ALLIGATION AND MIXTURES

Introduction

Weighted Average

It is observed that the average can be calculated only if the weights of all the factors are same. Hence, the weighted average is a more generalized form of average. This can be further understood with the following illustration.

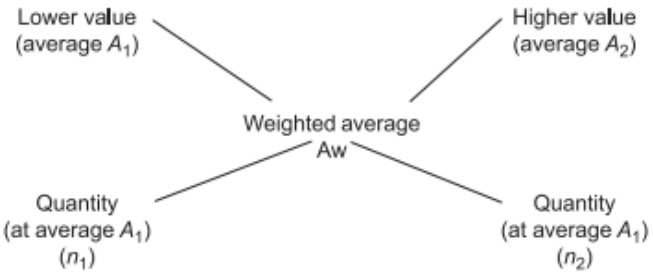
	Class A	Class B
No. of students	10	10
Average age	12 yrs	16 yrs

Now, if we combine both these classes, then the average age of all the students $=\frac{12+16}{2}=\frac{28}{2}=$ 14 years. This is one standard **example** of average.
Let us see another example:

	Class A	Class B
No. of students	10	14
Average age	12 yrs	14 yrs

Now, if we combine these two classes, then the average can not be calculated by the above mentioned method, since the weights attached to different averages are different.

Finding Expression for Weighted Average



And we write this as: $\frac{n_1}{n_2}=\frac{A_2-A_w}{A_{w-A_1}}$

i.e.,

$$\frac{\text{Quantity (Lower priced)}}{\text{Quantity (Higher priced)}}=\frac{\text{Higher price}-\text{Average price}}{\text{Average price}-\text{Lower price}}$$

It is quite obvious that the ratio of the number of persons /items in different groups is proportionate to the deviations of their average from the average of all the people combined. This average of all the members combined is known as weighted average and is denoted by A_w. This process of mixing the two groups is also referred as alligation.

Elements of Weighted Average

As we can see from the above derivation, there are five quantities:

i. Number of members in 1st group (n_1)
ii. Number of members in 2nd group (n_1)
iii. Average of 1st group (A_1)
iv. Average of 2nd group (A_2)
v. Weighted average (A_w)

Normally, in the case of weighted average, we get questions in which one of these five elements is missing, and with the help of the remaining four quantities, the value of that missing quantity is found. Different possibility (situations) are given below **(Y represents – data given, N represents – data not given):**

Sitution	N_1	N_2	A_1	A_2	A_W
First	Y	Y	Y	Y	N
Second	Y	Y	Y	N	Y
Third	Y	Y	N	Y	Y
Fourth	Y	N	Y	Y	Y
Fifith	N	Y	Y	Y	Y
Sixth	N	N	Y	Y	Y

First Situation

Example 7 10 kg of rice priced at Rs.12 per kg is mixed with 6 kg of rice priced at Rs.16 per kg. What is the average price of the whole mixture?

Solution Lower priced value = Rs.12 per kg and its quantity = 10 kg

Higher priced value = Rs.16 per kg and its quantity = 6 kg
Using alligation,

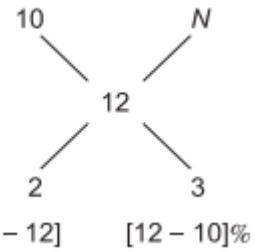
$\frac{10}{6}=\frac{16-A_w}{A_w-12}$, or, A_w = Rs.13.5/kg

However, in my opinion, in this situation, it is better to use the normal method rather than using the weighted average method of finding A_w.
Normal method – Total value = 12 × 10 + 16 × 6 = 216
Hence, average price = 216/16 = Rs.13.5/kg

Second/Third Situation

Example 8 Two varieties of rice are mixed in the ratio 2:3. The price of the mixture is Rs.12 per kg and the price of the variety having lower weight is Rs.10 per kg. Find the price of the other variety.

Solution

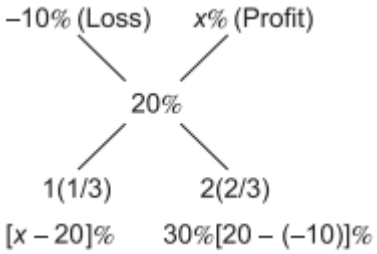


Now, $\frac{2}{3}=\frac{(N-12)}{(12-10)}=\frac{N-12}{2}$
Hence, N = Rs.13.33 per kg

Fourth/Fifth Situation

Example 9 Some articles are purchased for Rs.450. 1/3rd of the articles are sold at a loss of 10%. At what percentage profit should the remaining articles be sold to obtain a net profit of 20% on the whole transaction?

