Compound Interest
Ex 11B

1. Let Principal = P, Rate = R% per annum, Time = n years.
2. **When interest is compound Annually:**

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

3. **When interest is compounded Half-yearly:**

   $$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

4. **When interest is compounded Quarterly:**

   $$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

   $$\text{Amount} = P\left(1 + \frac{R}{100}\right)^{3} \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

6. **When Rates are different for different years**, say R_1%, R_2%, R_3% for 1st, 2nd and 3rd year respectively.

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

7. **Present worth of Rs. x due n years hence is given by:**

   $$\text{Present Worth} = \frac{x}{\left(1 + \frac{R}{100}\right)}.$$

Future Value Formula (compound interest)

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

Where:

A = resulting amount (future value)

P = amount of principal (present value)

r = annual interest rate

n = number of compounding periods per year

t = time (in years)

Q1.

Answer :

Principal amount, P = Rs 6000
Rate of interest, R = 9% per annum
Time, n = 2 years.
The formula for the amount including the compound interest is given below :

$$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^{n}$$

$$\Rightarrow A = \text{Rs. } 6000\left(1 + \frac{9}{100}\right)^{2}$$

$$\Rightarrow A = \text{Rs. } 6000\left(\frac{100+9}{100}\right)^{2}$$

$$\Rightarrow A = \text{Rs. } 6000\left(\frac{109}{100}\right)^{2}$$

$$\Rightarrow A = \text{Rs. } 6000\,(1.09 \times 1.09)^{2}$$

$$\Rightarrow A = \text{Rs. } 7128.6$$

i.e., the amount including the compound interest is Rs 7128.6.

$\therefore$ Compound interest = Rs (7128.6 − 6000) = Rs 1128.6

Q2.

Answer :

Principal amount, $P = \text{Rs. } 10000$
Rate of interest, $R = 11\%$ per annum.
Time, $n = 2$ years.
The formula for the amount including the compound interest is given below :

$$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow A = \text{Rs. } 10000\left(1 + \frac{11}{100}\right)^2$$

$$\Rightarrow A = \text{Rs. } 10000\left(\frac{100+11}{100}\right)^2$$

$$\Rightarrow A = \text{Rs. } 10000\left(\frac{111}{100}\right)^2$$

$$\Rightarrow A = \text{Rs. } 10000\,(1.11 \times 1.11)^2$$

$$\Rightarrow A = \text{Rs. } 12321$$

i.e., the amount including the compound interest is Rs 12321.
$\therefore$ Compound interest $= \text{Rs. } (12321 - 10000) = \text{Rs. } 2321$

Q3.

Answer :

Principal amount, $P = \text{Rs. } 31250$
Rate of interest, $R = 8\%$ per annum.
Time, $n = 3$ years.
The formula for the amount including the compound interest is given below :

$$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow A = \text{Rs. } 31250\left(1 + \frac{8}{100}\right)^3$$

$$\Rightarrow A = \text{Rs. } 31250\left(\frac{100+8}{100}\right)^3$$

$$\Rightarrow A = \text{Rs. } 31250\left(\frac{108}{100}\right)^3$$

$$\Rightarrow A = \text{Rs. } 31250\,(1.08 \times 1.08 \times 1.08)^3$$

$$\Rightarrow A = \text{Rs. } 39366$$

i.e., the amount including the compound interest is Rs 39366.
$\therefore$ Compound interest $= \text{Rs. } (39366 - 31250) = \text{Rs. } 8116$

Q4.

