3 \times 6 \times 3}{100} = ₹ 2025$$

14. (a) $A = P \left(1 + \frac{R}{100} \right)^T$

$$2 = 1 \left(1 + \frac{\text{Rate}}{100} \right)^{15}$$

Cubing on both sides, we have

$$8 = 1 \left(1 + \frac{\text{Rate}}{100} \right)^{45}$$

Required time = 45 years

15. (b) Let the annual instalment be ₹x.

$$\therefore \left(x + \frac{x \times 3 \times 5}{100} \right) + \left(x + \frac{x \times 2 \times 5}{100} \right) + \left(x + \frac{x \times 1 \times 5}{100} \right) + x = 6450$$

$$\Rightarrow \frac{115x}{100} + \frac{110x}{100} + \frac{105x}{100} + x = 6450$$

$$\Rightarrow 115x + 110x + 105x + 100x = 6450 \times 100$$

$$\Rightarrow 430x = 6450 \times 100$$

$$\therefore x = \frac{6450 \times 100}{430} = ₹ 1500$$

16. (a) Rate = 10% per annum = 5% half yearly

$$A = P \left(1 + \frac{R}{100} \right)^T$$

$$\Rightarrow 926.10 = 800 \left(1 + \frac{5}{100} \right)^T$$

$$\Rightarrow \frac{9261}{8000} = \left(\frac{21}{20} \right)^T \Rightarrow \left(\frac{21}{20} \right)^3 = \left(\frac{21}{20} \right)^T$$

$$\therefore \text{Time} = 3 \text{ half years} = 1\frac{1}{2} \text{ years}$$

17. (c) $T = \frac{SI \times 100}{P \times R}$ (For double SI = P = x)

$$= \frac{x \times 100}{x \times \frac{25}{4}} = 16 \text{ year.}$$

18. (d) $A = P \left(1 + \frac{R}{100} \right)^T$

$$\Rightarrow 24000 = 12000 \left(1 + \frac{R}{100} \right)^5$$

$$\Rightarrow 2 = \left(1 + \frac{R}{100} \right)^5$$

$$\Rightarrow 2^4 = \left(1 + \frac{R}{100} \right)^{20} = 16 \text{ times}$$

so, the sum equal to 16 times in 20 years.

i.e. The sum amounts to ₹192000.

19. (a) $\frac{\text{Simple Interest}}{\text{Principal}} = \frac{1}{4}$

$$\therefore \text{Rate} = \frac{S.I. \times 100}{\text{Principal} \times \text{Time}}$$

$$= \frac{1 \times 100}{4 \times 5} = 5\% \text{ per annum}$$

20. (a) Let principle = x

$$\therefore \text{S.I.} = \frac{9x}{25}$$

$$\text{Rate} = \frac{SI \times 100}{\text{Principal} \times \text{Time}}$$

$$= \frac{9x}{25} \times \frac{100}{6 \times x} = 6\% \text{ per annum}$$

21. (c) Amount invested in scheme A = ₹x (let).

\therefore Amount invested in scheme B = ₹2x

$$\text{S.I.} = \frac{\text{Principal} \times \text{Time} \times \text{Rate}}{100}$$

According to the question,

$$\frac{x \times 3 \times 8}{100} + \frac{2x \times 2 \times 9}{100} = 1800$$

$$\Rightarrow \frac{24x + 36x}{100} = 1800 \Rightarrow 60x = 180000$$

$$\Rightarrow x = \frac{180000}{60} = ₹ 3000$$

22. (e) $\text{S.I.} = \frac{\text{Principal} \times \text{Time} \times \text{Rate}}{100}$

