

MATHEMATICS

Class-VIII

Topic-12

COMPOUND INTEREST



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CH-12

COMPOUND INTEREST

TERMINOLOGIES

Interest, principal, amount, compound interest, simple interest, rate of interest, growth, depreciation, half yearly, quarterly, per annum, time period, compounded annually, compounded semi-annually.

INTRODUCTION

In previous classes, we have learnt about simple interest in dealings of day to day life the interest that is paid is rarely the simple interest. The interest which the banks post offices, insurance corporation and other finance companies charge is not the simple interest. In this chapter, we shall discuss the concept of compound interest and methods of calculating compound interest.

12.1 COMPOUND INTEREST

When we borrow money from a lender (like bank), we have to pay some additional money according to specified term along with the borrowed money. This additional money which we have to pay to the lender is called the **interest** and money which is borrowed is called the **principal**. The principal together with the interest is called the **amount**.

If **P** is the principal and **I** is the interest, then the amount **A** is, therefore, given by **A = P + I**. We recall that if principal remains constant for the entire loan period, then the interest obtained is simple interest. If the interest is added with the principal after a specified period of time to form a new principal and the interest for the subsequent period is calculated on the new principal then the interest obtained is called compound interest. In this case, the principal does not remain the same.

Illustration 12.1

Find the compound interest on Rs. 5000 at 10% per annum for 3 years.

Sol. Principal = Rs. 5000

Rate = 10% per annum

$$\text{Interest for the 1st year} = \text{Rs. } \frac{5000 \times 10 \times 1}{100} = \text{Rs. } 500$$

$$\text{Amount at the end of 1st year} = \text{Rs. } (5000 + 500) = \text{Rs. } 5500$$

Principal for the second year = Rs. 5500

$$\text{Interest for the 2nd year} = \text{Rs. } \frac{5500 \times 10 \times 1}{100} = \text{Rs. } 550$$

$$\text{Amount at the end of second year} = \text{Rs. } (5500 + 550) = \text{Rs. } 6050$$

Principal for the third year = Rs. 6050

$$\text{Interest for the third year} = \text{Rs. } \frac{6050 \times 10 \times 1}{100} = \text{Rs. } 605$$

$$\text{Amount at the end of 3rd year} = \text{Rs. } (6050 + 605) = \text{Rs. } 6655$$

$$\text{Compound Interest (C.I.)} = \text{Rs. } (6655 - 5000) = \text{Rs. } 1655$$

Deducing a Formula for Compound interest

Suppose P_1 is the sum on which interest is compounded annually at a rate of $R\%$ per annum.

$$\text{Interest for the first year} = \frac{P_1 \times R \times 1}{100}$$

$$\text{Amount at the end of first year} = P_1 + SI_1 = P_1 + \frac{P_1 R}{100} = P_1 \left(1 + \frac{R}{100}\right) = P_2$$

$$\text{Interest for the second year} = \frac{P_2 \times R \times 1}{100} = P_2 \left(1 + \frac{R}{100}\right) \times \frac{R}{100} = \frac{P_1 R}{100} \left(1 + \frac{R}{100}\right)$$

$$\begin{aligned} \text{Amount at the end of second year} &= P_2 + SI_2 = P_1 \left(1 + \frac{R}{100}\right) + \frac{P_1 R}{100} \left(1 + \frac{R}{100}\right) \\ &= P_1 \left(1 + \frac{R}{100}\right) \left(1 + \frac{R}{100}\right) = P_1 \left(1 + \frac{R}{100}\right)^2 = P_3 \end{aligned}$$

Proceeding in this way the amount at the end of n years will be : $A_n = P_1 \left(1 + \frac{R}{100}\right)^n$.

Difference between simple interest and compound interest

Let us look at the difference between simple interest and compound interest. We start with Rs 100. Try completing the chart.

		Under Simple Interest	Under Compound Interest
First year	Principal	Rs. 100.00	Rs. 100.00
	interest at 10%	Rs. 10.00	Rs. 10.00
	Year end amount	Rs. 110.00	Rs. 110.00
Second year	Principal	Rs. 100.00	Rs. 110.00
	interest at 10%	Rs. 10.00	Rs. 11.00
	Year end amount	Rs. (110 + 10) = 120	Rs. 121.00
Third year	Principal	Rs. 100.00	Rs. 121.00
	interest at 10%	Rs. 10.00	Rs. 12.10
	Year end amount	Rs. (120 + 10) = 130	Rs. 133.10

Note that in 3 year,

Interest earned by simple interest = Rs (130 – 100) = Rs 30

Interest earned by compound interest = Rs (133.10 – 100) = Rs. 33.10

Note also that the principal remains the same under simple interest, while it changes year after every year under compound interest.

