

Chapter 24

Instalments

REMEMBER

Before beginning this chapter, you should be able to:

- Recognise terms such as cost price, selling price, etc.
- Have a basic concept on interest and time period

KEY IDEAS

After completing this chapter, you would be able to:

- Learn about cash price, initial payment, etc.
- Understand calculation of interests, instalments.
- Study repayment of loan.
- Study important features of hire purchase scheme.

INTRODUCTION

Sometimes, a customer cannot buy an article, if he does not have enough money. In such cases, the trader offers the article on instalment basis.

Under this facility, the customer need not pay the entire amount at the time of purchasing the article. He pays only part of the amount at the time of purchasing the article and agrees to pay the balance in small amounts over a period of time. The payment of sale price in small amounts periodically is known as instalment scheme. The small amounts are known as instalments. These instalments may be either monthly, quarterly or yearly.

Usually in this scheme, the customer pays more than the sale price of the article, because the seller charges an interest on the sale price. Generally the interest charged is simple interest unless otherwise mentioned.

Cash Price

The price at which the article is offered to the customer, in case he wants to pay the entire amount right away.

Initial Payment or Down Payment

The amount which a customer has to pay as part payment at the time of purchasing an article is called down payment or initial payment.

EXAMPLE 24.1

A bag is available for ₹900 cash down or for ₹500 down payment followed by a payment of ₹440 after 5 months. Find the rate of interest under the instalment plan.

SOLUTION

Cash price = ₹900

Down payment = ₹500

Balance to be paid by instalments = ₹900 – ₹500 = ₹400

The instalment to be paid at the end of 5 months = ₹440

∴ The interest charged on ₹400 = ₹440 – ₹400 = ₹40 for 5 months.

Let $R\%$ be the rate of interest per annum.

$$\begin{aligned}\therefore I &= \frac{PTR}{100} \\ 40 &= \frac{(400)(5)(R)}{(100)(12)} \quad \left(\because 5 \text{ months} = \frac{5}{12} \text{ years} \right) \\ \Rightarrow \frac{(40)(100)(12)}{(400)(5)} &= R \\ \Rightarrow R &= 24\%.\end{aligned}$$

∴ The rate of interest = 24% per annum.

EXAMPLE 24.2

A scooter is offered for ₹28,000 cash down or for ₹12,000 down payment, followed by two monthly instalments of ₹8,200 each. Calculate the rate of interest under the instalment plan.

SOLUTION

Cash price = ₹28,000

Down payment = ₹12,000

Balance to be paid by instalments = ₹28,000 – ₹12,000 = ₹16,000.

Let R be the rate of interest per annum.

$$\text{After two months ₹16000 will amount to } 16000 + \frac{16000R(2)}{100(12)} = 16000 + \frac{80R}{3} \quad (1)$$

The customer has to pay ₹8,200 each month.

$$\therefore \text{ The first instalment will amount to } 8200 + \frac{8200R}{100(12)} = 8200 + \frac{41R}{6} \text{ after one month.}$$

$\therefore$ The second instalment is ₹8,200.

$$\therefore \text{ The total value of the two instalments is } 8200 + 8200 + \frac{41R}{6} = 16400 + \frac{41R}{6} \quad (2)$$

The value of the loan (₹16,000) at the end of 2 months is equal to the total value of the two instalments at the end of the two months.

$$\begin{aligned} \therefore 16000 + \frac{80R}{3} &= 16400 + \frac{41R}{6} \\ \Rightarrow \frac{80R}{3} - \frac{41R}{6} &= 16400 - 16000 \\ \Rightarrow \frac{160R - 41R}{6} &= 400 \\ \Rightarrow \frac{119R}{6} &= 400 \end{aligned}$$

$$R = \frac{400(6)}{119} \approx 20.17\%.$$

$\therefore$ The rate of interest is 20.17%.

EXAMPLE 24.3

A cycle is offered for ₹1,200 cash down or ₹600 down payment, followed by 4 equal monthly instalments. If the rate of interest charged by the dealer is 10% per annum, find the amount of each instalment.

