9. Simple and Compound Interest

EXERCISE 9(A)

Question 1.
Find the interest and the amount on:
(i) Rs. 750 in 3 years 4 months at 10% per annum.
(ii) Rs. 5,000 at 8% per year from 23rd December 2011 to 29th July 2012.
(iii) Rs. 2,600 in 2 years 3 months at 1% per month.
(iv) Rs. 4,000 in $1\frac{1}{3}$ years at 2 paise per rupee per month.

Solution:

(i) Given P = ₹750

Time (T) $= 3\dfrac{4}{12} = 3\dfrac{1}{3}$

$= \dfrac{10}{3}$ years

Rate (R) = 10%

∴ Interest (I) $= \dfrac{PRT}{100} = \dfrac{750 \times 10 \times \dfrac{10}{3}}{100}$

$= \dfrac{250 \times 10 \times 10}{100} = ₹250$

∴ Amount (A) = P + I = ₹750 + ₹250 = ₹1000

(ii) Principal (P) = ₹5000
Rate (R) = 8% p.a.
Time (T) = 23 December 2011 to 29 July 2012

Dec.	Jan.	Feb.	March	April	May	June	July
8	31	29	31	30	31	30	29

Total 219 days $= \dfrac{219}{365}$ years

∴ Interest $= \dfrac{PRT}{100} = \dfrac{5000 \times 8 \times 219}{100 \times 365}$

$= 10 \times 8 \times 3 = ₹240$

∴ Amount = P + I = ₹5000 + 240 = ₹5240

(iii) Here P = ₹2,600
Time (T) = 2 years 3 months = 27 months

Rate (R) = 1% per month

$$\therefore \text{Interest} = \frac{P \times T \times R}{100} = \frac{2600 \times 27 \times 1}{100}$$

$= 26 \times 27 = \text{Rs. } 702$

$\therefore$ Amount = Rs. (2600 + 702) = Rs. 3302

(iv) Here P = Rs. 4,000, Time (T) $1\frac{1}{3}$ year

$= 1 \text{ year} + \frac{12}{3} \text{ months} = 16 \text{ months}$

Rate (R) = 2 paise per rupee per month = 2% per month

$$\therefore \text{Interest (I)} = \frac{P \times T \times R}{100} = \frac{4,000 \times 2 \times 16}{100}$$

$= 40 \times 32 = \text{Rs. } 1280$

$\therefore$ Amount (A) = P + I = Rs. 4000 + Rs. 1280
$= \text{Rs. } 5280$

Question 2.
Rohit borrowed Rs. 24,000 at 7.5 percent per year. How much money will he pay at the end of 4th years to clear his debt ?
Solution:

Principal (P) = Rs. 24,000

Rate (R) = 7.5% P.A.

Time (T) = 4 years

$$\text{S.I.} = \frac{P \times T \times R}{100}$$

$$= \text{Rs. } \frac{24,000 \times 4 \times 7.5}{100}$$

$= \text{Rs. } 240 \times 4 \times 7.5$

$= 240 \times 30 = \text{Rs. } 7200$

Amount needed to clear the debt at the end of 4th year

= Rs. 24000 + Rs. 7200 = Rs. 3,1200

Question 3.
The interest on a certain sum of money is Rs. 1,480 in 2 years and at 10 per cent per year. Find the sum of money.
Solution:
Let P = Rs. x
Time (T) = 2 years
Rate (R) = 0%

$$\therefore \text{Interest} = \frac{P \times T \times R}{100} = \frac{x \times 10 \times 2}{100} = \frac{x}{5}$$

$$\frac{x}{5} = \text{Rs. } 1480 \qquad \text{(Given)}$$

$$\therefore x = 1480 \times 5 = \text{Rs. } 7400$$

Hence the money Rs. 7400

Question 4.
On what principal will the simple interest be Rs. 7,008 in 6 years 3 months at 5% per year ?
Solution:
Let Principal = Rs. P

Time (T) = 6 years 3 months = 6 year + $\frac{3}{12}$

year = $\frac{75}{12} = \frac{25}{4}$ year = $6\frac{1}{4}$ years

Rate (R) = 5%
Simple interest = Rs. 7,008
We know that

$$\text{Simple interest} = \frac{P \times T \times R}{100}$$

$$\Rightarrow 7,008 = \frac{P \times \frac{25}{4} \times 5}{100} \qquad \Rightarrow P = \frac{7008 \times 100 \times 4}{25 \times 5}$$

$$= \frac{7008 \times 16}{5} = \frac{112128}{5} = \text{Rs. } 22425.60$$

Question 5.
Find the principal which will amount to Rs. 4,000 in 4 years at 6.25% Per annum.
Solution:

Let Principal = Rs. P, Time (T) = 4 years

$$\text{Rate} = 6\frac{1}{4} = \frac{25}{4}\%$$

$$\text{Simple Interest} = \frac{P \times T \times R}{100} = \frac{P \times \frac{25}{4} \times 4}{100} = \frac{P}{4}$$

$$\therefore \text{Amount} = P + \frac{P}{4} = \frac{5P}{4}$$

$$\frac{5P}{4} = 4000 \qquad\qquad \text{(given)}$$

$$\Rightarrow \quad 5P = 4 \times 4000$$

$$P = \frac{4 \times 4000}{5} = 4 \times 800$$

$$\Rightarrow \quad P = Rs.\ 3200$$

Hence principal = Rs. 3200

Question 6.
(i) At what rate per cent per annum will Rs. 630 produce an interest of Rs. 126 in 4 years ?
(ii) At what rate per cent per year will a sum double itself in $6\frac{1}{4}$ years ?

