Mixture and Alligation

Simple Mixture: When two different ingredients are mixed together, it is known as a simple mixture.

Compound Mixture: When two or more simple mixtures are mixed together to form another mixture, it is known as a compound mixture.

Alligation: Alligation is nothing but a faster technique of solving problems based on the weighted average situation as applied to the case of two groups being mixed together.

The word 'Alligation' literally means 'linking'.

(Quantity of Cheaper)/(Quantity of Dearer)=(Price of Dearer – Mean Price)/ (Mean Price-Price of Cheaper)

Graphical representation of Alligation Rule:

(Quantiy of a) / (Quantity of b) = (b-d) / (d-a)

Page Contents

- Download RRB JE Study Material
- Mixture and Alligation PDF Download
- Download Exercise Questions with Answer Key Pdf
- Download Quantitative Aptitude Study Material
- Download RRB JE Study Material

Applications of Alligation Rule:

(i)To find the mean value of a mixture when the prices of two or more ingredients, which are mixed together and the proportion in which they are mixed are given.

(ii)To find the proportion in which the ingredients at given prices must be mixed to produce a mixture at a given price.

Price of the Mixture:

When quantities Q_i of ingredients M_i 's with the cost C_i 's are mixed then cost of the mixture C_m is given by $C_m = (\Sigma Ci Qi)/(\Sigma Qi)$

Example 3:

5 kg of rice of `6 per kg is mixed with 4 kg of rice to get a mixture costing `7 per kg. Find the price of the costlier rice.

Solution:

Let the price of the costlier rice be x.

By direct formula,

7= ⇒63-30=4x⇒4x=33 ⇒x=33/4=8.25 $(6\times5+4\times x)/9$

Alligation Rule for Compound Mixture:

Remember that in compound mixture, same mixtures i.e. mixtures of same ingredients are mixed together in different proportion to make a new mixture.

Let Mixture 1 has ingredients A and B in ratio a:b and Mixture 2 has ingredients A and B in ratio x: y.

Now, M unit of mixture I and N unit of mixture 2 are mixed to form compound mixture. Then, in the resultant mixture, the ratio of A and B is

(Quantity of ingredient A) / (Quantity of ingredient B) = qA / qB = (M(a/(a+b)) + N(x/(x+y))) / (M(b/(a+b)) + N(y/(x+y)))) And, Quantity of A in resultant mixture

=qA / (qA+qB) × (M+N)

Quantity of B in resultant mixture

 $=qB / (qA+qB) \times (M+N)$

(ii) When qA and qB are known and M and N have to be found out

(Quantity of mixture 1) / (Quantity of mixture 2)

$$= Q1/Q2 = ((x/(x+y)) - (qA/(qA+qB))) / (qA/(qA+q_B)) - (a/(a+b)))$$

And,

Quantity of mixture 1

= $Q1/(Q1+Q2) \times Quantity$ of resultant mixture

Quantity of mixture 2

=Q2 / (Q1+Q_2) × Quantity of resultant

REMOVAL AND REPLACEMENT

(i)Let a vessel contains Q unit of mixture of ingredients A and B. From this, R unit of mixture is taken out and replaced by an equal amount of ingredient B only.

If this process is repeated n times, then after n operations

(Quantity of A left) / (Quantity of A originally present) = (1-R/Q)n

and Quantity of B left = Q – Quantity of A Left

(ii)Let a vessel contains Q unit of ingredient A only. From this R unit of ingredient A is taken out and replaced by an equal amount of ingredient B.

If this process is repeated n times, then after n operations,

QuantityofAleft=Q(1-R/Q)nQuantity of B = 1 – Quantity of A left

Examples 7:

A dishonest hair dresser uses a mixture having 5 parts pure After shave lotion and 3 parts of pure water. After taking out some portion of the mixture, he adds equal amount of pure water to the remaining portion of the mixture such that the amount of Aftershave lotion and water become equal. The part of the mixture taken out is

Solution:

Let quantity of pure After shave lotion = 5kg

and quantity of pure water = 3 kg

 \therefore Total quantity of the mixture = 8 kg

Again let x kg of mixture is taken out of 8kg of mixture.

