11. PROFIT AND LOSS

IMPORTANT FACTS

Cost Price : The price at which an article is purchased, is called its ***cost price***, abbreviated as ***C.P.***

Selling Price : The price at which an article is sold, is called its ***selling price***, abbreviated as ***S.P.***

Profit or Gain : If S.P. is greater than C.P., the seller is said to have a ***profit*** or ***gain***.

Loss : If S.P. is less than C.P., the seller is said to have incurred a ***loss***.

FORMULAE

1. Gain = (S.P.) − (C.P.)
2. Loss = (C.P.) − (S.P.)
3. Loss or gain is always reckoned on C.P.
4. $\text{Gain\%} = \left(\frac{\text{Gain} \times 100}{\text{C.P.}}\right)$
5. $\text{Loss\%} = \left(\frac{\text{Loss} \times 100}{\text{C.P.}}\right)$
6. $\text{S.P.} = \frac{(100 + \text{Gain\%})}{100} \times \text{C.P.}$
7. $\text{S.P.} = \frac{(100 - \text{Loss\%})}{100} \times \text{C.P.}$
8. $\text{C.P.} = \frac{100}{(100 + \text{Gain\%})} \times \text{S.P.}$
9. $\text{C.P.} = \frac{100}{(100 - \text{Loss\%})} \times \text{S.P.}$
10. If an article is sold at a gain of say, 35%, then S.P. = 135% of C.P.
11. If an article is sold at a loss of say, 35%, then S.P. = 65% of C.P.
12. When a person sells two similar items, one at a gain of say, x%, and the other at a loss of x%, then the seller always incurs a loss given by :

$$\text{Loss\%} = \left(\frac{\text{Common Loss and Gain\%}}{10}\right)^2 = \left(\frac{x}{10}\right)^2.$$

13. If a trader professes to sell his goods at cost price, but uses false weights, then

$$\text{Gain\%} = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100\right]\%.$$

SOLVED EXAMPLES

Ex. 1. ***A man buys an article for Rs. 27.50 and sells it for Rs. 28.60. Find his gain percent.***

Sol. C.P. = Rs. 27.50, S.P. = Rs. 28.60.

So, Gain = Rs. (28.60 − 27.50) = Rs. 1.10.

$\therefore$ $\text{Gain\%} = \left(\frac{1.10}{27.50} \times 100\right)\% = 4\%$.

Ex. 2. *If a radio is purchased for Rs. 490 and sold for Rs. 465.50, find the loss percent.*

Sol. C.P. = Rs. 490, S.P. = Rs. 465.50.

Loss = Rs. (490 − 465.50) = Rs. 24.50.

$$\therefore \quad \text{Loss}\% = \left(\frac{24.50}{490} \times 100\right)\% = 5\%.$$

Ex. 3. *Find S.P., when*

(i) C.P. = Rs. 56.25, Gain = 20% *(ii) C.P. = Rs. 80.40, Loss = 5%*

Sol. *(i)* S.P = 120% of Rs. 56.25 = Rs. $\left(\frac{120}{100} \times 56.25\right)$ = Rs. 67.50.

(ii) S.P. = 85% of Rs. 80.40 = Rs. $\left(\frac{85}{100} \times 80.40\right)$ = Rs. 68.34.

Ex. 4. *Find C.P., when*

(i) S.P. = Rs. 40.60, Gain = 16% *(ii) S.P. = Rs. 51.70, Loss = 12%*

Sol. *(i)* C.P. = Rs. $\left(\frac{100}{116} \times 40.60\right)$ = Rs. 35.

(ii) C.P. = Rs. $\left(\frac{100}{88} \times 51.70\right)$ = Rs. 58.75.