Solution:

(i) P = Rs. 630, I = Rs. 126, T = 4 years

$$R = \frac{100 \times I}{P \times T} = \frac{100 \times 126}{630 \times 4} = \frac{100}{20} = 5\%$$

(ii) Let P = Rs. 100

$$\therefore \text{Amount} = 2 \times Rs.\ 100 = Rs.\ 200$$

Interest = A – P

$$= Rs.\ 200 - Rs.\ 100 = Rs.\ 100$$

$$T = 6\frac{1}{4} \text{ years} = \frac{25}{4} \text{ years}$$

$$R = \frac{100 \times I}{P \times T} = \frac{100 \times 100}{100 \times \frac{25}{4}}\% = \frac{100 \times 100}{100} \times \frac{4}{25} = 16\%$$

Question 7.
(i) In how many years will Rs.950 produce Rs.399 as simple interest at 7% ?
(ii) Find the time in which Rs.1200 will amount to Rs.1536 at 3.5% per year.
Solution:

(i)   P = Rs.950
          S.I. = Rs.399
          R = 7%

We know that :

$$T = \frac{100 \times I}{P \times R} = \frac{100 \times 399}{950 \times 7}$$

$$= \frac{10 \times 21}{5 \times 7} = 2 \times 3 = 6 \text{ years}$$

(ii)   A = Rs.1536
          P = Rs.1200
          I = A—P
            = Rs.1536 – Rs.1200
            = Rs.336

We know that :

$$T = \frac{100 \times I}{P \times R}$$

$$= \frac{100 \times 336}{1200 \times 3 \cdot 5} = \frac{100 \times 336 \times 10}{1200 \times 35} \quad \left[\because \frac{1}{3 \cdot 5} = \frac{10}{35} \right]$$

$$= \frac{28 \times 10}{35} = 8 \text{ years}$$

Question 8.

The simple interest on a certain sum of money is $\frac{3}{8}$ of the sum in $6\frac{1}{4}$ years. Find the rate percent charged.

Solution:

Let   P = Rs.8

$$\text{S.I.} = \text{Rs.}\frac{3}{8} \times 8$$

$$= \text{Rs.}3$$

$$T = 6\frac{1}{4} \text{ years} = \frac{25}{4} \text{ years}$$

We know that :

$$R = \frac{100 \times I}{P \times T}$$

$$= \frac{100 \times 3}{8 \times \frac{25}{4}} = \frac{100 \times 3}{8} \times \frac{4}{25} = 2 \times 3$$

$$= 6\%$$

Question 9.

What sum of money borrowed on 24th May will amount to Rs. 10210.20 on 17th October of the same year at 5 percent per annum simple interest.

Solution:

A = Rs. 10210.20

R = 5% P.A.

T=May + June + July + August + Sept.+ Oct.

$$= 7+30+31+31+30+17$$

$$= \frac{146}{365} \text{ days} = \frac{2}{5} \text{ year}$$

We know that :

$$P+I = A$$

$$\Rightarrow \quad P+\frac{P \times R \times T}{100} = A$$

$$\Rightarrow \quad P\left(1+\frac{R \times T}{100}\right) = A$$

$$\Rightarrow \quad P\left(1+\frac{5 \times \frac{2}{5}}{100}\right) = \text{Rs.} 10210 \cdot 20$$

$$\Rightarrow \quad P\left(1+\frac{2}{100}\right) = \text{Rs.} 10210 \cdot 20$$

$$\Rightarrow \quad P \times \frac{102}{100} = \text{Rs.} 10210 \cdot 20$$

$$\Rightarrow \quad P = \text{Rs.} 10210 \cdot 20 \times \frac{100}{102}$$

$$\Rightarrow \quad P = \text{Rs.} \frac{1021020}{102}$$

$$\Rightarrow \quad P = \text{Rs.} 10010$$

$\therefore$ Money to be borrowed $= \text{Rs.} 10010$

Question 10.

In what time will the interest on a certain sum of money at 6% be $\frac{5}{8}$ of itself ?

Solution:

Let $\quad P = \text{Rs.} 8$

$$\text{Interest} = \text{Rs.} 8 \times \frac{5}{8} = \text{Rs.} 5$$

$$R = 6\%$$

$$T = \frac{100 \times I}{P \times R}$$

$$= \frac{100 \times 5}{8 \times 6}$$

$$= \frac{500}{48} = \frac{125}{12} \text{ years}$$

$$= 10\frac{5}{12} \text{ years}$$

$$= 10 \text{ years } 5 \text{ months}$$

$$\left[\because \frac{5}{12} \text{ year} = \frac{5}{12} \times 12 \text{ months} = 5 \text{ months} \right]$$

$$\therefore \quad \text{Time} = 10 \text{ years } 5 \text{ months}$$

Question 11.
Ashok lent out Rs.7000 at 6% and Rs.9500 at 5%. Find his total income from the interest in 3 years.

Solution:

In I case :

$$P = Rs.7000$$
$$R = 6\%$$
$$T = 3 \text{ years}$$

$$S.I. = \frac{P \times R \times T}{100}$$

$$= Rs. \frac{7000 \times 6 \times 3}{100}$$

$$= Rs.1260$$

In II case :

$$P = Rs.9500$$
$$R = 5\%$$
$$T = 3 \text{ years}$$

$$S.I. = \frac{P \times R \times T}{100}$$

$$= Rs. \frac{9500 \times 5 \times 3}{100}$$

$$= Rs.1425$$

Total income from the interest

$$= Rs.1260 + Rs.1425$$
$$= Rs.2685$$

Question 12.
Raj borrows Rs.8,000; out of which Rs. 4500 at 5% and remainder at 6%. Find the total interest paid by him in 4 years.

Solution:

Total sum borrowed by Raj = Rs.8000

In the First Case :

$$P = Rs.4500$$
$$R = 5\%$$
$$T = 4 \text{ years}$$

$$S.I. = \frac{P \times R \times T}{100}$$

$$= Rs. \frac{4500 \times 5 \times 4}{100}$$

$$= Rs.900$$

In the Second Case :

$$P = Rs.8000 - Rs.4500$$
$$= Rs.3500$$

$$R = 6\%$$
$$T = 4 \text{ years}$$

$$S.I. = \frac{P \times R \times T}{100}$$

$$= Rs. \frac{3500 \times 6 \times 4}{100}$$

$$= 35 \times 6 \times 4 = Rs.840$$

Total interest paid by Raj

$$= Rs.900 + Rs.840$$
$$= Rs.1740$$

Question 13.

