05

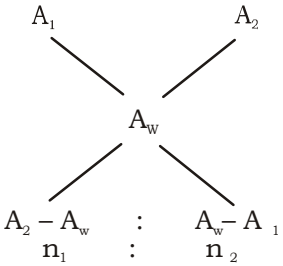
MIXTURE AND ALLIGATION

♦ **Rule of Alligation :** Two groups of elements are mixed together to form a third group containing the elements of both groups.

If the average of the first group is $A_1$and the number of element is n_1 and the average of the second group is A_2 and the number of elements is n_2, then to find the average of the new group formed, we can use either the weighted average equation or the alligation equation.

As a convenient convention, we take $A_1 < A_2$. Then by the principle of averages, we get $A_1 < A_w < A_2$.

♦ **Graphical Representation of Alligation:**



Or, it can be explained as follows :-

Let the two ingredients be mixed. Then,

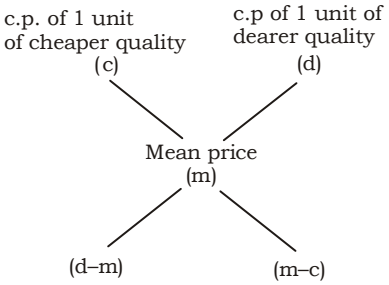
Some useful shortcut Methods :

(1) From a container having *x* units of a liquid, suppose y units are taken out and replaced by water.

After n operations, quantity of pure liquid

$$= x\left(1-\frac{y}{c}\right)^n \text{ units}$$

c Þ capacity of container



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

(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, ...,a_n : b_n respectively. If the contents of all the vessels are poured into a single vessel, then

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

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

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

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

$$= \frac{\left(\frac{a_1c_1}{a_1+b_1}+\frac{a_2c_2}{a_2+b_2}+.....+\frac{a_nc_n}{a_n+b_n}\right)}{\left(\frac{b_1c_1}{a_1+b_1}+\frac{b_2c_2}{a_2+b_2}+.....+\frac{b_nc_n}{a_n+b_n}\right)}$$

(4) If a vessel contains 'a' litres of liquid A and if 'b' litres be withdrawn and replaced by liquid B, then if 'b' litres of mixture be withdrawn and replaced by liquid B, and the operation is repeated 'n times in all, then

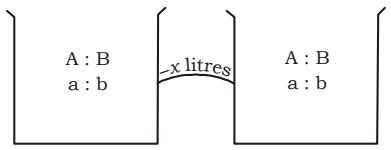
$$\frac{\text{Liquid A left after } n^{th} \text{ operation}}{\text{Liquid B left after } n^{th} \text{ operation}} = \frac{\left(\frac{a-b}{a}\right)^n}{1-\left(\frac{a-b}{a}\right)^n}$$

(5) A vessel, full of liquid A, contains 'a' litres of it of which several litres are withdrawn. The vessel is then filled with liquid B. Next the same volume of the mixture withdrawn and again the vessel is filled with liquid B. This porcess is repeated n times. As result, the vessel contains 'b' litres of liquid A, then

$$\frac{\text{Final quantity of liquid A}}{\text{Initial quantity of liquid A}} = \sqrt[n]{\frac{b}{a}}$$

Note : If a vessel contains liquid A and liquid B in the ration a : b and if some quantity of the mixture (or vessel) are withdrawn, then if the remaining mixture, liquid A and liquid B will be in the ratio a : b i.e. ratio will not change .

EXAMPLE



1. 20 Litres of a mixture contains milk and water in the ratio 3 : 1. Then the amount of milk to be added to the mixture so as to have milk and water in ratio 4 : 1 is
(a) 6 L (b) 5 L
(c) 7 L (d) 4 L

Sol. (B) In 20 L of mixture

$\text{milk} = \frac{3}{4} \times 20 = 15$ L

$\text{water} = \frac{1}{4} \times 20 = 5$ L

Let the quantity of milk added be y litres

A.T.Q. $\frac{15+y}{5} = \frac{4}{1}$

$\Rightarrow 15 + y = 4 \times 5$

$y = 20 - 15 = 5$ litres

Alternate:-

Milk Water

3 1= 4 $\xrightarrow{\times 5}$ 20

1

4 1

4 Units = 20

1 Unit = 5 lit.

2. A mixture contains milk and water in the ratio 5 : 1. On adding 5 litres of water the ratio of milk and water becomes 5 : 2. The quantity of milk in the mixture is
(a) 22.75 L (b) 32.5 L
(c) 16 L (d) 25 L

Sol. (d) Quantity of milk in mixture = $5x$

Quantity of water = x L

A.T.Q, on adding 5 L of water

$\frac{5x}{x+5} = \frac{5}{2} \Rightarrow 10x = 5x + 25$

$5x = 25$

$x = 5$

\ Required answer = 5 × 5 = 25 L

Alternate:-

Milk Water

5 1

1 $\xrightarrow{\times 5}$ 5

5 2

1 Unit = 5

\ 5 Units = 25 Litres

3. 80 Litres of a mixture contains milk and water in the ratio of 27 : 5. How much more water is to be added to get a mixture containing milk and water in the ratio of 3 : 1?
(a) 20 L (b) 10 L
(c) 12 L (d) 15 L

Sol. (B)

Milk : Water

27 : 5 = 32 → 80 (×5/2)

3×9 : 1×9 +4 (×5/2)

27 9

10

4. Zinc and Copper are in the ratio 5 : 3 in 200 gm of an alloy, How much grams of copper be added to make the ratio 3 : 5?
(a) 66 (b) 72
(c) $\frac{1}{200}$ (d) $133\frac{1}{3}$

Sol. (D)

Zinc : Copper

(15) 5×3 : 3×3 (9) = 24 → 200 (×25/3)

(15) 3×5 : 5×5 (25) +16 (×25/3)

$\frac{400}{3} = 133\frac{1}{3}$

5. An alloy contains Copper Zinc and Nickel in the ratio of 5 : 3 : 2. The quantity of Nickel that must be added to 100 kg of this alloy to have the new ratio 5 : 3 : 3 is
(a) 8 kg (b) 16 kg
(c) 12 kg (d) 10 kg

Sol. (d)

Copper : Zinc : Nickel

Old 5 : 3 : 2 +1 unit

New 5 : 3 : 3

Now old ratio = $5x + 3x + 2x = 10x$

$10x = 100$ kg

$x = 10$ kg

Nickel added to mixture = 10 kg (unit)

6. Two numbers are in the ratio 2:3. If 2 is subtracted from the first and 2 is added to the second. The ratio becomes 1:2. The sum of the numbers is:
(a) 24 (b) 10
(c) 30 (d) 28

Sol. (c) A : B = $2x : 3x$

Now, $\frac{2x-2}{3x+2} = \frac{1}{2}$

$4x - 4 = 3x + 2$

$x \Rightarrow 6$

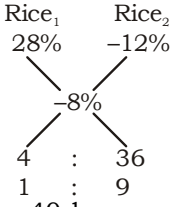
\ $A = 2 \times 6 = 12$

$B = 3 \times 6 = 18$

Sum of no. = A + B = 12 + 18 = 30

7. A trader has 40 kg of rice, a part of which he sells at 28%. Profit and rest at 12% loss. on the whole his loss is 8%. What is the quantity sold at 28% profit and that at 12% loss?

