

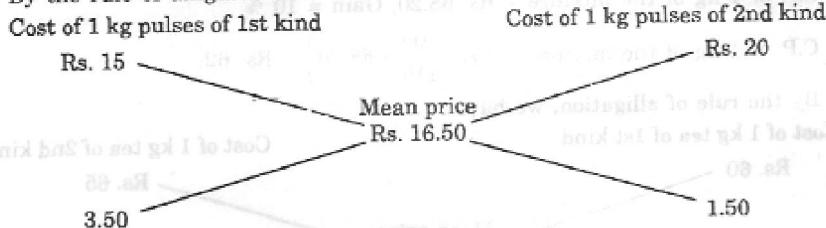
18. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of the water is 16 : 65. How much wine did the cask hold originally ?
 (N.I.F.T. 2003)
- (a) 18 litres (b) 24 litres (c) 32 litres (d) 42 litres
19. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially ?
 (a) 10 (b) 20 (c) 21 (d) 25
20. A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup ?
 (a) $\frac{1}{3}$ (b) $\frac{1}{4}$ (c) $\frac{1}{5}$ (d) $\frac{1}{7}$

ANSWERS

1. (c) 2. (b) 3. (a) 4. (a) 5. (a) 6. (a) 7. (d) 8. (a) 9. (c) 10. (d)
 11. (a) 12. (b) 13. (c) 14. (c) 15. (c) 16. (b) 17. (d) 18. (b) 19. (c) 20. (c)

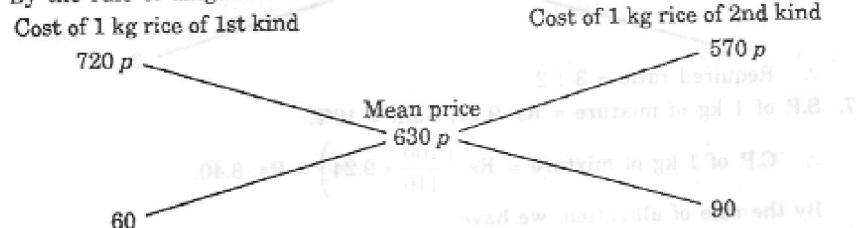
SOLUTIONS

1. By the rule of alligation :



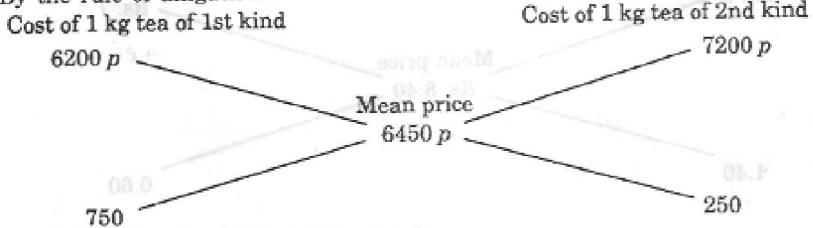
$$\therefore \text{Required rate} = 3.50 : 1.50 = 35 : 15 = 7 : 3.$$

2. By the rule of alligation :

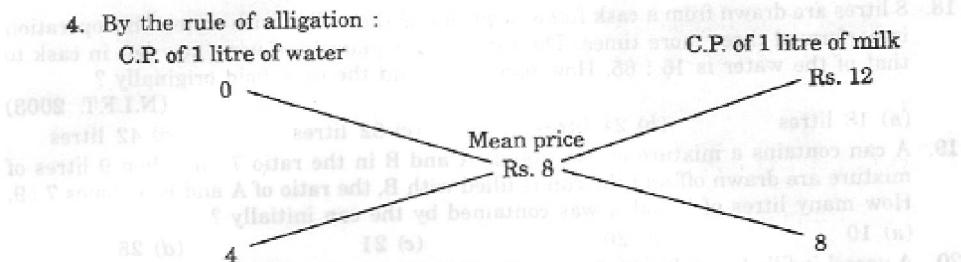


$$\therefore \text{Required ratio} = 60 : 90 = 2 : 3.$$

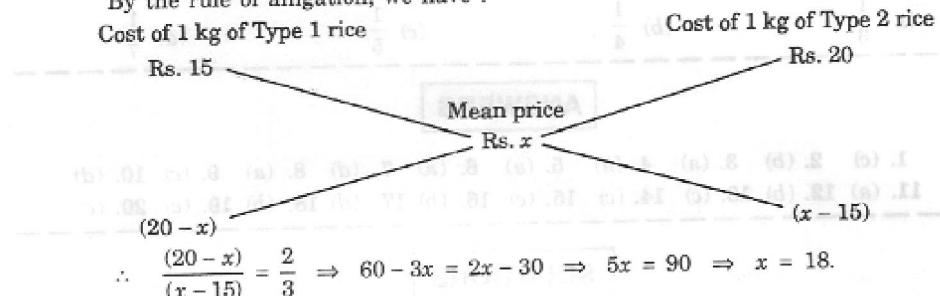
3. By the rule of alligation :



$$\therefore \text{Required ratio} = 750 : 250 = 3 : 1.$$



5. Let the price of the mixed variety be Rs. x per kg.
 By the rule of alligation, we have :

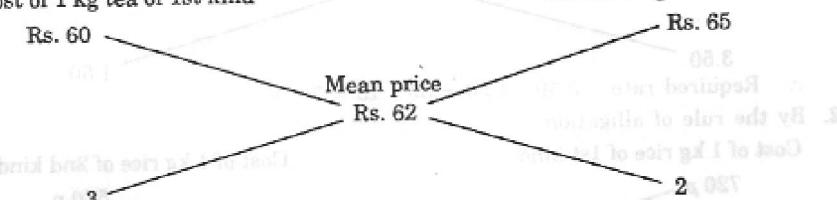


So, price of the mixture is Rs. 18 per kg.

6. S.P. of 1 kg of the mixture = Rs. 68.20, Gain = 10 %.

$$\text{C.P. of 1 kg of the mixture} = \text{Rs.} \left(\frac{100}{110} \times 68.20 \right) = \text{Rs.} 62.$$

By the rule of alligation, we have :

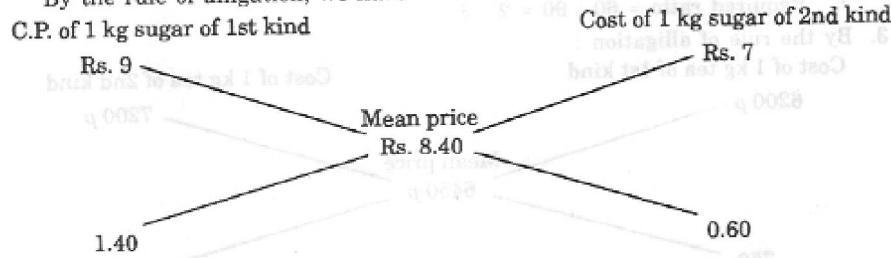


\therefore Required ratio = 3 : 2.

7. S.P. of 1 kg of mixture = Rs. 9.24, Gain = 10%.

$$\therefore \text{C.P. of 1 kg of mixture} = \text{Rs.} \left(\frac{100}{110} \times 9.24 \right) = \text{Rs.} 8.40.$$

By the rule of alligation, we have :



\therefore Ratio of quantities of 1st and 2nd kind = $14 : 6 = 7 : 3$. until 1 to 100

Let x kg of sugar of 1st kind be mixed with 27 kg of 2nd kind. (1)

$$\text{Then, } 7 : 3 = x : 27 \text{ or } x = \left(\frac{7 \times 27}{3} \right) = 63 \text{ kg.}$$

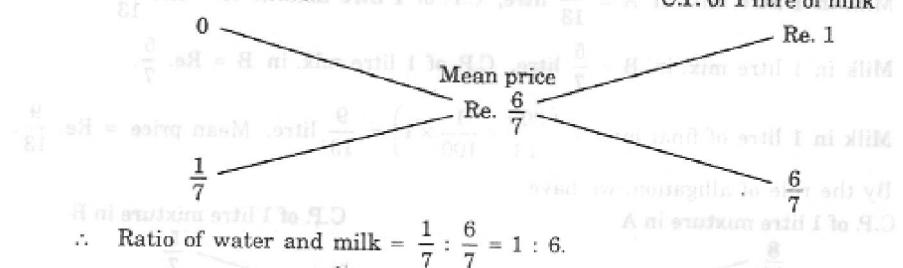
8. Let C.P. of 1 litre milk be Re. 1.

$$\text{S.P. of 1 litre of mixture} = \text{Re. 1}, \text{Gain} = \frac{50}{3}\%.$$

$$\therefore \text{C.P. of 1 litre of mixture} = \left(100 \times \frac{3}{350} \times 1 \right) = \text{Re. } \frac{6}{7}.$$

By the rule of alligation, we have :

C.P. of 1 litre of water until 1 to 100, until 1 to 100 and C.P. of 1 litre of milk



$$\therefore \text{Ratio of water and milk} = \frac{1}{7} : \frac{6}{7} = 1 : 6.$$

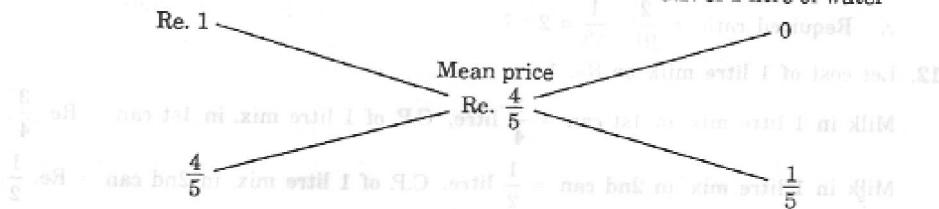
9. Let C.P. of 1 litre milk be Re. 1.

$$\text{Then, S.P. of 1 litre of mixture} = \text{Re. 1}, \text{Gain} = 25\%.$$

$$\text{C.P. of 1 litre mixture} = \text{Re. } \left(\frac{100}{125} \times 1 \right) = \text{Re. } \frac{4}{5}.$$

C.P. of 1 litre milk

C.P. of 1 litre of water



$$\therefore \text{Ratio of milk to water} = \frac{4}{5} : \frac{1}{5} = 4 : 1.$$

Hence, percentage of water in the mixture = $\left(\frac{1}{5} \times 100 \right)\% = 20\%$.

10. Let the C.P. of spirit be Re. 1 per litre.

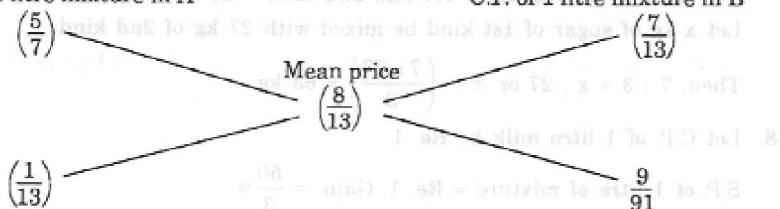
$$\text{Spirit in 1 litre mix. of A} = \frac{5}{7} \text{ litre; C.P. of 1 litre mix. in A} = \text{Re. } \frac{5}{7}.$$

$$\text{Spirit in 1 litre mix. of B} = \frac{7}{13} \text{ litre; C.P. of 1 litre mix. in B} = \text{Re. } \frac{7}{13}.$$

$$\text{Spirit in 1 litre mix. of C} = \frac{8}{13} \text{ litre; Mean price} = \text{Re. } \frac{8}{13}.$$

By the rule of alligation, we have :

C.P. of 1 litre mixture in A = Re. $\frac{5}{7}$ and C.P. of 1 litre mixture in B = Re. $\frac{7}{13}$



$$\therefore \text{Required ratio} = \frac{1}{13} : \frac{9}{91} = 7 : 9.$$

11. Let cost of 1 litre milk be Re. 1.

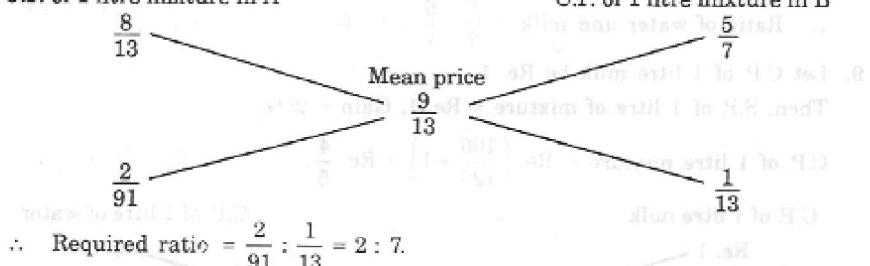
$$\text{Milk in 1 litre mix. in A} = \frac{8}{13} \text{ litre, C.P. of 1 litre mix. in A} = \text{Re. } \frac{8}{13}.$$

$$\text{Milk in 1 litre mix. in B} = \frac{5}{7} \text{ litre, C.P. of 1 litre mix. in B} = \text{Re. } \frac{5}{7}.$$

$$\text{Milk in 1 litre of final mix.} = \left(\frac{900}{13} \times \frac{1}{100} \times 1 \right) = \frac{9}{13} \text{ litre; Mean price} = \text{Re. } \frac{9}{13}.$$

By the rule of alligation, we have :

C.P. of 1 litre mixture in A = Re. $\frac{8}{13}$ and C.P. of 1 litre mixture in B = Re. $\frac{5}{7}$



$$\therefore \text{Required ratio} = \frac{2}{91} : \frac{1}{13} = 2 : 7.$$

12. Let cost of 1 litre milk be Re. 1.

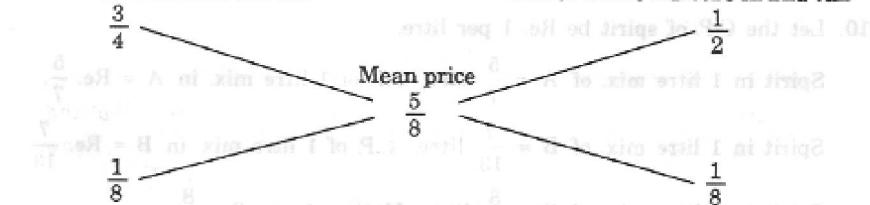
$$\text{Milk in 1 litre mix. in 1st can} = \frac{3}{4} \text{ litre, C.P. of 1 litre mix. in 1st can} = \text{Re. } \frac{3}{4}.$$

$$\text{Milk in 1 litre mix. in 2nd can} = \frac{1}{2} \text{ litre, C.P. of 1 litre mix. in 2nd can} = \text{Re. } \frac{1}{2}.$$

$$\text{Milk in 1 litre of final mix.} = \frac{5}{8} \text{ litre, Mean price} = \text{Re. } \frac{5}{8}.$$

By the rule of alligation, we have :

C.P. of 1 litre mixture in 1st can = Re. $\frac{3}{4}$ and C.P. of 1 litre mixture in 2nd can = Re. $\frac{1}{2}$

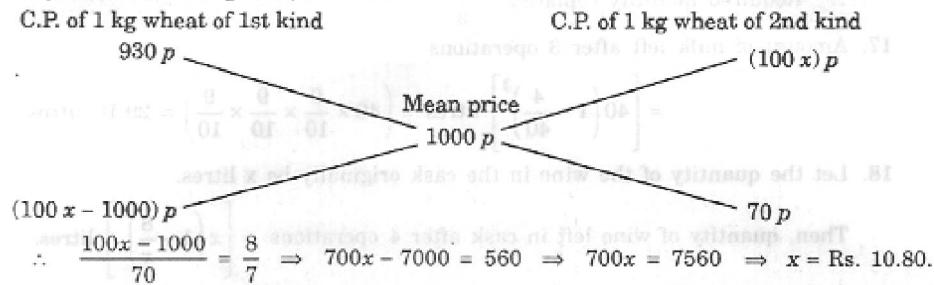


$$\therefore \text{Ratio of two mixtures} = \frac{1}{8} : \frac{1}{8} = 1 : 1.$$

So, quantity of mixture taken from each can = $\left(\frac{1}{2} \times 12 \right) = 6$ litres.

13. Let the rate of the second quality be Rs. x per kg.

By the rule of alligation, we have :

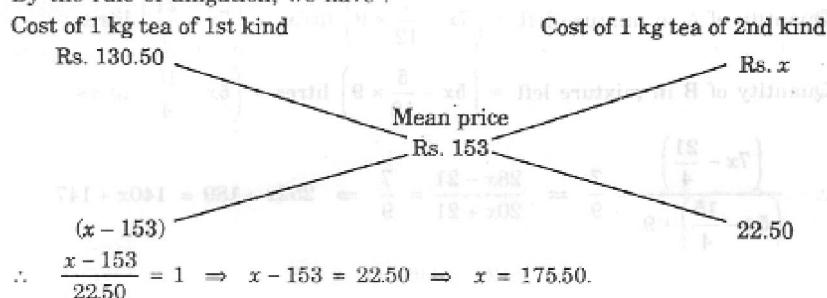


14. Since first and second varieties are mixed in equal proportions, so their average price

$$= \text{Rs. } \left(\frac{126 + 135}{2} \right) = \text{Rs. } 130.50.$$

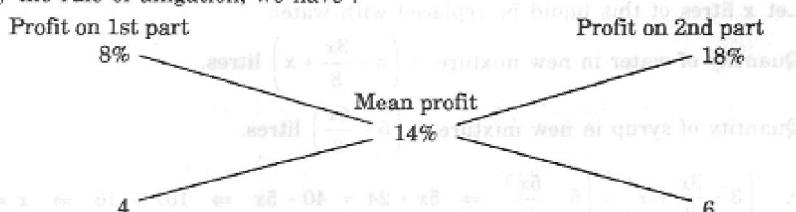
So, the mixture is formed by mixing two varieties, one at Rs. 130.50 per kg and the other at say, Rs. x per kg in the ratio 2 : 2, i.e., 1 : 1. We have to find x .

By the rule of alligation, we have :



Hence, price of the third variety = Rs. 175.50 per kg.

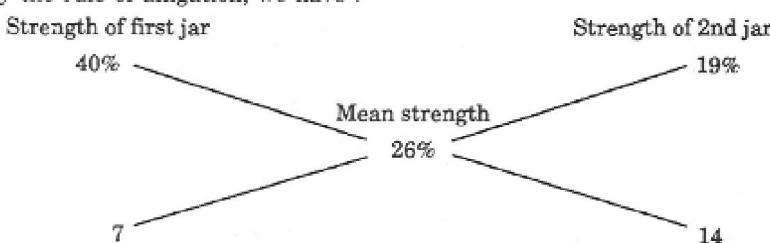
15. By the rule of alligation, we have :



Ratio of 1st and 2nd parts = 4 : 6 = 2 : 3

$$\therefore \text{Quantity of 2nd kind} = \left(\frac{3}{5} \times 1000 \right) \text{ kg} = 600 \text{ kg.}$$

16. By the rule of alligation, we have :



So, ratio of 1st and 2nd quantities = $7 : 14 = 1 : 2$.

∴ Required quantity replaced = $\frac{2}{3}$.