Mohan lends Rs.4800 to John for $4\frac{1}{2}$ years and Rs.2500 to Shy am for 6 years and receives a total sum of Rs.2196 as interest. Find the rate percent per annum, it being the same in both the cases.
Solution:

In the first case :

$$P = Rs.4800$$
$$R = x\% \text{ (Suppose)}$$
$$T = 4\frac{1}{2} \text{ years} = \frac{9}{2} \text{ years}$$
$$\text{Interest} = \frac{P \times R \times T}{100}$$

$$= Rs.\frac{4800 \times x \times 9}{100 \times 2} = Rs.24 \times x \times 9 = Rs.216\,x$$

In the second case :

$$P = Rs.2500$$
$$R = x\%$$
$$T = 6 \text{ years}$$
$$\text{Interest} = \frac{P \times R \times T}{100}.$$

$$= Rs.\frac{2500 \times x \times 6}{100} = Rs.\ 25 \times x \times 6$$

$$= Rs.150x$$

According to statement,

Interest in first case + Interest in second case

$$= Rs.2196$$

$$\therefore \quad Rs.216x + Rs.150x = Rs.2196$$
$$\Rightarrow \quad Rs.366x = Rs.2196$$
$$\Rightarrow \quad x = \frac{2196}{366}$$
$$\Rightarrow \quad x = 6$$
$$\therefore \quad Rate = 6\%$$

Question 14.
John lent Rs. 2550 to Mohan at 7.5 per cent per annum. If Mohan discharges the debt after 8 months by giving an old black and white television and Rs. 1422.50; find the price of the television.

Solution:

$$P = \text{Rs.}2550$$

$$R = 7\cdot5\%$$

$$T = 8 \text{ months} = \frac{8}{12} \text{ years}$$

$$= \frac{2}{3} \text{ years}$$

$$\text{S.I.} = \frac{P \times R \times T}{100}$$

$$= \text{Rs.}2550 \times 7\cdot5 \times \frac{2}{3} \times \frac{1}{100}$$

$$= \text{Rs.}\frac{2550 \times 7\cdot5 \times 2}{3 \times 100}$$

$$= \text{Rs.}\frac{2550 \times 5}{100}$$

$$= \text{Rs.}\frac{12750}{100}$$

$$= \text{Rs.}127\cdot50$$

$$\text{Amount} = P+I$$

$$= \text{Rs.}2550 + \text{Rs.}127\cdot50$$

$$= \text{Rs.}2677\cdot50$$

Mohan paid in cash $= \text{Rs.}1422\cdot50$

Price of the television

$$= \text{Amount} - \text{Paid in cash}$$

$$= \text{Rs.}2677\cdot50 - \text{Rs.}1422\cdot50$$

$$= \text{Rs.}1255$$

EXERCISE 9(B)

Question 1.

The interest on a certain sum of money is 0.24 times of itself in 3 years. Find the rate of interest.

Solution:

Let the sum borrowed = Rs. 100

Time = 3 years

Let rate of interest = $r\%$

∴ Interest = $\dfrac{100 \times 3 \times r}{100}$ $\left[\because S.I. = \dfrac{P \times R \times T}{100} \right]$

= $3r$ = (0.24) (100) = 24

(Given)

⇒ $r = \dfrac{24}{3} = 8$

Hence reqd. rate of interest = 8%

Question 2.
If ₹ 3,750 amount to ₹ 4,620 in 3 years at simple interest. Find:
(i) the rate of interest

(ii) the amount of Rs. 7,500 in $5\frac{1}{2}$ years at the same rate of interest
Solution:

(i) In first Case :

A = Rs. 4620   P = Rs. 3750

I = A – P = Rs. 4620 – Rs. 3750 = Rs. 870

T = 3 years

$R = \dfrac{100 \times 1}{P \times T} = \dfrac{100 \times 870}{3750 \times 3} = \dfrac{100 \times 290}{3750} = \dfrac{4 \times 29}{15}$

$= \dfrac{116}{15} = 7\dfrac{11}{15}\%$

In Second Case :

P = Rs. 7500 $R = \dfrac{116}{15}\%$

$T = 5\dfrac{1}{2}$ years = $\dfrac{11}{2}$ years

Interest = $\dfrac{P \times T \times R}{100}$

= Rs. $\dfrac{7500 \times 11 \times 116}{2 \times 15 \times 100} = \dfrac{250 \times 116 \times 11}{100}$

= 10 × 29 × 11 = 290 × 11 = Rs. 3190

Amount = Rs. 7500 + 3190 = Rs. 10,690

Question 3.
A sum of money, lent out at simple interst, doubles itself in 8 years. Find :
(i) the rate of interest
(ii) in how many years will the sum become triple (three times) of itself at the same rate per cent ?

Solution:

Let P = Rs. 100   A = Rs. 200

I = Rs. 200 – Rs. 100 = Rs. 100,   T = 8 years

$$R = \frac{100 \times I}{P \times T} = \frac{100 \times 100}{100 \times 8} = \frac{100}{8} = \frac{25}{2} \%$$

Now again P = Rs. 100

A = Rs. 300   I = Rs. 300 – Rs. 100

= Rs. 200

$$R = \frac{25}{2} \%$$

$$T = \frac{100 \times I}{P \times R} = \frac{100 \times 200}{100 \times \dfrac{25}{2}} = \frac{100 \times 200 \times 2}{100 \times 25} = 16 \text{ years}$$

So the given sum of money will become triple in 16 years.