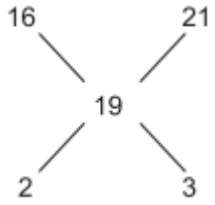
Solution



Now, = [20 – (–10)]/[x – 20] = 2/1
Hence, x = 35%
It is seen that the quantities are in the ratio of 1:2, so the deviation from mean percentage profit in the loss percentage and profit percentage will also be same.
Two corresponds to 30%, and 1 will correspond to 15%.
Hence, x = 35%

Sixth Situation

Example 10 Two di erent qualities of sugar are mixed in some ratio. The price of one quality of sugar is Rs.16/kg and that of another quality is Rs.21/kg. In what ratio have the sugar of two qualities been mixed if the price of the mixture is Rs.19/kg?
Solution



Hence, the ratio of quantity of sugar of di erent qualities = 2:3

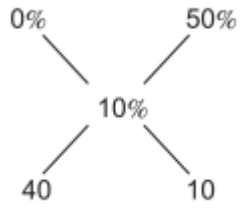
MIXTURES

When two or more than two pure substances/mixtures are mixed in a certain ratio, they create a mixture.

Mixing without Replacement

In this particular type of mixing, two or more than two substances are mixed without any part of any mixture being replaced.
Example 11 In a mixture of 420 L, the ratio of milk and water is 6:1. Now, 120 L of the water is added to the mixture. What is the ratio of milk and water in the final mixture?
Solution Volume of milk = 360 L and volume of water = 60 L.
When 120 L of water is added, volume of water = 180 L
Hence, the ratio of milk water = 2:1
Example 12 A milkman mixes 20 L of water with 80 L of milk. After selling one-fourth of this mixture, he adds water to replenish the quantity that he had sold. What is the current proportion of water to milk?
Solution Ratio of milk and water = 20:80
When one-fourth of this mixture is sold, total volume of mixture will be reduced by 25%, so 25% of milk and water both will reduce. So, volume of milk and water after selling out one-fourth of mixture = 60 L and 15 L, respeffectively. Addition of 25 L, of water will finally give us the following: volume of milk = 60 L and volume of water = 40 L. Hence, the ratio of water and milk is 40:60 = 2:3.

Example 13 How many litres of fresh water should be mixed with 30 L of 50% milk solution so that resultant solution is a 10% milk solution?
Solution
Method 1 Using Alligation



So, the ratio of fresh water added: milk solution = 4:1
Hence, 120 L of fresh water should be added.
Method 2 Principle of constant volume of one component
Since we add fresh water, the volume of milk will be constant.
Now, volume of milk = 15 L = 10% of the new mixture.
So, 100% of the new mixture = 150 L
So, volume of fresh water added = 150 – 30 = 120 L.
Method 3 Principle of inverse proportion
We know that concentration is inversely proportional to the volume of solute added.
So, in this case 30 × 50% = 10% × (30 + x), where x is the volume of water added.
So, x = 120 L
Method 4 Using equation

In the final mixture, $\frac{\text{Milk}}{\text{Total}} = 10\% = \frac{15}{30+X}$
So, x = 120 L

Mixing with replacement

In this particular type of mixing, two or more than two substances are mixed by replacing some part of a mixture. In these types of questions, total volume may or may not be the same and information regarding the same can be obtained from the question.
If V is the initial volume of milk (or any liquid), and x litres of milk is always replaced by water, then quantity of milk left after n such operations
$= V\left(1 - \frac{x}{v}\right)^n$
This formula is very similar to the standard formula we have seen in the case of **compound interest** $\left[P\left(1 + \frac{R}{100}\right)\right]$.
The only difference between the two formulae is that while the interest is being added every year (or for the given time-period), volume of milk gets reduced after every operation.
Using the values of the above example, quantity of milk left after three operations
$= 40 \times \frac{36}{40} \times \frac{36}{40} \times \frac{36}{40} = 19.16$ L
The same problem can be solved with straight-line approach of percentage also Since 10% of existing volume is taken out every time, the percentage of milk in the final mixture after the third operation = 72.9%