SOLUTION

Cash price = ₹1,200

Down payment = ₹600

Balance amount = ₹1,200 – ₹600 = ₹600

Rate of interest = 10% per annum.

$$\begin{aligned} \therefore \text{ After 4 months, the amount ₹600 will be equal to } 600 + \frac{(600)(10)(4)}{100(12)} \\ = 600 + 20 = ₹620. \end{aligned} \quad (1)$$

Let each instalment be ₹ x

The first instalment of ₹ x will amount to ₹ $\left(x + \frac{x(3)(10)}{100(12)}\right)$

That is, ₹ $\left(x + \frac{30x}{1200}\right)$ after 3 months.

The second instalment of ₹ x will amount to ₹ $\left(x + \frac{x(2)(10)}{100(12)}\right)$

That is, ₹ $\left(x + \frac{20x}{1200}\right)$ after 2 months.

The third instalment of ₹ x the will amount to ₹ $\left(x + \frac{x(10)}{100(12)}\right)$

That is, ₹ $\left(x + \frac{10x}{1200}\right)$ after 1 month.

∴ The 4th instalment is ₹ x . The total value of the 4 instalments is

$$\begin{aligned} &= \left(x + \frac{30x}{1200}\right) + \left(x + \frac{20x}{1200}\right) + \left(x + \frac{10x}{1200}\right) + x \\ &= 4x + \frac{60x}{1200}. \end{aligned}$$

This is equal to the value of ₹600 after 4 months.

$$\begin{aligned} \therefore \quad \frac{81x}{20} &= 620 \quad [\text{from Eq. (1)}] \\ \Rightarrow \quad x &= \frac{620(20)}{81} = 153.09. \end{aligned}$$

∴ Each instalment = ₹153 (approximately).

Repayment of Loan

In the above problems, the instalment payment does not extend for more than one year and the interest is calculated at simple interest. But when the amount is very large (e.g., housing loans, etc.) the instalments are payable yearly or half yearly and the interest is calculated at compound interest.

EXAMPLE 24.4

A man borrows money from a finance company and has to pay it back in two equal half-yearly instalments of ₹5,115 each. If the interest charged by the finance company is at the rate of 20% per annum, compounded semi-annually, find the sum borrowed.

SOLUTION

Each instalment = ₹5,115

Rate of interest = 20% per annum = 10% per half yearly.

The amount of ₹5,115 paid as an instalment at the end of the first six months includes the principal and interest on it at the rate of 10% half yearly.

$$\therefore \quad \text{Principal} = 5115 \div \left(1 + \frac{10}{100}\right) = 5115 \times \left(\frac{100}{110}\right) = ₹4,650.$$

Similarly, the value which amounts to ₹5,115 after 1 year at the rate of 10% compounded semi-annually is

$$= 5115 \div \left(1 + \frac{10}{100}\right)^2 = 5115 \left(\frac{100}{110}\right)^2.$$

$\approx ₹4,227.27.$

$\therefore$ Sum borrowed = $4650 + 4227 = ₹8,877$ (approximately).

Hire Purchase Scheme

In this scheme the buyer, called the hirer and the seller, called the vendor enter into an agreement which is known as Hire Purchase Agreement.

Important Features of Hire Purchase Scheme

1. The hirer pays an initial payment known as down payment.
2. The vendor allows the hirer to take possession of the goods on the date of signing the agreement, but he does not transfer the ownership of the goods.
3. The hirer promises to pay the balances amount in instalments.
4. If the hirer fails to pay the instalments the vendor can repossess the goods.
5. When goods are repossessed, hirer cannot ask for the repayment of the instalments of money already paid. This money paid will be treated as rent for the period.

