

Alligation or Mixture

INTRODUCTION

Alligation literally means 'linking'. It is a rule to find:

- the ratio in which two or more ingredients at their respective prices should be mixed to give a mixture at a given price.
- The mean or average price of a mixture when the prices of two or more ingredients which may be mixed together and the proportion in which they are mixed are given.

Here cost price of a unit quantity of mixture is called the *mean price*.

Alligation Rule

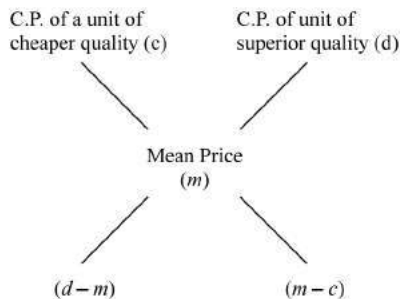
Suppose ₹ d per unit be the price of first ingredient (superior quality) mixed with another ingredient (cheaper quality) of price ₹ c per unit to form a mixture whose mean price is ₹ m per unit, then the two ingredients must be mixed in the ratio:

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of superior}}$$

$$= \frac{\text{C. P. superior} - \text{Mean price}}{\text{Mean price} - \text{C. P. of cheaper}}$$

i.e., the two ingredients are to be mixed in the inverse ratio of the differences of their prices and the mean price.

The above rule may be represented schematically as under:



$$\frac{\text{Quantity of cheaper quality}}{\text{Quantity of superior quality}} = \frac{d - m}{m - c}$$

Explanation

Suppose x kg of cheaper quality is mixed with y kg of superior quality

Price of cheaper ingredient = ₹ cx

Price of superior ingredient = ₹ dy

∴ Price of mixture = ₹ $(cx + dy)$

and quantity of mixture = $(x + y)$ kg.

$$\therefore \text{Price of mixture/kg} = ₹ \left(\frac{cx + dy}{x + y} \right)$$

$$\therefore \frac{cx + dy}{x + y} = m \Rightarrow cx + dy = mx + my$$

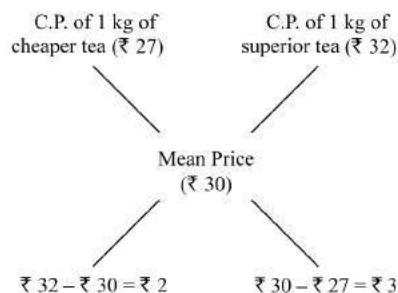
$$\Rightarrow dy - my = mx - cx$$

$$\Rightarrow y(d - m) = x(m - c)$$

$$\Rightarrow \frac{x}{y} = \frac{d - m}{m - c}$$

Illustration 1 In what ratio two varieties of tea one costing ₹27 per kg and the other costing ₹32 per kg should be blended to produce a blended variety of tea worth ₹30 per kg. How much should be the quantity of second variety of tea, if the first variety is 60 kg

Solution:



The required ratio of the two varieties of tea is 2:3, i.e.,

$$\frac{\text{Quantity of cheaper tea}}{\text{Quantity of superior tea}} = \frac{2}{3}$$

$$\therefore \text{Quantity of superior tea} = \frac{60 \times 3}{2} = 90 \text{ kg}$$

Thus, the second variety of tea is 90 kg.

Illustration 2 Sugar at ₹15 per kg is mixed with sugar at ₹20 per kg in the ratio 2:3. Find the price per kg of the mixture

Solution: Let the mean price of the mixture be ₹ x

C.P. of 1 kg of cheaper tea (₹15) C.P. of 1 kg of superior tea (₹20)

Mean Price (₹ x)

₹20 - ₹ x

₹ x - ₹15

$$\frac{\text{Quantity of cheaper sugar}}{\text{Quantity of dearer sugar}} = \frac{20 - x}{x - 15}$$

$$\therefore \frac{20 - x}{x - 15} = \frac{2}{3} \Rightarrow 60 - 3x = 2x - 30 \Rightarrow 5x = 90 \text{ or } x = 18$$

Thus, the price per kg of the mixture is ₹18.

SOME USEFUL METHODS

1. A vessel, full of wine, contains ' a ' litres of which ' b ' litres are withdrawn. The vessel is then filled with water. Next, ' b ' litres of the mixture are withdrawn and again the vessel is filled with water. This process is repeated n times. Then,

$$\frac{\text{Wine left in the vessel after } n\text{th operation}}{\text{Original quantity of wine in the vessel}}$$

$$= \left(\frac{a-b}{a} \right)^n$$

Explanation

Amount of wine after 1st operation

$$= a - b = \left(1 - \frac{b}{a} \right) \times a$$

Ratio of wine and water after 1st operation is $(a-b):b$

\therefore In ' b ' litres of mixture withdrawn in 2nd operation, amount of wine withdrawn

$$= \frac{a-b}{(a-b)+b} \times b = (a-b) \frac{b}{a}$$

\therefore Amount of wine left after 2nd operation

$$= (a-b) - (a-b) \times \frac{b}{a} = a \left(1 - \frac{b}{a} \right)^2$$

In general, quantity of wine left after n th operation

$$= \left(1 - \frac{b}{a} \right)^n a$$

$$\therefore \frac{\text{Wine left after } n\text{th operation}}{\text{Original quantity of wine}} = \left(1 - \frac{b}{a} \right)^n$$

Illustration 3 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?

Solution: Amount of wine left in the vessel

$$= \left(1 - \frac{25}{125} \right)^3 \times 125 = \frac{100 \times 100 \times 100 \times 125}{125 \times 125 \times 125} = 64 \text{ litres}$$

2. There are n vessels of equal size filled with mixtures of liquids A and B in the ratio $a_1:b_1, a_2:b_2, \dots, a_n:b_n$, respectively. If the contents of all the vessels are poured into a single large vessel, then

$$\frac{\text{Quantity of liquid } A}{\text{Quantity of liquid } B}$$

$$= \frac{\left(\frac{a_1}{a_1+b_1} + \frac{a_2}{a_2+b_2} + \dots + \frac{a_n}{a_n+b_n} \right)}{\left(\frac{b_1}{a_1+b_1} + \frac{b_2}{a_2+b_2} + \dots + \frac{b_n}{a_n+b_n} \right)}$$

Explanation

Let the capacity of each vessel be c litres.

Amount of liquid A in different vessels

$$= \frac{a_1 c}{a_1 + b_1}, \frac{a_2 c}{a_2 + b_2}, \frac{a_3 c}{a_3 + b_3}, \dots, \frac{a_n c}{a_n + b_n}$$

Amount of liquid B in different vessels

$$= \frac{b_1 c}{a_1 + b_1}, \frac{b_2 c}{a_2 + b_2}, \frac{b_3 c}{a_3 + b_3}, \dots, \frac{b_n c}{a_n + b_n}$$

So, in the resulting mixture, amount of liquid A

$$= \left(\frac{a_1}{a_1 + b_1} + \frac{a_2}{a_2 + b_2} + \dots + \frac{a_n}{a_n + b_n} \right) \times c$$

Amount of liquid B

$$= \left(\frac{b_1}{a_1 + b_1} + \frac{b_2}{a_2 + b_2} + \dots + \frac{b_n}{a_n + b_n} \right) \times c$$

Quantity of liquid A

Quantity of liquid B

$$= \frac{\left(\frac{a_1}{a_1 + b_1} + \frac{a_2}{a_2 + b_2} + \dots + \frac{a_n}{a_n + b_n} \right)}{\left(\frac{b_1}{a_1 + b_1} + \frac{b_2}{a_2 + b_2} + \dots + \frac{b_n}{a_n + b_n} \right)}$$

Illustration 4 Three equal glasses are filled with mixture of milk and water. The proportion of milk and water in each glass is as follows: In the first glass as 3:1, in the second glass as 5:3 and in the third as 9:7. The contents of the three glasses are emptied into a single vessel. What is the proportion of milk and water in it?

Solution:

$$\begin{aligned} \frac{\text{Quantity of milk}}{\text{Quantity of water}} &= \frac{\frac{3}{3+1} + \frac{5}{5+3} + \frac{9}{9+7}}{\frac{1}{3+1} + \frac{3}{5+3} + \frac{7}{9+7}} \\ &= \frac{31/16}{17/17} = 31:17. \end{aligned}$$

3. There are n vessels of sizes c_1, c_2, \dots, c_n filled with mixtures of liquids A and B in the ratio $a_1 : b_1, a_2 : b_2, \dots, a_n : b_n$, respectively. If the contents of all the vessels are poured into a single large vessel, then

$$\frac{\text{Quantity of Liquid } A}{\text{Quantity of liquid } B} = \frac{\frac{a_1 c_1}{a_1 + b_1} + \frac{a_2 c_2}{a_2 + b_2} + \dots + \frac{a_n c_n}{a_n + b_n}}{\frac{b_1 c_1}{a_1 + b_1} + \frac{b_2 c_2}{a_2 + b_2} + \dots + \frac{b_n c_n}{a_n + b_n}}$$

Illustration 5 Three glasses of sizes 3 litres, 4 litres and 5 litres contain mixture of milk and water in the ratio 2:3, 3:7 and 4:11, respectively. The contents of all the three glasses are poured into a single vessel. Find the ratio of milk to water in the resulting mixture

Solution:

$$\begin{aligned} \frac{\text{Quantity of milk}}{\text{Quantity of water}} &= \frac{\left(\frac{2 \times 3}{2+3} + \frac{3 \times 4}{3+7} + \frac{4 \times 5}{4+11} \right)}{\left(\frac{3 \times 3}{2+3} + \frac{7 \times 4}{3+7} + \frac{11 \times 5}{4+11} \right)} \\ &= \frac{\frac{6}{5} + \frac{12}{10} + \frac{20}{15}}{\frac{9}{5} + \frac{28}{10} + \frac{55}{15}} = 56:124 \text{ or, } 14:31 \end{aligned}$$

Practice Exercises

DIFFICULTY LEVEL-1

(BASED ON MEMORY)

1. Tea worth ₹126 per kg and ₹135 per kg are mixed with a third variety in the ratio 1:1:2. If the mixture is worth ₹153 per kg, then the price of the third variety per kg will be:

- (a) ₹169.50 (d) ₹170
(c) ₹175.50 (d) ₹180

[Based on MAT, 2001]

2. If the cost price of water is one-tenth that of milk and the milkman claims to sell the milk at a profit of 20%, then what is his actual net profit percentage?

- (a) 72% (b) 82%
(c) 79% (d) 68%

3. In a mixture of 45 litres, the ratio of milk and water is 3:2. How much water must be added to make the ratio 9:11?

- (a) 10 litres (b) 15 litres
(c) 17 litres (d) 20 litres

[Based on MAT, 2002]

4. Two jars contain milk and water in the ratio 5:4 and 2:1, respectively. What volume should be taken out from the first jar if volumes have to be taken out from both jars so as to fill up a third 30 litres jar with milk to water in the ratio 1:1?

- (a) 7.5 litres (b) 15 litres
(c) 22.5 litres (d) It is impossible

5. A dairy man pays ₹6.4 per litre of milk. He adds water and sells the mixture at ₹8 per litre, thereby making 37.5% profit. Find the proportion of the water to that of the milk received by the customers.

(a) 1:15 (b) 1:10
(c) 1:20 (d) 1:12

[Based on MAT, 2003]

6. Mr X mixed 10 kg of variety A rice with 15 kg of variety B rice and sold the mixture at a price 40% more than that of A. He did not get any profit. What is the ratio of the cost price of variety A to that of B per kg?

(a) 2:5 (b) 3:5
(c) 4:5 (d) 5:8

7. Several litres of acid were drawn off a 54-litre 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 litres of pure acid. How much of the acid was drawn off initially?

(a) 12 litres (b) 16 litres
(c) 18 litres (d) 24 litres

[Based on MAT, 2001]

8. If 50% of the 2:3 solution of milk and water is replaced with water, then the concentration of the solution is reduced by:

(a) 25% (b) 33.33%
(c) 50% (d) 75%

[Based on MAT, 2001]

9. Milk sold by a milkman contains 5% water. What quantity of pure milk should be added to 20 litres so that water content comes down to 2%?

(a) 16 litres (b) 20 litres
(c) 25 litres (d) None of these

[Based on IRMA, 2002]

10. Milk and water are in the ratio of 3:2 in a mixture of 80 litres. How much water should be added so that the ratio of the milk and water becomes 2:3?

(a) 25 litres (b) 40 litres
(c) 35 litres (d) 20 litres

[Based on FMS (Delhi), 2002]

11. How much water must be mixed in 300 ml of sugar solution which contains 40% sugar by weight, such that it becomes a 30% sugar solution?

(a) 50 ml (b) 75 ml
(c) 90 ml (d) 100 ml

12. Three vessels contain equal mixtures of milk and water in the ratio 6:1, 5:2 and 3:1 respectively. If all the solutions are mixed together, the ratio of milk to water in the final mixture will be:

(a) 64:65 (b) 65:64
(c) 19:65 (d) 65:19

13. In what ratio must a person mix three kinds of wheat costing him ₹1.20, ₹1.44 and ₹1.74 per kg, so that the mixture may be worth ₹1.41 per kg?

(a) 15:77:11 (b) 7:11:15
(c) 11:77:15 (d) 11:77:7

14. The ratio of kerosene to petrol in 100 kg of mixed petrol normally used by three wheelers is 7:25. The amount of kerosene to be added to 100 kg of mixed petrol to make the ratio 9:25 is:

(a) 5 kg (b) 6.625 kg
(c) 6.25 kg (d) 6.35 kg

15. Two equal containers are filled with a mixture of water and alcohol. One of them contains three times as much alcohol as in the other. The mixtures in the two containers are then mixed and it is found that the ratio of water to alcohol is 3:2. Find the ratio of water to alcohol in each of the original containers.