Answer :

Principal amount, $P = \text{Rs. } 10240$
Rate of interest, $R = 12\frac{1}{2}\%$ p.a.
Time, $n = 3$ years
The formula for the amount including the compound interest is given below :

$$A = \text{Rs. } P\left(1 + \frac{R}{100}\right)^n$$

$$\Rightarrow A = \text{Rs. } 10240\left(1 + \frac{25}{100\times2}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240\left(1 + \frac{25}{200}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240\left(1 + \frac{1}{8}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240\left(\frac{8+1}{8}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240\left(\frac{9}{8}\right)^3$$

$$\Rightarrow A = \text{Rs. } 10240\,(1.125 \times 1.125 \times 1.125)^3$$

$$\Rightarrow A = \text{Rs. } 14580$$

i.e., the amount including the compound interest is Rs 14580.
$\therefore$ Compound interest $= \text{Rs } (14580 - 10240) = \text{Rs. } 4340$

Q5.

Answer :

Principal amount, $P =$ Rs 62500
Rate of interest, $R = 12\%$ p.a.
Time, $n = 2$ years 6 months $= \frac{5}{2} = 2\frac{1}{2}$ years
The formula for the amount including the compound interest is given below :

$$A = \text{Rs. } P\left(1+\frac{R}{100}\right)^n$$

$$\Rightarrow A = \text{Rs. } 62500\left(1+\frac{12}{100}\right)^2 \times \left(1+\frac{\frac{1}{2}\times 12}{100}\right)$$

$$\Rightarrow A = \text{Rs. } 62500\left(1+\frac{12}{100}\right)^2 \times \left(1+\frac{6}{100}\right)$$

$$\Rightarrow A = \text{Rs. } 62500 \times 1.12 \times 1.12 \times 1.06$$

$$\Rightarrow A = \text{Rs. } 83104$$

i.e., the amount including the compound interest is Rs 83104.
$\therefore$ Compound interest $=$ Rs. $(83104 - 62500) =$ Rs. 20604

Q6

Answer :

Principal amount, $P =$ Rs. 9000
Rate of interest, $R = 10\%$ p.a.
Time, $n = 2$ years 4 months $= 2\frac{1}{3}$ years $= \frac{7}{3}$ years
The formula for *the* amount including the compound interest is given below :

$$A = \text{Rs. } P \times \left(1+\frac{R}{100}\right)^n$$

$$= \text{Rs. } \left(9000 \times \left(1+\frac{10}{100}\right)^2 \times \left(1+\frac{\frac{1}{3}\times 10}{100}\right)\right)$$

$$= \text{Rs. } (9000 \times 1.10 \times 1.10 \times 1.033)$$

$$= \text{Rs. } 11252.9 \approx 11253$$

i.e., the amount including the compound interest is Rs 11253.
$\therefore$ Compound interest $=$ Rs. $(11253 - 9000) =$ Rs. 2253

Q7.

Answer :

Principal amount, $P =$ Rs. 8000
Rate of interest for the first year, $p = 9\%$ p.a.
Rate of interest for the second year, $q = 10\%$ p.a.
Time, $n = 2$ years.
Formula for the amount including the compound interest for the first year :

$$A = \text{Rs. } \left\{\text{P} \times \left(1+\frac{p}{100}\right) \times \left(1+\frac{q}{100}\right)\right\}$$

$$= \text{Rs. } \left\{8000 \times \left(1+\frac{9}{100}\right) \times \left(1+\frac{10}{100}\right)\right\}$$

$$= \text{Rs. } \left\{8000 \times \left(\frac{109}{100}\right) \times \left(\frac{110}{100}\right)\right\}$$

$$= \text{Rs. } \{8000 \times (1.09) \times (1.1)\}$$

$$= \text{Rs. } 9592$$

i.e., the amount including the compound interest for first year is Rs 9592.

Q8.

Answer :

Principal amount, $P =$ Rs. 125000
Rate of interest, $R = 8\%$ p.a.
Time, $n = 3$ year s
The amount including the compound interest is calculated using the formula,

$$A = \text{Rs. P}\left(1+\frac{R}{100}\right)^n$$

$$= \text{Rs. } 125000\left(1+\frac{8}{100}\right)^3$$

$$= \text{Rs. } 125000\left(\frac{100+8}{100}\right)^3$$

$$= \text{Rs. } 125000\left(\frac{108}{100}\right)^3$$

$$= \text{Rs. } 125000\,(1.08)^3$$

$$= \text{Rs. } 125000\,(1.08 \times 1.08 \times 1.08)$$

$$= \text{Rs. } 157464$$

$\therefore$ Anand has to pay Rs 157464 after 3 years to clear the debt.

