Mixture and Alligation: Concepts, Solved Examples, & Preparation Strategies

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A mixture refers to the mix that is derived as a result of mixing two or more items or substances in a certain ratio or proportion. Usually, mixtures can be made by mixing solids, liquids or gases with other solids, liquids or gases. However, mixture can be also derived by mixing any combination of solids, liquids and gases.

Alligation is a rule that helps us solve the problems related to mixtures. Alligation rule helps in finding out the ratio in which two items or ingredients, having certain cost must be mixed to obtain a final mixture having ingredients in a known ratio.

In this article, we are going to cover the key concepts of Mixture and Alligation along with the various types of questions, and tips and tricks. We have also added a few solved examples, which candidates will find beneficial in their exam preparation. Read the article thoroughly to clear all the doubts regarding the same.

When you've finished with Mixture and Alligation, you can learn about Number Series in depth here!

What is Ratio and Proportion?

Before starting out the article on Mixture and Alligation we must know what is a Ratio and Proportion.

Ratio refers to the quantitative relation between two numbers or amounts or quantities. It shows the number of times one value contains the other value or is contained within the other value. Ratios are used when we require to express one number as the fraction of another. If we have two quantities, say x and y, then the ratio of x to y is calculated as x/y and is written as x:y. The first term of the ratio is called antecedent and the second term is called the consequent.

A proportion simply implies that one ratio is equal to the other. The proportion is signified by double colons. For example, ratio 6:8 is the same as ratio 3:4. This can be written as 6:8::3:4.

Alligation and Alligation Rule

Alligation problems involve application of the weighted average concept of average. You must be already aware that if we have 1, 2, 3, ..., k sets, each containing n1, n2, n3, ...nx elements, and the average of set k is represented by Ak, then the weighted average of all the sets together is calculated as

$Aw = n1\ A1 + n2\ A2 + \ldots\ldots + nk\ Ak / n1 + n2 + \ldots\ldots nk$

mixture. In such cases, the following formula is considered;

Quantity of cheaper ingredient / Quantity of dearer ingredient = Cost of dearer ingredient – Mean Price / Mean Price – Cost price of cheaper ingredient

The price per unit of the final mixture is called mean price or weighted price.

Graphical Solution of Alligation (Cross Method)

We can also solve the alligation problems by using graphical approach instead of doing it with the help of equations. The graphical method will look like a cross that is why it is also known as the cross method.

Types of Question Asked in Mixture and Alligation

Various types of questions are asked from the mixture and alligation, Some of them are as follows.

(a) Mixture of Two Things

In these types of questions we make a mixture of two things.

(b) Two mixtures are mixed to form a new mixture

In these types of questions, two or more mixtures are mixed together and form a new mixture, on which the questions will be asked.

(c) Selling of Mixtures

In these types of questions we make a mixture of two things and sell the resultant mixture.

How to Solve Question Based on Mixture and Alligation – Know all Tips and Tricks

Candidates can find different tips and tricks from below for solving the questions related to mixture and alligation

Tip # 1: In ratio, if both the antecedent and the consequent are multiplied or divided by the same number (except 0) then the ratio will remain the same.

Tip # 2: If a proportion is such as a:x::x:b then x is called the mean proportional or second proportional of a and b. And if a proportion is such that a:b::b:x then x is called the third proportional of a and b.

Tip # 3: Componendo rule: If a/b = c/d then a+b / b = c+d / d

Tip # 4: Dividendo rule: If a/b = c/d then a-b / b = c-d / d

Tip # 5: Componendo & Dividendo rule: If a/b = c/d then a+b / a-b = c+d / c-d

If you've learned Mixture and Alligation, you can move on to Data Interpretation concepts here!

Mixture and Alligation Solved Sample Questions

Question 1: A vessel contains a mixture of P and Q in the ratio of 5 : 3. 16 liters of this mixture is taken out and 5 liters of P is poured in. The new mixture has a ratio of P to Q as 11 : 6. Find the total original quantity of mixture.

Solution: P = 5x, Q = 3x

The quantity of P and Q in 16 liters of the mixture: Quantity of P = (16 × 5x)/8x = 10

Quantity of Q = (16 × 3x)/8x = 6

Now, 5 liters of P poured in and then ratio becomes 11 : 6 (5x – 10 + 5) / (3x – 6) = 11/6

(5x – 5) / (3x – 6) = 11/6

Therefore, x = 12

So total mixture originally = 8x = 8 × 12 = 96 liters

Question 2: The ratio of milk and water in a solution is 20 : 7 and after adding 5 liters of water in it the ratio of milk and water becomes 5 : 3, then find the final amount of water in the final solution.

Solution: Let the initial amount of milk be 20x and of water 7x.

Ratio of milk and water after adding 5 litres = 20x/ (7x + 5) = 5/3

⇒ 60x = 35x + 25

⇒ 25x = 25

⇒ x = 1.

∴ Final amount of water in solution = 7x + 5 = 7 + 5 = 12 litres. Smart approach

Initial ratio of milk and water = 20/7 —(1)

Final ratio of milk and water = 5/3 —(2)

Multiplying equation 2 with 4 (to make amount of milk equal), we get Final ratio of milk and water = 20/12 —(3)

∴ Amount of water in final solution = 12 litres.

