## SIMPLE AND COMPOUND INTEREST

## INTRODUCTION

Interest is called as the cost of borrowing money, and depending on how it is calculated, can be classified as simple interest or compound 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 $=R \%$ (p.a.) and
Time $=$ T years.
Then,
(I) $\mathrm{S} . \mathrm{I}=\frac{P T R}{100}$
(II) $\mathrm{P}=\frac{100 \times S . I}{R T}$
(III) $\mathrm{R}=\frac{100 \times S . I}{P T}$

Ex.1. Find the simple interest on Rs. 18,000 at 15\% per annum for 2 years.
Sol: $\mathrm{P}=18000$
$\mathrm{T}=2$ years
$\mathrm{R}=15 \%$
S.I $=\frac{P T R}{100}$
S.I $=\frac{18000 \times 15 \times 2}{100}$
S.I $=5400$

Ex.2.What is the simple interest on Rs. 21,000 at $14 \frac{2}{7} \%$ per annum for 8 months.
Sol: $\mathrm{P}=21000$
$R=\frac{100}{7} \%$
T=8 months
S.I $=\frac{P T R}{100}$
S.I $=\frac{21000 \times 100 \times 8}{100 \times 7 \times 12}=2000$

Ex.3. A sum of Rs. 1200 amounts to Rs. 1380 in 3 years at simple interest. If the rate of increased by 3\%, it would amount to how much?
Sol. S.I. $=1380-1200=180$
P = Rs. 800,
T = 3 yrs .
$R=\left(\frac{180 \times 100}{1200 \times 3}\right)=5 \%$.
New rate $=(5+3)=8 \%$.
New S.I. $=\left(\frac{1200 \times 8 \times 3}{100}\right)=288$
New Amount $=1200+288=1488$

Ex.4. The simple interest on a sum of money is $\frac{1}{4}$ of the principal .Find the rate percent, if both are numerically equal.
Sol: Principal = 4
Interest = 1
Time = rate
S.I $=\frac{P T R}{100}$
$1=\frac{4 \times R \times R}{100}$
$R^{2}=\frac{100}{4}$
$R^{2}=25$
$R=5$

Ex.5. At what rate percent per annum will a sum of money double in 8 years.
Sol: Let principal = 100
Then, S.I = 100 and
$\mathrm{T}=8 \mathrm{yrs}$.
Rate $=\frac{100 \times 100}{100 \times 8}=\frac{25}{2} \%$

Ex.6. A sum of Rs. 1800 is lent out into two parts, one at $5 \%$ and another one at $8 \%$. If the total annual income is Rs. 108, find the money lent at each rate.
Sol: Total sum = 1800
Let one part = X
Another part $=1800-x$
S.I $=\frac{P T R}{100}$
$=\frac{X \times 5 \times 1}{100}+\frac{(1800-X) \times 8 \times 1}{100}=108$
$=5 X+14400-8 X=10800$
$=3 X=3600$
= $\mathrm{X}=1200$
First part = 1200
Second part $=1800-1200=600$

## Compound Interest:

Compound interest is the addition of interest to the principal sum of a loan or deposit, or in other
words, it is the interest on interest. After a specified period, the difference between the amount and the money borrowed is called the Compound Interest (C.I.) for that period.
Amount $=$ Principal + Compound interest

## IMPORTANT FORMULAE

Principal = $P$,
Rate $=r \%$ per annum,
Time $=n$ years.
I. When interest is compound annually:

Amount $=\mathrm{P}\left(1+\frac{r}{100}\right)^{n}$
II. When interest is compounded Half-yearly:

Amount $=\mathrm{P}\left(1+\frac{r}{2 \times 100}\right)^{2 n}$
III. When interest is compounded quarterly:

Amount $=\mathrm{P}\left(1+\frac{r}{4 \times 100}\right)^{4 n}$
IV. When Rates are different for different years, say $\mathrm{r} 1 \%, \mathrm{r} 2 \%, \mathrm{r} 3 \%$ for 1 st , 2nd and 3rd year respectively.

Then, Amount $=\mathrm{P}\left(1+\frac{r 1}{100}\right)\left(1+\frac{r 2}{100}\right)\left(1+\frac{r 3}{100}\right)$
Amount $=$ Principal + Interest
C.I = Amount - Principal

Ex.1. Find compound interest on Rs. 5000 at $10 \%$ per annum for 2 years, compounded annually.
Sol. P = 5000
$R=10 \%$
$\mathrm{T}=2$ years
Amount $=\mathrm{P}\left(1+\frac{r}{100}\right)^{n}$
$=5000\left(1+\frac{10}{100}\right)^{2}$
$=5000 \times \frac{121}{100}$
$=6050$
C.I = Amount - Principal
C.I $=6050-5000=1050$