(a) Formulae for Simple and Compound Interest

If P is the principal, R is the rate of interest per annum and T is the time in years, then simple interest given by

$$S.I. = \frac{PRT}{100}$$

In case of the compound interest the amount **A** is given by the formula

$$A = P \left[1 + \frac{R}{100} \right]^n$$

Where P = Principal, R = Rate of interest, n = Time

$$\text{Compound interest (C.I.)} = A - P$$

$$\text{Hence, C.I.} = P \left[\left(1 + \frac{R}{100} \right)^n - 1 \right]$$

NOTE :

(i) When the interest is compounded half yearly, we have

$$\text{Rate} = \left(\frac{R}{2} \right) \% \text{ half yearly and Time} = 2n \text{ half years}$$

(ii) When the interest is compounded quarterly, we have

$$\text{Rate} = \frac{R}{4} \% \text{ per quarterly and time} = 4n \text{ quarters.}$$

(iii) When the interest is compounded annually but time in a fraction (Let $3\frac{3}{7}$ years)

$$\text{then, } A = P \left(1 + \frac{R}{100} \right)^3 \times \left(1 + \frac{\frac{3}{7} \times R}{100} \right)$$

(iv) If the rate of interest are different for different years, let $r_1, r_2, r_3 \dots$ for first, second, third ... years respectively then amount is given by

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

Illustration 12.2

Find the amount of Rs 8000 for 3 years, compounded annually at 5% per annum. Also, find the compound interest.

Sol. Here, P = Rs 8000, R = 5% per annum and n = 3 years.

Using the formula $A = P \left(1 + \frac{R}{100} \right)^n$, we get

$$\text{Amount after 3 years} = \text{Rs.} \left\{ 8000 \times \left(1 + \frac{5}{100} \right)^3 \right\} = \text{Rs.} \left(8000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs.} 9261$$

$$\text{Amount after 3 years} = \text{Rs.} 9261.$$

$$\text{And, compound interest} = \text{Rs.} (9261 - 8000) = \text{Rs.} 1261$$

Illustration 12.3

Find the compound interest on Rs 6400 for 2 years, compounded annually at $7\frac{1}{2}\%$ per annum.

Sol. Here, P = Rs 6400, R = $\frac{15}{2}\%$ p.a and n = 2 years

Using the formula $A = P \left(1 + \frac{R}{100} \right)^n$, we get

$$\text{Amount after 2 years} = \text{Rs. } \left\{ 6400 \times \left(1 + \frac{15}{2 \times 100} \right)^2 \right\} = \text{Rs. } \left(6400 \times \frac{43}{40} \times \frac{43}{40} \right) = \text{Rs. } 7396$$

$$\text{Compound interest} = \text{Rs. } (7396 - 6400) = \text{Rs. } 996.$$

Illustration 12.4

Find the amount of Rs. 12000 after 2 years compounded annually, the rate of interest being 5% p.a. during the first year and 6% p.a. during the second year, also find the compound interest.

Sol. Here, $P = \text{Rs. } 12000$, $r_1 = 5\%$ p.a. and $r_2 = 6\%$ p.a.

$$\text{Using the formula } A = P \left(1 + \frac{r_1}{100} \right) \left(1 + \frac{r_2}{100} \right),$$

$$\text{We have } A = 12000 \left(1 + \frac{5}{100} \right) \left(1 + \frac{6}{100} \right)$$

$$\text{Amount after 2 years} = \text{Rs. } \left(12000 \times \frac{21}{20} \times \frac{53}{50} \right) = \text{Rs. } 13356.$$

Thus, amount after 2 years = Rs. 13356.

And, compound interest = Rs. $(13356 - 12000) = \text{Rs. } 1356$

Illustration 12.5

Find the compound interest on Rs. 31250 at 8% per annum for $2\frac{3}{4}$ years.

$$\begin{aligned} \text{Sol. Amount after } 2\frac{3}{4} \text{ years} &= \left[31250 \times \left(1 + \frac{8}{100} \right)^2 \times \left\{ 1 + \frac{\frac{3}{4} \times 8}{100} \right\} \right] \text{Rs.} = \text{Rs. } \left\{ 31250 \times \left(\frac{27}{25} \right)^2 \times \left(\frac{53}{50} \right) \right\} \\ &= \text{Rs. } \left(31250 \times \frac{27}{25} \times \frac{27}{25} \times \frac{53}{50} \right) = \text{Rs. } 38637. \end{aligned}$$

Amount = Rs. 38637

Hence, compound interest = Rs. $(38637 - 31250) = \text{Rs. } 7387$

Illustration 12.6

The difference between the compound interest and the simple interest on a certain sum for 2 years at 6% per annum is Rs. 18. Find the sum.

Sol. Let the sum be Rs. P .

$$\text{Then, SI} = \text{Rs. } \left(P \times \frac{6}{100} \times 2 \right) = \text{Rs. } \frac{3P}{25}$$

$$\text{CI} = \text{Rs. } \left\{ P \times \left(1 + \frac{6}{100} \right)^2 - P \right\} = \text{Rs. } \left\{ \left(P \times \frac{53}{50} \times \frac{53}{50} \right) - P \right\} = \text{Rs. } \left(\frac{2809}{2500} P - P \right) = \text{Rs. } \left(\frac{309P}{2500} \right)$$

$$(\text{CI}) - (\text{SI}) = \text{Rs. } \left(\frac{309P}{2500} - \frac{3P}{25} \right) = \text{Rs. } \left(\frac{9P}{2500} \right).$$

$$\therefore \frac{9P}{2500} = 18 \Rightarrow P = \frac{2500 \times 18}{9}$$

Hence, the required sum is Rs. 5000.

