3. Compound Interest

Points to Remember

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

   Where P = Principal, or sum.

   r = Rate of p.a.

   t = Time in years

   Amount (A) = P + S.I.

2. Coumpound 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

   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

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

$= \dfrac{2500\times11\times1}{100} = 275$

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

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

Interest for the second year $= \dfrac{2775\times11\times1}{100} = \dfrac{30525}{100}$ = Rs. 305.25

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

= Rs. 3080.25

and compound interest for 2 years

= Rs. 3080.25 – Rs. 2500

= Rs. 580.25 **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

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

= Rs. $\frac{20000\times9\times1}{100}$

= Rs. 1800

$\therefore$ Amount after first year

= Rs. 20000 + 1800

= Rs. 21800

Principal for the second year = Rs. 21800

Interest for the second year = $\frac{21800\times9\times1}{100}$

= Rs. 1962

$\therefore$ Amount after second year

= Rs. 21800 + Rs. 1962

= Rs. 23762

Principal for the third year = Rs. 23762

Interest for the third year

= $\frac{23762\times9}{100}$ = Rs. 2138.58

$\therefore$ Amount after third year

= Rs. 23762 + Rs. 2138.58

= Rs. 25900.58

and compound interest for 3 years

= Rs. 25900.58 – Rs. 20000

= Rs. 5900.58 **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

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

= Rs. $\frac{9500\times8\times2}{100}$

= Rs. 1520

Interest for the first year = Rs. $\frac{9500\times8\times1}{100}$

= Rs. 760

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

= Rs. 10260

and principal for the second year = Rs. 10260

Interest for the second year = $\frac{10260\times8\times1}{100}$

= Rs. 820.80

$\therefore$ Amount after second year

= Rs. 10260 + Rs. 820.00

= Rs. 11080.80

and compound interest = A – P

= Rs. 11080.80 – 9500

= Rs. 1580.80

Difference between simple interest and compound interest

= Rs. 1580.80 – Rs. 1520

= Rs. 60.80 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

$\therefore$ Simple interest by Kiran

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

= Rs. 8100

When interest is compounded annually

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

= Rs. 2700

Amount after first year = Rs. 18000 + 2700

= Rs. 20700

$\therefore$ Principal for the second year = Rs. 20700

Interest for the second year

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

= Rs. 3105

Amount after second year = Rs. 20700 + 3105

= Rs. 23805

$\therefore$ Principal for the third year = Rs. 23805

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

= Rs. 3570.75

Amount after third year

= Rs. 23805 + Rs. 3570.75

= Rs. 27375.75

Compound interest received by shaloo

= Rs. 27375.75 – Rs. 18000

= Rs. 9375.75

$\therefore$ Her gain = 9375.75 – 8100.00

= Rs. 1275.75 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

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

= Rs. 1950

Amount after one year = Rs. 32500 + 1950

= Rs. 34450

$\therefore$ Principal for the second half-year = Rs. 34450

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

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

$\therefore$ Total interest for 2 half-years

= Rs. 1950 + 2067 = Rs. 4017 Ans.

6. Pulkit borrowed Rs. 16000 from a finance company at 15% per annum compounded half-yearl. 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

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

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

Amount after first half-year = Rs. 16000 + 1200

= Rs. 17200

Principal for the second half-year = Rs. 17200

$\therefore$ Interest for the second half-year

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

$\therefore$ Amount after second half-year

= Rs. 17200 + 1290 = Rs. 18490

Principal for the third half-year = Rs. 18490

Interest for the third half-year = $\frac{18490\times15\times1}{100\times2}$

= Rs. 1386.75

Amount after for the third half-year

= Rs. 18490 + 1386.75

= 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

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

Period (n) = 9 months or 3 quarters

Interest for the first quarter

= Rs. $\frac{15625\times4\times1}{100}$ = Rs. 625

∴ Amount after first quarter

= Rs. 15625 + 625

= Rs. 16250

Principal for the second quarter = Rs. 16250

Interest for the second quarter

= Rs. $\frac{16250\times4\times1}{100}$

= Rs. 650

∴ Amount after second quarter

= Rs. 16250 + 650

= Rs. 16900

Principal for the third quarter = Rs. 16900

∴ Interest for the third quarter

= Rs. $\frac{16900\times4\times1}{100}$

= Rs. 676

∴ Total interest for 3 quarters

= Rs. 625 + 650 + 670

= Rs. 1951 **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

Rate (r) = 8% p.a.

Period (n) = 2years

∴ Amount (A) = $P\left(1+\frac{r}{100}\right)^n = 6250\left(1+\frac{80}{100}\right)^2$

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

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

= Rs. 7290

i.e. Inters = A – P = Rs. 7290 – 6250

= Rs. 1040 **Ans.**

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

Sol. Principal (P) = Rs. 14500

Rate (r) = 10%

Period (n) = 3 years

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

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

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

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

= Rs. 19299.50

$\therefore$ Compound Interest = A – P

= Rs. 19299.50 – Rs. 14500

= Rs. 4799.50 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

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

Period (n) = 2 years

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

$= 25600 \times \left(1+\frac{55}{100\times4}\right)^2$

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

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

= Rs. 33124

$\therefore$ Compound Interest = A – P

= Rs. 33124 – Rs. 25600

= Rs. 7524 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

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

Period (n) = 3 years

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

$= \text{Rs. } 12800 \left(1+\frac{15}{2\times100}\right)^3$

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

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

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

$\therefore$ He will pay Rs. 15901.40 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

Rate (r_1) = 15% for first year

and r_2 = 16% for second year

period (n) = 2 years

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

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

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

= Rs. 16675 Ans.

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

Sol. Principal (P) = Rs. 31250

Rate (r) = 12% p.a.

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

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

$= 31250\left(1+\frac{12}{100}\right)^2\left(1+\frac{12}{2\times100}\right)^1$

$= 31250 \times \left(\frac{28}{25}\right)^2\left(\frac{53}{50}\right)$

$= \text{Rs. } 31250 \times \frac{28}{25}\times\frac{28}{25}\times\frac{53}{50}$

$= 41552$

$\therefore$ Compound interest $= A - P$

$= \text{Rs. } 41552 - \text{Rs. } 31250$

$= \text{Rs. } 10302$ Ans.

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

Sol. Principal (P) = Rs. 5120

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

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

$\therefore$ Amount $= P\left(1+\frac{25}{2\times100}\right)^2\left(1+\frac{25}{2\times100\times5}\right)^1$

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

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

$= \text{Rs. } 6642$

$\therefore$ Compound interest $= A - P$

$= \text{Rs. } 6642 - \text{Rs. } 5120 = \text{Rs. } 1522$ **Ans.**

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 ?

Sol. Principal (P) = Rs. 15625

Rate (r) = 16% p.a.

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

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

$= \text{Rs. } 15625\left(1+\frac{16}{100}\right)^2\left(1+\frac{16}{4\times100}\right)$

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

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

$= \text{Rs. } 21866$

Hence he will have to pay Rs. 21866 **Ans.**