



- Calculation of Compound Interest
(when total time period is not more than 3 units)
 - (a) Annual
 - (b) Half yearly
 - (c) Quarterly
- Rate of interest and depreciation in the cost of commodities

11.1 Introduction

Now-a-days so many loan sanctioning authorities are in abundance. These authorities provide loan on their own conditions and recover the principal with interest in installments. Almost all the institutions provide loan on the basis of compound interest.

Verbal meaning of compound interest (cycle + increasement where cycle means) repetition and increasement means addition. So compound interest is the interest for each cycle. In other words with the principal amount; interest on the interest is known as compound interest. During the calculation of the compound interest; after a definite time interest adds with principal amount. The fixed time may be annual, half yearly or quarterly after each interval the interest with the Principal amount makes a new principal amount; this process takes place for the fixed time.

Calculation of Compound interest :

Now let us know how to calculate the compound interest

We know that

$$1. \quad \text{Amount} = \text{Principal} \left(1 + \frac{\text{Rate}}{100} \right)^{\text{time}}$$

$$2. \quad A = P \left(1 + \frac{r}{100} \right)^n$$

where P is Principal, r is the rate of interest and n = time and

A = Compounded Amount.

3. Compound interest of n years = Compounded Amount – Principal

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

Here we see that the formulae we can calculate fourth unknown quantity when amount, rate of interest and time is given.

Example 1. Find compound interest ₹ 400 at the rate of 10% per annum for 2 years.

Solution : We know that

$$\text{Compounded Amount} = \text{Principal amount} \left(1 + \frac{\text{Rate}}{100} \right)^{\text{time}}$$

$$\text{Substituting the values} = ₹ 400 \left(1 + \frac{10}{100} \right)^2$$

$$= ₹ 400 \left(\frac{11}{10} \right)^2$$

$$= ₹ 400 \times \frac{11 \times 11}{100}$$

$$= ₹ 484$$

$$\therefore \text{Compound Interest} = \text{Compounded amount} - \text{Principal amount}$$

$$= 484 - 400$$

$$= ₹ 84$$

Try

1. Find compound interest on ₹ 25,600 at the rate of 6.25% per annum for 2 years.
2. At what principal with rate of interest 10% per annum; difference between simple interest and compound interest for 2 years will ₹ 200.
3. An amount of money doubles in 5 years. Find with same rate of interest in 2 years ₹ 12000 will amount to what value ?

11.2.1 Calculation of compound interest while interest is calculated (a) half yearly (b) quarterly.

Let us Know

How to convert a given rate of interest per annum into half yearly rate of interest and quarterly rate of interest.

Now observe the table given below carefully.

Per annum rate of interest	5%	8%	10%	12%	12.5%	20%
Half yearly rate of interest	$\frac{5}{2}\% = 2\frac{1}{2}\%$	$\frac{8}{2}\% = 4\%$	$\frac{10}{2}\% = 5\%$	$\frac{12}{2}\% = 6\%$	$12\frac{1}{2}\% = 6\frac{1}{4}\%$	$\frac{20}{2}\% = 10\%$
Quarterly rate of interest	$\frac{5}{4}\% = 1\frac{1}{4}\%$	$\frac{8}{4}\% = 2\%$	$\frac{10}{4}\% = \frac{5}{2}\%$	$\frac{12}{4}\% = 3\%$	$\frac{25}{4 \times 2}\% = \frac{25}{8}\%$	$\frac{20}{4}\% = 5\%$

We know that

- A year has 2 half years or 2 six monthly. That is why to convert a per annum rate of interest into half yearly rate of interest we divide by 2. As shown above in 6 monthly rate of interest table above.
- To convert per annum rate of interest into quarterly rate of interest we divide it by 4. Since a year has four quarterly.

Observe carefully table given below and answer the questions given below the table.