$100\% \xrightarrow{10\%\downarrow} 90\% \xrightarrow{10\%\downarrow} 81\% \xrightarrow{10\%\downarrow} 72.9\%$

Since 100% = 40, so 72.9% = 29.16 L

Case II When the quantity withdrawn and the quantity replaced are of the same volume, but the total volume before replacement does not remain the same.
Initially, there are 40 L of milk, and 4 L of milk is taken out and 4 L of water is poured in
So, there will be 36 L of milk and 4 L of water.
Now, 5 L of mixture is taken out and 5 L of water is poured in.
The quantity of milk and water being withdrawn here will be in the ratio of 36:4. So, the quantity of milk withdrawn = $\frac{36}{40} \times 5$
Milk left = $40 \times \frac{36}{40} \times \frac{35}{40}$
Again, if now 6 L of mixture is taken out and 6 L of water is poured in,
Milk left = $40 \times \frac{36}{40} \times \frac{35}{40} \times \frac{34}{40}$
Case III When the quantity withdrawn and the quantity replaced are not of the same volume.
Initially, there are 40 L of milk, and 4 L of milk is taken out and 5 L of water is poured in.
Obviously, there will be 36 L of milk and 5 L of water.
Now, 5 L of mixture is taken out and 6 L of water is poured in then the quantity of milk and water being withdrawn will be in the ratio of 36:5. So, the quantity of milk withdrawn = $\frac{36}{41} \times 5$
Milk left = $40 \times \frac{36}{40} \times \frac{36}{41}$
Again 6 L of mixture is taken out and 7 L of water is poured in.
Therefore, the volume of milk in the final mixture = $40 \times \frac{36}{40} \times \frac{36}{41} \times \frac{36}{42}$

Example 14 Two vessels A and B of equal capacities contain mixtures of milk and water in the ratio 4:1 and 3:1, respeffectively. 25% of the mixture from A is taken out and added to B. After mixing it thoroughly, an equal amount is taken out from B and added back to A. The ratio of milk to water in vessel A after the second operation is:
(a) 79:21 (b) 83:17
(c) 77:23 (d) 81:19
Solution Assume there is 20 L of the mixture in both the vessels.
In vessel A, milk = 16 L and water = 4 L
25% from A to B = milk in B = 15 + 4 = 19 L
= water in B = 5 + 1 = 6 L
ratio = 19:6 Equal amount from vessel B to vessel A

= milk in A = $12 + \frac{19}{5} = \frac{79}{5}$
= water in A = $3 + \frac{6}{5} = \frac{21}{5}$
Hence, the ratio is 79:21

PREVIOUS YEAR QUESTIONS

Q1.
In a mixture of milk and water the proportion of water by weight was 75%. If In the 60 gms mixture 15 gms. water was added, what would be the percentage of water in the new mixture ?
(a)75
(b)88
(c)90
(d)100
(e) None of these

Q2.
Sri Ganesh bought 40kgs of wheat at 12.50 per kg and 25 kgs of it at Rs. 15.10 per kg. He mixed them together. At what rate should he sell the mixture to earn 10% profit ?
(a) Rs. 13.50
(b) Rs. 13.25
(c) Rs. 14.75
(d) Rs. 14.85
(e) None of these

Q3.
Manish bought 25 kg of rice at Rs. 32 per kg and 15 kg of rice at Rs. 36 per kg. What profit did he get when he mixed the two varieties together and sold it at Rs. 40.20 per kg ?
(a)25%
(b)40%
(c)30%
(d)20%
(e) None of these

Q4.
A vessel contains 100 litres mixture of milk and water in the respective ratio of 22:3. 40 liters of the mixture is taken out from the vessel and 4.8 litres of pure milk and pure water each is added to the mixture . By what percentage the quantity of water in the final mixture less then the quantity of milk?
(a)78.5
(b)79.167
(c)72.83
(d)76
(e)77.5

