

## COMPOUND INTEREST

### I. INTRODUCTION

In the previous chapter, it is understood that when interest on a given principal for each year is same, it is called simple interest. But if the period of interest is one year and it is not paid as soon as it falls due but is added to the principal, so that the amount at the end of the period becomes the principal for the next year, then this interest is called Compound Interest (C.I.).

### II. COMPOUND INTEREST

Money is said to be lent at compound interest, if the interest instead of being paid over to the lender at the end of a year or fixed period becomes due and is added to the principal thus the amount after such period becomes the principal for the next period and so on. After a specified period, the difference between the amount and the original principal is called the compound interest (C.I.).

### III. SOME USEFUL RELATIONS

1.  $C.I. = P \left\{ \left( 1 + \frac{R}{100} \right)^n - 1 \right\}$
2.  $A = C.I. + P \Rightarrow C.I. = A - P$
3.  $A = P \left( 1 + \frac{R}{100} \right)^n$

4. Each annual instalment compounded annually is given by

$$\text{Loan amount} = \frac{P}{\left( 1 + \frac{R}{100} \right)^n} = P \left( \frac{100}{100+R} \right)^n$$

Where  $P$  = Principal or present worth

$R$  = Rate percent per annum

$n$  = number of periods

$A$  = Amount

C.I. = Compound interest annually

### IV. DIFFERENCE BETWEEN COMPOUND INTEREST (C.I.) AND SIMPLE INTEREST (S.I.)

We know

$$S.I. = \frac{PRT}{100} \quad \dots(i)$$

$$C.I. = P \left\{ \left( 1 + \frac{R}{100} \right)^n - 1 \right\} \quad \dots(ii)$$

Subtracting equation (i) from (ii)

$$C.I. - S.I. = P \left\{ \left( 1 + \frac{R}{100} \right)^n - 1 \right\} - \frac{PRT}{100}$$

$$C.I. - S.I. = P \left\{ \left( \frac{100+R}{100} \right)^n - \frac{RT}{100} - 1 \right\}$$

### V. SHORT CUT METHODS TO SOLVE SPECIAL TYPES OF PROBLEMS

**Case I :** When the interest is compounded half-yearly, then amount is given by

$$A = P \left[ 1 + \frac{\frac{R}{2}}{100} \right]^{2n}$$

$$A = P \left[ \frac{200+R}{200} \right]^{2n}$$

**Case II.** When the interest is compounded quarterly, then amount is given by

$$A = P \left[ 1 + \frac{\frac{R}{4}}{100} \right]^{4n}$$

$$A = P \left[ \frac{400+R}{400} \right]^{4n}$$

**Case III.** When the rate of interest for the 1st, 2nd and 3rd year are  $R_1\%$ ,  $R_2\%$ , and  $R_3\%$  respectively and vice versa, then amount is given by

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

**Case IV.** If a principal becomes 'P' times in 'n' years, the rate of compound interest is given by

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

**Case V.** If time is given in mixed fraction (say  $n\frac{k}{m}$  years) and interest is compounded annually, then amount is given by

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

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

**Case VI.** If principal becomes Amount ( $A_1$ ) in n years at compound interest,

then after m years, the principal becomes

$$A_2 = \frac{(A_1)^{\frac{m}{n}}}{(P)^{\frac{m}{n}-1}}$$

Where  $m > n$

$A_1$  = amount after n years

$A_2$  = amount after m years

### SOME IMPORTANT POINTS

1. Compound interest is always more than simple interest.
2. The time period after which the interest is added each time to form a new principal is called CONVERSION PERIOD.
3. Conversion period may be annually, half-yearly, quarterly or monthly.
4. There is no difference between simple interest and compound interest on any sum at the same rate per annum for one year, if the interest is compounded annually.
5. The amount of the previous year is the principal for the successive year.
6. The difference between two consecutive amounts is the interest on the proceeding years amount for 1 year.
7. The difference between the compound interest and the simple



interest for 2 years is equal to the simple interest for 1 year on 1 year's interest

$$C.I. - S.I. = \frac{R \times S.I.}{2 \times 100}$$

Where T = 2 years

$$\text{Or } C.I. - S.I. = P \left( \frac{R}{100} \right)^2$$

8. Similarly, the difference between the compound interest and the simple interest for 3 years is given by

$$C.I. - S.I. = \frac{PR^3(300+R)}{(100)^3}$$

$$\text{or } C.I. - S.I. = \frac{R(300+R)S.I.}{3(100)^2}$$

### Solved Question

1) Find the compound Interest on Rs. 2000 for 2 years at 10%.