Q9.

Answer :

Principal amount, $P =$ Rs. 11000
Rate of interest, $R = 10\%$ p.a.
Time, $n = 3$ years
The amount including the compound interest is calculated using the formula,

$$A = \text{Rs. } P\left(1+\frac{R}{100}\right)^n$$
$$= \text{Rs. } 11000\left(1+\frac{10}{100}\right)^3$$
$$= \text{Rs. } 11000\left(\frac{100+10}{100}\right)^3$$
$$= \text{Rs. } 11000\left(\frac{110}{100}\right)^3$$
$$= \text{Rs. } 11000\,(1.1)^3$$
$$= \text{Rs. } 11000\,(1.1\times 1.1\times 1.1)$$
$$= \text{Rs. } 14641$$

Therefore, Beeru has to pay Rs 14641 to clear the debt.

Q10.

Answer :

Principal amount, $P =$ Rs. 18000
Rate of interest for the first year, $p = 12\%$ p.a.
Rate of interest for the second year, $q = 12\frac{1}{2}\%$ p.a.
Time, $n = 2$ years
The formula for *the* amount including the compound interest for the first year is *given below* :

$$A = \left\{P\times\left(1+\frac{p}{100}\right)\times\left(1+\frac{q}{100}\right)\right\}$$
$$= \text{Rs. } \left\{18000\times\left(1+\frac{12}{100}\right)\times\left(1+\frac{25}{100\times 2}\right)\right\}$$
$$= \text{Rs. } \left\{18000\times\left(\frac{100+12}{100}\right)\times\left(1+\frac{25}{200}\right)\right\}$$
$$= \text{Rs. } \left\{18000\times\left(\frac{100+12}{100}\right)\times\left(1+\frac{1}{8}\right)\right\}$$
$$= \text{Rs. } \left\{18000\times\left(\frac{100+12}{100}\right)\times\left(\frac{8+1}{8}\right)\right\}$$
$$= \text{Rs. } \left\{18000\times\left(\frac{112}{100}\right)\times\left(\frac{9}{8}\right)\right\}$$
$$= \text{Rs. } \{18000\times(1.12)\times(1.125)\}$$
$$= \text{Rs. } 22680$$

$\therefore$ Shubhalaxmi has to pay Rs 22680 to the finance company after 2 years.

Q11.

Answer :

Principal amount, $P =$ Rs. 24000
Rate of interest, $R = 10\%$ p.a.
Time, $n = 2$ years 3 months $= 2\frac{1}{4}$ years
The formula for the amount including the compound interest is *given below* :

$$\text{A} = P\times\left(1+\frac{R}{100}\right)^n\times\left(1+\frac{\frac{1}{4}R}{100}\right)$$
$$= \text{Rs. } 24000\times\left(1+\frac{10}{100}\right)^2\times\left(1+\frac{\frac{1}{4}\times 10}{100}\right)$$
$$= \text{Rs. } 24000\times\left(\frac{100+10}{100}\right)^2\times\left(\frac{100+2.5}{100}\right)$$
$$= \text{Rs. } 24000\times\left(\frac{110}{100}\right)^2\times\left(\frac{100+2.5}{100}\right)$$
$$= \text{Rs. } 24000\times(1.1\times 1.1\times 1.025)$$
$$= \text{Rs. } 24000\times(1.250)$$
$$= \text{Rs. } 29766$$

Therefore, Neha should pay Rs 29766 to the bank after 2 years 3 months.

Q12.