Duration in number of years	$\frac{1}{2}$ years	$\frac{3}{4}$ years	2 years	$1\frac{1}{2}$ years	2 years
Number of half yearly	$\frac{1}{2} \times 2 = 1$ half yearly	$\frac{3}{4} \times 2 = 1\frac{1}{2}$ half yearly	$1 \times 2 = 2$ half yearly	$\frac{3}{2} \times 2 = 3$ half yearly	$2 \times 2 = 4$ half yearly
Number of quarterly	$\frac{1}{2} \times 4 = 2$ quarterly	$\frac{3}{4} \times 4 = 3$ quarterly	$1 \times 4 = 4$ quarterly	$\frac{3}{2} \times 4 = 6$ quarterly	$2 \times 4 = 8$ quarterly

We know that

An year has 12 months that is why an year can be divided into two half years or six months. Similarly $1\frac{1}{2}$ year is divided in 3 six months and 2 years is divided into 4 six months.

Now 12 months of an year can be divided into four quarterly. Therefore 1 year = 4 quarters

So 1 year = 2 Half year or Six months
= 4 quarters

- In the table given below conversion cycle of rate and time period is given. Fill in the blanks :

Per annum rate of Interest	Half Yearly rate of Interest	Quarterly rate of Interest	Time period in year	Time period half years	Time period quarter years
10%	5%		1 year		4 quarters
20%		5%		3 half years	6 quarter years
	4%	2%	2 years	4 half years	

- Convert 5% per annum rate into quarterly rate and half yearly rate of interest.
- In time period of 8 half years find number of years and number of quarter years.

From above we conclude the following :

- If rate of interest is half yearly compounded :
 - Number of year's number is multiplied by 2 and is converted into number of half years.
 - Rate of interest by dividing 2 we get half yearly rate of interest.
- If interest is compounded quarterly—
 - Time period given in years is multiplied by 4 and converted into quarters.
 - Rate of interest per annum is divided by 4, and rate of interest is converted into quarterly.

Conversion Period

Generally time period is in years. But interest can be applied per half yearly, per quarterly. That time period after which interest gained is added to get new Principal amount is called conversion period.

Example 2. Find compound Principal amount and compound interest of ₹ 2000 at the rate of 10% per annum for 1 year. If interest is compounded half yearly.

Solution : According to question

Principal amount (P) = ₹ 2000

rate $r = 10\%$ per annum = 5% half yearly (six monthly)

time $n = 1$ year = 2 half years

Compounded Principal amount = ₹ Principal $\left(1 + \frac{\text{Rate}}{100}\right)^{\text{time}}$

$$\begin{aligned} A &= P \left(1 + \frac{r}{100}\right)^n \\ &= ₹ 2000 \left(1 + \frac{5}{100}\right)^2 \\ &= 2000 \left(\frac{21}{20}\right) \times \left(\frac{21}{20}\right) \\ &= 2205 \end{aligned}$$

$$\begin{aligned} \text{Compound interest} &= \text{Compounded Principal amount} - \text{Principal Amount} \\ &= A - P \\ &= ₹ 2205 - ₹ 2000 \\ &= ₹ 205 \end{aligned}$$

Try

Find compound interest of ₹ 1600 at the rate of 10% per annum for six months. If interest is compounded quarterly.

Example 3. On saving bank account bank facilitates 8% per annum rate of interest. But after every six month interest is compounded the Principal amount. If Sanju deposited ₹ 250 at present, how much interest he receive after 1 year.

Solution : According to question

$$P = ₹ 250$$

$$r = 8\% \text{ per annum} = \frac{8}{2}\% \text{ or } 4\% \text{ half yearly (six monthly)}$$

$$n = 1 \text{ year} = 2 \text{ half years}$$

$$\text{Compounded amount} = ₹ P \left(1 + \frac{r}{100}\right)^n$$

$$\therefore = ₹ 250 \left(1 + \frac{8}{2 \times 100}\right)^2$$

$$= ₹ 250 \times \left(1 + \frac{1}{25}\right)^2$$

$$= ₹ 250 \times \left(\frac{26}{25}\right)^2$$

$$= ₹ 250 \times \frac{26 \times 26}{25 \times 25}$$

$$= ₹ \frac{1352}{5}$$

$$= ₹ 270.40$$

$$\begin{aligned} \text{Compound interest} &= \text{Compounded amount} - \text{Principal} \\ &= ₹ 270.40 - ₹ 250 \\ &= ₹ 20.40 \end{aligned}$$

Example 4. In how much time ₹ 800 will amount to ₹ 926.10 if rate of interest is 10% per annum and interest is compounded every six monthly ?