17. Amount of milk left after 3 operations

$$= \left[40 \left(1 - \frac{4}{40} \right)^3 \right] \text{ litres} = \left(40 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} \right) = 29.16 \text{ litres.}$$

18. Let the quantity of the wine in the cask originally be x litres.

Then, quantity of wine left in cask after 4 operations = $\left[x \left(1 - \frac{8}{x} \right)^4 \right]$ litres.

$$\frac{x \left(1 - \frac{8}{x} \right)^4}{x} = \frac{16}{81} \Rightarrow \left(1 - \frac{8}{x} \right)^4 = \left(\frac{2}{3} \right)^2 \Rightarrow \left(\frac{x-8}{x} \right) = \frac{2}{3}$$

$$\Rightarrow 3x - 24 = 2x \Rightarrow x = 24.$$

19. Suppose the can initially contains $7x$ and $5x$ litres of mixtures A and B respectively.

$$\text{Quantity of A in mixture left} = \left(7x - \frac{7}{12} \times 9 \right) \text{ litres} = \left(7x - \frac{21}{4} \right) \text{ litres.}$$

$$\text{Quantity of B in mixture left} = \left(5x - \frac{5}{12} \times 9 \right) \text{ litres} = \left(5x - \frac{15}{4} \right) \text{ litres.}$$

$$\therefore \frac{\left(7x - \frac{21}{4} \right)}{\left(5x - \frac{15}{4} \right) + 9} = \frac{7}{9} \Rightarrow \frac{28x - 21}{20x + 21} = \frac{7}{9} \Rightarrow 252x - 189 = 140x + 147$$

$$\Rightarrow 112x = 336 \Rightarrow x = 3.$$

So, the can contained 21 litres of A.

20. Suppose the vessel initially contains 8 litres of liquid.

Let x litres of this liquid be replaced with water.

$$\text{Quantity of water in new mixture} = \left(3 - \frac{3x}{8} + x \right) \text{ litres.}$$

$$\text{Quantity of syrup in new mixture} = \left(5 - \frac{5x}{8} \right) \text{ litres.}$$

$$\therefore \left(3 - \frac{3x}{8} + x \right) = \left(5 - \frac{5x}{8} \right) \Rightarrow 5x + 24 = 40 - 5x \Rightarrow 10x = 16 \Rightarrow x = \frac{8}{5}.$$

$$\text{So, part of the mixture replaced} = \left(\frac{8}{5} \times \frac{1}{8} \right) = \frac{1}{5}.$$

21. SIMPLE INTEREST

IMPORTANT FACTS AND FORMULAE

1. **Principal :** The money borrowed or lent out for a certain period is called the **principal** or the **sum**.
2. **Interest :** Extra money paid for using other's money is called **interest**.
3. **Simple Interest (S.I.) :** If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called **simple interest**.

Let Principal = P, Rate = R% per annum (p.a.) and Time = T years. Then,

$$(i) S.I. = \left(\frac{P \times R \times T}{100} \right)$$

$$(ii) P = \left(\frac{100 \times S.I.}{R \times T} \right), R = \left(\frac{100 \times S.I.}{P \times T} \right) \text{ and } T = \left(\frac{100 \times S.I.}{P \times R} \right)$$

SOLVED EXAMPLES

Ex. 1. Find the simple interest on Rs. 68,000 at $16\frac{2}{3}\%$ per annum for 9 months.

$$\text{Sol. } P = \text{Rs. } 68000, R = \frac{50}{3}\% \text{ p.a. and } T = \frac{9}{12} \text{ years} = \frac{3}{4} \text{ years.}$$

$$\therefore S.I. = \left(\frac{P \times R \times T}{100} \right) = \text{Rs. } \left(68000 \times \frac{50}{3} \times \frac{3}{4} \times \frac{1}{100} \right) = \text{Rs. } 8500.$$

Ex. 2. Find the simple interest on Rs. 3000 at $6\frac{1}{4}\%$ per annum for the period from 4th Feb., 2005 to 18th April, 2005.

$$\text{Sol. Time} = (24 + 31 + 18) \text{ days} = 73 \text{ days} = \frac{73}{365} \text{ year} = \frac{1}{5} \text{ year.}$$

$$P = \text{Rs. } 3000 \text{ and } R = 6\frac{1}{4}\% \text{ p.a.} = \frac{25}{4}\% \text{ p.a.}$$

$$\therefore S.I. = \text{Rs. } \left(3000 \times \frac{25}{4} \times \frac{1}{5} \times \frac{1}{100} \right) = \text{Rs. } 37.50.$$

Remark : The day on which money is deposited is not counted while the day on which money is withdrawn is counted.

Ex. 3. A sum at simple interest at $13\frac{1}{2}\%$ per annum amounts to Rs. 2502.50 after 4 years. Find the sum.

$$\text{Sol. Let sum be Rs. } x. \text{ Then, } S.I. = \text{Rs. } \left(x \times \frac{27}{2} \times 4 \times \frac{1}{100} \right) = \text{Rs. } \frac{27x}{50}.$$

$$\therefore \text{Amount} = \text{Rs. } \left(x + \frac{27x}{50} \right) = \text{Rs. } \frac{77x}{50}.$$

$$\therefore \frac{77x}{50} = 2502.50 \Leftrightarrow x = \frac{2502.50 \times 50}{77} = 1625.$$

Hence, sum = Rs. 1625.

Ex. 4. A sum of Rs. 800 amounts to Rs. 920 in 3 years at simple interest. If the interest rate is increased by 3%, it would amount to how much?

Sol. S.I. = Rs. (920 - 800) = Rs. 120; P = Rs. 800, T = 3 yrs.

$$\therefore R = \left(\frac{100 \times 120}{800 \times 3} \right)\% = 5\%.$$

New rate = $(5 + 3)\% = 8\%$.

$$\text{New S.I.} = \text{Rs.} \left(\frac{800 \times 8 \times 3}{100} \right) = \text{Rs.} 192.$$

\therefore New amount = Rs. $(800 + 192) = \text{Rs.} 992$.

Ex. 5. Adam borrowed some money at the rate of 6% p.a. for the first two years, at the rate of 9% p.a. for the next three years, and at the rate of 14% p.a. for the period beyond five years. If he pays a total interest of Rs. 11,400 at the end of nine years, how much money did he borrow? (Bank P.O. 1999)

Sol. Let the sum borrowed be x . Then,

$$\left(\frac{x \times 6 \times 2}{100} \right) + \left(\frac{x \times 9 \times 3}{100} \right) + \left(\frac{x \times 14 \times 4}{100} \right) = 11400$$

$$\Leftrightarrow \left(\frac{3x}{25} + \frac{27x}{100} + \frac{14x}{25} \right) = 11400 \Leftrightarrow \frac{95x}{100} = 11400 \Leftrightarrow x = \left(\frac{11400 \times 100}{95} \right) = 12000.$$

Hence, sum borrowed = Rs. 12,000.

Ex. 6. A certain sum of money amounts to Rs. 1008 in 2 years and to Rs. 1164 in $3\frac{1}{2}$ years. Find the sum and the rate of interest.

Sol. S.I. for $1\frac{1}{2}$ years = Rs. $(1164 - 1008) = \text{Rs.} 156$.

$$\text{S.I. for 2 years} = \text{Rs.} \left(156 \times \frac{2}{3} \times 2 \right) = \text{Rs.} 208.$$

\therefore Principal = Rs. $(1008 - 208) = \text{Rs.} 800$.

Now, P = 800, T = 2 and S.I. = 208.

$$\therefore \text{Rate} = \left(\frac{100 \times 208}{800 \times 2} \right)\% = 13\%.$$

Ex. 7. At what rate percent per annum will a sum of money double in 16 years? (R.R.B. 2003)

Sol. Let principal = P. Then, S.I. = P and T = 16 yrs.

$$\therefore \text{Rate} = \left(\frac{100 \times P}{P \times 16} \right)\% = 6\frac{1}{4}\% \text{ p.a.}$$

Ex. 8. The simple interest on a sum of money is $\frac{4}{9}$ of the principal. Find the rate percent and time, if both are numerically equal. (S.S.C. 2000)

Sol. Let sum = Rs. x. Then, S.I. = Rs. $\frac{4x}{9}$.

Let rate = R% and time = R years.

Then, $\left(\frac{x \times R \times R}{100}\right) = \frac{4x}{9}$ or $R^2 = \frac{400}{9}$ or $R = \frac{20}{3} = 6\frac{2}{3}$.

\therefore Rate = $6\frac{2}{3}\%$ and Time = $6\frac{2}{3}$ yrs = 6 yrs 8 months.

Ex. 9. The simple interest on a certain sum of money for $2\frac{1}{2}$ years at 12% per annum is Rs. 40 less than the simple interest on the same sum for $3\frac{1}{2}$ years at 10% per annum. Find the sum.

Sol. Let the sum be Rs. x. Then, $\left(\frac{x \times 10 \times 7}{100 \times 2}\right) - \left(\frac{x \times 12 \times 5}{100 \times 2}\right) = 40$

$$\Leftrightarrow \frac{7x}{20} - \frac{3x}{10} = 40 \Leftrightarrow x = (40 \times 20) = 800.$$

Hence, the sum is Rs. 800.

Ex. 10. A sum was put at simple interest at a certain rate for 3 years. Had it been put at 2% higher rate, it would have fetched Rs. 360 more. Find the sum.

Sol. Let sum = P and original rate = R. Then, $\left[\frac{P \times (R+2) \times 3}{100}\right] - \left[\frac{P \times R \times 3}{100}\right] = 360$

$$\Leftrightarrow 3PR + 6P - 3PR = 36000 \Leftrightarrow 6P = 36000 \Leftrightarrow P = 6000.$$

Hence, sum = Rs. 6000.

Ex. 11. What annual instalment will discharge a debt of Rs. 1092 due in 3 years at 12% simple interest?

Sol. Let each instalment be Rs. x. Then, $\left(x + \frac{x \times 12 \times 1}{100}\right) + \left(x + \frac{x \times 12 \times 2}{100}\right) + x = 1092$

$$\Leftrightarrow \frac{28x}{25} + \frac{31x}{25} + x = 1092 \Leftrightarrow (28x + 31x + 25x) = (1092 \times 25)$$

$$\Leftrightarrow x = \left(\frac{1092 \times 25}{84}\right) = 325.$$

\therefore Each instalment = Rs. 325.

Ex. 12. A sum of Rs. 1550 is lent out into two parts, one at 8% and another one at 6%. If the total annual income is Rs. 106, find the money lent at each rate.

(L.I.C. A.A.O. 2003)

Sol. Let the sum lent at 8% be Rs. x and that at 6% be Rs. $(1550 - x)$.

$$\therefore \left[\frac{x \times 8 \times 1}{100}\right] + \left[\frac{(1550 - x) \times 6 \times 1}{100}\right] = 106$$

$$\Leftrightarrow 8x + 9300 - 6x = 10600 \Leftrightarrow 2x = 1300 \Leftrightarrow x = 650.$$

\therefore Money lent at 8% = Rs. 650. Money lent at 6% = Rs. $(1550 - 650) =$ Rs. 900.

EXERCISE 21A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

- At the rate of $8\frac{1}{2}\%$ p.a. simple interest, a sum of Rs. 4800 will earn how much interest in 2 years 3 months?
 (a) Rs. 796 (b) Rs. 816 (c) Rs. 918 (d) Rs. 956

2. What will be the simple interest earned on an amount of Rs. 16,800 in 9 months at the rate of $6\frac{1}{4}\%$ p.a. ?
(a) Rs. 787.50 (b) Rs. 812.50 (c) Rs. 860 (d) Rs. 887.50
3. The simple interest on Rs. 1820 from March 9, 2003 to May 21, 2003 at $7\frac{1}{2}\%$ rate will be :
(a) Rs. 22.50 (b) Rs. 27.30 (c) Rs. 28.80 (d) Rs. 29
4. A person borrows Rs. 5000 for 2 years at 4% p.a. simple interest. He immediately lends it to another person at $6\frac{1}{4}\%$ p.a. for 2 years. Find his gain in the transaction per year.
(S.S.C. 2000)
(a) Rs. 112.50 (b) Rs. 125 (c) Rs. 150 (d) Rs. 167.50
5. How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at 4.5% per annum of simple interest ?
(IGNOU, 2003)
(a) 3.5 years (b) 4 years (c) 4.5 years (d) 5 years
6. A sum of Rs. 12,500 amounts to Rs. 15,500 in 4 years at the rate of simple interest. What is the rate of interest ?
(Bank P.O. 2003)
(a) 3% (b) 4% (c) 5% (d) 6% (e) None of these
7. A sum of Rs. 1600 gives a simple interest of Rs. 252 in 2 years and 4 months. The rate of interest per annum is :
(a) 6% (b) $6\frac{1}{4}\%$ (c) $6\frac{1}{2}\%$ (d) $6\frac{3}{4}\%$
8. Reena took a loan of Rs. 1200 with simple interest for as many years as the rate of interest. If she paid Rs. 432 as interest at the end of the loan period, what was the rate of interest ?
(R.B.I. 2003)
(a) 3.6 (b) 6 (c) 18
(d) Cannot be determined (e) None of these
9. A man took a loan from a bank at the rate of 12% p.a. simple interest. After 3 years he had to pay Rs. 5400 interest only for the period. The principal amount borrowed by him was :
(S.S.C. 2004)
(a) Rs. 2000 (b) Rs. 10,000 (c) Rs. 15,000 (d) Rs. 20,000
10. What is the present worth of Rs. 132 due in 2 years at 5% simple interest per annum ?
(C.B.I. 1997)
(a) Rs. 112 (b) Rs. 118.80 (c) Rs. 120 (d) Rs. 122
11. A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum ?
(NABARD, 2002)
(a) Rs. 4462.50 (b) Rs. 8032.50 (c) Rs. 8900
(d) Rs. 8925 (e) None of these
12. The simple interest at $x\%$ for x years will be Rs. x on a sum of :
(a) Rs. x (b) Rs. $\left(\frac{100}{x}\right)$ (c) Rs. $100x$ (d) Rs. $\left(\frac{100}{x^2}\right)$
13. Rs. 800 becomes Rs. 956 in 3 years at a certain rate of simple interest. If the rate of interest is increased by 4%, what amount will Rs. 800 become in 3 years ?
(a) Rs. 1020.80 (b) Rs. 1025 (c) Rs. 1052
(d) Data inadequate (e) None of these
(Bank P.O. 2000)
14. A certain amount earns simple interest of Rs. 1750 after 7 years. Had the interest been 2% more, how much more interest would it have earned ?
(Bank P.O. 2003)
(a) Rs. 35 (b) Rs. 245 (c) Rs. 350
(d) Cannot be determined (e) None of these

15. In how many years, Rs. 150 will produce the same interest @ 8% as Rs. 800 produce in 3 years @ $4\frac{1}{2}\%$? (R.R.B. 2001)
(a) 6 (b) 8 (c) 9 (d) 12
16. If Rs. 64 amounts to Rs. 83.20 in 2 years, what will Rs. 86 amount to in 4 years at the same rate percent per annum? (a) Rs. 114.80 (b) Rs. 124.70 (c) Rs. 127.40 (d) Rs. 137.60
17. The simple interest on a certain sum of money at the rate of 5% p.a. for 8 years is Rs. 840. At what rate of interest the same amount of interest can be received on the same sum after 5 years? (a) 6% (b) 8% (c) 9% (d) 10%
18. The interest on a certain deposit at 4.5% p.a. is Rs. 202.50 in one year. How much will the additional interest in one year be on the same deposit at 5% p.a.? (a) Rs. 20.25 (b) Rs. 22.50 (c) Rs. 25 (d) Rs. 42.75
19. A sum invested at 5% simple interest per annum grows to Rs. 504 in 4 years. The same amount at 10% simple interest per annum in $2\frac{1}{2}$ years will grow to : (C.D.S. 2003)
(a) Rs. 420 (b) Rs. 450 (c) Rs. 525 (d) Rs. 550
20. What will be the ratio of simple interest earned by certain amount at the same rate of interest for 6 years and that for 9 years? (Bank P.O. 1998)
(a) 1 : 3 (b) 1 : 4 (c) 2 : 3 (d) Data inadequate (e) None of these
21. Nitin borrowed some money at the rate of 6% p.a. for the first three years, 9% p.a. for the next five years and 13% p.a. for the period beyond eight years. If the total interest paid by him at the end of eleven years is Rs. 8160, how much money did he borrow? (Bank P.O. 2000)
(a) Rs. 8000 (b) Rs. 10,000 (c) Rs. 12,000
(d) Data inadequate (e) None of these
22. The simple interest on a sum of money will be Rs. 600 after 10 years. If the principal is trebled after 5 years, what will be the total interest at the end of the tenth year? (a) Rs. 600 (b) Rs. 900 (c) Rs. 1200
(d) Rs. 1500 (e) Data inadequate
23. The simple interest on Rs. 10 for 4 months at the rate of 3 paise per rupee per month is : (S.S.C. 2001)
(a) Rs. 1.20 (b) Rs. 1.60 (c) Rs. 2.40 (d) Rs. 3.60
24. An automobile financier claims to be lending money at simple interest, but he includes the interest every six months for calculating the principal. If he is charging an interest of 10%, the effective rate of interest becomes : (N.I.F.T. 2000)
(a) 10% (b) 10.25% (c) 10.5% (d) None of these
25. A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is : (Section Officers', 2001)
(a) Rs. 650 (b) Rs. 690 (c) Rs. 698 (d) Rs. 700
26. A sum of money lent out at simple interest amounts to Rs. 720 after 2 years and to Rs. 1020 after a further period of 5 years. The sum is : (S.S.C. 2004)
(a) Rs. 500 (b) Rs. 600 (c) Rs. 700 (d) Rs. 710
27. A sum of money amounts to Rs. 9800 after 5 years and Rs. 12005 after 8 years at the same rate of simple interest. The rate of interest per annum is : (S.S.C. 2003)
(a) 5% (b) 8% (c) 12% (d) 15%