Question 4.
Rupees 4000 amount to Rs.5000 in 8 years ; in what time will Rs.2100 amount to Rs.2800 at the same rate ?
Solution:

In first case :

A = Rs.5000

P = Rs.4000

I = A—P

= Rs.5000 – Rs.4000

= Rs.1000

T = 8 years

$$R = \frac{100 \times I}{P \times R}$$

$$= \frac{100 \times 1000}{4000 \times 8}$$

$$= \frac{25}{8}\%$$

In the second case :

A = Rs.2800
P = Rs.2100
I = Rs.2800 – Rs.2100 = Rs.700

$$R = \frac{25}{8}\%$$

$$T = \frac{100 \times I}{P \times R} = \frac{100 \times 700}{2100 \times \frac{25}{8}}$$

$$= \frac{100 \times 700 \times 8}{2100 \times 25} = \frac{32}{3} \text{ years } = 10\frac{2}{3} \text{ years}$$

$$= 10\frac{2}{3} \times 12 \text{ months } = 10\frac{24}{3} \text{ months}$$

$$= 10 \text{ years } 8 \text{ months}$$

Question 5.
What sum of money lent at 6.5% per annum will produce the same interest in 4 years as Rs.7500 produce in 6 years at 5% per annum ?
Solution:

In first case :

$$P = \text{Rs.7500}$$
$$R = 5\%$$
$$T = 6 \text{ years}$$

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

$$= \text{Rs.} \frac{7500 \times 5 \times 6}{100}$$

$$= \text{Rs.} 75 \times 5 \times 6$$

$$= \text{Rs.} 2250$$

In second case :

According to the statement, interest = Rs.2250

$$R = 6.5\% \text{ P.A.}$$
$$T = 4 \text{ years}$$

$$P = \frac{100 \times I}{R \times T}$$

$$= \text{Rs.} \frac{100 \times 2250}{6.5 \times 4}$$

$$= \text{Rs.} \frac{225000}{26} = \text{Rs.} \frac{112500}{13}$$

$$= \text{Rs.} 8653.85$$

Required principal = Rs.8653.85

Question 6.

A certain sum amounts to Rs.3825 in 4 years and to Rs.4050 in 6 years. Find the rate percent and the sum.

Solution:

In 6 years sum amounts to = Rs.4050

In 4 years sum amounts to = Rs.3825

$\therefore$ Interest of 2 years = Rs.4050 – Rs.3825

$\qquad\qquad\qquad\quad = Rs.225$

Interest of 4 years = Rs.$\dfrac{225}{2}$ ×4

$\qquad\qquad\qquad = Rs.450$

($\because$ Rs.225 is interest for 2 years)

Now $\qquad$ P = A—I

$\qquad\qquad = Rs.3825 - Rs.450$

$\qquad\qquad = Rs.3375$

$\quad$ I = Rs.450

$\quad$ T = 4 years

$\quad$ R = $\dfrac{100 \times I}{P \times T}$

$\qquad = \dfrac{100 \times 450}{3375 \times 4}$

$\qquad = \dfrac{45000}{13500}\ \% = \dfrac{450}{135}\ \%$

$\qquad = \dfrac{10}{3}\ \% = 3\dfrac{1}{3}\ \%$

$\therefore \qquad\qquad R = 3\dfrac{1}{3}\ \%$

$\qquad\qquad\qquad P = Rs.3375$

Question 7.
At what rafepercent of simple interest will the interest on Rs.3750 be one-fifth of itself in 4 years ? To what will it amount in 15 years ?
Solution:

P = Rs.3750

I = Rs.3750 × $\dfrac{1}{5}$

  = Rs.750

T = 4 years

$$R = \dfrac{100 \times I}{P \times T}$$

$$= \dfrac{100 \times 750}{3750 \times 4}$$

$$= \dfrac{100 \times 750}{3750 \times 4}$$

$$= 5\%$$

Again, P = Rs.3750

Interest of 4 years = Rs.750

Interest of 1 year = Rs. $\dfrac{750}{4}$

Interest of 15 years = Rs. $\dfrac{750}{4} \times 15$

$$= Rs. \dfrac{750 \times 15}{4}$$

$$= Rs. \dfrac{5625}{2}$$

$$= Rs.2812 \cdot 50$$

Amount in 15 years will be

$$= Rs.3750 + Rs.2812 \cdot 50$$

$$= Rs.6562 \cdot 50$$

∴ Rate = 5%

Amount in 15 years will be

$$= Rs.6562 \cdot 50$$

Question 8.

On what date will ₹ 1950 lent on 5th January, 2011 amount to ₹ 2125.50 at 5 percent per annum simple interest?

Solution:

P = Rs.1950

A = Rs.2125·50

R = 5% p.a.

$I = A - P$

  = Rs.2125·50 – Rs.1950

  = Rs.175·50

$$T = \frac{100 \times I}{P \times R}$$

$$= \frac{100 \times 175 \cdot 50}{1950 \times 5}$$

$$= \frac{17550}{9750} = \frac{1755}{975} = \frac{117}{65}$$

$$= \frac{9}{5} \text{ years} = 1\frac{4}{5} \text{ years}$$

$$= 1 \text{ years } 292 \text{ days}$$

$$\boxed{\begin{array}{l} \because \dfrac{4}{5} \text{ years} \\ = \dfrac{4}{5} \times 365 \text{ days} = 292 \text{ days} \end{array}}$$

Jan + Feb. + March + April + May + June + July

+ Aug. + Sept. + Oct.

(31–5) + 29 + 31 + 30 + 31 + 30 + 31 + 31 + 30 + 23

= 292 days

∴ Required date = 23rd October 2012

Question 9.

If the interest on Rs.2400 be more than the interest on Rs.2000 by Rs.60 in 3 years at the same rate percent ; find the rate.

Solution:

In first case :

$$P = Rs.2400$$
$$R = x\% \text{ (Assume)}$$
$$T = 3 \text{ years}$$

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

$$= Rs.\frac{2400 \times x \times 3}{100}$$

$$= Rs.72\,x$$

In second case :

$$P = Rs.2000$$
$$R = x\%$$

(Rate same as in first case)

$$T = 3 \text{ years}$$

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

$$= Rs.\frac{2000 \times x \times 3}{100}$$

$$= Rs.60\,x$$

According to the statement,

$$72\,x = 60x + 60$$
$$\Rightarrow \qquad 72\,x - 60\,x = 60$$
$$\Rightarrow \qquad 12\,x = 60$$
$$\Rightarrow \qquad x = \frac{60}{12}$$
$$\Rightarrow \qquad x = 5$$
$$\therefore \qquad \text{Rate} = 5\%$$

Question 10.
Divide Rs. 15,600 into two parts such that the interest on one at 5 percent for 5 years may be equal to that on the other at $4\frac{1}{2}$ per cent for 6 years.