According to the question,

$$\frac{P \times 4 \times 9}{100} - \frac{P \times 2 \times 12}{100} = 360$$

$$\Rightarrow \frac{36P}{100} - \frac{24P}{100} = 360 \Rightarrow \frac{12P}{100} = 360$$

$$\Rightarrow P = \frac{360 \times 100}{12} = ₹ 3000$$

23. (c) Let sum be ₹x

According to the question,

$$\frac{x \times 10 \times 1}{100} + \frac{x \times 12 \times 1}{100} = 1650$$

$$22x = 1650 \times 100$$

$$x = \frac{1650 \times 100}{22} = ₹ 7500$$

24. (c) Let the investment in scheme A be ₹100

\therefore Investment in scheme B = ₹75

$$\text{S.I.} = \frac{\text{Principal} \times \text{Time} \times \text{Rate}}{100}$$

According to the question,

$$\frac{100 \times 10 \times 6}{100} = \frac{75 \times 5 \times R}{100}$$

$$\Rightarrow 75 \times 5 \times R = 1000 \times 6$$

$$\Rightarrow R = \frac{1000 \times 6}{75 \times 5} = 16\% \text{ per annum}$$

25. (c) According to the question,

$$\left(\frac{3}{2}\right)^2 x = \left(\frac{3}{2}\right)^3 y = \left(\frac{3}{2}\right)^4 z = k \text{ (let)}$$

$$\Rightarrow x = \left(\frac{2}{3}\right)^2 k, y = \left(\frac{2}{3}\right)^3 k \text{ and } z = \left(\frac{2}{3}\right)^4 k$$

$$\begin{aligned} \therefore x : y : z &= \left(\frac{2}{3}\right)^2 k : \left(\frac{2}{3}\right)^3 k : \left(\frac{2}{3}\right)^4 k \\ &= 1 : \frac{2}{3} : \left(\frac{2}{3}\right)^2 = 9 : 6 : 4 \end{aligned}$$

26. (d) Let the amount invested = ₹ P

According to the question,

$$\frac{P \times 9 \times 2}{100} + \frac{P \times 10 \times 2}{100} = 760$$

$$\frac{(18P + 20P)}{100} = 760$$

$$38P = 76000, P = 2000$$

27. (a) Let the principal in each case = 100 units

According to the question,

	I st part	II nd part	III rd part
Principal	→ 100 × 6	100 × 3	100 × 2
Rate %	→ 10	12	15
Time	→ 6	10	12
Interest	→ 60 × 6	120 × 3	180 × 2

Interest → Interest is same in each, so equal the interest.

Hence, required ratio of sum = 600 : 300 : 200 = 6 : 3 : 2

28. (c) Principal Amount Interest

4 × 5	: 5 × 5	→ diff. 1 × 5) + 3
5 × 4	: 7 × 4	→ diff. 2 × 4	

Note : Principal will be same so equate the principal.

Principal	Amount	Interest	
20	: 25	→ diff. 5) + 3
20	: 28	→ diff. 8	

Interest in 3 years = 3 units

Interest in 1 year = $\frac{3}{3} = 1$ unit

Required rate % = $\frac{1}{20} \times 100 = 5\%$

29. (c) Remaining amount

$$= 50,000 - (8000 + 24000) = ₹ 18000$$

Let rate of interest = R%

According to the question,

$$\frac{8000}{100} \times \frac{11}{2} \times 1 + \frac{24000 \times 6}{100} \times 1 + \frac{18000 \times R}{100} \times 1 = 3680$$

$$\frac{44000}{100} + \frac{144000}{100} + \frac{18000R}{100} = 3680$$

$$\frac{188000}{100} + \frac{18000R}{100} = 3680$$

$$\frac{18000R}{100} = 3680 - 1880$$

$$180R = 1800$$

$$R = 10\%$$

Hence, required rate % = 10%

30. (d) Difference between their rates he gained from both boys

$$\Rightarrow 15 \times 5\% - 12 \times 4\%$$

$$\Rightarrow 75\% - 48\%$$

$$\Rightarrow 27\% = 1350$$

$$\Rightarrow 100\% = ₹ 5000$$

(Given)