40. Simple interest on a certain sum at a certain annual rate of interest is $\frac{1}{9}$ of the sum.
If the numbers representing rate percent and time in years be equal, then the rate of interest is :
(a) $3\frac{1}{3}\%$ (b) 5% (c) $6\frac{2}{3}\%$ (d) 10%
41. Simple interest on a certain amount is $\frac{9}{16}$ of the principal. If the numbers representing the rate of interest in percent and time in years be equal, then time, for which the principal is lent out, is : (R.R.B. 2003)
(a) $5\frac{1}{2}$ years (b) $6\frac{1}{2}$ years (c) 7 years (d) $7\frac{1}{2}$ years
42. A lends Rs. 2500 to B and a certain sum to C at the same time at 7% p.a. simple interest. If after 4 years, A altogether receives Rs. 1120 as interest from B and C, then the sum lent to C is : (S.S.C. 2003)
(a) Rs. 700 (b) Rs. 1500 (c) Rs. 4000 (d) Rs. 6500
43. Two equal sums of money were lent at simple interest at 11% p.a. for $3\frac{1}{2}$ years and $4\frac{1}{2}$ years respectively. If the difference in interests for two periods was Rs. 412.50, then each sum is :
(a) Rs. 3250 (b) Rs. 3500 (c) Rs. 3750 (d) Rs. 4250
44. If the simple interest on a certain sum for 15 months at $7\frac{1}{2}\%$ per annum exceeds the simple interest on the same sum for 8 months at $12\frac{1}{2}\%$ per annum by Rs. 32.50, then the sum (in Rs.) is :
(a) Rs. 3000 (b) Rs. 3060 (c) Rs. 3120 (d) Rs. 3250
45. A man invests a certain sum of money at 6% p.a. simple interest and another sum at 7% p.a. simple interest. His income from interest after 2 years was Rs. 354. One-fourth of the first sum is equal to one-fifth of the second sum. The total sum invested was :
(a) Rs. 2600 (b) Rs. 2700 (c) Rs. 2880 (d) Rs. 2900
46. A borrowed some money from B at 12% p.a. S.I. for 3 years. He then added some more money to the borrowed sum and lent it to C for the same period at 14% p.a. rate of interest. If A gains Rs. 93.90 in the whole transaction, how much money did he add from his side ?
(a) Rs. 35 (b) Rs. 55 (c) Rs. 80 (d) Rs. 105
47. A person borrowed Rs. 500 @ 3% per annum S.I. and Rs. 600 @ $4\frac{1}{2}\%$ per annum on the agreement that the whole sum will be returned only when the total interest becomes Rs. 126. The number of years, after which the borrowed sum is to be returned, is :
(a) 2 (b) 3 (c) 4 (d) 5
48. A lent Rs. 5000 to B for 2 years and Rs. 3000 to C for 4 years on simple interest at the same rate of interest and received Rs. 2200 in all from both of them as interest. The rate of interest per annum is : (C.B.I. 2003)
(a) 5% (b) 7% (c) $7\frac{1}{8}\%$ (d) 10%

49. A sum of Rs. 725 is lent in the beginning of a year at a certain rate of interest. After 8 months, a sum of Rs. 362.50 more is lent but at the rate twice the former. At the end of the year, Rs. 33.50 is earned as interest from both the loans. What was the original rate of interest ?
(Bank P.O. 2003)
(a) 3.6% (b) 4.5% (c) 5% (d) 6% (e) None of these
50. The difference between the simple interest received from two different sources on Rs. 1500 for 3 years is Rs. 13.50. The difference between their rates of interest is :
(a) 0.1% (b) 0.2% (c) 0.3% (d) 0.4% (e) None of these
(S.S.C. 1999)
51. Peter invested an amount of Rs. 12,000 at the rate of 10 p.c.p.a. simple interest and another amount at the rate of 20 p.c.p.a. simple interest. The total interest earned at the end of one year on the total amount invested became 14 p.c.p.a. Find the total amount invested.
(S.B.I.P.O. 1999)
(a) Rs. 20,000 (b) Rs. 22,000 (c) Rs. 24,000 (d) Rs. 25,000 (e) None of these
52. What should be the least number of years in which the simple interest on Rs. 2600 at $6\frac{2}{3}\%$ will be an exact number of rupees ?
(a) 2 (b) 3 (c) 4 (d) 5
53. The rates of simple interest in two banks A and B are in the ratio 5 : 4. A person wants to deposit his total savings in two banks in such a way that he received equal half-yearly interest from both. He should deposit the savings in banks A and B in the ratio :
(a) 2 : 5 (b) 4 : 5 (c) 5 : 2 (d) 5 : 4
54. A sum was put at simple interest at a certain rate for 2 years. Had it been put at 3% higher rate, it would have fetched Rs. 72 more. The sum is :
(a) Rs. 1200 (b) Rs. 1500 (c) Rs. 1600 (d) Rs. 1800
55. If the annual rate of simple interest increases from 10% to $12\frac{1}{2}\%$, a man's yearly income increases by Rs. 1250. His principal (in Rs.) is :
(S.S.C. 2004)
(a) 45,000 (b) 50,000 (c) 60,000 (d) 65,000
56. A moneylender finds that due to a fall in the annual rate of interest from 8% to $7\frac{3}{4}\%$, his yearly income diminishes by Rs. 61.50. His capital is :
(S.S.C. 2003)
(a) Rs. 22,400 (b) Rs. 23,800 (c) Rs. 24,600 (d) Rs. 26,000
57. What annual payment will discharge a debt of Rs. 6450 due in 4 years at 5% simple interest ?
(a) Rs. 1400 (b) Rs. 1500 (c) Rs. 1550 (d) Rs. 1600
58. A sum of Rs. 10 is lent to be returned in 11 monthly instalments of Re. 1 each, interest being simple. The rate of interest is :
(a) $9\frac{1}{11}\%$ (b) 10% (c) 11% (d) $21\frac{9}{11}\%$
59. A person takes a loan of Rs. 200 at 5% simple interest. He returns Rs. 100 at the end of 1 year. In order to clear his dues at the end of 2 years, he would pay :
(a) Rs. 105 (b) Rs. 110 (c) Rs. 115 (d) Rs. 115.50
60. The price of a T.V. set worth Rs. 20,000 is to be paid in 20 instalments of Rs. 1000 each. If the rate of interest be 6% per annum, and the first instalment be paid at the time of purchase, then the value of the last instalment covering the interest as well will be :
(Hotel Management, 1998)
(a) Rs. 1050 (b) Rs. 2050 (c) Rs. 3000 (d) None of these

61. If the rate increases by 2%, the simple interest received on a sum of money increases by Rs. 108. If the time period is increased by 2 years, the simple interest on the same sum increases by Rs. 180. The sum is :
(a) Rs. 1800 (b) Rs. 3600 (c) Rs. 5400
(d) Data inadequate (e) None of these
62. Mr. Thomas invested an amount of Rs. 13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs. 3508, what was the amount invested in Scheme B ? (R.B.I. 2003)
(a) Rs. 6400 (b) Rs. 6500 (c) Rs. 7200
(d) Rs. 7500 (e) None of these
63. A sum of Rs. 2600 is lent out in two parts in such a way that the interest on one part at 10% for 5 years is equal to that on another at 9% for 6 years. The sum lent out at 10% is :
(a) Rs. 1150 (b) Rs. 1250 (c) Rs. 1350 (d) Rs. 1450
64. A sum of Rs. 1550 was lent partly at 5% and partly at 8% p.a. simple interest. The total interest received after 3 years was Rs. 300. The ratio of the money lent at 5% to that lent at 8% is :
(a) 5 : 8 (b) 8 : 5 (c) 16 : 15 (d) 31 : 6
65. A man lends Rs. 10,000 in four parts. If he gets 8% on Rs. 2000; $7\frac{1}{2}\%$ on Rs. 4000 and $8\frac{1}{2}\%$ on Rs. 1400; what percent must he get for the remainder, if his average annual interest is 8.13% ?
(a) 7% (b) 9% (c) $9\frac{1}{4}\%$ (d) $10\frac{1}{2}\%$
66. An amount of Rs. 1,00,000 is invested in two types of shares. The first yields an interest of 9% p.a. and the second, 11% p.a. If the total interest at the end of one year is $9\frac{3}{4}\%$, then the amount invested in each share was : (M.B.A. 2002)
(a) Rs. 52,500; Rs. 47,500 (b) Rs. 62,500; Rs. 37,500
(c) Rs. 72,500; Rs. 27,500 (d) Rs. 82,500; Rs. 17,500
67. David invested certain amount in three different schemes A, B and C with the rate of interest 10% p.a., 12% p.a. and 15% p.a. respectively. If the total interest accrued in one year was Rs. 3200 and the amount invested in Scheme C was 150% of the amount invested in Scheme A and 240% of the amount invested in Scheme B, what was the amount invested in Scheme B ? (Bank P.O. 2003)
(a) Rs. 5000 (b) Rs. 6500 (c) Rs. 8000
(d) Cannot be determined (e) None of these
68. A person invested in all Rs. 2600 at 4%, 6% and 8% per annum simple interest. At the end of the year, he got the same interest in all the three cases. The money invested at 4% is : (S.S.C. 2003)
(a) Rs. 200 (b) Rs. 600 (c) Rs. 800 (d) Rs. 1200
69. Divide Rs. 2379 into 3 parts so that their amounts after 2, 3 and 4 years respectively may be equal, the rate of interest being 5% per annum at simple interest. The first part is : (C.B.I. 1997)
(a) Rs. 759 (b) Rs. 792 (c) Rs. 818 (d) Rs. 828
70. A man invested $\frac{1}{3}$ of his capital at 7%; $\frac{1}{4}$ at 8% and the remainder at 10%. If his annual income is Rs. 561, the capital is :
(a) Rs. 5400 (b) Rs. 6000 (c) Rs. 6600 (d) Rs. 7200

ANSWERS

1. (c) 2. (a) 3. (b) 4. (a) 5. (b) 6. (d) 7. (d) 8. (b) 9. (c)
10. (c) 11. (d) 12. (b) 13. (c) 14. (d) 15. (c) 16. (d) 17. (b) 18. (b)
19. (c) 20. (c) 21. (a) 22. (c) 23. (a) 24. (b) 25. (c) 26. (b) 27. (c)
28. (c) 29. (d) 30. (b) 31. (c) 32. (d) 33. (b) 34. (b) 35. (d) 36. (a)
37. (a) 38. (d) 39. (a) 40. (a) 41. (d) 42. (b) 43. (c) 44. (c) 45. (b)
46. (d) 47. (b) 48. (d) 49. (e) 50. (c) 51. (a) 52. (b) 53. (b) 54. (a)
55. (b) 56. (c) 57. (b) 58. (d) 59. (c) 60. (d) 61. (d) 62. (a) 63. (c)
64. (c) 65. (b) 66. (b) 67. (a) 68. (d) 69. (d) 70. (c)

SOLUTIONS

1. Time = 2 yrs 3 mths = $2\frac{1}{4}$ yrs = $\frac{9}{4}$ yrs.
 \therefore S.I. = Rs. $\left(4800 \times \frac{17}{2} \times \frac{9}{4} \times \frac{1}{100}\right)$ = Rs. 918.
2. Time = 9 months = $\frac{3}{4}$ year.
 \therefore S.I. = Rs. $\left(16800 \times \frac{25}{4} \times \frac{3}{4} \times \frac{1}{100}\right)$ = Rs. 787.50.
3. Time = (22 + 30 + 21) days = 73 days = $\frac{1}{5}$ year.
 \therefore S.I. = Rs. $\left(1820 \times \frac{15}{2} \times \frac{1}{5} \times \frac{1}{100}\right)$ = Rs. 27.30.
4. Gain in 2 yrs. = Rs. $\left[\left(5000 \times \frac{25}{4} \times \frac{2}{100}\right) - \left(\frac{5000 \times 4 \times 2}{100}\right)\right]$ = Rs. (625 - 400) = Rs. 225.
 \therefore Gain in 1 year = Rs. $\left(\frac{225}{2}\right)$ = Rs. 112.50.
5. Time = $\left(\frac{100 \times 81}{450 \times 4.5}\right)$ years = 4 years.
6. S.I. = Rs. (15500 - 12500) = Rs. 3000.
Rate = $\left(\frac{100 \times 3000}{12500 \times 4}\right)\% = 6\%$.
7. Time = 2 years 4 months = $2\frac{1}{3}$ years = $\frac{7}{3}$ years.
Rate = $\left(\frac{100 \times 252 \times 3}{1600 \times 7}\right)\% = 6\frac{3}{4}\%$.
8. Let rate = R% and time = R years. Then,
 $\left(\frac{1200 \times R \times R}{100}\right) = 432 \Leftrightarrow 12R^2 = 432 \Leftrightarrow R^2 = 36 \Leftrightarrow R = 6$.
9. Principal = Rs. $\left(\frac{100 \times 5400}{12 \times 3}\right)$ = Rs. 15000.

Simple Interest

10. Let the present worth be Rs. x . Then, S.I. = Rs. $(132 - x)$.

$$\text{S.I.} = \left(\frac{x \times 5 \times 2}{100} \right) = 132 - x \Leftrightarrow 10x = 13200 - 100x \Leftrightarrow 110x = 13200 \Leftrightarrow x = 120.$$

$$11. \text{Principal} = \text{Rs.} \left(\frac{100 \times 4016.25}{9 \times 5} \right) = \text{Rs.} \left(\frac{401625}{45} \right) = \text{Rs.} 8925.$$

$$12. \text{Sum} = \left(\frac{100 \times \text{S.I.}}{\text{R} \times \text{T}} \right) = \text{Rs.} \left(\frac{100 \times x}{x \times x} \right) = \text{Rs.} \left(\frac{100}{x} \right).$$

$$13. \text{S.I.} = \text{Rs.} (956 - 800) = \text{Rs.} 156.$$

$$\text{Rate} = \left(\frac{100 \times 156}{800 \times 3} \right)\% = 6\frac{1}{2}\%.$$

$$\text{New rate} = \left(6\frac{1}{2} + 4 \right)\% = 10\frac{1}{2}\%.$$

$$\text{New S.I.} = \text{Rs.} \left(800 \times \frac{21}{2} \times \frac{3}{100} \right) = \text{Rs.} 252.$$

$$\therefore \text{New amount} = \text{Rs.} (800 + 252) = \text{Rs.} 1052.$$

14. We need to know the S.I., principal and time to find the rate. Since the principal is not given, so data is inadequate.

$$15. P = \text{Rs.} 800, R = 4\frac{1}{2}\% = \frac{9}{2}\%, T = 3 \text{ years. Then,}$$

$$\text{S.I.} = \text{Rs.} \left(800 \times \frac{9}{2} \times \frac{3}{100} \right) = \text{Rs.} 108.$$

$$\text{Now, } P = \text{Rs.} 150, \text{S.I.} = \text{Rs.} 108, R = 8\%.$$

$$\therefore \text{Time} = \left(\frac{100 \times 108}{150 \times 8} \right) \text{years} = 9 \text{ years.}$$

$$16. P = \text{Rs.} 64, \text{S.I.} = \text{Rs.} (83.20 - 64) = \text{Rs.} 19.20, T = 2 \text{ years.}$$

$$\text{So, rate} = \left(\frac{100 \times 19.20}{64 \times 2} \right)\% = 15\%.$$

$$\text{Now, } P = \text{Rs.} 86, R = 15\%, T = 4 \text{ years.}$$

$$\therefore \text{S.I.} = \text{Rs.} \left(\frac{86 \times 15 \times 4}{100} \right) = \text{Rs.} 51.60.$$

$$17. \text{S.I.} = \text{Rs.} 840, R = 5\%, T = 8 \text{ years.}$$

$$\text{Principal} = \text{Rs.} \left(\frac{100 \times 840}{5 \times 8} \right) = \text{Rs.} 2100.$$

$$\text{Now, } P = \text{Rs.} 2100, \text{S.I.} = \text{Rs.} 840, T = 5 \text{ years.}$$

$$\therefore \text{Rate} = \left(\frac{100 \times 840}{2100 \times 5} \right)\% = 8\%.$$

$$18. \text{S.I.} = \text{Rs.} 202.50, R = 4.5\%, T = 1 \text{ year.}$$

$$\text{Principal} = \text{Rs.} \left(\frac{100 \times 202.50}{4.5 \times 1} \right) = \text{Rs.} 4500.$$

$$\text{Now, } P = \text{Rs.} 4500, R = 5\%, T = 1 \text{ year.}$$

$$\text{S.I.} = \text{Rs.} \left(\frac{4500 \times 5 \times 1}{100} \right) = \text{Rs.} 225.$$

$$\therefore \text{Difference in interest} = \text{Rs.} (225 - 202.50) = \text{Rs.} 22.50.$$

19. Let the sum be Rs. x . Then, S.I. = Rs. $(504 - x)$.

$$\left(\frac{x \times 5 \times 4}{100} \right) = 504 - x \Leftrightarrow 20x = 50400 - 100x \Leftrightarrow 120x = 50400 \Leftrightarrow x = 420.$$

Now, P = Rs. 420, R = 10%, T = $\frac{5}{2}$ years.

$$S.I. = \text{Rs. } \left(\frac{420 \times 10}{100} \times \frac{5}{2} \right) = \text{Rs. } 105.$$

∴ Amount = Rs. $(420 + 105) = \text{Rs. } 525.$

20. Let the principal be P and rate of interest be R%.

$$\therefore \text{Required ratio} = \left[\frac{\left(\frac{P \times R \times 6}{100} \right)}{\left(\frac{P \times R \times 9}{100} \right)} \right] = \frac{6PR}{9PR} = \frac{6}{9} = 2 : 3.$$

21. Let the sum be Rs. x . Then,

$$\left(\frac{x \times 6 \times 3}{100} \right) + \left(\frac{x \times 9 \times 5}{100} \right) + \left(\frac{x \times 13 \times 3}{100} \right) = 8160 \Leftrightarrow 18x + 45x + 39x = (8160 \times 100) \Leftrightarrow 102x = 816000 \Leftrightarrow x = 8000.$$

22. Let the sum be Rs. x . Now, S.I. = Rs. 600, T = 10 years.

$$\text{Rate} = \left(\frac{100 \times 600}{x \times 10} \right)\% = \left(\frac{6000}{x} \right)\%.$$

$$\text{S.I. for first 5 years} = \text{Rs. } \left(\frac{x \times 5 \times 6000}{x \times 100} \right) = \text{Rs. } 300.$$

$$\text{S.I. for last 5 years} = \text{Rs. } \left(3x \times 5 \times \frac{6000}{x \times 100} \right) = \text{Rs. } 900.$$

∴ Total interest = Rs. 1200.

$$23. S.I. = \text{Rs. } \left(10 \times \frac{3}{100} \times 4 \right) = \text{Rs. } 1.20.$$

24. Let the sum be Rs. 100. Then,

$$\text{S.I. for first 6 months} = \text{Rs. } \left(\frac{100 \times 10 \times 1}{100 \times 2} \right) = \text{Rs. } 5.$$

$$\text{S.I. for last 6 months} = \text{Rs. } \left(\frac{105 \times 10 \times 1}{100 \times 2} \right) = \text{Rs. } 5.25.$$

So, amount at the end of 1 year = Rs. $(100 + 5 + 5.25) = \text{Rs. } 110.25.$

∴ Effective rate = $(110.25 - 100) = 10.25\%.$

25. S.I. for 1 year = Rs. $(854 - 815) = \text{Rs. } 39.$

S.I. for 3 years = Rs. $(39 \times 3) = \text{Rs. } 117.$

∴ Principal = Rs. $(815 - 117) = \text{Rs. } 698.$

26. S.I. for 5 years = Rs. $(1020 - 720) = \text{Rs. } 300.$

$$\text{S.I. for 2 years} = \text{Rs. } \left(\frac{300}{5} \times 2 \right) = \text{Rs. } 120.$$

∴ Principal = Rs. $(720 - 120) = \text{Rs. } 600.$

Simple Interest

27. S.I. for 3 years = Rs. $(12005 - 9800) = \text{Rs. } 2205$

S.I. for 5 years = Rs. $\left(\frac{2205}{3} \times 5\right) = \text{Rs. } 3675$.