Answer :

Principal amount, $P =$ Rs 16000
Rate of interest, $R = \frac{15}{2}\%$ *p.a.*
Time, $n = 2$ years
Now, simple interest $=$ Rs $\left(\frac{16000 \times 2 \times 15}{100 \times 2}\right) =$ Rs. 2400
Amount including the simple interest $=$ Rs $(16000 + 2400) =$ Rs 18400
The formula for *the* amount including the compound interest is *given below* :

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

$$= \text{Rs. } 16000\left(1 + \frac{15}{100 \times 2}\right)^2$$

$$= \text{Rs. } 16000\left(1 + \frac{15}{200}\right)^2$$

$$= \text{Rs. } 16000\left(1 + \frac{3}{40}\right)^2$$

$$= \text{Rs. } 16000\left(\frac{40+3}{40}\right)^2$$

$$= \text{Rs. } 16000\left(\frac{43}{40}\right)^2$$

$$= \text{Rs. } 16000\,(1.075 \times 1.075)$$

i.e., the amount including the compound interest is Rs 18490.
Now, (CI $-$ SI) $=$ Rs. $(18490 - 18400) =$ Rs. 90
Therefore, Abhay *gains* Rs. 90 as profit at the end of 2 years.

Q13.

Answer :

Simple interest $\left(\text{SI}\right) =$ Rs. 2400
Rate of interest, $R = 8\%$
Time, $n = 2$ years
The principal can be calculated using the formula :

$$\text{Sum} = \left(\frac{100 \times \text{SI}}{\text{R} \times \text{T}}\right)$$

$$\Rightarrow \text{Sum} = \text{Rs. } \left(\frac{100 \times 2400}{8 \times 2}\right) = \text{Rs. } 15000$$

i.e., the principal is Rs. 15000.
The amount including the compound interest is calculated using the formula *given below* :

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

$$= \text{Rs. } 15000\left(1 + \frac{8}{100}\right)^2$$

$$= \text{Rs. } 15000\left(\frac{100+8}{100}\right)^2$$

$$= \text{Rs. } 15000\left(\frac{108}{100}\right)^2$$

$$= \text{Rs. } 15000\,(1.08 \times 1.08)$$

$$= \text{Rs. } 17496$$

i.e., the amount including the compound interest is Rs. 17496.
$\therefore$ Compound interest $\left(\text{CI}\right) =$ Rs. $(17496 - 15000) =$ Rs. 2496

Q14.

Answer :

Let Rs P *be the* sum.
Then SI $= \left(\frac{P \times 2 \times 6}{100}\right) =$ Rs. $\frac{12P}{100} =$ Rs. $\frac{3P}{25}$

Also, CI $= \left\{P \times \left(1 + \frac{6}{100}\right)^2 - P\right\}$

$$= \text{Rs. } \left\{P \times \left(\frac{100+6}{100}\right)^2 - P\right\}$$

$$= \text{Rs. } \left\{P \times \left(\frac{53}{50}\right)^2 - P\right\}$$

$$= \text{Rs. } \left\{\left(\frac{2809P}{2500}\right) - P\right\}$$

$$= \text{Rs. } \left\{\frac{2809P - 2500P}{2500}\right\} = \text{Rs. } \frac{309P}{2500}$$

Now, (CI $-$ SI) $=$ Rs. $\left(\frac{309P}{2500} - \frac{3P}{25}\right)$

$$= \text{Rs. } \left(\frac{309P - 300P}{2500}\right)$$

$$= \text{Rs. } \frac{9P}{2500}$$

Now, Rs. $90 = \frac{9P}{2500}$

$$\Rightarrow P = \left(\frac{90 \times 2500}{9}\right) = \text{Rs. } 25000$$

Hence, the *required* sum is Rs. 25000.

Q15.

Answer :

Let P be the sum.