Solution : According to question :

$$P = ₹ 800$$

$$A = ₹ 926.10$$

$$r = 10\% \text{ per annum}$$

$$= 5\% \text{ per half yearly (six monthly)}$$

$$n = ?$$

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

$$\text{or } P \left(1 + \frac{r}{100} \right)^n = \text{Compounded amount}$$

$$\text{as per question } 800 \left(1 + \frac{5}{100} \right)^n = 926.10$$

$$\text{or } \left(1 + \frac{5}{100} \right)^n = \frac{926.10}{800}$$

$$\text{or } \left(\frac{21}{20} \right)^n = \frac{9261}{8000}$$

$$= \left(\frac{21}{20} \right)^n = \left(\frac{21}{20} \right)^3$$

$\therefore n = 3$
Therefore time = 3 six monthly = $1\frac{1}{2}$ years.

Try

1. Find simple interest of ₹ 2000 at the rate of 10% per annum for 1 year. If interest is compounded half yearly find compound interest for one year ? Find the difference of earned compound interest to that simple interest on the Principal why is this difference occurred ?
2. "Conversion" means what ? What will be conversion years of six quarterly?

Example 5. At what rate of interest Principal ₹ 31250 amounts to ₹ 35152 in $1\frac{1}{2}$ years, while interest is compounded half yearly ? Find rate of interest per annum.

Solution : According to question,

$$P = ₹ 31250$$

$$A = ₹ 35152$$

$$n = 1\frac{1}{2} \text{ years} = 3 \text{ half yearly}$$

$$\text{Rate of interest} = r\% \text{ per annum} = \frac{r}{2}\% \text{ per half yearly}$$

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

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

$$\text{or } P \left(1 + \frac{r}{2 \times 100}\right)^n = A; \text{ by taking } n \text{ half years}$$

as per question

$$₹ 31250 \left(1 + \frac{r}{2 \times 100}\right)^3 = ₹ 35152$$

$$\text{or} \quad \left(1 + \frac{r}{2 \times 100}\right)^3 = \frac{35152}{31250} = \frac{17576}{15625} = \left(\frac{26}{25}\right)^3$$

$$\text{or} \quad \left(1 + \frac{r}{2 \times 100}\right) = \left(\frac{26}{25}\right)$$

$$\text{or} \quad \frac{r}{2 \times 100} = \frac{26}{25} - 1 = \frac{1}{25}$$

$$r = \frac{2 \times 100}{25} = 8$$

Therefore $r = 8\%$ per annum.

Exercise 11(a)

- Any principal value amount to ₹ 2400 in two years and same principal amount to ₹ 2520 in 3 years then rate of interest will be :
(a) 6% (b) 5% (c) 7.5% (d) 10%
- If interest is compounded quarterly then correct conversion of 8% per annum will be :
(a) 5% (b) 4% (c) 2% (d) 1%
- Following are the groups A and B. In group A questions and answers in group B are jumbled. Find the correct order.

First Group A

- Number of quarterly in year (three monthly)
- Conversion of 10% six monthly rate of interest into three monthly
- Conversion of 3 years into number of six monthly
- If rate of interest for $\frac{1}{2}$ year if 5% per annum is rate of interest

Second Group B

- (M) 5%
- (N) 6
- (P) 4
- (R) $2\frac{1}{2}\%$

- Find compound interest of ₹ 100 for 2 years at the rate of 10% per annum.
- Find difference between simple interest and compound interest of ₹ 500 at the rate of 15% per annum for 1 year ?