Now, the amount of Aftershave lotion left

Now, Aftershave the amount of lotion left (5-5x/8)kg = and the amount of water left (3-3x/8)kg = ∴ The amount of water after adding x kg of water becomes According question, to 5-5x/8 = 3 + 5x/8 $\Rightarrow 10x/8 = 2 \Rightarrow x = 8/5$ \Rightarrow 1/50f the 8 kg mixture is taken out.

If in x liters mixture of A and B, the ratio of A and B is a: b, the quantity of B to be added in order to make the ratio c : d = x(ad-bc)/c(a+b)

If x glasses of equal size are filled with a mixture of milk and water. The ratio of milk and water in each glass are as follows: $a_1:b_1$, $a_2:b_2$, $a_3:b_3...a_x:b_x$

If the content of all the x glasses are emptied into a single large vessel, then proportion of milk and water in it is given by

 $(a1 / (a1+b1) + a2/ (a2+b2) + \cdots + ax / (ax+bx)) : (b1/ (a1+b1) + b2 / (a2+b2) + \cdots + bx / (ax+bx))$

Example 8:

In four vessels each of 20 liters capacity mixture of milk and water is filled. The ratio of milk and water are 2:1, 3:1, 3:2 and 1:1 in the four respective vessels. If alt the four vessels are emptied into a single large vessel, find the proportion of milk and water in the mixture.

Solution:

(2/3 + 3/4 + 3/5 + 1/2): (1/3 + 1/4 + 2/5 + 1/2) = 151/60: 89/60 = 151:89

Example 9:

The ratio of water and milk in a 30 liters mixture is 7:3. Find the quantity of water to be added to the mixture in order to make this ratio 6: 1.

Solution:

In this example the ratio of water: milk is given and water is further added. But in the above formula ratio of A:B is given and quantity B is added. So the formula in this changed scenario becomes:

Quantity	of	В	added	=x(bc-ad)/d(a+b)
		Required		quantity
=30(3×6-	7×1)/1(7+3)			=30(18-7)/(1×10)
$=(30 \times 11)$	/10=33			liters.
A mixture	contains A and E	3 in the ratio	a:b. If x	liters of B is added to the
mixture, A	and B become in	the ratio a: c.	Then the	quantity of A in the mixture

is given by and that of B is given by ax/(c-b) and that of B is given by bx/(c-b)

Example 10:

A mixture contains beer and soda in the ratio of 8:3. On adding 3 liters of soda, the ratio of beer to soda becomes 2:1 (i.e., 8:4). Find the quantity of beer and soda in the is mixture.

Solution:

Quantit	У	of	beer	in	the		mixture
$=(8 \times 3)$	/(4-3)=	=24					liters
and	the	quantity	of	soda	in	the	mixture
$=(3\times3)$	/(4-3)=	=9 liters					

Example 13:

Nine liters are from drawn from a case full of water and it is then filled with milk. Nine liters of mixture are drawn and the cask is again filled with milk. The quantity of water now left in the cask is to that of the milk in it as 16:9, How much does the cask hold?

Solution:

Let there be x liters in the cask.From the above formula we have, after n operations:

(Water left in vessel after n operations) / (Whole quantity of milk in vessel)=((x-y)/x)nThus in this case, ((x-9)/x)2=(16/(16+9))=16/25 $\therefore x = 45$ litres

Example 15:

Three vessels containing mixtures of milk and water are of capacities which are in the ratio 1:2:3. The ratios of milk and water in the three vessels are 4:1, 3:2 and 2:3 respectively. If one-fourth the contents of the first vessel, one-third of that of the second vessel and half of that of the third vessel are mixed; what is the ratio of milk and water in the new mixture?

Solution:

Part of milk in the resultant solution

 $1/4 \times 1/6 \times 4/5 + 1/3 \times 2/6 \times 3/5 + 1/2 \times 3/6 \times 2/5 = 1/5$

Part of water in the resultant solution

 $=1/4 \times 1/6 \times 1/5 + 1/3 \times 2/6 \times 2/5 + 1/2 \times 3/6 \times 3/5 = 73/360$ Ratio of milk-to water =1/5:73/360=72:73

Example 16:

Sea water contains 5 % salt by weight. How many kg of fresh water must be added to 60 kg if sea water for the content of salt in solution to be made 3%.

Solution:

Let x kg of fresh water is added to sea water

q salt / ((q salt + q water)) = (5% of 60) / (60+x) = 3/100(given 3% salt in solution) 3 / ((60+x)) = 3/100 = x = 40 kg