\therefore Principal = Rs. $(9800 - 3675) = \text{Rs. } 6125$.

Hence, rate = $\left(\frac{100 \times 3675}{6125 \times 5}\right)\% = 12\%$.

28. S.I. for $1\frac{1}{2}$ years = Rs. $(1067.20 - 1012) = \text{Rs. } 55.20$.

S.I. for $2\frac{1}{2}$ years = Rs. $\left(55.20 \times \frac{2}{3} \times \frac{5}{2}\right) = \text{Rs. } 92$.

\therefore Principal = Rs. $(1012 - 92) = \text{Rs. } 920$.

Hence, rate = $\left(\frac{100 \times 92 \times 2}{920 \times 5}\right)\% = 4\%$.

29. Let sum = x. Then, S.I. = x.

\therefore Time = $\left(\frac{100 \times \text{S.I.}}{P \times R}\right) = \left(\frac{100 \times x}{x \times 12}\right)$ years = $8\frac{1}{3}$ years = 8 years 4 months.

30. Let sum = x. Then, S.I. = x.

\therefore Rate = $\left(\frac{100 \times \text{S.I.}}{P \times T}\right) = \left(\frac{100 \times x}{x \times 12}\right)\% = \frac{25}{3}\% = 8\frac{1}{3}\%$.

31. Let sum = x. Then, S.I. = $3x$.

\therefore Rate = $\left(\frac{100 \times \text{S.I.}}{P \times T}\right) = \left(\frac{100 \times 3x}{x \times 15}\right)\% = 20\%$.

32. Let sum = x. Then, S.I. = x.

\therefore Rate = $\left(\frac{100 \times x}{x \times 6}\right)\% = \frac{50}{3}\%$.

Now, sum = x, S.I. = $3x$, Rate = $\frac{50}{3}\%$.

\therefore Time = $\frac{100 \times 3x}{x \times \frac{50}{3}} = 18$ years.

33. Let sum = x. Then, S.I. = $2x$, Time = $15\frac{1}{2}$ years = $\frac{31}{2}$ years.

\therefore Rate = $\left(\frac{100 \times 2x}{x \times \frac{31}{2}}\right)\% = \frac{400}{31}\%$.

Now, sum = x, S.I. = x, Rate = $\frac{400}{31}\%$.

\therefore Time = $\frac{100 \times x}{x \times \frac{400}{31}} = \frac{31}{4}$ years = 7 years 9 months.

34. Let sum be x. Then, S.I. = x.

1. Time = $\frac{100 \times x}{x \times \frac{50}{3}} = 6$ years (False)

2. Time = $\frac{100 \times x}{x \times 20} = 5$ years (True)

3. Suppose sum = x . Then, S.I. = x and Time = 5 years.

$$\text{Rate} = \left(\frac{100 \times x}{x \times 5} \right) \% = 20\%$$

Now, sum = x , S.I. = $3x$ and Rate = 20%.

$$\therefore \text{Time} = \left(\frac{100 \times 3x}{x \times 20} \right) \text{years} = 15 \text{ years} \quad (\text{False})$$

So, 2 alone is correct.

35. Let sum = x . Then, S.I. = $\frac{x}{2}$.

$$\therefore \frac{x}{2} = \frac{x \times 8 \times 6}{100}. \text{ Clearly, data is inadequate.}$$

36. Let sum = x . Then, S.I. = $\frac{2x}{5}$, Time = 10 years.

$$\therefore \text{Rate} = \left(\frac{100 \times 2x}{x \times 5 \times 10} \right) \% = 4\%$$

37. Let sum = x . Then, S.I. = $0.125x = \frac{1}{8}x$, R = 10%.

$$\therefore \text{Time} = \left(\frac{100 \times x}{x \times 8 \times 10} \right) \text{years} = \frac{5}{4} \text{ years} = 1\frac{1}{4} \text{ years.}$$

38. Let the sum be x . Then, S.I. = 40% of $x = \frac{2x}{5}$; Rate = 5%.

$$\therefore \text{Time} = \left(\frac{100 \times 2x}{5 \times x \times 5} \right) = 8 \text{ years.}$$

39. Let sum = x . Then, amount = $\frac{7x}{6}$.

$$\text{S.I.} = \left(\frac{7x}{6} - x \right) = \frac{x}{6}; \text{Time} = 3 \text{ years.}$$

$$\therefore \text{Rate} = \left(\frac{100 \times x}{x \times 6 \times 3} \right) \% = \frac{50}{9}\% = 5\frac{5}{9}\%$$

40. Let sum = x . Then, S.I. = $\frac{x}{9}$.

Let rate = R% and time = R years.

$$\therefore \left(\frac{x \times R \times R}{100} \right) = \frac{x}{9} \Leftrightarrow R^2 = \frac{100}{9} \Leftrightarrow R = \frac{10}{3} = 3\frac{1}{3}$$

Hence, rate = $3\frac{1}{3}\%$.

41. Let sum = x . Then, S.I. = $\frac{9}{16}x$.

Let rate = R% and time = R years.

$$\therefore \left(\frac{x \times R \times R}{100} \right) = \frac{9x}{16} \Leftrightarrow R^2 = \frac{900}{16} \Leftrightarrow R = \frac{30}{4} = 7\frac{1}{2}$$

Hence, time = $7\frac{1}{2}$ years.

42. Let the sum lent to C be Rs. x. Then, $\left(\frac{2500 \times 7 \times 4}{100}\right) + \left(\frac{x \times 7 \times 4}{100}\right) = 1120$

$$\Leftrightarrow \frac{7}{25}x = (1120 - 700) \Rightarrow x = \left(\frac{420 \times 25}{7}\right) = 1500.$$

43. Let each sum be Rs. x. Then, $\left(\frac{x \times 11 \times 9}{100 \times 2}\right) - \left(\frac{x \times 11 \times 7}{100 \times 2}\right) = 412.50$

$$\Leftrightarrow (99x - 77x) = 82500 \Leftrightarrow 22x = 82500 \Leftrightarrow x = 3750.$$

44. Let the sum be Rs. x. Then, $\left(x \times \frac{15}{2} \times \frac{5}{4} \times \frac{1}{100}\right) - \left(x \times \frac{25}{2} \times \frac{2}{3} \times \frac{1}{100}\right) = 32.50$

$$\Leftrightarrow \frac{75x}{8} - \frac{25x}{3} = 32.50 \Leftrightarrow 25x = (32.50 \times 24) \Leftrightarrow x = \left(\frac{32.50 \times 24}{25}\right) = 3120.$$

45. Let the sums be x and y.

$$\frac{x \times 6 \times 2}{100} + \frac{y \times 7 \times 2}{100} = 354 \text{ or } 6x + 7y = 17700. \quad \dots(i)$$

$$\text{Also, } \frac{x}{4} = \frac{y}{5} \text{ or } 5x - 4y = 0 \quad \dots(ii)$$

Solving (i) and (ii), we get : x = 1200 and y = 1500.

\therefore Total sum = Rs. 2700.

46. Let the money added be Rs. x. Then, $\frac{(830 + x) \times 14 \times 3}{100} - \frac{830 \times 12 \times 3}{100} = 93.90$

$$\Leftrightarrow 830 \times 42 + 42x - 830 \times 36 = 9390 \Leftrightarrow 42x + 830 \times (42 - 36) = 9390$$

$$\Leftrightarrow 42x = 9390 - 4980 \Leftrightarrow x = \frac{4410}{42} = 105.$$

\therefore Money added = Rs. 105.

47. Let the time be x years. Then, $\left(\frac{500 \times 3 \times x}{100}\right) + \left(\frac{600 \times 9 \times x}{100 \times 2}\right) = 126$

$$\Leftrightarrow 15x + 27x = 126 \Leftrightarrow 42x = 126 \Leftrightarrow x = 3.$$

\therefore Required time = 3 years.

48. Let the rate be R% p.a. Then, $\left(\frac{5000 \times R \times 2}{100}\right) + \left(\frac{3000 \times R \times 4}{100}\right) = 2200$

$$\Leftrightarrow 100R + 120R = 2200 \Leftrightarrow R = \left(\frac{2200}{220}\right) = 10.$$

\therefore Rate = 10%.

49. Let the original rate be R%. Then, new rate = (2R)%.

$$\therefore \left(\frac{725 \times R \times 1}{100}\right) + \left(\frac{362.50 \times 2R \times 1}{100 \times 3}\right) = 33.50$$

$$\Leftrightarrow (2175 + 725) R = 33.50 \times 100 \times 3 = 10050$$

$$\Leftrightarrow R = \frac{10050}{2900} = 3.46. \quad \therefore R_1 = \left(\frac{T \times R \times x}{100}\right) - \left[\frac{(T \times (2 + R) \times x)}{100}\right]$$

\therefore Original rate = 3.46%.

50. $\left(\frac{1500 \times R_1 \times 3}{100}\right) - \left(\frac{1500 \times R_2 \times 3}{100}\right) = 13.50$

$$\Leftrightarrow 4500(R_1 - R_2) = 1350 \Leftrightarrow R_1 - R_2 = \frac{1350}{4500} = 0.3\%.$$

51. Let the second amount be Rs. x . Then,

$$\left(\frac{12000 \times 10 \times 1}{100} \right) + \left(\frac{x \times 20 \times 1}{100} \right) = \left[\frac{(12000 + x) \times 14 \times 1}{100} \right]$$

$$\Leftrightarrow 12000 + 20x = 168000 + 14x \Leftrightarrow 6x = 48000 \Leftrightarrow x = 8000.$$

∴ Total investment = Rs. $(12000 + 8000)$ = Rs. 20000.

$$52. S.I. = \text{Rs. } \left(2600 \times \frac{20}{3} \times \frac{1}{100} \times T \right) = \text{Rs. } \left(\frac{520}{3} \times T \right),$$

which is an exact number of rupees when $T = 3$.

53. Let the savings be X and Y and the rates of simple interest be $5x$ and $4x$ respectively.

$$\text{Then, } X \times 5x \times \frac{1}{2} \times \frac{1}{100} = Y \times 4x \times \frac{1}{2} \times \frac{1}{100} \text{ or } \frac{X}{Y} = \frac{4}{5}, \text{ i.e., } X : Y = 4 : 5.$$

$$54. \text{Let the sum be Rs. } x \text{ and original rate be R\%. Then, } \frac{x \times (R+3) \times 2}{100} - \frac{x \times R \times 2}{100} = 72$$

$$\Leftrightarrow 2Rx + 6x - 2Rx = 7200 \Leftrightarrow x = 1200.$$

$$55. \text{Let the sum be Rs. } x. \text{ Then, } \left(x \times \frac{25}{2} \times \frac{1}{100} \right) - \left(\frac{x \times 10 \times 1}{100} \right) = 1250$$

$$\Leftrightarrow 25x - 20x = 250000 \Leftrightarrow 5x = 250000 \Leftrightarrow x = 50000.$$

$$56. \text{Let the capital be Rs. } x. \text{ Then, } \left(\frac{x \times 8 \times 1}{100} \right) - \left(x \times \frac{31}{4} \times \frac{1}{100} \right) = 6150$$

$$\Leftrightarrow 32x - 31x = 6150 \times 4 \Leftrightarrow x = 24600.$$

57. Let the annual instalment be Rs. x . Then,

$$\left[x + \left(\frac{x \times 3 \times 5}{100} \right) \right] + \left[x + \left(\frac{x \times 2 \times 5}{100} \right) \right] + \left[x + \left(\frac{x \times 1 \times 5}{100} \right) \right] + x = 6450$$

$$\Leftrightarrow \frac{23x}{20} + \frac{22x}{20} + \frac{21x}{20} + x = 6450 \Leftrightarrow 86x = 6450 \times 20 \Leftrightarrow x = 1500.$$

58. Rs. 10 + S.I. on Rs. 10 for 11 months

$$= \text{Rs. } 11 + \text{S.I. on Re. } 1 \text{ for } (1 + 2 + 3 + 4 + \dots + 10) \text{ months}$$

$$\Rightarrow \text{Rs. } 10 + \text{S.I. on Re. } 1 \text{ for } 110 \text{ months} = \text{Rs. } 11 + \text{S.I. on Re. } 1 \text{ for } 55 \text{ months}$$

$$\Rightarrow \text{S.I. on Re. } 1 \text{ for } 55 \text{ months} = \text{Re. } 1.$$

$$\therefore \text{Rate} = \left(\frac{100 \times 12}{1 \times 55} \right)\% = 21 \frac{9}{11}\%$$

$$59. \text{Amount to be paid} = \text{Rs. } \left(100 + \frac{200 \times 5 \times 1}{100} + \frac{100 \times 5 \times 1}{100} \right) = \text{Rs. } 115.$$

60. Money paid in cash = Rs. 1000.

$$\text{Balance payment} = \text{Rs. } (20000 - 1000) = \text{Rs. } 19000.$$

61. Let the sum be Rs. x , rate be R\% p.a. and time be T years.

$$\text{Then, } \left[\frac{x \times (R+2) \times T}{100} \right] - \left(\frac{x \times R \times T}{100} \right) = 108 \Leftrightarrow 2xT = 10800 \quad \dots(i)$$

$$\text{And, } \left[\frac{x \times R \times (T+2)}{100} \right] - \left(\frac{x \times R \times T}{100} \right) = 180 \Leftrightarrow 2xR = 18000 \quad \dots(ii)$$

Clearly, from (i) and (ii), we cannot find the value of x .

So, the data is inadequate.

62. Let the sum invested in Scheme A be Rs. x and that in Scheme B be Rs. $(13900 - x)$.

$$\text{Then, } \left(\frac{x \times 14 \times 2}{100} \right) + \left[\frac{(13900 - x) \times 11 \times 2}{100} \right] = 3508$$

$$\Leftrightarrow 28x - 22x = 350800 - (13900 \times 22) \Leftrightarrow 6x = 45000 \Leftrightarrow x = 7500.$$

So, sum invested in Scheme B = Rs. $(13900 - 7500)$ = Rs. 6400.

63. Let the sum lent at 10% be Rs. x and that lent at 9% be Rs. $(2600 - x)$. Then,

$$\begin{aligned} \left(\frac{x \times 10 \times 5}{100} \right) &= \frac{(2600 - x) \times 9 \times 6}{100} \\ \Leftrightarrow 50x &= (2600 \times 54) - 54x \Rightarrow x = \left(\frac{2600 \times 54}{104} \right) = 1350. \\ \therefore \text{Sum lent at 10\%} &= \text{Rs. 1350}. \end{aligned}$$

64. Let the sum lent at 5% be Rs. x and that lent at 8% be Rs. $(1550 - x)$. Then,

$$\begin{aligned} \left(\frac{x \times 5 \times 3}{100} \right) + \left[\frac{(1550 - x) \times 8 \times 3}{100} \right] &= 300 \\ \Leftrightarrow 15x - 24x + (1550 \times 24) &= 30000 \Leftrightarrow 9x = 7200 \Leftrightarrow x = 800. \\ \therefore \text{Required ratio} &= 800 : 750 = 16 : 15. \\ 65. \text{Let the required rate be R. Then,} & \\ \left(\frac{20000 \times 8 \times 1}{100} \right) + \left(4000 \times \frac{15}{2} \times \frac{1}{100} \right) + \left(1400 \times \frac{17}{2} \times \frac{1}{100} \right) & \\ + \left(2600 \times R \times \frac{1}{100} \right) &= \left(\frac{813}{10000} \times 10000 \right) \\ \Leftrightarrow 160 + 300 + 119 + 26R &= 813 \Leftrightarrow R = 9. \end{aligned}$$

66. Let the sum invested at 9% be Rs. x and that invested at 11% be Rs. $(100000 - x)$.

$$\text{Then, } \left(\frac{x \times 9 \times 1}{100} \right) + \left[\frac{(100000 - x) \times 11 \times 1}{100} \right] = \left(100000 \times \frac{39}{4} \times \frac{1}{100} \right)$$

$$\Leftrightarrow \frac{9x + 1100000 - 11x}{100} = \frac{39000}{4} = 9750$$

$$\Leftrightarrow 2x = (1100000 - 97500) = 125000 \Leftrightarrow x = 62500.$$

\therefore Sum invested at 9% = Rs. 62500.

Sum invested at 11% = Rs. $(100000 - 62500)$ = Rs. 37500.

67. Let x, y and z be the amounts invested in schemes A, B and C respectively. Then,

$$\left(\frac{x \times 10 \times 1}{100} \right) + \left(\frac{y \times 12 \times 1}{100} \right) + \left(\frac{z \times 15 \times 1}{100} \right) = 3200$$

$$\Leftrightarrow 10x + 12y + 15z = 320000 \quad \dots(i)$$

$$\text{Now, } z = 240\% \text{ of } y = \frac{12}{5}y \quad \dots(ii)$$

$$\text{And, } z = 150\% \text{ of } x = \frac{3}{2}x \Rightarrow x = \frac{2}{3}z = \left(\frac{2}{3} \times \frac{12}{5}y \right) = \frac{8}{5}y \quad \dots(iii)$$

From (i), (ii) and (iii), we have :

$$16y + 12y + 36y = 320000 \Leftrightarrow 64y = 320000 \Leftrightarrow y = 5000.$$

\therefore Sum invested in Scheme B = Rs. 5000.

68. Let the parts be x, y and $[2600 - (x + y)]$. Then,

$$\frac{x \times 4 \times 1}{100} = \frac{y \times 6 \times 1}{100} = \frac{[2600 - (x + y)] \times 8 \times 1}{100}$$

$\therefore \frac{y}{x} = \frac{4}{6} = \frac{2}{3}$ or $y = \frac{2}{3}x$.

So, $\frac{x \times 4 \times 1}{100} = \frac{(2600 - \frac{5}{3}x) \times 8}{100}$

 $\Leftrightarrow x = \frac{(7800 - 5x) \times 8}{3} \Leftrightarrow 52x = (7800 \times 8) \Leftrightarrow x = \left(\frac{7800 \times 8}{52}\right) = 1200.$

\therefore Money invested at 4% = Rs. 1200.

69. Let the parts be x, y and $[2379 - (x + y)]$.

$$\begin{aligned} x + \left(x \times 2 \times \frac{5}{100}\right) &= y + \left(y \times 3 \times \frac{5}{100}\right) = z + \left(z \times 4 \times \frac{5}{100}\right) \\ \Rightarrow \frac{11x}{10} &= \frac{23y}{20} = \frac{6z}{5} = k \Rightarrow x = \frac{10k}{11}, y = \frac{20k}{23}, z = \frac{5k}{6} \\ \text{But } x + y + z &= 2379 \\ \Rightarrow \frac{10k}{11} + \frac{20k}{23} + \frac{5k}{6} &= 2379 \Rightarrow 1380k + 1320k + 1265k = 2379 \times 11 \times 23 \times 6 \\ \Rightarrow k &= \frac{2379 \times 11 \times 23 \times 6}{3965} = \frac{3 \times 11 \times 23 \times 6}{5} \\ \therefore x &= \left(\frac{10}{11} \times \frac{3 \times 11 \times 23 \times 6}{5}\right) = 828. \end{aligned}$$

Hence, the first part is Rs. 828.