Then $\text{SI} = \text{Rs}\left(\frac{P\times3\times10}{100}\right) = \text{Rs}\ \frac{30P}{100} = \text{Rs}\ \frac{3P}{10}$

$Also,\ \text{CI} = \text{Rs.}\left\{P\times\left(1+\frac{10}{100}\right)^3 - P\right\}$

$= \text{Rs.}\left\{P\times\left(\frac{100+10}{100}\right)^3 - P\right\}$

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

$= \text{Rs.}\left\{\left(\frac{1331P}{1000}\right) - P\right\}$

$= \text{Rs.}\left\{\frac{1331P-1000P}{1000}\right\}$

$= \text{Rs.}\ \frac{331P}{1000}$

Now, $(\text{CI} - \text{SI}) = \text{Rs}\left(\frac{331P}{1000} - \frac{3P}{10}\right)$

$= \text{Rs}\left(\frac{331P-300P}{1000}\right)$

$= \text{Rs}\ \frac{31P}{1000}$

Now, $\text{Rs.}\ 93 = \frac{31P}{1000}$

$\Rightarrow P = \left(\frac{93\times1000}{31}\right) = \text{Rs.}\ 3000$

Hence, the *required* sum is Rs. 3000.

Q16.

Answer :

Let P be the sum.

Rate of interest, $R = 6\frac{2}{3}\% = \frac{20}{3}\%$

Time, $n = 2$ years

$Now,\ A = P\times\left(1+\frac{20}{100\times3}\right)^2$

$= \text{Rs.}\ P\times\left(1+\frac{20}{300}\right)^2$

$= \text{Rs.}\ P\times\left(\frac{300+20}{300}\right)^2$

$= \text{Rs.}\ P\times\left(\frac{320}{300}\right)^2$

$= \text{Rs.}\ P\times\left(\frac{16}{15}\times\frac{16}{15}\right)$

$= \text{Rs.}\ \frac{256P}{225}$

$\Rightarrow \text{Rs.}\ 10240 = \text{Rs.}\ \frac{256P}{225}$

$\Rightarrow \text{Rs.}\left(\frac{10240\times225}{256}\right) = P$

$\therefore P = \text{Rs.}\ 9000$

Hence, the *required* sum is Rs. 9000

Q17.

Answer :

Let P be the sum.

Rate of interest, $R = 10\%$

Time, $n = 3$ years

Now, $A = P\times\left(1+\frac{10}{100}\right)^3$

$= \text{Rs.}\ P\times\left(\frac{100+10}{100}\right)^3$

$= \text{Rs.}\ P\times\left(\frac{110}{100}\right)^3$

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

$= \text{Rs.}\ \frac{1331P}{1000}$

However, amount $= \text{Rs.}\ 21296$

Now, $\text{Rs.}\ 21296 = \text{Rs.}\ \frac{1331P}{1000}$

$\Rightarrow \text{Rs.}\left(\frac{21296\times1000}{1331}\right) = P$

$\therefore P = \text{Rs.}\ 16000$

Hence, the *required* sum is Rs. 16000.

Q18.

Answer :

Let $R\%$ p.a. be the required rate.
$A = 4410$
$P = 4000$
$n = 2$ years

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

$\Rightarrow 4410 = 4000\left(1+\frac{R}{100}\right)^2$

$\Rightarrow \frac{4410}{4000} = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow \frac{441}{400} = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow \left(\frac{21}{20}\right)^2 = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow \frac{21}{20} - 1 = \frac{R}{100}$

$\Rightarrow \frac{21-20}{20} = \frac{R}{100}$

$\Rightarrow \frac{1}{20} = \frac{R}{100}$

$\Rightarrow R = \left(\frac{1\times100}{20}\right) = 5$

Hence, the required rate is 5% p.a.

Q19.

Answer :

Let the required rate be $R\%$ p.a.
$A = 774.40$
$P = 640$
$\mathrm{n} = 2$ years

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

$\Rightarrow 774.40 = 640\left(1+\frac{R}{100}\right)^2$

$\Rightarrow \frac{774.40}{640} = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow 1.21 = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow (1.1)^2 = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow 1.1 - 1 = \frac{R}{100}$

$\Rightarrow 0.1 = \frac{R}{100}$

$\Rightarrow R = (0.1\times100) = 10$

Hence, the required rate is 10% p.a.