Sol.



Q 10 units = 40 kg

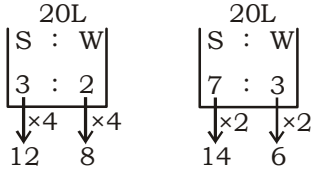
\ 1 unit = 4 kg

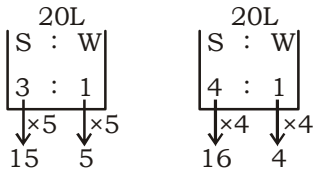
\ 9 units = 4 × 9 = 36 kg

\ Quantites sold at 28% profit and 12% loss is 4 kg and 36 kg respectively.

8. Four vessels of equal size contain mixture of spirit and water. The concentration of spirit in 4 vessels is 60%, 70%, 75% and 80% respectively if all four mixtures are mixed, Find in the resultant mixture the ratio of spirit to water?

Sol. Assume each vessels contain 20 L of mixture





Quantity of spirit to water

$$= \frac{12+14+15+16}{8+6+5+4} = \frac{57}{23}$$

\ Ratio of spirit to water = 57 : 23

9. A -25- litres cylinder contains a mixture of oxygen and nitrogen, the volume of oxygen being 25% 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 a result the oxygen content becomes 9% of the total volume. How many litres of mixture is released each time?

Sol. $\frac{\text{Remaining oxygen}}{\text{original oxygen}}$

$$= \left(1 - \frac{\text{Vol. of each time released / added}}{\text{Total vol. of vessel}}\right)$$

$$\Rightarrow \frac{9\%}{25\%} = \left(1 - \frac{x}{25}\right)^2$$

$$\Rightarrow \sqrt{\frac{9}{25}} = 1 - \frac{x}{25}$$

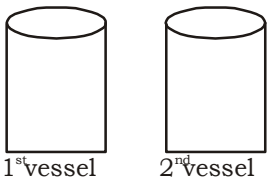
$$\Rightarrow \frac{3}{5} = 1 - \frac{x}{25} \Rightarrow \frac{x}{25} = \frac{2}{5}$$

$$\Rightarrow x = \frac{2}{5} \times 25 = 10 \text{ L}$$

\ Amount of mixture released each time = 10 litre.

10. 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 by 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 contents of the first are poured in the second till it is full. What is the proportion of milk in the second vessel?

Sol.



Assuming vol. of the each vessel = 18 L.

Ist Case:-

When 12 lit milk in poured in 2nd Vessel

Ist vessel	2nd vessel
m	m : w
6	12 : 6

2nd Case:-

When 2/3 of 2nd vessel is poured in 1st vessel.

$$\text{Milk} = 12 \times \frac{2}{3} = 8 \text{ lit.}$$

$$\text{Water} = 6 \times \frac{2}{3} = 4 \text{ lit.}$$

Ist vessel	2nd vessel
M : W	M : W
6 + 8 : 4	4 : 2
= 7 : 2	= 2 : 1

3rd Case:-

When 2/3 rd of 1st vessel is poured in 2nd vessel

$$\text{Milk} = 7 \times \frac{2}{3} = \frac{14}{3}$$

$$\text{Water} = 2 \times \frac{2}{3} = \frac{4}{3}$$

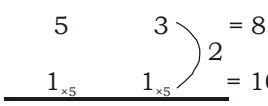
Ist Vessel	2nd Vessel
M : W	M : W
$7 - \frac{14}{3} : 2 - \frac{4}{3}$	$2 + \frac{14}{3} : 1 + \frac{4}{3}$
$\frac{7}{3} : \frac{2}{3}$	$\frac{20}{3} : \frac{7}{3}$

i.e. In 2nd vessel, M : W = 20 : 7

\ Proportion of Milk in final mixture = 20 : 20 + 7 = 20 : 27

11. A dishonest hair dresser use a mixture having 5 parts pure after-shave lotion and 3 parts pure water. After taking out some portion of the mixture, he adds equal amount of pure water to the remaining portion of mixture such that the amount of after shave lotion and water becomes equal. Find the part of mixture taken out?

Sol.



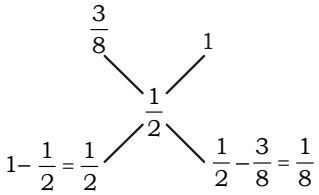
\ Mixture taken out = $\frac{2}{10} = \frac{1}{5}$

12. A vessel is filled with liquid, 3 parts of which are water in 5 parts group. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half group?

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

(c) $\frac{2}{7}$ (d) $\frac{1}{5}$

Sol. (b)



Ratio = 4 : 1

\ Required quantity = $\frac{1}{4}$

13. In two alloys A and B, the ratio of zinc to tin is 5 : 2 and 3 : 4 respectively. 7kg of the alloy A and 21 kg of the alloy B are mixed together to form a new alloy. What will be the ratio of zinc and tin in the new alloy?

