Profit and Loss

Theory and Concepts :-

In day- to-day life we sell and purchase the things as per our requirement. A customer can get things in the following manner :

Manufacturer(or producer) $\longrightarrow$ Whole-seller (shopkeeper or sales person) $\longrightarrow$ Retailser $\longrightarrow$ Customer

Terminology

- **Cost Price (C.P.) :** The price at which an article is bought is called its cost price. It is abbreviated as C.P.
- **Selling Price (S.P.) :** The price at which an article is sold is called its selling price. It is abbreviated as S.P.
- **Profit or Gain :** If the selling price of an article is more than the cost price, there is a gain or profit.

  Thus, profit or gain =S.P – C.P. when S.P > C.P.
- **Loss :** If the cost price of an article is greater than the selling price, the seller suffers a loss.

  Thus, Loss = C.P. – S.P., C.P. > S.P.

Important Formulae

(i) Profit = S.P. – C.P.

(ii) Loss = C.P. – S.P.

(iii) Profit Percentage

$$= \frac{\text{Profit}}{\text{C.P.}} \times 100$$

(iv) `Loss percentage

$$= \frac{\text{Loss}}{\text{C.P.}} \times 100$$

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

$$= \left(\frac{100 - \text{loss}\%}{100}, \text{C.P.}\right)$$

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

(v) $= \left(\frac{100}{100 - \text{loss}\%} \times \text{S.P.}\right)$

(vii) S.P. = (100 + x)% of C.P.; when profit = x % of C.P.

(viii) S.P. = (100 – x) % of C.P; when loss = x % of C.P.

Note :- Profit or loss is always calculated on the basis of cost price unless otherwise mentioned in the problem.

Overhead Expenses (or overheads): If an article is purchased for some amount and there are some additional expenses on transportation, labour, commission etc, these are to be added in the cost price. Such expenses are called overheads.

→ We will solve all the problems with the help of ratio . For this some percentage in the form of fraction given below (memorize all of them to speed up your calculation)

$2\% = \frac{1}{50}$

$4\% = \frac{1}{25}$ (×3)

$12\% = \frac{12}{100} = \frac{3}{25}$ (×3)

$36\% = \frac{36}{100} = \frac{9}{25}$

$20\% = \frac{1}{5}$

$6\frac{1}{4}\% = \frac{1}{16}$

$11\frac{1}{9}\% = \frac{1}{9}$

$66\frac{2}{3}\% = \frac{2}{3}$ (×$\frac{1}{2}$)

$33\frac{1}{3}\% = \frac{1}{3}$ (×$\frac{1}{2}$)

$16\frac{2}{3}\% = \frac{1}{6}$ (×$\frac{1}{2}$)

$8\frac{1}{3}\% = \frac{1}{12}$

$14\frac{2}{7}\% = \frac{1}{7}$

$12\frac{1}{2}\% = \frac{1}{8}$ (×7) → $87\frac{1}{2}\% = \frac{7}{8}$

(×3) → $37\frac{1}{2}\% = \frac{3}{8}$

$69\frac{3}{13}\% = \frac{9}{13}$

Note :- When we change profit % or loss % in fraction then numerator shows porfit value or loss value respectively and denominator value shows Actual value at which profit % or loss % is calculated. It can be C.P. or S.P.

Examples

(i) If profit is $11\frac{1}{9}\%$ (calculated on C.P.), then

$11\frac{1}{9}\% = \frac{1}{9}$ → Profit

$\frac{1}{9}$ → C.P.

$\Rightarrow$ profit : C.P. = 1 : 9

Since S.P. = C.P. + profit

= 9 + 1 = 10

$\therefore$ CP : SP = 9 : 10

(ii) If loss in $14\frac{2}{7}\%$ calculated on C.P. then

$14\frac{2}{7}\% = \frac{1}{7} \longrightarrow$ Loss
$\longrightarrow$ C.P.

$\Rightarrow$ Loss : C.P. = 1 : 7

$\therefore$ S.P. = C.P. – Loss = 7 – 1 = 6

$\Rightarrow$ S.P. : C.P. 6 : 7

(iii) If profit is $6\frac{1}{4}\%$ calculated on C.P., then

$6\frac{1}{4}\% = \frac{1}{16} \longrightarrow$ Profit
$\longrightarrow$ C.P.