Ex. 2. Find the compound interest on Rs. 10,000 in 2 years at $10 \%$ per annum, the interest being compounded half-yearly.
Sol: P=10000
R=8\%
Time $=2$ years
Amount $=\mathrm{P}\left(1+\frac{r}{2 \times 100}\right)^{2 n}$
Amount $=10000\left(1+\frac{10}{2 \times 100}\right)^{4}$
Amount $=10000\left(1+\frac{1}{20}\right)^{4}$
Amount $=10000\left(\frac{21}{20}\right)^{4}$
Amount $=12155.0625$
C.I $=12155.0625-10000=2155.0625$

Ex. 3. In what time will Rs. 1000 become Rs. 1331 at $10 \%$ per annum compounded annually?
Sol: $P=1000$
A $=1331$
$R=10 \%$
Amount $=\mathrm{P}\left(1+\frac{r}{100}\right)^{n}$
$1331=1000\left(1+\frac{10}{100}\right)^{n}$
$\frac{1331}{1000}=\left(\frac{11}{10}\right)^{n}$
$\left(\frac{11}{10}\right)^{3}=\left(\frac{11}{10}\right)^{n}$
$\mathrm{N}=3$ years

Ex.4. The difference between the compound interest and the simple interest accrued on an amount of Rs. 8,000 in 2 years was Rs. 320. What was the rate of interest (p.a.)?
Sol: $\mathrm{P}=8000, \mathrm{~T}=2$ years
Difference $=320$
Difference $=\mathrm{P}\left(\frac{r}{100}\right)^{2}$
$320=8000\left(\frac{r}{100}\right)^{2}$
$\frac{320}{8000} \times 10000=r^{2}$
$r^{2}=400=r=20 \%$

Ex.5. a sum of money doubles itself at compound interest in 15 years.in how many years will it become eight times?
Sol: Let Sum = P
Amount $=2 \mathrm{P}$
C. $I=P$

Time $=15$ years
It takes 15 years to double the sum.
Sum will be four times after another 15 years
Sum will be Eight times after another 15 years
Total time $=15+15+15=45$ years

## Important Questions for Practice

1. Navin invested certain amount in three different schemes $X, Y$ and $Z$ with the rate of interest $20 \%$ p.a., $15 \%$ p.a. and $10 \%$ p.a. respectively. If he received total interest of Rs. 2875 in one year and the amount invested in Scheme $Z$ was $175 \%$ of the amount invested in Scheme $Y$ and $140 \%$ of the amount invested in Scheme $X$, then what was the amount invested in Scheme $Y$ ?
(A) 4500
(B) 5000
(C) 5250
(D) 5500
(E) None of these
2. Sumit invested in three schemes $A, B$, and $C$ in the ratio of 3:4:5 respectively. If the schemes $A, B$ and C offered interest at 20\% p.a., 15\%p.a. and $12 \%$ p.a., Find the respective ratio of their amounts after one year?
(A) $18: 23: 28$
(B) $18: 21: 25$
(C) $20: 23: 28$
(D) $20: 22: 27$
(E) None of these
3. A sum of money triples itself in 11 years and 6 months by earning simple interest on it. In how many years would it double itself?
(A) 5 years 3 months
(B) 5 years 6 months
(C) 5 years 9 months
(D) 6 years 9 months
(E) None of these
4. Mukesh borrows Rs. 6000 at simple interest from a moneylender. At the end of 4 years, he again borrows Rs. 4000 and settles his account after paying Rs. 4050 as interest after 7 years from the time he made his first borrowing. What is the rate of interest?
(A) $4.5 \%$
(B) $5.5 \%$
(C) $6.5 \%$
(D) $7.5 \%$
(E) None of these
5. The simple interest accrued on an amount of Rs. 22,500 at the end of four years is Rs. 10,800. What would be the compound interest accrued on the same amount at the same rate at the end of two years?
(A) 4,832
(B) 5,248
(C) 5,724
(D) 6,484
(E) None of these
6. A sum of Rs. 2200 is invested at two different rates of interest. The difference between the interests got after 4 years is Rs. 202.40. What is the difference between the rates of interest?
(A) $2.3 \%$
(B) $2.5 \%$
(C) $3.2 \%$
(D) $3.5 \%$
(E) None of these
7. The rate of interest for first 3 years is $6 \%$ per annum, for the next 4 years, 7 per cent per annum and for the period beyond 7 years, 7.5 percentages per annum. If a man lent out Rs. 1200 for 11 years, find the total interest earned by him?
(A) 1002
(B) 912
(C) 864
(D) 948
(E) None of These
8. The compound interest earned on a sum is 3 years at $15 \%$ per annum compounded annually is
Rs. 6500.52. What is the sum?
(A) 12480
(B) 10500
(C) 14800
(D) 13620
(E) None of these
9. A sum of 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?
(A) $3.6 \%$
(B) $4.5 \%$
(C) $5 \%$
(D) $3.46 \%$
(E) None of these
10. Deepika invested an amount of Rs. 5800 for 2 years. At what rate of compound interest will she get an amount of Rs. 594.5 at the end of two years?
(A) $5 \%$
(B) $4 \%$
(C) $6 \%$
(D) $8 \%$
(E) None of these