(a) 3 : 1 (b) 3 : 2

(c) 1 : 1 (d) 2 : 1

Sol. (c) In 7kg of alloy A

Ratio of Zinc to tin is 5 : 2

zinc = 5kg, Tin = 2kg

In 21 kg of alloy B

$$\text{zinc} = \frac{21 \times 3}{7} = 9\text{kg}$$

$$\text{Tin} = \frac{21 \times 4}{7} = 12\text{kg}$$

\ Required ratio = (5 + 9) : (2 + 12) = 14 : 14 or 1 : 1

14. Three vessels whose capacities are 3 : 2 : 1 are completely filled with milk mixed with water. The ratio of milk and water in the mixture of vessels are 5 : 2, 4 : 1 and 4 : 1 respec-

tively. Taking $\frac{1}{3}$ of first, $\frac{1}{2}$ of second and $\frac{1}{7}$ of third mixtures, a new mixture kept in a new vessel is prepared. The percentage of water in the new mixture is

(a) 30 (b) 32
(c) 28 (d) 24

Sol. (d) Let there be 3 litres, 2 litres and 1 litre of mixtures in three vessels respectively are:

vessel I

In 1 litre of mixture,

Milk = $\frac{5}{7}$ litre, water = $\frac{2}{7}$ litre

Vessel II

In 1 litre of mixture,

Milk = $\frac{4}{5}$ litre, water = $\frac{1}{5}$ litre

Vessel III

In $\frac{1}{7}$ litre of mixture,

Milk = $\frac{4}{5}\times\frac{1}{7}=\frac{4}{35}$ litre

Water = $\frac{1}{35}$ litre

In new vessel,

Mixture = $1+1+\frac{1}{7}$

$= 2+\frac{1}{7}=\frac{14+1}{7}=\frac{15}{7}$ litres

Water = $\frac{2}{7}+\frac{1}{5}+\frac{1}{35}=\frac{10+7+1}{35}$

$= \frac{18}{35}$ litre

Required percentage

$= \frac{\frac{18}{35}}{\frac{15}{7}}\times 100$ Þ $\frac{18}{35}\times\frac{7}{15}\times 100$

= 24%

Alternate

	M	W
V_1	$5_{\times 15}$	$2_{\times 15} = 7\times5\times3$
V_2	$4_{\times 14}$	$1_{\times 14} = 5\times7\times2$
V_3	$4_{\times 7}$	$1_{\times 7} = 5\times7\times1$

	M	W	
⇒	V_1 75	30	= 105
	V_2 56	14	= 705
	V_3 28	7	= 35
	New mixture		
	$V_1 \to 25$	10	= 35
	$V_2 \to 28$	7	= 35
	$V_3 \to 4$	1	= 5
	57	18	= 75

Required % = $\frac{18}{75}\times 100 = 24\%$

15. 60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and alloy B has tin and copper in the ratio 1 : 4, the amount of tin in the new alloy is

(a) 44 kg (b) 50 kg
(c) 80 kg (d) 27 kg

Sol. (a) In 60 kg of alloy A,

Lead = $\frac{3}{5}\times 60$ = 36kg

Tin = $\frac{2}{5}\times 60$ = 24kg

In 100 kg of alloy B,

Tin = $\frac{1}{5}\times 100$ = 20kg

In 160 kg of new alloy,

Tin = 24 + 20 = 44kg

16. Two blends of a commodity costs ` 35 and ` 40 per kg respectively are mixed in the ratio 2 : 3 by weight. If one-fifth of the mixture is sold at ` 46 per kg and the remaining at the rate of ` 55 per kg. The profit percent is

(a) 20 (b) 30
(c) 40 (d) 50

Sol. (c) Let 5 kg of mixture be prepared

\ CP of 5 kg of mixture

= ` (2 × 35 + 3 × 40)

= ` (70 + 120) = ` 190

Total SP of this mixture

= ` (46 + 4 × 55)

= ` (46 + 220) = ` 266

\ Profit percent = $\left(\frac{266-190}{190}\right)\times 100$

= $\frac{7600}{190}$ = 40%

17. 20 litres of a mixture contains milk and water in the ratio 3 : 1. Then the amount of milk to be added to the mixture so as to have milk and water in ratio 4 : 1 is :

(a) 4 litres (b) 5 litres
(c) 6 litres (d) 7 litres

Sol. (b) In 20 litres of mixture,

Milk = $\frac{3}{4}\times 20$ = 15 litres

water = $\frac{1}{4}\times 20$ = 5 litres

Let the quantity of milk added be x litres.

According to the question,

$\frac{15+x}{5} = \frac{4}{1}$

Þ $15 + x = 4 \times 5$

Þ $x = 20 - 15$

Þ 5 litres.

18. A vessel contains 60 litres of milk. 12 litres of milk is taken out from it and replaced by water. The 12 litres is again taken out and replaced by water. The ratio of milk and water in the resultant mixture is:

(a) 9 : 5 (b) 16 : 9
(c) 16 : 10 (d) 15 : 10

Sol. (b) Remaining amount of milk = Initial quantity

$\left(1-\frac{\text{quantity taken out}}{\text{Initial quantity}}\right)^n$

$= 60\left(1-\frac{12}{60}\right)^2 = 60\left(1-\frac{1}{5}\right)^2$

$= 60\times\frac{4}{5}\times\frac{4}{5}$ = 38.4 litres

Quantity of water = 60 – 38.4

= 21.6 litres

\ Required ratio Þ 38.4 : 21.6

Þ 16 : 9

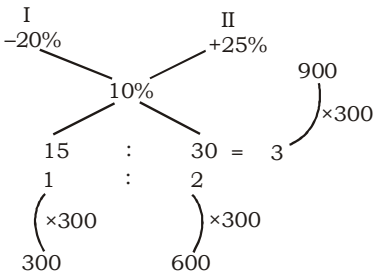
19. A man purchased two chairs in ` 900, he sells the first chair at $\frac{4}{5}$ of its cost price and the second chair at $\frac{5}{4}$ of its cost

price. If during the whole transaction he earns a profit of ` 90 find the cost price of cheaper chair

Sol. Ist $\frac{4 \to \text{S.P}}{5 \to \text{C.P}} - \frac{1}{5} \times 100 = -20\%$

IInd $\frac{5 \to \text{S.P}}{4 \to \text{C.P}} + \frac{1}{4} \times 100 = +25\%$

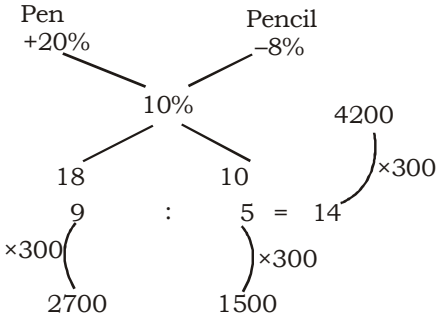
Q $P\% = \frac{90}{900} \times 100 = 10\%$



The C.P of cheaper chair = 300 `

20. Renu Purchased 200 pens and 100 pencils in 4200 ` she sells the each pen at the profit of 20% and each pencils at 8% loss. If during the whole transaction she earns a profit of 420 `. Find the cost price of each pen and each pencil ?

