

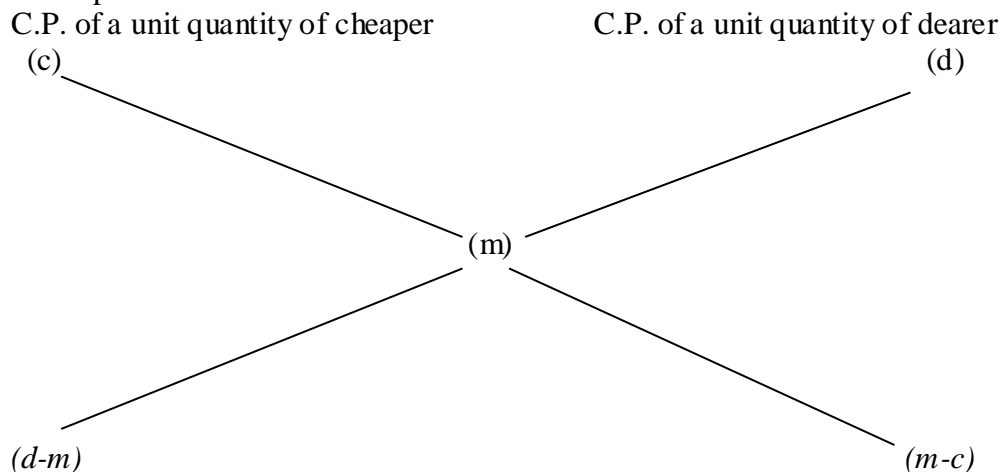
## 20. ALLIGATION OR MIXTURE

## IMPORTANT FACTS AND FORMULAE

1. **Alligation:** It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.
2. **Mean Price:** The cost price of a unit quantity of the mixture is called the mean price.
3. **Rule of Alligation:** If two ingredients are mixed, then

$$\frac{\text{(Quantity of cheaper)}}{\text{(Quantity of dearer)}} = \frac{\text{(C.P. of dearer)} - \text{(Mean price)}}{\text{(Mean price)} - \text{(C.P. of cheaper)}}$$

We present as under:



$$\therefore (\text{Cheaper quantity}) : (\text{Dearer quantity}) = (d - m) : (m - c).$$

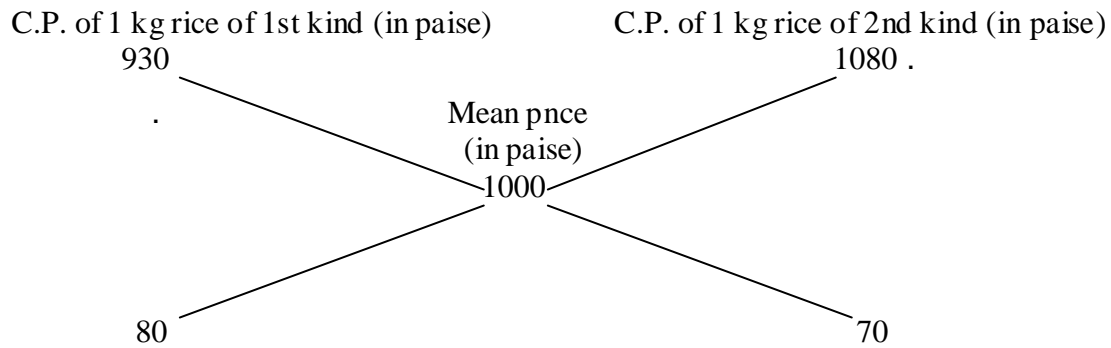
4. Suppose a container contains  $x$  units of liquid from which  $y$  units are taken out and replaced by water. After  $n$  operations the quantity of pure liquid =  $\left[ x(1-y/x)^n \right]$  units.

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## SOLVED EXAMPLES

**Ex. 1.** In what ratio must rice at Rs. 9.30 per kg be mixed with rice at Rs. 10.80 per kg so that the mixture be worth Rs. 10 per kg ?