(a) 2:1, 3:4 (b) 1:3, 1:2
(c) 2:3, 4:1 (d) None of the above

16. I added 1 litre of water to 5 litres of a 20 per cent solution of alcohol and water. The strength of alcohol is:

(a) unaltered (b) 5%
(c) 12.5% (d) 16.66%

17. One type of liquid contains 25% of milk, the other contains 30% of milk. A can is filled with 6 parts of the first liquid and 4 parts of the second liquid. Find the percentage of milk in the new mixture.

(a) 28% (b) 25%
(c) 30% (d) 27%

18. A jar contains a mixture of two liquids A and B in the ratio 4:1. When 10 litres of the mixture is taken out and 10 litres of liquid B is poured into the jar, the ratio becomes 2:3. How many litres of liquid A was contained in the jar?

(a) 14 litres (b) 18 litres
(c) 20 litres (d) 16 litres

19. How many litres of a 3% hydrogen peroxide solution should be mixed with 6 litres of a 30% hydrogen peroxide solution so as to get a 12% solution?

(a) 3 litres (b) 6 litres
(c) 9 litres (d) 12 litres

20. How much water must be added to 100 cc of 80 per cent solution of boric acid to reduce it to a 50 per cent solution?

(a) 30 (b) 40
(c) 50 (d) 60

21. Milk and water are in the ratio of 3:2 in a mixture of 80 litres. How much water should be added so that the ratio of the milk and water becomes 2:3?

(a) 25 litres (b) 40 litres
(c) 35 litres (d) 20 litres

22. Milk sold by a milkman contains 5 per cent water. What quantity of pure milk should be added to 20 litres so that water content comes down to 2%?

(a) 16 litres (b) 20 litres
(c) 25 litres (d) None of these

23. A dairy man pays ₹6.4 per litre of milk. He adds water and sells the mixture at ₹8 per litre, thereby making 37.5% profit. Find the proportion of the water to that of the milk received by the customers.

(a) 1:15 (b) 1:10
(c) 1:20 (d) 1:12

24. In a mixture of 60 litres, the ratio of milk to water is 2:1. If this ratio is to be 1:2, then the quantity of water (in litres) to be further added is:

(a) 20 (b) 30
(c) 40 (d) 60

25. Mira's expenditure and savings are in the ratio 3:2. Her income increases by 10 per cent. Her expenditure also increases by 12 per cent. By how much per cent does her saving increase?

(a) 7% (b) 10%
(c) 9% (d) 13%

26. A trader has 50 kg of rice, a part of which he sells at 10 per cent profit and the rest at 5 per cent loss. He gains 7 per cent on the whole. What is the quantity sold at 10 per cent gain and 5 per cent loss?

(a) 30 kg, 10 kg (b) 40 kg, 15 kg
(c) 35 kg, 40 kg (d) 40 kg, 10 kg

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

(a) 85 kg (b) 50 kg
(c) 135 kg (d) 150 kg

[Based on MAT (Feb), 2011]

28. One type of liquid contains 25% of milk, the other contains 30% of milk. A container is filled with 6 parts of the first liquid and 4 parts of the second liquid. The percentage of milk in the mixture is:

(a) 27% (b) 31%
(c) 29% (d) 33%

[Based on MAT (Dec), 2009 (Sept), 2009]

29. A solution of sugar syrup has 15% sugar. Another solution has 5% sugar. How many litres of the second solution must be added to 20 litres of the first solution to make a solution of 10% sugar?

(a) 10 litres (b) 5 litres
(c) 15 litres (d) 20 litres

[Based on MAT (Sept), 2009]

30. An 8-litre cylinder contains a mixture of oxygen and nitrogen, the volume of oxygen being 16% of total volume. A few litres of the mixture is released and an equal amount of nitrogen is added. Then, the same amount of the mixture as before is released and replaced by nitrogen for the second time. As result, the oxygen content becomes 9% of total volume. How many litres of mixture is released each time?

(a) 7 litres (b) 40 litres
(c) 2 litres (d) None of these

[Based on MAT (Sept), 2009, 2008 (Dec), 2005]

31. Two gallons of a mixture of spirit and water contain 12% of water. They are added to 3 gallons of another mixture, containing 7% of water and half a gallon of water is then added to the whole. Find the percentage of water in the resulting mixture.

(a) $17\frac{3}{11}\%$ (b) $16\frac{12}{11}\%$
(c) $14\frac{1}{11}\%$ (d) None of these

[Based on MAT (Sept), 2009]

32. A jar full of milk contains 40% water. A part of this milk is replaced by another containing 19% water and now the percentage of water is found to be 26%. The quantity of milk replaced is:

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$
(c) $\frac{3}{7}$ (d) $\frac{4}{7}$

[Based on MAT (Feb), 2009]

33. One litre of water is evaporated from 6 litres of a solution containing 5% salt. Find the percentage of salt in the remaining solution.

(a) 8% (b) 10%
(c) 6% (d) 4%

[Based on MAT (Feb), 2009]

34. When processing flower nectar into honey, a considerable amount of water is added. How much flower nectar must be processed to yield 1 kg of honey, if nectar contains 70% water and the honey obtained from this nectar contains 17% water?

(a) 4.11 kg (b) 1.76 kg
(c) 0.36 kg (d) 2.77 kg

[Based on MAT (Sept), 2008]

35. The amount of water (in mL) that should be added to reduce 9 mL lotion, containing 50% alcohol, to a lotion containing 30% alcohol, is:

(a) 5 ml (b) 4 ml
(c) 3 ml (d) 6 ml

[Based on MAT (May), 2007]

36. The ratio of milk to water in three containers of equal capacity is 3:2, 7:3 and 11:4 respectively. The three containers are mixed together. What is the ratio of milk to water after mixing?

(a) 38:8 (b) 21:9
(c) 61:29 (d) 41:18

[Based on MAT (May), 2010]

37. There are 2 bottles containing a mixture of wine, water and alcohol. The first bottle contains wine, water and alcohol in the ratio 3:5:2. The second bottle contains water and wine in the ratio 5:4. 1 litre of the first and 2 litres of the second are mixed together. What fraction of the mixture is alcohol?

(a) 1/15 litres (b) 6/13 litres
(c) 2/15 litres (d) 6/19 litres

[Based on MAT (May), 2010]

38. Two vessels contain spirit of 0.5 and 0.75 concentrations. If 2 litres from the first vessel and 3 litres from the second vessel are mixed, then what will be the ratio of the spirit and the water in the resultant solution?

(a) 15:17 (b) 7:17
(c) 13:7 (d) 17:15

[Based on MAT (Dec), 2009 (Feb), 2008]

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

(a) 40 litres (b) 30 litres
(c) 20 litres (d) 60 litres

[Based on MAT (Dec), 2009]

40. One test tube contains some acid and another test tube contains an equal quantity of water. To prepare a solution, 20 g of the acid is poured into the second test tube. Then, two-thirds of the so-formed solution is poured from the second tube into the first. If the fluid in the first test tube is four times that in the second, what quantity of water was taken initially?

(a) 80 g (b) 60 g
(c) 40 g (d) None of these

[Based on MAT (May), 2009]

41. A trader has 50 kg of pulses, part of which he sells at 8 per cent profit and the rest at 18 per cent profit. He gains 14 per cent on the whole. What is the quantity sold at 18 per cent profit?

(a) 30 kg (b) 25 kg
(c) 20 kg (d) 40 kg

42. A bottle contains three-fourths of milk and the rest water. How much of the mixture must be taken away and replaced by an equal quantity of water so that the mixture has half milk and half water?

(a) 25% (b) $33\frac{1}{3}\%$
(c) 45% (d) 50%

[Based on MAT (Dec), 2008]

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

(a) 5 litres (b) 3 litres
(c) 4 litres (d) 6 litres

[Based on MAT (Dec), 2008]

44. A vessel contains liquid P and Q in the ratio 5:3. If 16 litres of the mixture are removed and the same quantity of liquid Q is added, the ratio become 3:5. What quantity does the vessel hold?

(a) 35 litres (b) 45 litres
(c) 40 litres (d) 50 litres

[Based on MAT (Dec), 2007]

45. A bottle is full of dettol. One-third of it is taken out and then an equal amount of water is poured into the bottle to fill it. This operation is done four times. Find the final ratio of dettol and water in the bottle.

(a) 13:55 (b) 20:74
(c) 16:65 (d) 10:48

[Based on MAT (Dec), 2007]

46. A person has a chemical of ₹25 per litre. In what ratio should water be mixed in that chemical, so that after selling the mixture at ₹20 per litre he may get a profit of 25%?

(a) 13:16 (b) 12:15
(c) 16:9 (d) 19:22

[Based on MAT (Dec), 2007]

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

(a) 350 kg (b) 300 kg
(c) 250 kg (d) 325 kg

[Based on MAT (May), 2007]

48. 5 litres of water is added to a certain quantity of pure milk costing ₹3/litres. 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 litres (b) 30 litres
(c) 25 litres (d) 35 litres

[Based on MAT (May), 2006]

49. A sink contains exactly 12 litres of water. If water is drained from the sink until it holds exactly 6 litres of water less than the quantity drained away, how many litres of water were drained away?

(a) 2 litres (b) 6 litres
(c) 3 litres (d) 9 litres

[Based on MAT (Feb), 2006]

50. A chemist has 10 litres of a solution that is 10% nitric acid by volume. He wants to dilute the solution to 4% strength by adding water. How many litres of water must be added?

(a) 15 (b) 20
(c) 18 (d) 25

[Based on MAT (Feb), 2006]

51. Suppose, that a maximum of 25 g of salt dissolves in 100 g of water. Any more salt, if added, remains undissolved and a sediment falls at the bottom. Now water is evaporated from 1 kg of a 4% solution at the rate of 28% g/h. After how long will it start sedimenting?

(a) 35 hrs (approx) (b) 29 hrs (approx)
(c) 31 hrs (approx) (d) 23 hrs (approx)

[Based on MAT (Sept), 2008]

52. An alloy contains copper and zinc in the ratio 5:3 and another alloy contains copper and tin in the ratio 8:5. If equal weights of both the alloys are melted together, then the weight of tin in the resulting alloy per kg will be:

(a) 26/5 (b) 5/26
(c) 7/31 (d) 31/7

[Based on MAT, 1997]

53. Alok bought 25 kg of rice at the rate of ₹6 per kg and 35 kg of rice at the rate of ₹7 per kg. He mixed the two and sold the mixture at the rate of ₹6.75 per kg. What was his gain or loss in the transaction?

(a) ₹16 gain (b) ₹16 loss
(c) ₹20 gain (d) ₹10 gain

[Based on MAT, 2000]

54. How much water must be added to 100 cc of 80% solution of boric acid to reduce it to a 50% solution?

(a) 30 (b) 40
(c) 50 (d) 60

[Based on MAT, 2000]

55. A bought 4 bottles of beer and B bought one bottle of lager. Lager per bottle costing twice that of the beer. C bought nothing but paid ₹50 for his share of the drink which they mixed together and shared equally. If C's ₹50 covered his share, then what is the cost of the lager?

(a) 50 (b) 75
(c) 30 (d) 46

[Based on MAT, 2000]

56. An alloy of gold and silver weighs 50 g. It contains 80% gold. How much gold should be added to the alloy so that percentage of gold is increased to 90?

(a) 50 g (b) 60 g
(c) 30 g (d) 40 g

[Based on SNAP, 2009]

57. 300 gm of salt solution has 40% salt in it. How much salt should be added to make it 50% in the solution?

(a) 40 gm (b) 60 gm
(c) 70 gm (d) 80 gm

[Based on SNAP, 2009]

58. 300 g of salt solution has 40% salt in it. How much salt should be added to make it 50% in the solution?

(a) 40 g (b) 60 g
(c) 70 g (d) 80 g

[Based on SNAP, 2010]

59. Two alloys contain zinc and copper in the ratio of 2:1 and 4:1. In what ratio the two alloys should be added together to get as new alloy having zinc and copper in the ratio of 3:1?

(a) 7:5 (b) 5:7
(c) 3:5 (d) None of these

[Based on IIFT, 2005]

60. In a glass of milk, the proportion of pure milk and water is 3:1, how much of the mixture must be withdrawn and substituted by water so that the resulting mixture may become half pure milk and half water?

(a) $\frac{1}{4}$ unit (b) $\frac{1}{3}$ unit
(c) $\frac{3}{4}$ unit (d) $\frac{1}{2}$ unit

[Based on ATMA, 2006]

61. A person has a chemical of ₹25 per litres. In what ratio should water be mixed in that chemical so that after selling the mixture at ₹20 per litres, he may get a profit of 25%?

(a) 12:15 (b) 16:9
(c) 13:16 (d) 19:22

[Based on MAT (Sept), 2011]

62. An oil refinery takes 100 liters of crude oil as input and after refining for 1 hr gives certain amount of output oil X litres. This can be sold in the market at a profit of ₹30 per litres. If this oil is further refined for $\frac{1}{2}$ h, it gives oil Y litres.

