

3. Compound Interest

Points to Remember

1. Simple Interest (S.I.) = $\frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} = \frac{Pr t}{100}$

Where P = Principal, or sum.

r = Rate of p.a.

t = Time in years

Amount (A) = P + S.I.

2. Compound Interest (C.I.)

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

where A = Amount

r = rate of p.a.

n = Period in years / half-years / quaters / Compound Interest (C.I.) = A - P

$$\text{or, } P \left[\left(1 + \frac{r}{100}\right)^n - 1 \right]$$

Exercise 3-A

Q. 1. Find the amount and the compound interest on Rs. 2500 for 2 years at 11% per annum.

Sol. Principal (P) = Rs. 2500

Rate (r) = 11%

Period = 2 years

$$\therefore \text{S.I. for the first year} = \frac{Pr t}{100}$$

$$= \frac{2500 \times 11 \times 1}{100} = 275$$

Amount = Principal + Interest = Rs. 2500 + 275 = 2775

$\therefore$ Principal for second year = Rs. 2775

$$\text{Interest for the second year} = \frac{2775 \times 11 \times 1}{100} = \frac{30525}{100} = \text{Rs. } 305.25$$

$$\therefore \text{Amount} = P + A = \text{Rs. } 2775 + \text{Rs. } 305.25$$

$$= \text{Rs. } 3080.25$$

and compound interest for 2 years

$$= \text{Rs. } 3080.25 - \text{Rs. } 2500$$

$$= \text{Rs. } 580.25 \text{ Ans.}$$

2. Find the amount and the compound interest on Rs. 20000 for 3 years at 9% per annum.

Sol. Principal (P) = Rs. 20000

Rate (r) = 9% p.a.

Period (t) = 3 years

$$\therefore \text{Interest for the first year} = \frac{\text{Prt}}{100}$$

$$= \text{Rs. } \frac{20000 \times 9 \times 1}{100}$$

$$= \text{Rs. } 1800$$

$$\therefore \text{Amount after first year}$$

$$= \text{Rs. } 20000 + 1800$$

$$= \text{Rs. } 21800$$

Principal for the second year = Rs. 21800

$$\text{Interest for the second year} = \frac{21800 \times 9 \times 1}{100}$$

$$= \text{Rs. } 1962$$

$$\therefore \text{Amount after second year}$$

$$= \text{Rs. } 21800 + \text{Rs. } 1962$$

$$= \text{Rs. } 23762$$

Principal for the third year = Rs. 23762

Interest for the third year

$$= \frac{23762 \times 9}{100} = \text{Rs. } 2138.58$$

$$\therefore \text{Amount after third year}$$

$$= \text{Rs. } 23762 + \text{Rs. } 2138.58$$

$$= \text{Rs. } 25900.58$$

and compound interest for 3 years

$$= \text{Rs. } 25900.58 - \text{Rs. } 20000$$

$$= \text{Rs. } 5900.58 \text{ Ans.}$$

3. Find the difference between simple interest and the compound interest on Rs. 9500 for 2 years at 8% per annum.

Sol. Principal (P) = Rs. 9500

Rate (r) = 8% p.a.

Period (n) = 2 years

$$\therefore \text{Simple Interest} = \frac{\text{Prn}}{100}$$

$$= \text{Rs. } \frac{9500 \times 8 \times 2}{100}$$

$$= \text{Rs. } 1520$$

$$\text{Interest for the first year} = \text{Rs. } \frac{9500 \times 8 \times 1}{100}$$

$$= \text{Rs. } 760$$

$$\therefore \text{Amount after first year} = \text{Rs. } 9500 + 760$$

$$= \text{Rs. } 10260$$

and principal for the second year = Rs. 10260

$$\text{Interest for the second year} = \frac{10260 \times 8 \times 1}{100}$$

$$= \text{Rs. } 820.80$$

$$\therefore \text{Amount after second year}$$

$$= \text{Rs. } 10260 + \text{Rs. } 820.80$$

$$= \text{Rs. } 11080.80$$

and compound interest = A - P

$$= \text{Rs. } 11080.80 - 9500$$

$$= \text{Rs. } 1580.80$$

Difference between simple interest and compound interest

$$= \text{Rs. } 1580.80 - \text{Rs. } 1520$$

$$= \text{Rs. } 60.80 \text{ Ans.}$$

4. Kiran borrowed Rs. 18000 from her friend shaloo at 15% per annum simple interest lent it to Rahul at the same rate but compounded annually. Find her gain after 3 years.