70. Let total capital be Rs. x . Then, $\left(\frac{x}{3} \times \frac{7}{100} \times 1\right) + \left(\frac{x}{4} \times \frac{8}{100} \times 1\right) + \left(\frac{5x}{12} \times \frac{10}{100} \times 1\right) = 561$

 $\Leftrightarrow \frac{7x}{300} + \frac{x}{50} + \frac{x}{24} = 561 \Leftrightarrow 51x = (561 \times 600) \Leftrightarrow x = \left(\frac{561 \times 600}{51}\right) = 6600.$

71. Let the sum be Rs. 100 be invested for 1 year. Then,

$$\text{S.I.} = \text{Rs.} \left[\left(\frac{40 \times 15 \times 1}{100} \right) + \left(\frac{30 \times 10 \times 1}{100} \right) + \left(\frac{30 \times 18 \times 1}{100} \right) \right] = \text{Rs.} 14.40.$$

\therefore Effective rate = 14.4%.

EXERCISE 21B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 6) : Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

1. What is the rate of simple interest ? (Bank P.O. 2003)
I. The total interest earned was Rs. 4000.
II. The sum was invested for 4 years.

2. The simple interest on a sum of money is Rs. 50. What is the sum ? (R.B.I. 2003)
I. The interest rate is 10% p.a.
II. The sum earned simple interest in 10 years.

3. How much money did X invest ?
I. An increase in the rate of interest from $4\frac{7}{8}\%$ to $5\frac{1}{8}\%$ per annum increases his yearly income by Rs. 25.
II. The sum invested gets doubled, when invested at 8% p.a. for $12\frac{1}{2}$ years.

4. What percentage of simple interest per annum did Anand pay to Deepak ?
I. Anand borrowed Rs. 8000 from Deepak for four years.
II. Anand returned Rs. 8800 to Deepak at the end of two years and settled the loan. (I.B.P.S. 2002)

5. A man borrowed a total sum of Rs. 24000 from two moneylenders. For one loan, he paid interest @ $7\frac{1}{2}\%$ p.a. and for the other 9% p.a. How much money did he borrow at each rate ?
I. The sum of the interests after one year was Rs. 2025.
II. The interest on one sum was twice that on the other.

6. What is the sum which earned interest ? (NABARD, 2002)
I. The total simple interest was Rs. 7000 after 7 years.
II. The total of sum and simple interest was double of the sum after 5 years.

Directions (Questions 7-8) : Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

ANSWERS

1. (d) 2. (e) 3. (a) 4. (e) 5. (c) 6. (e) 7. (e) 8. (a)

SOLUTIONS

1. We know that, $R = \left(\frac{100 \times S.I.}{P \times T} \right)$

Now, I gives, S.I. = Rs. 4000.

II gives, T = 4 years.

But, P is unknown. So, we cannot find R.

So, given data is insufficient to get R.

∴ Correct answer is (d).

2. Given : S.I. = Rs. 50.

I gives, $R = 10\% \text{ p.a.}$

II gives, T = 10 years.

$$\therefore \text{Sum} = \left(\frac{100 \times S.I.}{T \times R} \right) = \text{Rs. } \left(\frac{100 \times 50}{10 \times 10} \right) = \text{Rs. } 50.$$

Thus, I and II together give the answer.

∴ Correct answer is (e).

3. Suppose X invests Rs. x.

$$\text{I gives : } R_1 = \frac{39}{8}\%, R_2 = \frac{41}{8}\%.$$

Increase in S.I. = Rs. 25.

$$\Rightarrow \left(\frac{x \times 1 \times \frac{41}{8}}{100} \right) - \left(\frac{x \times 1 \times \frac{39}{8}}{100} \right) = 25$$

$$\Rightarrow (41x - 39x) = (25 \times 800) \Rightarrow x = \left(\frac{25 \times 800}{2} \right) = 10000.$$

Thus, I only gives the answer.

$$\text{II gives, S.I. = Rs. } x, R = 8\% \text{ and } T = \frac{25}{2} \text{ years.}$$

$$P = \frac{100 \times S.I.}{R \times T} = \left(\frac{100 \times x}{8 \times 25} \times 2 \right)$$

Thus, P is not obtained.

∴ I alone is sufficient to get the answer and II is not sufficient to get the answer.

∴ Correct answer is (a).

4. Let the rate be R% p.a.

I gives, P = Rs. 8000 and T = 4 years.

II gives, S.I. = Rs. $(8800 - 8000) = \text{Rs. } 800.$

$$\therefore R = \frac{100 \times S.I.}{P \times T} = \left(\frac{100 \times 800}{8000 \times 4} \right)\% = 2\frac{1}{2}\% \text{ p.a.}$$

Thus, I and II both are needed to get the answer.

∴ Correct answer is (e).

5. Suppose he borrowed Rs. x at $7\frac{1}{2}\% \text{ p.a.}$ and Rs. $(24000 - x)$ at 9% p.a.

I gives, total interest = Rs. 2025.

$$\therefore \left(x \times 1 \times \frac{15}{2} \times \frac{1}{100} \right) + \left((24000 - x) \times 1 \times \frac{9}{100} \right) = 2025.$$

This gives x .

II gives Interest on Rs. $(24000 - x) = 2 \times$ (interest on Rs. x)

$$\Rightarrow (24000 - x) \times \frac{9}{100} \times 1 = \left(2 \times x \times \frac{15}{2} \times \frac{1}{100} \right)$$

This gives x .

Thus, data in I as well as well as in II are sufficient to answer the question.

\therefore Correct answer is (c).

6. Let the sum be Rs. x .

I gives, S.I. = Rs. 7000 and $T = 7$ years.

II gives, Sum + S.I. for 5 years = $2 \times$ Sum \Rightarrow Sum = S.I. for 5 years

Now, S.I. for 7 years = Rs. 7000

$$\therefore \text{S.I. for 1 year} = \text{Rs. } \frac{7000}{7} = \text{Rs. } 1000.$$

$$\text{S.I. for 5 years} = \text{Rs. } (1000 \times 5) = \text{Rs. } 5000.$$

Thus, I and II both are needed to get the answer.

\therefore Correct answer is (e).

7. Clearly, any of the three will give us the answer.

\therefore Correct answer is (e).

8. Let sum be Rs. x . Then, S.I. = Rs. $(3x - x) =$ Rs. $2x$, $T = ?$

I gives : When $T = 4$, then S.I. = Rs. $\frac{x}{2}$.

$$\therefore R = \frac{100 \times \text{S.I.}}{P \times T} = \left(100 \times \frac{x}{2} \times \frac{1}{x} \times \frac{1}{4} \right) = 12\frac{1}{2}\% \text{ p.a.}$$

$$\text{Now, Sum} = \text{Rs. } x, \text{ S.I.} = \text{Rs. } 2x, R = \frac{25}{2}\% \text{ p.a., } T = ?$$

$$\therefore T = \frac{100 \times \text{S.I.}}{P \times R} = \left(\frac{100 \times 2x}{x \times 25} \times 2 \right) = 16 \text{ years.}$$

Thus, I only gives the answer.

$$\text{II gives, } R = \frac{25}{2}\% \text{ p.a.}$$

$$\therefore T = \frac{100 \times \text{S.I.}}{P \times R} = \left(\frac{100 \times 2x}{x \times 25} \times 2 \right) = 16 \text{ years.}$$

Thus, II only also gives the answer.

III gives, $R = 5\%$ p.a.

$$\therefore T = \frac{100 \times \text{S.I.}}{P \times R} = \left(\frac{100 \times 2x}{x \times 5} \right) = 40 \text{ years.}$$

Thus, III only also gives the answer.

\therefore Correct answer is (a).

22. COMPOUND INTEREST

Compound Interest : Sometimes it so happens that the borrower and the lender agree to fix up a certain unit of time, say *yearly* or *half-yearly* or *quarterly* to settle the previous account.

In such cases, the amount after first unit of time becomes the principal for the second unit, the amount after second unit becomes the principal for the third unit and so on.

After a specified period, the difference between the amount and the money borrowed is called the **Compound Interest** (abbreviated as *C.I.*) for that period.

IMPORTANT FACTS AND FORMULAE

Let Principal = P , Rate = $R\%$ per annum, Time = n years.

I. When interest is compound Annually :

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

II. When interest is compounded Half-yearly :

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

III. When interest is compounded Quarterly :

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

IV. When interest is compounded Annually but time is in fraction, say

$3\frac{2}{5}$ years.

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

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

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

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

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

SOLVED EXAMPLES

Ex. 1. Find compound interest on Rs. 7500 at 4% per annum for 2 years, compounded annually.

$$\text{Sol. Amount} = \text{Rs.} \left[7500 \times \left(1 + \frac{4}{100}\right)^2\right] = \text{Rs.} \left(7500 \times \frac{26}{25} \times \frac{26}{25} \right) = \text{Rs.} 8112.$$

$$\therefore \text{C.I.} = \text{Rs.} (8112 - 7500) = \text{Rs.} 612.$$

Ex. 2. Find compound interest on Rs. 8000 at 15% per annum for 2 years 4 months, compounded annually.

$$\text{Sol. Time} = 2 \text{ years } 4 \text{ months} = 2 \frac{4}{12} \text{ years} = 2 \frac{1}{3} \text{ years.}$$

$$\text{Amount} = \text{Rs.} \left[8000 \times \left(1 + \frac{15}{100}\right)^2 \times \left(1 + \frac{\frac{1}{3} \times 15}{100}\right) \right] = \text{Rs.} \left(8000 \times \frac{23}{20} \times \frac{23}{20} \times \frac{21}{20} \right)$$

$$= \text{Rs.} 11109.$$

$$\therefore \text{C.I.} = \text{Rs.} (11109 - 8000) = \text{Rs.} 3109.$$

Ex. 3. Find the compound interest on Rs. 10,000 in 2 years at 4% per annum, the interest being compounded half-yearly. (S.S.C. 2000)

Sol. Principal = Rs. 10000; Rate = 2% per half-year; Time = 2 years = 4 half-years.

$$\therefore \text{Amount} = \text{Rs.} \left[10000 \times \left(1 + \frac{2}{100}\right)^4\right] = \text{Rs.} \left(10000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \right)$$

$$= \text{Rs.} 10824.32.$$

$$\therefore \text{C.I.} = \text{Rs.} (10824.32 - 10000) = \text{Rs.} 824.32.$$

Ex. 4. Find the compound interest on Rs. 16,000 at 20% per annum for 9 months, compounded quarterly.

Sol. Principal = Rs. 16000; Time = 9 months = 3 quarters;

Rate = 20% per annum = 5% per quarter.

$$\therefore \text{Amount} = \text{Rs.} \left[16000 \times \left(1 + \frac{5}{100}\right)^3\right] = \text{Rs.} \left(16000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs.} 18522.$$

$$\therefore \text{C.I.} = \text{Rs.} (18522 - 16000) = \text{Rs.} 2522.$$

Ex. 5. If the simple interest on a sum of money at 5% per annum for 3 years is Rs. 1200, find the compound interest on the same sum for the same period at the same rate.

Sol. Clearly, Rate = 5% p.a., Time = 3 years, S.I. = Rs. 1200.

$$\text{So, Principal} = \text{Rs.} \left(\frac{100 \times 1200}{3 \times 5} \right) = \text{Rs.} 8000.$$

$$\text{Amount} = \text{Rs.} \left[8000 \times \left(1 + \frac{5}{100}\right)^3\right] = \text{Rs.} \left(8000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs.} 9261.$$

$$\therefore \text{C.I.} = \text{Rs.} (9261 - 8000) = \text{Rs.} 1261.$$

Ex. 6. In what time will Rs. 1900 become Rs. 1331 at 10% per annum compounded annually? (S.S.C. 2004)

Sol. Principal = Rs. 1000; Amount = Rs. 1331; Rate = 10% p.a.

Let the time be n years. Then,

$$1000 \left(1 + \frac{10}{100}\right)^n = 1331 \text{ or } \left(\frac{11}{10}\right)^n = \left(\frac{1331}{1000}\right) = \left(\frac{11}{10}\right)^3$$

$\therefore n = 3$ years.

Ex. 7. If Rs. 500 amounts to Rs. 583.20 in two years compounded annually, find the rate of interest per annum.

Sol. Principal = Rs. 500; Amount = Rs. 583.20; Time = 2 years.

Let the rate be $R\%$ per annum. Then,

$$500 \left(1 + \frac{R}{100}\right)^2 = 583.20 \text{ or } \left(1 + \frac{R}{100}\right)^2 = \frac{5832}{5000} = \frac{11664}{10000}$$

$$\therefore \left(1 + \frac{R}{100}\right)^2 = \left(\frac{108}{100}\right)^2 \text{ or } 1 + \frac{R}{100} = \frac{108}{100} \text{ or } R = 8.$$

So, rate = 8% p.a.

Ex. 8. If the compound interest on a certain sum at $16\frac{2}{3}\%$ for 3 years is Rs. 1270, find the simple interest on the same sum at the same rate and for the same period.

Sol. Let the sum be Rs. x . Then,

$$C.I. = \left[x \times \left(1 + \frac{50}{3 \times 100}\right)^3 - x \right] = \left(\frac{343x}{216} - x \right) = \frac{127x}{216}$$

$$\therefore \frac{127x}{216} = 1270 \text{ or } x = \frac{1270 \times 216}{127} = 2160.$$

Thus, the sum is Rs. 2160.

$$\therefore S.I. = \text{Rs.} \left(2160 \times \frac{50}{3} \times 3 \times \frac{1}{100} \right) = \text{Rs.} 1080.$$

Ex. 9. The difference between the compound interest and simple interest on a certain sum at 10% per annum for 2 years is Rs. 631. Find the sum.

Sol. Let the sum be Rs. x . Then,

$$C.I. = x \left(1 + \frac{10}{100}\right)^2 - x = \frac{21x}{100}, \quad S.I. = \left(\frac{x \times 10 \times 2}{100} \right) = \frac{x}{5}.$$

$$\therefore (C.I.) - (S.I.) = \left(\frac{21x}{100} - \frac{x}{5} \right) = \frac{x}{100}.$$

$$\therefore \frac{x}{100} = 631 \Leftrightarrow x = 63100.$$

Hence, the sum is Rs. 63,100.

Ex. 10. The difference between the compound interest and the simple interest accrued on an amount of Rs. 18,000 in 2 years was Rs. 405. What was the rate of interest p.c.p.a. ? (Bank P.O. 2003)

Sol. Let the rate be $R\%$ p.a. Then,

$$\left[18000 \left(1 + \frac{R}{100}\right)^2 - 18000 \right] - \left(\frac{18000 \times R \times 2}{100} \right) = 405$$

$$\therefore 18000 \left[\frac{(100+R)^2 - 2R}{10000} \right] - 1 = \frac{405}{100}$$

$$\begin{aligned} & \Leftrightarrow 18000 \left[\frac{(100+R)^2 - 10000 - 200R}{10000} \right] = 405 \\ & \Leftrightarrow \frac{9}{5} R^2 = 405 \Leftrightarrow R^2 = \left(\frac{405 \times 5}{9} \right) = 225 \Leftrightarrow R = 15. \\ & \therefore \text{Rate} = 15\%. \end{aligned}$$

Ex. 11. Divide Rs. 1301 between A and B, so that the amount of A after 7 years is equal to the amount of B after 9 years, the interest being compounded at 4% per annum.

Sol. Let the two parts be Rs. x and Rs. $(1301 - x)$.

$$\begin{aligned} x \left(1 + \frac{4}{100}\right)^7 &= (1301 - x) \left(1 + \frac{4}{100}\right)^9 \Leftrightarrow \frac{x}{(1301 - x)} = \left(1 + \frac{4}{100}\right)^2 = \left(\frac{26}{25} \times \frac{26}{25}\right). \\ \therefore 625x &= 676(1301 - x) \Leftrightarrow 1301x = 676 \times 1301 \Leftrightarrow x = 676. \end{aligned}$$

So, the two parts are Rs. 676 and Rs. $(1301 - 676)$ i.e. Rs. 676 and Rs. 625.

Ex. 12. A certain sum amounts to Rs. 7350 in 2 years and to Rs. 8575 in 3 years. Find the sum and rate percent.

Sol. S.I. on Rs. 7350 for 1 year = Rs. $(8575 - 7350) = \text{Rs. } 1225$.

$$\therefore \text{Rate} = \left(\frac{100 \times 1225}{7350 \times 1} \right) \% = 16\frac{2}{3}\%.$$

Let the sum be Rs. x. Then,

$$x \left(1 + \frac{50}{3 \times 100}\right)^2 = 7350 \Leftrightarrow x \times \frac{7}{6} \times \frac{7}{6} = 7350 \Leftrightarrow x = \left(7350 \times \frac{36}{49}\right) = 5400.$$

∴ Sum = Rs. 5400.

Ex. 13. A sum of money amounts to Rs. 6690 after 3 years and to Rs. 10,035 after 6 years on compound interest. Find the sum.

Sol. Let the sum be Rs. P. Then,

$$P \left(1 + \frac{R}{100}\right)^3 = 6690 \quad \dots(i) \quad \text{and} \quad P \left(1 + \frac{R}{100}\right)^6 = 10035 \quad \dots(ii)$$

$$\text{On dividing, we get } \left(1 + \frac{R}{100}\right)^3 = \frac{10035}{6690} = \frac{3}{2}.$$

Substituting this value in (i), we get :

$$P \times \frac{3}{2} = 6690 \text{ or } P = \left(6690 \times \frac{2}{3}\right) = 4460.$$

Hence, the sum is Rs. 4460.

Ex. 14. A sum of money doubles itself at compound interest in 15 years. In how many years will it become eight times?

$$\text{Sol. } P \left(1 + \frac{R}{100}\right)^{15} = 2P \Rightarrow \left(1 + \frac{R}{100}\right)^{15} = \frac{2P}{P} = 2 \quad \dots(i)$$

$$\text{Let } P \left(1 + \frac{R}{100}\right)^n = 8P \Rightarrow \left(1 + \frac{R}{100}\right)^n = 8 = 2^3 = \left\{ \left(1 + \frac{R}{100}\right)^{15} \right\}^3 \quad [\text{using (i)}]$$

$$\Rightarrow \left(1 + \frac{R}{100}\right)^n = \left(1 + \frac{R}{100}\right)^{45} \Rightarrow n = 45.$$

Thus, the required time = 45 years.

Ex. 15. What annual payment will discharge a debt of Rs. 7620 due in 3 years at $16\frac{2}{3}\%$ per annum compound interest ?