Q5.
There was 120 litres of pure milk in a vessel. Some quantity of milk was taken out and replaced with 23 litres of water in such a way that the resultant ratio between the quantities of milk and water in the mixture was 4:1 respectively. Again 23 litres of the mixture was taken out and replaced with 27 litres of water. What is the respective ratio of milk and water in the resultant mixture ?
(a) 58 : 37
(b) 116 : 69
(c) 69 : 43
(d) 101 : 37
(e) 368 : 227

Q6.
18 litres of pure water was added to a vessel containing 80 litres of pure milk. 49 litres of the resultant mixture was then sold and some more

quantity of pure milk and pure water was added to the vessel in the respective ratio of 2:1. If the resultant respective ratio of milk and water in the vessel was 4:1, what was the quantity of pure milk added in the vessel ? (in litres)

(a)4
(b)8
(c)10
(d)12
(e)2

Q7.

In a vessel, there is a mixture of apple, orange and mango juices in the ratio of 3 : 5 : 4 respectively. A quantity of 12 litres from the mixture is replaced by 8 litres of apple juice. Thereafter the quantities of apple and orange juices in the resultant, mixture become same. Find out the initial quantity of mixture in the vessel.

(a) 76 litres
(b) 65 litres
(c) 60 litres
(d) 80 litres
(e) None of these

Q8.

A vessel contains a mixture of Grapes, Pineapple and Banana juices in the respective ratio of 4:6:5. 15 litres of this mixture is taken out and 8 litres of grape juice and 2 litres of pineapple juice is added to the vessel. If the resultant quantity of grape juice is 10 litres less than the resultant quantity of pineapple juice, what was the initial quantity of mixture in the vessel ? (in litres)

(a)120
(b)150
(c)105
(d)135
(e)90

Q9.

A 20 litre mixture contains milk and water in the respective ratio of 3 : 2. Then 10 litres of the mixture is removed and replaced with pure milk and the operation is repeated once more. At the end of the two removals and replacements, what is the ratio of milk and water in the resultant mixture respectively?

(a) 17 : 3
(b) 9 : 1
(c) 4 : 17
(d) 5 : 3
(e) 3 : 14

Q10.

A jar has 60 litres of milk. From the jar, 12 litres of milk was taken out and replaced by an equal amount of water. If 12 litres of the newly formed mixture is taken out of the jar, what is the final quantity of milk left in the jar?.

(a) 38.4 litres
(b) 40 litres
(c) 36 litres
(d) 28.6 litres
(e) 36.5 litres

Q11.

In 1kg mixture of sand and iron, 20% is iron. How much sand should be added, so that the proportion of iron becomes 5%?

(a) 3 kg
(b) 4 gms
(c) 5 gms
(d) 6 kg
(e) None of these

Q12.

2 The wheat sold by a grocer contained 10% low quality wheat. What quantity of good quality wheat should be added to 150 kgs of wheat , so that the percentage of low quality wheat becomes 5% ?

(a) 150 kgs
(b) 135 kgs
(c) 50 kgs
(d) 85 kgs
(e) None of these

Q13.

A grocer purchased 2 kg. of rice at the rate of Rs. 15 per kg. and 3 kg. of rice at the rate of Rs. 13 per kg. At what price per kg. should he sell the mixture to earn 33-1/3% profit on the cost price ?

(a) Rs 28.00
(b) Rs 20.00
(c) Rs 18.40
(d) Rs 17.40
(e) None of these

Q14.

From a container of milk, 5 litres of milk is replaced with 5 litres of water. This process is repeated again. Thus In two attempts the ratio of milk and water became 81 : 19. The initial amount of milk in the container was

(a) 50 litres
(b) 45 litres
(c) 40 litres
(d) 25 litres
(e) None of these

Q15.

A vessel contains a mixture of milk and water in the respective ratio of 3:1. 32 litres of mixture was taken out and replaced with the same quantity of milk so that the resultant ratio between the quantities of milk and water in the mixture was 4:1 respectively. If 10

litres of mixture is again taken out from the vessel, what is the resultant quantity of water in the mixture? (in litres)

(a)24
(b)30
(c)20
(d)36
(e)32

Q16.

In a vessel there is a certain quantity of mixture of milk and water in the ratio 5 : 1 respectively. 24 litres of mixture is taken out and same quantity of milk is added to the vessel. The ratio of milk and water now becomes 13 : 2 respectively. Again 15 litres of mixture is taken out. What is the quantity of milk in the resulting mixture? (in litres)

(a) 85 litres
(b) 80 litres
(c) 81 litres
(d) 91 litres
(e) None of these

Q17.