6. Some money is lent for 1 year at the rate of 12% per annum compound interest. If interest is compounded every three months then find three monthly rate of interest ?
7. Find compound interest of ₹ 2000 for $1\frac{1}{2}$ years at the rate of 10% per annum. If interest is compounded every six months.
8. In how many years ₹ 640 amount ₹ 810 at the rate of interest $12\frac{1}{2}$ % Principal amount.
9. Find compound interest of ₹ 5120 with rate of interest 12.5% for $\frac{1}{2}$ year, if interest is compounded quarterly.
10. At what rate of interest a compound interest of ₹ 630.50 can be acquired on ₹ 4000 in 9 months. If interest is compounded every three months.
11. In what time interval ₹ 12000 will earn compound interest of ₹ 1230 at 10% per annum rate of interest, if interest is compounded half yearly ?
12. Any amount of money ₹ 88720 at the rate of compound interest 5% in two years. Find principal amount of money ?
13. A principal amount earns simple interest ₹ 200 in two years at the rate of 20% per annum. Find its compound interest at the same conditions ?
14. If difference between simple interest and compound interest on ₹ 8000 for 2 years is ₹ 20 then find rate of interest. (Interest is compounded yearly)
15. Any principal amount has difference of ₹ 160 in its simple interest and compound interest at the rate of 5% per annum for 2 years. Find the Principal amount.

Applications of Compound interest :

There are certain conditions where we can use the formulae of calculations of compound interest. They are given below.

- (a) Increase or decrease in population.
- (b) Rate of increase of bacteria culture known then to find total increase.
- (c) To find price of any article if in certain years its prices are increased or decreased.

11.3 Rate of increase or decrease in the price of articles

In our daily life, we observe that plants grow as trees, children grow to younger ones and then adults. Present year population becomes more than the previous year population due to increase in it. This increase in population is as compound interest. This type of increase is called "positive increase". This means as time passes it increases compoundly. In this situation

the formulae of compound interest we use initial price, population in place of Principal; Per year increasement rate in place of rate; stated period in place of time, we find years price or population. Again to find increase we subtract initial value from final value as explain in coming examples.

If present price of an article is ₹ P, there is increase rate of 4% then to calculate Price A after n years we perform the formulae as given below :

$$\text{Price after 1 year} = P \left(1 + \frac{r}{100} \right)$$

$$\text{Price after 2 year} = P \left(1 + \frac{r}{100} \right)^2$$

$$\text{Price after n year} = P \left(1 + \frac{r}{100} \right)^n$$

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

Example 6. Population of a city is increasing at the rate of 5% per annum. If present population is 12000. Find population after two years ?

Solution : Present population = 12000 = P

Time (n) = 2 years

r (Percentage growing rate) = 5

Let Population after 2 years = A

putting the values in $A = \left(1 + \frac{r}{100} \right)^n$

$$\therefore A = 1200 \left(1 + \frac{5}{100} \right)^2$$

$$= 1200 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 13230$$

So the population of the city after 2 years will be = 13,230.

Example 7. The population of a city increases from 1000000 to 1157625 in three years.
Find rate of increase per years.

Solution : According to the question

Present population of the city = 1000000 = P

Increased Population after three years = 1157625 = A

Increases rate per year = r%

Time period in years = 3 = n.

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

$$\text{or } 1157625 = 1000000 \left(1 + \frac{r}{100}\right)^3$$

$$\text{or } 1000000 \left(1 + \frac{r}{100}\right)^3 = 1157625$$

$$\text{or } \left(1 + \frac{r}{100}\right)^3 = \frac{1157625}{1000000}$$

$$\text{or } 1 + \frac{r}{100} = \frac{105}{100}$$

$$\begin{aligned}\text{or } \frac{r}{100} &= \frac{105}{100} - 1 \\ &= \frac{105 - 100}{100}\end{aligned}$$

$$\text{or } r = 5$$

Annual increased rate = 5%

Example 8. Production rate of a cycle manufacturing company increases 5% per year. If production in years 2000 is 40,000 then what will be the production in the year 2002 ?

Solution : Number of cycles in the present year

P = 40,000

rate per year r = 5%

time $n = 2$ years

Let the numbers of cycles after two years = A

$$\begin{aligned}\text{then } A &= \left(1 + \frac{r}{100}\right)^n \\ &= 40,000 \left(1 + \frac{5}{100}\right)^2 \\ &= 40,000 \left(\frac{105}{100}\right)^2 \\ &= 40,000 \left(\frac{21}{20}\right)^2 \\ &= 40,000 \times \frac{21}{20} \times \frac{21}{20} \\ &= 44100\end{aligned}$$

So the production of cycles in 2002 will be 44100.