Sol.. Profit = $\frac{420}{4200} \times 100 = 10\%$

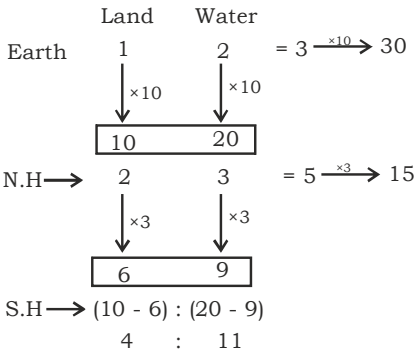


C.P of each pen = $\frac{2700}{200} = 13.50$ `

C.P of each pencils = $\frac{1500}{100} = 15$ `

21. Ratio of land and water on earth is 1 : 2 and ratio of land : water in northern hemisphere is 2 : 3 find the ratio of land : water in southern hemisphere.

Sol. Let on earth total Land & water = 30



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

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

Sol. (c)

18 kg	18 kg
G : C	G : C
7 : 2	7 : 11
(×2)×2	(×1)×1
14 4	7 11

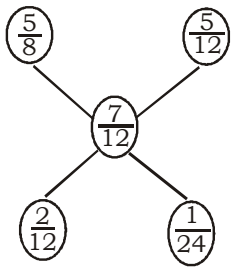
\ Proportion of gold and copper inalloy C

$\frac{14+7}{4+11} = \frac{21}{15} = \frac{7}{5} = 7:5$

23. The ratio of the numbers of boys and girls in a school was 5:3. Some new boys and girls were admitted to the school, in the ratio 5:7. At this, the total number of students in the school become 1200, and the ratio of boys to girls changed to 7:5, The number of students in the school before new admission was

(a) 700 (b) 960
(c) 720 (d) 900

Sol. (b)



4 : 1

Q 5 units = 1200

\ 1 unit = 240

\ 4 units = 240 × 4 = 960

24. Silver is 19 times as heary as water and Copper is 10 times as water. In what ratio should

Exercise

1. The average weight of a class of 40 students is 30 kg and the average weight of a class of 20 students is 15 kg. Find the average weight of both the classes combined.
   (a) 20 (b) 25
   (c) 17.5 (d) 15
2. If the average weight of a class is 15 kg and the average weight of another class is 30 kg, then find the ratio of the students of the first class to the another class students when the average weight of both the classes is 25 kg:
   (a) 1: 2 (b) 2 : 1
   (c) 1 : 3 (d) 3 : 4
3. The average weight of girls is 15 and the average weight of boys is 30 and the average weight of boys and girls both is 25. If the number of boys are 12, then the number of girls are:
   (a) 4 (b) 6
   (c) 10 (d) 18
4. The ratio of number of girls to number of boys is 1 : 2. If the average weight of the boys is 30 kg and the average weight of both the boys and girls be 25 kg, then the average weight of the girls is :
   (a) 15 kg (b) 20 kg
   (c) 35 kg (d) 40 kg
5. Two varieties of milk with different prices is mixed in the ratio of 2 : 3. The price of first type of milk is Rs. 10 per litre while the price of second type of milk is Rs. 15 per litre, respectively. The average price of the mixture (per litres) is :
   (a) Rs. 12 (b) Rs. 13
   (c) Rs. 14 (d) Rs. 15
6. 5 kg of superior quality of rice is mixed with 25 kg of inferior quality rice. The price of superior quality and inferior quality rice is Rs. 18 and Rs. 12 respectively. The average price per kg of the mixture is:
   (a) Rs. 13 (b) Rs. 15
   (c) Rs. 18 (d) Rs. 21
7. 16 litres of wine is mixed with 5 litres of water. The price of wine is Rs. 12 litre and the price of water is Rs. 33 per litres. The average price of the mixture per litres is:
   (a) Rs. 15 (b) Rs. 17
   (c) Rs. 23 (d) Rs. 27
8. Bhuvnesh travels 30 minutes at the speed of 25 km/hr. Further he travels 20 minutes at the speed of 40 km/hr. Find his average speed.
   (a) 25 km/hr
   (b) 30 km/hr
   (c) 31 km/hr
   (d) None of these
9. A milkman has two types of milk. In the first container the percentage of milk is 80% and in the second container the percentage of milk is 60%. If he mixes 28 litres of milk of the first container to the 32 litres of milk of the second container, then the percentage of milk in the mixture is :
   (a) 63.99 (b) 69.33
   (c) 72.5 (d) 75.2
10. Rakesh Yadav reader publication sold the 30% books at the profit of 50% and 70% books at the profit of 10%. Find the average profit percent of the Rakesh Yadav Reader publication shop is, if it sells only these two kinds of books:
    (a) 15 (b) 22
    (c) 25 (d) 45
11. Bhuvnesh covered 150 km distance in 10 hours. The first part of his journey he covered by car, then he hired a rickshaw. The speed of car and rickshaw is 20 km/hr and 12 km/hr respectively. The ratio of distances covered by car and the rickshaw respectively are :
    (a) 2 : 3
    (b) 4 : 5
    (c) 1 : 1
    (d) None of these
12. A mixture of sugar is sold at Rs. 3.00 per kg. This mixture is formed by mixing the sugar of Rs. 2.10 and Rs. 2.52 per kg. What is the ratio of cheaper to the costlier quality in the mixture if the profit of 25% is being earned.
    (a) 5 : 2 (b) 2 : 7
    (c) 2 : 5 (d) 15 : 8
13. A milkman has 20 litres of milk. If he mixes 5 litres of water, which is freely available, in 20 litres of pure milk. If the cost of pure milk is Rs. 18 per litre, then the profit of the milkman, when he sells all the mixture at cost price, is:
    (a) 20% (b) 25%
    (c) 33.33% (d) 18%
14. In what ratio should water and soda be mixed that after selling the mixture at the cost price a profit of 33.33% is made ?
    (a) 1 : 4 (b) 1 : 3
    (c) 2 : 3 (d) 3 : 4
15. In what ratio should freely available water be mixed with the soda worth Rs. 60 per litre so that after selling the mixture at Rs. 50 per litre, the profit will be 25% ?