Sol. Principal (P) = Rs. 18000

Rate (r) = 15% p.a.

period (x) = 3 years

∴ Simple interest by Kiran

$$= \frac{Prn}{100} = \frac{18000 \times 15 \times 3}{100}$$

$$= \text{Rs. } 8100$$

When interest is compounded annually

$$\text{Interest for the first year} = \frac{18000 \times 15 \times 1}{100}$$

$$= \text{Rs. } 2700$$

$$\text{Amount after first year} = \text{Rs. } 18000 + 2700$$

$$= \text{Rs. } 20700$$

∴ Principal for the second year = Rs. 20700

Interest for the second year

$$= \text{Rs. } \frac{20700 \times 15 \times 1}{100}$$

$$= \text{Rs. } 3105$$

$$\text{Amount after second year} = \text{Rs. } 20700 + 3105$$

$$= \text{Rs. } 23805$$

∴ Principal for the third year = Rs. 23805

$$\text{Interest for the third year} = \frac{23805 \times 15 \times 1}{100}$$

$$= \text{Rs. } 3570.75$$

Amount after third year

$$= \text{Rs. } 23805 + \text{Rs. } 3570.75$$

$$= \text{Rs. } 27375.75$$

Compound interest received by shaloo

$$= \text{Rs. } 27375.75 - \text{Rs. } 18000$$

$$= \text{Rs. } 9375.75$$

∴ Her gain = 9375.75 – 8100.00

$$= \text{Rs. } 1275.75 \text{ Ans.}$$

5. Deepak deposited a sum of Rs. 32500 in a bank for 1 year 1 compounded half-yearly at 12% per annum. Find the compound interest, he gets.

Sol. Principal (P) = Rs. 32500

Rate (r) = 12% p.a. or 6% half-yearly

Period (n) = 1 year or 2 half-years

Interest for the first half-year

$$= \frac{Prn}{100} = \frac{32500 \times 6 \times 1}{100}$$

$$= \text{Rs. } 1950$$

$$\text{Amount after one year} = \text{Rs. } 32500 + 1950$$

$$= \text{Rs. } 34450$$

∴ Principal for the second half-year = Rs. 34450

$$\text{Interest} = \frac{34450 \times 6 \times 1}{100}$$

$$= \text{Rs. } \frac{206700}{100} = \text{Rs. } 2067$$

∴ Total interest for 2 half-years

$$= \text{Rs. } 1950 + 2067 = \text{Rs. } 4017 \text{ Ans.}$$

6. Pulkit borrowed Rs. 16000 from a finance company at 15% per annum compounded half-yearly. What amount of money

discharge his debt after $1\frac{1}{2}$ years?

Sol. Sum borrowed (P) = Rs. 16000

Rate (r) = 15% p.a. or $\frac{15}{2}$ % half-yearly

Period (n) = $1\frac{1}{2}$ years or 3 half-years

$$\text{Interest for the first half-year} = \frac{Prn}{100}$$

$$= \frac{16000 \times 15 \times 1}{100 \times 2} = \text{Rs. } 1200$$

$$\text{Amount after first half-year} = \text{Rs. } 16000 + 1200$$

$$= \text{Rs. } 17200$$

Principal for the second half-year = Rs. 17200

∴ Interest for the second half-year

$$= \text{Rs. } \frac{17200 \times 15 \times 1}{100 \times 2} = \text{Rs. } 1290$$

∴ Amount after second half-year

$$= \text{Rs. } 17200 + 1290 = \text{Rs. } 18490$$

Principal for the third half-year = Rs. 18490

$$\text{Interest for the third half-year} = \frac{18490 \times 15 \times 1}{100 \times 2}$$

$$= \text{Rs. } 1386.75$$

Amount after for the third half-year

$$= \text{Rs. } 18490 + 1386.75$$

$$= \text{Rs. } 19876.75$$

∴ She will pay Rs. 19876.75 to clear her debt.

Ans.