Sol. Let each instalment be Rs. x . Then,

$$\begin{aligned} & (\text{P.W. of Rs. } x \text{ due 1 year hence}) + (\text{P.W. of Rs. } x \text{ due 2 years hence}) \\ & \quad + (\text{P.W. of Rs. } x \text{ due 3 years hence}) = 7620. \end{aligned}$$

$$\begin{aligned} & \left(1 + \frac{50}{3 \times 100}\right)x + \left(1 + \frac{50}{3 \times 100}\right)^2 x + \left(1 + \frac{50}{3 \times 100}\right)^3 x = 7620 \\ \Leftrightarrow & \frac{6x}{7} + \frac{36x}{49} + \frac{216x}{343} = 7620 \Leftrightarrow 294x + 252x + 216x = 7620 \times 343 \\ \Leftrightarrow & x = \left(\frac{7620 \times 343}{762}\right) = 3430. \\ \therefore & \text{Amount of each instalment} = \text{Rs. } 3430. \end{aligned}$$

EXERCISE 22A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

1. Albert invested an amount of Rs. 8000 in a fixed deposit scheme for 2 years at compound interest rate 5 p.c.p.a. How much amount will Albert get on maturity of the fixed deposit ? (Bank P.O. 1999)
 - (a) Rs. 8600
 - (b) Rs. 8620
 - (c) Rs. 8800
 - (d) Rs. 8840
 - (e) None of these
2. What will be the compound interest on a sum of Rs. 25,000 after 3 years at the rate of 12 p.c.p.a. ? (S.B.I.P.O. 2003)
 - (a) Rs. 9000.30
 - (b) Rs. 9720
 - (c) Rs. 10123.20
 - (d) Rs. 10483.20
 - (e) None of these
3. The compound interest on Rs. 20,480 at $6\frac{1}{4}\%$ per annum for 2 years 73 days, is : (Hotel Management, 2003)
 - (a) Rs. 2929
 - (b) Rs. 3000
 - (c) Rs. 3131
 - (d) Rs. 3636
4. A man saves Rs. 200 at the end of each year and lends the money at 5% compound interest. How much will it become at the end of 3 years ? (S.B.I.P.O. 2002)
 - (a) Rs. 565.25
 - (b) Rs. 635
 - (c) Rs. 662.02
 - (d) Rs. 666.50
5. Sam invested Rs. 15,000 @ 10% per annum for one year. If the interest is compounded half-yearly, then the amount received by Sam at the end of the year will be : (N.D.A. 2000)
 - (a) Rs. 16,500
 - (b) Rs. 16,525.50
 - (c) Rs. 16,537.50
 - (d) Rs. 18,150
 - (e) None of these
6. A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs. 1600 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is : (N.D.A. 2000)
 - (a) Rs. 120
 - (b) Rs. 121
 - (c) Rs. 122
 - (d) Rs. 123
7. What is the difference between the compound interests on Rs. 5000 for $1\frac{1}{2}$ years at 4% per annum compounded yearly and half-yearly ? (S.S.C. 2000)
 - (a) Rs. 2.04
 - (b) Rs. 3.06
 - (c) Rs. 4.80
 - (d) Rs. 8.30

8. Find the compound interest on Rs. 15,625 for 9 months at 16% per annum compounded quarterly. (R.R.B. 2002)
(a) Rs. 1851 (b) Rs. 1941 (c) Rs. 1951 (d) Rs. 1961
9. If the simple interest on a sum of money for 2 years at 5% per annum is Rs. 50, what is the compound interest on the same sum at the same rate and for the same time? (C.B.I. 1997)
(a) Rs. 51.25 (b) Rs. 52 (c) Rs. 54.25 (d) Rs. 60
10. What will be the difference between simple and compound interest @ 10% per annum on a sum of Rs. 1000 after 4 years? (Bank P.O. 2002)
(a) Rs. 31 (b) Rs. 32.10 (c) Rs. 40.40
(d) Rs. 64.10 (e) None of these
11. The difference between simple interest and compound interest on Rs. 1200 for one year at 10% per annum reckoned half-yearly is : (R.R.B. 2002)
(a) Rs. 2.50 (b) Rs. 3 (c) Rs. 3.75
(d) Rs. 4 (e) None of these
12. The compound interest on Rs. 30,000 at 7% per annum is Rs. 4347. The period (in years) is : (L.I.C.A.A.O. 2003)
(a) 2 (b) $2\frac{1}{2}$ (c) 3 (d) 4
13. At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348.32 in 2 years? (S.S.C. 2000)
(a) 6% (b) 6.5% (c) 7% (d) 7.5%
14. The principal that amounts to Rs. 4913 in 3 years at $6\frac{1}{4}\%$ per annum compound interest compounded annually, is : (S.S.C. 2000)
(a) Rs. 3096 (b) Rs. 4076 (c) Rs. 4085 (d) Rs. 4096
15. The present worth of Rs. 169 due in 2 years at 4% per annum compound interest is : (S.S.C. 2000)
(a) Rs. 150.50 (b) Rs. 154.75 (c) Rs. 156.25 (d) Rs. 158
16. In how many years will a sum of Rs. 800 at 10% per annum compounded semi-annually become Rs. 926.10? (Section Officers', 2001)
(a) $1\frac{1}{3}$ (b) $1\frac{1}{2}$ (c) $2\frac{1}{3}$ (d) $2\frac{1}{2}$
17. If the compound interest on a sum for 2 years at $12\frac{1}{2}\%$ per annum is Rs. 510, the simple interest on the same sum at the same rate for the same period of time is : (S.S.C. 2004)
(a) Rs. 400 (b) Rs. 450 (c) Rs. 460 (d) Rs. 480
18. The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. The simple interest on the same sum for double the time at half the rate percent per annum is : (C.B.I. 1997)
(a) Rs. 400 (b) Rs. 500 (c) Rs. 600 (d) Rs. 800
19. The simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs. 4000 for 2 years at 10% per annum. The sum placed on simple interest is : (S.S.C. 2003)
(a) Rs. 1550 (b) Rs. 1650 (c) Rs. 1750 (d) Rs. 2000
20. There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate? (SIDBI, 2000)
(a) Rs. 2160 (b) Rs. 3120 (c) Rs. 3972
(d) Rs. 6240 (e) None of these

21. The difference between compound interest and simple interest on an amount of Rs. 15,000 for 2 years is Rs. 96. What is the rate of interest per annum ?
(a) 8 (b) 10 (c) 12
(d) Cannot be determined (e) None of these (R.B.I. 2003)
22. The difference between simple and compound interests compounded annually on a certain sum of money for 2 years at 4% per annum is Re. 1. The sum (in Rs.) is :
(a) 625 (b) 630 (c) 640 (d) 650
(S.S.C. 2003)
23. The compound interest on a sum of money for 2 years is Rs. 832 and the simple interest on the same sum for the same period is Rs. 800. The difference between the compound interest and the simple interest for 3 years will be :
(a) Rs. 48 (b) Rs. 66.56 (c) Rs. 98.56 (d) None of these
24. The difference between the simple interest on a certain sum at the rate of 10% per annum for 2 years and compound interest which is compounded every 6 months is Rs. 124.05. What is the principal sum ?
(a) Rs. 6000 (b) Rs. 8000 (c) Rs. 10,000
(d) Rs. 12,000 (e) None of these (S.B.I.P.O. 2000)
25. The difference between compound interest and simple interest on a sum for 2 years at 10% per annum, when the interest is compounded annually is Rs. 16. If the interest were compounded half-yearly, the difference in two interests would be :
(a) Rs. 24.81 (b) Rs. 26.90 (c) Rs. 31.61 (d) Rs. 32.40
26. A sum of money lent at compound interest for 2 years at 20% per annum would fetch Rs. 482 more, if the interest was payable half-yearly than if it was payable annually. The sum is :
(a) Rs. 10,000 (b) Rs. 20,000 (c) Rs. 40,000 (d) Rs. 50,000
27. On a sum of money, the simple interest for 2 years is Rs. 660, while the compound interest is Rs. 696.30, the rate of interest being the same in both the cases. The rate of interest is : (Hotel Management, 1997)
(a) 10% (b) 10.5% (c) 12% (d) None of these
28. The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half-yearly is : (S.S.C. 2000)
(a) 6.06% (b) 6.07% (c) 6.08% (d) 6.09%
29. A person lent out a certain sum on simple interest and the same sum on compound interest at a certain rate of interest per annum. He noticed that the ratio between the difference of compound interest and simple interest of 3 years and that of 2 years is 25 : 8. The rate of interest per annum is :
(a) 10% (b) 11% (c) 12% (d) $12\frac{1}{2}\%$
30. Mr. Dua invested money in two schemes A and B offering compound interest @ 8 p.c.p.a. and 9 p.c.p.a. respectively. If the total amount of interest accrued through two schemes together in two years was Rs. 4818.30 and the total amount invested was Rs. 27,000, what was the amount invested in Scheme A ?
(a) Rs. 12,000 (b) Rs. 13,500 (c) Rs. 15,000
(d) Cannot be determined (e) None of these (Bank P.O. 2003)
31. A sum of money invested at compound interest amounts to Rs. 800 in 3 years and to Rs. 840 in 4 years. The rate of interest per annum is : (S.S.C. 2001)
(a) $2\frac{1}{2}\%$ (b) 4% (c) 5% (d) $6\frac{2}{3}\%$

32. A sum of money invested at compound interest amounts to Rs. 4624 in 2 years and to Rs. 4913 in 3 years. The sum of money is :
 (a) Rs. 4096 (b) Rs. 4260 (c) Rs. 4335 (d) Rs. 4360
33. A sum of money becomes Rs. 13,380 after 3 years and Rs. 20,070 after 6 years on compound interest. The sum is :
 (a) Rs. 8800 (b) Rs. 8890 (c) Rs. 8920 (d) Rs. 9040
34. A sum of Rs. 12,000 deposited at compound interest becomes double after 5 years. After 20 years, it will become :
 (a) Rs. 96,000 (b) Rs. 1,20,000 (c) Rs. 1,24,000 (d) Rs. 1,92,000
35. A sum of money placed at compound interest doubles itself in 5 years. It will amount to eight times itself at the same rate of interest in : (Hotel Management, 2003)
 (a) 7 years (b) 10 years (c) 15 years (d) 20 years
36. If a sum on compound interest becomes three times in 4 years, then with the same interest rate, the sum will become 27 times in :
 (a) 8 years (b) 12 years (c) 24 years (d) 36 years
37. The least number of complete years in which a sum of money put out at 20% compound interest will be more than doubled is : (N.I.F.T. 2003)
 (a) 3 (b) 4 (c) 5 (d) 6
38. A man borrows Rs. 2550 to be paid back with compound interest at the rate of 4% per annum by the end of 2 years in two equal yearly instalments. How much will each instalment be ?
 (a) Rs. 1275 (b) Rs. 1283 (c) Rs. 1352 (d) Rs. 1377
39. What annual payment will discharge a debt of Rs. 1025 due in 2 years at the rate of 5% compound interest ? (S.S.C. 2000)
 (a) Rs. 550 (b) Rs. 551.25 (c) Rs. 560 (d) Rs. 560.75
40. A man borrows Rs. 12,500 at 20% compound interest. At the end of every year he pays Rs. 2000 as part repayment. How much does he still owe after three such instalments ?
 (a) Rs. 12,000 (b) Rs. 12,864 (c) Rs. 15,600 (d) None of these
41. A sum of money is borrowed and paid back in two annual instalments of Rs. 882 each allowing 5% compound interest. The sum borrowed was : (A.I.M.A.T.S. 2002)
 (a) Rs. 1620 (b) Rs. 1640 (c) Rs. 1680 (d) Rs. 1700

ANSWERS

1. (e) 2. (c) 3. (a) 4. (c) 5. (c) 6. (b) 7. (a) 8. (c) 9. (a)
 10. (d) 11. (b) 12. (a) 13. (a) 14. (d) 15. (c) 16. (b) 17. (d) 18. (b)
 19. (c) 20. (c) 21. (a) 22. (a) 23. (c) 24. (b) 25. (a) 26. (b) 27. (d)
 28. (d) 29. (d) 30. (a) 31. (c) 32. (a) 33. (c) 34. (d) 35. (c) 36. (b)
 37. (b) 38. (c) 39. (b) 40. (d) 41. (b)

SOLUTIONS

1. Amount = Rs. $\left[8000 \times \left(1 + \frac{5}{100}\right)^2 \right] = \text{Rs.} \left(8000 \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs.} 8820.$
2. Amount = Rs. $\left[25000 \times \left(1 + \frac{12}{100}\right)^3 \right] = \text{Rs.} \left(25000 \times \frac{28}{25} \times \frac{28}{25} \times \frac{28}{25} \right) = \text{Rs.} 35123.20.$
- $\therefore \text{C.I.} = \text{Rs.} (35123.20 - 25000) = \text{Rs.} 10123.20.$

3. Time = $2 \frac{73}{365}$ years = $2 \frac{1}{5}$ years.

$$\therefore \text{Amount} = \text{Rs.} \left[20480 \times \left(1 + \frac{25}{4 \times 100} \right)^2 \left(1 + \frac{5}{100} \right) \right]$$

$$= \text{Rs.} \left(20480 \times \frac{17}{16} \times \frac{17}{16} \times \frac{81}{80} \right) = \text{Rs.} 23409.$$

$$\therefore \text{C.I.} = \text{Rs.} (23409 - 20480) = \text{Rs.} 2929.$$

$$4. \text{Amount} = \text{Rs.} \left[200 \left(1 + \frac{5}{100} \right)^3 + 200 \left(1 + \frac{5}{100} \right)^2 + 200 \left(1 + \frac{5}{100} \right) \right]$$

$$= \text{Rs.} \left[200 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} + 200 \times \frac{21}{20} \times \frac{21}{20} + 200 \times \frac{21}{20} \right]$$

$$= \text{Rs.} \left[200 \times \frac{21}{20} \left(\frac{21}{20} \times \frac{21}{20} + \frac{21}{20} + 1 \right) \right] = \text{Rs.} 662.02.$$

5. P = Rs. 15000; R = 10% p.a. = 5% per half-year; T = 1 year = 2 half-years.

$$\therefore \text{Amount} = \text{Rs.} \left[15000 \times \left(1 + \frac{5}{100} \right)^2 \right] = \text{Rs.} \left(15000 \times \frac{21}{20} \times \frac{21}{20} \right) = \text{Rs.} 16537.50.$$

$$6. \text{Amount} = \text{Rs.} \left[1600 \times \left(1 + \frac{5}{2 \times 100} \right)^2 + 1600 \times \left(1 + \frac{5}{2 \times 100} \right) \right]$$

$$= \text{Rs.} \left[1600 \times \frac{41}{40} \times \frac{41}{40} + 1600 \times \frac{41}{40} \right]$$

$$= \text{Rs.} \left[1600 \times \frac{41}{40} \left(\frac{41}{40} + 1 \right) \right] = \text{Rs.} \left(\frac{1600 \times 41 \times 81}{40 \times 40} \right) = \text{Rs.} 3321.$$

$$\therefore \text{C.I.} = \text{Rs.} (3321 - 3200) = \text{Rs.} 121.$$

7. C.I. when interest is compounded yearly

$$\text{Amount} = \text{Rs.} \left[5000 \times \left(1 + \frac{4}{100} \right) \times \left(1 + \frac{1}{2} \times 4 \right) \right] = \text{Rs.} \left(5000 \times \frac{26}{25} \times \frac{51}{50} \right) = \text{Rs.} 5304.$$

C.I. when interest is compounded half-yearly

$$= \text{Rs.} \left[5000 \times \left(1 + \frac{2}{100} \right)^3 \right] = \text{Rs.} \left(5000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \right) = \text{Rs.} 5306.04.$$

$$\therefore \text{Difference} = \text{Rs.} (5306.04 - 5304) = \text{Rs.} 2.04.$$

8. P = Rs. 15625, n = 9 months = 3 quarters, R = 16% p.a. = 4% per quarter.

$$\text{Amount} = \text{Rs.} \left[15625 \times \left(1 + \frac{4}{100} \right)^3 \right] = \text{Rs.} \left(15625 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25} \right) = \text{Rs.} 17576.$$

$$\therefore \text{C.I.} = \text{Rs.} (17576 - 15625) = \text{Rs.} 1951.$$

9. Sum = Rs. $\left(\frac{50 \times 100}{2 \times 5} \right)$ = Rs. 500.

Amount = Rs. $\left[500 \times \left(1 + \frac{5}{100} \right)^2 \right]$ = Rs. $\left(500 \times \frac{21}{20} \times \frac{21}{20} \right)$ = Rs. 551.25.

∴ C.I. = Rs. (551.25 - 500) = Rs. 51.25.

10. S.I. = Rs. $\left(\frac{1000 \times 10 \times 4}{100} \right)$ = Rs. 400.

C.I. = Rs. $\left[1000 \times \left(1 + \frac{10}{100} \right)^4 - 1000 \right]$ = Rs. 464.10.

∴ Difference = Rs. (464.10 - 400) = Rs. 64.10.

11. S.I. = Rs. $\left(\frac{1200 \times 10 \times 1}{100} \right)$ = Rs. 120.

C.I. = Rs. $\left[1200 \times \left(1 + \frac{5}{100} \right)^2 - 1200 \right]$ = Rs. 123.

∴ Difference = Rs. (123 - 120) = Rs. 3.

12. Amount = Rs. (30000 + 4347) = Rs. 34347.

Let the time be n years. Then,

$$30000 \left(1 + \frac{7}{100} \right)^n = 34347 \Leftrightarrow \left(\frac{107}{100} \right)^n = \frac{34347}{30000} = \frac{11449}{10000} = \left(\frac{107}{100} \right)^2.$$

∴ $n = 2$ years.

13. Let the rate be $R\%$ p.a. Then,

$$1200 \times \left(1 + \frac{R}{100} \right)^2 = 1348.32 \Leftrightarrow \left(1 + \frac{R}{100} \right)^2 = \frac{134832}{120000} = \frac{11236}{10000}$$

∴ $\left(1 + \frac{R}{100} \right)^2 = \left(\frac{106}{100} \right)^2$ or $1 + \frac{R}{100} = \frac{106}{100}$ or $R = 6\%$.

14. Principal = Rs. $\left[\frac{4913}{\left(1 + \frac{25}{4 \times 100} \right)^3} \right]$ = Rs. $\left(4913 \times \frac{16}{17} \times \frac{16}{17} \times \frac{16}{17} \right)$ = Rs. 4096.

15. Present worth = Rs. $\left[\frac{169}{\left(1 + \frac{4}{100} \right)^2} \right]$ = Rs. $\left(169 \times \frac{25}{26} \times \frac{25}{26} \right)$ = Rs. 156.25.

16. Let the time be n years. Then,

$$800 \times \left(1 + \frac{5}{100} \right)^{2n} = 926.10 \text{ or } \left(1 + \frac{5}{100} \right)^{2n} = \frac{9261}{8000} \Leftrightarrow \left(\frac{105}{100} \right)^{2n} = \left(\frac{9261}{8000} \right) \times 1.05$$

or $\left(\frac{21}{20} \right)^{2n} = \left(\frac{21}{20} \right)^3$ or $2n = 3$ or $n = \frac{3}{2}$.