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

16. A mixture of water and milk contains 80% milk. In 50 litres of such a mixture, how many litres of water is required to increase the percentage of water to, 50% ?
(a) 20
(b) 15
(c) 30
(d) None of these

17. In a 50 litre mixture of water and milk, water is only 20%. The milkman gives 10 litre 'of this' mixture to a customer and then he adds up 10 litres of pure water in the remaining mixture. The percentage of water in the final mixture is :
(a) 84% (b) 74%
(c) 26% (d) 36%

18. There are three types of Butter, Parag, Amul and Nestle. The ratio of fat to the non-fat contents in butter is 4 : 5, 5 : 6, 6 : 7 respectively. If all these three types of butter is mixed in equal quantity, the ratio of fat to the non-fat contents in the mixture will be:
(a) 1751 : 2110 (b) 175 : 543
(c) 3 : 5 (d) 10 : 18

19. Rakesh Yadav purchased two different kinds of alcohol. In the first mixture the ratio of alcohol to water is 3 : 4 and in the second mixture it is 5 : 6. If he mixes the two given mixture and makes a third mixture of 18 litres in which the ratio of alcohol to water is 4 : 5, the quantity of first mixture (whose ratio is 3 : 4) is required to make the 18 litres of the third kind of mixture is:
(a) 6 (b) 7
(c) 8 (d) 9

20. Some amount out of Rs. 6000 was lent out at 10% per annum and the rest amount @ at 20% per annum and thus in 4 years the total interest from both the amounts collected was Rs. 3400. What is the amount which was lent out @ 10% per annum?
(a) Rs. 2500 (b) Rs. 2800
(c) Rs. 3200 (d) Rs. 3500

21. From the 50 litres of pure milk, 5 litres of milk is taken out and after it 5 litres of water is added to the rest amount of milk. Again 5 litres of mixture of milk and water is drawn out and it was replaced by 5 litres of water. If this process is continued similarly for the three times, the amount of milk left after the third replacement:
(a) 45 Litre (b) 36.45 Litre
(c) 40.5 Litre (d) 42.5 Litre

22. From a tank of petrol, which contains 200 litres of petrol, the seller replaces each time with kerosene when he sells 40 litres of petrol (or its mixture). Every time he sells out only 40 litres of petrol (pure or impure). After replacing the petrol with kerosene 4th time, the total amount of kerosene in the mixture is :
(a) 81.92Litre
(b) 96Litre
(c) 118.08Litre
(d) None of these

23. From a container of beer, a thief has stolen 15 litres of beer and replaced it with same quantity of water. He again repeated the same process. Thus in three attempts the ratio of beer and water became 343 : 169. The initial amount of beer in the container was :
(a) 75 litres (b) 100 litres
(c) 150 litres (d) 120 litres

24. A jar was full with milk. A person used to draw out 20% of the milk from the jar and replaced it with sugar solution. He has repeated the same process 4 times and thus there was only 512 gm of milk left in the jar, the rest part of the jar was filled with the sugar solution. The initial amount of the milk in the jar was :
(a) 1.25 kg
(b) 1 kg
(c) 1.5 kg
(d) None of these

25. In a MCD parking there are some two wheelers and rest are 4 wheelers. If wheels are counted, there are total 520 wheels but the incharge of the parking told me that there are only 175 vehicles. If no vehicle has a stepney, then the no. of two wheelers is:
(a) 75 (b) 100
(c) 90 (d) 85

26. In my big pocket there are Rs. 25 consisting of only the denominations of 20 paise and 50 paise. Thus there are total 80 coins in my pocket. The no. of coins of the denomination of 50 paise is :
(a) 30 (b) 70
(c) 50 (d) 25

27. There are some piegons and sheep in a grazing field. The no. of total heads are 60 and total legs are 168 including both piegons and sheep. The no. of sheep is :
(a) 18 (b) 26
(c) 24 (d) 36

28. In the 75 litres of mixture of soda and water, the ratio of soda and water is 4 : 1. The quantity of water required to make the ratio of soda and water 3 : 1 is:
(a) 1 litre (b) 3 litres
(c) 4 litres (d) 5 litres

29. In my office(Rakesh Yadav Reader Publication) the

average age of all the female employees is 21 years and that of male employees is 32 years, where the average age of all the (male and female) employees is 28 years. The total no. of employees in my office could be:

(a) 35 (b) 78

(c) 231 (d) 90

30. A Bus agency has 108 Buses. He sold some Bus at 9% profit and rest at 36% profit. Thus he gains 17% on the sale of all his Buses. The no. of Buses sold at 36% profit is :

(a) 25 (b) 32

(c) 35 (d) 75

31. Rs. 69 were divided among 115 students so that each girl gets 50 paise less than a boy. Thus each boy recieved twice the paise as each girl received. The no. of girls in the class is:

(a) 92 (b) 42

(c) 33 (d) 23

32. In what proportion water be mixed with milk to gain 12.5% by selling it at cost price ?

(a) 3 : 5 (b) 1 : 8

(c) 2 : 7 (d) 1 : 9

33. A butler stole wine from shop containing 50% of spirit, then he replenished it by different wine containing 20% spirit. Thus there was only 30% strength (spirit) in the new mixture. How much of the original wine did he steal ?

(a) 1/3 (b) 2/3

(c) 1/2 (d) 1/4

34. Mr. Rakesh Yadav purchased two book factories, one in India and other one in China for total Rs. 72 crores. Later on he sold the Indian factory at 16% profit and Chineese factory at 24% profit. Thus he gained a total profit of 19%. The selling price of Indian factory is :

(a) 45 crore

(b) 52.2 crore

(c) 8.55 crore

(d) can not be determined

35. In a 25 litres mixture of milk and water, the water is only 20%. How many litres of water is required to increase the percentage of water to 90% ?

(a) 45 litres (b) 70 litres

(c) 115 litres (d) 175 litres

36. A milkman sells the milk at the cost price but he mixes the water (freely available) in it and thus he gains 9.09%. The quantity of water in the mixture of 1 litre is :

(a) 83.33 mL

(b) 90.90 mL

(c) 99.09 mL

(d) can't be determined

37. The price of petrol is Rs. 60 per litre and the price of oil is Rs. 40 per litres. In what ratio the petrol and oil be mixed such that the profit after selling the mixture at Rs. 75 per litre be 25% ?

(a) 1 : 1

(b) 3 : 2

(c) 5 : 1

(d) such a mixture is not possible

38. A trader sells total 315 TV sets. He sells black and white TV sets at a loss of 6% and colour TV sets at a profit of 15%. Thus he gains 9% on the whole. The no. of black and white TV sets, which he has sold is :

(a) 126 (b) 216

(c) 135 (d) 90

39. Rakesh Yadav sells two types of Books viz. National Books and International Books. He sells National Books at Rs.18 per book and incurs a loss of 10% whereas on selling the International Books at Rs. 30 per book, he gains 20%. In what proportion should the national books and international books be mixed such that he can gain a profit of 25% by selling the combined books at Rs. 27.5 per book?