- a) 420                      b) 400  
c) 380                      d) 26420

2) Find the C.I on Rs. 7500, at 4% P.A for 2 years.

- a) 612                      b) 600  
c) 370                      d) 650

3) Kamal borrows Rs. 500 from bank. If the bank charges interest at 6% P.A. How much amount shall he pay after 2 years?

- a) 561.8                      b) 562.9  
b) 562.8                      d) 562.9





7) Find the Compound Interest on Rs. 2400 for 2 ½ years at 5% PA. CI annually.

- a) 2712.15      b) 312.15  
c) 300            d) 312

4) Find the CI on Rs. 8000 at 15% PA for 2 years 4 months. CI annually.

- a) 3109            b) 5619  
b) 11109          d) 4239

8) What will be the Compound Interest on sum of Rs. 7200 at 5% to per annum in 2 years?

- a) 7938            b) 738  
c) 765             d) 712

5) Find the compound Interest on Rs. 4000 for 1.5 years at 10% interest payable after half year

- a) 650.50            b) 630.50  
b) 620.30            d) 610.50

9) What will be the Compound Interest on Rs. 18600 for 2 years the rate of interest for first year being 8% and for the second year being 15%?

- a) 4501.2          b) 4501.3  
c) 4601.2          d) 6021.3

6) Find the CI on Rs. 16000 at 20% PA for 9 months. CI annually

- a) 2522            b) 1522  
b) 1562            d) 362

10) How much will a sum of Rs. 6300 amounts in a span of 2 years at 5% per annum rate of CI.

- a) 6945.75      b) 6945.25  
c) 2345.75      d) 5925.75





11) The cost price of car is Rs. 400000. If its price decreases 10% every year what will be the cost of car after 3 years?

- a) 291600   b) 298600  
c) 392100   d) 287600

14) A sum amounts to Rs. 9680 in 2 years and Rs. 10648 in 3 years CI annually. Find the rate of interest per annum.

- a) 10%   b) 20%  
c) 15%   d) 12%

12) The population of a city increases at the rate of 15% per annum. If its population was 4000 at the end of the year 2009. What will be its population at the end of the year 2011?

- a) 5794   b) 5290  
b) 1279   d) 5298

15) If Rs. 750 amounts to Rs. 1000 in 5 years, then how much will it amounts to in 10 years at SI?

- a) 500   b) 1250  
c) 700   d) 600

13) The Compound Interest for 6th and 7th year is Rs. 1320 and Rs. 1440 respectively. Find the rate%.

- a) 9.09%   b) 9.01%  
c) 9.092%   d) 9.032%

16) What is the CI on a sum of Rs. 5000 at the rate of 10% per annum for 2 years?

- a) 1050   b) 1250  
c) 1210   d) 1801





17) The rate of interest on a sum of money is 4% for the first 3 years, 6% for the next 2 years. 8% for the next 4 years. If SI occurred by the sum for the total principal years is 13, 440, then find the sum.

- a) 28000    b) 26000  
c) 24000    d) 22000

2) In what time Rs. 12000 will amount to Rs. 13230 at 5% CI?

- a) 3    b) 4  
c) 2    d) 1

3) A sum of money doubled itself at compounded Interest in 15 years. In how many years will it becomes eight times.

- a) 30    b) 15  
c) 45    d) 12

4) At what rate should Vimal lend Rs. 80000 at CI, so that it may amount to Rs. 97240.50 in 4 years?

- a) 3%    b) 5%  
c) 2%    d) 1%

### Special Question

1) In what time will Rs. 1000 becomes Rs. 1331 at 10% PA. CI Annually.

- a) 3    b) 4  
c) 2    d) 1

5) The difference between the Compound Interest and the Simple Interest on a sum of money for 2 years at  $12\frac{1}{2}\%$  per annum is Rs. 150 Find the sum.

- a) 9600    b) 96000  
c) 960    d) 960.50





**6) If the difference between the CI and SI on a sum of money at 5% per annum for 2 years is Rs. 16. The amount is?**

- a) 6400                      b) 6200  
c) 6500                      d) 6100

**7) If the difference between the CI and SI on certain sum of money for 3 years at 5% is Rs. 61. Find the sum.**

- a) 4880000    b) 588000  
c) 2180000    d) 648000

**8) At what rate of Compound Interest will a sum of money become 25 / 16 times of itself in 2 years?**

- a) 25%                      b) 125%  
c) 75%                      d) 50%

**9) A sum of Rs. 8400 is borrowed to be paid back in 2 years by two equal instalments at 10% CI. Find the Instalment.**

- a) 4840                      b) 4820  
c) 4620                      d) 4610

