

EXERCISE 8.3

Q1 : Calculate the amount and compound interest on

(a) Rs 10800 for 3 years at $12\frac{1}{2}\%$ per annum compounded annually.

(b) Rs 18000 for $2\frac{1}{2}$ years at 10% per annum compounded annually.

(c) Rs 62500 for $1\frac{1}{2}$ years at 8% per annum compounded half yearly.

(d) Rs 8000 for 1 year at 9% per annum compound half yearly.

(You could use the year by year calculation using SI formula to verify)

(e) Rs 10000 for 1 year at 8% per annum compounded half yearly.

Answer :

(a) Principal (P) = Rs 10, 800

Rate (R) = $12\frac{1}{2}\%$ = $\frac{25}{2}\%$ (annual)

Number of years (n) = 3

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

$$= \text{Rs} \left[10800 \left(1 + \frac{25}{200} \right)^3 \right]$$

$$= \text{Rs} \left[10800 \left(\frac{225}{200} \right)^3 \right]$$

$$= \text{Rs} \left(10800 \times \frac{225}{200} \times \frac{225}{200} \times \frac{225}{200} \right)$$

$$= \text{Rs } 15377.34375$$

$$= \text{Rs } 15377.34 \quad (\text{approximately})$$

$$\text{C.I.} = A - P = \text{Rs } (15377.34 - 10800) = \text{Rs } 4,577.34$$

(b) Principal (P) = Rs 18,000

Rate (R) = 10% annual

Number of years (n) = $2\frac{1}{2}$ years

The amount for 2 years and 6 months can be calculated by first calculating the amount for 2 years using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 2 years.

Firstly, the amount for 2 years has to be calculated.

$$A = \text{Rs} \left[18000 \left(1 + \frac{10}{100} \right)^2 \right] = \text{Rs} \left(18000 \times \frac{11}{10} \times \frac{11}{10} \right) = \text{Rs} 21780$$

By taking Rs 21780 as principal, the S.I. for the next $\frac{1}{2}$ year will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{21780 \times \frac{1}{2} \times 10}{100} \right) = \text{Rs} 1089$$

\therefore Interest for the first 2 years = Rs (21780 - 18000) = Rs 3780

And interest for the next $\frac{1}{2}$ year = Rs 1089

\therefore Total C.I. = Rs 3780 + Rs 1089 = Rs 4,869

$A = P + \text{C.I.} = \text{Rs} 18000 + \text{Rs} 4869 = \text{Rs} 22,869$

(c) Principal (P) = Rs 62,500

Rate = 8% per annum or 4% per half year

Number of years = $1\frac{1}{2}$

There will be 3 half years in $1\frac{1}{2}$ years.

$$\begin{aligned}
 A &= P \left(1 + \frac{R}{100} \right)^n = \text{Rs} \left[62500 \left(1 + \frac{4}{100} \right)^3 \right] \\
 &= \text{Rs} \left(62500 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25} \right) \\
 &= \text{Rs } 70304
 \end{aligned}$$

$$\text{C.I.} = A - P = \text{Rs } 70304 - \text{Rs } 62500 = \text{Rs } 7,804$$

(d) Principal (P) = Rs 8000

Rate of interest = 9% per annum or $\frac{9}{2}$ % per half year

Number of years = 1 year

There will be 2 half years in 1 year.

$$\begin{aligned}
 A &= P \left(1 + \frac{R}{100} \right)^n \\
 &= \text{Rs} \left[8000 \left(1 + \frac{9}{200} \right)^2 \right] \\
 &= \text{Rs} \left[8000 \left(\frac{209}{200} \right)^2 \right] = \text{Rs } 8,736.20
 \end{aligned}$$

$$\text{C.I.} = A - P = \text{Rs } 8736.20 - \text{Rs } 8000 = \text{Rs } 736.20$$

(e) Principal (P) = Rs 10,000

Rate = 8% per annum or 4% per half year

Number of years = 1 year

There are 2 half years in 1 year.

$$\begin{aligned}
 A &= P \left(1 + \frac{R}{100} \right)^n \\
 &= \text{Rs} \left[10000 \left(1 + \frac{4}{100} \right)^2 \right] = \text{Rs} \left[10000 \left(1 + \frac{1}{25} \right)^2 \right] \\
 &= \text{Rs} \left(10000 \times \frac{26}{25} \times \frac{26}{25} \right) = \text{Rs } 10,816
 \end{aligned}$$

$$\text{C.I.} = A - P = \text{Rs } 10816 - \text{Rs } 10000 = \text{Rs } 816$$

Q2 : Kamala borrowed Rs 26400 from a Bank to buy a scooter at a rate of 15% p.a. compounded yearly. What amount will she pay at the end of 2 years and 4 months to clear the loan?