**Sol.** By the rule of alligation, we have:



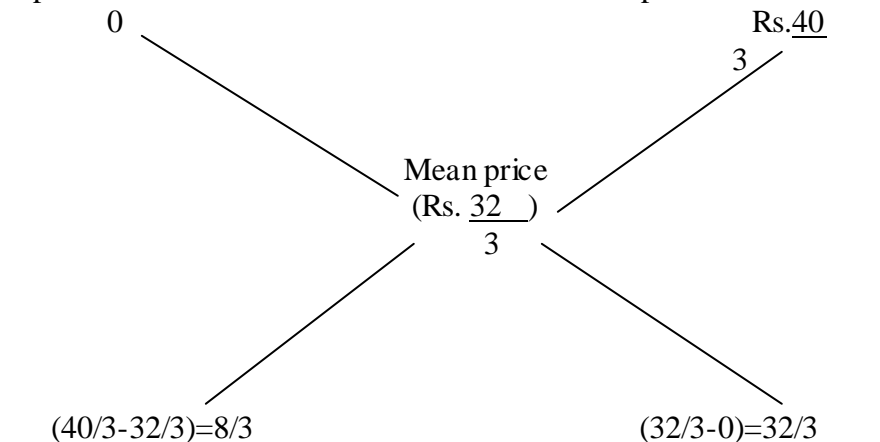
∴ Required ratio = 80 : 70 = 8 : 7.

**Ex. 2.** How much water must be added to 60 litres of milk at  $1\frac{1}{2}$  litres for Rs. 2 So as to have a mixture worth Rs.  $10\frac{2}{3}$  a litre ?

**Sol.** C.P. of 1 litre of milk = Rs.  $(20 \times \frac{2}{3}) = \text{Rs. } \frac{40}{3}$

c.p of 1 litre of milk

c.p of 1 litre of milk



∴ Ratio of water and milk =  $\frac{8}{3} : \frac{32}{3} = 8 : 32 = 1 : 4$

∴ Quantity of water to be added to 60 litres of milk =  $\left[ \frac{1}{4} \times 60 \right]$  litres = 15 litre

**Ex. 3.** In what ratio must water be mixed with milk to gain 20 % by selling the mixture at cost price?

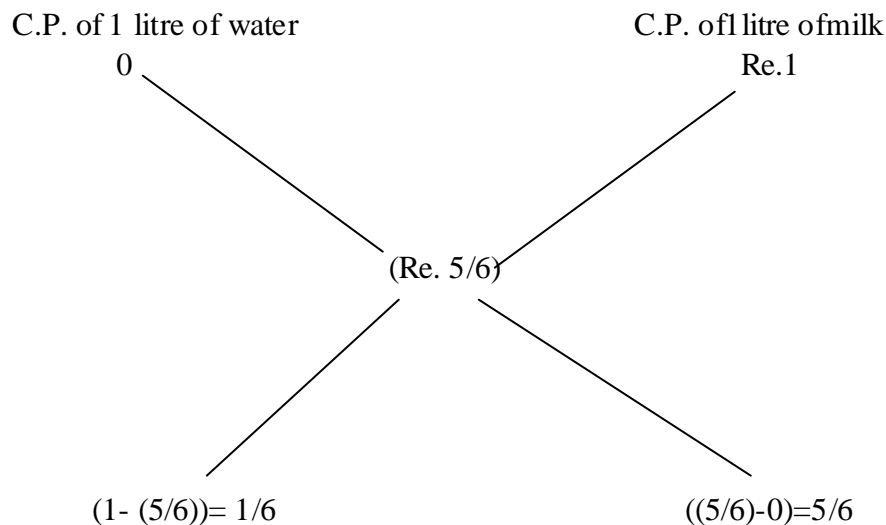
**Sol.** Let C.P. of milk be Re. 1 per litre.

Then, S.P. of 1 litre of mixture = Re. 1.

Gain obtained = 20%.

$$\therefore \text{C.P. of 1 litre of mixture} = \text{Rs.} \left[ (100/120) * 1 \right] = \text{Rs. } 5/6$$

By the rule of alligation, we have:



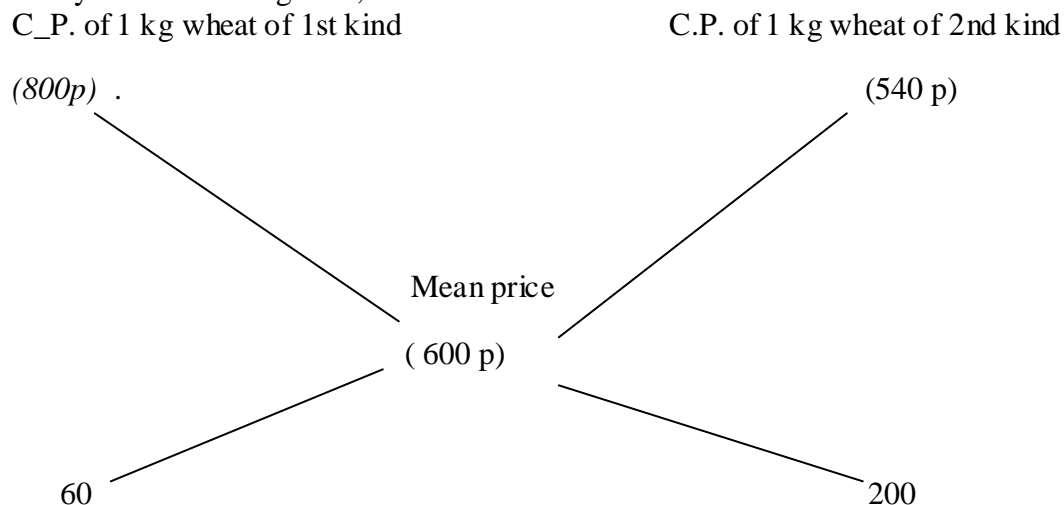
$$\therefore \text{Ratio of water and milk} = 1/6 : 5/6 =$$

**Ex. 4.** *How many kgs. of wheat costing Rs. 8 per kg must be mixed with 86 kg of rice costing Rs. 6.40 per kg so that 20% gain may be obtained by Selling the mixture at Rs. 7.20 per kg ?*

**Sol.** S.P. of 1 kg mixture = Rs. 7.20, Gain = 20%.

$$\therefore \text{C.P. of 1 kg mixture} = \text{Rs.} \left[ (100/120) * 7.20 \right] = \text{Rs. } 6.$$

By the rule of alligation, we have:



Wheat of 1st kind: Wheat of 2nd kind = 60 : 200 = 3 : 10.

Let x kg of wheat of 1st kind be mixed with 36 kg of wheat of 2nd kind.

Then,  $3 : 10 = x : 36$  or  $10x = 3 * 36$  or  $x = 10.8$  kg.

**Ex. 5.** *The milk and water in two vessels A and B are in the ratio 4 : 3 and 2: 3 respectively. In what ratio, the liquids in both the vessels be mixed to obtain a new mixture in vessel C containing half milk and half water?*

**Sol.** Let the C.P. of milk be Re. 1 per litre

Milk in 1 litre mixture of A =  $\frac{4}{7}$  litre; Milk in 1 litre mixture of B =  $\frac{2}{5}$  litre;

Milk in 1 litre mixture of C =  $\frac{1}{2}$  litre

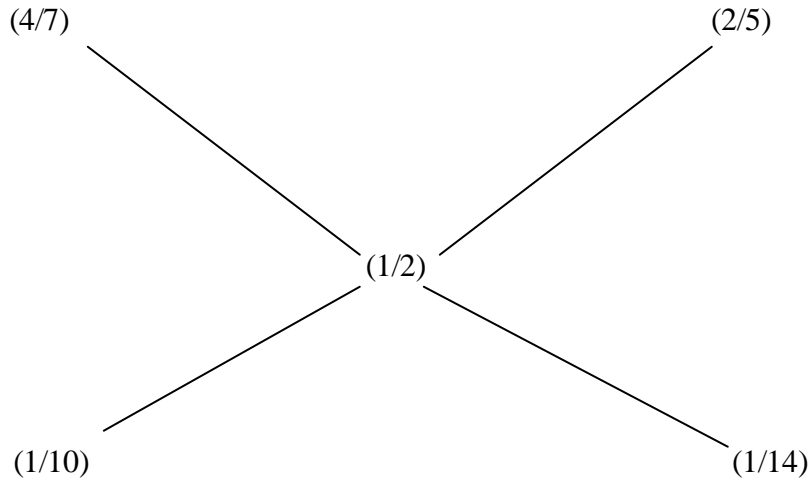
C.P. of 1 litre mixture in A = Re.  $\frac{4}{7}$ ; C.P. of 1 litre mixture in B = Re.  $\frac{2}{5}$

Mean price = Re.  $\frac{1}{2}$

By the rule of alligation, we have:

C.P. of 1 litre mix. in A

C.P. of 1 litre mix. in B



Required ratio =  $\frac{1}{10} : \frac{1}{14} = 7 : 5$