7. Find the compound interest on Rs. 15625 at 16% p.a. annum, for 9 months, where compounded quarterly.

Sol. Principal (P) = Rs. 15625

$$\text{Rate } (r) = 16\% \text{ p.a. or } \frac{16}{4} = 4\% \text{ quarterly}$$

$$\text{Period } (n) = 9 \text{ months or } 3 \text{ quarters}$$

Interest for the first quarter

$$= \text{Rs. } \frac{15625 \times 4 \times 1}{100} = \text{Rs. } 625$$

∴ Amount after first quarter

$$= \text{Rs. } 15625 + 625$$

$$= \text{Rs. } 16250$$

Principal for the second quarter = Rs. 16250

Interest for the second quarter

$$= \text{Rs. } \frac{16250 \times 4 \times 1}{100}$$

$$= \text{Rs. } 650$$

∴ Amount after second quarter

$$= \text{Rs. } 16250 + 650$$

$$= \text{Rs. } 16900$$

Principal for the third quarter = Rs. 16900

∴ Interest for the third quarter

$$= \text{Rs. } \frac{16900 \times 4 \times 1}{100}$$

$$= \text{Rs. } 676$$

∴ Total interest for 3 quarters

$$= \text{Rs. } 625 + 650 + 670$$

$$= \text{Rs. } 1951 \text{ Ans.}$$

Exercise 3-B

1. Find the amount of Rs. 6250 at 8% per annum compound interest for 2 years.

Also calculate the compound interest.

Sol. Principal (P) = Rs. 6250

$$\text{Rate } (r) = 8\% \text{ p.a.}$$

$$\text{Period } (n) = 2 \text{ years}$$

$$\therefore \text{Amount } (A) = P \left(1 + \frac{r}{100} \right)^n = 6250 \left(1 + \frac{8}{100} \right)^2$$

$$= \text{Rs. } 6250 \times \left(\frac{27}{25} \right)^2$$

$$= \text{Rs. } 6250 \times \frac{27}{25} \times \frac{27}{25}$$

$$= \text{Rs. } 7290$$

$$\text{i.e. Inters} = A - P = \text{Rs. } 7290 - 6250$$

$$= \text{Rs. } 1040 \text{ Ans.}$$

2. Calculate the compound interest on Rs. 14500 at 10% per annum for 3 years.

Sol. Principal (P) = Rs. 14500

$$\text{Rate } (r) = 10\%$$

$$\text{Period } (n) = 3 \text{ years}$$

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

$$= 14500 \left(1 + \frac{10}{100} \right)^3$$

$$= \text{Rs. } 14500 \times \left(\frac{11}{10} \right)^3$$

$$= \text{Rs. } 14500 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10}$$

$$= \text{Rs. } 19299.50$$

$$\therefore \text{Compound Interest} = A - P$$

$$= \text{Rs. } 19299.50 - \text{Rs. } 14500$$

$$= \text{Rs. } 4799.50 \text{ Ans.}$$

3. Mohan Lal took a loan of Rs. 25600 from a bank to renovate his house. If the rate of interest be $13\frac{3}{4}\%$ per annum, find the compound interest, he will pay after 2 years.

Sol. Principal loan (P) = Rs. 25600

$$\text{Rate } (r) = 13\frac{3}{4} = \frac{55}{4}\% \text{ p.a.}$$

$$\text{Period } (n) = 2 \text{ years}$$

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

$$= 25600 \times \left(1 + \frac{55}{100 \times 4}\right)^2$$

$$= \text{Rs. } 25600 \times \left(\frac{91}{80}\right)^2$$

$$= \text{Rs. } 25600 \times \frac{91}{80} \times \frac{91}{80}$$

$$= \text{Rs. } 33124$$

$$\therefore \text{Compound Interest} = A - P$$

$$= \text{Rs. } 33124 - \text{Rs. } 25600$$

$$= \text{Rs. } 7524 \text{ Ans.}$$

4. A farmer obtained a loan of Rs. 12800 Vijaya Bank for buying a tractor. If the bank charges compound interest at $7\frac{1}{2}\%$ per annum. What amount he will have to pay after 3 years ?