Ex. 5. *A person incurs 5% loss by selling a watch for Rs. 1140. At what price should the watch be sold to earn 5% profit ?* (R.R.B. 2002)

Sol. Let the new S.P. be Rs. x. Then,

(100 − loss%) : (1st S.P.) = (100 + gain%) : (2nd S.P.)

$$\Rightarrow \quad \left(\frac{100-5}{1140}\right) = \left(\frac{100+5}{x}\right) \Rightarrow x = \left(\frac{105 \times 1140}{95}\right) = 1260.$$

$\therefore$ New S.P. = Rs. 1260.

Ex. 6. *A book was sold for Rs. 27.50 with a profit of 10%. If it were sold for Rs. 25.75, then what would have been the percentage of profit or loss ?*

(Hotel Management, 2003)

Sol. S.P. = Rs. 27.50, Profit = 10%.

So, C.P. = Rs. $\left(\frac{100}{110} \times 27.50\right)$ = Rs. 25.

When S.P. = Rs. 25.75, profit = Rs. (25.75 − 25) = Re. 0.75.

$$\therefore \quad \text{Profit}\% = \left(\frac{0.75}{25} \times 100\right)\% = 3\%.$$

Ex. 7. *If the cost price is 96% of the selling price, then what is the profit percent?*

Sol. Let S.P. = Rs. 100. Then, C.P. = Rs. 96; Profit = Rs. 4.

$$\therefore \quad \text{Profit}\% = \left(\frac{4}{96} \times 100\right)\% = \frac{25}{6}\% = 4.17\%.$$

Ex. 8. *The C.P. of 21 articles is equal to S.P. of 18 articles. Find the gain or loss percent.*

Sol. Let C.P. of each article be Re. 1.

Then, C.P. of 18 articles = Rs. 18, S.P. of 18 articles = Rs. 21.

$$\therefore \quad \text{Gain}\% = \left(\frac{3}{18} \times 100\right)\% = 16\frac{2}{3}\%.$$

Ex. 9. ***By selling 33 metres of cloth, one gains the selling price of 11 metres. Find the gain percent.*** **(Section Officers', 2001)**

Sol. (S.P. of 33 m) – (C.P. of 33 m) = Gain = S.P. of 11 m.

$\therefore$ S.P. of 22 m = C.P. of 33 m.

Let C.P. of each metre be Re. 1. Then, C.P. of 22 m = Rs. 22, S.P. of 22 m = Rs. 33.

$\therefore$ $\text{Gain}\% = \left(\frac{11}{22} \times 100\right)\% = 50\%.$

Ex. 10. ***A vendor bought bananas at 6 for Rs. 10 and sold them at 4 for Rs. 6. Find his gain or loss percent.***

Sol. Suppose, number of bananas bought = L.C.M. of 6 and 4 = 12.

$\therefore$ C.P. = Rs. $\left(\frac{10}{6} \times 12\right)$ = Rs. 20; S.P. = Rs. $\left(\frac{6}{4} \times 12\right)$ = Rs. 18.

$\therefore$ $\text{Loss}\% = \left(\frac{2}{20} \times 100\right)\% = 10\%.$

Ex. 11. ***A man bought toffees at 3 for a rupee. How many for a rupee must he sell to gain 50% ?***

Sol. C.P. of 3 toffees = Re. 1; S.P. of 3 toffees = 150% of Re. 1 = $\frac{3}{2}$.

For Rs. $\frac{3}{2}$, toffees sold = 3. For Re. 1, toffees sold = $\left(3 \times \frac{2}{3}\right) = 2$.

Ex. 12. ***A grocer purchased 80 kg of sugar at Rs. 13.50 per kg and mixed it with 120 kg sugar at Rs. 16 per kg. At what rate should he sell the mixture to gain 16% ?***

Sol. C.P. of 200 kg of mixture = Rs. (80 × 13.50 + 120 × 16) = Rs. 3000.

