ALLIGATION OR MIXTURE

The word allegation means linking. It helps in dealing with the problem on Mixture.

I.MIXTURE

When two or more quantities are mixed in a definite proportion, it is called mixture.

II. RULE OF ALLIGATION

If two ingredients of different cost are mixed in a ratio to produce a mixture of mean price, then

$$\frac{Quntity\ of\ cheaper}{Quntity\ of\ dearer} = \frac{Cost\ price\ dearer - mean\ price}{mean\ price - cost\ price\ of\ cheaper}$$

We represent as under:

CP of a Unit quantity of Cheaper (C)

CP of a unit quantity of dearer (d)

Mean Price (m)

$(c^2 - m)$

(m-c)

$$\frac{Cheaper\ quntity}{dearer\ quntity} = \frac{d-m}{m-c}$$

III. MEAN PRICE OF TWO MIXTURE

The average cost price of a unit quantity of the mixture is called the mean price (m).

When two ingredient of quantity q_1 and q_2 with cost price c and d respectively are mixed then,

$$m = \frac{c \times q_1 + d \times q_2}{q_1 + q_2}$$

where c = cost price of cheaper
d = cost price of dearer

IV. APPLICATION OF ALLIGATION RULE

Alligation rule helps in finding

(i)The mean or average value of the mixture when the price of two or more ingredient and their proportion is known.

(ii) The proportion in which the two or more ingredient at given price are mixed and their mean price is known.

V. SOME SHORT CUTS

Case I : When three ingredient of quantities q_1, q_2 and q_3 are mixed and the cost price are c_2, c_2 and c_3 respectively with the mean price m, then by the rule of allegation, their proportion is given by

$Q_1 : q_2 : q_3 = (c_2 - m)(c_3 - m) : (m - c_1)(c_3 - m) : (c_2 - m)(m - c_1)$

Case II : To make x gm of a mixture into required percentage (p2) when percentage of ingredient (p1) is given. Then quantity of that ingredient in gm is given by

$$\text{Quantity of ingredient added} = \frac{x\,(p_2 - p_1)}{100 - p_2}$$

SOME IMPORTANT POINTS

1) Alligation rule can be employed to deal with the problem containing comparison of percentage value, ratio, rate, prices, speed etc.
2) When two ingredients are mixed, it is called simple mixture but when two or more simple mixture but when two or more simple mixture are mixed it is called compound mixture.
3) Mean price is always less than the cost price of dearer quantity and always greater than the cost price of cheaper quantity.
4) The cost price of water is always taken as zero.

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Practice Question

1) In what ratio must rice at Rs. 9.30 per Kg be mixed with rice at Rs. 10.80 per kg so that the mixture worth Rs. 10 per Kg?

a) 8 : 7 b) 9 : 8
c) 5 : 9 d) 9 : 4

2) In what ratio must a grocer mix two varieties of costing Rs. 15 and Rs. 20 per Kg respectively to get mixtures with Rs. 16.50 per Kg.

a) 7 : 4 b) 7 : 2
c) 7 : 3 d) 7 : 1

3) In what ratio should tea worth Rs. 10 per Kg be mixed with tea worth Rs. 14 per kg so that the average price of the mixture may be Rs. 11 per kg ?

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

4)In what ratio oil worth Rs. 36 per kg be mixed with another kind of oil worth Rs. 51 per kg so that the mixture is worth Rs. 45 per kg?

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

5) In what ratio should water and wine be mixed to reduce the price of wine from Rs. 15 per litre to Rs. 12 per litre?

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

6) A butler stole wine from a buff of sherry which contained 32% of spirit and then replaced what he stole, by wine containing only 18% spirit. The buff was then of 24% strength only. How much of the buff had he stolen?

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

7) In what ration must water be mixed with milk coasting Rs. 12 per litre and a mixture worth Rs. 8 per Litre?

