IBPS CWE PO/MT

SAMPLE THEORY

- **SIMPLE INTEREST**
- **COMPOUND INTEREST**
- **PROFIT AND LOSS**
- **ALLIGATION AND MIXTURE**

VPM CLASSES

For IIT-JAM, JNU, GATE, NET, NIMCET and Other Entrance Exams

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1. SIMPLE INTEREST

(i). Principal (P):

The money borrowed or lent out for a certain period, is called the principal or the sum.

(ii). Amount (A):

The sum of interest and principal is called the amount.

Thus, Amount = Principal + Interest

(iii). Rate percent per Annum (R):

The interest is charged according to some pre-condition which is expressed in general as a rate percent of the principal for each year and is called rate percent per annum.

(iv). Simple Interest (S.I.) :

If the interest on a sum borrowed for certain period is charged on the original sum (principal) , it is called simple interest.

- **Useful formulae to remember**

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

1. $S.I. = \frac{P \times R \times T}{100}$
2. $P = \frac{S.I \times 100}{R \times T}$
3. $R = \frac{S.I \times 100}{P \times T}$
4. $T = \frac{S.I \times 100}{P \times R}$
5. $A = P + I = P + \frac{P \times R \times T}{100}$
6. If a sum of money becomes x in T years at simple interest, the rate of interest is given by $\frac{100 \times (x-1)}{T}\%$.

7. A sum of Rs. x is lent out in parts in such a way that the interest on 1st part at $R_1\%$ for T_1 years ,the interest on second part at $R_2\%$ for T_2 years and so on, are equal, the ration in which the sum was divided in parts is given by $\frac{1}{R_1T_1} : \frac{1}{R_2T_2} : ..... \frac{1}{R_nT_n}$.

8. If the rate percent is given half-yearly or quarterly then to find the rate percent per annum multiply by 2 or 4 respectively.

9. In counting the number of days between the two given dates, the either day(first or last) is exclude. It is important to note that interest is not charged for the day on which money is borrowed but it is charged for the day it is returned.

SOLVED EXAMPLES

EX-1. 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 -

Sol.1 According to given problem -

R = 12% , S.I. = 5400 Rs. ,T = 3 years

$$\text{Principal} \quad (P) = \frac{S.I \times 100}{R \times T}$$

$$P = \frac{5400 \times 100}{12 \times 3}$$

$$P = 15{,}000 \text{ Rs.}$$

EX-2. The price of a T.V set worth Rs. 20,000 is to be paid in 20 installments of Rs. 1000 each. If the rate of interest be 6% per annum, and the first installments be paid at the time of purchase, then the value of the last installments covering the interest as well will be

Sol.2 According to given problem -

Money paid in cash = 1000 Rs.

Balance amount = (20000 - 1000) Rs.

= 19000 Rs.

EX-3 A money lender charged Rs. 25 as a simple interest on a loan of Rs. 150 for 2 months. What was the rate % per annum?

Sol.3 According to given problem-

P= 150 Rs. ,T = 2 moths = $\frac{2}{12}=\frac{1}{6}$ year , S.I. = 25 Rs.

$\therefore$ R = $\frac{S.I\times 100}{P\times T}$

$\therefore R=\frac{25\times 100}{150\times\frac{1}{6}}$

$\therefore$ 25 × 100 × 6 = 150 × R

$\therefore R=\frac{25\times 100\times 6}{150}$

$\therefore$ R = 100%

EX-4 Rs. 4200 becomes Rs. 5712 in four years at a certain rate of simple interest. If the interest rate is increased by 3%. What would be the amount?

Sol.4 According to given problem-

P= 4200 Rs. ,T = 4 years , A = 5712 Rs.

A = P + S. I.

$A=\left(P+\frac{PRT}{100}\right)$

$P\left(1+\frac{RT}{100}\right)=5712$

$\Rightarrow \quad P\left(1+\frac{RT}{100}\right)=5712$

$\Rightarrow \quad 1+\frac{RT}{100}=\frac{5712}{4200}$

$\Rightarrow \quad \frac{RT}{100}=\frac{5712-4200}{4200}$

$$\Rightarrow \quad R = \frac{1512 \times 100}{4 \times 4200} = \frac{1512}{168} = 9\%$$

Therefore. new amount with 3% more interest (9% + 3%) = 12%

A = S. I. + P

$$A = \left(\frac{4200 \times 12 \times 4}{100}\right) + 4200 = 2016 + 4200 = Rs.6216$$

EX-5 Neetu borrows Rs.800 at the rate of 12% per annum simple interest and Manisha borrows Rs. 910 at the rate of 10% per annum simple interest. In how many years will their amounts of debts be equal?