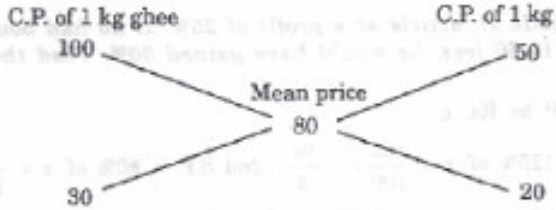
S.P. = 116% of Rs. 3000 = Rs. $\left(\frac{116}{100} \times 3000\right)$ = Rs. 3480.

$\therefore$ Rate of S.P. of the mixture = Rs. $\left(\frac{3480}{200}\right)$ per kg = Rs. 17.40 per kg.

Ex. 13. ***Pure ghee costs Rs. 100 per kg. After adulterating it with vegetable oil costing Rs. 50 per kg, a shopkeeper sells the mixture at the rate of Rs. 96 per kg, thereby making a profit of 20%. In what ratio does he mix the two ?***

Sol. Mean cost price = Rs. $\left(\frac{100}{120} \times 96\right)$ = Rs. 80 per kg.

By the rule of alligation :



$\therefore$ Required ratio = 30 : 20 = 3 : 2.

Ex. 14. ***A dishonest dealer professes to sell his goods at cost price but uses a weight of 960 gms for a kg. weight. Find his gain percent.***

Sol. $\text{Gain}\% = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100\right]\% = \left(\frac{40}{960} \times 100\right)\% = 4\frac{1}{6}\%.$

Ex. 15. ***If the manufacturer gains 10%, the wholesale dealer 15% and the retailer 25%, then find the cost of production of a table, the retail price of which is Rs. 1265?***

Sol. Let the cost of production of the table be Rs. x.

Then, 125% of 115% of 110% of x = 1265

$$\Rightarrow \frac{125}{100}\times\frac{115}{100}\times\frac{110}{100}\times x = 1265 \Rightarrow \frac{253}{160}x = 1265 \Rightarrow x = \left(\frac{1265\times 160}{253}\right) = \text{Rs. } 800.$$

Ex. 16. ***Monika purchased a pressure cooker at $\frac{9}{10}$th of its selling price and sold it at 8% more than its S.P. Find her gain percent.***

Sol. Let the S.P. be Rs. x. Then, C.P. = Rs. $\frac{9x}{10}$, Receipt = 108% of Rs. x = Rs. $\frac{27x}{25}$.

$$\text{Gain} = \text{Rs. } \left(\frac{27x}{25}-\frac{9x}{10}\right) = \text{Rs. } \left(\frac{108x-90x}{100}\right) = \text{Rs. } \frac{18x}{100}.$$

$$\therefore \quad \text{Gain\%} = \left(\frac{18x}{100}\times\frac{10}{9x}\times 100\right)\% = 20\%.$$

Ex. 17. ***An article is sold at a certain price. By selling it at $\frac{2}{3}$ of that price one loses 10%. Find the gain percent at original price.***

Sol. Let the original S.P. be Rs. x. Then, New S.P. = Rs. $\frac{2}{3}x$, Loss = 10%.

$$\text{So, C.P.} = \text{Rs. } \left(\frac{100}{90}\times\frac{2}{3}x\right) = \frac{20x}{27}.$$

$$\text{Now, C.P.} = \text{Rs. } \frac{20x}{27}, \text{ S.P.} = \text{Rs. } x, \text{ Gain} = \text{Rs. } \left(x-\frac{20x}{27}\right) = \text{Rs. } \frac{7x}{27}.$$

$$\therefore \quad \text{Gain\%} = \left(\frac{7x}{27}\times\frac{27}{20x}\times 100\right)\% = 35\%.$$

Ex. 18. ***A tradesman sold an article at a loss of 20%. If the selling price had been increased by Rs. 100, there would have been a gain of 5%. What was the cost price of the article?*** (S.S.C. 2004)

Sol. Let C.P. be Rs. x. Then, (105% of x) − (80% of x) = 100 or 25% of x = 100

$$\therefore \quad \frac{x}{4} = 100 \text{ or } x = 400.$$

So, C.P. = Rs. 400.