(Hint: Find A for 2 years with interest is compounded yearly and then find SI on the 2nd year amount for $\frac{4}{12}$ years.)

Answer :

Principal (P) = Rs 26,400

Rate (R) = 15% per annum

Number of years (n) = $2\frac{4}{12}$ years

The amount for 2 years and 4 months can be calculated by first calculating the amount for 2 years using the compound interest formula, and then calculating the simple interest for 4 months on the amount obtained at the end of 2 years.

Firstly, the amount for 2 years has to be calculated.

$$\begin{aligned} A &= \text{Rs} \left[26400 \left(1 + \frac{15}{100} \right)^2 \right] = \text{Rs} \left[26400 \left(1 + \frac{3}{20} \right)^2 \right] \\ &= \text{Rs} \left(26400 \times \frac{23}{20} \times \frac{23}{20} \right) = \text{Rs} 34,914 \end{aligned}$$

By taking Rs 34,914 as principal, the S.I. for the next $\frac{1}{3}$ years will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{34914 \times \frac{1}{3} \times 15}{100} \right) = \text{Rs} 1,745.70$$

Interest for the first two years = Rs (34914 - 26400) = Rs 8,514

And interest for the next $\frac{1}{3}$ year = Rs 1,745.70

Total C.I. = Rs (8514 + Rs 1745.70) = Rs 10,259.70

Amount = P + C.I. = Rs 26400 + Rs 10259.70 = Rs 36,659.70

Q3 : Fabina borrows Rs 12,500 at 12% per annum for 3 years at simple interest and Radha borrows the same amount for the same time period at 10% per annum, compounded annually. Who pays more interest and by how much?

Answer :

$$\text{Interest paid by Fabina} = \frac{P \times R \times T}{100}$$

$$= \text{Rs} \left(\frac{12500 \times 12 \times 3}{100} \right) = \text{Rs } 4,500$$

$$\text{Amount paid by Radha at the end of 3 years} = A = P \left(1 + \frac{R}{100} \right)^n$$

$$\begin{aligned} A &= \text{Rs} \left[12500 \left(1 + \frac{10}{100} \right)^3 \right] \\ &= \text{Rs} \left(12500 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100} \right) = \text{Rs } 16,637.50 \end{aligned}$$

$$\text{C.I.} = A - P = \text{Rs } 16637.50 - \text{Rs } 12500 = \text{Rs } 4,137.50$$

The interest paid by Fabina is Rs 4,500 and by Radha is Rs 4,137.50.

Thus, Fabina pays more interest.

$$\text{Rs } 4500 - \text{Rs } 4137.50 = \text{Rs } 362.50$$

Hence, Fabina will have to pay Rs 362.50 more.

Q4 : I borrowed 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 extra amount would I have to pay?

Answer :

$$P = \text{Rs } 12000$$

$$R = 6\% \text{ per annum}$$

$$T = 2 \text{ years}$$

$$\text{S.I.} = \frac{P \times R \times T}{100} = \text{Rs } \left(\frac{12000 \times 6 \times 2}{100} \right) = \text{Rs } 1,440$$

To find the compound interest, the amount (A) has to be calculated.

$$\begin{aligned} A &= P \left(1 + \frac{R}{100} \right)^n = \text{Rs } \left[12000 \left(1 + \frac{6}{100} \right)^2 \right] \\ &= \text{Rs } \left[12000 \left(1 + \frac{3}{50} \right)^2 \right] = \text{Rs } \left(12000 \times \frac{53}{50} \times \frac{53}{50} \right) \\ &= \text{Rs } 13,483.20 \end{aligned}$$

$$\therefore \text{C.I.} = A - P = \text{Rs } 13483.20 - \text{Rs } 12000 = \text{Rs } 1,483.20$$

$$\text{C.I.} - \text{S.I.} = \text{Rs } 1,483.20 - \text{Rs } 1,440 = \text{Rs } 43.20$$

Thus, the extra amount to be paid is Rs 43.20.