Sol. Amount of loan (P) = Rs. 12800

$$\text{Rate } (r) = 7\frac{1}{2} = \frac{15}{2}\% \text{ p.a.}$$

$$\text{Period } (n) = 3 \text{ years}$$

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

$$= \text{Rs. } 12800 \left(1 + \frac{15}{2 \times 100}\right)^3$$

$$= \text{Rs. } 12800 \times \left(\frac{43}{40}\right)^3$$

$$= \text{Rs. } 12800 \times \frac{43}{40} \times \frac{43}{40} \times \frac{43}{40}$$

$$= \text{Rs. } \frac{79507}{5} = \text{Rs. } 15901.40$$

$$\therefore \text{He will pay Rs. } 15901.40 \text{ after 3 years}$$

Ans.

5. Find the amount of Rs. 12500 for 2 years compounded annually, the rate of interest being 15% for the first year and 16% for the second year.

Sol. Principal (P) = Rs. 12500

$$\text{Rate } (r_1) = 15\% \text{ for first year}$$

$$\text{and } r_2 = 16\% \text{ for second year}$$

$$\text{period } (n) = 2 \text{ years}$$

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

$$= \text{Rs. } 12500 \left(1 + \frac{15}{100}\right) \left(1 + \frac{16}{100}\right)$$

$$= \text{Rs. } 12500 \times \frac{115}{100} \times \frac{116}{100}$$

$$= \text{Rs. } 16675 \text{ Ans.}$$

6. Find the compound interest on Rs. 31250 at 12% per annum for $2\frac{1}{2}$ years.

Sol. Principal (P) = Rs. 31250

$$\text{Rate } (r) = 12\% \text{ p.a.}$$

$$\text{Period } (n) = 2\frac{1}{2} \text{ years}$$

$$\begin{aligned}\therefore \text{Amount} &= P \left(1 + \frac{r}{100}\right)^n \\ &= 31250 \left(1 + \frac{12}{100}\right)^2 \left(1 + \frac{12}{2 \times 100}\right)^1 \\ &= 31250 \times \left(\frac{28}{25}\right)^2 \left(\frac{53}{50}\right) \\ &= \text{Rs. } 31250 \times \frac{28}{25} \times \frac{28}{25} \times \frac{53}{50} \\ &= 41552\end{aligned}$$

$$\begin{aligned}\therefore \text{Compound interest} &= A - P \\ &= \text{Rs. } 41552 - \text{Rs. } 31250 \\ &= \text{Rs. } 10302 \text{ Ans.}\end{aligned}$$

7. Calculate the amount and compound interest on Rs. 5120 at $12\frac{1}{2}\%$ per annum for $2\frac{1}{5}$ years.

$$\text{Sol. Principal } (P) = \text{Rs. } 5120$$

$$\text{Rate } (r) = 12\frac{1}{2}\% = \frac{25}{2}\% \text{ p.a.}$$

$$\text{Period } (n) = 2\frac{1}{5} \text{ years}$$

$$\therefore \text{Amount} = P \left(1 + \frac{25}{2 \times 100}\right)^2 \left(1 + \frac{25}{2 \times 100 \times 5}\right)^1$$

$$= \text{Rs. } 5120 \times \left(\frac{9}{8}\right)^2 \left(\frac{41}{40}\right)$$

$$= \text{Rs. } 5120 \times \frac{9}{8} \times \frac{9}{8} \times \frac{41}{40}$$

$$= \text{Rs. } 6642$$

$$\begin{aligned}\therefore \text{Compound interest} &= A - P \\ &= \text{Rs. } 6642 - \text{Rs. } 5120 = \text{Rs. } 1522 \text{ Ans.}\end{aligned}$$

8. Sahil borrowed Rs. 15625 from Canara Bank to buy a refrigerator. If the rate of interest be 16% per annum compounded annually, what payment he will have to make after 2 years 3 months?

$$\text{Sol. Principal } (P) = \text{Rs. } 15625$$

$$\text{Rate } (r) = 16\% \text{ p.a.}$$

$$\text{Period } (n) = 2 \text{ years, } 3 \text{ months} = 2\frac{1}{4} \text{ years}$$

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

$$= \text{Rs. } 15625 \left(1 + \frac{16}{100}\right)^2 \left(1 + \frac{16}{4 \times 100}\right)$$

$$= 15625 \left(\frac{29}{25}\right)^2 \left(\frac{26}{25}\right)$$

$$= \text{Rs. } 15625 \times \frac{29}{25} \times \frac{29}{25} \times \frac{26}{25}$$

$$= \text{Rs. } 21866$$

$$\text{Hence he will have to pay Rs. } 21866 \text{ Ans.}$$