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**
$\textbf{Amount}\ (\boldsymbol{A}) = \boldsymbol{P} + \textbf{SI}$

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

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

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

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

(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

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

(iii) When interest is half-yearly Amount $= P \times \left(1+\frac{R}{2\times 100}\right)^{2n}$

(iv) When interest is quarterly= **Amount** $= P \times \left(1+\frac{R}{4\times 100}\right)^{4n}$

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 $= 2P$, 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

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

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

$$= ₹10824.32$$

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