ALTERNATIVE METHOD :

Let the sum be Rs 100. Then $SI = Rs. \left(\frac{100 \times 6 \times 2}{100} \right) = Rs. 12$

$$CI = Rs. \left\{ 100 \times \left(1 + \frac{6}{100} \right)^2 - 100 \right\} = Rs. \left\{ \left(100 \times \frac{53}{50} \times \frac{53}{50} \right) - 100 \right\} = Rs. \left(\frac{2809}{25} - 100 \right) = Rs. \frac{309}{25}$$

$$(CI) - (SI) = Rs. \left(\frac{309}{25} - 12 \right) = Rs. \frac{9}{25}$$

If the difference between the CI and SI is Rs. $\frac{9}{25}$, then the sum = Rs. 100.

If the difference between the CI and SI is Rs. 18 then the sum

$$= Rs. \left(100 \times \frac{25}{9} \times 18 \right) = Rs. 5000. \text{ Hence, the required sum is Rs. 5000.}$$

Illustration 12.7

A certain sum amounts to Rs. 72900 in 2 years at 8% per annum compound interest. Find the sum.

Sol. Let the sum be Rs. P. Then,

$$\text{Amount} = Rs. \left\{ P \times \left(1 + \frac{8}{100} \right)^2 \right\} = Rs. \left\{ P \times \frac{27}{25} \times \frac{27}{25} \right\} = Rs. \left(\frac{729P}{625} \right).$$

$$\frac{729P}{625} = 72900 \quad \Rightarrow \quad P = \left(\frac{72900 \times 625}{729} \right) \Rightarrow P = 62500.$$

Hence, the required sum is Rs. 62500.

ALTERNATIVE METHOD :

Let the sum be Rs 100. Then,

$$\text{Amount} = Rs. \left\{ 100 \times \left(1 + \frac{8}{100} \right)^2 \right\} = Rs. \left(100 \times \frac{27}{25} \times \frac{27}{25} \right) = Rs. \left(\frac{2916}{25} \right)$$

If the amount is Rs. $\frac{2916}{25}$, then the sum = Rs 100.

$$\text{If the amount is Rs. 72900, then the sum} = Rs. \left(100 \times \frac{25}{2916} \times 72900 \right) = Rs. 62500$$

Hence, the required sum is Rs. 62500.

Illustration 12.8

At what rate percent per annum will a sum of Rs. 2000 amount to Rs. 2205 in 2 years, compounded annually ?

Sol. Let the required rate be R% per annum.

Here, A = Rs. 2205, P = Rs. 2000 and n = 2 years.

Using the formula $A = P \left(1 + \frac{R}{100} \right)^n$, we get

$$\Rightarrow 2205 = 2000 \times \left(1 + \frac{R}{100} \right)^2 \Rightarrow \left(1 + \frac{R}{100} \right)^2 = \frac{2205}{2000} = \frac{441}{400} = \left(\frac{21}{20} \right)^2$$

$$\Rightarrow \left(1 + \frac{R}{100} \right) = \frac{21}{20} \quad \therefore \quad \frac{R}{100} = \left(\frac{21}{20} - 1 \right) = \frac{1}{20} \Rightarrow R = \left(100 \times \frac{1}{20} \right) = 5$$

Hence, the required rate of interest is 5% per annum.

Illustration 12.9

In what time will Rs. 1000 amount to Rs. 1331 at 10% per annum, compounded annually ?

Sol. Let the required time be n years. Then,

$$\text{Amount} = \text{Rs.} \left\{ 1000 \times \left(1 + \frac{10}{100} \right)^n \right\} = \text{Rs.} \left\{ 1000 \times \left(\frac{11}{10} \right)^n \right\}$$

$$1000 \times \left(\frac{11}{10} \right)^n = 1331 \quad [\because \text{amount} = \text{Rs } 1331 \text{ (given)}]$$

$$\Rightarrow \left(\frac{11}{10} \right)^n = \frac{1331}{1000} = \frac{11 \times 11 \times 11}{10 \times 10 \times 10} = \left(\frac{11}{10} \right)^3 \Rightarrow \left(\frac{11}{10} \right)^n = \left(\frac{11}{10} \right)^3 \Rightarrow n = 3.$$

Thus, $n = 3$. Hence, the required time is 3 years.

Illustration 12.10

What sum will become Rs. 9826 in 18 months if the rate of interest is $2\frac{1}{2}\%$ per annum and the interest is compounded half-yearly ?

Sol. Let the required sum i.e. the principal be Rs. P .