TEST YOUR CONCEPTS

Very Short Answer Type Questions

1. If an article is bought under an instalment scheme, the amount a customer has to pay as part payment of the selling price of the article at the time of its purchase is called _____.
2. The scheme of buying an article by making the part payments periodically is called _____.
3. If a bicycle is available for ₹1,200 cash down or ₹700 down payment followed by five equal monthly instalments of ₹120 each, then the interest charged is _____.
4. If an article is bought under an instalment scheme, the amount paid in addition to the cash price of the article is known as _____.
5. Under hire purchase scheme, the ownership of the goods lies with the _____ until the repayment of all instalments is made.
6. Under hire purchase scheme, if the hirer fails to pay the instalments, the vendor can repossess the goods. The money already paid by the hirer is treated as _____.
7. A car is available for ₹2,00,000 cash down or ₹50,000 down payment followed by 16 equal monthly instalments. If the interest charged due to this scheme at the end of 16 months is ₹10,000, then each monthly instalment is _____.
8. A water filter is available for ₹500 down payment followed by two instalments of ₹600 each. If the total interest paid is ₹100, then the cash down price of the water filter is _____.
9. An electric generator is offered for ₹30,000 cash down or 22% down payment under instalment scheme. If a buyer has chosen the instalment scheme, then the buyer has to pay ₹_____ as down payment.
10. A mobile phone is available for a cash price of ₹1,200 or for a certain down payment followed by three equal instalments of ₹300 each. The total interest paid is ₹100 when bought under the instalment scheme. The down payment for the mobile phone is _____.

Short Answer Type Questions

11. An article can be sold for ₹20,000 cash down or for ₹12,000 down payment and 4 equal monthly instalments of ₹2,200 each. Find the interest paid.
12. A washing machine is available for ₹9,000 cash down or 45% down payment and 3 equal monthly instalments. Each instalment is 20% of the cash down payment. If the interest is calculated at simple interest, what is the approximate annual rate of interest?
13. A sum is lent at compound interest, under instalment scheme, interest compounded annually at 10% pa. If after one year, ₹4,400 is repaid and after another year, the balance ₹4,300 is repaid, find approximate present value of the instalments.
14. A computer is sold by a company for ₹20,000 cash down or ₹8,000 down payment followed by 5 equal monthly instalments of ₹2,500 each. Find the total principal on which the interest is charged to realize the total interest in a month.
15. A man borrows ₹10,500 from a finance company and repays it in two equal annual instalments. If the rate of interest being compounded annually is 10% pa, find the value of each instalment.

Essay Type Questions

16. A loan has to be repaid in three equal half yearly instalments. If the rate of interest, compounded semi-annually, is 16% pa and each instalment is ₹3,500, find (approximately) the sum borrowed.
17. A plasma TV is available for ₹42,000 cash down or ₹8,900 down payment and three equal quarterly instalments of ₹12,000 each. Find the interest charged under instalment plan.



18. A table is available for a down payment of ₹1,590 and 3 equal half-yearly instalments of ₹1,331 each. If a shop owner charges interest compounded semi-annually at the rate of 20% pa, then find the cash down price of the table.
19. Prasad borrowed some money under compound interest and repaid it in 3 equal instalments of ₹8,470 each. If the rate of interest is 10% pa, then

what is the present value of the instalment paid at the end of the second year?

20. A TV set is available for ₹36,000 or some amount of down payment and two equal annual instalments of ₹12,100 each. If a shop keeper charges interest, compounded annually, at the rate of 10% pa find the down payment.