Sol.5 Assume the required time be x years. Then,

$$800 + 800 \times \frac{12}{100} \times x = 910 + 910 \times \frac{10}{100} \times x$$

$\Rightarrow$ 800 + 96x = 910 + 91x

$\Rightarrow$ 96x – 91x = 100

$\Rightarrow$ 5x = 110

$$\therefore \quad x = \frac{110}{5} = 22$$

Therefore, required time = 22 years.

2. COMPOUND INTEREST

When money us borrowed on simple interest then the interest is calculated uniformly on the original principal throughout the loan period. Under this method, 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 interest accrued during the first unit of time is added to the original principal and the amount so obtained is taken as the Principal for the second unit of time. The amount of this principal at the end of second unit of time becomes the principal for the third unit of time ans so on. After a certain specified period, the difference between the amount and the money borrowed is called the compound interest (C.I.) for that period.

- **Useful formulae to remember**

1. If P is the original principal, R is the rate of interest per annum, T is the number of years, of which the money is lent and A is the final amount, then

$$A = P\left(1+\frac{R}{100}\right)^{T}$$ and C.I. = A – P

2. When interest is compounded half-yearly, then $A = P\left(1+\frac{(R/2)}{100}\right)^{2T}$

3. When interest is compound quarterly, then $A = P\left(1+\frac{(R/4)}{100}\right)^{4T}$

4. When time is a fraction of a year, say $4\frac{2}{3}$ years, then

$$A = P\left(1+\frac{R}{100}\right)^{4}\times\left(1+\frac{2/3R}{100}\right)$$

5. When rate are different for different year, say R_1%, R_2%, R_3% for 1st, 2nd and 3rd year respectively Then, $A = P\left(1+\frac{R_1}{100}\right)\times\left(1+\frac{R_2}{100}\right)\times\left(1+\frac{R_3}{100}\right)$

6. If a certain sum becomes m times in t years, then rate of compound interest R is equal to 100 $[(m)^{1/t}-1]$.

7. If the difference between simple interest and compound interest on a certain sum of money for 2 years at R% per annum is D. Then the sum (Principal) $P = \left(\frac{100}{R}\right)^{2}\times D.$

8. If a sum A becomes B in T_1 years at a compound rate of interest, then after T_2 years the sum becomes $\frac{(B)^{\frac{T_2}{T_1}}}{A^{\frac{T_2}{T_1}}}$ rupees.

9. The fixed unit of time is known as conversion period.

10. The compound interest is calculated annually in general unless some other period is clearly otherwise mentioned.

SOLVED EXAMPLES

Ex.1 What would be the compound interest obtained on an amount of Rs. 12000 at the rate of 9 percent per annum for Rs.3 years? (Round off two digits after decimal).

Sol.1 Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]=12000\left[\left(1+\frac{9}{100}\right)^{3}-1\right]$

$= 12000\left[\left(\frac{109}{100}\right)^{3}-1\right]=12000\left[\frac{109\times109\times109-100\times100\times100}{100\times100\times100}\right]$

$= 12000\times\frac{295029}{1000000}=12000\times0.295029=\text{Rs.}3540.35$

Ex.2 The simple interest accrued on an amount of Rs. 19800 at the end of three years is Rs. 7128. What would be the compound interest accrued on the same amount at the same rate in the same period?

Sol.2 Rate = $\frac{\text{Interest}\times100}{P\times T}=\frac{7128\times100}{19800\times3}=12$

Compound interest = $P\left[\left(1+\frac{R}{100}\right)^{T}-1\right]$

$= 19800\left[\left(1+\frac{12}{100}\right)^{3}-1\right]=19800\left[\frac{112\times112\times112-100\times100\times100}{100\times100\times100}\right]$

= 19800 × 0.4050 = Rs. 8019

Therefore, required compound interest = 8019.

Ex.3 The difference between compound interest and simple interest on a certain sum at 8% per annum for 2 years is Rs. 480. What is the sum?

Sol.3 Given that the difference between simple interest and compound interest on a certain sum of money for 2 years at 8% per annum is 480.

Then the sum (Principal) $P = \left(\frac{100}{R}\right)^2 \times D.$

$$P = \left(\frac{100}{8}\right)^2 \times 480$$

P = 75,000 Rs.