A container has 30 litres of water. If 3 litres of water is replaced by 3 litres of spirit and this operation is repeated twice, what will be the quantity of water in the new mixture ?

(a) 24 litres
(b) 23 litres
(c) 24.3 litres
(d) 23.3 litres
(e) None of these

Q18.

A man purchased 35 kg of rice at the rate of Rs. 9.50 per kg and 30 kg at the rate of Rs. 10.50 per kg. He mixed the two. Approximately, at what price (in Rupees) per kg should he sell the mixture to make 35 per cent profit in the transaction?

(a)12
(b)12.5
(c)13
(d)13.5
(e) None of these

Q19.

To M litres of a m% solution of acid, x litres of water is mixed to yield (M - 10)% solution of acid. If m > 25, then x equals

(a) 10m/[m-10]
(b) 5m/[m -10]
(c) 2m/[m-10]
(d) m/[m- 10]
(e) None of these

Q20.

When one litre of water is added to a mixture of acid and water, the new mixture contains 20% acid. When one litre of acid is added to the new mixture, then the resulting mixture contains 33-1/3 % acid. The percent age of acid in the original mixture was

(a)20%
(b)22%
(c)24%
(d)25%
(e) None of these

Q21.

5 Two barrels contain a mixture of ethanol and gasoline. The content of the ethanol is 60% in the first barrel and 30% in the second barrel. In what ratio must the mixtures from the first and the second barrels be taken to form a mixture containing 50% ethanol?

(a) 1 : 2
(b) 2 : 1
(c) 2 : 3
(d) 3 : 2
(e) None of these

Q22.

To x litres of an x % solution of acid y litres of water is added to get (x-10)% solution of acid.If x > 20, then value of y is

(a) 10x.x/100
(b) 10x/[x -10]
(c) 10x/[x+10]
(d) 10x.x/[x-10]
(e) None of these

Q23.

A and B are two alloys of gold and copper prepared by mixing metals in the ratio 7 : 2 and 7:11 respectively. If equal quantities of the alloy are melted to form a third alloy C, the ratio of gold and copper in C will be :

(a) 5 : 7
(b) 5 : 9
(c) 7 : 5
(d) 9 : 5
(e) None of these

Q24.

In two vessels A and B, there is mixture of milk and water. The ratio of milk and water in these vessels is 5:2 and 8 : 5 respectively. In what ratio these mixtures be mixed together so that the ratio of milk and water in the new mixture becomes 9 : 4?

(a) 7 : 2
(b) 2 : 7
(c) 3 : 5
(d) 5 : 3
(e) 7 : 9

Q25.

A merchant has 1000 kg of sugar, part of which he sells at 8% profit and the rest at 18% profit. He gains 14% on the whole. The quantity (in kg.) sold at 18% profit is :

(a)560
(b)600
(c)400
(d)640
(e) None of these

Q26.

Several litres of acid were drawn off a 54 L vessel full of acid and an equal amount of water added. Again, the same volume of the mixture was drawn off and replaced by water. As a result the vessel contained 24 L of pure acid. How much of the acid was drawn off initially?

(a) 12 L
(b) 16 L
(c) 18 L
(d) 24 L
(e) None of these

Q27.

37.85% and 92% alcoholic solutions are mixed to get 35 L of an 89% alcoholic solution. How many litres of each solution are there in the new mixture,?

(a) 10 of the first and 25 of the second
(b) 20 of the first and 15 of the second
(c) 15 of the first and 20 of the second
(d) 25 of first and 10 of second
(e) None of these

Q28.

Three containers, A, B and C are having mixtures of milk and water in the ratio 1 : 5, 3 : 5 and 5 : 7 respectively. If the capacities of the containers are in the ratio 5 : 4 : 5, then find the ratio of the milk to the water, if the mixtures of all the three containers are mixed together

(a) 51 : 115
(b) 52 : 115
(c) 53 : 115
(d) 54 : 115
(e) None of these

Q29.

A chemist has 10 L of a solution that is 10% nitric acid by volume. He wants to dilute the solution to 40% strength by adding water. How many litres of water must be added?