CONCEPT APPLICATION

Level 1

- A fan is sold for ₹900 cash down or ₹200 down payment followed by two equal monthly instalments of each ₹375. The annual rate of interest is _____ (approximately).
(a) 25%. (b) 30%.
(c) 54%. (d) 59%.
- A briefcase available for ₹500 cash down or for a certain down payment followed by a payment of ₹312 after 4 months. If the rate of interest is 12% pa, find the down payment.
(a) ₹198 (b) ₹205
(c) ₹195 (d) ₹200
- A typewriter is available for ₹970 cash down or for a certain down payment followed by 3 equal monthly instalments of ₹260 each. If the rate of interest is 16% pa, then find the down payment for purchasing it. (Approximately)
(a) ₹200 (b) ₹210
(c) ₹205 (d) ₹220
- A pressure cooker is sold for ₹600 cash down or ₹300 down payment followed by ₹310 after one month. The annual rate of interest is _____.
(a) 40% (b) 30%
(c) 33% (d) 20%
- A ceiling fan is available at a certain cash down price or for ₹250 down payment together with ₹305 to be paid after two months. If the rate of interest is 10% pa, then find the price of the fan?
(a) ₹545 (b) ₹540
(c) ₹550 (d) ₹535
- A man borrows ₹6,500 from a finance company and has to return it in two equal annual

instalments. If the rate of interest is 8% pa, interest being compounded annually, then each instalment is (in ₹)

- (a) 3,645 (b) 2,916
(c) 2,542 (d) 1,980

- A book is available for ₹800 cash down or for ₹250 down payment followed by 3 equal monthly instalments of ₹200 each. Find the principal for the third month.
(a) ₹550 (b) ₹350
(c) ₹150 (d) ₹250
- An article is available for ₹6,000 cash down or for ₹1,275 down payment and 5 equal monthly instalments. If the rate of interest is 4% per month, then each monthly instalment is (in ₹ approximately)
(a) 1200 (b) 954
(c) 1050 (d) 875
- An article is available for ₹24,000 cash down or for a certain down payment followed by six equal instalments of ₹2,800 each. If the rate of interest is 12% pa, find the down payment for purchasing it (approximately).
(a) ₹7,500 (b) ₹7,605
(c) ₹7,755 (d) ₹7,800
- A sum of ₹64,890 is to be paid back in 3 equal annual instalments. If the interest is compounded annually at the rate of $6\frac{2}{3}\%$ pa, then each instalment is (in ₹)
(a) 26,476 (b) 25,326
(c) 22,600 (d) 24,576



Level 2

11. A loan has to be returned in two equal annual instalments. If the rate of interest is 16% pa, interest being compounded annually and each instalment is ₹6,728, then the total interest is (in ₹)
- (a) 4,000 (b) 3,250
(c) 3,600 (d) 2,656
12. A loan of ₹15,580 is to be paid back in two equal half-yearly instalments. If the interest is compounded half-yearly at 10% pa, then the interest is (in ₹)
- (a) 1,200 (b) 1,500
(c) 1,178 (d) 1,817
13. A loan has to be returned in two equal annual instalments. If the rate of interest is 15% pa, interest being compounded annually and each instalment is ₹3,703, then the principal of the loan is (in ₹)
- (a) 7,090 (b) 6020
(c) 5,090 (d) 8,040
14. A refrigerator is available at a certain price on full payment or for ₹1,400 down payment and five equal monthly instalments of ₹1,030 each. If the rate of interest is 12%, find the cost of the refrigerator approximately.
- (a) ₹6,000 (b) ₹9,009
(c) ₹8,008 (d) ₹6,403
15. A sofa set is available for ₹50,000 cash down or for ₹30,000 down payment followed by 4 equal monthly instalments of ₹6,000 each. Find the principal for the second month.
- (a) ₹20,000 (b) ₹18,000
(c) ₹5,000 (d) ₹14,000
16. A mobile phone is available for ₹2,180 cash down or for a certain down payment followed by three equal monthly instalments of ₹600 each.

The annual rate of interest is $57\frac{1}{7}\%$. Find the down payment to be paid (in ₹) if the interest paid is at simple interest.