Example 9. Production of a car manufacturing company increases 10% per year. If in present the production is 60,000, then in how many years the production will be 79860 ?

Solution : Production of cars in present year (P) = 60,000

Rate percentage per year (r) = 10

Let after n years, the production (A) = 79860

$$\begin{aligned}\text{Formula } A &= \left(1 + \frac{r}{100}\right)^n \\ 79860 &= 60,000 \left(1 + \frac{10}{100}\right)^n \\ &= 60000 \left(\frac{11}{10}\right)^n \\ \therefore \left(\frac{11}{10}\right)^n &= \frac{79860}{60000} \\ &= \frac{1331}{1000}\end{aligned}$$

$$= \left(\frac{11}{10}\right)^3$$

so $n = 3$

So after 3 years production will be 79860 cars per year.

11.3.1 Loss rate in values or Depreciation rate

Some time we see that as the time increases value of the commodities decreases. As when Machine, Scooter, Car or other article gets old, their value of articles decreases and depreciation of this type is called negative increment and rate of this negative increment is said to be depreciation rate. After depreciation the adjustment of the values of the article compounded according to time.

Now it can be understood by this formulae approach.

If current value of the object is ₹ P and rate of devaluation is 4% per annum then value A after n years can be calculated by replacing r in the formulae by -r as given below

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

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

To understand this look at example 10.

Example 10. Price of a television devalued at the rate of 10% per annum. If present value of television is ₹ 25000 then what will be its value after 3 years.

Solution : Present value of television (P) = ₹ 25000

rate of devaluation = 10%

So rate of increase = -r%

= -10%

∴ r = -10%

time (n) = 3 years

Let value of the television after 3 years = A

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

$$\begin{aligned}
 &= 25000 \left(1 - \frac{10}{100}\right)^3, \text{ (here value of } r \text{ is negative)} \\
 A &= 25000 \left(\frac{9}{10}\right)^3 \\
 &= 25000 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} \\
 &= 25000 \times \frac{729}{10 \times 10 \times 10} \\
 &= 25 \times 729 \\
 &= ₹ 18225
 \end{aligned}$$

Therefore value of television after 3 years = ₹ 18,225.

Example 11. Population of village is reducing at the rate of 5% per annum. If present population of the village is 3610, then find the population of the village 2 years ago.

Solution : Present population of the village = ₹ 3610

rate of reduction $r\% = 5\%$

time (n) = 2 years

Let the population of the village 2 years ago = P

$$\begin{aligned}
 A &= P \left(1 - \frac{r}{100}\right)^n \\
 \text{or} \quad 3610 &= P \left(1 - \frac{5}{100}\right)^2 \\
 &= P \left(\frac{19}{20}\right)^2
 \end{aligned}$$

$$\text{or} \quad P \frac{19}{20} \times \frac{19}{20} \times \frac{19}{20} = 3610$$

$$\begin{aligned}
 \text{or} \quad P &= \frac{3610 \times 20 \times 20}{19 \times 19} \\
 &= 10 \times 20 \times 20 \\
 &= 4000
 \end{aligned}$$

Therefore population of the village 2 years ago = 4,000

Note : In the given question population before 2 years is asked, due to devaluation population 2 years ago will be more than the present one. Now we assume present population P and population 2 years ago as A and time $n = -2$.

OPTIONAL METHOD

Present population of village $P = 3610$

Per year depreciation rate $r = 5\%$

So if population 2 years ago be A then

$$\begin{aligned}
 A &= P \left(1 - \frac{r}{100}\right)^n \\
 &= P \left(1 - \frac{5}{100}\right)^{-2} \\
 &= 3610 \left(1 - \frac{5}{100}\right)^{-2} \\
 &= \frac{3610}{\left(1 - \frac{5}{100}\right)^2} \\
 &= \frac{3610}{\frac{95}{100} \times \frac{95}{100}} \\
 &= \frac{3610 \times 100 \times 100}{95 \times 95} \\
 &= 2 \times 100 \times 20 \\
 &= 40 \times 100 \\
 &= 4000
 \end{aligned}$$

Example 12. Ramu purchased a two year old boat for ₹ 10830. If value of boat devalued at the rate 5% per annum, then what was the price of boat 2 years ago?