This can be sold at a profit of ₹50 per litres. Output and input ratio at both the stages is 90% The maximum amount that can be earned from 1000 liters of crude input is:

(a) ₹40000 (b) ₹30000
(c) ₹27000 (d) ₹40500

[Based on MAT, 2011]

63. 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 alloys are melted to form a third alloy C, the ratio of gold and copper in C will be:

(a) 7:5 (b) 5:9
(c) 5:7 (d) 9:5

[Based on MAT, 2011]

64. Two casks of 48 liters and 42 liters are filled with mixtures of wine and water, the proportions in the two casks being respectively 13:7 and 18:17. If the contents of the two casks be mixed and 20 liters of water is added to the whole, what will be the proportion of wine to water in the resultant solution?

(a) 21:31 (b) 12:13
(c) 13:12 (d) None of the above

[Based on MAT, 2011]

65. Three containers of capacity 20 litres, 5 litres and 9 litres contain mixture of milk and water with milk concentrations 90%, 80% and 70% respectively. The contents of three containers are emptied into a large vessel. What is the approximate ratio of milk to water in the resultant mixture?

(a) 3:1 (b) 4:1
(c) 5:1 (d) 2:1

[Based on MAT, 2011]

66. The concentration of petrol in three different mixtures (of petrol and kerosene) is $\frac{1}{2}$, $\frac{3}{5}$ and $\frac{4}{5}$, respectively. If 2 litres, 3 litres and 1 litre are taken from these three different vessels and mixed, what is the ratio of petrol and kerosene in the new mixture?

(a) 4:5 (b) 3:2
(c) 3:5 (d) 2:3

[Based on MAT, 2012]

67. Vijay purchased two different kinds of alcohol. In the first mixture, the ratio of alcohol to water is 3:4 and the second mixture it is 5:6. If he mixes, the two given mixtures and makes a third mixture of 18 litres in which the ratio of alcohol to water is 4:5, the quantity of the first mixture (whose ratio is 3:4) that is required to make 18 litres of the third kind of mixture is:

(a) 6 (b) 7
(c) 8 (d) 9

[Based on MAT, 2012]

68. Two casks of 48 litres and 42 litres are filled with mixtures of milk and water, the proportions in the two casks being respectively, 13:7 and 18:17. If the contents of the two casks be mixed and 20 litres of water be added to the whole, what will be the proportion of milk and water in the resulting mixture?

(a) 5:12 (b) 7:13
(c) 12:13 (d) 8:15

[Based on MAT, 2012]

69. What amounts (in litres) of 90% and 97% pure acid solutions are mixed to obtain 21 litres of 95% pure acid solution?

(a) 6 and 15 litres (b) 14 and 15 litres
(c) 12 and 15 litres (d) 13 and 12 litres

[Based on MAT, 2012]

70. Two equal glasses are filled with mixture of alcohol and water in the proportions of 2:1 and 1:1 respectively were emptied into a third glass. What is the ratio of alcohol and water in the third glass?

(a) 5:6 (b) 7:5
(c) 4:2 (d) 8:1

[Based on MAT, 2012]

71. A litre of water weighs a kilogram and a litre of another liquid weighs 1350 g. A mixture of the two weighs 1250 g/L. The volume of water and the liquid respectively, in a litre of mixture is:

(a) $\frac{2}{7}, \frac{5}{7}$ (b) $\frac{5}{7}, \frac{2}{7}$
(c) $\frac{3}{4}, \frac{1}{4}$ (d) $\frac{1}{4}, \frac{3}{4}$

[Based on MAT, 2013]

72. A merchant has six barrels with capacities of 15, 16, 18, 19, 20 and 31 litres. One barrel contains wine and the other five contain oil. He keeps the barrel of wine for himself and sells the oil to two men in the ratio 1:2. The capacity of the barrel containing the wine, in litres, is:

(a) 15 (b) 20
(c) 19 (d) 18

[Based on MAT, 2013]

73. Two qualities of tea are mixed in the ratio 4:1 and the mixture is sold at ₹72 per kg for a profit of 12.5%. If the tea of the second quality costs ₹3.25 more per kg than the tea of first quality, what is the cost per kg of the tea of the first quality?

(a) ₹63.35 (b) ₹23.65
(c) ₹70.62 (d) ₹73.54

[Based on MAT, 2013]

74. Three different containers contain different quantities of a mixture of milk and water, whose measurements are 430 kg, 403 kg and 465 kg. What biggest measure must be there to measure all the different quantities exactly?

(a) 70 kg (b) 51 kg
(c) 31 kg (d) 41 kg

[Based on MAT, 2013]

75. A jar full of milk contains 40% water. A part of this milk is replaced by another containing 19% water and now the percentage of water is found to be 26%. The quantity of milk replaced is:

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$
(c) $\frac{3}{7}$ (d) $\frac{4}{7}$

[Based on MAT, 2013]

76. 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, find the ratio of milk to water, if the mixtures of all the three containers are mixed together?

(a) 53:115 (b) 23:123
(c) 11:4 (d) None of these

[Based on MAT, 2014]

77. What will be the ratio of petrol and kerosene in the final solution formed by mixing petrol and kerosene that are present in three vessels in the ratio 4:1, 5:2 and 6:1 respectively?

(a) 166:22 (b) 83:22
(c) 83:44 (d) None of these

[Based on MAT, 2014]

DIFFICULTY LEVEL-2
(BASED ON MEMORY)

1. An empty container is filled with pure alcohol. The alcohol is slowly allowed to run out and when the container is one-fourth empty, it is replaced with water. Next, when the container is half empty it is again filled with water. Finally, when it is three-fourths empty, it is again filled with water. What percentage of container is alcohol now?

- (a) $8\frac{1}{2}\%$ (b) $11\frac{3}{4}\%$
(c) $9\frac{3}{8}\%$ (d) $14\frac{3}{8}\%$

2. Two solutions of milk and water are kept in two vessels *A* and *B*. The ratio of quantity of milk in vessels *A* and *B* is 4:5 while the ratio of quantity of water in vessels *A* and *B* is 8:9. It is known that the concentration of milk in one of these vessels is between 60% and 80%. What could be the concentration of milk in the other vessel?

- (a) 55% (b) 65%
(c) 75% (d) 85%

3. Two vessels contain spirit of 0.5 and 0.75 concentrations. If two litres from the first vessel and three litres from the second vessel are mixed, then what will be the ratio of the spirit and the water in the resultant solution?

- (a) 13:7 (b) 7:17
(c) 15:17 (d) 17:15

[Based on IIT Joint Man. Ent. Test, 2004]

Directions (4 and 5): Refer to the data below and answer the questions that follow. Selling price of milk depends on the fat content of milk. Normal fat content is 60% and normal selling price is ₹20/litre. If the fat content falls below 55% then the selling price decreases by 20%. A milkman procures milk at ₹16/litre.

4. How much water as per cent of pure milk can be added so that selling price is not affected?

- (a) 9% (b) 12.375%
(c) 10% (d) 15%

5. What per cent of the water should be added to pure milk so that even if selling price decreases the profit percentage is not affected?

- (a) 10% (b) 30%
(c) 20% (d) 25%

6. There are 3 containers *A*, *B* and *C* which contain water, milk and acid respectively in equal quantities. 10% of the content of *A* is taken out and poured into *B*. Then, the same

amount from *B* is transferred to *C*, from which again the same amount is transferred to *A*. What is the proportion of milk in container *A* at the end of the process?

- (a) 9/10 (b) 1/11
(c) 1/121 (d) 2/13

[Based on FMS (Delhi), 2002]

7. A beaker contains a 105 ml mixture of alcohol and water. three-sevenths of the mixture is alcohol; the remainder is water. An additional quantity of 105 ml of alcohol is poured into the mixture. What is the ratio of the volume of alcohol to water in the new mixture?

- (a) 3:7 (b) 3:4
(c) 5:2 (d) 1:1

8. Two vessels *A* and *B* contain mixtures of spirit and water. A mixture of 3 parts from *A* and 2 parts from *B* is found to contain 29% of spirit and a mixture of 1 part from *A* and 9 parts from *B* is found to contain 34 per cent of spirit. Find the percentage of spirit in *B* and *A*.

- (a) 35, 25 (b) 40, 20
(c) 25, 25 (d) 50, 50

9. Three vessels whose capacities are as 5:3:2 are completely filled with milk mixed with water. The ratio of milk to water in the mixture of vessels are as 3:2, 2:1 and 3:1 respectively. Find the percentage of water in the new mixture obtained when one-third of first, half of second and two-thirds of the third vessel is taken out and mixed together.

- (a) 66.66% (b) 50%
(c) 16.66% (d) 33.33%

10. Two bottles *A* and *B* contain diluted sulphuric acid. In bottle *A*, the amount of water is double the amount of acid while in bottle *B*, the amount of acid is 3 times that of water. How much mixture should be taken from each bottle in order to prepare 5 litres of diluted sulphuric acid containing equal amount of acid and water?

- (a) 1, 4 (b) 3, 2
(c) 2, 3 (d) 4, 1

11. An alloy contains only zinc and copper. One such alloy weighing 15 gm contains zinc and copper in the ratio of 2:3 by weight. If 10 gm of zinc is added then find what amount of copper has to be removed from the alloy such that the final alloy has zinc and copper in the ratio of 1:4 by weight?

- (a) 5 gm (b) 5.5 gm
(c) 6 gm (d) 4.8 gm

12. Three beakers namely, A , B and C each contain 100 ml of milk $\frac{1}{m}$ water solution. The ratio of milk to water in the beakers A , B and C is 1:3, 1:4 and 2:3 respectively. 40 ml of solution is transferred from beaker A to beaker C and than 28 ml of solution is transferred from beaker C to beaker B . Find the final ratio of milk in the beakers A , B and C .
- (a) 3:6:8 (b) 6:15:20
(c) 15:28:42 (d) None of these
13. Aqua regia is a mixture containing 50 per cent concentrated HCL and 70% concentrated HNO_3 in the ratio 1:3, respectively. Aqua regia is to be formed with 15 litres of HCL of 80% concentration and 56 litres of HNO_3 of 90% concentration by adding water as a diluting agent. Another mixture 'X' having 40% concentrated HCL and 30% concentrated H_2SO_4 in the ratio 5:7, respectively is added to the Aqua regia to form a solution of 111 litres. Find the ratio of HCL to water in the solution. Only water is used as a diluting agent.
- (a) 3:8 (b) 4:7
(c) 1:3 (d) 2:5
14. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio these two metals be mixed so that the alloy is 15 times as heavy as water is:
- (a) 2:1 (b) 3:2
(c) 1:2 (d) 2:3
15. 25% of a solution containing 20% petrol, 50% diesel and 30% kerosene was replaced with kerosene. Now, two-thirds of the solution obtained in the previous step was replaced with petrol. What is the percentage of diesel in this new solution?
- (a) 15% (b) 15.83%
(c) 12.5% (d) None of these
16. 2 l of Bournvita drink contains 236 calories and 2 l of complan drink contains 166 calories. If liters mixture of both the drinks contains 88 calories, then the percentage of Bournvita drink in the mixture is:
- (a) 25% (b) 16.66%
(c) 14.28% (d) 83.33%
17. A vessel of capacity 2 litre has 25% alcohol and another vessel of capacity 6 litre has 40% alcohol. The total liquid of 8 litre is poured out in a vessel of capacity 10 litre and the rest part of the vessel is filled with water. What is the new concentration of mixture?
- (a) 31% (b) 71%
(c) 49% (d) 29%
18. A housewife has 11 litre of solution that contains milk and water in the ratio 3:1. She adds 250 ml of 3:2 solution of milk and water to it and then uses 250 ml of the combined mixture to make curd How much of pure milk is she left with?
- (a) 1,000 ml (b) 912.5 ml
(c) 750 ml (d) 720 ml
19. There are two alloys made up of copper and aluminium. In the first alloy copper is half as much as aluminium and in the second alloy copper is thrice as much as aluminium. How many times the second alloy must be mixed with first alloy to get the new alloy in which copper is twice as much as aluminium?
- (a) 2 (b) 3
(c) 4 (d) 5
20. A solution of sugar syrup has 15% sugar. Another solution has 5% sugar. How many litres of the second solution must be added to 20 litres of the first solution to make a solution of 10% sugar?
- (a) 10 (b) 5
(c) 15 (d) 20
21. There are 3 containers A , B and C which contain water, milk and acid respectively in equal quantities. 10% of the content of A is taken out and poured into B . Then, the same amount from B is transferred to C , from which again the same amount is transferred to A . What is the proportion of milk in container A at the end of the process?
- (a) 9/10 (b) 1/11
(c) 1/121 (d) 2/13
22. If 50 per cent of the 2:3 solution of milk and water is replaced with water, then the concentration of the solution is reduced by:
- (a) 25% (b) 33.33%
(c) 50% (d) 75%
23. Several litres of acid were drawn off a 54-litre vessel full of acid and an equal amount of water was added. Again the same volume of the mixture was drawn off and replaced by water. As a result, the vessel contained 24 litres of pure acid. How much of the acid was drawn off initially?
- (a) 12 litres
(b) 16 litres
(c) 18 litres
(d) 24 litres
24. A dairyman pays ₹8.0 per litre of milk. He adds water and sells the mixture at ₹9 per litre, thereby making 40% profit. The proportion of water to milk received by the customers is:
- (a) 45:11 (b) 11:45
(c) 2:45 (d) 45:2

25. How many kg of tea worth ₹25 per kg must be blended with 30 kg of tea worth ₹30 per kg so that by selling the blended variety at ₹30 per kg there should be a gain of 10%?