- (a) 480 (b) 530
(c) 580 (d) 640
17. A loan of ₹3,640 is to be repaid in three equal half-yearly instalments. The rate of interest is 40% pa, interest being compounded semi-annually. Find each instalment (in ₹).
- (a) 1,440 (b) 1,728
(c) 1,5334 (d) 1,487
18. Anil borrowed a certain sum from a bank at $R\%$ pa compound interest, interest being compounded annually. He repaid it in two equal annual instalments. The values of the first and second instalments, when the second instalment was paid, were in the ratio 5 : 4. Find R .
- (a) 20 (b) 15
(c) 25 (d) 30
19. A TV is available at a certain price on full payment or for ₹2,000 down payment and two equal quarterly instalments of ₹8,640 each. The shopkeeper charged interest at 20% per quarter, interest being computed quarterly. Find the cost of the TV (in ₹).
- (a) 15,200 (b) 15,800
(c) 16,400 (d) 16,800
20. A gold ring is available for ₹10,220 cash payment or ₹3,600 down payment and three equal annual instalments. The shopkeeper charged interest at 10% pa, interest being compounded annually. Find each instalment (in ₹).
- (a) 2,684 (b) 2,618
(c) 2,574 (d) 2,662

Level 3

21. A car is available for ₹2,00,000 cash or for ₹50,000 cash down payment followed by 4 equal half-yearly instalments of ₹52,000 each. Find the total interest charged.

- (a) ₹58,000
(b) ₹48,000
(c) ₹44,000
(d) ₹50,000



22. A microwave oven is available for ₹4,500 cash down or for ₹2,100 down payment followed by three equal monthly instalments. If the shop keeper charges interest at the rate of 10% pa, compounded every month, find the total of the present values of the three instalments.
- (a) ₹1,800 (b) ₹2,400
(c) ₹4,500 (d) ₹2,100
23. A gold chain is available for ₹10,500 cash down or for ₹4,000 down payment and three equal instalments. If the shopkeeper charges interest at the rate of 10% pa, compounded annually, find the total of the present value of the three instalments.
- (a) ₹8,000 (b) ₹10,000
(c) ₹6,500 (d) ₹4,000
24. Alok borrowed some money from Prasad which is to be paid back in 3 equal annual instalments of ₹322 each. The present value of the first instalment paid at the end of first year is ₹280. Find the rate of interest if the interest is being compounded annually.
- (a) 12% (b) 18%
(c) 15% (d) 20%
25. Find the principal if it is lent at 5% pa, interest being compounded annually, in two parts. One part amounts to ₹1,050 at the end of the 1st year and the other part amounts to ₹1,323 at the end of the 2nd year.
- (a) ₹1,900 (b) ₹2,000
(c) ₹1,800 (d) ₹2,200
26. Each of Ganesh and Harish bought a car. Each bought it by paying two half-yearly instalments under the same rate of compound interest, interest being compounded half-yearly. Ganesh's first instalment was equal to Harish's second instalment and vice-versa. The present values of Ganesh's instalments were the same. Which person's car had the lower cash price?
- (a) Harish's
(b) Ganesh's
(c) Both cars had the same price
(d) Cannot say
27. A double cot is available for ₹13,000 cash down or for ₹1,300 down payment followed by four equal monthly instalments of ₹3,000 each. Find the principal for the third month, if interest charged at simple interest (in ₹).
- (a) 5,200 (b) 4,900
(c) 6,200 (d) 5,700
28. In the previous question, the difference in Ganesh's and Harish's first instalments was ₹4,410 and the rate of the interest was 10% pa. Find the difference in the cost of the two cars.
- (a) 240 (b) 400
(c) 200 (d) 320
29. A car is available for a certain price or four yearly instalments of ₹1,46,410 each. The rate of interest is 10% pa, interest being compounded annually. Find the cost of the car (in lakhs).
- (a) 4.641 (b) 4.583
(c) 4.727 (d) 4.799
30. Bhavan borrowed a certain sum of money. He had to repay it in three equal annual instalments at a fixed rate of compound interest. The present values of his first and second instalments were ₹16,900 and ₹13,000 respectively. Find the present value of his third instalment (in ₹).
- (a) 8,000 (b) 19,000
(c) 10,000 (d) 11,000