Solution : Present value of boat (A) = 10830

Rate of annual devaluation ($-r$) = -5%

time in years $n = 2$ years

Value of boat 2 years ago (P) is to be calculated

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

$$10830 = P \left(1 - \frac{5}{100}\right)^2$$

$$= P \left(1 - \frac{1}{20}\right)^2$$

$$10830 = P \left(\frac{20-1}{20}\right)^2$$

$$= P \left(\frac{19 \times 19}{20 \times 20}\right)^2$$

$$= P \left(\frac{19}{20}\right)^2$$

$$\begin{aligned}\therefore P &= \frac{10830 \times 20 \times 20}{19 \times 19} \\ &= 12000\end{aligned}$$

Therefore cost of boat 2 years ago = ₹ 12000

Optional method :

Present value of boat (P) = ₹ 10830

rate of annual devaluation (-r) = -5

2 years ago time n -2

Here by formulae $A = P \left(1 - \frac{r}{100}\right)^n$

$$A = 10830 \left(1 - \frac{5}{100}\right)^2$$

$$= 10830 \left(\frac{19}{20}\right)^{-2}$$

$$= 10830 \times \frac{1}{\left(\frac{19}{20}\right)^2}$$

$$= 10830 \times \frac{1}{\frac{19}{20} \times \frac{19}{20}}$$

$$= 10830 \times \frac{20 \times 20}{19 \times 19}$$

$$= 12000$$

Therefore value of boat 2 years ago = ₹ 12000

Try

1. Population of a village is increasing at the rate 5% per year. If present population is 4410 then find its population 2 years ago.
2. Value of a motorcycle devaluated at the rate 5% yearly. If its present value be ₹ 40,000 then what will be its value after 2 years ?

From above example it is clear.

1. If “r” is yearly increase rate, then $A = P \left(1 + \frac{r}{100}\right)^n$
where “A” is last value, P is initial value “n” is time period in years.
2. If rate of increase is negative meaning it is rate of devaluation then
 $A = P \left(1 - \frac{r}{100}\right)^n$; Here A is last value, P is initial value, n is time period years.

Exercise 11 (b)

1. Population of city was 100000 on 31 December 1978. If rate of increase in population be 10% yearly, then what will be population of the city on 31 December 1981.
2. Population of a village increases 5% every year. If present population of the village be 4410, then what was its population 2 years ago ?

3. Any area has an increase of population at the rate $6\frac{2}{3}\%$. What will be its population after 3 years. Present population of the city is 33750.
4. There is devaluation at the rate of 12% yearly in the value of a machine. What was its value 2 years ago ? Present value of the machine is ₹ 29040.
5. In what time period value of an old tractor devalued from 100000 to 81000. If rate of devaluation is 10% per year.
6. A type of organism are increasing at the rate of 5% every hour. If number of organism is 25000000 at 9 AM. then what will their number at 12.0 O'clock.Noon.
7. A coloured television price is ₹ 15625. If its value is devalued by 8% every year. What devaluation it will have in 3 years.
8. Population of a country at present is 53 crores. If it increases at the rate of 5% per year. Find total increase in population in two years.
9. What is the annual devaluation rate that devaluates capital of a company from ₹ 62,50,00,000 to 57,60,00,000 in two years.
10. At the rate of increase 5% per year population of a place in the end of year 2016 is 926100. What population
 - (a) was in the year 2013,
 - (b) will be in the year 2018.

Discuss in the Group

1. How many quarterly are there in $3\frac{1}{2}$ year ?
2. 5 half years equals to what number of years ?
3. In the formula $A = P \left(1 + \frac{r}{100}\right)^n$, r is rate of increase or decrease ?
4. Convert the rate 18 percent per year to quarterly ?
5. In case of devaluation which is major initial capital and the last capital ?

Efficiency Practice- 11

1. Mohan bought a 2 year old cycle in ₹ 1296 from Rakesh which was purchased in ₹ 1600. At what rate price of cycle is devalued ?