∴ $n = 1\frac{1}{2}$ years.

17. Let the sum be Rs. P. Then,

$$\left[P \left(1 + \frac{25}{2 \times 100} \right)^2 - P \right] = 510 \text{ or } P \left[\left(\frac{9}{8} \right)^2 - 1 \right] = 510 \text{ or } P = \left(\frac{510 \times 64}{17} \right) = 1920.$$

$\therefore \text{Sum} = \text{Rs. } 1920.$

$$\text{So, S.I.} = \text{Rs.} \left(\frac{1920 \times 25 \times 2}{2 \times 100} \right) = \text{Rs. } 480.$$

18. Let the sum be Rs. P. Then,

$$\left[P \left(1 + \frac{10}{100} \right)^2 - P \right] = 525 \Leftrightarrow P \left[\left(\frac{11}{10} \right)^2 - 1 \right] = 525 \Leftrightarrow P = \left(\frac{525 \times 100}{21} \right) = 2500.$$

$\therefore \text{Sum} = \text{Rs. } 2500.$

$$\text{So, S.I.} = \text{Rs.} \left(\frac{2500 \times 5 \times 4}{100} \right) = \text{Rs. } 500.$$

$$19. \text{C.I.} = \text{Rs.} \left[4000 \times \left(1 + \frac{10}{100} \right)^2 - 4000 \right] = \text{Rs.} \left(4000 \times \frac{11}{10} \times \frac{11}{10} - 4000 \right) = \text{Rs. } 840.$$

$$\therefore \text{Sum} = \text{Rs.} \left(\frac{420 \times 100}{3 \times 8} \right) = \text{Rs. } 1750.$$

20. Let $P = \text{Rs. } 100$. Then, S.I. Rs. 60 and $T = 6$ years.

$$\therefore R = \frac{100 \times 60}{100 \times 6} = 10\% \text{ p.a.}$$

Now, $P = \text{Rs. } 12000$, $T = 3$ years and $R = 10\% \text{ p.a.}$

$$\therefore \text{C.I.} = \text{Rs.} \left[12000 \times \left(\left(1 + \frac{10}{100} \right)^3 - 1 \right) \right] = \text{Rs.} \left(12000 \times \frac{331}{1000} \right) = \text{Rs. } 3972.$$

$$21. \left[15000 \times \left(1 + \frac{R}{100} \right)^2 - 15000 \right] - \left(\frac{15000 \times R \times 2}{100} \right) = 96$$

$$\Leftrightarrow 15000 \left[\left(1 + \frac{R}{100} \right)^2 - 1 - \frac{2R}{100} \right] = 96 \Leftrightarrow 15000 \left[\frac{(100+R)^2 - 10000 - 200R}{10000} \right] = 96$$

$$\Leftrightarrow R^2 = \frac{96 \times 2}{3} = 64 \Leftrightarrow R = 8.$$

$\therefore \text{Rate} = 8\%.$

22. Let the sum be Rs. x . Then,

$$\text{C.I.} = \left[x \left(1 + \frac{4}{100} \right)^2 - x \right] = \left(\frac{676}{625} x - x \right) = \frac{51}{625} x.$$

$$\text{S.I.} = \left(\frac{x \times 4 \times 2}{100} \right) = \frac{2x}{25}.$$

$$\therefore \frac{51x}{625} - \frac{2x}{25} = 1 \text{ or } x = 625.$$

23. Difference in C.I. and S.I. for 2 years = Rs. 32.

S.I. for one year = Rs. 400.

∴ S.I. on Rs. 400 for one year = Rs. 32.

$$\text{So, Rate} = \left(\frac{100 \times 32}{400 \times 1} \right) \% = 8\%.$$

Hence, difference in C.I. and S.I. for 3rd year

$$= \text{S.I. on Rs. } 832 = \text{Rs. } \left(\frac{832 \times 8 \times 1}{100} \right) = \text{Rs. } 66.56.$$

Total difference = Rs. (32 + 66.56) = Rs. 98.56.

24. Let the sum be Rs. P. Then

$$P \left[\left(1 + \frac{5}{100} \right)^4 - 1 \right] - \frac{P \times 10 \times 2}{100} = 124.05$$

$$\Rightarrow P \left[\left(\frac{21}{20} \right)^4 - 1 - \frac{1}{5} \right] = 124.05 \Rightarrow P \left[\frac{194481}{160000} - \frac{6}{5} \right] = \frac{12405}{100}$$

$$\Rightarrow P \left[\frac{194481 - 192000}{160000} \right] = \frac{12405}{100} \Rightarrow P = \left(\frac{12405}{100} \times \frac{160000}{2481} \right) = 8000.$$

25. For first year, S.I. = C.I.

Now, Rs. 16 is the S.I. on S.I. for 1 year.

Rs. 10 is S.I. on Rs. 100.

∴ Rs. 16 is S.I. on Rs. $\left(\frac{100}{10} \times 16 \right)$ = Rs. 160.

So, S.I. on principal for 1 year at 10% is Rs. 160.

∴ Principal = Rs. $\left(\frac{100 \times 160}{10 \times 1} \right)$ = Rs. 1600.

Amount for 2 years compounded half yearly = Rs. $\left[1600 \times \left(1 + \frac{5}{100} \right)^4 \right]$ = Rs. 1944.81.

∴ C.I. = Rs. (1944.81 - 1600) = Rs. 344.81.

S.I. = Rs. $\left(\frac{1600 \times 10 \times 2}{100} \right)$ = Rs. 320.

∴ (C.I.) - (S.I.) = Rs. (344.81 - 320) = Rs. 24.81.

26. Let the sum be Rs. x. Then,

C.I. when compounded half-yearly = $\left[x \times \left(1 + \frac{10}{100} \right)^4 - x \right] = \frac{4641}{10000} x$.

C.I. when compounded annually = $\left[x \times \left(1 + \frac{20}{100} \right)^2 - x \right] = \frac{11}{25} x$.

$\therefore \frac{4641}{10000} x - \frac{11}{25} x = 482$ or $x = \frac{482 \times 10000}{241} = 20000$.

27. Difference in C.I. and S.I. for 2 years = Rs. (696.30 - 660) = Rs. 36.30.

S.I. for one year = Rs. 330.

∴ S.I. on Rs. 330 for 1 year = Rs. 36.30.

∴ Rate = $\left(\frac{100 \times 36.30}{330 \times 1} \right) \% = 11\% = \left(\frac{11}{100} + I \right) = S.I. = \left[\left(\frac{R}{100} + I \right) \right] x$.

28. Amount of Rs. 100 for 1 year when compounded half-yearly

$$= \text{Rs.} \left[100 \times \left(1 + \frac{3}{100} \right)^2 \right] = \text{Rs. } 106.09.$$

$$\therefore \text{Effective rate} = (106.09 - 100)\% = 6.09\%.$$

29. Let the principal be Rs. P and rate of interest be R% per annum.

Difference of C.I. and S.I. for 2 years

$$= \left[P \times \left(1 + \frac{R}{100} \right)^2 - P \right] - \left(\frac{P \times R \times 2}{100} \right) = \frac{PR^2}{104}.$$

Difference of C.I. and S.I. for 3 years

$$= \left[P \times \left(1 + \frac{R}{100} \right)^3 - P \right] - \left(\frac{P \times R \times 3}{100} \right) = \frac{PR^2}{104} \left(\frac{300 + R}{100} \right).$$

$$\therefore \frac{\frac{PR^2}{104} \left(\frac{300 + R}{100} \right)}{\frac{PR^2}{104}} = \frac{25}{8} \Rightarrow \left(\frac{300 + R}{100} \right) = \frac{25}{8} \Rightarrow R = \frac{100}{8} = 12\frac{1}{2}\%.$$

30. Let the investment in scheme A be Rs. x.

Then, investment in scheme B = Rs. (27000 - x).

$$\therefore \left[x \times \left(1 + \frac{8}{100} \right)^2 - 1 \right] + (27000 - x) \left(\left(1 + \frac{9}{100} \right)^2 - 1 \right) = 4818.30.$$

$$\Leftrightarrow \left(x \times \frac{104}{625} \right) + \frac{1881(27000 - x)}{10000} = \frac{481830}{100}$$

$$\Leftrightarrow 1664x + 1881(27000 - x) = 48183000$$

$$\Leftrightarrow (1881x - 1664x) = (50787000 - 48183000)$$

$$\Leftrightarrow 217x = 2604000 \Leftrightarrow x = \frac{2604000}{217} = 12000.$$

31. S.I. on Rs. 800 for 1 year = Rs. $(840 - 800) = \text{Rs. } 40.$

$$\therefore \text{Rate} = \left(\frac{100 \times 40}{800 \times 1} \right)\% = 5\%.$$

32. S.I. on Rs. 4624 for 1 year = Rs. $(4913 - 4624) = \text{Rs. } 289.$

$$\therefore \text{Rate} = \left(\frac{100 \times 289}{4624 \times 1} \right)\% = 6\frac{1}{4}\%.$$

$$\text{Now, } x \left(1 + \frac{25}{4 \times 100} \right)^2 = 4624 \text{ or } x \times \frac{17}{16} \times \frac{17}{16} = 4624$$

$$\therefore x = \left(4624 \times \frac{16}{17} \times \frac{16}{17} \right) = \text{Rs. } 4096.$$

$$34. 12000 \times \left(1 + \frac{R}{100} \right)^5 = 24000 \Rightarrow \left(1 + \frac{R}{100} \right)^5 = 2$$

$$\therefore \left[\left(1 + \frac{R}{100} \right)^5 \right]^4 = 2^4 = 16 \Rightarrow \left(1 + \frac{R}{100} \right)^{20} = 16 \Rightarrow P \left(1 + \frac{R}{100} \right)^{20} = 16P$$

$$\Rightarrow 12000 \left(1 + \frac{R}{100}\right)^{20} = 16 \times 12000 = 192000.$$

$$35. P \left(1 + \frac{R}{100}\right)^5 = 2P \Rightarrow \left(1 + \frac{R}{100}\right)^5 = 2 \quad \dots(i)$$

$$\text{Let } P \left(1 + \frac{R}{100}\right)^n = 8P \Rightarrow \left(1 + \frac{R}{100}\right)^n = 8 = 2^3 = \left\{ \left(1 + \frac{R}{100}\right)^5 \right\}^3 \quad [\text{using (i)}]$$

$$\Rightarrow \left(1 + \frac{R}{100}\right)^n = \left(1 + \frac{R}{100}\right)^{15} \Rightarrow n = 15.$$

∴ Required time = 15 years.

$$36. P \left(1 + \frac{R}{100}\right)^4 = 3P \Rightarrow \left(1 + \frac{R}{100}\right)^4 = 3 \quad \dots(ii)$$

$$\text{Let } P \left(1 + \frac{R}{100}\right)^n = 27P \Rightarrow \left(1 + \frac{R}{100}\right)^n = 27 = (3)^3 = \left\{ \left(1 + \frac{R}{100}\right)^4 \right\}^3 \quad [\text{using (ii)}]$$

$$\Rightarrow \left(1 + \frac{R}{100}\right)^n = \left(1 + \frac{R}{100}\right)^{12} \Rightarrow n = 12.$$

∴ Required time = 12 years.

$$37. P \left(1 + \frac{20}{100}\right)^n > 2P \text{ or } \left(\frac{6}{5}\right)^n > 2$$

Direction: (Quesions 38 to 40 are based on the above information.)

Now, $\left(\frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5}\right) > 2$. So, $n = 4$ years.

38. Let the value of each instalment be Rs. x . Then,

$$(\text{P.W. of Rs. } x \text{ due 1 year hence}) + (\text{P.W. of Rs. } x \text{ due 2 years hence}) = \text{Rs. } 2550$$

$$\Leftrightarrow \frac{x}{\left(1 + \frac{4}{100}\right)} + \frac{x}{\left(1 + \frac{4}{100}\right)^2} = 2550 \Leftrightarrow \frac{25x}{26} + \frac{625x}{676} = 2550$$

$$\Leftrightarrow 1275x = 2550 \times 676 \Leftrightarrow x = \left(\frac{2550 \times 676}{1275}\right) = 1352.$$

∴ Value of each instalment = Rs. 1352.

39. Let each instalment be Rs. x . Then,

$$\frac{x}{\left(1 + \frac{5}{100}\right)} + \frac{x}{\left(1 + \frac{5}{100}\right)^2} = 1025 \Leftrightarrow \frac{20x}{21} + \frac{400x}{441} = 1025$$

$$\Leftrightarrow 820x = 1025 \times 441 \Leftrightarrow x = \left(\frac{1025 \times 441}{820}\right) = 551.25.$$

So, value of each instalment = Rs. 551.25.

40. Balance = $12500 - [12500 \times \left(1 + \frac{20}{100}\right)^3] - [2000 \times \left(1 + \frac{20}{100}\right)^2 + 2000 \times \left(1 + \frac{20}{100}\right) + 2000]$

$$= \text{Rs. } \left[\left\{ 12500 \times \left(1 + \frac{20}{100}\right)^3 \right\} - \left\{ 2000 \times \left(1 + \frac{20}{100}\right)^2 + 2000 \times \left(1 + \frac{20}{100}\right) + 2000 \right\} \right]$$

$$= \text{Rs.} \left[\left(12500 \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} \right) - \left(2000 \times \frac{6}{5} \times \frac{6}{5} + 2000 \times \frac{6}{5} + 2000 \right) \right] = 00081$$

$$= \text{Rs.} [21600 - (2880 + 2400 + 2000)] = \text{Rs.} 14320.$$

41. Principal

$$= (\text{P.W. of Rs. 882 due 1 year hence}) + (\text{P.W. of Rs. 882 due 2 years hence})$$

$$= \left[\frac{882}{\left(1 + \frac{5}{100}\right)} + \frac{882}{\left(1 + \frac{5}{100}\right)^2} \right] = \left(\frac{882 \times 20}{21} + \frac{882 \times 400}{441} \right) = \text{Rs.} 1640.$$

EXERCISE 22B

(DATA SUFFICIENCY TYPE QUESTIONS)

1. The difference between the compound interest and the simple interest earned on a sum of money at the end of 4 years is Rs. 256.40. To find out the sum, which of the following informations given in the statements P and Q is/are necessary?

P : Amount of simple interest accrued after 4 years.

Q : Rate of interest per annum.

(a) Only P is necessary (b) Only Q is necessary

(c) Either P or Q is necessary (d) Neither P nor Q is necessary

(e) Both P and Q are necessary

Directions (Questions 2 to 8) : Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

2. What is the rate of compound interest?

I. The principal was invested for 4 years.

II. The earned interest was Rs. 1491.

(Bank P.O. 2003)

3. What will be the compounded amount?

(Bank P.O. 1999)

I. Rs. 200 were borrowed for 192 months at 6% compounded annually.

II. Rs. 200 were borrowed for 16 years at 6%.

4. What is the compound interest earned by Robert at the end of 2 years?

I. Simple interest at the same rate for one year is Rs. 1020 and the rate of interest is 12 p.c.p.a.

II. The amount invested is Rs. 8500.

5. What is the total compound interest accrued on a sum of money after 5 years ?

 - The sum was Rs. 20,000.
 - The total amount of simple interest on the sum after 5 years was Rs. 4000.

6. What was the total compound interest on a sum after 3 years ? (Bank P.O. 2003)

 - The interest after one year was Rs. 100 and the sum was Rs. 1000.
 - The difference between simple and compound interest on a sum of Rs. 1000 at the end of 2 years was Rs. 10.

7. An amount of money was lent for 3 years. What will be the difference between the simple and the compound interest earned on it at the same rate ?

 - The rate of interest was 8 p.c.p.a.
 - The total amount of simple interest was Rs. 1200.

8. What was the rate of interest on a sum of money ? (S.B.I.P.O. 1998)

 - The sum fetched a total of Rs. 2522 as compound interest at the end of 3 years.
 - The difference between the simple interest and the compound interest at the end of 2 years at the same rate was Rs. 40.

Directions (Questions 9 to 12) : Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is / are necessary to answer the question :

9. What is the rate of interest p.c.p.a. ? (R.B.I. 2002)

 - An amount doubles itself in 5 years on simple interest.
 - Difference between the compound interest and the simple interest earned on a certain amount in 2 years is Rs. 400.
 - Simple interest earned per annum is Rs. 2000.
 - I only
 - II and III only
 - All I, II and III
 - Any two of the three
 - I only or II and III only

10. A sum of money is put at compound interest. What is the rate of interest ?

 - The sum amounts to Rs. 5290 in 2 years.
 - The sum amounts to Rs. 6083.50 in 3 years.
 - The sum is Rs. 4000.
 - I and II only
 - II and III only
 - I and III only
 - Any two of the three
 - I and III only, or II and III only

11. What will be the compound interest earned on an amount of Rs. 5000 in 2 years ? (S.B.I.P.O. 2000)

 - The simple interest on the same amount at the same rate of interest in 5 years is Rs. 2000.
 - The compound interest and the simple interest earned in one year is the same.
 - The amount becomes more than double on compound interest in 10 years.
 - I only
 - I and II only
 - II and III only
 - I and III only
 - None of these

12. A sum of money is placed at compound interest. In how many years will it amount to sixteen times of itself ?

 - The sum doubles itself in 4 years.
 - The sum amounts to eight times of itself in 12 years.
 - The sum amounts to four times of itself in 8 years.
 - I only
 - I and II only
 - II and III only
 - I and III only
 - Any one of the three

Directions (Questions 13 to 16) : In each of the following questions, a question is asked and is followed by three statements. While answering the question, you may or may not require the data provided in all the statements. You have to read, the question and the three statements and then decide whether the question can be answered with any one or two of the statements or all the three statements are required to answer the question. The answer number bearing the statements, which can be dispensed with, if any, while answering the question is your answer.

ANSWERS

1. (b) 2. (d) 3. (c) 4. (a) 5. (e) 6. (c) 7. (e) 8. (e) 9. (e)
 10. (d) 11. (a) 12. (e) 13. (c) 14. (d) 15. (d) 16. (d)

SOLUTIONS

1. To find the sum, difference between C.I. and S.I., the time and the rate of interest are needed.
 ∴ Only Q is necessary.
 ∴ Correct answer is (B).

2. Let Principal = Rs. P and Rate = R% p.a. Then,

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

$$\therefore \text{C.I.} = P \left[\left(1 + \frac{R}{100} \right)^4 - 1 \right] \Rightarrow P \left[\left(1 + \frac{R}{100} \right)^4 - 1 \right] = 1491.$$

Given : T = 5 years
 $\therefore P = \frac{1491}{\left(1 + \frac{R}{100} \right)^4 - 1}$

Clearly, it does not give the answer.

∴ Correct answer is (d).

3. I. Amount = Rs. $\left[200 \times \left(1 + \frac{6}{100} \right)^{16} \right]$.

$$\text{II. Amount} = \text{Rs. } \left[200 \times \left(1 + \frac{6}{100} \right)^{16} \right] \times \left[1 + \left(\frac{3}{100} + 1 \right) \right] P$$

Thus, I as well as II gives the answer.