Ex. 19. ***A man sells an article at a profit of 25%. If he had bought it at 20% less and sold it for Rs. 10.50 less, he would have gained 30%. Find the cost price of the article.***

Sol. Let the C.P. be Rs. x.

$$\text{1st S.P.} = 125\% \text{ of } x = \frac{125}{100}x = \frac{5x}{4}; \text{ 2nd S.P.} = 80\% \text{ of } x = \frac{80}{100}x = \frac{4x}{5}.$$

$$\text{2nd S.P.} = 130\% \text{ of } \frac{4x}{5} = \left(\frac{130}{100}\times\frac{4x}{5}\right) = \frac{26x}{25}.$$

$$\therefore \quad \frac{5x}{4}-\frac{26x}{25} = 10.50 \Leftrightarrow \frac{21x}{100} = 10.50 \Leftrightarrow x = \left(\frac{10.50\times 100}{21}\right) = 50.$$

Hence, C.P. = Rs. 50.

Ex. 20. ***The price of a jewel, passing through three hands, rises on the whole by 65%. If the first and the second sellers earned 20% and 25% profit respectively, find the percentage profit earned by the third seller.***

Sol. Let the original price of the jewel be Rs. P and let the profit earned by the third seller be x%.

Then, $(100 + x)$% of 125% of 120% of P = 165% of P

$$\Rightarrow \left[\frac{(100+x)}{100}\times\frac{125}{100}\times\frac{120}{100}\times P\right] = \left(\frac{165}{100}\times P\right)$$

$$\Rightarrow (100+x) = \left(\frac{165\times100\times100}{125\times120}\right) = 110 \Rightarrow x = 10\%.$$

Ex. 21. ***A man sold two flats for Rs. 6,75,958 each. On one he gains 16% while on the other he loses 16%. How much does he gain or lose in the whole transaction ?***

Sol. Remember : In such a case, there is always a loss. The selling price is immaterial.

$$\therefore \text{Loss\%} = \left(\frac{\text{Common Loss and Gain\%}}{10}\right)^2 = \left(\frac{16}{10}\right)^2\% = \left(\frac{64}{25}\right)\% = 2.56\%.$$

Ex. 22. ***A dealer sold three-fourth of his articles at a gain of 20% and the remaining at cost price. Find the gain earned by him in the whole transaction.***

Sol. Let C.P. of whole be Rs. x.

C.P. of $\frac{3}{4}$th = Rs. $\frac{3x}{4}$, C.P. of $\frac{1}{4}$th = Rs. $\frac{x}{4}$.

$$\therefore \text{Total S.P.} = \text{Rs.}\left[\left(120\% \text{ of } \frac{3x}{4}\right) + \frac{x}{4}\right] = \text{Rs.}\left(\frac{9x}{10} + \frac{x}{4}\right) = \text{Rs.}\ \frac{23x}{20}.$$

$$\text{Gain} = \text{Rs.}\left(\frac{23x}{20} - x\right) = \text{Rs.}\ \frac{3x}{20}.$$

$$\therefore \text{Gain\%} = \left(\frac{3x}{20}\times\frac{1}{x}\times100\right)\% = 15\%.$$

Ex. 23. ***A man bought a horse and a carriage for Rs. 3000. He sold the horse at a gain of 20% and the carriage at a loss of 10%, thereby gaining 2% on the whole. Find the cost of the horse.*** **(M.B.A. 2002)**

Sol. Let the C.P. of the horse be Rs. x. Then, C.P. of the carriage = Rs. $(3000 - x)$.

$$\therefore 20\% \text{ of } x - 10\% \text{ of } (3000 - x) = 2\% \text{ of } 3000$$

$$\Rightarrow \frac{x}{5} - \frac{(3000-x)}{10} = 60 \Rightarrow 2x - 3000 + x = 600 \Rightarrow 3x = 3600 \Rightarrow x = 1200.$$

Hence, C.P. of the horse = Rs. 1200.

