19.SIMPLE INTEREST

Interest

It is the sum which is paid by the borrower to the lender for using the money for a specific time period.

The money borrowed is called the **Principal**.

The rate at which the interest is calculated on the principal is called **Rate of Interest**.

The time for which the money is borrowed is called **Time.**

The total sum of principal and interest is called **Amount.**

Simple Interest:

If P = Principal, R = Rate per cent per annum T= Number of years, SI = Simple Interest and A= Amount.

Then,

(i) $SI = \frac{P \times T \times R}{100}$

(ii) $P = \frac{100 \times SI}{R \times T}$

(iii) $R = \frac{100 \times SI}{P \times T}$

(iv) $T = \frac{100 \times SI}{P \times R}$

(v) $A = P + SI = P + \frac{P \times T \times R}{100} = P\left(1 + \frac{RT}{100}\right)$

Here, the interest is calculated on the original principal i.e., the principal to calculate the interest remains constant throughout the time period. The interest earned on the principal is not taken into account for the purpose of calculating interest for later years.

Example 1: Find the SI on Rs. 7200 at 8% per annum for 10 months.

Solution: Here, P = Rs. 7200, R = 8% per annum and $T = \frac{10}{12}$yr $= \frac{5}{6}yr$

$SI = \left(\frac{P \times T \times R}{100}\right) =$ Rs. $\left(7200 \times \frac{5}{6} \times 8 \times \frac{1}{100}\right) =$ Rs. 480

Example 2: A sum is lent at 10% per annum Simple interest . In how many years it will get doubled?

Solution: Sum will be doubled when SI = P

Therefore,

$$SI = P = \frac{PRT}{100}$$

$$RT = 100 \Rightarrow T = \frac{100}{R} = \frac{100}{10} = 10 \; years$$

Example 3: Three persons separately borrow Rs. 51000 in all from a banker at 10% and returned with interest after 2, 5 and 6 year respectively. If the returned amounts are equal, what are the sums borrowed by each of them?

Solution: If P_1, P_2, P_3 be the sums borrowed and A_1, A_2, A_3 be the amounts. Then,

$$A_1 = A_2 = A_3$$

$$P_1 + \frac{P_1 \times 10 \times 2}{100} = P_2 + \frac{P_2 \times 10 \times 5}{100} = P_3 + \frac{P_3 \times 10 \times 6}{100}$$

$$\Rightarrow \frac{6P_1}{5} = \frac{3P_2}{2} = \frac{8P_3}{5} = K$$

$$\Rightarrow P_1 = \frac{5K}{6}, P_2 = \frac{2K}{3}, P_3 = \frac{5K}{8}$$

But $P_1 + P_2 + P_3 = 51000 \Rightarrow \frac{5K}{6} + \frac{2K}{3} + \frac{5K}{8} = 51000$

$$\Rightarrow \frac{20K + 16K + 15K}{24} = 51000 \Rightarrow K = \frac{51000 \times 24}{51}$$

$$\Rightarrow K = 24000$$

Hence, $P_1 = \frac{5K}{6} = \frac{5}{6} \times 24000 =$ Rs. 20000

$P_2 = \frac{2K}{3} = \frac{2}{3} \times 24000 =$ Rs. 16000

$P_3 = \frac{5K}{8} = \frac{5}{8} \times 24000 =$ Rs. 15000

EXERCISE

1. Find SI if P = Rs. 1000, $R = 20\%$ per annum 4 yr
   (a) Rs. 400   (b) Rs. 600
   (c) Rs. 800   (d) Rs. 850

2. A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is:
   (a) Rs. 850   (b) Rs. 790
   (c) Rs. 698   (d) Rs. 800

3. If Rs. 64 accounts to Rs. 83.20 in 2 years, what will Rs. 86 amount to in 4 years at the same rate of S.I?
   (a) Rs. 115.80   (b) Rs. 127.70
   (c) Rs. 127.40   (d) Rs. 137.60

4. If a sum of money at simple interest doubles in 6 years, it will become 4 times in:
   (a) 17 years   (b) 15 years
   (c) 16 years   (d) 18 years

5. The rate at which a sum becomes four times of itself in 15 years at S.I will be:
   (a) 18%   (b) 17.2%
   (c) 20%   (d) 27%

6. A sum of money triples itself in 15 years 6 months. In how many years would it double itself?
   (a) 5 years 3 months
   (b) 7 years 9 months
   (c) 10 years 3 months
   (d) 11 years 6 months