(a) 36 kg (b) 40 kg
(c) 32 kg (d) 42 kg

[Based on SNAP, 2009]

26. A person travels 285 km in 6 hrs in two stages. In the first part of the journey, he travels by bus at the speed of 40 Km/h. In the second part of the journey, he travels by train at the speed of 55 Km/h. How much distance did he travel by train?

(a) 205 km (b) 145 km
(c) 165 km (d) 185 km

27. A person has a chemical of ₹25 per litre. In what ratio should water be mixed in that chemical so that after selling the mixture at ₹20 per litre he may get a profit of 25 per cent?

(a) 13:16 (b) 16:9
(c) 12:15 (d) 19:22

28. A mixture contains milk and water in the ratio 5:1 or adding 5 litres of water, the ratio of milk to water becomes 5:2. The quantity of milk in the original mixture is:

(a) 16 litres (b) 25 litres
(c) 22.75 litres (d) 32.5 litres

[Based on FMS (MS), 2006]

29. An alloy contains zinc and copper in the ratio 5:8 and another alloy contains zinc and copper in the ratio 5:3. If equal amounts of both the alloys are melted together, then the ratio of zinc and copper in the resulting alloy is:

(a) 25:24 (b) 3:8
(c) 103:105 (d) 105:103

[Based on FMS, 2006]

30. Two vessels A and B contain milk and water mixed in the ratio 5:3 and 2:3. When these mixtures are mixed to form a new mixture containing half milk and half water, they must be taken in the ratio:

(a) 2:5 (b) 3:5
(c) 4:5 (d) 7:3

[Based on FMS, 2006]

31. The average weekly salary per head of all employees (supervisors and labourers) is ₹100. The average weekly salary per head of all the supervisors is ₹600 while the average weekly salary per head of all the labourers is ₹75. Find the number of supervisors in the factory if there are 840 labourers in it.

(a) 46 (b) 42
(c) 44 (d) 48

32. Three equal glasses are filled with mixtures of spirit and water. The ratio of the spirit to water is as follows: in the

first glass as 3:4, in the second glass as 4:5 and in the third glass as 5:6. The contents of the three glasses are emptied into a single vessel. What is the ratio of the spirit to water in the mixture now?

(a) 920:1159 (b) 820:1149
(c) 1120:1134 (d) 1010:1122

[Based on IIFT, 2005]

33. Ashok a master adulterator cum grosser sells haldi powder (turmeric powder), which contains five per cent saw dust. What quantity of pure haldi should be added to two kilos of haldi (containing five per cent saw dust) so that the proportion of saw dust becomes four per cent?

(a) 1 kg (b) 2 kg
(c) 0.5 kg (d) None of these

[Based on IIFT, 2007]

34. A manufacturer has 200 litres of acid solution which has 15% acid content. How many litres of solution with 30% acid content may be added so that acid content in the resulting mixture will be more than 20% but less than 25%?

(a) More than 100 litres but less than 300 litres
(b) More than 120 litres but less than 400 litres
(c) More than 100 litres but less than 400 litres
(d) More than 120 litres but less than 300 litres

[Based on XAT, 2010]

35. There are two vessels of equal capacity, one full of milk, and the second one-third full of water. The second vessel is, then filled up out of the first, the contents of the second are then poured back into the first till it is full and then again the contents of the first are poured back into the second till it is full. What is the proportion of milk in the second vessel, if capacity of the vessel is 20 litres?

(a) $\frac{37}{20}$ (b) $\frac{20}{27}$
(c) $\frac{20}{37}$ (d) $\frac{27}{20}$

[Based on NMAT, 2005]

36. Two barrels contain a mixture of ethanol and gasoline. The content of 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

[Based on JMET, 2006]

37. A milkman mixes 20 liters of water with 80 liters milk. After selling one-fourth of this mixture, he adds water to replenish the quantity that he has sold. What is the current proportion of water to milk?

(a) 2:3 (b) 1:2
(c) 1:3 (d) 3:4

[Based on CAT, 2004, 2010]

38. Auto fare in Bombay is ₹2.40 for the first 1 km, ₹2.00 per km for the next 4 km and 1.20 for each additional km thereafter. Find the fare in rupees for k km ($k \geq 5$).

(a) $2.4k + 1.2(2k - 3)$
 (b) $10.4 + 1.2(k - 5)$
 (c) $2.4 + 2(k - 3) + 1.2(k - 5)$
 (d) $10.4 + 1.2(k - 4)$

[Based on CAT, 2011]

39. Half of the volume of milk and water mixture of ratio 7:5 is converted into a mixture of ratio 3:1 by the substitution (or replacement) method. The mixture of ratio 7:5 was formed from the mixture 7:3 by adding the water in it. If 240 litres milk is required in the replacement method. What is the total amount of water added to prepare the mixture in the ratio 7:5?

(a) 100 litres (b) 400 litres
 (c) 50 litres (d) 200 litres

[Based on CAT, 2013]

40. What is the minimum amount of sucrose (to the nearest gram) that must be added to one gram of saccharin to make mixture that will be at least 100 times as sweet as glucose?

(a) 7 (b) 8
 (c) 9 (d) 100

[Based on CAT, 1999]

41. Approximately how many times sweeter than sucrose is a mixture consisting of glucose, sucrose and fructose in the ratio of 1:2:3?

(a) 1.3 (b) 1.0
 (c) 0.6 (d) 2.3

[Based on CAT, 1999]

42. There are two containers: the first contains 500 mL of alcohol, while the second contains 500 mL of water. Three cups of alcohol from the first container is taken out and is mixed well in the second container. Then, three cups of this mixture is taken out and is mixed in the first container. Let, A denote the proportion of water in the first container and B denote the proportion of alcohol in the second container. Then,

(a) $A > B$ (b) $A < B$
 (c) $A = B$ (d) Cannot be determined

[Based on CAT, 1998]

43. Two liquids A and B are in the ratio 5:1 in container 1 and 1:3 in container 2. In what ratio should the contents of the two containers be mixed so as to obtain a mixture of A and B in the ratio 1:1?

(a) 2:3 (b) 4:3
 (c) 3:2 (d) 3:4

[Based on CAT, 1996]

44. A man buys spirit at ₹60 per litre, adds water to it and then sells it at ₹75 per litre. What is the ratio of spirit to water if his profit in the deal is 37.5%?

(a) 9:1 (b) 10:1
 (c) 11:1 (d) None of these

[Based on CAT, 1994]

45. Gopal has 73 liters of wine a drum. He replaces 3.65 liters of it with water and keeps doing so till the time the concentration of wine is less than 85%. The minimum number of operations that Gopal has to perform is:

(a) 3 (b) 4
 (c) 2 (d) None of these

[Based on MAT, 2013]

Answer Keys

DIFFICULTY LEVEL-1

1. (c) 2. (a) 3. (b) 4. (d) 5. (b) 6. (b) 7. (c) 8. (c) 9. (d) 10. (b) 11. (d) 12. (d) 13. (d)
 14. (c) 15. (c) 16. (d) 17. (d) 18. (d) 19. (d) 20. (d) 21. (b) 22. (d) 23. (b) 24. (d) 25. (a) 26. (d)
 27. (d) 28. (a) 29. (d) 30. (c) 31. (a) 32. (a) 33. (c) 34. (d) 35. (d) 36. (c) 37. (a) 38. (c) 39. (d)
 40. (d) 41. (a) 42. (b) 43. (b) 44. (c) 45. (c) 46. (c) 47. (b) 48. (c) 49. (d) 50. (a) 51. (b) 52. (b)
 53. (d) 54. (d) 55. (a) 56. (a) 57. (b) 58. (b) 59. (c) 60. (d) 61. (b) 62. (d) 63. (a) 64. (b) 65. (c)
 66. (b) 67. (b) 68. (c) 69. (a) 70. (b) 71. (a) 72. (b) 73. (a) 74. (c) 75. (a) 76. (a) 77. (b)

DIFFICULTY LEVEL-2

1. (c) 2. (b, c) 3. (a) 4. (a) 5. (d) 6. (c) 7. (c) 8. (a) 9. (d) 10. (b) 11. (a) 12. (a) 13. (c)
 14. (b) 15. (c) 16. (c) 17. (d) 18. (d) 19. (c) 20. (d) 21. (c) 22. (b) 23. (c) 24. (b) 25. (a) 26. (c)
 27. (b) 28. (b) 29. (d) 30. (c) 31. (b) 32. (a) 33. (c) 34. (c) 35. (b) 36. (b) 37. (a) 38. (b) 39. (d)
 40. (c) 41. (a) 42. (c) 43. (d) 44. (b) 45. (b)

Explanatory Answers

DIFFICULTY LEVEL-1

1. (c) Suppose the quantities of Tea worth ₹126 per kg, ₹135 per kg and ₹ x per kg purchased are y , y and $2y$ kg respectively.

$$\therefore \frac{126y + 135y + 2xy}{4y} = 153$$

$$\Rightarrow 261 + 2x = 612$$

$$\Rightarrow x = \frac{351}{2} = 175.50$$

\therefore Tea of the third variety is purchased @ ₹175.50 per kg.

2. (a) Since $x + y = \frac{1}{2}$, he mixes milk and water in the ratio 2:1.

Let, us say, in 100 litres milk, he mixes 50 litres water.

$$\text{C.P. of milk} = 10x \text{ per } 100 \text{ l}$$

$$\text{C.P. of water} = x \text{ per } 100 \text{ l, i.e., } \frac{x}{2} \text{ per } 50 \text{ l}$$

$$\text{S.P. of milk} = (1.2) \times 15x = 18x$$

$$\begin{aligned} \text{So, profit percentage} &= \frac{(18x - 10.5x)}{10.5x} \times 100 \\ &= 72\% \text{ (approximately)} \end{aligned}$$

3. (b) Let, $M = 3K$, $W = 2K$

$$\therefore 3K + 2K = 45 \Rightarrow K = 9$$

$$\Rightarrow \text{Milk} = 27 \text{ litres and Water} = 18 \text{ litres}$$

Now suppose x litres of water is added to the mixture such that

$$\frac{27}{18+x} = \frac{9}{11} \Rightarrow 162 + 9x = 297$$

$$\Rightarrow 9x = 135 \Rightarrow x = 15.$$

4. (d) In both jars concentration of milk is more than 50% Therefore, in jar three concentration of milk cannot be 50% Hence, we cannot decide the volumes.

5. (b) Suppose the quantity of milk purchased = x litres
Suppose quantity of water mixed = y litres
 \therefore Required ratio of the water and the milk in the mixture = $y:x$
C.P. of x litres of milk = ₹6.4 x
S.P. of x litres of milk = ₹8 $(x + y)$

$$\text{Profit \%} = 37.5$$

$$\therefore \text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{Gain\%}}$$

$$\Rightarrow 6.4x = \frac{(8x + 8y) \times 100}{100 + 37.5}$$

$$\Rightarrow 880x = 800x + 800y$$

$$\Rightarrow 80x = 800y \Rightarrow x = 10y$$

$$\Rightarrow \frac{x}{10} = \frac{y}{1}$$

$$\therefore \text{Required ratio} = 1:10.$$

6. (b) Let, ₹ X , ₹ Y be the cost price per kg of variety A and variety B of rice

$$\text{By data } 10X + 15Y = 25 \text{ (1.4) } X.$$

Since sale price of the mixture is 40% more than the cost price of A .

$$\text{Therefore } 10X + 15Y = 35X$$

$$\Rightarrow 15Y = 25X$$

$$\text{Hence, } X:Y = 15:25 = 3:5$$

7. (c) Suppose x litres of acid was drawn off initially.

$$\therefore \text{Remaining acid in the 54-litre vessel full of acid.} \\ = (54 - x) \text{ litres and water added} = x \text{ litres.}$$

Now out of the 54 litres of mixture of acid and water, x litres of mixture is drawn off.

$$\Rightarrow \text{Quantity of acid drawn off} = \left(\frac{54 - x}{54} \times x \right) \text{ litres}$$

$$\text{and quantity of water drawn off} = \frac{x^2}{54} \text{ litres.}$$

$$\text{Now the vessel contains } \left[54 - x - \left(\frac{54 - x}{54} \right) x \right] \text{ litres of acid.}$$

$$\therefore 54 - x - \left(\frac{54 - x}{54} \right) x = 24$$

$$\Rightarrow x^2 - 108x + 1620 = 0$$

$$\Rightarrow x = 90, 18.$$

Since $90 > 54$, therefore $x = 90$ is ruled out.

$$\text{Hence } x = 18.$$

8. (c)	Milk	:	Water
	20		30
	-10		-15
			+25
	10		40

Therefore, the concentration of the solution is reduced from 20 to 10, i.e., reduced by 50%. The dilution of the solution increased from 30 to 40, i.e., increased by $33\frac{1}{3}\%$

9. (d) Total milk = 20 litres

Water	Milk	Total
1 litre	19 litres	20
1	$19 + x$	$20 + x$

Now $1 = 2\%$ of $(20 + x)$, where x is the quantity of pure milk added to the mixture.

$$\Rightarrow x = 30$$

where x = quantity of pure milk added to the mixture.

10. (b) Quantity of milk in the mixture = 48 litres.

Quantity of water in the mixture = 32 litres

Let, x litres of water be added in the mixture so that

$$\frac{48}{32 + x} = \frac{2}{3} \Rightarrow 2x + 64$$

$$= 144 \Rightarrow x = 40.$$

11. (d) Total quantity = 300 ml

Sugar by weight = 120 ml

Water = 180 ml

Let, x be the amount of water added to the solution.

$$\text{Then, } \frac{120}{300 + x} = \frac{30}{100}$$

$$\Rightarrow 1200 = 900 + 3x \Rightarrow 300 = 3x \Rightarrow x = 100 \text{ ml.}$$

12. (d) Given that all vessels contain equal amount of mixture say V .