Ex. 24. ***Find the single discount equivalent to a series discount of 20%, 10% and 5%.***

Sol. Let marked price be Rs. 100.

Then, Net S.P. = 95% of 90% of 80% of Rs. 100

$$= \text{Rs.}\left(\frac{95}{100}\times\frac{90}{100}\times\frac{80}{100}\times100\right) = \text{Rs. } 68.40.$$

$$\therefore \text{Required discount} = (100 - 68.40)\% = 31.6\%.$$

Ex. 25. ***After getting two successive discounts, a shirt with a list price of Rs. 150 is available at Rs. 105. If the second discount is 12.5%, find the first discount.***

Sol. Let the first discount be x%.

Then, 87.5% of $(100 - x)$% of 150 = 105

$$\Rightarrow \frac{87.5}{100}\times\frac{(100-x)}{100}\times150 = 105 \Rightarrow 100 - x = \left(\frac{105\times100\times100}{150\times87.5}\right) = 80$$

$$\Rightarrow x = (100 - 80) = 20.$$

$$\therefore \text{First discount} = 20\%.$$

Ex. 26. ***An uneducated retailer marks all his goods at 50% above the cost price and thinking that he will still make 25% profit, offers a discount of 25% on the marked price. What is his actual profit on the sales ?*** (IGNOU, 2003)

Sol. Let C.P. = Rs. 100. Then, marked price = Rs. 150.

S.P. = 75% of Rs. 150 = Rs. 112.50.

$\therefore$ Gain% = 12.50%.

Ex. 27. ***A retailer buys 40 pens at the marked price of 36 pens from a wholesaler. If he sells these pens giving a discount of 1%, what is the profit percent ?*** (S.S.C. 2003)

Sol. Let the marked price of each pen be Re. 1.

Then, C.P. of 40 pens = Rs. 36. S.P. of 40 pens = 99% of Rs. 40 = Rs. 39.60.

$\therefore$ Profit% $= \left(\frac{3.60}{36} \times 100\right)\% = 10\%$.

Ex. 28. ***At what percentage above the C.P. must an article be marked so as to gain 33% after allowing a customer a discount of 5% ?*** (M.B.A. 2003)

Sol. Let C.P. = Rs. 100. Then, S.P. = Rs. 133.

Let marked price be Rs. x.

Then, 95% of $x = 133 \Rightarrow \frac{95}{100}x = 133 \Rightarrow x = \left(133 \times \frac{100}{95}\right) = 140$.

$\therefore$ Marked price = 40% above C.P.

Ex. 29. ***When a producer allows 36% commission on the retail price of his product, he earns a profit of 8.8%. What would be his profit percent if the commission is reduced by 24% ?*** (M.B.A. 2002)

Sol. Let retail price = Rs. 100. Then, commission = Rs. 36.

$\therefore$ S.P. = Rs. (100 − 36) = Rs. 64.

But, profit = 8.8%.

$\therefore$ C.P. = Rs. $\left(\frac{100}{108.8} \times 64\right)$ = Rs. $\frac{1000}{17}$.

Now commission = Rs. 12. New S.P. = Rs. (100 − 12) = Rs. 88.

Gain = Rs. $\left(88 - \frac{1000}{17}\right)$ = Rs. $\frac{496}{17}$.

$\therefore$ Gain% $= \left(\frac{496}{17} \times \frac{17}{1000} \times 100\right)\% = 49.6\%$.

EXERCISE 11A

(OBJECTIVE TYPE QUESTIONS)

Directions : ***Mark (✓) against the correct answer :***

1. I gain 70 paise on Rs. 70. My gain percent is :

   (a) 0.1% (b) 1% (c) 7% (d) 10%

2. In terms of percentage profit, which is the best transaction ? (C.B.I. 2003)

	C.P. (in Rs.)	Profit (in Rs.)
(a)	36	17
(b)	50	24
(c)	40	19
(d)	60	29