7. The simple interest on *Rs.*10 for 4 months at the rate of 3 paise per rupee per month is:
   (a) Rs. 1.20   (b) Rs.1.90

   (c) Rs. 3.60   (d) Rs. 4.80

8. In how much time would the simple interest on a certain sum be 0.125 times the principal at 10% per annum?
   (a) $1\frac{3}{4}$ % years (b) $2\frac{1}{4}$% years
   (c) $5\frac{1}{4}$% years   (d) $1\frac{1}{4}$% years

9. At what rate percent per annum will the simple interest on a sum of money be $2/5^{th}$ of the amount in 10 years?
   (a) 4%   (b) 55%
   (c) 8%   (d) 65 %

10. 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) 10%   (b) 8%
    (c) 9%   (d) 12%

11. 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. 30.25   (b) Rs. 22.50
    (c) Rs. 25   (d) Rs. 52.75

12. 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?
    (a) 5 :3   (b) 4 : 7
    (c) 2 : 3   (d) data inadequate

13. 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 for 11 years is 8160 how much money did he borrow?

(a) Rs. 8000   (b) Rs. 13,000

(c) 11,000 (d) data inadequate

14. Consider the following statements:

If a sum of money is lent at simple interest, then the

(1) Money gets doubled in 5 years if the rate of interest is $16\frac{2}{3}\%$.

(2) Money gets doubled in 5 years if the rate of interest is 20%.

(3) Money becomes four times in 11 years if it gets doubled in 5 years.

Of these statements,

(a) 1 and 3 are correct

(b) 2 alone is correct

(c) 3 alone is correct

(d) 2 and 3 are correct

15. The SI on a sum of money is 25% of the principal, and the rate per annum is equal to the number of years. Find the rate per cent,

(a) 4.5%   (b) 6%

(c) 5%   (d) 8%

16. A man wanted to invest Rs. 20000 for a period of $7\frac{1}{2}\,yr$ in order to get an interest of Rs. 20000. At what rate of simple interest should he invest?

(a) $13\frac{1}{3}\%$ (b) $13\frac{2}{5}\%$

(c) $13\frac{4}{5}\%$ (d) $13\frac{2}{3}\%$

17. A sum becomes 10/9 times itself in 1 yr. Find the rate of simple interest.

(a) $11\frac{1}{2}\%$ (b) $11\frac{1}{9}\%$

(c) $12\frac{1}{2}\%$ (d) $12\frac{1}{9}\%$

18. At simple interest of 5%, 6% and 8% for three consecutive year, the interest earned is Rs. 760. Find the principal.

(a) Rs. 4600   (b) Rs. 3200

(c) Rs. 4000   (d) Rs. 3600

19. A man borrowed Rs. 5000 at $6\frac{1}{4}\%$ per annum simple interest for 6 yr. Instead of clearing the loan at the end of 6 yr, if he

returns the loan with interest at the end of 4 yr, .how much does the man save?

(a) Rs. 625   (b) Rs. 450

(c) Rs. 575   (d) Rs. 700

20. Find the simple interest on Rs. 4500 from Oct. 10, 2009 to Dec. 22, 2009 at $9\frac{1}{3}\%$ per annum

(a) Rs. 96   (b) Rs. 84

(c) Rs. 86   (d) Rs. 94

21. A person borrowed Rs. 2000 at 5% per annum simple interest and immediately lent it at 6% per annum simple interest. At the end of $2\frac{1}{2}$ yr he collected the amount and settled his loan. What was his profit?

(a) Rs. 45   (b) Rs. 40

(c) Rs. 50   (d) Rs. 56

22. What annual payment will discharge a debt of Rs. 9675 due in 4 installments at 5% simple interest?

(a) Rs. 2240   (b) Rs. 2180

(c) Rs. 2250   (d) Rs. 2160

23. A person invests money in three different schemes for 5 yr, 10 yr and 15 yr at 8%, 10% and 12% simple interest respectively. At the completion of each scheme, he gets the same interest. The ratio of his investments is

(a) 45: 9: 5   (b) 45: 18: 10

(c) 25: 18: 10   (d) 25: 9: 5

24. Two equal sums of money were lent at simple interest at 10% per annum for 4 yr and 5 yr respectively. If the difference in interests for two periods was Rs. 220, then each sum is

(a) Rs. 880   (b) Rs. 1100

(c) Rs. 2200   (d) Rs. 1640

25. 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:

(a) 13%   (b) 10.25%

(c) 15%   (d) 11%

ANSWER KEY									
1	c	7	a	13	a	19	a	25	b
2	c	8	d	14	b	20	b		
3	d	9	a	15	c	21	c		
4	d	10	b	16	a	22	c		
5	c	11	b	17	b	23	b		
6	b	12	c	18	c	24	c		

SOLUTIONS

1. $S.I = \frac{PRT}{100} = \frac{1000 \times 20 \times 4}{100} = $ Rs. 800

2. S.I. for 1 year = Rs. (854 - 815) = 39.
   S.I. for 3 years = Rs. (39 × 3) = Rs. 117.
   ∴ Principal = Rs. (815 - 117) = Rs. 698.

3. P = Rs. 64,
   S.I. = Rs. (83.20 - 64) = Rs. 19.20,
   T = 2 years.
   So, rate R = $\left(\frac{100 \times 19.20}{64 \times 2}\right)\% = 15\%$
   Now, P = Rs. 86, R = 15%, T = 4 years.
   ∴ S.I. = $\left(\frac{86 \times 15 \times 4}{100}\right)$ = Rs. 51.60.
   ∴ $A = 86 + 51.60$
   $= 137.60$

4. Let the sum be x. Then, S.I. = x.
   ∴ Rate = $\left(\frac{100 \times x}{x \times 6}\right)\% = \frac{50}{3}\%$
   Now, sum = x, S.I. = 3x, Rate = $\frac{50}{3}\%$.
   Time = $\frac{100 \times 3x}{x \times \frac{50}{3}}$ = 18 years.

5. Let the sum be x.
   Then, S.I. = 3x.
   ∴ $Rate = \left(\frac{100 \times S.I}{P \times T}\right) = \left(\frac{100 \times 3x}{x \times 15}\right)\%$
   $= 20\%$.

6. Let the sum be x. Then, S.I. = 2x,
   Time = $15\frac{1}{2}$ years
   ∴ $Rate = \left(\frac{100 \times 2x}{x \times \frac{31}{2}}\right)\% = \frac{400}{31}\%$
   Now, sum = x,

   S.I. = x, Rate = $\frac{400}{31}\%$
   ∴ Time = $\frac{100 \times x}{x \times \frac{400}{31}} = \frac{31}{4} \, years$
   = 7 years 9 months.

7. S.I. = Rs. $(10 \times \frac{3}{100} \times 4)$ = Rs. 1.20

8. Let the sum be x.
   Then, S.I. = 0.125 $x = \frac{1}{8}x$, R = 10%.
   ∴ Time = $\left(\frac{100 \times x}{x \times 8 \times 10}\right)$ years
   = $\frac{5}{4}$ years = $1\frac{1}{4}$ years.

9. Let the sum be x. Then, S.I. = $\frac{2x}{5}$,
   Time = 10 years.
   Rate = $(\frac{100 \times 2x}{x \times 5 \times 10})\% = 4\%$

10. S.I. = Rs. 840, R = 5%, T = 8 years.
    Principal (P) = Rs. $\left(\frac{100 \times 840}{5 \times 8}\right)$
    = Rs. 2100.
    Now, P = Rs. 2100, S.I. = Rs. 840,
             T = 5 years.
    ∴ $Rate = \left(\frac{100 \times 840}{2100 \times 5}\right)\% = 8\%$

11. S.I. = Rs. 202.50, R = 4.5%, T = 1 year.
    Principal = Rs. $\left(\frac{100 \times 202.50}{4.5 \times 1}\right)$ = Rs. 4500.
    Now, P = Rs. 4500, R = 5%,
             T = 1 year.
    S.I. = Rs. $(\frac{4500 \times 5 \times 1}{100})$ = Rs. 225.
    Difference in interest
    = Rs. (225 - 202.50) = Rs. 22.50.

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

Required ratio $= \left[\frac{\left(\frac{P \times R \times 6}{100}\right)}{\left(\frac{P \times R \times 9}{100}\right)}\right]$

$$= \frac{6PR}{9PR} = 2:3$$

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

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

14. Let the 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.

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

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

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

So, 2 alone is correct.