Profit : C.P. C.P. : S.P.

1 : 16 $\Rightarrow$ 16 : 17

(iv) If loss is $6\frac{1}{4}\%$ calculated on C.P., then

$6\frac{1}{4}\% = \frac{1}{16} \longrightarrow$ Loss
$\longrightarrow$ C.P.

Loss : C.P. C.P. : S.P.

1 : 16 $\Rightarrow$ 16 : 15

Note :- While solving the questions we compare (actual) value with the ratio value to find out the required value of answer.

e.g. C.P. = 50 , profit = 20 %, S.P. = ?

Sol. 20 % = $\frac{1}{5} \longrightarrow$ Profit
$\longrightarrow$ C.P.

$\therefore$ S.P. = 5 + 1 = 6

$\Rightarrow$ S.P. : C.P.

6 : 5

$\times 10$ $\times 10$

(60) 50 (given)

or $5 \cong 50$

$\therefore 6 \cong \frac{50}{5} \times 6 = 60$

i.e. S.P. = Rs. 60

Some Useful Shortcut Methods :

1. If a man buys x items for Rs. y and sells z items for Rs. w , then the gain or loss per cent made by him is

$$\left(\frac{xw}{zy} - 1\right) \times 100\%$$

Quantity Price

x — y

z — w

Example :- If 6 oranges are nought for Rs. 5 and sold at 5 for Rs. 6, what is the gain or loss per cent ?

Sol. Quantity Price

6 — 5 (c.p) $5 \times 5 = 25$

5 — 6 (s.p) $6 \times 6 = 36$

$\therefore$ % profit = $\frac{36-25}{25} \times 100 = 44\%$

2. If the cost price of m articles is equal to the selling price of n articles, then

$$\% \text{ gain or loss} = \frac{m-n}{n} \times 100$$

[If m > n, it is % gain and if m<n, it is % loss]

Example :-

If the selling price of 9 articles is equal to the cost price of 12 articles. What is the profit % or loss % ?

Sol. Here, m = 12, n = 9

Θ m > n

$$\therefore \text{ profit \%} = \frac{m-n}{n} \times 100$$

$$= \frac{12-9}{9} \times 100 = \frac{1}{3} \times 100 = 33\frac{1}{3}\%$$

3. If 'A' sells an article to 'B' at a gain/loss of m% and 'B' sells it to 'C' at a gain/loss of n%, then the resultant profit/loss percent is given by

$$m + n + \frac{mn}{100} \quad \text{.....(i)}$$

where m or n will be negative, if it indicates a loss, otherwise it will be positive.

Note :- The expression given by (i) represents resultant profit or loss accordingly as it can be positive or negative.

4. When two different articles are sold at the same selling price getting a gain of x % on the first and loss of x % on the second, then the overall % loss is the transaction in given by

$$\left(\frac{x}{10}\right)^2 \%$$

Note:- that in such questions there is always a loss.

5. A merchant uses faulty measure and sells his goods at a gain/loss of x %. The overall percent gain/loss is given by

$$\frac{100+g}{100+x} = \frac{\text{True measure}}{\text{Faulty measure}}$$

Note :- If the merchant sells his goods at cost price, then $x = 0$

6. If the price of an item is increased by x %, then the consumption should be decreased by $\left(\frac{x}{100+x}\right)\%$

So that expenditure remains same.

7. If the price of an item is decreased by x %, then the consumtion should be increased by $\left(\frac{x}{100-x}\right)\%$ so that expenditure remains same.

8. If a shopkeeper do x % cheating at the time of selling. Or In other word, A shopkeeper gains x % while buying the goods and y% while selling them, then his total profit %

$$= \left(x + y + \frac{xy}{100}\right)\%$$

Examples

1. The cost price of 36 books is equal to the selling price of 30 books. The gain percent is:

(a) 20% (b) $16\frac{4}{6}\%$

(c) 18% (d) $82\frac{2}{6}\%$

Sol. (a) Given :