3. PROFIT & LOSS

- **Important facts about profit and Loss**

1. **Cost Price (C.P):** The price at which an article is bought is called its cost price.
2. **Selling price (S.P):** The price at which an article is sold is called its selling price.
3. Profit or Gain = (S.P.)-(C.P)
4. Loss = (C.P.) - (S.P.)
5. Gain%= $\left(\frac{\text{Gain} \times 100}{\text{C.P.}}\right)$
6. LOSS% = $\left(\frac{\text{Loss} \times 100}{\text{C.P}}\right)$
7. S.P. = $\left(\frac{100 + \text{Gain\%}}{100} \times \text{C.P.}\right)$
8. S.P. = $\left(\frac{100 - \text{Loss\%}}{100} \times \text{C.P.}\right)$

9. C.P. = $\left(\frac{100}{100+\text{Gain\%}}\times \text{S.P.}\right)$

10. C.P. = $\left(\frac{100}{100-\text{Loss\%}}\times \text{S.P.}\right)$

11. If an article is sold at a gain of 30%, then S.P. = 130% of C.P.

12. If an article is sold at a loss of 20%, then S.P. = (100-20)% of C.P. = 80% of C.P.

13. List price is called the marked price of the article.

14. Discount is reckoned on the marked price.

15. Dishonest dealer who professes to sell his goods at cost price but uses a weight which is not equal to the required level. Therefore,

Percentage gain of dishonest dealer = $\left[\frac{\text{Error}}{\text{True Value}-\text{Error}}\times 100\right]\%$

16. If X_1 and X_2 both are the rates of gain or both are the rates of loss, then,

C.P. = $\left(\frac{100}{X_1-X_2}\right)\times$ Amount of difference between selling prices.

17. A. dealer purchases a certain number of articles at x a rupee and the same number at y a rupee. He mixes them together and sells them at z a rupee. Then,

Gain of loss % = $\left[\frac{2y}{z(x+y)}-1\right]\times 100$, according to positive or negative sign.

18. If a shopkeeper marks his good at x% above his. C.P. and allows buyers a discount of y% for cash payment. Then,

Gain or loss% = $\left(x-y-\frac{xy}{100}\right)\%$, according to positive or negative sign.

SOLVED EXAMPLES

EX.1 The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price the article should be sold to make 25% profit?

- **Sol.1** According to the question, SP_1 = 1920 Rs. and SP_2 = 1280 Rs.

$$\text{C.P.} = \left(\frac{100}{100+\text{Gain\%}}\times \text{S.P.}\right) = \left(\frac{100}{100-\text{Loss\%}}\times \text{S.P.}\right)$$

$$\text{cost price} = \frac{1920\times 100}{100+x} = \frac{1280\times 100}{(100-x)}$$

$\Rightarrow$ 192 (100–x) = 128 (100 + x)

$\Rightarrow$ 19200 – 192x = 12800 + 128x

$\Rightarrow$ 128x + 192x = 19200 – 12800

$\Rightarrow$ 320x = 6400 $\Rightarrow$ $x = \frac{6400}{320} = 20$

$\therefore$ $\text{cost price} = \frac{1920\times 100}{100+20} = \frac{1920\times 100}{120} = \text{Rs.}1600$

$$\text{S.P.} = \left(\frac{100+\text{Gain\%}}{100}\times \text{C.P.}\right)$$

Required selling price (S.P.) = $\left(\frac{100+25}{100}\times 1600\right)$ = Rs. 2000.

EX.2 Narendra sells a certain article with 25% discount of the marked price and his profit is 25%. If the discount decreases to 10%, then what is the profit percentage?

Sol.2 Let marked price = 100

Then after discount of 25%,

$$\text{Selling price (S.P.)} = \left(\frac{100-\text{Loss\%}}{100}\times \text{C.P.}\right)$$

$$= \left(\frac{100-25}{100}\times 100\right)$$

S.P. = 75

Since, profit is 25%,

$\therefore$ $\text{C.P.} = \left(\frac{100}{100+\text{Gain\%}}\times \text{S.P.}\right)$

$$\text{C.P} = \left(\frac{100}{100+25}\times 75\right) = 60$$

If discount is 10%, then selling price = 90

Now profit percentage = $\frac{90-60}{60}\times 100 = \frac{30}{60}\times 100 = \frac{1}{2}\times 100 = 50\%$

EX.3 A dishonest shopkeeper pretends to sell his goods at cost price but uses false weights and gain $11\frac{1}{9}\%$. What is the actual he uses as pretend to be 1 kg?

Sol.3 Percentage gain of dishonest dealer = $\left[\frac{\text{Error}}{\text{True Value} - \text{Error}}\times 100\right]\%$

Assume the error be x grams. Then,

$$\frac{x}{(1000-x)}\times 100 = \frac{100}{9}$$

$$\Rightarrow \quad \frac{x}{1000-x} = \frac{1}{9}$$

$\Rightarrow$ $9x = 1000 - x$

$\Rightarrow$ $10x = 1000$ $\quad\quad\quad\quad$ $\therefore$ $x = 100$ grams

Actual weight used = (1000 – 100) grams = 900 gram.