2. Present population of a city is 1000000. Due to availability of employment population increases by 10% yearly rate; then what will be population of the city after 3 years ?
3. Number of animals in a village Panchayat is decreased by $2\frac{1}{2}\%$. If number of animals at present is 6400. How many animals will be lacking in the field after 2 years ?
4. Find compound interest on ₹ 40960 at the rate of interest $12\frac{1}{2}\%$ yearly in $1\frac{1}{2}\%$ years. Interest is compounded every six monthly ?
5. If Principal = ₹ 10000 rate of interest = 24% yearly, time = 2 month interest compounded monthly, Calculate its compound interest.
(Hint : 24% yearly interest rate = 2% monthly rate)
6. If ₹ 62500 earned compound interest ₹ 7804, in $1\frac{1}{2}$ year. Interest compounded half yearly then find rate of interest per annum.
7. In what time ₹ 2,50,000 will amount to ₹ 265302 at 8% per annum rate of interest; where interest is compounded quarterly.
8. Find compound interest on the investment of ₹ 30,000 at the rate of interest 5% yearly for the time 3 years.
9. Difference of compound interest and simple interest on ₹ 1000 for 2 years at the rate of interest 10% yearly will be—
(a) ₹ 10.00 (b) ₹ 11.00 (c) ₹ 1110.00 (d) ₹ 100.00
10. A Principal acquires compound interest of ₹ 123.00 in 2 years at the rate of interest 5% yearly then Principal is—
(a) ₹ 1000.00 (b) ₹ 1100 (c) ₹ 1200 (d) ₹ 1300
11. A person deposited ₹ 6000 in a bank at the rate of 5% yearly simple interest. Another person deposited ₹ 5000 in the bank at the rate of 8% yearly at compound interest. What will be the difference between interest earned—
(a) ₹ 230 (b) ₹ 232 (c) ₹ 832 (d) ₹ 600

We have learnt

1. Principal = P, $r\%$ = annual rate, n = time, A = Compound Amount. Formula for finding any one of these four—

$$A = P \left(1 + \frac{r}{100} \right)^n \text{ is to be used}$$

2. Rate of interest can be converted to monthly, quarterly (every three month) half yearly (every six months)
3. If interest is compounded six monthly then number of years multiplied by 2 converts it into half yearly and rate of interest per annum is divided by 2 and half yearly rate is obtained.
4. If interest is compounded quarterly then number of years multiplied by 4 and this period is converted to quarterly and rate of interest per annum is divided by 4 gives quarterly rate of interest.
5. Conversion period is the time after which interest acquired is added to principal to obtain new compounded principal.
6. Any population which is at higher number at present is called increase positively or rise. Sometime as time passes number becomes less, it is called negative increase or devaluation. Such as old machines and old cars which price is devaluate.
7. Increase or increasement or positive increase; earlier values are obtained by assigning $-ve$ to the number of years given as time period for this $A = P \left(1 + \frac{r}{100} \right)^n$ formula is to be used.
8. In case of devaluation negative sign is assigned to both time period given and rate of decrease to find previous values. Formulae used $A = P \left(1 + \frac{-r}{100} \right)^{-n} = P \left(1 - \frac{r}{100} \right)^{-n}$ is to be used.

ANSWERS

Exercise 11(a)

1. (b), 2. (c) 2%; 3. (a) $\rightarrow$ (P); (b) $\rightarrow$ (M), (c) $\rightarrow$ (N); (d) $\rightarrow$ (R) 4. ₹ 21; 5. Zero;
6. 3% every quarterly, 7. ₹ 315.25; 8. 2 years; 9. ₹ 325 ; 10. 20% per annum rate of interest;
11. 1 year; 12. ₹ 80471.655; 13. ₹ 220; 14. 5%; 15. ₹ 64000.

Exercise 11(b)

1. 1,33,100; 2. 4000; 3. 40960; 4. ₹ 37500; 5. 2 years; 6. 28940625 organisms;
7. ₹ 3458; 8. 54325000, 8% 9. 4% yearly; 10. (a) 8,00,000 (b) 10, 21, 025 approximately.

Efficiency Practice 11

1. 10% yearly; 2. 133100; 3. 316 animals; 4. ₹ 8170; 5. ₹ 404; 6. 8%; 7. 9 month
or $\frac{3}{4}$ year; 8. ₹ 4728.75; 9. (a), 10. (c) 11. (b)