We have, Principal = P , Amount = Rs. 9826,

$$R = 2\frac{1}{2}\% \text{ per annum and } n = 18 \text{ months} = \frac{18}{12} = \frac{3}{2} \text{ years.}$$

$$\therefore A = P \left(1 + \frac{R}{200} \right)^{2n} \Rightarrow 9826 = P \left(1 + \frac{\frac{5}{2}}{200} \right)^{2 \times \frac{3}{2}}$$

$$\Rightarrow 9826 = P \left(1 + \frac{1}{80} \right)^3 \Rightarrow 9826 = P \left(\frac{81}{80} \right)^3 \Rightarrow P = 9826 \times \left(\frac{80}{81} \right)^3 = 9466.54$$

Hence, required sum = Rs. 9466.54

ALTERNATIVE METHOD :

Let the required sum be Rs. 100. Then, the amount after 18 months i.e., $\frac{3}{2}$ years at the rate of $2\frac{1}{2}\%$ compounded half-yearly, is given by :

$$\text{Amount} = \text{Rs.} \left[100 \times \left(1 + \frac{\frac{5}{2}}{200} \right)^{2 \times \frac{3}{2}} \right] = \text{Rs.} \left[100 \times \left(\frac{81}{80} \right)^3 \right] = \text{Rs.} \frac{531441}{5120}$$

If amount is Rs. $\frac{531441}{5120}$, then principal = Rs 100

If the amount is Re 1, then principal = Rs. $\left(\frac{100 \times 5120}{531441} \right)$

If the amount is Rs. 9826, then principal = Rs. $\left(\frac{100 \times 5120}{531441} \times 9826 \right) = \text{Rs. } 9466.54$

Hence, required sum = Rs. 9466.54

Illustration 12.11

In what time will Rs. 64000 amount to Rs 68921 at 5% per annum, interest being compounded half-yearly?

Sol. Here, Principal, $P = \text{Rs } 64000$, Amount $A = \text{Rs } 68921$, rate $R = 5\%$ per annum. Since the interest is compounded half-yearly. Therefore,

$$A = P \left(1 + \frac{R}{200}\right)^{2n}, \text{ where } n \text{ is the number of years.}$$

$$\Rightarrow 68921 = 64000 \left(1 + \frac{5}{200}\right)^{2n} \Rightarrow \frac{68921}{64000} = \left(\frac{41}{40}\right)^{2n}$$

$$\Rightarrow \left(\frac{41}{40}\right)^3 = \left(\frac{41}{40}\right)^{2n} \Rightarrow 2n = 3 \Rightarrow n = \frac{3}{2} \text{ years} = 1\frac{1}{2} \text{ years.}$$

Illustration 12.12

Reena borrowed from Kamla certain sum for two years at simple interest. Reena lent this to Hamid at the same rate for two years compound interest. At the end of two years she received Rs 110 as compound interest but paid Rs 100 as simple interest. Find the sum and rate of interest.

Sol. Let the principal be Rs P and the rate of interest be $R\%$ per annum.

We have,

C.I. = Rs 110, S.I. = Rs 100 and Time = 2 years

$$\therefore 110 = P \left(1 + \frac{R}{100}\right)^2 - P \text{ and } 100 = \frac{P \times R \times 2}{100}$$

$$\Rightarrow 110 = P \left[\left(1 + \frac{R}{100}\right)^2 - 1\right] \text{ and } 100 = \frac{PR}{50} \Rightarrow 110 = P \left[\left(1 + \frac{R}{100}\right)^2 - 1\right] \text{ and } PR = 5000$$

$$\Rightarrow 110 = P \left[1 + \frac{2R}{100} + \frac{R^2}{10000} - 1\right] \text{ and } PR = 5000$$

$$\Rightarrow 110 = \frac{2PR}{100} + \frac{PR^2}{10000} \text{ and } PR = 5000 \Rightarrow 110 = \frac{PR}{50} + \frac{PR}{10000} \times R \text{ and } PR = 5000$$

$$\Rightarrow 110 = \frac{5000}{50} + \frac{5000}{10000} \times R \quad [\text{Putting } PR = 5000]$$

$$\Rightarrow 110 = 100 + \frac{R}{2} \Rightarrow 10 = \frac{R}{2} \Rightarrow R = 20$$

Putting $R = 20$ in $PR = 5000$, we get

$$20P = 5000 \Rightarrow P = 250$$

Hence, principal = Rs 250 and rate = 20% per annum.

(b) Growth and depreciation

We have seen that money grow when it is invested for some time and we can calculate the increased amount by using the formula. The same formula can also be used in calculating the growth in population, increase in the height of a tree and so on. We can therefore, use the formula :

$$A = P \left[1 + \frac{R}{100}\right]^n$$

Where, A = Increased value, P = Original value, R = Rate of growth, n = Time
 Some times the value of certain things may decrease for example, a value of machine or a car. In that case, we can calculate the depreciated value of the item by using the same formula with the difference that R is replaced by $-R$.

$$\text{Decreased value, } A = P \left[1 - \frac{R}{100} \right]^n.$$

Illustration 12.13

The present population of a town is 25000. It grows at the rate of 4%, 5% and 8% during the first year, second year and third year respectively. Find its population after 3 years.

Sol. Population after 3 years.

$$\begin{aligned} &= 25000 \left[1 + \frac{4}{100} \right] \left[1 + \frac{5}{100} \right] \left[1 + \frac{8}{100} \right] \\ &= 25000 \times \frac{26}{25} \times \frac{21}{20} \times \frac{27}{25} = 29484. \end{aligned}$$

Hence, the population after 3 years = 29484

Illustration 12.14

The value of refrigerator which was purchased 2 years ago depreciates at 12% p.a. If its present value is Rs. 9680, for how much was it purchased ?