4. ALLIGATION OR MIXTURE

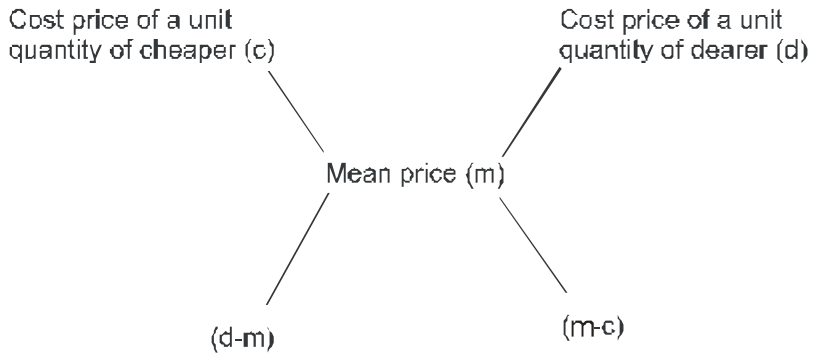
Alligation: It is the rule that enables us to find the proportion in which two or more ingredients at the given price must be mixed to produce a mixture at a given price.

Cost price of unit quantity of the mixture is called the Mean Price.

Rule of Alligation: If two ingredients are mixed in a ratio, then

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{\text{Cost price of dearer} - \text{Mean price}}{\text{Mean price} - \text{Cost price of cheaper}}$$

We represent it as follows:



Cheaper quantity: dearer quantity = (d – m): (m -c)

Important facts: From a container having x units of a liquid, suppose y units are taken out and replaced by water.

After n operations,

Quantity of pure liquid = $\left[x\left(1-\frac{y}{x}\right)^{n} \right]$ units.

SOLVED EXAMPLES

Ex.1 In a mixture of 45 litre, the ratio of milk and water is 1: 4. If 3 litre of milk is added and resulting solution drained in such a way that 12 litre of water goes off, what is the net quantity of the remaining solution?

Sol. Given, Milk = $\frac{1}{5}\times 45 = 9$ litre

Water = $\frac{4}{5}\times 45 = 36$ litre

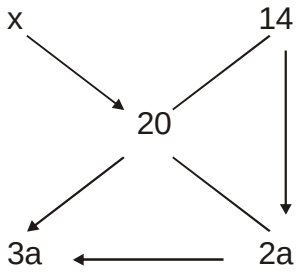
After adding of 3 litre milk, the ration of milk and water = 12 : 36 = 1 : 3.

If 12 litre of water is removed then 4 litre of milk will be also removed. Here total mixture is 48 litre and after removing the milk (4 litre) and water (12 litre), the remaining quantity of mixture is 32 litre.

Ex.2 Rice is mixed in the ratio 2 : 3 and sold at Rs. 22 per kilogram, resulting in a profit of 10%. If the smaller quantity be Rs. 14 per kilogram, then what is the cost per kilogram of the larger quantity?

Sol.2 Cost price of the mixture per kilogram = $\frac{22\times100}{110} = \text{Rs.}20$

Assume cost price of the larger quantity per kilogram be x.



$\frac{x-20}{20-14} = \frac{2a}{3a}$ $\Rightarrow$ $\frac{x-20}{6} = \frac{2}{3}$

$\Rightarrow 3x - 60 = 12$ $\Rightarrow 3x = 72$

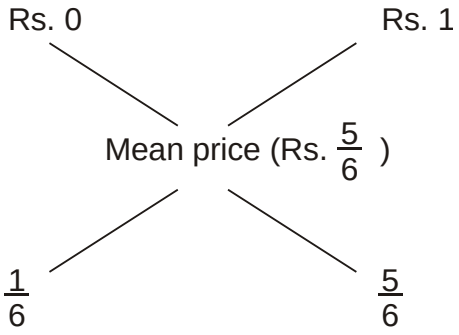
$\therefore \quad x = \frac{72}{3} = \text{Rs.}24$

Ex.3 In what proportion must water be added to spirit to gain 20% by selling it at the cost price?

Sol.3 Assume the cost price be Rs. 1 per litre ?

Selling price of 1 litre of mixture = Rs.1, gain = 20%

Cost price of 1 litre of mixture = $\frac{100}{120}\times1= \text{Rs.}\frac{5}{6}$



Therefore, required ratio of water and spirit = $\frac{1}{6}:\frac{5}{6} = 1:5$