Solution:

Let one part = Rs. x

∴ Second part = Rs. $(15,600 - x)$

By the given condition

$$= \frac{x \times 5 \times 5}{100} = \frac{(15,600-x) \times \frac{9}{2} \times 6}{100}$$

$\Rightarrow 25x = 27 \times 15,600 - 27x$

$\Rightarrow 25x + 27x = 27 \times 15,600$

$\Rightarrow 52x = 27 \times 15,600$

$\Rightarrow x = \dfrac{27 \times 15,600}{52} = 27 \times 300 = 8100$

Hence one part = Rs. 8100 and second part

Rs. $(15,600 - 8,100)$ = Rs. 7,500

EXERCISE 9(C)

Question 1.

A sum of Rs. 8,000 is invested for 2 years at 10% per annum compound interest. Calculate:

(i) interest for the first year.

(ii) principal for the second year.

(iii) interest for the second year.

(iv) final amount at the end of second year

(v) compound interest earned in 2 years.

Solution:

(i) Here Principal (P) = Rs. 8,000

Rate of interest = 10%

$$\text{Interest for the first year} = \frac{8,000 \times 10 \times 1}{100}$$

$$= \text{Rs. } 800$$

(ii) ∴ Amount = Rs. 8,000 + Rs. 800 = Rs. 8,800

Thus Principal for the second year = Rs. 8,800

(iii) Interest for the second year

$$= \frac{8,800 \times 10 \times 1}{100} = \text{Rs. } 880$$

(iv) Amount at the end of second year = Rs. 8,800 + Rs. 880 = Rs. 9,680

(v) Hence compound interest earned in 2 years = Rs. 9,680 – Rs. 8,000 = Rs. 1680

Question 2.
A man borrowed Rs. 20,000 for 2 years at 8% per year compound interest. Calculate :
(i) the interest of the first year.
(ii) the interest of the second year.
(iii) the final amount at the end of second year.
(iv) the compound interest of two years.

Solution:

Here Principal (P) = Rs. 20,000, Time = 1 year
Rate = 8%

(i) ∴ Interest of the first year = $\dfrac{20,000 \times 8 \times 1}{100}$

= Rs. 1600

(ii) ∴ Amount after one year

i.e. Principal for second year = Rs. 20,000 + Rs. 1,600 = Rs. 21,600

∴ Interest for second year = $\dfrac{21,600 \times 8 \times 1}{100}$

= 216 × 8 = Rs. 1728

(iii) Final amount at the end of second year
= Rs. (21,600 + 1728) = Rs. 23,328

(iv) Interest of two years = Rs. 23,328 – Rs. 20,000 = Rs. 3,328

Question 3.
Calculate the amount and the compound interest on Rs. 12,000 in 2 years and at 10% per year.

Solution:

For 1st year

Principal (P) = Rs. 12,000

Rate (R) = 10%

Time (T) = 1 year

$$I = \text{Interest} = \frac{12,000 \times 10 \times 1}{100} = 120 \times 10 = \text{Rs.}$$

1200

Amount = P + I = Rs. 12,000 + Rs. 1200

= Rs. 13,200

For IInd year

P = Rs. 13,200, R = 10%, Time (T) = 1 year

$$\therefore \text{Interest} = \frac{13,200 \times 10 \times 1}{100} = 132 \times 10$$

= Rs. 1320

∴ Amount in 2 years = Rs. (13,200) + (1320)

= Rs. 14520

Compound interest in 2 years = Rs. 1200 + Rs. 1320 = Rs. 2520

[or directly = Rs. 14520 – Rs. 12000

= Rs. 2520]

Question 4.

Calculate the amount and the compound interest on Rs. 10,000 in 3 years at 8% per annum.

Solution:

For 1st year

Principal (P) = Rs. 10,000, Rate (R) = 8%

Time (T) = 1 year

$$\therefore \text{Interest} = \frac{10,000 \times 8 \times 1}{100} = 100 \times 8 = \text{Rs. } 800$$

For 2nd year

P = Rs. 10,000 + Rs. 800 = Rs. 10,800

Rate (R) = 8% Time (T) = 1 year

$$\therefore \text{Interest} = \frac{10,800 \times 8 \times 1}{100} = 108 \times 8 = \text{Rs. } 864$$

For 3rd year

∴ P = Rs. 10,800 + Rs. 864 = Rs. 11664,

R = 8%, T = 1 year

$$\therefore \text{ Interest} = \frac{11664 \times 8 \times 1}{100} = \frac{11664 \times 2}{25}$$

$$= \text{Rs. } 933.12$$

$\therefore$ Amount = Rs. 11664 + 933.12 = Rs. 12597.12

Hence required amount = Rs. 12597.12

$\therefore$ Compound interest

$$= \text{Rs. } 12597.12 - 10000 = \text{Rs. } 2597.12$$

Question 5.

Calculate the compound interest on Rs. 5,000 in 2 years ; if the rates of interest for successive years be 10% and 12% respectively.

Solution:

For 1st year

Principal (P) = Rs. 5,000, Rate (R) = 10%

Time (T) = 1 year

$$\therefore \text{ Interest} = \frac{5,000 \times 10 \times 1}{100} = 50 \times 10 = \text{Rs. } 500$$

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

For 2nd year

P = Rs. 5550, Rate 12%, T = 1 year

$$\therefore \text{ Interest} = \frac{5500 \times 12 \times 1}{100} = 55 \times 12 = \text{Rs. } 660$$

$\therefore$ Amount at the end of 2nd year

$$= \text{Rs. } 5500 + \text{Rs. } 660 = \text{Rs. } 6160$$

Hence compound interest = Rs. 6160 – Rs. 5000
= Rs. 1160

Question 6.