Sol. Let the cost price of the refrigerator be Rs x.

$$\text{Then, its present value} = x \left[1 - \frac{12}{100} \right]^2$$

$$9680 = \left[1 - \frac{12}{100} \right]^2 x \Rightarrow 9680 = x \left[\frac{22}{25} \right]^2$$

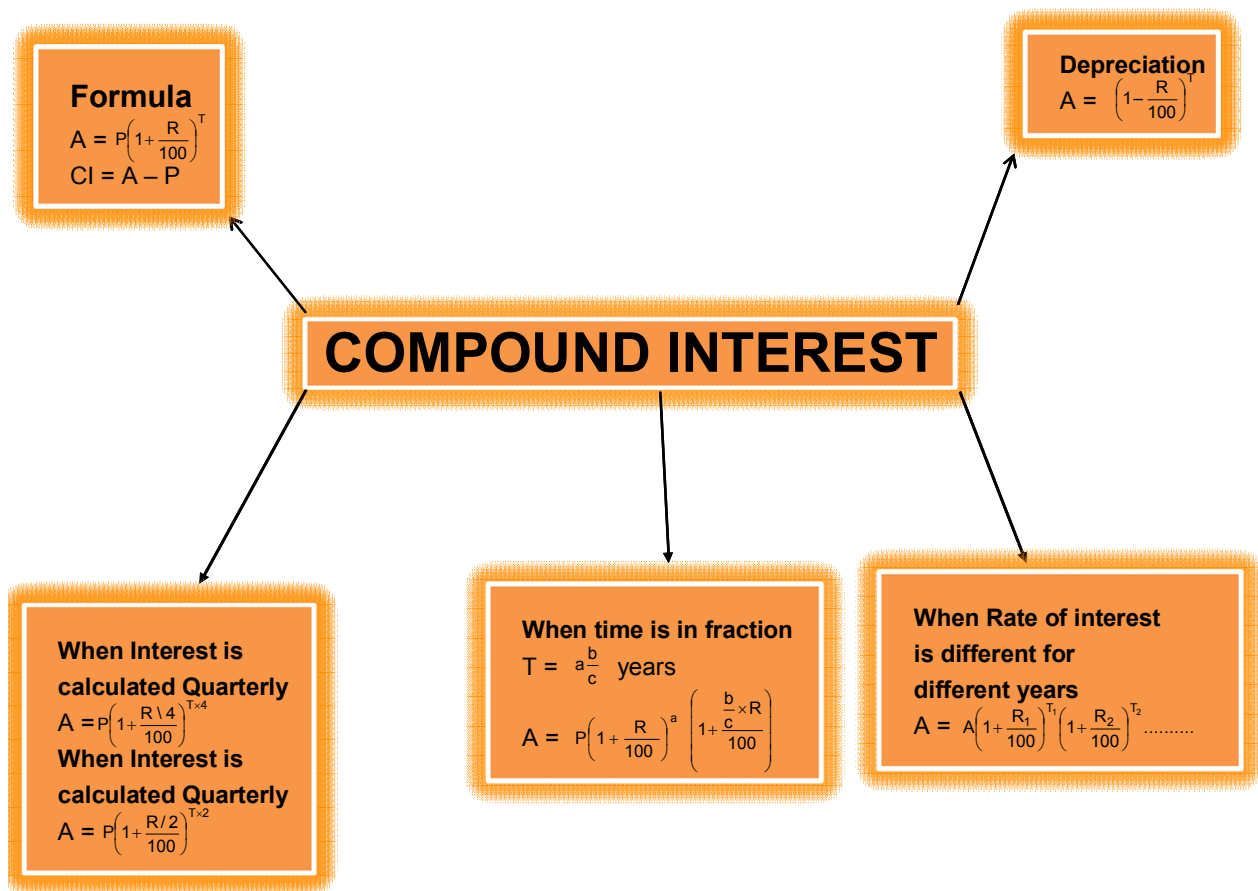
$$\Rightarrow x = 9680 \times \frac{25}{22} \times \frac{25}{22} \Rightarrow x = \text{Rs. } 12500$$

Hence, the cost price of the refrigerator = Rs 12500.

Ask yourself

1. In the following questions, calculate the amount and the compound interest by using the formulae for compound interest.
 - (i) Principal = Rs. 4000, Rate = 5 % per annum, Time = 2 years
 - (ii) Principal = Rs. 6000, Rate = 10 % per annum, Time = 2 years
2. I borrow Rs. 12000 from Jamshed at 6% per annum simple interest for 2 years. Had I borrowed this sum at 6% per annum compound interest, what excess amount would I have to pay to him ?
3. Compute the compound interest on :
 - (i) Rs. 1500 for 2 years at 6% per annum.
 - (ii) Rs. 2860 for 2 years at 5% per annum.
 - (iii) Rs. 3000 for 2 years at 5% per annum.
 - (iv) Rs. 5000 for 2 years at 10% per annum.
 - (v) Rs. 8500 for 2 years at 8% per annum.

Concept Map



Summary

1. If the principal remains the same throughout the loan period, then the interest calculated on this principal is called the simple interest.
2. The time period after which interest is added each time to form a new principal is called the conversion period and the interest so obtained is called the compound interest.
3. If the conversion period is one year, the interest is said to be compounded annually.
4. The main difference between the simple interest and the compound interest on a certain sum is that in the case of simple interest, the principal remains constant throughout whereas in the case of compound interest, it goes on changing periodically.