Q5 : Vasudevan invested Rs 60000 at an interest rate of 12% per annum compounded half yearly.
What amount would he get

(i) after 6 months?

(ii) after 1 year?

Answer :

(i) P = Rs 60,000

Rate = 12% per annum = 6% per half year

n = 6 months = 1 half year

$$A = P \left(1 + \frac{R}{100} \right)^n$$
$$= \text{Rs} \left[60000 \left(1 + \frac{6}{100} \right)^1 \right] = \text{Rs} \left(60000 \times \frac{106}{100} \right) = \text{Rs } 63,600$$

(ii) There are 2 half years in 1 year.

n = 2

$$A = \text{Rs} \left[60000 \left(1 + \frac{6}{100} \right)^2 \right] = \text{Rs} \left(60000 \times \frac{106}{100} \times \frac{106}{100} \right) = \text{Rs } 67,416$$

Q6 : Arif took a loan of Rs 80,000 from a bank. If the rate of interest is 10% per annum, find the difference in amounts he would be paying after $1\frac{1}{2}$ years if the interest is

(i) Compounded annually

(ii) Compounded half yearly

Answer :

(i) $P = \text{Rs } 80,000$

$R = 10\%$ per annum

$n = 1\frac{1}{2}$ years

The amount for 1 year and 6 months can be calculated by first calculating the amount for 1 year using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 1 year.

Firstly, the amount for 1 year has to be calculated.

$$\begin{aligned} A &= \text{Rs} \left[80000 \left(1 + \frac{10}{100} \right)^1 \right] \\ &= \text{Rs} \left[80000 \left(1 + \frac{10}{100} \right) \right] = \text{Rs} \left(80000 \times \frac{11}{10} \right) = \text{Rs } 88,000 \end{aligned}$$

By taking Rs 88,000 as principal, the SI for the next $\frac{1}{2}$ year will be calculated.

$$\text{S.I.} = \frac{P \times R \times T}{100} = \text{Rs} \left(\frac{88000 \times 10 \times \frac{1}{2}}{100} \right) = \text{Rs } 4,400$$

Interest for the first year = Rs 88000 - Rs 80000 = Rs 8,000

And interest for the next $\frac{1}{2}$ year = Rs 4,400

Total C.I. = Rs 8000 + Rs 4,400 = Rs 1,2400

$$A = P + C.I. = \text{Rs } (80000 + 12400) = \text{Rs } 92,400$$

(ii) The interest is compounded half yearly.

Rate = 10% per annum = 5% per half year

There will be three half years in $1\frac{1}{2}$ years.

$$\begin{aligned} A &= \text{Rs } \left[80000 \left(1 + \frac{5}{100} \right)^3 \right] = \text{Rs } \left[80000 \left(1 + \frac{1}{20} \right)^3 \right] \\ &= \text{Rs } \left(80000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs } 92,610 \end{aligned}$$

Difference between the amounts = Rs 92,610 - Rs 92,400 = Rs 210

Q7 : Maria invested Rs 8,000 in a business. She would be paid interest at 5% per annum compounded annually. Find.

(i) The amount credited against her name at the end of the second year

(ii) The interest for the 3rd year.

Answer :

(i) $P = \text{Rs } 8,000$

$R = 5\%$ per annum

$n = 2$ years

$$\begin{aligned} A &= \text{Rs } \left[8000 \left(1 + \frac{5}{100} \right)^2 \right] = \text{Rs } \left(8000 \left(1 + \frac{1}{20} \right)^2 \right) \\ &= \text{Rs } \left(8000 \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs } 8,820 \end{aligned}$$

(ii) The interest for the next one year, i.e. the third year, has to be calculated.

By taking Rs 8,820 as principal, the S.I. for the next year will be calculated.

$$\text{S.I.} = \text{Rs } \left(\frac{8820 \times 5 \times 1}{100} \right) = \text{Rs } 441$$

Q8 : Find the amount and the compound interest on Rs 10,000 for $1\frac{1}{2}$ years at 10% per annum, compounded half yearly. Would this interest be more than the interest he would get if it was compounded annually?