36 C.P = 30 S.P

$$\frac{CP}{SP} = \frac{30}{36} = \frac{5}{6} \Rightarrow 1 \text{ (Profit)}$$

$$\text{Profit\%} = \frac{\text{profit}}{C.P} \times 100$$

$$= \frac{1}{5} \times 100 = 20\%$$

2. The cost price of 15 articles is same as the selling price of 10 articles. The profit percent is :

(a) 30% (b) 40%

(c) 50% (d) 45%

Sol. (c) Given

15C.P = 10 S.P

$$\frac{CP}{SP} = \frac{10}{15} = \frac{2}{3} \Rightarrow 1 \text{ (Profit)}$$

$$\text{Profit\%} = \frac{1}{2} \times 100 = 50\%$$

3. The selling price of 5 articles is the same as the cost price of 3 articles. The gain or loss percent is:

(a) 20% gain (b) 25% gain

(c) 33.33% loss (d) 40% loss

Sol. (d) S.P of 5 article = C.P of 3 article

$$\frac{S.P}{C.P} = \frac{3}{5}$$

$\therefore$ Loss = 5 – 3 = 2

$$\text{Loss} = \frac{2}{5} \times 100 = 40\%$$

4. If 3 toys are sold at the cost price of 4 toys of the same kind, the profit will be:

(a) 25% (b) $33\frac{1}{3}\%$

(c) $66\frac{2}{3}\%$ (d) 50%

Sol. (b) According to question,

3 S.P = 4 C.P

$$\frac{S.P}{C.P} = \frac{4}{3} \Rightarrow 1 \text{ gain}$$

$$\text{gain\%} = \frac{\text{Gain}}{C.P} \times 100$$

$$= \frac{1}{3} \times 100 = 33\frac{1}{3}\%$$

5. If the cost price of 15 tables is equal to selling price of 20 tables. The loss percent is :

(a) 20% (b) 30%

(c) 25% (d) 37.5%

Sol. (c) According to question,

15 C.P = 20 S.P

$$\frac{C.P}{S.P} = \frac{20}{15} \Rightarrow 5 \text{ units loss}$$

$$\therefore \text{ Loss\%} = \frac{5}{20} \times 100 = 25\%$$

6. The cost price of 18 articles is equal to the selling price of 15 articles. The gain percent is :

(a) 15% (b) 20%

(c) 25% (d) 18%

Sol. (b) According to question,

18 C.P = 15 S.P

$$\frac{C.P}{S.P} = \frac{15}{18} \Rightarrow 3 \text{ units profit}$$

$$\text{Profit\%} = \frac{3}{15} \times 100 = 20\% \text{ profit}$$

7. The ratio of cost price and selling price is 5 : 4 the loss percent is :

(a) 20% (b) 25%

(c) 40% (d) 50%

Sol. (a) According to question,

$$\frac{C.P}{S.P} = \frac{5}{4} \Rightarrow 1 \text{ unit loss}$$

$$\text{loss\%} = \frac{1}{5} = 20\% \text{ loss}$$

8. The ratio of the C.P and S.P of an article is 20 : 21. What is the gain percent ?

(a) 5% (b) 5.5%

(c) 6% (d) 6.25%

Sol. (a) According to question,

$$\frac{C.P}{S.P} = \frac{20}{21} \Rightarrow 1 \text{ unit profit}$$

$$\text{profit\%} = \frac{1}{20} \times 100 = 5\%$$

9. If selling price of an article is $\frac{8}{5}$ times of its cost price, the profit percent on it is :

(a) 120% (b) 160%

(c) 40% (d) 60%

Sol. (d) According to question,

$$S.P = \frac{8}{5} \times C.P$$

$$\frac{S.P}{C.P} = \frac{8}{5} \Rightarrow 3 \text{ gain}$$

$\therefore$ gain% = $\frac{3}{5} \times 100 = 60\%$

10. If the cost price of 10 articles is equal to the selling price of 9 articles, the gain or loss percent is

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

(b) $7\frac{6}{11}\%$ profit

(c) $11\frac{1}{9}\%$ of loss

(d) $1\frac{12}{13}\%$ loss

Sol. (a) According to question,

10 C.P = 9 S.P

$$\frac{C.P}{S.P} = \frac{9}{10} \Rightarrow 1 \text{ profit}$$

$$\text{Profit\%} = \frac{1}{9} \times 100 = 11\frac{1}{9}\%$$

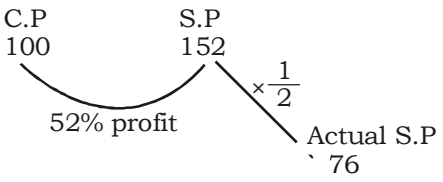
11. In selling an article for ` 76, there is a profit of 52%. If it is sold for ` 75, the profit percent will be