Calculate the compound interest on Rs. 15,000 in 3 years ; if the rates of interest for successive years be 6%, 8% and 10% respectively.
Solution:

For 1st year

Principal (P) = Rs. 15,000, Rate (R) = 6%

Time (T) = 1 year

$\therefore$ Interest = $\dfrac{15,000 \times 6 \times 1}{100}$ = 150 × 6 = Rs. 900

$\therefore$ Amount at the end of 1st year

= Rs. 15,000 + Rs. 900 = Rs. 15900

For 2nd year

P = Rs. 15900, R = 8%, T = 1 year

$\therefore$ Interest = $\dfrac{15,900 \times 8 \times 1}{100}$ = 159 × 8 = Rs. 1272

$\therefore$ Amount at the end of 2nd year

= Rs. (15900 + 1272) = Rs. 17172

For 3rd year

P = Rs. 17172, R = 10%, T = 1 year

$\therefore$ Interest = $\dfrac{17172 \times 10 \times 1}{100}$ = Rs. 1717.20

$\therefore$ Amount at the end of 3rd year

= Rs. (17172 + 1717.20) = Rs. 18889.20

$\therefore$ Compound interest = 18889.20 – 15,000

= Rs. 3889.20

Question 7.
Mohan borrowed Rs. 16,000 for 3 years at 5% per annum compound interest. Calculate the amount that Mohan will pay at the end of 3 years.
Solution:

For 1st year

Principal (P) = Rs. 16,000, Rate (R) = 5%

Time (T) = 1 year

$\therefore$ Interest = $\dfrac{16{,}000 \times 5 \times 1}{100}$ = 160 × 5 = Rs. 800

$\therefore$ Amount at the end of 1st year = Rs. (16,000 + 800) = Rs. 16,800

For 2nd year

P = Rs. 16,800, R = 5%, T = 1 year

$\therefore$ Interest = $\dfrac{16{,}800 \times 5 \times 1}{100}$ = 168 × 5 = Rs. 840

$\therefore$ Amount at the end of 2nd year = Rs. (16,800 + 840) = Rs. 17640

For 3rd year

P = 17640, R = 5%, T = 1 year

$\therefore$ Interest = $\dfrac{17640 \times 5 \times 1}{100} = \dfrac{1764}{2}$ = Rs. 882

$\therefore$ Amount at the end of 3rd year = Rs. (17640 + 882) = Rs. 18522

Hence reqd. amount = Rs. 18522

Question 8.
Rekha borrowed Rs. 40,000 for 3 years at 10% per annum compound interest. Calculate the interest paid by her for the second year.

Solution:

For 1st year

Principal = Rs. 40,000, Rate = 10%, Time = 1 year

$\therefore$ Interest = $\dfrac{40{,}000 \times 10 \times 1}{100}$ = 400 × 10 = Rs. 4000

$\therefore$ Amount at the end of 1st year = Rs. (40,000 + 4000) = Rs. 44,000

For 2nd year

P = Rs. 44,000, R = 10%, T = 1 year

$\therefore$ Interest = Rs. $\dfrac{44{,}000 \times 10 \times 1}{100}$ = 440 × 10 = Rs. 4400

Thus interest earned in the second year = Rs. 4400

Question 9.
Calculate the compound interest for the second year on Rs. 15000 invested for 5 years at 6% per annum.
Solution:

Principal (P) = Rs. 15000
Rate (R) = 6% p.a.
Period (n) = 5 years

Interest for the first year $= \dfrac{PRT}{100}$

$= \dfrac{15000 \times 6 \times 1}{100} = $ Rs. 900

$\therefore$ Amount for the first year = Rs. 15000 + 900
= Rs. 15900
Principal for the second year = Rs. 15900

Interest for the second year $= \dfrac{15900 \times 6 \times 1}{100}$

= 159 x 6 = Rs. 954

Question 10.
A man invests Rs. 9600 at 10% per annum compound interest for 3 years. Calculate :
(i) the interest for the first year.
(ii) the amount at the end of the first year.
(iii) the interest for the second year.
(iv) the interest for the third year.
Solution:

Principal (P) = Rs. 9600
Rate (R) = 10% p.a.
Period (n) = 3 years

(i) ∴ Interest for the first year = $\dfrac{PRT}{100}$

$= \dfrac{9600 \times 10 \times 1}{100}$ = Rs. 960

(ii) Amount at the end of first year
   = P + S.I. = Rs. 9600 + 960 = Rs. 10560

(iii) Principal for the second year = Rs. 10560

   Interest for the second year = $\dfrac{10560 \times 10 \times 1}{100}$

   = Rs. 1056
   ∴ Amount after second year = Rs. 10560 + 1056 = Rs. 11616

(iii) Principal for the third year = Rs. 11616

   Interest for the third year = $\dfrac{11616 \times 10 \times 1}{100}$

   116.16 × 10 = Rs. 1161.60

Question 11.
A person invests Rs. 5,000 for two years at a certain rate of interest compounded annually. At the end of one year, this sum amounts to Rs. 5,600. Calculate :
(i) the rate of interest per year.
(ii) the amount at the end of the second year.
Solution:

Principal (P) = Rs. 5000
Period (T) = 2 years
Amount at the end of one year = Rs. 5600
∴ Interest for the first year = A − P
= Rs. 5600 − 5000 = Rs. 600

(i) ∴ Rate of interest = $\dfrac{S.I. \times 100}{P \times T}$

$= \dfrac{600 \times 100}{5000 \times 1}$ = 12% p.a.

(ii) Principal for the second year = Rs. 5600

Interest for the second year = $\dfrac{5600 \times 12 \times 1}{100}$

= ₹672

∴ Amount at the end of second year
= P + S.I. = 5600 + 672 = ₹6272

Question 12.
Calculate the difference between the compound interest and the simple interest on ₹ 7,500 in two years and at 8% per annum.

Solution:

Principal (P) = ₹7500
Rate (R) = 8% p.a.
Period (T) = 2 years

∴ Simple interest = $\dfrac{PRT}{100} = \dfrac{7500 \times 8 \times 2}{100}$

= ₹1200

Interest for the first year = $\dfrac{7500 \times 8 \times 1}{100}$

= ₹600

∴ Amount at the end of first year = P + S.I.
= ₹7500 + ₹600 = ₹8100
Principal for the second year = ₹8100

∴ Interest for the second year = $\dfrac{8100 \times 8 \times 1}{100}$

= ₹648

∴ Total C.I. for 2 years = ₹600 + ₹648
= ₹1248

∴ Difference between C.I. and S.I. for 2 years
= ₹1248 − ₹1200 = ₹48

Question 13.