(a) 3 : 2 (b) 2 : 3

(c) 2 : 5 (d) 3 : 5

40. The average age of boys in class is 16.66 years, while the average age of girls is 18.75 years. Thus the average age of all the 40 students of the class is 17.5 years. If the difference between the no. of boys and girls is 8, then the no. of girls in the class is :

(a) 12 (b) 16

(c) 18

(d) data insufficient

41. The ratio of water and wine in two different containers is 2 : 3 and 4 : 5. In what ratio we are required to mix the mixture of two containers in order to get the new mixture in which the ratio of wine and water be 7 : 5 ?

(a) 7 : 3 (b) 5 : 3

(c) 8 : 5 (d) 2 : 7

42. The average marks of the students in four sections A, B, C and D together is 60%. The average marks of the students of A, B, C and D individually are 45%, 50% 72% and 80% respectively. If the average marks of the students of section A and B together is 48% and that of the students of B and C together is 60%. What is the ratio of number of students in sections A and D ?

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

(c) 5 : 3 (d) 3 : 5

43. The diluted alcohol contains only 8 litres of alcohol and the rest is water. A new mixture in which concentration of alcohol is 30%, is to be formed by replacing diluted alcohol. How many litres of mixture shall be replaced with pure alcohol if there was initially 32 litres of water in the mixture?

(a) 4 (b) 5

(c) 8 (d) None of these

44. The average weight of boys in a class is 30 kg and the average weight of girls in the same

class is 20 kg. If the average weight of the whole class is 23.25 kg, what could be the possible strength of boys and girls respectively in the same class?

(a) 14 and 26 (b) 13 and 27
(c) 17 and 27 (d) 13 and 13

45. In a mixture of milk and water, there is only 26% water. After replacing the mixture with 7 litres of pure milk, the percentage of milk in the mixture become 76%. The quantity of mixture is :

(a) 65 litres (b) 91 litres
(c) 38 litres (d) None of these

46. The ratio of expenditure and savings is 3 : 2. If the income increases by 15% and the savings increases by 6%, then by how much per cent should his expenditure increases?

(a) 25 (b) 21
(c) 12 (d) 24

47. 4 kg of a metal contains $\frac{1}{5}$ copper and rest is iron. Another 5 kg of metal contains $\frac{1}{6}$ copper and rest is iron. The ratio of copper and iron into the mixture of these two metals:

(a) 49 : 221
(b) 39 : 231
(c) 94 : 181
(d) None of these

48. 450 litres of a mixture of milk and water contain the milk and water in the ratio 9 : 1. How much water should be added to get a new mixture containing milk and water in the ratio of 3 : 1?

(a) 54 (b) 90
(c) 45 (d) 63

49. The ratio of oil and kerosene in the container is 3 : 2 when 10 litres of the mixture is taken out and is replaced by the kerosene, the ratio becomes 2 : 3. The total quantity of the mixture in the container is :

(a) 25
(b) 30
(c) 45
(d) cannot be determined

50. From a container, 6 litres milk was drawn out and was replaced by water. Again 6 litres of mixture was drawn out & was replaced by the water in the container after these two operations the ratio of milk and water is 9 : 16. The quantity of mixture is:

(a) 15 (b) 16
(c) 25 (d) 31

Solution

1. (b) Average weight of 40 students = 30

Total weight = 40 × 30 = 1200

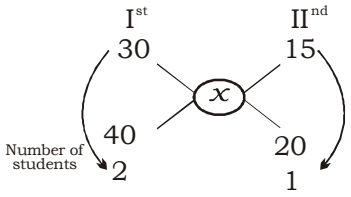
Average weight of 20 students

= 15

Total weight = 20 × 15 = 300

Average weight = $\frac{(1200+300)}{(40+20)} = \frac{1500}{60} = 25$

Alternatively (1) :

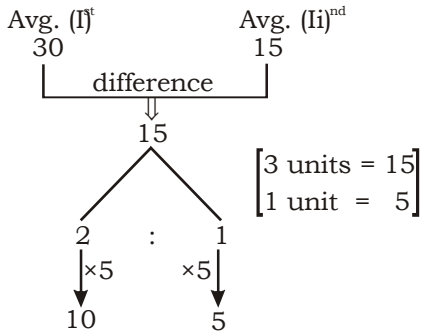


Required avg. (x)

$= \frac{30\times2+15\times1}{(2+1)} = \frac{75}{3} = 25$

Alternatively (2) :

Note : To save your valuable time try to understands the below given method.

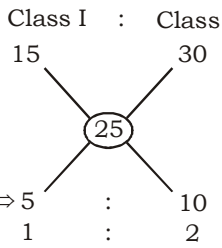


The average of the class will lie in between 15 to 30.

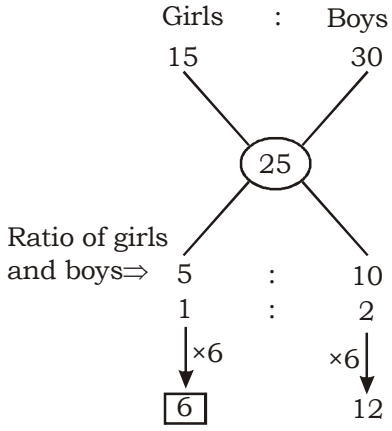
Average of the class = (15 + 10) = 25

or Average of the class = (30 –5) = 25

2. (a) By alligation Rule



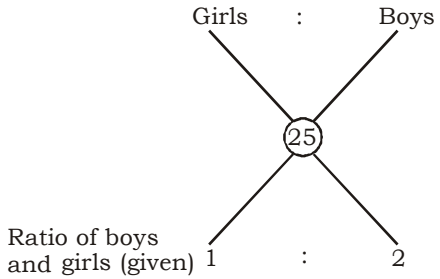
3. (b) By Alligation method,



Required number of girls = 6

4. (a) Let the average weight of girls = x

By alligation method,

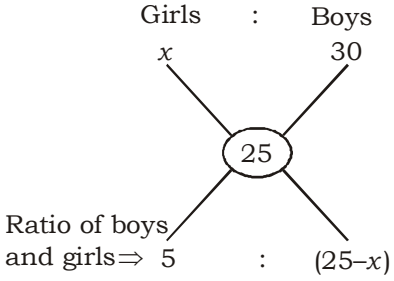


$\frac{x\times1+30\times2}{(1+2)} = 25$

$\Rightarrow$ $x + 60 = 75$

$x = 15$ kg

Alternatively:-



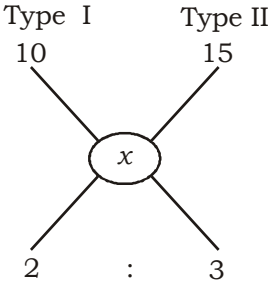
According to the question,

$\frac{5}{(25-x)} = \frac{1}{2}$

$\Rightarrow$ $10 = 25 - x$

$\Rightarrow$ $x = 15$ kg

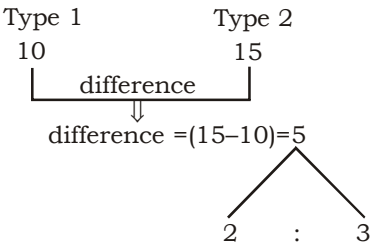
5. (b) By alligation method,



Required average price (x)