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

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

where A is the amount, P the principal, r the rate percent per conversion period and n is the number of conversion periods.

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. Compound interest is :
 (A) Always greater than the simple interest
 (B) Always less than the simple interest
 (C) Always equal to the simple interest
 (D) Always greater or equal to the simple interest

2. The formula for calculating the compound interest is:
 (A) $\text{Principal} = \text{Amount} \left(1 + \frac{\text{rate}}{100}\right)^{\text{time}}$
 (B) $\text{Amount} = \text{Principal} \left(1 + \frac{\text{rate}}{100}\right)^{\text{time}}$
 (C) $\text{Amount} = \text{Principal} \left(1 + \frac{\text{time}}{100}\right)^{\text{rate}}$
 (D) None of these

3. In case of compound interest :
 (A) The amount for the first year becomes interest for the second year
 (B) The amount for the first year becomes principal for the second year
 (C) Principal for the second year becomes interest for the third year
 (D) None of these

4. The compound interest on Rs. 5000 at 4 % per annum for 2 years compounded annually is
 (A) Rs 804 (B) Rs 708 (C) Rs 408 (D) Rs 5408

5. In case of compound interest the principal :
 (A) Increases every year
 (B) Decreases every year
 (C) Remains constant throughout the loan period
 (D) Increases for first year and then decreases

6. A sum becomes Rs. 3136 after 2 years at 12 % per annum compounded annually. The sum is
 (A) Rs. 2000 (B) Rs. 2500 (C) Rs. 3000 (D) Rs. 3500

7. The compound interest on Rs. 3000 for 3 years at 5% per annum compounded annually is
 (A) Rs. 472 (B) Rs. 472.88 (C) Rs. 472.25 (D) Rs. 472.5

8. The correct relationship is :
 (A) $\text{Amount} + \text{C.I.} = \text{P}$
 (B) $\text{C.I.} = \text{Amount} - \text{P}$
 (C) $\text{C.I.} - \text{P} = \text{Amount}$
 (D) None of these

9. The difference between the compound interest compounded annually and the simple interest on Rs. 625 at 10% per annum for 1 year is :
 (A) Rs. 10 (B) Rs. 100 (C) Rs. 15 (D) Rs. 0

10. David borrowed Rs. 1500 at 8 % simple interest for 2 years and he lend it to Tahir for 2 years at 10 % per annum compound interest compounded annually. David's profit is :
 (A) Rs. 240 (B) Rs. 315 (C) Rs. 75 (D) None of these

11. A sum of money at compound interest yields Rs. 200 and Rs. 220 at the end of first and second year respectively. The rate % is :
 (A) 20 (B) 15 (C) 10 (D) 6
12. A sum of money at CI amounts to thrice itself in 3 years. In how many years will it be 9 times itself.
 (A) 18 (B) 12 (C) 9 (D) 6
13. The CI on a certain sum for 2 years is Rs 41 and SI is Rs 40. Then the rate percent per annum is :
 (A) 4% (B) 5% (C) 6% (D) 8%
14. The difference in SI and CI on a certain sum of money in 2 years at 15% p.a. is Rs 144. The sum is :
 (A) Rs 6000 (B) Rs 6200 (C) Rs 6300 (D) Rs 6400
15. In what time will a sum of Rs 800 at 5 % p.a. CI amounts to Rs 882 ?
 (A) 1 year (B) 5 year (C) 4 year (D) 2 year

FILL IN THE BLANKS

1. $CI = P \times \left[1 + \frac{R}{100} \right]^n - \{P\}$
2. The difference between CI and SI on Rs. 500 at 10% p.a. for 2 years is _____.
3. The sum of money that would amount to Rs. 363 in 2 years at 10% p.a. CI is _____.
4. If the SI on Rs. x for 2 years is Rs. $\frac{x}{10}$, then the SI for 3 years is _____
5. The SI and CI on a certain sum of money for 1 year will be _____

TRUE / FALSE

1. If the interest is compounded half-yearly, then the rate of interest R% per year changes to 2R% per half year.
2. When the interest is compounded quarterly, there are four conversion periods in a year.
3. If CI and SI are the compound interest and simple interest respectively on a sum P for n years at the rate of R% p.a., then CI is always greater than SI.
4. The interest when compounded half yearly is less than the interest compounded yearly on the same amount for the same period at the same rate.
5. The interest when compounded quarterly, we change the rate of interest from R% per annum to $\frac{R}{4}$ % per quarter.
6. Compounded interest is the interest calculated on the previous year's amount.
7. Three and a half years have 7 conversion period when the interest is compounded half yearly.

8. The SI and CI on a certain sum of money for 2 years will be same.
9. Compound interest and simple interest is equal for one year at the same rate of interest.
10. For 10,000 Rs. SI is greater than the CI at the rate of 3.45% per annum for 2 years.
11. An interest of 10% compounded semi-annually means that 10% interest is added every six months.
12. The difference between SI and CI on Rs. 15000 for 2 years at 4% is Rs. 24.

