Alligation And Mixture

Mixture: Mixing of two or more than two type of quantities gives us a mixture.

Example:

Quantities of these elements can be expressed as percentage or ratio.(20% of sugar in water)

Fraction (A solution of sugar and water such that sugar : water = 1:4)

Alligation : Alligation is a rule which is used to solve the problems related to mixture and its ingredient.

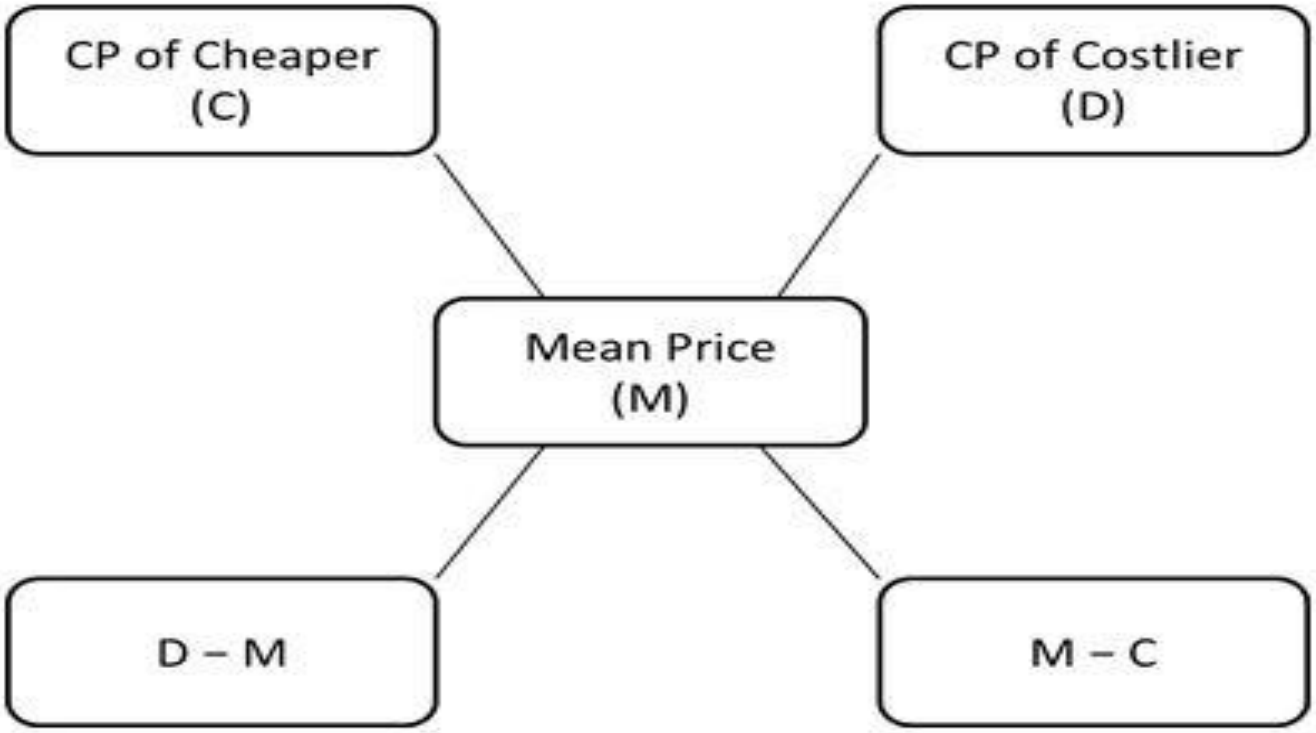
It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of desired price.

Alligation Rule

When two elements are mixed to make a mixture and one of the elements is cheaper and other one is costlier then,

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Costlier}} = \frac{\text{CP of Costlier} - \text{Mean Price}}{\text{Mean Price} - \text{CP of Cheaper}}$$

Diagram Representation



Then,
Cheaper Quantity : Costlier Quantity = (D – M) : (M – C)

Practice Questions

Q1. In what ratio must a grocer mix two varieties of pulses costing Rs. 15 and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 kg?

A.7:3
B.4:5
C.6:4
D.None

Option A

- 15 20

  16.5

  3.5 1.5

35/15=7:3 Ans

Verification

7 * 15 + 3 * 20 = 165 = 10 * 16.5

Q2. How much water be added to 14 litres of milk worth Rs. 5.40 a litre so that the value of the mixture may be Rs. 4.20 a litre ?

A. 7 litres
B. 6 litres
C. 5 litres
D. 4 litres

Option D

W M

0 5.40

4.20

1.2 4.20

So Ratio of Cheaper (Water) / Costlier (Milk) = 1.2/4.2=2/7

W:M

2 : 7 if milk is 14 litres water must be 4 litresAns

Verification

Let total mixture be x litres

Cp per kg of mixture =4.2

x*4.2=14*5.4

X=18

Q3. How many kg of tea worth Rs. 20/kg must be blended with 30 kg of tea worth Rs. 30/kg so that by selling the blended variety at Rs. 30/kg there should be a gain of 25%?

A. 45 kg
B. 40 kg
C. 50 kg
D. None

Option A

% increase 25%=1/4

% decrease = 1/5 so CP of Mixture / Kg = 30-1/5*30=24

Or

SP=125/100 *CP i.e 30=125/100 *CP

so CP of mixture =24

20 30

24

6 4 i.e Quantity of Cheaper/ Quantity of Costlier = 6/4=3/2

So Ans should be 45Kg because 3/2=x/30

Verification

Total mixture 45 Kg + 30 Kg = 75 Kg Total Cp of mixture = 75*24=1800

Total SP of mixture = 75 *30=2250

clearly profit % is 25% as Given

Q4. In what ratio must water be added to spirit to gain 10% by selling it at the cost price?