15. Let the principal be P,

Then interest $= \frac{P}{4}$ and

Rate $=$ Time $= T$

Now SI$= \frac{PRT}{100}$

$$\frac{P}{4} = \frac{P.T^2}{100}$$
$$\Rightarrow T^2 = 25$$
$$\Rightarrow T = 5 \text{ years}$$
$$\Rightarrow R = 5\% \ (\because T = R)$$

16. P = Rs. 20000, SI = 20000, T $= \frac{15}{2}$ year

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

$= \left(\frac{100 \times 20000 \times 2}{20000 \times 15}\right)\% \ per \ annum$

$= 13\frac{1}{3}\%$per annum

17. Let the sum be Rs. x, Amount = Rs. $\frac{10x}{9}$, T= 1 year

$SI =$ (Amount - sum) = Rs. $\left(\frac{10x}{9} - x\right)$

$=$ Rs. $\left(\frac{x}{9}\right)$

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

$= \left(100 \times \frac{x}{9} \times \frac{1}{x}\right)\%$per annum

$= \left(\frac{100}{9}\right)\%$ per annum $= 11\frac{1}{9}\%$ per annum

18. Let the principal be Rs. x Then,

$$\left(\frac{x \times 1 \times 5}{100}\right) + \left(\frac{x \times 1 \times 6}{100}\right) + \left(\frac{x \times 1 \times 8}{100}\right) = 760$$
$$\Rightarrow \frac{5x}{100} + \frac{6x}{100} + \frac{8x}{100} = 760 \Rightarrow 19x = 760 \times 100$$
$$\Rightarrow x = \left(\frac{760 \times 100}{19}\right) = 4000$$

Hence, the principal is Rs. 4000.

19. P = Rs. 5000, $R = \frac{25}{4}\%$ per annum,

T = 6 year

Simple interest for 6 year

$=$ Rs. $\left(5000 \times 6 \times \frac{25}{4} \times \frac{1}{100}\right) =$ Rs. 1875

Simple interest for 4 year

$=$ Rs. $\left(5000 \times 4 \times \frac{25}{4} \times \frac{1}{100}\right) =$ Rs. 1250

Savings = Rs. (1875 - 1250) = Rs. 625

20. P = Rs. 4500, $R = \frac{28}{3}\%$

T = (21 + 30 + 22) days

$= 73$ days $= \left(\frac{73}{365}\right)$ year

SI $= \left(\frac{P \times T \times R}{100}\right) =$ Rs. $\left(4500 \times \frac{1}{5} \times \frac{28}{3} \times \frac{1}{100}\right) =$ Rs. 84

21. For borrowed money

P = Rs. 2000, R = 5% per annum and

T $= \frac{5}{2}$ year

SI $=$ Rs. $\left(2000 \times \frac{5}{2} \times 5 \times \frac{1}{100}\right) =$ Rs. 250

For lent money

P = Rs. 2000, R $= 6\%$ per annum and

T $= \frac{5}{2}$ year

SI= Rs. $\left(2000 \times \frac{5}{2} \times 6 \times \frac{1}{100}\right) =$ Rs. 300

His profit = Rs. (300 - 250) = Rs. 50

22. Let the annual installment be Rs. x . Then,

$$= \left[x + \left(\frac{x \times 3 \times 5}{100}\right)\right] + \left[x + \left(\frac{x \times 2 \times 5}{100}\right)\right]$$
$$+ \left[x + \left(\frac{x \times 1 \times 5}{100}\right)\right] + x$$
$$= 9675$$

$$\Rightarrow \frac{23x}{20} + \frac{22x}{20} + \frac{21x}{20} + x = 9675$$
$$\Rightarrow 86x = 9675 \times 20$$
$$\Rightarrow x = 9675 \times \frac{20}{86} = 2250$$

Hence, the annual installment is Rs. 2250.

23. Let the investments be x, y, and z respectively

$$\therefore \quad \frac{x \times 5 \times 8}{100} = \frac{y \times 10 \times 10}{100}$$
$$= \frac{z \times 15 \times 12}{100}$$
$$2x = 5y = 9z \Rightarrow \frac{x}{45} = \frac{y}{18} = \frac{z}{10}$$
$$\therefore x : y : z = 45 : 18 : 10$$

24. Let each sum be Rs. x. Then,

$$\left(\frac{x \times 10 \times 5}{100}\right) - \left(\frac{x \times 10 \times 4}{100}\right) = 220$$

$$\Rightarrow \frac{x}{10} = 220 \Rightarrow x = 2200$$

Hence, each sum is Rs. 2200.

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

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

= Rs. 5.

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

= Rs. 5.25.

So, amount at the end of 1 year

= Rs. (100 + 5 + 5.25) = Rs. 110.25.

∴ Effective rate = (110.25 -100)

= 10.25%.