Answer :

P = Rs 10,000

Rate = 10% per annum = 5% per half year

$n = 1\frac{1}{2}$ years

There will be 3 half years in $1\frac{1}{2}$ years.

$$\begin{aligned} A &= \text{Rs} \left[10000 \left(1 + \frac{5}{100} \right)^3 \right] = \text{Rs} \left[10000 \left(1 + \frac{1}{20} \right)^3 \right] \\ &= \text{Rs} \left(10000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs} 11,576.25 \end{aligned}$$

C.I. = A - P

= Rs 11576.25 - Rs 10000 = Rs 1,576.25

The amount for 1 year and 6 months can be calculated by first calculating the amount for 1 year using the compound interest formula, and then calculating the simple interest for 6 months on the amount obtained at the end of 1 year.

The amount for the first year has to be calculated first.

$$\begin{aligned} A &= \text{Rs} \left[10000 \left(1 + \frac{10}{100} \right)^1 \right] = \text{Rs} \left[10000 \left(1 + \frac{1}{10} \right) \right] \\ &= \text{Rs} \left(10000 \times \frac{11}{10} \right) = \text{Rs} 11,000 \end{aligned}$$

By taking Rs 11,000 as the principal, the S.I. for the next $\frac{1}{2}$ year will be calculated.

$$\text{S.I.} = \text{Rs} \left(\frac{11000 \times 10 \times \frac{1}{2}}{100} \right) = \text{Rs } 550$$

\therefore Interest for the first year = Rs 11000 - Rs 10000 = Rs 1,000

\therefore Total compound interest = Rs 1000 + Rs 550 = Rs 1,550

Therefore, the interest would be more when compounded half yearly than the interest when compounded annually.

Q9: Find the amount which Ram will get on Rs 4,096, he gave it for 18 months at $12\frac{1}{2}\%$ per annum, interest being compounded half yearly.

Answer :

$$P = \text{Rs } 4,096$$

$$R = 12\frac{1}{2}\% \text{ per annum} = \frac{25}{4}\% \text{ per half year}$$

$$n = 18 \text{ months}$$

There will be 3 half years in 18 months.

Therefore,

$$A = \text{Rs} \left[4096 \left(1 + \frac{25}{400} \right)^3 \right] = \text{Rs} \left[4096 \left(1 + \frac{1}{16} \right)^3 \right]$$

$$= \text{Rs} \left(4096 \times \frac{17}{16} \times \frac{17}{16} \times \frac{17}{16} \right) = \text{Rs } 4,913$$

Thus, the required amount is Rs 4,913.

Q10: The population of a place increased to 54000 in 2003 at a rate of 5% per annum

(i) find the population in 2001

(ii) what would be its population in 2005?

Answer :

(i) It is given that, population in the year 2003 = 54,000

Therefore,

$$54000 = (\text{Population in 2001}) \left(1 + \frac{5}{100} \right)^2$$

$$\text{Population in 2001} = 54000 \times \frac{20}{21} \times \frac{20}{21} = 48979.59$$

Thus, the population in the year 2001 was approximately 48,980.

$$\begin{aligned} \text{(ii) Population in 2005} &= 54000 \left(1 + \frac{5}{100}\right)^2 \\ &= 54000 \left(1 + \frac{1}{20}\right)^2 = 54000 \times \frac{21}{20} \times \frac{21}{20} = 59,535 \end{aligned}$$

Thus, the population in the year 2005 would be 59,535.

Q11 : In a laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours if the count was initially 5,06,000.

Answer :

The initial count of bacteria is given as 5,06,000.

$$\begin{aligned} \text{Bacteria at the end of 2 hours} &= 506000 \left(1 + \frac{2.5}{100}\right)^2 \\ &= 506000 \left(1 + \frac{1}{40}\right)^2 = 506000 \times \frac{41}{40} \times \frac{41}{40} \\ &= 531616.25 = 5,31,616 \text{ (approx.)} \end{aligned}$$

Thus, the count of bacteria at the end of 2 hours will be 5,31,616 (approx.).

Q12 : A scooter was bought at Rs 42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.

Answer :

Principal = Cost price of the scooter = Rs 42,000

Depreciation = 8% of Rs 42,000 per year

$$\begin{aligned} &= \text{Rs} \left(\frac{42000 \times 8 \times 1}{100} \right) \\ &= \text{Rs } 3,360 \end{aligned}$$

Value after 1 year = Rs 42000 - Rs 3360 = Rs 38,640