$= \frac{2\times10+3\times15}{(2+3)} = \frac{65}{5} = 13$

Alternatively:-



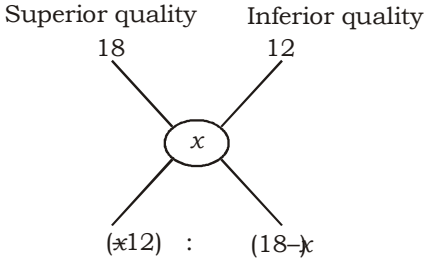
I^st part = $\frac{5}{(2+3)} \times 2 = 2$

II^nd part = $\frac{5}{(2+3)} \times 3 = 3$

Required average = (10 + 3) = 13

or required average = (15 – 2) = 13

6. (a) By alligation Method,



According to the question,

$\frac{(x-12)}{(18-x)} = \frac{5}{25}$

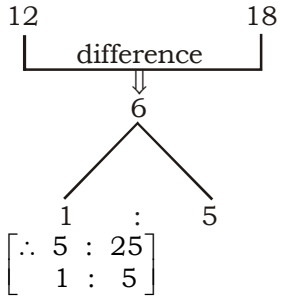
$$\frac{(x-12)}{(18-x)} = \frac{1}{5}$$

$\Rightarrow 5x - 60 = 18 - x$

$\Rightarrow 6x = 60 + 18$

$$x = \frac{78}{6} = 13$$

Alternatively:-



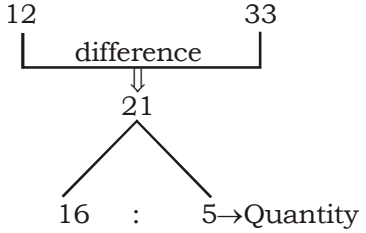
$$I^{st} \text{ part} = \frac{6}{(1+5)} \times 1 = 1$$

$$II^{nd} \text{ part} = \frac{6}{(1+5)} \times 5 = 5$$

Required average = (12 + 1) = 13

or Required average = (18 – 5) = 13

7. (b) By alligation method,



$$I^{st} \text{ part} = \frac{21}{(16+5)} \times 16 = 16$$

$$II^{nd} \text{ part} = \frac{21}{(16+5)} \times 5 = 5$$

Note : The average price will lie between 12 and 33

∴ Required average price

= (12 + 5) = Rs. 17

or required average price

= (33 – 16) = Rs. 17

Alternate:-

By avg. method

Total Price of wine

Þ 16 × 12 = 192

Total Price of water

Þ 5 × 33 = 165

Avg. Price

Þ $\frac{192+165}{16+5} = \frac{357}{21} = 17$

8. (c)

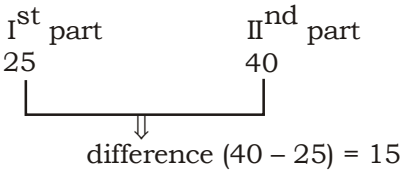
$$\boxed{\text{Average Speed} = \frac{\text{Total distance}}{\text{Total time}}}$$

Required average speed

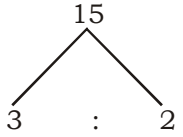
$$= \frac{25\times\frac{1}{2} + 40\times\frac{1}{3}}{\frac{5}{6}} = \frac{75+80}{5}$$

$$= \frac{155}{5} = 31 \text{ km/h}$$

Alternatively:-



Divide it in the ratio of time.



$$I^{st} \text{ part} = \frac{15}{(3+2)} \times 3 = 9 \text{ km/h}$$

$$II^{nd} \text{ part} = \frac{15}{(3+2)} \times 2 = 6 \text{ km/h}$$

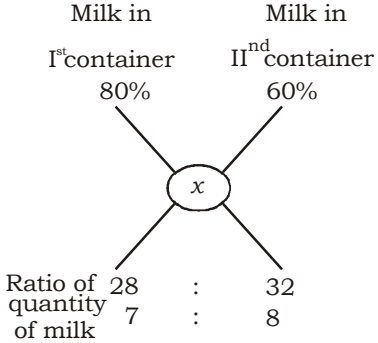
Required average speed

= (25 + 6) = 31 km/h

or Required average speed

= (40 – 9) = 31 km/h

9. (b) By alligation Method,

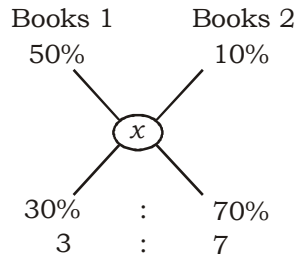


Required % of milk in the new mixture

$$= \frac{80\times7 + 60\times8}{15} = \frac{560+480}{15}$$

$$= \frac{1040}{15} = 69.33\%$$

10. By Alligation method,



Required average profit percent

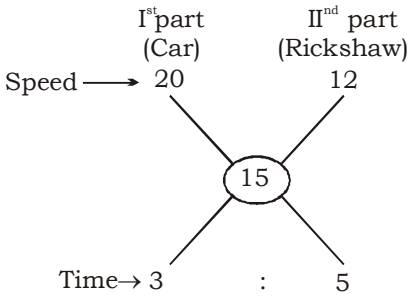
$$= \frac{50\times3+7\times10}{(3+7)} = \frac{220}{10} = 22\%$$

11. (c) Average speed of Bhuvnesh

$$= \frac{\text{distance}}{\text{time}}$$

$$= \frac{150}{10} = 15 \text{ km/hr}$$

Now by alligation Method,



Time for travelling by Car

$$= \frac{10}{(3+5)} \times 3 = \frac{15}{4} \text{ hours}$$

Time for travelling by Rickshaw

$$= \frac{10}{(3+5)} \times 5 = \frac{25}{4} \text{ hours}$$

Distance travelled by Car

$$= 20 \times \frac{15}{4} = 75 \text{ km}$$

Distance travelled by Rickshaw

$$= 12 \times \frac{25}{4} = 75\text{km}$$

Ratio of distances = 75 : 75 = 1 : 1

Note: We can save our time in such type of questions, not to calculate actual distance and actual time, If in question examiner is asking about ratio of distances.