Q20.

Answer :

Let the required time be n years.
Rate of interest, $R = 10\%$
Principal amount, $P =$ Rs. 1800
Amount with compound interest, $A =$ Rs. 2178

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

$=$ Rs. $1800\times\left(1+\frac{10}{100}\right)^n$

$=$ Rs. $1800\times\left(\frac{100+10}{100}\right)^n$

$=$ Rs. $1800\times\left(\frac{110}{100}\right)^n$

$=$ Rs. $1800\times\left(\frac{11}{10}\right)^n$

However, amount $=$ Rs. 2178

$Now,$ Rs. $2178 =$ Rs. $1800\times\left(\frac{11}{10}\right)^n$

$\Rightarrow \frac{2178}{1800} = \left(\frac{11}{10}\right)^n$

$\Rightarrow \frac{121}{100} = \left(\frac{11}{10}\right)^n$

$\Rightarrow \left(\frac{11}{10}\right)^2 = \left(\frac{11}{10}\right)^n$

$\Rightarrow n = 2$

$\therefore$ Time, $n = 2$ years

Q21.

Answer :

Let the required time be n years.
Rate of interest, $R = 8\%$
Principal amount, $P =$ Rs. 6250
Amount with compound interest, $A =$ Rs. 7290

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

$\Rightarrow$ A $=$ Rs. $6250 \times \left(1 + \frac{8}{100}\right)^n$

$=$ Rs. $6250 \times \left(\frac{100+8}{100}\right)^n$

$=$ Rs. $6250 \times \left(\frac{108}{100}\right)^n$

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

However, amount $=$ Rs. 7290

Now, Rs. $7290 =$ Rs. $6250 \times \left(\frac{27}{25}\right)^n$

$\Rightarrow \frac{7290}{6250} = \left(\frac{27}{25}\right)^n$

$\Rightarrow \frac{729}{625} = \left(\frac{27}{25}\right)^n$

$\Rightarrow \left(\frac{27}{25}\right)^2 = \left(\frac{27}{25}\right)^n$

$\Rightarrow n = 2$

$\therefore$ Time, $n = 2$ years

Q22.

Answer :

Population of the town, $P = 125000$
Rate of increase, $R = 2\%$
Time, $n = 3$ years
Then the population of the town after 3 years is *given by*

Population $= P \times \left(1 + \frac{R}{100}\right)^3$

$= 125000 \times \left(1 + \frac{2}{100}\right)^3$

$= 125000 \times \left(\frac{100+2}{100}\right)^3$

$= 125000 \times \left(\frac{102}{100}\right)^3$

$= 125000 \times \left(\frac{51}{50}\right)^3$

$= 125000 \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right)$

$= (51 \times 51 \times 51)$

$= 132651$

Therefore, the population of the town after three years is 132651.

Q23.

Answer :

Let the population of the town be 50000.
Rate of increase for the first year, $p = 5\%$
Rate of increase for the second year, $q = 4\%$
Rate of increase for the third year, $r = 3\%$
Time $= 3$ years

Now, present population $= \left\{P \times \left(1 + \frac{p}{100}\right) \times \left(1 + \frac{q}{100}\right) \times \left(1 + \frac{r}{100}\right)\right\}$

$= \left\{50000 \times \left(1 + \frac{5}{100}\right) \times \left(1 + \frac{4}{100}\right) \times \left(1 + \frac{3}{100}\right)\right\}$

$= \left\{50000 \times \left(\frac{100+5}{100}\right) \times \left(\frac{100+4}{100}\right) \times \left(\frac{100+3}{100}\right)\right\}$

$= \left\{50000 \times \left(\frac{105}{100}\right) \times \left(\frac{104}{100}\right) \times \left(\frac{103}{100}\right)\right\}$

$= \left\{50000 \times \left(\frac{21}{20}\right) \times \left(\frac{26}{25}\right) \times \left(\frac{103}{100}\right)\right\}$

$= (21 \times 26 \times 103)$

$= 56238$

Therefore, the present population of the town is 56238.