TEST YOUR CONCEPTS

Very Short Answer Type Questions

- | | |
|----------------------|------------|
| 1. down payment | 6. rent. |
| 2. instalment scheme | 7. ₹10,000 |
| 3. ₹100 | 8. ₹1,600 |
| 4. interest | 9. ₹6,600 |
| 5. vendor/seller. | 10. ₹400 |

Short Answer Type Questions

- | | |
|---------------|--------------|
| 11. ₹800 | 14. ₹35,000. |
| 12. 57.14% pa | 15. ₹6,050 |
| 13. ₹7,554. | |

Essay Type Questions

- | | |
|------------|-------------|
| 16. ₹9,020 | 19. ₹7,000 |
| 17. ₹2,900 | 20. ₹15,000 |
| 18. ₹4,900 | |

CONCEPT APPLICATION

Level 1

1. (d) 2. (d) 3. (b) 4. (a) 5. (c) 6. (a) 7. (c) 8. (b) 9. (c) 10. (d)

Level 2

11. (d) 12. (c) 13. (b) 14. (d) 15. (d) 16. (b) 17. (b) 18. (c) 19. (a) 20. (d)

Level 3

21. (a) 22. (b) 23. (c) 24. (c) 25. (d) 26. (b) 27. (d) 28. (c) 29. (a) 30. (c)



CONCEPT APPLICATION

Level 1

- Calculate the interest and principle amount for 2 months.
 - Assume each installment amount as ₹ x .
 - Calculate the balance, interest and the principle.
- Let the down payment amount be ₹ x .
 - Calculate balance and interest.
 - Let the down payment be ₹ x .
Balance = ₹ $(970 - x)$.
 - Interest paid under instalment scheme
= ₹ $[3 \times 260 - (970 - x)] = ₹[x - 190]$.
 - Principal for the 1st month = ₹ $(970 - x)$.
Principal for the 2nd month = ₹ $(970 - x - 260)$. Principal for the 3rd month = ₹ $(970 - x - 260 - 260)x$.
 - Use $SI = \frac{PRT}{100}$, (P = total principal).
- Find the interest paid under instalment scheme.
- Let the cost of ceiling fan in cash be ₹ x .
 - Calculate balance, interest and the principle amount.
 - Let the cash price be ₹ x .
 - Balance = ₹ $(x - 250)$.
 - Interest = ₹ $[350 - (x - 250)]$.
 - Use, $SI = \frac{PRT}{100}$, P = Balance,
 $R = 10\%$ and $T = \frac{2}{12}$ years.

- Principal = $\frac{\text{Installment}}{\left(1 + \frac{r}{100}\right)^n}$.
 - Find the principal value for both the instalments and equate to the total sum.
- Calculate the balance.
 - Calculate the principle for the first, 2nd and the 3rd months successively.
 - Use, Total principal = Each instalment value
 $\left[\frac{1}{\left(1 + \frac{R}{100}\right)} + \frac{1}{\left(1 + \frac{R}{100}\right)^2} + \frac{1}{\left(1 + \frac{R}{100}\right)^3} \right]$ and evaluate R .
- Let the cash down payment be ₹ x .
 - Down payment = 45% of 9,000 and each instalment = 20% of 9,000.
 - Calculate the amount to be paid in the each instalment.
 - Equate the above value to the amount that has to be paid and find R .
- Let the cash down payment be ₹ x .
 - Use, Total present value = Each instalment value
 $\left[\frac{1}{\left(1 + \frac{R}{100}\right)} + \frac{1}{\left(1 + \frac{R}{100}\right)^2} \right]$ and evaluate R .
- Refer to the hint of Q. No. 4.