So in the first vessel \rightarrow water:milk = $1/7:6/7$

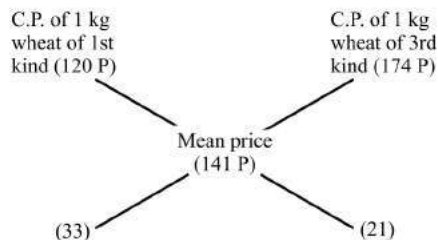
In the second vessel $\rightarrow 2/7:5/7$

In the third vessel $\rightarrow 1/4:3/4$.

Hence, the final ratio is = $\frac{(6/7) + (5/7) + (3/4)}{(1/7) + (2/7) + (1/4)}$

$$= \frac{65}{19}$$

13. (d) **Step 1:** Mixture of wheats of first and third kind to get a mixture worth ₹1.41 per kg?

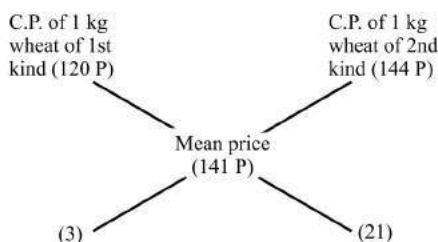


By alligation rule:

$$\frac{(\text{Quantity of 1st kind of wheat})}{(\text{Quantity of 3rd kind of wheat})} = \frac{33}{21} = \frac{11}{7}$$

i.e., they must be mixed in the ratio 11:7

Step II: Mix wheat of 1st kind and 2nd kind to obtain a mixture worth of ₹1.41 per kg.



\therefore By alligation rule:

$$\frac{(\text{Quantity of 1st kind of wheat})}{(\text{Quantity of 2nd kind of wheat})} = \frac{3}{21} = \frac{1}{7}$$

i.e., they must be mixed in the ratio 1:7

Thus, $\frac{(\text{Quantity of 2nd kind of wheat})}{(\text{Quantity of 3rd kind of wheat})}$

$$= \frac{(\text{Quantity of 2nd kind of wheat})}{(\text{Quantity of 3rd kind of wheat})}$$

$$\times \frac{(\text{Quantity of 1st kind of wheat})}{(\text{Quantity of 3rd kind of wheat})}$$

$$= \left(\frac{7}{1} \times \frac{11}{7} \right) = \frac{11}{1}$$

\therefore Quantities of wheat of (1st kind:2nd kind:3rd kind)

$$= \left(1:7:\frac{7}{11} \right) = (11:77:7).$$

14. (c) Kerosene in 100 kg = $7/32 \times 100 = 21.875$ kg

Petrol in 100 kg = $25/32 \times 100 = 78.125$ kg

Now 78.125 is 25 parts out of $(25 + 9) = 34$ parts

Hence 9 parts = $9/25 \times 78.125 = 28.125$

Amount to be added = $28.125 - 21.875 = 6.25$ kg

15. (c) In the new mixture, water:alcohol = 3:2 = 12:8
 \Rightarrow The capacity of each container = $(12 + 8)/2$
 = 10 units

\Rightarrow The ratios of water to alcohol of the containers are 4:6 and 8:2 = 2:3 and 4:1

16. (d) 5 litres of 20% of solution = 1 litre, i.e., the amount of alcohol. Now new strength of alcohol will be $\frac{1}{6}$ i.e., 16.66%

17. (d) $\frac{30-x}{x-25} = \frac{6}{4} = \frac{3}{2} \Rightarrow 5x = 135$ or $x = 27$ so, required percentage of milk = 27%

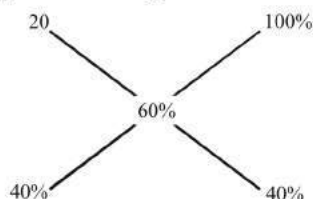
18. (d) % of liquid B in the original mixture.

$$= \frac{1}{5} \times 100 = 20\%$$

In the final mixture % of liquid B

$$= \frac{3}{5} \times 100 = 60\%$$

Now using the rule of alligation

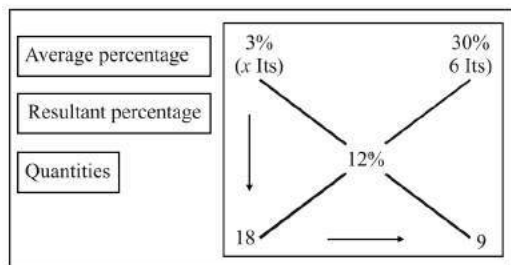


Hence reduced quantity of the first mixture and the quantity of mixture B which is to be added are the same.

\therefore Total mixture = 10 + 10 = 20 liters and quantity of

$$\text{liquid A} = \frac{20}{5} \times 4 = 16 \text{ litres.}$$

19. (d)



i.e., 2:1

Hence x litres must be 12 litres, i.e., (6×2) .

20. (d) In 100 cc solution, quantity of boric acid = 80 cc and quantity of water = 20 cc. Suppose x litres of water be added to make the solution 50%

$$\therefore 50\% (100 + x) = 80 \Rightarrow x = 60$$

21. (b) Quantity of milk in the mixture = 48 litres

Quantity of water in the mixture = 32 litres

Let, x litres of water be added in the mixture so that

$$\frac{48}{32+x} = \frac{2}{3} \Rightarrow 2x + 64 = 144 \Rightarrow x = 40$$

22. (d) Total milk = 20 litres

Water	Milk	Total
1 litre	19 litres	20
1	$19 + x$	$20 + x$

Now 1 = 2% of $(20 + x)$, where x is the quantity of pure milk added to the mixture.

$$\Rightarrow x = 30$$

where, x = quantity of pure milk added to the mixture.

23. (b) Suppose the quantity of milk purchased = x litres

Suppose quantity of water mixed = y litres

\therefore Required ratio of the water and the milk in the mixture = $y:x$

C.P. of x litres of milk = ₹6.4 x

S.P. of x litres of milk = ₹8 $(x + y)$

Profit % = 37.5

$$\therefore \text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{Gain\%}}$$

$$\Rightarrow 6.4 = \frac{(8x + 8y) \times 100}{100 + 37.5}$$

$$\Rightarrow 880x = 800x + 800y$$

$$\Rightarrow 80x = 800y \Rightarrow x = 10y$$

$$\Rightarrow \frac{x}{10} = \frac{y}{1}$$

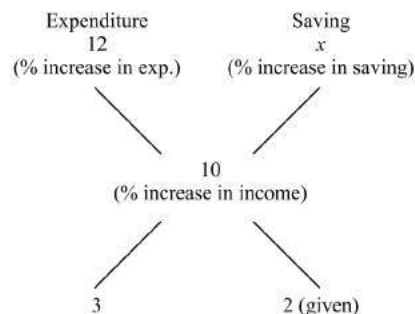
\therefore Required ratio = 1:10

24. (d) Milk = 40 litres

Water = 20 litres

To make the ratio $M:W = 1:2$, 60 litres of water should be added.

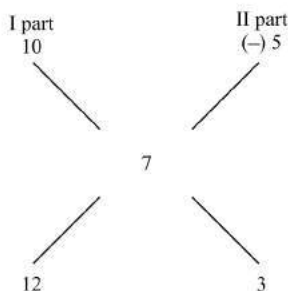
25. (a)



We get two values of x , 7 and 13. But to get a viable answer, we must keep in mind that the central value (10) must lie between x and 12. Thus, the value of x should be 7 and not 13.

Required % increase = 7%

26. (d) \therefore Ratio of quantities sold at 10 % profit and 5% loss = 12:3 = 4:1



\therefore The quantity sold at 10% profit

$$= \frac{50}{4+1} \times 4 = 40 \text{ kg}$$

and, the quantity sold at 5% loss

$$= 50 - 40 = 10 \text{ kg}$$

27. (d) Here 10% of 150 kg = 15 kg

\therefore Good quality of wheat is 135.

To becomes the 5% low quality of wheat, we add 150 kg of more wheat.

28. (a) Milk in mixture = $6 \times \frac{25}{100} + 4 \times \frac{30}{100} = \frac{270}{100}$

$$\text{For 10 parts} = \frac{270 \times 10}{100} = 27\%$$

29. (d) Let, x litres of second solution must be added.

Then,

$$\frac{15 \times 20 + 5 \times x}{20 + x} = 10$$

$$\Rightarrow 300 + 5x = 200 + 10x$$

$$\Rightarrow x = \frac{100}{5} = 20 \text{ litres}$$

- 30 (c) Go through options, options (a) and (b) are ruled out as released amount cannot be either 7 or 8.

For option (c),

$$\text{Oxygen} = 1.28 \text{ and Nitrogen} = 6.72$$

After first released oxygen

$$= 1.28 - 0.32 = 0.96 \text{ litres}$$

After second released oxygen

$$= 0.96 - 0.24 = 0.72 \text{ litres}$$

which is 9% of 8 litres.

31. (a) Total quantity of mixture = $2 + 3 + 0.5 = 5.5$ gallon

Total quantity of water

$$= 2 \times \frac{12}{100} + 3 \times \frac{7}{100} + 0.5$$

$$= 0.95 \text{ gallon}$$

\therefore Required percentage

$$= \frac{0.95}{5.5} \times 100$$

$$= \frac{190}{11} = 17\frac{3}{11}\%$$

32. (a) Let, the quantity of milk replaced be x .

$$\text{Then, } \frac{40}{100}(1-x) + \frac{19}{100} \times x = \frac{26}{100} \times 1$$

$$\Rightarrow 40 - 40x + 19x = 26$$

$$\Rightarrow 21x = 14$$

$$\Rightarrow x = \frac{2}{3}$$

33. (c) Quantity of salt in 6 litres of solution

$$= \frac{5}{100} \times 6 = 0.3 \text{ litres}$$

Percentage of salt in 5 litres of solution

$$= \frac{0.3}{5} \times 100 = 6\%$$

34. (d) Given that nectar contains 70% water.

And honey obtained contains 17% water.

It means that out of 1 kg honey 17% is water, i.e., pure honey = 0.83 kg

Which is 20% of the flower nectar

[\because 70% is water].

Now, let quantity of flower nectar processed be x kg.

Then,

$$0.3 \times x = 0.83$$

$$\therefore x = \frac{0.83}{0.3} = 2.77 \text{ kg}$$

35. (d) Required quantity of water

$$= \frac{9 \times (50 - 30)}{30} = \frac{9 \times 20}{30} = 6 \text{ ml}$$

36. (c) LCM of (3 + 2), (7 + 3) and (11 + 4) is 30.

Let, the capacity of each container be 30 litres.

\therefore Quantity of milk after mixing

$$= \left(\frac{3}{5} + \frac{7}{10} + \frac{11}{15} \right) \times 30$$

$$= 61 \text{ litres}$$

Quantity of water after mixing

$$= \left(\frac{2}{5} + \frac{3}{10} + \frac{4}{15} \right) \times 30$$

$$= 29 \text{ litres}$$

\therefore Required ratio = 61 : 29

37. (a) Quantity of alcohol in 1 litres mixture of first bottle

$$= \frac{2}{10} \times 1 = \frac{1}{5} \text{ litres}$$

As second bottle does not contains alcohol.

$$\text{So, required fraction} = \frac{1}{3} \times \frac{1}{5} = \frac{1}{15} \text{ litres}$$

38. (c)

	Spirit		Water
Vessel 1	0.5	:	0.5
	1	:	1
Vessel 2	0.75	:	0.25
	3	:	1

$$\frac{\text{Spirit}}{\text{Water}} = \frac{\frac{1}{2} \times 2 + \frac{3}{4} \times 3}{\frac{1}{2} \times 2 + \frac{1}{4} \times 3} = \frac{13}{7}$$

39. (d) Quantity of milk = $\frac{2}{3} \times 60 = 40$ litres

$$\text{Quantity of water} = \frac{1}{3} \times 60 = 20 \text{ litres}$$

Quantity of water added = x litres (suppose)

$$\text{Now, } \frac{40}{20+x} = \frac{1}{2}$$

$$\Rightarrow x = 60 \text{ litres}$$

40. (d) Initially, let x g of water was taken.