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

8) The cost of type 1 rice is Rs. 15 per Kg and type 2 rice is Rs. 20 per Kg. if both are mixed in the ratio of 2 : 3. Then the price per Kg of the mixed variety rice?

a) 13 b) 15
c) 12 d) 18

9) In what ratio must a grocer mix two varieties of tea Rs. 60 per Kg and Rs. 65 per Kg so that by selling mixture at Rs. 68.20 Kg the gain 10%

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

10) How many Kgs of sugar costing Rs. 9 per Kg must be mixed with 27 Kg of sugar costing Rs. 7 per Kg so that there may be

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a gain 10%, mixture by selling the mixture at Rs. 9.24 per Kg?

a) 65 Kg b) 62 Kg
c) 63 Kg d) 66 Kg

11) How many Kgs of wheat costing Rs. 8 per Kg be mixed with 36 Kg of rice costing Rs. 5.4 per Kg so that 20% gain may be selling the mixture at Rs. 7.20 per Kg?

a) 10.5 Kg b) 10.8 Kg
b) 10.3 Kg d) 10 Kg

12) How many kg of salt at 42 paise per kg must a shopkeeper mix with 25 kg of salt at 24 paise so that on selling the mixture at 40 paise, he could gain 25%?

c) a) 10 kg b) 20 kg
d) c) 30 kg d) 40 kg

13) A man adds water to 25 litres of pure milk and sells the mixture at Rs. 3 per litre. If pure pure milk costs Rs. 3.60 per litre. How many litres of water does he add?

a) 4 liter b) 5 liter
c) 7 liter d) 8 liter

14) A dishonest milk man professes to sell his milk at cost price, but he mixes with water and there by gains 25%. The % of water in mixture is

a) 28% b) 20%
b) 21% d) 26%

15) In what ratio must water to mixed with milk to gain 25% by selling it at cost price?

c) a) 1 : 5 b) 1 : 3
d) c) 1 : 6 d) 1 : 4

16) A dishonest milk man professes to sell his milk at cost price but he mixes with water and there by gains $16\frac{2}{3}$ %. The % of water in mixture is

a) 12. 28% b) 13. 28%
c) 14.28% d) 15.25%

17) In what ratio must water be mixed with milk to gain 10% by selling the mixture of CP?

a) 5 : 2 b) 3 : 5
c) 2 : 3 d) 1 : 10

18) In what proportion must water be mixed with spirit to gain $16\frac{2}{3}$ % by selling it at cost price ?

d) a) 1:3 b) 1 :4
e) c) 1 :5 d) 1 :6

19) 20 gm of salt solution has 10% water. How much water must be added to this mixture to raise the percentage of water by 25%.

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a) 5 gm b) 4 gm
c) 2 gm d) 6 gm

20) The pure spirit be added to 400 mi of a 15% solution to make its strength 32% is
a) 80 ml b) 100ml
c) 110 ml d) 125 ml

21) 50 kg of an alloy of lead and tin contains 60% lead. How much lead must be melted into it to make an alloy containing 75% lead
a) 20 kg b) 25 kg
c) 30 kg d) 40 Kg

22) A chemist has 60 litres of 70 % acid and wishes to add enough water so that the resultant mixture is 40% acid. The water should be added in litres is
a) 45 litres b) 30 litres
c) 35 litres d) 35 litres

23) A mixture of 40 litres of milk and water contains 10% water. How much water should be added to this so that water may be 20% in the new mixture?
a) 4 litres b) 5 litres
c) 6 litres d) 7 litres

24) A mixture of 66 litres of milk and water are in the ratio 5:1 and water is added make the ratio 5:3. The quantity of water added is
a) 20 litres b) 22 litres
c) 24 litres d) 25 litres

25) In an alloy the ratio of copper to zinc is 5 : 1. In another alloy, this ratio is 7 : 2. What ratio of two alloys should be melted and mixed together so as to make up a new mass with 80% of the copper?
a) 2 : 5 b) 2 : 4
c) 2 : 3 d) 2: 6