Level 2

- Refer to the hint of Q. No. 6.
 - First of all amount paid in instalment is to be found.
 - Calculate the amount to be paid in the each instalment.
 - Equate the above value to the amount that has to be paid and find R .
- Refer to the hint of Q. No. 4.
- Refer to the hint of Q. No. 4.
- Let the cost of refrigerator in full payment be ₹ x .
- Let the down payment to be paid be ₹ x cash price = ₹2,180. The balance is ₹ $2,180 - x$.
The instalments are paid at the end of the first, second and third months.
The values of instalments at the end of the first, the second and the third month are (in ₹)
 $600\left(1 + \frac{(2)(R)}{1200}\right), 600\left(1 + \frac{(1)(R)}{1200}\right)$ and 600 respectively,



where $R = 57\frac{1}{7}$.

$$\begin{aligned} & 600\left(1 + \frac{2R}{1200}\right) + 600\left(1 + \frac{R}{1200}\right) + 600 \\ &= (2180 - x)\left(1 + \frac{3R}{1200}\right) \\ &\Leftrightarrow \frac{1800 + 1.5R}{1 + \frac{R}{400}} = (2180 - x) \end{aligned}$$

But $R = 57\frac{1}{7} = \frac{400}{7}$

$$\therefore \frac{1800 + 1.5\left(\frac{400}{7}\right)}{1 + \frac{400}{7}\left(\frac{1}{400}\right)} = 2180 - x - \frac{\frac{13200}{7}}{\frac{8}{7}} = 2180 - x$$

$$1650 = 2180 - x$$

$$x = 530.$$

17. Let each instalment be ₹ i

Rate of interest = 40% per annum = 20% half-yearly.
The present values of the first, the second and the third instalments are ₹ $\frac{i}{1 + \frac{20}{100}}$, ₹ $\frac{i}{\left(1 + \frac{20}{100}\right)^2}$ and ₹ $\frac{i}{\left(1 + \frac{20}{100}\right)^3}$ respectively.

$$\frac{i}{1.2} + \frac{i}{(1.2)^2} + \frac{i}{(1.2)^3} = 3,640$$

$$\frac{(1.2)^2 + 1.2 + 1}{(1.2)^3} i = 3,640$$

$$\frac{(1.44 + 1.2 + 1)}{1.728} i = 3,640$$

That is, $\frac{3,640}{1.728} i = 3,640$

$$i = 1,728.$$

18. Let each instalment be ₹ i

Present value of the first instalment = ₹ $\frac{i}{1 + \frac{R}{100}}$

Present value of the second instalment

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

$$\frac{i}{1 + \frac{R}{100}} : \frac{i}{\left(1 + \frac{R}{100}\right)^2} = 5 : 4$$

$$1 + \frac{R}{100} = \frac{4}{5} R = 25.$$

19. Let the cash price be ₹ x

Down payment = ₹2,000

Balance to be paid by instalments = ₹ $(x - 2000)$

Present value of the first instalment

$$= ₹ \frac{8640}{1 + \frac{20}{100}} = ₹ \frac{8640}{1.2} = ₹7,200$$

Present value of the second instalment

$$= ₹ \frac{8640}{\left(1 + \frac{20}{100}\right)^2} = ₹ \frac{8640}{1.44} = ₹6,000$$

Total of the present values = ₹13,200

$$x - 2000 = 13,200$$

$$x = 15,200.$$

20. Cash price = ₹10,220

Down payment = ₹3,600

Balance to be paid by instalments (in ₹) = 10220 - 3600 = 6620

Let each instalment be ₹ i

Present value of the first instalment = $\frac{i}{1 + \frac{R}{100}}$

Present value of the second instalment

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

Present value of the third instalment = $\frac{i}{\left(1 + \frac{R}{100}\right)^3}$

$$\frac{i}{1.1} + \frac{i}{(1.1)^2} + \frac{i}{(1.1)^3} = 6,620$$

$$\frac{i(1.1^2 + 1.1 + 1)}{(1.1)^3} = 6,620$$

$$\frac{i(1.21 + 1.1 + 1)}{1.331} = 6,620,$$

$$\text{i.e., } \frac{i(3.31)}{1.331} = 6,620$$

$$i = 2,662.$$



Level 3

21. (i) Interest = (Total amount paid in installments) – (Principal).