MATCH THE COLUMN

Column –I	Column –II
(A) Interest compounded yearly when P = Rs. 1000, R = 8% and T = 2 years	(p) Rs. 160
(B) Interest compounded half yearly when P = Rs. 1000, R = 8%, p.a. and T = 2 years	(q) Rs. 1000
(C) Interest compounded quarterly when P = 1000, R = 8% p.a. and T = 2 years	(r) Rs.1000 $\left(\frac{27}{25}\right)^2$
(D) Simple interest when P = 1000, R = 8%, p.a. and T = 2 years	(s) Rs. 1000 $\left[\left(\frac{26}{25}\right)^4 - 1\right]$
(E) Principal when CI = Rs. 1000, R = 8%, p.a. and T = 2 years	(t) Rs. 1000 $\left[\left(\frac{51}{50}\right)^8 - 1\right]$
(F) Amount received on P = Rs. 1000, after 2 years at 8%, p.a	(u) $1000\left[\left(\frac{27}{25}\right)^2 - 1\right]^{-1}$

SECTION -B (FREE RESPONSE TYPE)
VERY SHORT ANSWER TYPE

1. Find the amount and the compound interest on Rs. 2000 for 3 years at the rate of 5 % per annum.
2. A sum of money amount to Rs. 88200 in 2 years at 5 % per annum compounded annually. Find the sum.
3. At what percent rate of compound interest will a sum of money becomes 8 times itself in 3 years ?
4. Find the compound interest on Rs. 10,000 for 3 years if the rate of interest is 4 % for the first year, 5 % for the second year & 10 % for the third year each interest being compounded annually.
5. The population of a city is increasing at the rate of 4 % per annum, then find the population of the city after 2 years if the present population is 160000 ?

SHORT ANSWER TYPE

6. Find the compound interest on Rs. 15625 for 9 months, at 16 % per annum, compounded quarterly.
7. The difference between the compound interest and simple interest on a certain sum for 2 years at 5 % p.a. is Rs. 40. Find the sum.
8. Find the amount of Rs. 4096 for 18 months at $12\frac{1}{2}$ % per annum, the interest being compounded semiannually.
9. Ishita invested a sum of Rs. 12000 at 5 % per annum compound interest. She received an amount of Rs. 13230 after n years. Find the value of n.

LONG ANSWER TYPE

10. If the difference between the C.I. and S.I. at the end of 2 years is Rs. 100, what is the principal? Rate is 5% per annum in both the cases. Assume same principal for both the cases.
11. A sum of Rs. 12000 deposited at compound interest become double after 5 years. After 20 years it will become

Exercise-2
SECTION -A (COMPETITIVE EXAMINATION QUESTION)
MULTIPLE CHOICE QUESTIONS

1. Find the compound interest for Rs. 8192 for $1\frac{1}{2}$ years at $12\frac{1}{2}$ % per annum the interest being compounded half yearly.
 (A) Rs 9826 (B) Rs 1634 (C) Rs 1500 (D) Rs 4913
2. Find the amount of Rs. 15625 for 9 months at 16% per annum compounded quarterly.
 (A) Rs 17576 (B) Rs 17675 (C) Rs 16575 (D) Rs 16755
3. The population of a state 3 years ago was 40000000 and increased by 2%, 3% and 2.5% in previous years respectively. Find present population of that state.
 (A) 43074600 (B) 43074400 (C) 43075600 (D) 43084600
4. The amount for a sum of money in 5 years is Rs. 15625 and in 3 years. at the same rate of interest is Rs. 10000. Find the rate of interest.
 (A) 10% (B) 12% (C) 25% (D) 20%
5. Mrs.Anita Sehgal borrowed some money from a bank at 20% p.a. simple interest for 2 years. She invested that money at 20% per annum for 2 years, interest being compounded half yearly and she gained Rs. 1282. Find the money she borrowed from the bank.
 (A) Rs 20000 (B) Rs 13000 (C) Rs 16000 (D) Rs 18000

6. Find the compound interest on Rs. 8000 at 15% per annum for 2 years and 4 months, interest being compounded annually.
 (A) Rs 3309 (B) Rs 3109 (C) Rs 3209 (D) Rs 3190
7. A sum of money was lent for 2 years at 20% compounded annually. If the interest is payable half yearly, then, Rs. 482 more is paid as interest. Find the sum.
 (A) Rs. 16000 (B) Rs. 20000 (C) Rs. 22000 (D) Rs. 18000
8. The difference between the compound interest and simple interest on a certain sum of money at 10% per annum for 3 years is Rs. 372. Find the sum, if interest is compounded annually.
 (A) Rs. 12000 (B) Rs. 14000 (C) Rs. 16000 (D) Rs. 15000
9. Mr. Ram Singh purchased a car for Rs. 1,90,000. After two years he sold it out. If its value depreciated at 20% and 15% respectively, what did he get for the car ?
 (A) Rs. 1,29,300 (B) Rs. 1,49,200 (C) Rs. 1,29,200 (D) Rs. 1,39,200
10. At what rate percent per annum, compounded half yearly will Rs. 10000 amount to Rs 13310 in 18 months ?
 (A) 20% (B) 15% (C) 18% (D) 12%

SECTION -B (TECHIE STUFF)