## Solutions

1. Answer is option B

Explanation
Let Y's share $=100 \mathrm{x}$
Z's share $=100 \mathrm{x} \times \frac{175}{100}=175 \mathrm{x}$
X's share $=175 \mathrm{x} \times \frac{100}{140}=125 \mathrm{x}$
S.I $=\frac{125 x \times 20}{100}+\frac{100 x \times 15}{100}+\frac{175 x \times 10}{100}$
$2875=25 x+15 x+17.5 x$
$2875=57.5 x$
$100 x=2875 \times \frac{100}{57.5}$
$100 x=5000$

## 2. Answer is option A

Explanation
$=3 \times \frac{120}{100}: 4 \times \frac{115}{100}: 5 \times \frac{112}{100}$
$=18: 23: 28$

## 3. Answer is option C

## Explanation

Let sum = x. Then,
Money trebles itself
So simple interest $=2 \mathrm{x}$,
Time $=11 \frac{1}{2}$ years
As we know that,
Simple Interest $=\frac{\text { Principal } \times \text { Rate } \times \text { Time }}{100}$
Rate $=\frac{2 x \times 100 \times 2}{x \times 23}=\frac{400}{23} \%$
Now, sum = $x$,
Simple interest $=x$,
Rate $=\frac{400}{23} \%$
Time $=\frac{x \times 23 \times 100}{x \times 400}=\frac{23}{4}$ years
$=5$ years 9 months

## 4. Answer is option D

Explanation:
$P=6000$
Time $=4$ years
Rate $=$ r\%
Interest $=\frac{6000 \times 4 \times r}{100}$
$=240 \mathrm{r}$
After 4 years, he borrowed 4000 more.
Now, $\mathrm{P}=6000+4000=10000$
Interest $=\frac{10000 \times 3 \times r}{100}$
$=300 \mathrm{r}$
Total interest $=240 r+300 r=540 r$
Actual interest $=4050$
So, $540 \mathrm{r}=4050$
R = 7.5\%

## 5. Answer is option C

Explanation
$\mathrm{R}=\frac{100 \times S . I}{P T}$
$\mathrm{R}=\frac{100 \times 10800}{22500 \times 4}$
$\mathrm{R}=12 \%$
Amount $=\mathrm{P}\left(1+\frac{r}{100}\right)^{n}$
Amount $=22500\left(1+\frac{12}{100}\right)^{2}$
Amount $=22500\left(\frac{28}{25}\right)^{2}$
Amount $=28224$
C. $I=28224-22500=5724$

## 6. Answer is option A

## Explanation

Let R1 and R2 be the two different rate of interest, where R1 > R2
$\frac{2200 \times R 1 \times 4}{100}-\frac{2200 \times R 2 \times 4}{100}=202.40$
$\left(\frac{2200 \times 4}{100}\right)(R 1-R 2)=202.40$
$(R 1-R 2)=\frac{2024 \times 100}{2200 \times 4 \times 10}$
$(R 1-R 2)=2.3 \%$

## 7. Answer is option B

## Explanation

For any amount, interest for the 1st three years @ $6 \%$ SI will be equal to $6 \times 3=18 \%$
Again, interest for next 4 years will be equal to $7 \times$ 4 = 28\%.
And interest for next 4 years (till 11 years) $-7.5 \times$ 4 = 30\%
So, total interest $=18+28+30=76 \%$

So, total interest earned by him $=76 \%$ of the amount $=912$
This calculation can be done very conveniently using the percentage rule as $75 \%+1 \%=900+12$ $=912$

## 8. Answer is option A <br> Explanation

$\mathrm{P}\left(1+\frac{r}{100}\right)^{n}-\mathrm{P}=\frac{650052}{100}$
$\mathrm{P}\left(1+\frac{15}{100}\right)^{3}-P=\frac{650052}{100}$
$\mathrm{P} \times \frac{23}{20} \times \frac{23}{20} \times \frac{23}{20}-\mathrm{P}=\frac{650052}{100}$
$12167 \mathrm{P}-8000 \mathrm{P}=\frac{650052 \times 8000}{100}$
$P=\frac{650052 \times 8000}{100 \times 4167}=156 \times 80=12480$

## 9. Answer is option D

Explanation
Let the original rate be R\%.
Then, new rate $=(2 R) \%$.
$\left(\frac{725 \times R \times 1}{100}\right)+\left(\frac{362.5 \times 2 R \times 1}{100}\right)=33.50$
$=(2175+725) R=33.50 \times 100 \times 3=10050$
$=R=\frac{10050}{2900}=3.46 \%$
10. Answer is option $A$

Explanation
C. $\mathrm{I}=\mathrm{P}\left(1+\frac{r}{100}\right)^{n}-\mathrm{P}$
$594.5=5800\left[\left(1+\frac{r}{100}\right)^{2}-1\right]$
$\frac{594.5}{5800}+1=\left(1+\frac{r}{100}\right)^{2}$
$\frac{6394.5}{5800}=\left(1+\frac{r}{100}\right)^{2}$
$1.05=\left(1+\frac{r}{100}\right)$
$1.05-1=\frac{r}{100}$
$\mathrm{R}=0.05 \times 100$
R = 5\%