Calculate the difference between the compound interest and the simple interest on ₹ 8,000 in three years and at 10% per annum.

Solution:

Principal (P) = ₹ 8000
Rate (R) = 10% p.a.
Period (T) = 3 years

$$\therefore \text{ S.I. for 3 years} = \frac{PRT}{100} = \frac{8000 \times 10 \times 3}{100}$$

$$= ₹ 2400$$

Now, S.I. for 1st year = ₹ $\dfrac{8000 \times 10 \times 1}{100}$

$$= 80 \times 10 \times 1 = ₹ 800$$

Amount for the first year = P + S.I.

$$= ₹ 8000 + ₹ 800 = ₹ 8800$$

Principal for the second year = ₹ 8800

Interest for the second year = $\dfrac{8800 \times 10 \times 1}{100}$

$$= ₹ 880$$

$\therefore$ Amount after second year = ₹ 8800 + ₹ 880

$$= ₹ 9680$$

Principal for the third year = ₹ 9680

Interest for the third year

$$= ₹ \frac{9680 \times 10 \times 1}{100} = ₹ 968$$

$\therefore$ C.I. for 3 years = ₹ 800 + ₹ 880 + ₹ 968

$$= ₹ 2648$$

$\therefore$ Difference between C.I. and S.I. for 3 years

$$= ₹ 2648 - ₹ 2400 = ₹ 248$$

Question 14.

Rohit borrowed ₹ 40,000 for 2 years at 10% per annum C.I. and Manish borrowed the same sum for the same time at 10.5% per annum simple interest. Which of these two gets less interest and by how much?
Solution:

Sum borrowed (P) = ₹40000

Rate (R) = 10% p.a. compounded annually

Time (T) = 2 years

∴ Interest for first year = $\dfrac{PRT}{100}$

$= ₹\dfrac{40000 \times 10 \times 1}{100} = ₹4000$

Amount after one year = ₹40000 + 4000

= ₹44000

Principal for the second year = ₹44000

∴ Interest for the second year

$= \dfrac{44000 \times 10 \times 1}{100} = ₹4400$

∴ C. Interest for 2 years = ₹4000 + 4400

= ₹8400

In second case,

Principal (P) = ₹40000

Rate (R) = 10.5% p.a.

Time (T) = 2 years

∴ S. Interest = $\dfrac{PRT}{100} = \dfrac{40000 \times 10.5 \times 2}{100}$

$= ₹\dfrac{40000 \times 105 \times 2}{100 \times 10} = ₹8400$

In both the cases, interest is same.

Question 15.
Mr. Sharma borrowed ₹ 24,000 at 13% p.a. simple interest and an equal sum at 12% p.a. compound interest. Find the total interest earned by Mr. Sharma in 2 years.
Solution:

Sum borrowed (P) = ₹24000
Rate (R) = 13% p.a.
Time (T) = 2 years
In case of simple interest,

S. Interest for 2 years = $\dfrac{PRT}{100}$

$= ₹\dfrac{24000 \times 13 \times 2}{100} = ₹6240$

In case of compound interest,

Interest for the first year = $\dfrac{24000 \times 12 \times 1}{100}$

$= ₹2880$

Amount after first year
$= ₹24000 + 2880 = ₹26880$

Interest for second year $= ₹\dfrac{26880 \times 12 \times 1}{100}$

$= ₹\dfrac{322560}{100} = ₹3225.60$

∴ C.I. for 2 years = ₹2880 + 3225.60
$= ₹6105.60$

Total interest = ₹6240 + 6105.60
$= ₹12345.60$

Question 16.
Peter borrows ₹ 12,000 for 2 years at 10% p.a. compound interest. He repays ₹ 8,000 at the end of first year. Find:
(i) the amount at the end of first year, before making the repayment.
(ii) the amount at the end of first year, after making the repayment.
(iii) the principal for the second year.
(iv) the amount to be paid at the end of second year, to clear the account.

Solution:

Sum borrowed = ₹12000
Rate (R) = 10% p.a. compound annually
Time (T) = 2 years

Interest for the first year = $\dfrac{PRT}{100}$

$= \dfrac{12000 \times 100 \times 1}{100} = ₹1200$

(i) Amount = ₹12000 + 1200 = ₹13200
Amount paid = ₹8000

(ii) Balance amount = ₹13200 − 8000 = ₹5200

(iii) ∴ Principal for the second year = ₹5200

(iv) Interest for the second year = $\dfrac{5200 \times 10 \times 1}{100}$

= ₹520

∴ Amount = ₹5200 + 520 = ₹5720

Question 17.

Gautam takes a loan of ₹ 16,000 for 2 years at 15% p.a. compound interest. He repays ₹ 9,000 at the end of first year. How mucH must he pay at the end of second year to clear the debt?

Solution:

Loan taken (P) = ₹ 16000
Rate (R) = 15% p.a.
Time (T) = 2 years

∴ Interest for the first year

$= \dfrac{PRT}{100} = \dfrac{16000 \times 15 \times 1}{100} = ₹2400$

Amount after one year = ₹16000 + 2400
= ₹18400

At the end of one year amount paid back
= ₹9000

Balance amount = ₹18400 − 9000
= ₹9400

Interest for the second year = $\dfrac{9400 \times 15 \times 1}{100}$

= ₹1410

Amount after second year = ₹9400 + 1410
= ₹10810

Question 18.

A certain sum of money, invested for 5 years at 8% p.a. simple interest, earns an interest of ₹ 12,000. Find:

(i) the sum of money.

(ii) the compound interest earned by this money in two years and at 10% p.a. compound interest.

Solution:

Rate (R) = 8% p.a.

Period (T) = 5 years

Interest (T) = ₹12000

(i) ∴ Sum = $\dfrac{I \times 100}{R \times T}$

$= ₹ \dfrac{12000 \times 100}{8 \times 5} = ₹30000$

(ii) Rate (R) = 10% p.a.