Q24.

Answer :

Population of the city in 2009, P $=$ 120000
Rate of increase, R $=$ 6%
Time, n $=$ 3 years
Then the population of the city in the year 2010 is *given by*

Population $= P \times \left(1 + \frac{R}{100}\right)^n$

$= 120000 \times \left(1 + \frac{6}{100}\right)^1$

$= 120000 \times \left(\frac{100+6}{100}\right)$

$= 120000 \times \left(\frac{106}{100}\right)$

$= 120000 \times \left(\frac{53}{50}\right)$

$= 2400 \times 53$
$= 127200$

Therefore, the population of the city in 2010 is 127200.
Again, population of the city in 2010, $P = 127200$
Rate of decrease, $R = 5\%$
Then the population of the city in the year 2011 is *given by*

Population $= P \times \left(1 - \frac{R}{100}\right)^n$

$= 127200 \times \left(1 - \frac{5}{100}\right)^1$

$= 127200 \times \left(\frac{100-5}{100}\right)$

$= 127200 \times \left(\frac{95}{100}\right)$

$= 127200 \times \left(\frac{19}{20}\right)$

$= 6360 \times 19$
$= 120840$

Therefore, the population of the city in 2011 is 120840.

Q25.

Answer :

Initial count of bacteria, $P = 500000$
Rate of increase, $R = 2\%$
Time, $n = 2$ hours
Then the count of bacteria at the end of 2 hours is *given by*

Count of bacteria $= P \times \left(1 + \frac{R}{100}\right)^n$

$= 500000 \times \left(1 + \frac{2}{100}\right)^2$

$= 500000 \times \left(\frac{100+2}{100}\right)^2$

$= 500000 \times \left(\frac{102}{100}\right)^2$

$= 500000 \times \left(\frac{51}{50}\right)^2$

$= 500000 \times \left(\frac{51}{50}\right) \times \left(\frac{51}{50}\right)$

$= (200 \times 51 \times 51)$
$= 520200$

Therefore, the count of bacteria at the end of 2 hours is 520200.

Q26.

Answer :

Initial count of bacteria, $P = 20000$
Rate of increase, $R = 10\%$
Time, $n = 3$ hours
Then the count of bacteria at the end of the first hour is given by

Count of bacteria $= P \times \left(1 + \frac{10}{100}\right)^n$

$= 20000 \times \left(1 + \frac{10}{100}\right)^1$

$= 20000 \times \left(\frac{100+10}{100}\right)$

$= 20000 \times \left(\frac{110}{100}\right)$

$= 20000 \times \left(\frac{11}{10}\right)$

$= 2000 \times 11$
$= 22000$
Therefore, the count of bacteria at the end of the first hour is 22000.
The count of bacteria at the end of the second hour is given by

Count of bacteria $= P \times \left(1 - \frac{10}{100}\right)^n$

$= 22000 \times \left(1 - \frac{10}{100}\right)^1$

$= 22000 \times \left(\frac{100-10}{100}\right)$

$= 22000 \times \left(\frac{90}{100}\right)$

$= 22000 \times \left(\frac{9}{10}\right)$

$= 2200 \times 9$
$= 19800$
Therefore, the count of bacteria at the end of the second hour is 19800.
Then the count of bacteria at the end of *the* third hour is *is given by*

Count of bacteria $= \mathrm{P} \times \left(1 + \frac{10}{100}\right)^{\mathrm{n}}$

$= 19800 \times \left(1 + \frac{10}{100}\right)^1$

$= 19800 \times \left(\frac{100+10}{100}\right)$

$= 19800 \times \left(\frac{110}{100}\right)$

$= 19800 \times \left(\frac{11}{10}\right)$

$= 1980 \times 11$
$= 21780$
Therefore, the count of bacteria at the end of *the* first 3 hours is 21780.

Q27.