(a) 15 L
(b) 20L
(c) 18 L
(d) 25L
(e) None of these

Q30.

5 L of water is added to a certain quantity of pure milk costing Rs. 3/L. If by selling the mixture at the same price as before, a profit of 20% is made, then what is the amount of pure milk in the mixture?

(a) 20 L
(b) 30 L
(c) 25 L
(d) 35 L
(e) None of these

Q31.

How many kg of sugar costing Rs. 5.75 per kg should be mixed with 75 kg of cheaper sugar costing Rs. 4.50 per kg so that the mixture is worth Rs. 5.50 per kg?

(a) 350 kg
(b) 300 kg
(c) 250 kg
(d) 325 kg
(e) None of these

ANSWERS :

1 e	**2** d	**3** d	**4** b	**5** e	**6** a
7 c	**8** d	**9** b	**10** a	**11** a	**12** a
13 c	**14** a	**15** b	**16** d	**17** c	**18** d
19 a	**20** d	**21** b	**22** b	**23** c	**24** a
25 b	**26** c	**27** d	**28** c	**29** a	**30** c
31 b					

1.(5) In 60 gm. of mixture, Quantity of water
= 60 × 75/100 = 45 gm
Quantity of milk = 15 gm
After mixing 15 gm of more water,
Quantity of water in the new mixture = 45 + 15 = 60 gm
∴ Quantity of water in 75 gm of mixture = 60 gm
∴ 100 gm of mixture will contain
= 60/75 × 100 = 80% of water

2.(4) Total weight of the mixture = 40 + 25 = 65 kg
Total cost price of wheat
= Rs. (40 × 12.50 + 25 × 15.10)
= Rs. (500 + 377.50)
= Rs. 877.50
Total selling price of wheat
= Rs. 877.50 × 110/100
= Rs. 965.25
∴ SP per kg = Rs. 965.25/65
= Rs. 14.85

3.(4) C.P. of 40 kg of mixture
= Rs. (25 × 32) + (15 × 36)
= Rs. 800 + 540
= Rs. 1340
S.P = of 40 kg of mixture
= Rs. (40 × 40.2)
= Rs. 1608
Profit = Rs. (1608 - 1340) = Rs. 268
Profit % = 268/1340 × 100 = 20%

4.(2) Remaining mixture in the vessel = 60 litres
Milk = 22/25 × 60 = 52.8 litres
Water = 7.2 litres
On adding additional milk and water,
Milk = 52.8 + 4.8 = 57.6 litres