According to the problem:

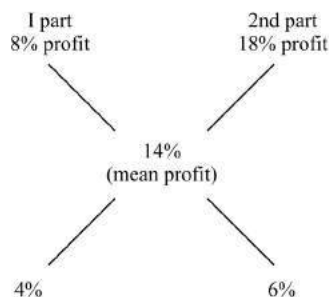
$$(x-20) + \frac{2}{3}(x+20) = 4 \times \frac{1}{3}(x+20)$$

$$\Rightarrow x-20 = \frac{2}{3}(x+20)$$

$$\Rightarrow 3x-60 = 2x+40$$

$$\Rightarrow x = 100 \text{ g}$$

41. (a) \therefore Ratio of quantities sold at 8% profit and 18% profit
= 4:6 = 2:3



Therefore, the quantity sold at 18% profit

$$= \frac{50}{2+3} \times 3 = 30 \text{ kg}$$

42. (b) Milk = $\frac{3}{4} \times 100 = 75$

Ratio of milk and water = 3:1

$$\text{Water} = \frac{1}{4} \times 100 = 25$$

Let, x litres of mixture is taken away, then quantity of

$$\text{milk left} = \left(3 - \frac{3x}{4} \right)$$

$$\text{and water left} = \left(1 - \frac{x}{4} \right) + x$$

$$\text{Given, } 3 - \frac{3x}{4} = 1 - \frac{x}{4} + x$$

$$\Rightarrow 3-1 = \frac{3x}{4} - \frac{x}{4} + x$$

$$\Rightarrow 2 = \frac{6x}{4}$$

$$\Rightarrow x = \frac{4}{3}$$

$$\therefore \text{ Required percentage} = \frac{4}{\frac{4}{3}} \times 100 = 33\frac{1}{3} \%$$

43. (b) Quantity of water in the mixture

$$= \frac{20}{100} \times 45 = 9 \text{ L}$$

Let, x litres of water must be added to make the water 25% in the solution.

$$\therefore \frac{9+x}{45+x} \times 100 = 25$$

$$\Rightarrow 36 + 4x = 45 + x$$

$$\Rightarrow 3x = 9$$

$$\Rightarrow x = 3 \text{ litres}$$

44. (c) Let, the quantity of liquid P and Q be $5x$ and $3x$ litres respectively.

$$\text{Quantity of } P \text{ removed} = \frac{5}{5+3} \times 16 = 10 \text{ litres}$$

$$\text{Quantity of } Q \text{ removed} = \frac{3}{5+3} \times 16 = 6 \text{ litres}$$

$$\text{Now, } \frac{5x-10}{3x-6+16} = \frac{3}{5}$$

$$\Rightarrow 25x - 50 = 9x + 30$$

$$\Rightarrow 16x = 80$$

$$\Rightarrow x = 5$$

$$\therefore \text{Quantity that vessel hold} = 8 \times 5 = 40 \text{ litres.}$$

45. (c) Amount of dettol after

$$\text{First operation} = \frac{2}{3}$$

$$\text{Second operation} = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$$

$$\text{Third operation} = \frac{4}{9} \times \frac{2}{3} = \frac{8}{27}$$

$$\text{Fourth operation} = \frac{8}{27} \times \frac{2}{3} = \frac{16}{81}$$

Amount of water after fourth operation

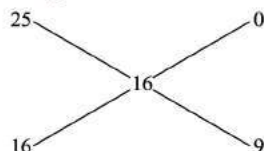
$$= 1 - \frac{16}{81} = \frac{65}{81}$$

$$\therefore \text{Required ratio} = \frac{16}{81} : \frac{65}{81} = 16 : 65$$

46. (c) Selling price of mixture = ₹20

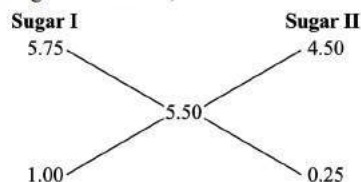
$$\text{Cost price of mixture} = \frac{100}{125} \times 20 = ₹16$$

By the rule of alligation



So, required ratio = 16:9

47. (b) Using Alligation Method,



i.e., 4:1

Hence, the required quantity of Sugar I

$$= \frac{75}{1} \times 4 = 300 \text{ kg}$$

48. (c) Let, the quantity of pure milk be x litres.

If 5 litres of water is added to it, then cost of $(5+x)$ litres = ₹ $(3x+5)$

$$\therefore \text{Profit} = ₹15$$

Given, 20% of $3x = 15$

$$\Rightarrow \frac{3x}{5} = 15$$

$$\Rightarrow x = 25 \text{ litres}$$

\therefore The amount of pure milk in the mixture was 25 litres.

49. (d) Water (W) + Drained (D) = 12

$$\Rightarrow W + D = 12$$

$$\text{Now, } W = D - 6$$

$$D - 6 + D = 12$$

$$\Rightarrow D = 9 \text{ litres}$$

50. (a) Quantity of nitric acid = $10 \times \frac{1}{10} = 1$ litre

$$\text{Water} = 10 - 1 = 9 \text{ litres}$$

Let, x litres of water be added.

$$\text{Then, } (10+x) \times \frac{4}{100} = 1 \Rightarrow x = 15 \text{ litres}$$

51. (b) Given, that sedimenting starts when the ratio of salt to water is 1:4.

Now, 1000 g solution has 40 g salt and 960 g water.

Process of sedimenting will start when the ratio of salt to water is 1:4 i.e., 40:160.

Hence, 800 g of water has to be evaporated.

Now, time required to evaporate 800 g of water

$$= \frac{800}{28} = 28.57 \text{ hrs} \approx 29 \text{ hrs}$$

52. (b) $\frac{5}{13}$ of the tin is in 1 kg of alloy. Since quantity of tin is

constant (because the other alloy does not contain tin),

therefore, there is $\frac{5}{13}$ of the tin in 2 kg of alloy.

Hence, there is $\frac{5}{26}$ of tin in 1 kg of alloy.

53. (d) CP of 25 kg of rice @ ₹6 = ₹25 × 6 = ₹150

CP of 35 kg of rice @ ₹7 = ₹35 × 7 = ₹245

∴ CP of 25 + 35, i.e., 60 kg of rice

$$= ₹(150 + 245) = ₹395$$

SP of 1 kg of rice = ₹6.75

∴ SP of 60 kg of rice = ₹6.75 × 60 = ₹405

Hence, total gain = ₹405 - ₹395 = ₹10.

54. (d) Concentration of basic acid = 80% = 80 cc

Quantity of water = 20 cc

Let, x cc of water be added to get the concentration of 50%

$$\frac{80}{100 + x} = \frac{50}{100}$$

$$\Rightarrow \frac{80}{100 + x} = \frac{1}{2}$$

$$\Rightarrow x = 60 \text{ cc}$$

55. (a) Let, Cost of beer = ₹ x / bottle

∴ Cost of lager = ₹2 x / bottle

∴ A spent ₹4 x and B spent ₹2 x C paid ₹50

∴ Cost of lager = ₹50 per bottle

Cost of beer = ₹12.50 per bottle

56. (a) Content of gold in alloy = $50 \times \frac{80}{100} = 40$ g

Let, x g of gold should be added to alloy and solve the equation for ' x '.

$$\frac{40 + x}{50 + x} \times 100 = 90$$

57. (b) Write now the amount of salt in the solutions

$$= 300 \times \frac{90}{100} = 12 \text{ g}$$

Let, x g salt is added to the solution

$$\therefore \frac{120 + x}{300 + x} \times 100 = 50$$

$$\Rightarrow x = 60$$

58. (b) 300 g solution has 40% salt in it.

So, the amount of salt in it

$$= \frac{40 \times 300}{100} = 120 \text{ g}$$

For the salt percentage to be 50%,

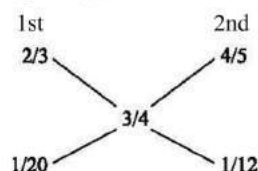
$$\frac{120 + x}{300 + x} = \frac{1}{2}$$

$$\therefore 240 + 2x = 300 + x$$

$$x = 60 \text{ g}$$

Hence, option (b).

59. (c)



$$\therefore \text{Ratio} = \frac{1}{20} : \frac{1}{12} = 3:5$$

60. (d) Milk and water ratio = 3:1

∴ Total = 4

∴ We take half of pure milk and half of water, then

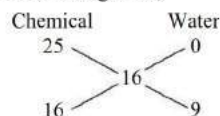
$$\text{total remainder} = \frac{2}{4} = \frac{1}{2} \text{ unit.}$$

61. (b) SP of mixture = ₹20 per L

Profit = 25%

$$\therefore \text{CP of mixture} = \frac{100}{25} \times 20 = ₹16$$

By the rule of allegation,



the ratio of chemical and water = 16:9.

62. (d) We have 1000 liters of crude oil as input.

After refining for 1 hr, we get

Output = 90% of 1000 = 900 litres

Profit = ₹900 × 30 = 27000

Further refining for $\frac{1}{2}$ hrs, we get

Output = 90% of 900 = 8100 litres

Profit = ₹8100 × 50 = ₹40500

Hence, maximum profit = ₹40500

63. (a) Quantity of gold in A = $\frac{7}{7+2} = \frac{7}{9}$

$$\text{Quantity of gold in B} = \frac{7}{7+11} = \frac{7}{18}$$

Let, quantity of gold in C = x

According to the question,

$$x - \frac{7}{18} = \frac{7}{9} - x \Rightarrow 2x = \frac{7}{9} + \frac{7}{18} = \frac{21}{18}$$

$$\Rightarrow x = \frac{7}{12}$$

Hence, ratio of gold and copper in C = 7:5.

64. (b) In first cask,

$$\text{Quantity of wine} = \frac{13}{20} \times 48 = 31.2 \text{ litres}$$

$$\text{Quantity of water} = \frac{7}{20} \times 48 = 16.8 \text{ litres}$$

In second cask,

$$\text{Quantity of wine} = \frac{18}{35} \times 42 = 21.6 \text{ litres}$$

$$\text{Quantity of water} = \frac{17}{35} \times 42 = 20.4 \text{ litres}$$

After mixing,

$$\text{Quantity of wine} = 31.2 + 21.6 = 52.8 \text{ litres}$$

$$\text{Quantity of water} = 16.8 + 20.4 + 20 = 57.2 \text{ litres}$$

$$\therefore \text{ Required ratio} = \frac{52.8}{57.2} = \frac{132}{143} = \frac{12}{13} = 12:13.$$

65. (c) In first container,

$$\text{Milk} = 90\% \text{ of } 20 = 18 \text{ litres}$$

$$\therefore \text{ Water} = 20 - 18 = 2 \text{ litres}$$

In second container,

$$\text{Milk} = 80\% \text{ of } 5 = 4 \text{ litres}$$

$$\text{Water} = 5 - 4 = 1 \text{ litres}$$

In third container,

$$\text{Milk} = 70\% \text{ of } 9 = 6.3 \text{ litres}$$

$$\text{Water} = 9 - 6.3 = 2.7 \text{ litres}$$

After mixing,

$$\text{Total milk} = 18 + 4 + 6.3 = 28.3 \text{ litres}$$

$$\text{Total water} = 2 + 1 + 2.7 = 5.7 \text{ litres}$$

$$\therefore \text{ Required ratio} = 28.3:5.7 = 5:1$$

66. (b) Quantity of petrol in the mixture

$$= \frac{1}{2} \times 2 + \frac{3}{5} \times 3 + \frac{4}{5} \times 1$$

$$= 1 + \frac{9}{5} + \frac{4}{5} = 1 + \frac{13}{5}$$

$$= \frac{18}{5}$$

and quantity of kerosene in the mixture

$$= \frac{1}{2} \times 2 + \frac{2}{5} \times 3 + \frac{1}{5} \times 1$$

$$= 1 + \frac{6}{5} + \frac{1}{5} = 1 + \frac{7}{5}$$

$$= \frac{12}{5}$$

Thus, ratio of petrol and kerosene

$$= \frac{18}{5} : \frac{12}{5} = 3:2.$$

67. (b) Let, quantities of first and second kinds of alcohols be X L and $(18 - X)$ L, respectively.

$$\text{Then, } \frac{3}{7} \times \frac{5}{11} (18 - X) = \frac{4}{9} (18)$$

$$\Rightarrow \frac{3X}{7} + \frac{90}{11} - \frac{5X}{11} = 8$$

$$\Rightarrow \frac{5X}{11} - \frac{3X}{7} = \frac{90}{11} - 8$$

$$\Rightarrow \frac{2X}{77} = \frac{2}{11}$$

$$\Rightarrow X = 7 \text{ L}$$

68. (c) In the mixture of two casks,

Quantity of milk

$$= \frac{13}{20} \times 48 + \frac{18}{35} \times 42$$

$$= \frac{156}{5} + \frac{108}{5} = \frac{264}{5} \text{ litres}$$

$$\text{Quantity of water} = \frac{7}{20} \times 48 + \frac{17}{35} \times 42$$

$$= \frac{84}{5} + \frac{102}{5} = \frac{186}{5} \text{ litres}$$

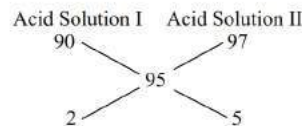
When 20 L of water is added to the mixture, then

$$\text{quantity of water} = \frac{186}{5} + 20$$

$$= \frac{186 + 100}{5} = \frac{286}{5} \text{ litres}$$

$$\text{Thus, required ratio} = \frac{264}{5} : \frac{286}{5} = 12:13.$$

69. (a)



\therefore Amounts of the solutions I and II are in the ratio 2:1.

\therefore Amounts of the solutions I and II are $\frac{2}{7} = 21 = 6$ litres and $\frac{5}{7} \times 21 = 15$ litres, respectively.

70. (b) Let, both glasses have ' x ' litres of mixture.

$$\text{In first glass, alcohol} = \frac{2}{3}x$$

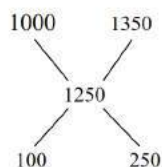
$$\text{Water} = \frac{1}{3}x$$

$$\text{In second glass, alcohol} = \frac{1}{2}x$$

$$\text{Water} = \frac{1}{2}x$$

$$\text{Required ratio in the third glass} = \frac{\frac{2}{3}x + \frac{1}{2}x}{\frac{1}{3}x + \frac{1}{2}x} = \frac{7}{5} = 7:5.$$

71. (a)



$$\text{Required ratio} = \frac{100}{250} = \frac{2}{5}$$

$$\therefore \text{Volume of water} = \frac{2}{2+5} = \frac{2}{7}$$

$$\text{Volume of liquid} = \frac{5}{2+5} = \frac{5}{7}$$

72. (b) By using options,

Let, the barrel which contain wine is 20 liters barrel.