Time (T) = 2 years

Principal (P) = ₹30000

Interest for the first year $= \dfrac{PRT}{100}$

$= ₹ \dfrac{30000 \times 10 \times 1}{100} = ₹3000$

∴ Amount after one year = ₹30000 + 3000

$= ₹33000$

Principal for the second year = ₹33000

Interest for the second year $= \dfrac{33000 \times 10 \times 1}{100}$

$= ₹3300$

∴ Compound Interest for two years

$= ₹3000 + 3300 = ₹6300$

Question 19.
Find the amount and the C.I. on ₹ 12,000 at 10% per annum compounded half-yearly.

Solution:

Principal (P) = ₹12,000

Rate (r) = 10%

Time (t) = 1 years

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

$$= ₹12,000 \times \left(1 + \frac{10}{200}\right)^{2}$$

$$= ₹12,000 \times \left(\frac{210}{200}\right)^{2}$$

$$= ₹12,000 \times \frac{21}{20} \times \frac{21}{20} = ₹13,230$$

C.I. = Amount − Principal

= ₹13230 − ₹12000 = ₹1230

Question 20.
Find the amount and the C.I. on ₹ 8,000 in $1\frac{1}{2}$ years at 20% per year compounded half-yearly.

Solution:

Principal (P) = ₹8000

Rate = 20%

$$\text{Time} = 1\frac{1}{2} \text{ years} = \frac{3}{2} \text{ years}$$

$$\text{Amount} = \text{Principal} \times \left(1 + \frac{r}{2 \times 100}\right)^{n \times 2}$$

$$= ₹8000 \times \left(1 + \frac{20}{200}\right)^{\frac{3}{2} \times 2}$$

$$= ₹8000 \times \left(\frac{220}{200}\right)^{3}$$

$$= ₹8000 \times \frac{11}{10} \times \frac{11}{10} \times \frac{11}{10} = ₹10648$$

C.I. = Amount − Principal

= ₹10648 − ₹8000 = ₹2648

Question 21.
Find the amount and the compound interest on ₹ 24,000 for 2 years at 10% per annum compounded yearly.

Solution:
Principal (P) = ₹24,000
Time (t) = 2 years
Rate (r) = 10%

$$\text{Amount} = \text{Principal} - \left(1 + \frac{r}{2 \times 100}\right)^{n \times 2}$$

$$= ₹24,000 \times \left(1 + \frac{10}{200}\right)^{2 \times 2}$$

$$= ₹24,000 \times \left(\frac{210}{200}\right)^{4}$$

$$= ₹24,000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= ₹29,172$$

C.I. = Amount − Principal
= ₹29,172 − ₹24,000 = ₹5,172

Question 22.
Find the amount and the compound interest on ₹ 16,000 for 3 years at 5% per annum compounded annually.
Solution:
Principal (P) = ₹16,000
Time (t) = 3 years
Rate (r) = 5%

$$\text{Amount} = \text{Principal} \times \left(1 + \frac{r}{2 \times 100}\right)^{n \times 2}$$

$$= ₹16,000 \times \left(1 + \frac{5}{200}\right)^{3 \times 2}$$

$$= ₹16,000 \times \left(\frac{205}{200}\right)^6$$

$$= ₹16,000 \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40} \times \frac{41}{40}$$

$$= ₹18,555$$

C.I. = Amount – Principal

$$= ₹18,555 - ₹16,000 = ₹2555$$

Question 23.

Find the amount and the compound interest on ₹ 20,000 for $1\frac{1}{2}$ years at 10% per annum compounded half-yearly.

Solution:

Principal (P) = ₹20,000

$$\text{Time } (t) = 1\frac{1}{2} \text{ years} = \frac{3}{2} \text{ years}$$

Rate (r) = 10%

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

$$= ₹20,000 \times \left(1 + \frac{10}{200}\right)^{\frac{3}{2} \times 2}$$

$$= ₹20,000 \times \left(\frac{210}{200}\right)^3$$

$$= ₹20,000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= ₹23,152.50$$

C.I. = Amount – Principal

$$= ₹23,152.50 - ₹20,000 = ₹3,152.50$$

Question 24.
Find the amount and the compound interest on ₹ 32,000 for 1 year at 20% per annum compounded half-yearly.
Solution:

Principal (P) = ₹32,000

Time (t) = 1 year

Rate (r) = 20%

$$\text{Amount} = \text{Principal} \times \left(1 + \frac{r}{2 \times 100}\right)^{n \times 2}$$

$$= ₹32,000 \times \left(1 + \frac{20}{200}\right)^{1 \times 2}$$

$$= ₹32,000 \times \left(\frac{11}{10}\right)^2$$

$$= ₹32,000 \times \frac{11}{10} \times \frac{11}{10} = ₹38,720$$

C.I. = Amount – Principal
= ₹38,720 – ₹32,000 = ₹6,720

Question 25.
Find the amount and the compound interest on ₹ 4,000 in 2 years, if the rate of interest for first year is 10% and for the second year is 15%.
Solution:

. Principal (P) = ₹4,000

Time (t) = 2 years

Rate (R_1) = 10% and rate (R_2) = 15%

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

$$= ₹4,000\left(1 + \frac{10}{100}\right)\left(1 + \frac{15}{100}\right)$$

$$= ₹4,000 \times \frac{11}{10} \times \frac{23}{20} = ₹5060$$

C.I. = Amount – Principal
= ₹5060 – ₹4000 = ₹1060

Question 26.
Find the amount and the compound interest on ₹ 10,000 in 3 years, if the rates of interest for the successive years are 10%, 15% and 20% respectively.
Solution:

Principal (P) = ₹10,000

Time (t) = 3 years

Rate (R$_1$) = 10%

Rate (R$_2$) = 15%

Rate (R$_3$) = 20%

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

$$= ₹10,000 \times \left(1+\frac{10}{100}\right)\left(1+\frac{15}{100}\right)\left(1+\frac{20}{100}\right)$$

$$= ₹10,000 \times \frac{11}{10} \times \frac{23}{20} \times \frac{6}{5} = ₹15,180$$

C.I. = Amount – Principal
= ₹15,180 – ₹10,000 = ₹5180