Water = 7.2 + 4.8 = 12 litres
∴ Requried percent
= 57.6 – 12/57.6 × 100
= 45.6/57.6 × 100
= 475/6
5.(5) Let x litres of milk was taken out firstly.
∴ (120 - x)/23 = 4/1
= 120 – x = 92
= x =120 – 92 = 28 litres
∴ Quantity of milk
= 120 – 28 = 92 litres
Quantity of water = 23 litres
Case II
In 23 litres of mixture,
Milk = 4/5 × 23 = 92/5 litres
Water = 23/5 litres
∴ Remaining milk
= 92 – 92/5 = (460 - 92)/5
= 368/5 litres
Quantity of water
= 23- 23/5 + 27
= (115 – 23 + 135)/5 = 227/5 litres
∴ Required ratio = 368/5 : 227/5
= 368 : 227
6.(1) In Initial mixture of the vessel,
Milk : Water = 80 : 18 = 40 : 9
In 49 litres of mixture,
Milk = 40 litres
Water = 9 litres
Let 2x litres of milk and x litres of water be added.
Let 2x litres of milk and litres of water be added.
According to the question.
(40 + 2x)/(9 + x) = 4/1
= 36 + 4x = 40 + 2x
= 4x – 2x = 40 – 36
= 2x =4
x = 2 litres
7.(3) Initial quantity of mixture in the vessel = x litres (let)
∴ In the vessel,
Apple Juice = 3x/12 litres
= x/4 litres
Orange juice = 5x / 12 litres
Mango Juice = 4x / 12 = x/3 litres
In 12 litres of mixture,
Apple Juice= 3 litres
Orange juice=5 litres
Mango juice = 4 litres
On adding 8 litres of apple juice,
Apple juice in the vessel
= x/4 – 3 + 8 = (x/4 + 5) litres
According to the question
x/4 + 5 = 5x/12 – 5
= x + 20/4 = (5x – 60)/12
= x + 20 = (5x – 60)/3
= 3x + 60 = 5x – 60
= 5x- 3x = 60 + 60
= 2x = 120
x = 60 litres
8.(4) Total initial quantity of juice in the vessel = 4x+ 6x + 5x =
15x litres
In 15 litres of juice,
Grapes's juice = 4 litres
Pineapple's juice = 6 litres
Banana juice = 5 litres
According to the question,
(6x – 6 + 2) – (4x – 4 + 8) = 10
= 6x – 4 – 4x – 4 = 10
=2x – 8 = 10
= 2x = 10 + 8 = 18
= x = 9
∴ Intial quantity of mixture = 15x
= 15 × 9 = 135 litres
9.(2) In 20 litres of mixture
Milk = 3/5 × 20 = 12 litres
Water = 8 litres
In 10 litres of mixture,
Milk = 6 litres
Water = 4 litres
On adding 10 litres of milk,
Milk = 12 – 6 + 10 = 16 litres
Water = 8 – 4 = 4 litres
Again,in 10 litres of mixture,
Milk =4/5 × 10 = 8 litres
Water = 2 litres
On adding 10 litres of milk,
Milk = 16 – 8 + 10 = 18 litres
Water = 2 litres
Required ratio = 18 : 2
= 9 : 1
10.(1) Remaining quantity of milk
= Initial quantity
= (1 – Quantity taken out/Initial quantity)^n
$60[1(12/60)]^2$
$= 60\ (1 - 1/5)^2 = 60\ (4/5)^2$
= (60 × 4 × 4)/(5 × 5)= 38.4 litres
11.(1) Amount of iron in 1 kg mixture
= 20% of 1000 gms
= 20 × 1000/100 gms
= 200 gms
∴ Amount of sand in mixture
= (1000 - 200) gms
= 800 gms
Now, let the total mixture is x kg in which iron is 20%
∴ According to question,
5% of x = 200 gm
= 5 × x/100 = 200
x = 200 × 100/5 gms
x = 20000/5 gms = 4000 gms
∴ Required answer
= 4000 gms – 1000 gms
= 3000 gms
= 3 kg.
12.(1) Good quality content in150 kgs of wheat = 90% of 150
= 135 kg.
In new mixture, low quality wheat is 5%, so good quality wheat 95%
and 5% of the new mixture = 15 kg
∴ New mixture
= 15 × 100/5 = 300 kg
∴ Good quality of wheat added
= (300 - 150) = 150 kg.
13.(3) Mixture : 2 kg of rice at Rs.
15/kg + 3 kg of rice at Rs. 13/kg
Total weight = 2 + 3 = 5kg
Total cost price

= (2 × 15) + (3 × 13)
= 30 + 39 = Rs.69
Cost price per kg of the mixture
= 69/5 = Rs. 13.80
Selling price to get 100/3 % profit
= [100 + (100/3)]/100 = Rs.13.80
= 400 /(3 × 100) =Rs. 13.80
= (4/3) = 13.80
= Rs. 18.40

14.(1) Milk (Remaining)/ Water = 81/19
Milk (remaining)/ Milk (Initial) = 81 / 81 + 19 = 81/100
∴ Remaining milk
= Initial concentration
= [1 - (Quantity taken out)/(Total Amount)]^n
= 81x= 100x $(1 - 5/k)^2$
= 81/100 = $(9/10)^2$ = $(1 - 5/k)^2$
= 1 – 5/k = 9/10
= 5/k = 1 – 9/10 = 1/10
= k = 50 litres

15.(2) Initial quantity of milk in the vessel = 3x litres
Initial quantity of water
= x litres
In 32 litres of mixture,
Milk = ¾ × 32 = 24 litres
Water = 8 litres
According to the question,
(3x – 24 + 32)/ (x-8)
=4/1
= 3x + 8 = 4x – 32
= 4x – 3x = 32 + 8
= x = 40
∴ Quantity of water = x – 8
= 40 – 8 = 32 litres
In 10 litres of mixture,
Water = 1/5 × 10 = 2 litres
∴ Required quantity of water
= 32 – 2 = 30 litres