Then, he has to divide the remaining in ratio of 1:2

This can be divided as follows

$$15 + 18:19 + 16 + 31:66 = 1:2$$

So, the barrel containing wine is 20 liters barrel.

73. (a) Let, the price/kg of tea of 1st kind be ₹x.

Then, price/kg of tea of 2nd kind = ₹(x+325)

Now, quantity of two tea be 4a and a, respectively.

We are given,

$$[4a \times x + a \times (x + 3.25)] \times \frac{112.5}{100} = (4a + a)72$$

$$\Rightarrow 49x + a \times (x + 3.25) = \frac{5a \times 72 \times 100}{112.5}$$

$$\Rightarrow 4a + x + 3.25 = \frac{5 \times 72 \times 100}{112.5}$$

$$\Rightarrow 5x + 3.25 = 320$$

$$\Rightarrow x = \frac{320 - 3.25}{5} = \frac{316.75}{5} = 63.35$$

\therefore Price per kg of tea of 1st kind = ₹63.35.

74. (c) Quantity of milk to be measured is 403 kg, 434 kg and 465 kg.

\therefore Biggest measure to measure all the quantities exactly

$$= \text{HCF of } 403, 434, 465 = 31 \text{ kg.}$$

75. (a) Let, amount of solution be 100 ml

\therefore Amount of water = 40 ml

\therefore Amount of milk = 60 ml

Let, amount of solution replaced be x ml.

New solution that is added has 81% milk and 19% water.

\therefore Amount of water in new solution obtained = 26% = 26 ml

$$\therefore 40 - \frac{40x}{100} + \frac{19x}{100} = 26$$

$$\Rightarrow 40 - 26 = \frac{21x}{100}$$

$$\Rightarrow 14 = \frac{21x}{100}$$

$$\Rightarrow x = \frac{14}{21} \times 100 = \frac{2}{3} \times 100$$

$$\therefore \text{Quantity of milk replaced} = \frac{\frac{2}{3} \times 100}{100} = \frac{2}{3}$$

76. (a) If we assume that quantity of mixture in all three containers are 5, 4 and 5, then total quantity of milk

$$= \frac{1}{6} \times 5 + \frac{3}{8} \times 4 + \frac{5}{12} \times 5$$

$$= \frac{5}{6} + \frac{3}{2} + \frac{25}{12}$$

$$= \frac{10 + 18 + 25}{12} = \frac{53}{12} \text{ litres}$$

$$\text{and quantity of water} = (5 + 4 + 5) - \frac{53}{12} = \frac{115}{12} \text{ litres}$$

$$\therefore \text{Required ratio} = \frac{53}{12} : \frac{115}{12} = 53:115.$$

77. (b) Solution in first vessel = 4:1 = 5 × 7

Solution in second vessel = 5:2 = 7 × 5

Solution in third vessel = 6:1 = 7 × 5

Now, ratio in first, second and third vessel are respectively 28:7, 25:10 and 30:5.

\therefore Required ratio 28:7

25:10

30:5

83:22

DIFFICULTY LEVEL-2

1. (c) Ratio of quantity of alcohol left to total quantity

$$= \frac{1}{1} \times \frac{3}{4} \times \frac{1}{2} \times \frac{1}{4} = \frac{3}{32}$$

$$\text{Alcohol percentage} = \frac{3}{32} \times 100 = 9\frac{3}{8}\%$$

2. (b, c) Milk and water in $A = 4x$ and $8y$

Milk and water in $B = 5x$ and $9y$

If concentration of milk in A is between 60% and 80%, then ratio of milk and water would be between 60:40 and 80:20

$$\Rightarrow \frac{60}{40} \leq \frac{4x}{8y} \leq \frac{80}{20}$$

$$\Rightarrow \frac{60}{40} \times \frac{8}{4} \times \frac{5}{9} \leq \frac{5x}{9y} \leq \frac{80}{20} \times \frac{8}{4} \times \frac{5}{9}$$

$$\Rightarrow \frac{5}{3} \leq \frac{5x}{9y} \leq \frac{40}{9}$$

\Rightarrow Concentration of milk in B is between 62.5% and 81% If concentration of milk in B is between 60% and 80%, then ratio of milk and water would be between 60:40 and 80:20.

$$\Rightarrow \frac{60}{40} \leq \frac{5x}{9y} \leq \frac{80}{20}$$

$$\Rightarrow \frac{60}{40} \times \frac{9}{5} \times \frac{4}{8} \leq \frac{4x}{8y} \leq \frac{80}{20} \times \frac{9}{5} \times \frac{4}{8}$$

$$\Rightarrow \frac{27}{20} \leq \frac{4x}{8y} \leq \frac{18}{5}$$

\Rightarrow Concentration of milk in A is between 57.44% and 78.26%

3. (a) From vessel A (0.5 concentration), 1 litre of spirit and 1 litre of water is taken and from vessel B (0.75 concentration), 2.25 litres of spirit and 0.75 litre of water is taken.

\therefore Ratio of spirit to water in the resulting mixture

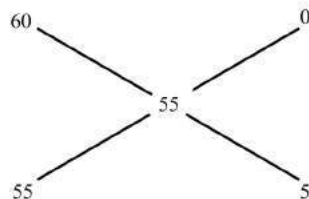
$$= \frac{1 + 2.25}{1 + 0.75}$$

$$= \frac{3.25}{1.75}$$

$$= \frac{13}{7}$$

4. (a) If selling price is not to be affected then fat content of the mixture should be 55% Fat content of milk is 60 and of water is 0.

By alligation



$$\text{i.e., 11:1. Water as \% of milk} = \frac{1}{11} \times 100 = 9\%$$

5. (d) Current selling price = ₹20

Procurement price = ₹16

Profit % = 25

Decrease in selling price = 20%

\therefore Selling price if fat content is less than 55%

₹16 if profit % is 25%

$$\therefore \text{cost price } \frac{16}{1.25} = ₹12.80$$

60% fat is available in 1 liter at ₹16.

Cost price of the mixture should be ₹12.80.

By alligation,

\therefore Water as % of pure milk = 25%

6. (c) Suppose there is 100 cc of liquid in each container initially.

I Step: Container B has 10 cc water in 110 cc of mixture.

II Step: 10 cc of this mixture contains.

$$10 \times \frac{100}{100} = \frac{100}{11} \text{ cc of milk and } \frac{10}{11} \text{ cc of water,}$$

which is transferred to container C .

Container C has 100 cc of acid, $\frac{100}{11}$ cc of milk and $\frac{10}{11}$ cc of water.

Total quantity of mixture in container $C = 110$ cc.

III Step: 10 cc of this mixture is transferred to A which contains.

$$\frac{100}{1210} \times 10 \text{ cc of milk} = \frac{100}{121} \text{ cc of milk}$$

Thus, in 100 cc of mixture, there is $\frac{100}{121}$ cc of milk of

the $\frac{1}{121}$ th proportion of the mixture.

7. (c) The amount of alcohol in the old mixture is $\frac{3}{7} \times 105$

= 45 ml. Further 105 ml alcohol is added.

Therefore, total alcohol in new mixture is 150 ml.

Water content is $(105 - 45) = 60$ ml. Alcohol to water ratio is 150:60 or 5:2.

8. (a) Let, $X\%$ be the percentage of spirit in A and $Y\%$ in B .

$$\frac{3X}{100} + \frac{2Y}{100} = 29\% \text{ of } (3 + 2)$$

$$\frac{3X}{100} + \frac{2Y}{100} = 1.45 \Rightarrow 3x + 2Y = 145 \quad (1)$$

$$\frac{X}{100} + \frac{9Y}{100} = \frac{34}{100} \times 10 = X + 9Y = 340 \quad (2)$$

Solving (1) and (2), we get $X = 25$ and $Y = 35$

A contains 25% spirit and B contains 35% of spirit.

9. (d) The quantity of new mixture = $\frac{5X}{3} + \frac{3X}{2} + \frac{4X}{3}$
 $= \frac{27X}{6} = \frac{9X}{2}$

$$\text{Percentage of milk} = \frac{5X}{3} \times \frac{3}{5} + \frac{3X}{2} \times \frac{2}{3} + \frac{3X}{2} \times \frac{2}{3}$$

$$= 3X$$

$$\text{Percentage of water} = \frac{5X}{3} \times \frac{2}{5} + \frac{3X}{2} \times \frac{1}{3} + \frac{1X}{2} \times \frac{2}{3}$$

$$= \frac{3X}{2}$$

$$\text{Percentage of water} = \frac{3X/2}{9X/2} \times 100$$

$$= \frac{100}{3} = 33\frac{1}{3}\%$$

10. (b)

A		B	
Acid	Water	Acid	Water
1	: 2	3	: 1

$$\text{Acid} = 1/3 \text{ Acid} = 3/4$$

$$\text{Mixture: Acid:Water} = 1:1$$

$$\text{Required acid} = 1/2$$

Now

$$\begin{array}{ccc} 1/3 & & 3/4 \\ & \searrow \quad \swarrow & \\ & 1/2 & \\ & \swarrow \quad \searrow & \\ 1/4 & & 1/6 \end{array}$$

$$\text{Required ratio} = 1/4:1/6 = 3:2$$

So, the required quantity is 3 and 2 litres respectively.

11. (a) Weight of zinc in the alloy = 6 gms and weight of copper in the alloy = 9 gms.

Suppose ' x ' gms of copper is removed.

Weight of copper in the alloy = $9 - x$

Weight of zinc in the alloy = $6 + 10 = 16$.

Now, $16 = 4(9 - x)$

Therefore, $x = 5$ gm

12. (a) Initial quantity of milk and water in the beakers.

Beaker A : Milk = 25 ml and Water = 75 ml

Beaker B : Milk = 20 ml and Water = 80 ml

Beaker C : Milk = 40 ml and Water = 60 ml

After 40 ml is transferred from beaker A to beaker C , the quantity of milk and water in the beakers is as follows:

Beakers A : Milk = $25 - 10 = 15$ ml and

Water = $75 - 30 = 40$ ml

Beaker B : Milk = 20 ml and Water = 80 ml

Beaker C : Milk = $40 + 10 = 50$ ml and

Water = $60 + 30 = 90$ ml

Now, Milk: Water in Beaker $C = 5:9$

After 20 ml is transferred from beaker C to beaker B :

Beaker A : Milk = 15 and Water = 40 ml

Beaker B : Milk = $20 + 10 = 30$ ml and

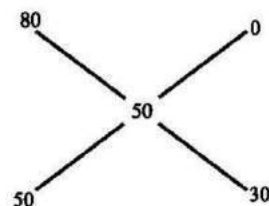
Water = $80 + 18 = 98$ ml

Beaker C : Milk = $50 - 10 = 40$ ml and

Water = $90 - 18 = 72$ ml

Required ratio = $15:30:40 = 3:6:8$

13. (c) 80% concentrated HCL is to be diluted to form a 50% concentrated HCL solution. The quantity of water to be added to the 15 litres solution is



i.e., 5:3

$$\therefore \frac{3}{5} \times 15 = 9 \text{ l}$$

\therefore 9 litres of water is added to HCL solution Similarly 16 litres of water is added to 90% concentrated solution of HNO_3 to dilute it to 70% concentration.

\therefore The total quantity of HCL and HNO_3 solutions are 24 litres and 72 litres respectively and that of the aqua regia formed is 96 litres and that of water in it is 33.6 litres.

\therefore The quantity of mixture 'X' is $111 - 96 = 15$

In the mixture X, the quantity of HCL is

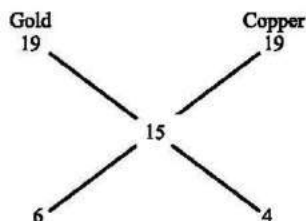
$$\frac{5}{12} \times 0.4 \times 15 = 2.5 \text{ litres}$$

and the quantity of water is

$$\left[\frac{5}{12} \times 0.6 + \frac{7}{12} \times 0.7 \right] \times 15 \equiv (0.25 + 0.41) \times 15 = 9.91$$

$$\therefore \text{The required ratio is } \frac{12 + 2.5}{33.6 + 9.9} = \frac{14.5}{43.5} = \frac{1}{3}$$

14. (b)

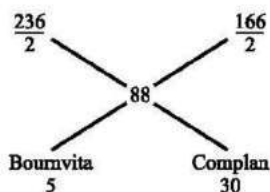


The alloy formed should contain gold and copper in the ratio 6:4 i.e., 3:2

15. (c)

	Petrol	Diesel	Kerosene
Initially	20	50	30
Step 1	15	37.5	47.5
Step 2	71.66	12.5	15.83

16. (c)



(\because IL mixture)

$$\frac{\text{Bournvita}}{\text{Complan}} = \frac{5}{30} = \frac{1}{6}$$

$$\text{Bournvita} = \frac{1}{7} \text{ of the mixture.}$$

17. (d) Amount of alcohol in first vessel = $0.25 \times 2 = 0.5$ litre
amount of alcohol in second vessel = $0.4 \times 6 = 2.4$ litre

Total amount of alcohol out of 10 liters of mixture is $0.5 + 2.4 = 2.9$ litre

Hence, the concentration of the mixture is 29%

$$\left(= \frac{2.9}{10} \times 100 \right)$$

18. (d) In a mixture of 1,000 ml, milk:water = 3:1.

Hence, milk = 750 ml, water 250 ml

A 250 ml of 3:2 solution contains 150 ml milk and 100 ml water.