26) What ratio of rice worth Rs. 2.50 per kg be mixed with rice worth Rs.4.00 per kg, so that the resulting mixture is worth Rs. 3.00 per Kg?
a) 100:50 = 2:1 b) 200:100 = 4:1
c) 80: 30 = 3:1 d) 150: 70 = 5:1

27) In what ratio should three varieties of rice be mixed being worth Rs. 4, Rs. 6 and Rs. 8 per kg, as to sell the mixture at Rs. 5 per kg ?
a) 1 :1: 3 b) 3 :3 :1
c) 1 : 1: 4 d) 4 : 1 : 1

28) In what ratio must a person mix three kinds of rice costing Rs. 21, Rs. 24.60 and Rs. 27 per kg so that the mixture may be worth Rs. 24.20 per kg?
a) 7 : 56 : 8 b) 8 : 57; 9
c) 6: 67: 2 d) 8 : 89: 5

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29) A milkman borrowed Rs. 2500 from two money lenders. For one loan, he paid 5% p.a. and for the other he paid 7% p.a. The total interest paid for two years was Rs. 275. The sum borrowed at the rate of 7% p.a. is

a) Rs. 625 b) Rs. 1250
c) Rs. 1875 d) Rs. 2000

30) The sum of Rs. 15000 was lent in such a way that its certain part was lent at 10% per year and the remaining at $12\frac{1}{2}\%$ per year. The total simple interest earned in 3 years was Rs. 5175. Find the sum lent in each case?

a) Rs. 9000 b) Rs. 8000
c) Rs. 7000 d) Rs. 5000

31) 729 ml of mixture contains milk and water in the ratio 7 : 2. The quantity of water added to get a new mixture containing milk and water in the ratio 7 : 3 is

a) 72 ml b) 79 ml
c) 81ml d) 91 ml

32) Milk and water are mixed in a vessel A in the proportion 5:2, and in vessel B in the proportion 8 :5. In what proportion should quantities be taken from the two vessels so as to form a mixture in which milk and water will be in the proportion of 9 :4?

a) 7 :2 b) 3:5
c) 3:4 d) 4:9

33) A sum of Rs. 39 was divided among 45 boys and girls. Each girl gets 50 paise, whereas a boy gets one rupee. The number of boys are

a) 28 b) 30
c) 33 d) 34

34) There are some doves and hares in a forest. If head are counted, they are 200. If legs are counted, they are 580. The number of hares in the forest are

a) 88 b) 90
c) 94 d) 98

35) One variety of sugar is sold for Rs. 3.20 a kg at a loss of 20% and another variety is sold for Rs.6 per kg at a gain of 20%. If equal quantities of the two are mixed and the mixture is sold at Rs.5.40 per kg, the loss or gain percent is

a) 20% gain b) 20% loss
c) 10% gain d) 10% loss

36. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is

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a) 1/3 b) 2/3 c) 400, 600 d) 300, 500
c) 2/5 d) 3/5

37. A mixture contains milk and water in the ratio 3:2. If 4 litres of water is added to the mixture, milk and water in the mixture becomes equal. The quantity of milk in the mixture, in litres are
a) 5 litres b) 8 litres
c) 10 litres d) 20 litres

38) A man covered a distance of 2000km in 18 hours partly by bus at 72 km/hr and partly by train at 160 km/hr. The distance covered by bus is
a) 1280 km b) 720 km
c) 860 km d) 640 km

39) One quality of wheat at Rs. 9.30 per Kg is mixed with another quality at a certain rate in the ratio 8 : 7. If the mixture so formed worm Rs. 10 per Kg. what is the rate per Kg of the 2nd quality of wheat?

a) 10.8 b) 18.9
c) 12.8 d) 13. 6

40)A merchant has 1000Kg of sugar part of which the sales at 8% profit and the rest at 18% profit. The gains 14% overall. The quantity sold at 18% profit is?

a) 800, 600 b) 400, 500

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