Answer :

Initial value of the machine, $P =$ Rs 625000
Rate of depreciation, $R = 8\%$
Time, $n = 2$ years
Then the value of the machine after two years is given by

Value $= P \times \left(1 - \frac{R}{100}\right)^n$

$=$ Rs $625000 \times \left(1 - \frac{8}{100}\right)^2$

$=$ Rs $625000 \times \left(\frac{100-8}{100}\right)^2$

$=$ Rs $625000 \times \left(\frac{92}{100}\right)^2$

$=$ Rs $625000 \times \left(\frac{23}{25}\right)^2$

$=$ Rs $625000 \times \left(\frac{23}{25}\right) \times \left(\frac{23}{25}\right)$

$=$ Rs $(1000 \times 23 \times 23)$
$=$ Rs 529000
Therefore, the value of the machine after two years will be Rs. 529000.

Q28.

Answer :

Initial value of the scooter, $P =$ Rs 56000
Rate of depreciation, $R = 10\%$
Time, $n = 3$ years
Then the value of the scooter after three years is given by

Value $= P \times \left(1 - \frac{R}{100}\right)^n$

$= \text{Rs. } 56000 \times \left(1 - \frac{10}{100}\right)^3$

$= \text{Rs. } 56000 \times \left(\frac{100-10}{100}\right)^3$

$= \text{Rs. } 56000 \times \left(\frac{90}{100}\right)^3$

$= \text{Rs. } 56000 \times \left(\frac{9}{10}\right)^3$

$= \text{Rs. } 56000 \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right)$

$= \text{Rs. } (56 \times 9 \times 9 \times 9)$

$= \text{Rs. } 40824$

Therefore, the value of the scooter after three years will be Rs. 40824.

Q29.

Answer :

Initial value of the car, $P =$ Rs 348000
Rate of depreciation for the first year, $p = 10\%$
Rate of depreciation for the second year, $q = 20\%$
Time, $n = 2$ years.
Then the value of the car after two years is given by

Value $= \left\{P \times \left(1 - \frac{p}{100}\right) \times \left(1 - \frac{q}{100}\right)\right\}$

$= \text{Rs. } \left\{348000 \times \left(1 - \frac{10}{100}\right) \times \left(1 - \frac{20}{100}\right)\right\}$

$= \text{Rs. } \left\{348000 \times \left(\frac{100-10}{100}\right) \times \left(\frac{100-20}{100}\right)\right\}$

$= \text{Rs. } \left\{348000 \times \left(\frac{90}{100}\right) \times \left(\frac{80}{100}\right)\right\}$

$= \text{Rs. } \left\{348000 \times \left(\frac{9}{10}\right) \times \left(\frac{8}{10}\right)\right\}$

$= \text{Rs. } (3480 \times 9 \times 8)$

$= \text{Rs. } 250560$

$\therefore$ The value of the car after two years is Rs 250560.

Q30.

Answer :

Let the initial value of the machine, P be Rs x.
Rate of depreciation, $R = 10\%$
Time, $n = 3$ years
The present value of the machine is Rs 291600.
Then the initial value of the machine is given by

Value $= P \times \left(1 - \frac{R}{100}\right)^n$

$= \text{Rs. } x \times \left(1 - \frac{10}{100}\right)^3$

$= \text{Rs. } x \times \left(\frac{100-10}{100}\right)^3$

$= \text{Rs. } x \times \left(\frac{90}{100}\right)^3$

$= \text{Rs. } x \times \left(\frac{9}{10}\right)^3$

$\therefore$ Present value of the machine $=$ Rs 291600

Now, Rs $291600 =$ Rs $x \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right) \times \left(\frac{9}{10}\right)$

$\Rightarrow x =$ Rs $\frac{291600 \times 10 \times 10 \times 10}{9 \times 9 \times 9}$

$\Rightarrow x =$ Rs $\frac{291600000}{729}$

$\Rightarrow x =$ Rs 400000

$\therefore$ The initial value of the machine is Rs 400000.