Total milk = 900 ml, total water = 350 ml

After using 250 ml to make curd milk used

$$= \frac{250}{1250} \times 900 = 180 \text{ ml}$$

Pure milk left = $900 - 180 = 720$ ml

19. (c) First Alloy Second Alloy
C Al C Al

\therefore Required alloy

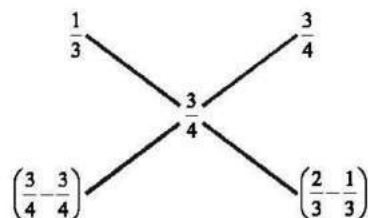
C Al
2 1

\therefore Copper in first alloy = $\frac{1}{3}$

copper in second alloy = $\frac{3}{4}$

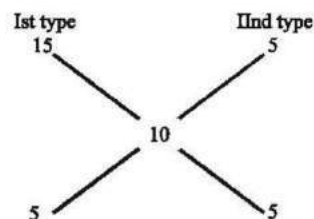
copper in required alloy (mixture) = $\frac{2}{3}$

Now, by alligation



$$\Rightarrow \frac{1}{12} : \frac{1}{3} \Rightarrow 1 : 4$$

20. (d)



Hence both the types should be added in the ratio of 1:1 to obtain the required strength. Hence 20 litres of first type should be added to the 20 litres of the second type to get the desired solution.

21. (c) Suppose there is 100 cc of liquid in each container initially.

I Step: Container B has 10 cc water in 110 cc of mixture.

II Step: 10 cc of this mixture contains

$$10 \times \frac{100}{100} = \frac{100}{11} \text{ cc of milk and } \frac{10}{11} \text{ cc of water,}$$

which is transferred to container C.

Container C has 100 cc of acid, $\frac{100}{11}$ cc of milk and $\frac{10}{11}$ cc of water.

Total quantity of mixture in container C = 110 cc

III Step: 10 cc of this mixture is transferred to A which contains.

$$\frac{100}{1210} \times 10 \text{ cc of milk} = \frac{100}{121} \text{ cc of milk}$$

Thus, in 100 cc of mixture, there is $\frac{100}{121}$ cc of milk of the $\frac{1}{121}$ th proportion of the mixture.

22. (b)

Milk	Water
20	30
-10	-15
	+25
<u>10</u>	<u>40</u>

Therefore, the concentration of the solution is reduced from 20 to 10, i.e., reduced by 50% The dilution of the solution increased from 30 to 40, i.e., increased by 33%

23. (c) Suppose x litres of acid was drawn off initially.

\therefore Remaining acid in the 54-litre vessel full of acid.

$$= (54 - x) \text{ litres and water added} = x \text{ litres.}$$

Now out of the 54 litres of mixture of acid and water, x litres of mixture is drawn off.

$$\Rightarrow \text{Quantity of acid drawn off} = \left(\frac{54 - x}{54} \times x \right) \text{ litres}$$

$$\text{and quantity of water drawn off} = \frac{x^2}{54} \text{ litres.}$$

Now the vessel contains $\left[54 - x - \left(\frac{54 - x}{54} \right) x \right]$ litres of acid.

$$\therefore 54 - x - \left(\frac{54 - x}{54} \right) x = 24$$

$$\Rightarrow x^2 - 108x + 1620 = 0$$

$$\Rightarrow x = 90, 18$$

Since $90 > 54$, therefore $x = 90$ is ruled out. Hence $x = 18$.

24. (b) Suppose the quantity of milk purchased = x litres

Suppose quantity of water mixed = y litres

\therefore Required ratio of the water and the milk in the mixture = $y:x$

C.P. of x litres of milk = ₹8.0x

S.P. of x litres of milk = 9 ($x + y$)

$$\therefore \text{C.P.} = \frac{\text{S.P.} \times 100}{100 + \text{Gain\%}}$$

$$\Rightarrow 6.4 = \frac{(9x + 9y) \times 100}{100 + 40}$$

$$\Rightarrow 1120x = 900x + 900y$$

$$\Rightarrow 220x = 900y$$

$$\Rightarrow \frac{y}{x} = \frac{220}{900} = \frac{11}{45}$$

25. (a) Let, x kg tea is blended.

$$\therefore \text{Total CP} = ₹(25x + 900)$$

\therefore Selling price on 10% profit

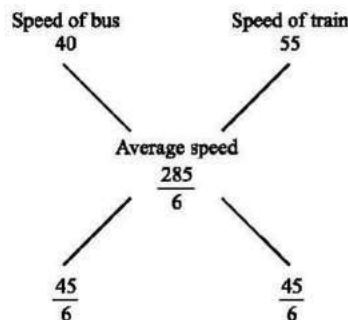
$$(25x + 900) + (25x + 900) \times \frac{10}{100} = ₹(27.5x + 990)$$

Total weight of tea = $(30 + x)$ kg

$$\therefore \text{Selling price at the rate of 30 kg} = ₹(900 + 30x)$$

On comparing both the selling prices, we get ' x '.

26. (c) In this question, the alligation method is applicable for the speed.



∴ Time spent in bus:time spent in train

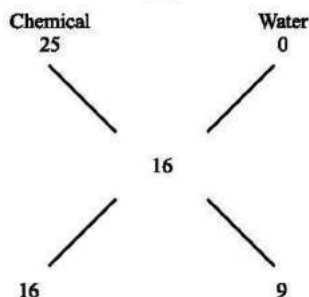
$$= \frac{45}{6} : \frac{45}{6} = 1:1.$$

∴ Distance travelled by train = $55 \times 3 = 165$ Km

27. (b) In this question the alligation method is applicable on prices, so we should get the average price of mixture.

S.P. of mixture = ₹20/litre, profit = 25%

∴ Average price = $20 \times \frac{100}{125} = ₹16/\text{litre}$



∴ Chemical:Water = 16:9.

28. (b) $\frac{5x}{x+5} = \frac{5}{2} \Rightarrow 10x = 5x + 25 \Rightarrow x = 5$

Milk = 25 litres.

29. (d)

Zinc	Copper
$\frac{5}{13}$	$\frac{8}{13}$
$\frac{5}{8}$	$\frac{3}{8}$

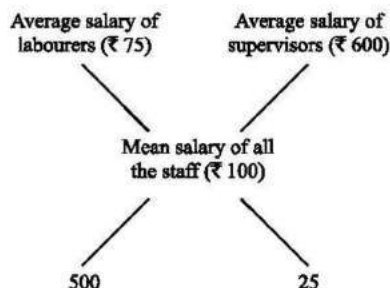
$$\therefore \left(\frac{5}{13} + \frac{5}{8} \right) : \left(\frac{8}{13} + \frac{3}{8} \right) = 105:103.$$

30. (c) $\frac{5}{8}x + \frac{2}{5}y = \frac{3}{8}x + \frac{3}{5}y$

$$\Rightarrow \frac{x}{y} = \frac{4}{5}$$

$$\Rightarrow \text{Ratio} = 4:5.$$

31. (b)



The required ratio is 500:25 or 20:1

$$\frac{\text{Number of labourers}}{\text{Number of supervisors}} = \frac{20}{1}$$

$$\Rightarrow \frac{840}{\text{Number of supervisors}} = \frac{20}{1}$$

$$\therefore \text{Number of supervisors} = \frac{840}{20} = 42.$$

32. (a) Spirit:Water

$$= \left(\frac{3}{7} + \frac{4}{9} + \frac{5}{11} \right) : \left(\frac{4}{7} + \frac{5}{9} + \frac{6}{11} \right)$$

$$= 920:1159.$$

33. (c) Amount of saw dust in 2 kg of haldi

$$= 2000 \times \frac{5}{100} = 100 \text{ g}$$

Required proportion = 4%

$$\Rightarrow \frac{100}{2000 + x} = \frac{4}{100}$$

$$\Rightarrow x = 500 \Rightarrow x = 0.5 \text{ kg}$$

34. (c) Let, x litres of solution is mixed

$$\therefore \text{Content of acid in new mixture} = \left(30 + \frac{3x}{10} \right) \text{ litres}$$

∴ Range of the new solution can be found by the

$$\text{equations } \frac{300 + 3x}{10(200 + x)} \times 100 = 20\% \text{ and}$$

$$\frac{300 + 3x}{10(200 + x)} \times 100 = 25\%$$

35. (b) Amount of liquid left after n operations, when the container originally contain x units of liquid from

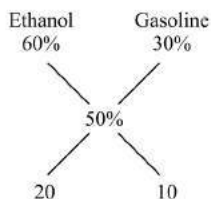
which y units is taken out each time is $x \left(1 - \frac{y}{x} \right)^n$ units.

$$\text{Here } x = 20 \text{ litres, } y = 20 \times \frac{2}{3} = \frac{40}{3}, n = 3$$

$$\therefore 20 \left(1 - \frac{40/3}{20} \right)^3 = 20 \left(1 - \frac{2}{3} \right)^3$$

$$= 20 \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} = \frac{20}{27}$$

36. (b) Applying allegation



Hence, the required ratio is 2:1.

37. (a) Out of total 100 liters of mixture there is 20 liters of water and 80 liters milk.

He sells $\frac{1}{4}$ part of mixture that is 25 litres.

Now water will be 15 liters and 60 liters of milk in total 75 litres of mixture. When he adds 25 liters water in it now total water will be $25 + 15 = 40$ liters and milk 60 litres. So, the required ratio is $40:60 = 2:3$.

Hence, answer is (a)

38. (b) The fare in rupees for k km ($k \geq 5$) is

$$2.4 + 4 \times 2 + 1.2(k - 5) \\ = 10.4 + 1.2(k - 5)$$

39. (d) Let, the amount of milk and water be $7x$ and $3x$ L

Then, we have

$$\frac{1}{4} = \frac{5}{2} \left(1 - \frac{240}{12x} \right) \Rightarrow \frac{3}{5} = \left(1 - \frac{240}{12x} \right) \\ \frac{2}{5} = \frac{20}{x} \Rightarrow x = 50$$

\therefore Half of the initial amount = $(350 + 150)$ L

Then, the required amount of water = $5x - 3x = 2x = 2 \times 50 = 100$ L

But for the whole amount water required to be added = $2 \times 100 = 200$ L.

Directions (Q 40–41): Answer the questions based on the following information:

The following table presents the sweetness of different items relative to sucrose, whose sweetness is taken to be 1.00

Lactose	0.16
Maltose	0.32
Glucose	0.74
Sucrose	1.00
Fructose	1.70
Saccharin	675.00

40. (c) Let, x g of sucrose be added with 1 g of saccharin to obtain a mixture 100 times as sweet as glucose.

$$\text{Then, } 1.00x + 1 \times 675.00 = 0.74(x + 1) \times 100$$

$$\Rightarrow x + 675 = 74(x + 1)$$

$$\Rightarrow x = 9.26 \text{ g or } 9 \text{ g (approximately).}$$

41. (a) $\frac{[(0.74) + (1.00)(2) + (1.7)(3)]}{6} = 1.3$

42. (c) Let, the capacity of each cup be 100 ml.

After first operation, first container will have 200 mL of alcohol and second container will have 300 mL alcohol and 500 mL water.

Ratio of water to alcohol in the second container = 5:3.

After second operation, the quantity of water and

alcohol left would be $\left(300 \times \frac{5}{8} \right) = 187.5$ mL and

$\left(300 \times \frac{3}{8} \right) = 112.5$ mL, respectively and quantity of

water and alcohol in the first container is 187.5 mL and $(200 + 112.5)$ mL = 312.5 mL, hence, ratio of water and alcohol = $187.5:312.5 = 3:5$

Hence, on comparing ratio of water and alcohol in both the containers, we find that $A = B$.

43. (d) Let, the ratio of contents of the two containers be x and y .

Then, quantity of a liquid A in the mixture = $\frac{5}{6}x + \frac{1}{4}y$

And quantity of liquid B in the mixture = $\frac{1}{6}x + \frac{3}{4}y$

We are given

$$\frac{\frac{5x}{6} + \frac{y}{4}}{\frac{x}{6} + \frac{3y}{4}} = \frac{1}{1}$$

$$\Rightarrow \frac{5x}{6} - \frac{x}{6} = \frac{3y}{4} - \frac{y}{4}$$

$$\text{or } \frac{4x}{6} = \frac{2y}{4}$$

$$\Rightarrow \frac{x}{y} = \frac{3}{4}$$

44. (b) Selling price of the mixture at a profit of 37.5% is ₹75.

$$\text{Hence, cost price} = \frac{75}{1.375} = ₹54.54.$$

Assuming cost of water is 0. By allegation rule, we get

Spirit	Water
60	0
54.54	
54.54	5.454
10:1	

45. (b) 85% of 73 liters of wine = $\frac{85 \times 73}{100}$

Now, let the process be repeated n times.

Then, $\frac{85 \times 73}{100} > \left[73 \left(1 - \frac{3.65}{73} \right)^n \right]$

$$\Rightarrow \frac{85 \times 73}{100} > 73 \times \left(1 - \frac{3.65}{73} \right)^n$$

$$\Rightarrow \frac{85}{100} > \left(\frac{73 - 3.65}{73} \right)^n$$

$$\Rightarrow \frac{17}{20} > \left(\frac{69.35}{73} \right)^n$$

$$\Rightarrow \frac{17}{20} > \left(\frac{19}{20} \right)^n$$

$$\Rightarrow 0.85 > (0.95)^n$$

On solving, we get $n > 3$

\therefore Minimum 4 operations are required.