A. 1 : 11

B. 1 : 5

C. 1 : 10

D. 1 : 9

Option A

% increase=10%=1/10

% decrease = 1/11 Ans

Verification

%decrease=100/11=9.09%

If Cp of 100 l Spirit was Rs100

now he is selling 100-9.09=90.91l for rs 100

So cp of 90.9 l=Rs 90.9

P= 100-90.9=9.1 p%=9.1/90.9 * 100 = 10% as given

Q. In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg and Rs. 65 a kg so that by selling the mixture at Rs. 68.20 a kg he may gain 10%?

A.3:2
B.3:5
C.3:6
D.None

Option A

- SP=110/100 * cp
- 68.2=110/100 * cp cp (mixture)=62/kg

- 60 65

  62

  3 2

Verification

Total CP=3Kg @ 60/kg + 2 kg @65/kg=310 or 5Kg@62=310

Total SP= 5Kg@68.2/kg = 341 clearly 10 % profit

Q. Sea water contains 5% salt by weight. How many kilograms of fresh water must be added to 40kg of sea water for the salt content of the solution to be 2%?

A. 50

B. 60

C. 65

D. 70

Option B

- 40 Kg of sea water salt = 5% of 40 = 2 Kg
- Now for Salt to be 2% i.e 2 with respect to 100

- Add 60 Kg Ans

Q. In a mixture of 60 L, the ratio of milk and water is 2:1, If the rate of milk and water is to be 1:2, then the amount of water to be further added must be ?

A. 12 L

B. 20 L

C. 40 L

D. 60 L

Option D

- 60 L contain M = 40 L and W= 20 L
- now W should be double than M i.e W=80 L
- So ans is 60L

Q. An alcohol water mixture of 729 L is in the ratio 7:2, how much more water is to be added to get a new alcohol and water ratio of 7:3?

A. 81 L

B. 72 L

C. 80 L

D. 78 L

Q. A mixture of certain quantity of juice with 32 liters of water is worth 1.50 per liter. If pure juice is to be worth 4.50 per liter, how much juice is there in the mixture?

A. 18 L

B. 14 L

C. 16 L

D. 20 L

- 16 * 4.5=72
- (16+32)*1.5 is also 72

Q. A mixture of 45 L of spirit and water contains 20% of water in it. How much water must be added to it to make the water 25% in the new mixture?

A. 3 L

B. 4 L

C. 5 L

D. 6 L

Option A

- 45 L contains 9 L water 36 L spirit
- So 9 +3 =12 which is 25% of 45 + 3 =48

Q. One mixture contains 25% milk and other contains 30% milk and the rest water. A jar is filled with 6 parts of first mixture and 4 parts of second mixture. The percentage of milk in the mixture is

A. 23%

B. 67%

C. 27%

D. 16%

Option C

- Mix 1 In 100 parts 25 part milk

  in 6 parts 25/100 * 6 =1.5 part milk

Mix 2 In 100 parts 30 part milk

in 4 parts 30/100 * 4 = 1.2 part milk

So in 10 parts 2.7 part milk

In 100 parts 27 part milk

Q. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is:

A.20%
B.10%
C.11%
D.None

- % increase = 1/n
- % decrease = 1/(n+1)

Q. In what ratio must a person mix three kinds of tea costing Rs.60/kg, Rs.75/kg and Rs.100 /kg so that the resultant mixture when sold at Rs.96/kg yields a profit of 20%?

A. 1 : 2 : 4

B. 3 : 7 : 6

C. 1 : 4 : 2

D. None of these

- Total CP=60*1+ 75 * 4 + 100 * 2= 560
- or
- Total CP=7*80(CP of mixture) = 560
- Total SP= 7 * 96=672 profit is clearly 20 %

Removal and Replacement

If a vessel contains “x” liters of liquid A and if “y” liters be withdrawn and replaced by liquid B, then if “y” liters of the mixture be withdrawn and replaced by liquid B, and the operation is repeated ‘n’ times in all, then :

$$\frac{\text{Quantity of liquid A after } n^{th} \text{ operation}}{\text{Initial quantity of liquid of A}} = \left[\frac{x-y}{x}\right]^n = \left[1-\frac{y}{x}\right]^n$$

$$\mathbf{F.C = I.C(1-y/x)^n}$$

FC= Final concentration

IC= Initial concentration

y = no. of liters replaced

x = Total concentration

n = total number of iterations

Q. A vessel contains 125 litres of wine. 25 litres of wine was taken out of the vessel and replaced by water. Then, 25 litres of mixture was withdrawn and again replaced by water. The operation was repeated for third time. How much wine is now left in the vessel?

A. 49 L

B. 64 L

C. 72 L

D. 56 L

- $125 * (1 – 25 /125)^{3}$

Q A container contains 40 liters of milk. From this container 4 liters of milk was taken out and replaced with water. This process was repeated further three times. How much milk is now contained by the container?

A. 27.36 L

B. 26.24 L

C. 29.36 L

D. 24.36 L

- $40 * (1 – 4 / 40)^{4}$

Q. From a cylindrical can containing milk of 30 liters, 5 liters are drawn and replaced with water. If the same process is repeated for 3 more times, what is the amount of milk left in the cylindrical can?

A. 14.46 L

B. 15.56 L

C. 17 L

D. 20 L

- $30(1 - 5/30)^4$

Thank You!