∴ Correct answer is (c).

4. I. S.I. = Rs. 1020, R = 12% p.a. and T = 1 year.

$$\therefore P = \frac{100 \times \text{S.I.}}{R \times T} \Rightarrow P = \text{Rs. } \left(\frac{100 \times 1020}{12 \times 1} \right) = \text{Rs. 8500.}$$

$$\therefore \text{C.I. for 2 years} = \text{Rs. } \left[8500 \times \left\{ \left(1 + \frac{12}{100} \right)^2 - 1 \right\} \right].$$

II gives : only P and T.

∴ II alone does not give the answer.

∴ Correct answer is (a).

5. Given : Time = 5 years.

I gives : Sum = Rs. 20000.

II gives : S.I. = Rs. 4000.

Let the rate be R% p.a. Then,

$$R = \frac{100 \times \text{S.I.}}{P \times T} = \left(\frac{100 \times 4000}{5 \times 20000} \right) = 4\% \text{ p.a.}$$

$$\therefore \text{C.I.} = \text{Rs. } \left[20000 \times \left\{ \left(1 + \frac{4}{100} \right)^5 - 1 \right\} \right].$$

∴ Both I and II are needed to get the answer.

So, the correct answer is (e).

6. I gives : P = Rs. 1000 and S.I. for 1 year = Rs. 100.

$$\therefore \text{Rate} = \frac{100 \times \text{S.I.}}{P \times T} = \left(\frac{100 \times 100}{1000 \times 1} \right) = 10\% \text{ p.a.}$$

Thus, P = Rs. 1000, T = 3 years and R = 10% p.a.

∴ C.I. may be obtained.

II. Sum = Rs. 1000, [(C.I.) - (S.I.)] for 2 years = Rs. 10.

Let the rate be R% p.a.

$$1000 \times \left[\left(1 + \frac{R}{100} \right)^2 - 1 \right] - \left(\frac{1000 \times R \times 2}{100} \right) = 10.$$

- From this, we can find R. Thus P, T and R are given and therefore, C.I. may be calculated. Thus, I alone as well as II alone is sufficient to get the answer. \therefore Correct answer is (c).
7. Given : T = 3 years.
- I gives : $R = 8\% \text{ p.a.}$ $P \left[\left(1 + \frac{R}{100} \right)^3 - 1 \right] = 1200$ $\Rightarrow \left(1 + \frac{8}{100} \right)^3 - 1 = \frac{1200}{P}$
- II gives : S.I. = Rs. 1200.
- Thus, P = Rs. 5000, R = 8% p.a. and T = 3 years. \therefore Difference between C.I. and S.I. may be obtained. So, the correct answer is (e).
8. I gives : C.I. for 3 years = Rs. 2522.
- II gives : (C.I.) - (S.I.) for 2 years at same rate is Rs. 40.
- $$P \left[\left(1 + \frac{R}{100} \right)^3 - 1 \right] = 2522 \quad \dots(i)$$
- $$P \left[\left(1 + \frac{R}{100} \right)^2 - 1 \right] - \frac{P \times R \times 2}{100} = 40 \quad \dots(ii)$$
- On dividing (i) by (ii) we get :
- $$\frac{\left(1 + \frac{R}{100} \right)^3 - 1}{\left(1 + \frac{R}{100} \right)^2 - 1 - \frac{R}{50}} = \frac{2522}{40} \Rightarrow \frac{\frac{R^3}{1000000} + \frac{3R}{100} + \frac{3R^2}{10000}}{\frac{R^2}{10000}} = \frac{1261}{20}$$
- $$\Rightarrow \frac{R}{100} + \frac{300}{R} = \frac{1261}{20} \Rightarrow R^2 - 6005R + 30000 = 0$$
- $$\Rightarrow R^2 - 6000R - 5R + 30000 = 0$$
- $$\Rightarrow R(R - 6000) - 5(R - 6000) = 0$$
- $$\Rightarrow (R - 5)(R - 6000) = 0 \Rightarrow R = 5.$$
- \therefore Both I and II are needed to get R. \therefore Correct answer is (e).
9. I. $\frac{P \times R \times 5}{100} = P \Rightarrow R = 20.$
- II. $P \left(1 + \frac{R}{100} \right)^2 - P - \frac{P \times R \times 2}{100} = 400 \Rightarrow PR^2 = 4000000.$
- III. $\frac{P \times R \times 1}{100} = 2000 \Rightarrow PR = 200000$
- $$\therefore \frac{PR^2}{PR} = \frac{4000000}{200000} \Rightarrow R = 20.$$
- Thus I only or (II & III) give answer. \therefore Correct answer is (e).
10. I. $P \left(1 + \frac{R}{100} \right)^2 = 5290 \quad \dots(i)$
- II. $P \left(1 + \frac{R}{100} \right)^3 = 6083.50 \quad \dots(ii)$
- On dividing (ii) by (i), we get :
- $$\left(1 + \frac{R}{100} \right) = \frac{6083.50}{529000} = \frac{23}{20} \Rightarrow \frac{R}{100} = \left(\frac{23}{20} - 1\right) = \frac{3}{20} \Rightarrow R = 15$$
- Thus, I and II give answer.

III. gives $P = 4000$.

Putting this value of P in (i), we get the answer.

Putting this value of P in (ii), we get the answer.

∴ (I & II) or (I & III) or (II & III) all give the answers.

Hence, the correct answer is (d).

11. $P = \text{Rs. } 5000$ & $T = 2$ years.

I. S.I. on Rs. 5000 in 5 years is Rs. 2000.

$$\frac{5000 \times R \times 5}{100} = 2000 \Rightarrow R = 8$$

Thus I only gives the answer.

∴ Correct answer is (a).

$$12. \text{ I. } P \left(1 + \frac{R}{100}\right)^4 = 2P \Rightarrow \left(1 + \frac{R}{100}\right)^4 = 2 \quad \dots(i)$$

$$\text{II. } P \left(1 + \frac{R}{100}\right)^{12} = 8P \Rightarrow \left(1 + \frac{R}{100}\right)^{12} = 8 \quad \dots(ii)$$

$$\text{III. } P \left(1 + \frac{R}{100}\right)^8 = 4P \Rightarrow \left(1 + \frac{R}{100}\right)^8 = 4 \quad \dots(iii)$$

Let the given sum become 16 times in n years. Then,

$$P \left(1 + \frac{R}{100}\right)^n = 16P \Rightarrow \left(1 + \frac{R}{100}\right)^n = 16 \quad \dots(iv)$$

∴ Any one of (i), (ii) and (iii) with (iv) will give the value of n .

∴ Correct answer is (c).

13. I and II will give us, R , S.I. and T.

$$\therefore P = \frac{100 \times S.I.}{R \times T} = \left(\frac{100 \times 2000}{5 \times 8} \right) = 5000.$$

$[(C.I.) - (S.I.)]$ for 4 years may be calculated.

In this case, III is redundant.

I and III give us R and P , using

$$P \left[\left(1 + \frac{5}{100}\right)^2 - 1 \right] - \frac{P \times 5 \times 2}{100} = 12.50$$

So, $[(C.I.) - (S.I.)]$ for 4 years may be calculated.

∴ Correct answer is (c).

14. I gives, Rate = 5% p.a.

II gives, S.I. for 1 year = Rs. 600.

III gives, sum = $10 \times (\text{S.I. for 2 years})$.

Now, I and II give the sum.

For this sum, C.I. and hence amount can be obtained.

Thus, III is redundant.

Again, II gives S.I. for 2 years = $\text{Rs. } (600 \times 2) = \text{Rs. } 1200$.

Now, from III, Sum = $\text{Rs. } (10 \times 1200) = \text{Rs. } 12000$.

$$\text{Thus, Rate} = \frac{100 \times 1200}{2 \times 12000} = 5\% \text{ p.a.}$$

Thus, C.I. for 2 years and therefore, amount can be obtained.

Thus, I is redundant.

Hence, I or III redundant.

15. I gives, S.I. for 3 years = Rs. 4500

II gives, Rate = 10% p.a.

III gives, (C.I.) - (S.I.) = Rs. 465.

Clearly, using I and III we get C.I. = Rs. (465 + 4500).

Thus, II is redundant.

Also, from I and II, we get sum = $\left(\frac{100 \times 4500}{10 \times 3} \right) = 15000$.

Now C.I. on Rs. 15000 at 10% p.a. for 3 years may be obtained.

Thus, III is redundant.

∴ Either II or III is redundant.

16. I gives, Amount after 2 years = Rs. 11025, when compounded.

II gives, Amount after 2 years at S.I. = Rs. 11000.

III gives, Principal = Rs. 10000.

From II and III, we have :

Principal = Rs. 10000, S.I. = Rs. (11000 - 10000) = Rs. 1000 and Time = 2 years.

Hence, Rate can be obtained.

∴ I is redundant.

From I and III, we get $11025 = 10000 \times \left(1 + \frac{R}{100} \right)^2$. This gives R.

∴ II is redundant.

From I and II, we have

$$P \left(1 + \frac{R}{100} \right)^2 = 11025 \quad \dots(i) \text{ and } P \left[1 + \frac{R \times 2}{100} \right] = 11000 \quad \dots(ii)$$

$$\text{On dividing (i) by (ii), we get } \frac{\left(1 + \frac{R}{100} \right)^2 \times 5}{(50 + R)} = \frac{11025}{550000}$$

This gives R.

Thus, III is redundant.

Hence I or II or III is redundant.

23. LOGARITHMS

IMPORTANT FACTS AND FORMULAE

I. Logarithm : If a is a positive real number, other than 1 and $a^m = x$, then we write :
 $m = \log_a x$ and we say that the value of $\log x$ to the base a is m .

Example :

$$\begin{aligned} & (i) 10^3 = 1000 \Rightarrow \log_{10} 1000 = 3 \quad (ii) 3^4 = 81 \Rightarrow \log_3 81 = 4 \\ & (iii) 2^{-3} = \frac{1}{8} \Rightarrow \log_2 \frac{1}{8} = -3 \quad (iv) (.1)^2 = .01 \Rightarrow \log_{(.1)} .01 = 2. \end{aligned}$$

II. Properties of Logarithms :

1. $\log_a (xy) = \log_a x + \log_a y$
2. $\log_a \left(\frac{x}{y}\right) = \log_a x - \log_a y$
3. $\log_x x = 1$
4. $\log_a 1 = 0$
5. $\log_a (x^p) = p (\log_a x)$
6. $\log_a x = \frac{1}{\log_x a}$
7. $\log_a x = \frac{\log_b x}{\log_b a} = \frac{\log x}{\log a}$

Remember : When base is not mentioned, it is taken as 10.

III. Common Logarithms : Logarithms to the base 10 are known as common logarithms.

IV. The logarithm of a number contains two parts, namely *characteristic* and *mantissa*.

Characteristic : The integral part of the logarithm of a number is called its *characteristic*.

Case I : When the number is greater than 1.

In this case, the characteristic is one less than the number of digits in the left of the decimal point in the given number.

Case II : When the number is less than 1.

In this case, the characteristic is one more than the number of zeros between the decimal point and the first significant digit of the number and it is negative.

Instead of -1 , -2 , etc. we write, $\bar{1}$ (one bar), $\bar{2}$ (two bar), etc.

Example :

Number	Characteristic	Number	Characteristic
348.25	2	0.6173	$\bar{1}$
46.583	1	0.03125	$\bar{2}$
9.2193	0	0.00125	$\bar{3}$

Mantissa : The decimal part of the logarithm of a number is known as its *mantissa*.

For mantissa, we look through log table.

SOLVED EXAMPLES

Ex. 1. Evaluate : (i) $\log_3 27$

$$(ii) \log_7\left(\frac{1}{343}\right)$$

$$(iii) \log_{100} (0.01)$$

Sol. (i) Let $\log_3 27 = n$.

$$\text{Then, } 3^n = 27 = 3^3 \text{ or } n = 3. \therefore \log_3 27 = 3.$$

(ii) Let $\log_7\left(\frac{1}{343}\right) = n$.

$$\text{Then, } 7^n = \frac{1}{343} = \frac{1}{7^3} = 7^{-3} \text{ or } n = -3. \therefore \log_7\left(\frac{1}{343}\right) = -3.$$

(iii) Let $\log_{100} (0.01) = n$.

$$\text{Then, } (100)^n = 0.01 = \frac{1}{100} = (100)^{-1} \text{ or } n = -1. \therefore \log_{100} (0.01) = -1.$$

Ex. 2. Evaluate : (i) $\log_7 1 = 0$

$$(ii) \log_{34} 34$$

$$(iii) 36^{\log_6 4}$$

Sol. (i) We know that $\log_a 1 = 0$, so $\log_7 1 = 0$.

(ii) We know that $\log_a a = 1$, so $\log_{34} 34 = 1$.

(iii) We know that $a^{\log_a x} = x$.

$$\text{Now, } 36^{\log_6 4} = (6^2)^{\log_6 4} = 6^{2(\log_6 4)} = 6^{\log_6 (4^2)} = 6^{\log_6 16} = 16.$$

Ex. 3. If $\log_{\sqrt{8}} x = 3\frac{1}{3}$, find the value of x .

$$\text{Sol. } \log_{\sqrt{8}} x = \frac{10}{3} \Leftrightarrow x = (\sqrt{8})^{10/3} = (2^{3/2})^{10/3} = 2^{\frac{3}{2} \times \frac{10}{3}} = 2^5 = 32.$$

Ex. 4. Evaluate : (i) $\log_5 3 \times \log_{27} 25$

$$(ii) \log_9 27 - \log_{27} 9$$

$$\text{Sol. (i) } \log_5 3 \times \log_{27} 25 = \frac{\log 3}{\log 5} \times \frac{\log 25}{\log 27} = \frac{\log 3}{\log 5} \times \frac{\log (5^2)}{\log (3^3)} = \frac{\log 3}{\log 5} \times \frac{2 \log 5}{3 \log 3} = \frac{2}{3}.$$

(ii) Let $\log_9 27 = n$.

$$\text{Then, } 9^n = 27 \Leftrightarrow 3^{2n} = 3^3 \Leftrightarrow 2n = 3 \Leftrightarrow n = \frac{3}{2}.$$

Again, let $\log_{27} 9 = m$.

$$\text{Then, } 27^m = 9 \Leftrightarrow 3^{3m} = 3^2 \Leftrightarrow 3m = 2 \Leftrightarrow m = \frac{2}{3}.$$

$$\therefore \log_9 27 - \log_{27} 9 = (n - m) = \left(\frac{3}{2} - \frac{2}{3} \right) = \frac{5}{6}.$$

$$\text{Ex. 5. Simplify : } \left(\log \frac{75}{16} - 2 \log \frac{5}{9} + \log \frac{32}{243} \right) \quad \text{(S.S.C. 2000)}$$

$$\text{Sol. } \log \frac{75}{16} - 2 \log \frac{5}{9} + \log \frac{32}{243} = \log \frac{75}{16} - \log \left(\frac{5}{9} \right)^2 + \log \frac{32}{243} = \log \frac{75}{16} - \log \frac{25}{81} + \log \frac{32}{243}$$

$$= \log \left(\frac{75}{16} \times \frac{32}{243} \times \frac{81}{25} \right) = \log 2.$$

Ex. 6. Find the value of x which satisfies the relation

$$\log_{10} 3 + \log_{10} (4x + 1) = \log_{10} (x + 1) + 1 \quad \text{(M.B.A. 2002)}$$

$$\begin{aligned}
 \text{Sol. } & \log_{10} 3 + \log_{10} (4x+1) = \log_{10} (x+1) + 1 \\
 \Leftrightarrow & \log_{10} 3 + \log_{10} (4x+1) = \log_{10} (x+1) + \log_{10} 10 \\
 \Leftrightarrow & \log_{10} [3(4x+1)] = \log_{10} [10(x+1)] \\
 \Leftrightarrow & 3(4x+1) = 10(x+1) \Leftrightarrow 12x+3 = 10x+10 \Leftrightarrow 2x = 7 \Leftrightarrow x = \frac{7}{2}.
 \end{aligned}$$

$$\text{Ex. 7. Simplify : } \left[\frac{1}{\log_{xy}(xyz)} + \frac{1}{\log_{yz}(xyz)} + \frac{1}{\log_{zx}(xyz)} \right]$$

$$\begin{aligned}
 \text{Sol. Given expression} &= \log_{xyz}(xy) + \log_{xyz}(yz) + \log_{xyz}(zx) \\
 &= \log_{xyz}(xy \times yz \times zx) = \log_{xyz}(xyz)^2 \\
 &= 2 \log_{xyz}(xyz) = 2 \times 1 = 2. \quad \left[\because \log_a x = \frac{1}{\log_x a} \right]
 \end{aligned}$$

(C.B.I. 1997)

Ex. 8. If $\log_{10} 2 = 0.30103$, find the value of $\log_{10} 50$.

$$\text{Sol. } \log_{10} 50 = \log_{10} \left(\frac{100}{2} \right) = \log_{10} 100 - \log_{10} 2 = 2 - 0.30103 = 1.69897.$$

Ex. 9. If $\log 2 = 0.3010$ and $\log 3 = 0.4771$, find the values of :

- (i) $\log 25$ (ii) $\log 4.5$

$$\text{Sol. (i) } \log 25 = \log \left(\frac{100}{4} \right) = \log 100 - \log 4 = 2 - 2 \log 2 = (2 - 2 \times 0.3010) = 1.398.$$

$$\begin{aligned}
 \text{(ii) } \log 4.5 &= \log \left(\frac{9}{2} \right) = \log 9 - \log 2 = 2 \log 3 - \log 2 \\
 &= (2 \times 0.4771 - 0.3010) = 0.6532.
 \end{aligned}$$

Ex. 10. If $\log 2 = 0.30103$, find the number of digits in 2^{56} .

$$\text{Sol. } \log(2^{56}) = 56 \log 2 = (56 \times 0.30103) = 16.85768. \quad \text{Its characteristic is 16. Hence, the number of digits in } 2^{56} \text{ is 17.}$$

EXERCISE 23

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer:

(M.B.A. 2002)

1. The value of $\log_2 16$ is :

- (a) $\frac{1}{8}$ (b) 4 (c) 8 (d) 16.

2. The value of $\log_{343} 7$ is :

- (a) $\frac{1}{3}$ (b) -3 (c) $-\frac{1}{3}$ (d) 3.

3. The value of $\log_5 \left(\frac{1}{125} \right)$ is :

- (a) 3 (b) -3 (c) $\frac{1}{3}$ (d) $-\frac{1}{3}$.

4. The value of $\log_{\sqrt{2}} 32$ is :

- (a) $\frac{5}{2}$ (b) 5 (c) 10 (d) $\frac{1}{10}$.

5. The value of $\log_{10} (0.0001)$ is :

- (a) $\frac{1}{4}$ (b) $-\frac{1}{4}$ (c) -4 (d) 4.