16.(1) Initial quantity mixture in the vessel = 6x litres (let)
In24 litres of mixture,
Milk = 5/6 × 24 = 20 litres
Water = 4 litres
According to the question,
(5x – 20 + 24)/(x - 4) = 13/2
= (5x + 4)/(x- 4) = 13/2
= 13x – 52 = 10x + 8
= 13x – 10x = 52 + 8
= 3x = 60
x = 60/3 = 20
Again in 15 litres of mixture
Milk = 13 litres
∴ Required quantity of milk
= 5x – 20 + 24 – 13
= (5x - 9) litres
= 20 × 5 – 9 = 91 litres

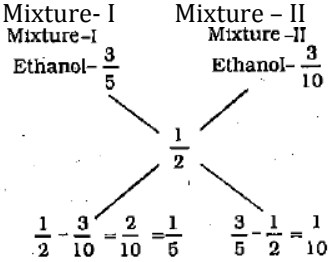
17.(3) Suppose a container contains x units of from which y units are taken out and replaced by water. After n operations, the quantity of pure liquid
= x$(1-y/x)^n$ units
∴ Remaining water
= 30 $(1 – 3/30)^2$
= (30 × 9 × 9)/100
= 24.3 litres

18.(4) CP of 65 kg of the mixture
= Rs. (35 × 9.50 + 30 × 10.50)
= Rs. (332.5+ 315)
= Rs. 647.5
∴ Rate per kg of the mixture
= Rs. (647.5/65)
∴ Required rate
= 647.65 × 135/100 = Rs. 13.50/kg

19.(1) **(Tricky approach)**
Acid = m/100 × m = m^2 /100
New percentage = (m^2 × 100)/(m + x) × 100
= m^2 /m + x = m – 10
= m^2/m + x = m - 10
=m^2 - 10m + mx – 10x = m^2
= x (m - 10) = 10 m
=x = 10/ (m - 10)

20.(4) If there be 1 litre of acid in 4 litres of mixture, then incase I.
Percentage of acid
= 1/(4 + 1) × 100 = 20%
Case II
Percentage of acid
= 2/6 × 100 = 100 / 3%
∴ Percentage of acid in original mixture = ¼ × 100 = 25%

21.(2) By allegation,
Mixture- I Mixture – II

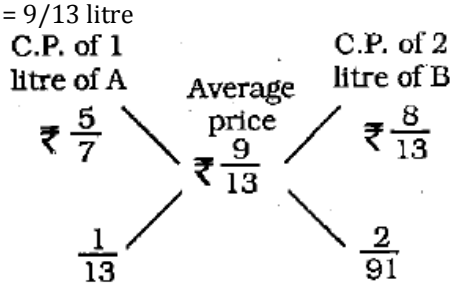


∴ Required ratio
= 1/5 : 1/10
= 2 : 1

22.(2) In x litres of solution,
Acid = x/100 × x = x^2/100
∴ Water = x - x^2/100
∴ [(x^2/100)/(x+ 4)] × 100 = x – 10
= x^2 = x^2 - 10x + y (x - 10)
= y = +10 / (x - 10)

23.(3) In 1 kg of of alloy A,
Gold = 7/9, Copper = 2/9
In 1 kg of alloy B,
Gold = 7/18, Copper = 11/18
∴ Ratio fo gold and copper in alloy C
= 7/9 + 7/18 : 2/9 + 11/18
= 21 : 15 = 7 : 5

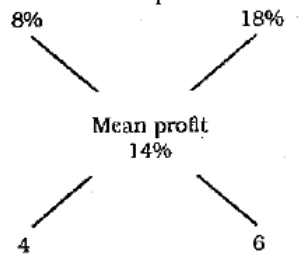
24.(1) Let. C.P. of milk per litre be Rs. 1
Milk in 1 litre of A = 5/7 litre
Milk in 1 litre of B = 8/13 litre
Milk in 1 litre of mixture
= 9/13 litre



∴ Required ratio
= 1/13 : 2/91 = 7 : 2

25.(2)

Profit on first part Profit on second part



Ratio of first and second part
= 4 : 6 = 2 : 3
∴ Quality of 2nd part
= (3/5 × 1000)kg
= 600kg

26.

27.

28.

29.

30.

31.