(ii) Use, Total present value

$$= \frac{4400}{\left(1 + \frac{R}{100}\right)} + \frac{4300}{\left(1 + \frac{R}{100}\right)^2} \text{ and evaluate } R.$$

22. (i) Refer to the hint of Q. No. 6.

(ii) Use, Present value at the end of the second year

$$= \frac{\text{Each instalment value}}{\left(1 + \frac{R}{100}\right)^2} \text{ and evaluate } R.$$

23. Interest = (Total amount paid in installments) – (Principal)

24. (i) Principal = $\frac{\text{Instalment}}{\left(1 + \frac{r}{100}\right)^n}$

(ii) Use, Total present value = Each instalment value

$$\left[\frac{1}{\left(1 + \frac{R}{100}\right)} + \frac{1}{\left(1 + \frac{R}{100}\right)^2} \right] \text{ and evaluate } R.$$

25. Use, Total principal = Each instalment value

$$\left[\frac{1}{\left(1 + \frac{R}{100}\right)} + \frac{1}{\left(1 + \frac{R}{100}\right)^2} + \frac{1}{\left(1 + \frac{R}{100}\right)^3} \right] \text{ and}$$

evaluate R .

26. Ganesh's (G) and Harish's (H) first and second instalments are tabulated below

	1	2
G	Q	$Q(1 + r)$
H	$Q(1 + r)$	Q

As the present values of G's instalments are equal, if his first instalment are equal if his first instalment is Q , the second is $Q(1 + r)$, where r is the half-yearly rate of interest.

The total value of G's instalments (when the second is paid) is $Q(1 + r) + Q(1 + r) = Q(2 + 2r)$

The total value of H's instalment is $Q(1 + r)^2 + Q = Q(2 + 2r + r^2)$

$\therefore$ The cost of Ganesh's car is lower.

27. Cash price = ₹13,000

Down payment = ₹1,300

Balance to be paid by instalment (in ₹)

$$= 13000 - 1300 = 11,700.$$

$\therefore$ Principal for the first month = ₹11,700

Principal for the second month (in ₹) = 11,700 – 3,000 = 8,700

Principal for the third month (in ₹) = 8700 – 3000 = 5,700.

28. The difference in G's and H's first instalment is Qr .

The cost of G's car is $\frac{2Q}{(1 + r)}$

The cost of H's car is

$$Q + \frac{Q}{(1 + r)^2} = \frac{Q}{(1 + r)^2} [2 + 2r + r^2]$$

$\therefore$ The difference is

$$\frac{Q}{(1 + r)^2} [(2 + 2r + r^2) - (2 + 2r)]$$

$$= Qr \left[\frac{r}{(1 + r)^2} \right] = ₹4410 \frac{(0.05)}{(1.05)(1.05)} = ₹200.$$

29. Let the price of the car be ₹ p and each of the 4 instalments be Q . ($Q = ₹1,46,410$)

$$P(1 + r)^4 = Q[(1 + r)^3 + (1 + r)^2 + (1 + r) + 1]$$

where $r = 0.1$ pa = 10% pa

$$\therefore P = Q \frac{[1 + 1.1 + 1.21 + 1.331]}{1.4641}$$

$$= 146410 \left(\frac{4.641}{1.4641} \right) = 4,64,100.$$

30. Let the each instalment be ₹ Q and let the annual rate of interest be r (or $100r$ % pa)

The value of the first instalment (at the time of borrowing) = $\frac{Q}{1 + r} = 16,900$ (1)

The value of the second (at the time of borrowing) = $\frac{Q}{(1 + r)^2} = 13,000$ (2)

The value of the third is $\frac{Q}{(1 + r)^3}$.

Eq. (1) ÷ Eq. (2)

$$\Rightarrow 1 + r = 1.3$$

$$\therefore \frac{Q}{(1 + r)^3} = \frac{Q}{(1 + r)^2} \frac{1}{(1 + r)} = \frac{13000}{1.3} = 10,000.$$