11. A sum of money becomes its twice in 4 years at simple interest at same interest rate in how much time it will be 5 times ?
 (A) 10 years (B) 12 years (C) 16 years (D) 20 years
12. A sum of money at compound interest becomes its 2 times in 5 years then at same rate of interest it will become in 8 times in
 (A) 10 years (B) 15 years (C) 20 years (D) 25 years

Exercise-3

(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. The difference in simple and compound interest on a certain sum of money in 2 years at 15% per annum is Rs. 144. What is the sum ? **[Aryabhata - 2003]**
 (A) Rs. 6500 (B) Rs. 6000 (C) Rs. 6250 (D) Rs.6400
2. A certain sum invested at compound interest becomes Rs. 6,500 after a period of 6 years and Rs. 7,800 after a further period of 2 more years. Find the amount due after the further period of 2 more years. **[Aryabhata - 2009]**
 (A) Rs. 9560 (B) Rs. 9500 (C) Rs. 9360 (D) Rs.9000
3. What will be the difference between simple and compound interest at the rate of 10% per annum on a sum of Rs. 1000 after 4 years ? **[NSTSE - 2009]**
 (A) Rs. 64.10 (B) Rs. 40.40 (C) Rs. 32.10 (D) Rs. 31

4. If the difference between the compound interest, compounded every six months, and the simple interest on a certain sum of money at the rate of 12% per annum for one year is Rs. 36, the sum is **[NSTSE - 2010]**
 (A) Rs. 10000 (B) Rs. 12000 (C) Rs. 15000 (D) Rs. 18000
5. The compound interest on a certain sum of money for 2 years at 5% per annum is Rs. 102.50. Find the compound interest on the same for the same period at 4% per annum **[Aryabhata - 2011]**
 (A) Rs. 81.60 (B) Rs. 85.70 (C) Rs. 82.50 (D) Rs. 79.60
6. A sum of money invested at compound interest amounts to Rs. 800 in 3 years and to Rs.840 in 4 years. The rate of interest per annum is_____. **[IMO - 2011]**
 (A) $2\frac{1}{2}$ % (B) 4% (C) 5% (D) $6\frac{2}{3}$ %
7. The difference between compound interest and simple interest for 3 years @ 20% p.a. is Rs.152. What is the principal lent in each case? **[IMO - 2011]**
 (A) Rs.1200 (B) Rs.1155 (C) Rs.1187.50 (D) None of these
8. The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. Find the simple interest on the same sum for double the time at half the rate percent per annum. **[Aryabhata - 2012]**
 (A) Rs. 600 (B) Rs. 500 (C) Rs. 1500 (D) Rs.2000
9. Consider the following statements. **[IMO - 2012]**
 If a money is loaned at simple interest then the :
 (i) money gets doubled in 5 years if the rate of interest is 16%.
 (ii) money gets doubled in 5 years if the rate of interest is 20 %.
 (iii) money becomes four times in 10 years if it gets doubled in 5 years.
 Of these statements :
 (A) (i) and (ii) are correct (B) (iii) alone is correct
 (C) (ii) alone is correct (D) None of these
10. A tree increases annually by $\left(\frac{1}{8}\right)^{\text{th}}$ of its height. By how much will it increase after 2 years, if it stands today 64 cm high? **[IMO - 2012]**
 (A) 72 cm (B) 74 cm (C) 75 cm (D) 81 cm
11. The value of a machine depreciates every year at the rate of 10% on its value at the beginning of that year. If the present value of the machine is Rs.729, its worth 3 years ago was _____. **[IMO - 2012]**
 (A) 947.10 (B) 800 (C) Rs.1000 (D) Rs.750.87
12. What is the present worth of Rs. 169 due in 2 years at 4% per annum compound interest ? **[NSTSE - 2013]**
 (A) Rs. 150.50 (B) Rs. 154.75 (C) Rs. 156.25 (D) Rs. 158
13. A man borrowed Rs. 3125 for C.I. Which amounted to Rs. 4500 in 2 years. What was the rate of interest per annum ? **[NSTSE - 2014]**
 (A) 30% (B) 25% (C) 20% (D) 15%

Answer Key
Exercise-1
SECTION -A (FIXED RESPONSE TYPE)
MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	D	B	B	C	A	B	B	B	D	C	C	D	B	D	D

FILL IN THE BLANKS

1. Time 2. 5 3. 300 4. Same
5. Same

TRUE / FALSE

1. False 2. True 3. True 4. False
5. True 6. True 7. True 8. False
9. True 10. False 11. True 12. True

MATCH THE COLUMN

- 1 (A) – q , (B) – s, (C) – t , (D) – p, (E) – r ,(F) – u

SECTION -B (FREE RESPONSE TYPE)
VERY SHORT ANSWER TYPE

1. Rs. 2315.25, Rs. 315.25 2. 80,000 3. 100%
4. Rs. 2012 5. 173056

SHORT ANSWER TYPE

6. Rs. 1951 7. Rs 16000 8. Rs. 4913 9. 2 years

LONG ANSWER TYPE

10. 40,000 11. 16 times

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	B	A	A	C	A	B	B	A	C	A	C	B

Exercise-3

PREVIOUS YEAR EXAMINATION QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	D	C	A	A	A	C	C	B	C	D	C	C	C