Question 3: Two vessels of equal capacity contain juice and water in the ratio of 7 : 2 and 11 : 7 respectively. The mixture of both the vessels is mixed and transferred into a bigger vessel. What is the ratio of juice and water in the

Total capacity of first vessel = 7 + 2 = 9 units

The ratio of juice and water in the second vessel = 11 : 7 —(2)

Total capacity of second vessel = 11 + 7 = 18 units

We will have to equal the total capacity of both vessels, so multiply by 2 in equation (1).

The ratio of juice and water in the first vessel = 14 : 4 —(3)

The ratio of juice and water in the second vessel = 11 : 7 —(4)

Ratio of juice and water in bigger vessel = (14 + 11) : (4 + 7) = 25 : 11

Question 4: A butler stole wine from a butt of Rony which contained 40% of spirit and he replaced what he had stolen with wine containing only 16% spirit. The butt was then 24% strength only. How much of the butt did he steal?

Solution:

Part of 40% of spirit which is use to make 24% spirit = 1/3

Part of 16% of spirit which is use to make 24% spirit = 1 – 1/3 = 2/3

Since 16% of spirit is replaced by the butler after stealing 40% of spirit.

∴ Part of 40% of spirit which is stolen by the Butler = 2/3

Question 5: A shopkeeper mixed low-quality vegetable oil costing Rs. 40 per litre with sunflower refined oil costing Rs. 80 per litre in the ratio of 2 : 3 respectively. If he sold the mixture at Rs. 100 per litre, find his profit percentage.

Solution: Let the total quantity of the mixture be 10 ltr. 10 litres of mixture contains,

⇒ (2/5) × 10 = 4 litres of low quality vegetable oil

⇒ (3/5) × 10 = 6 litres of sunflower refined oil

The cost price of 10 litres mixture = 4 × 40 + 6 × 80 = 160 + 480 = Rs. 640 The cost price of 1 litre mixture = 640/10 = Rs. 64

Profit earned = 100 – 64 = Rs. 36

∴ Profit percentage = (36/64) × 100 = 56.25%

Question 6: A bucket contains 64 liters of petrol. 16 liters of petrol is removed and replaced with kerosene. 16

Here X = Liquid remaining after replacement A = Total quantity of liquid before replacement R = Quantity of replaced liquid

C = Total Capacity

n = No. of times the liquid was replaced

⇒ A = 64, R = 16, C = 64 and n = 2

Putting these values in the formula,

⇒ X = 64 × (1 – 1/4)2

⇒ X = 64 × 9/16

⇒ X = 36 liters

⇒ Amount of petrol present after replacement = 36 liters

∴ Amount of kerosene present after replacement = 64 – 36 = 28 liters

Question 7: A vessel is full of Petrol. 1/4th of the Petrol is taken out and replaced with kerosene oil. If the process is repeated 3 more times, 81 litres of Petrol is finally left in the vessel. Find the capacity of the vessel.

Solution:

We know the formula,

[Petrol left/Total capacity] = [1 – 1/4]4

Since 81 litres of Petrol is finally left in the vessel

⇒ 81/Total capacity = 81/256

∴ Total capacity = 256 L

Question 8: 8L Cold drink was added to a 20L mixture of water and alcohol such that the ratio of alcohol to that of cold drink and water is 1 : 3. Find the amount of alcohol in the solution.

Solution: We have a 20L mixture of alcohol and water.

⇒ A + W = 20————– (1)

Let the cold drink be denoted by C According to question, A : (W + C) = 1 : 3

⇒ A/ (W + 8) = 1/3

From (1) and (2)

$\Rightarrow 4A = 28$

$\Rightarrow A = 7$

Hence 7L of alcohol is present in the mixture.

Exams where Mixture and Alligation is Part of Syllabus

Questions based on Mixture and Alligation come up often in various prestigious government exams some of them are as follows.

- SBI PO, SBI Clerk, IBPS PO, IBPS Clerk
- SSC CGL, SSC CHSL, SSC MTS
- LIC AAO, LIC ADO
- RRB NTPC, RRB ALP
- UPSC
- MPSC
- KPSC
- BPSC
- WBPSC
- Other State Level Recruitment Examinations

We hope you found this article regarding Mixture and Alligation was informative and helpful, and please do not hesitate to contact us for any doubts or queries regarding the same. You can also download the Testbook App, which is absolutely free and start preparing for any government competitive examination by taking the mock tests before the examination to boost your preparation.

If you are checking Mixture and Alligation article, also check the related maths articles in the table below:	
Problems on Ages	Find Roots of Quadratic Equation
Pie Diagram	Differential Calculus
Number Series	Linear Algebra

Mixture and Alligation FAQs

Q.2 What is Ratio and Proportion?

Ans.2 Ratio refers to the quantitative relation between two numbers or amounts or quantities. It shows the number of times one value contains the other value or is contained within the other value. A proportion simply implies that one ratio is equal to the other.

Q.3 How to solve the problem related to Mixture and Alligation?

Ans.3 Tips and tricks to solve the problems related to Mixture and Alligation are given above in the article. Kindly go through the article for the same.

Q.4 Where I will find some of the sample questions related to Mixture and Alligation?

Ans.4 Various example questions along with their solutions are given above in the article. Kindly go through the article for the same.

Q.5 In which exam questions from Mixture and Alligation come up?

Ans.5 Mixture and Alligation comes in various government competitive examinations on a regular basis. The names of such examinations are given above in the article.