(a) 44 (b) 46

(c) 48 (d) 50

Sol. (d) According to question,

Let the CP = 100



152 units ® ` 76

1 unit ® $\frac{76}{152}$ Þ $=\frac{1}{2}$

100 units ® $\frac{1}{2} \times 100 = 50$

C.P ® ` 50

\ If SP ® ` 75

$$\text{Profit\%} = \frac{25}{50} \times 100 = 50\%$$

12. The cost price of 8 articles is equal to the selling price of 9 articles. The profit or loss per cent in the transaction is

(a) $12\frac{1}{2}\%$ loss (b) $12\frac{1}{2}\%$ profit

(c) $11\frac{1}{9}\%$ loss (d) None of these

Sol. (c) According to question,

8 C.P = 9 S.P

$$\frac{C.P}{S.P} = \frac{9}{8} \Rightarrow 1 \text{ loss}$$

$$\text{Loss\%} = \frac{1}{9} \times 100 \text{ Þ } 11\frac{1}{9}\%$$

13. A coconut merchant finds that the cost price of 2750 coconut is the same as the selling price of 2500 coconuts. His loss or gain will be

(a) 5% (b) 10% gain

(c) 15% loss (d) 20% gain

Sol. (b) According to question,

2750 C.P = 2500 S.P

$$\frac{C.P}{S.P} = \frac{2500}{2750} = \frac{10}{11} \Rightarrow 1 \text{ profit}$$

$$\text{Profit\%} = \frac{1}{10} \times 100 \text{ Þ } 10\% \text{ gain}$$

14. The cost price : selling price of an article is a : b. If b is 200% of a then the percentage of profit on cost price is

(a) 75% (b) 125%

(c) 100% (d) 200%

Sol. (c) CP : SP

a : b

According to question,

b = 200% of a

$$b = \frac{200}{100} \times a$$

$$\frac{b}{a} = \frac{2}{1}$$

$$\frac{C.P}{S.P} = \frac{a}{b} = \frac{1}{2} \Rightarrow 1 \text{ profit}$$

$$\text{Profit\%} = \frac{1}{1} \times 100 \text{ Þ } 100\%$$

15. If toys are bought at ` 5 each and sold at ` 4.50 each, then the loss is :

(a) 10% (b) 115%

(c) 12% (d) 13%

Sol. (a) According to question,

C.P of toys = ` 5

S.P of toys = ` 4.5

Loss = C.P – S.P = 5 – 4.5 = 0.5

$$\text{Loss\%} = \frac{SP - CP}{CP} \times 100$$

$$\text{Loss\%} = \frac{0.5}{5} \times 100 = 10\%$$

16. A person sells two machines at ` 396 each on one machine he gains 10% and on the other he loss 10%. His profit or loss in the whole transaction is

(a) no gain no loss

(b) 1% loss

(c) 1% profit

(d) 8% profit

Sol. Basic Method :-

According to question

First machine gain = 10%

\ S.P = 110% of C.P

$$396 = \frac{110}{100} \times C.P$$

$$C.P = \frac{396 \times 100}{110} = ` 360$$

For second machine = Loss = 10%

\ S.P = 90% of C.P

$$396 = \frac{90}{100} \times C.P$$

$$C.P = \frac{396 \times 100}{90} = ` 440$$

Total C.P = ` (360 + 440) Þ ` 800

Total S.P = ` (396 + 396) Þ ` 792

Loss = ` 8

$$\text{Loss\%} = \frac{8}{800} \times 100 = 1\% \text{ loss}$$

Alternate:

	Machine(1)		Machine(2)	
C.P	10	×9 = 90	10	×11 = 110
		10% Profit		10% loss
S.P	11	×9 = 99	9	×11 = 99

Total C.P = 90 + 110 = 200

Total S.P = 99 + 99 = 198

Loss = 2

$$\text{Loss\%} = \frac{2}{200} \times 100 = 1\% \text{ loss}$$