$$\frac{\text{Distance travelled by car}}{\text{Distance travelled by Rickshaw}}$$

$= \frac{20\times3}{12\times5} = \frac{1}{1}$

Required ratio = 1 : 1

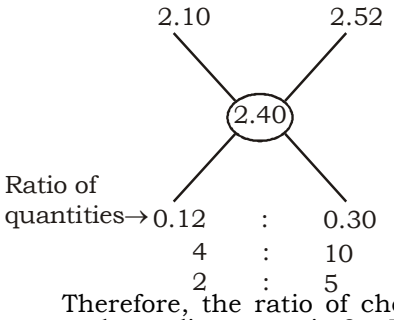
12. (c) sp of sugar = Rs. 3/kg

Profit = 25%

$\therefore$ CP of sugar = $\frac{3}{(100+25)} \times 100$

$= \frac{300}{125} = \frac{12}{5} = ` 2.4/kg$

Now by alliagation Method,



Therefore, the ratio of cheaper and costlier sugar is 2 : 5.

13. (b) **Note** : In such type of questions save your valuable time to think like that, water is freely available and all the water is sold at the price of milk, then the water gives the profit on cost of milk.

$\therefore$ profit percentage = $\frac{5}{20} \times 100$

= 25%

Note: These type of questions are similar to

SP of 20 articles = CP of 25 articles

Hence, Profit % = $\frac{5}{20} \times 100 = 25\%$

14. (b) 33.33% = $\frac{1 \to \text{water}}{3 \to \text{soda}}$

for 33.33 % profit,

required units of water = 1

required units of soda = 3

Ratio of water : Soda = 1 : 3

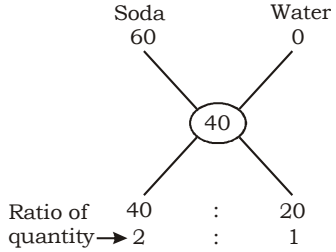
Note : For detailed method of such type of questions refer solutions of earliers questions of same type.

15. (a) Selling price of mixture = 50/litres

profit % = 25%

$\therefore$ Cost price of mixture = $\frac{50}{125} \times 100$ = Rs.40/litres

Now by alligation method,



Ratio of water and Soda = 1 : 2

16. (c) 80% = $\frac{4 \to \text{quantity of milk}}{5 \to \text{total mixture}}$

$\therefore$ qunatity of water = (5 – 4) = 1

Now similarly 50% = $\frac{1}{2}$

Milk : Water

4 : 1

$1_{\times4}$: $1_{\times4}$

Note : In this process quantity of milk remains constant because the quantity of water is added.

Now ratio of milk to water

Milk : Water

4 : 1 $\xrightarrow{+}$ 5

$\xrightarrow{+3}$

4 : 4

According to the question,

5 units = 50 litres

1 unit = 10 litres

3 units = 10 × 3 = 30 litres

17. (d) Total quantity of mixture = 50 litres

Milk : Water

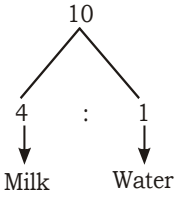
80 : 20

4 : 1 $\xrightarrow{+\text{sum}}$ 5

$\downarrow\times10$ $\downarrow\times10$ $\downarrow\times10$

40 10 50

Note : 10 litres mixture is taken out.



Quantity of milk taken out

$= \frac{10}{(4+1)} \times 4 = 8$ litres

Quantity of water taken out

$= \frac{10}{(4+1)} \times 1 = 2$ litres

Now remaining quantity of milk and water in mixture.

Milk : Water

32 : 8

$\downarrow+10$

18

Required percentage of water

$= \frac{18}{(32+18)} \times 100 = 36\%$

18. (a)

Fat : Non-fat

$4_{\times143}$: $5_{\times143} \xrightarrow{+} 9$ 143

$5_{\times117}$: $6_{\times117} \xrightarrow{+} 11$ 117 → 1287

$6_{\times99}$: $7_{\times99} \xrightarrow{+} 13$ 99

⇓

Total capacity

Note : Quantity of all three types of butter is equal in the mixture.

$\therefore$ New ratio,

	Fat	:	Non-fat
Pages →	572	:	715
Amul →	585	:	702
Nestle →	594	:	693
	1751	:	2110

19. (b)

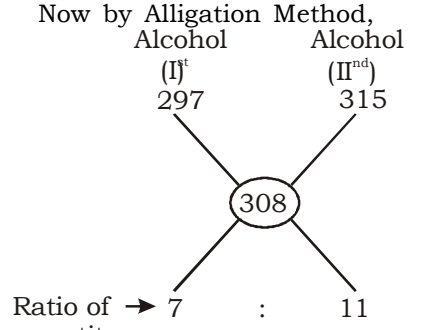
Alcohol : Water

I^{st} → $3_{\times99}$: $4_{\times99} \xrightarrow{+} 7$ 99

II^{nd} → $5_{\times63}$: $6_{\times63} \xrightarrow{+} 11$ 63 → 693

III^{rd} → $4_{\times77}$: $5_{\times77} \xrightarrow{+} 9$ 77

Now by Alligation Method,



Hence, the ratio of first mixture is to scored mixture is 7 : 11.

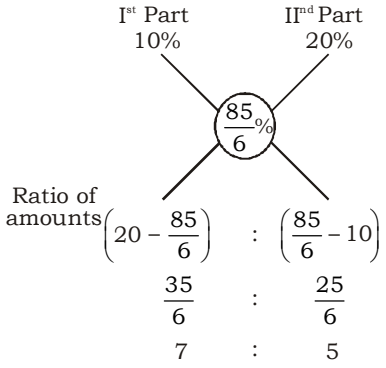
$\therefore$ Required first type alcohol

$= \frac{18}{(7+11)} \times 7 = 7$

20. (d) Total interest = Rs. 3400

Average rate of interest

$= \frac{3400}{6000} \times \frac{100}{4} = \frac{85}{6}\%$



Amount lent on 10%

$= \frac{6000}{(7+5)} \times 7 =$ **Rs. 3500**

21. (b) **Note** → In such type of questions use the below given formula.

$$\text{Final} = \text{initial}\left(1-\frac{x}{m}\right)^n$$

where x = amount being replaced in each operation.

m = total amount

$\text{Final} = 50\left(1-\frac{5}{50}\right)^3$

n = Who many times

Final Quantity of milk

$= 50 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} =$ **36.45 Litres**

Alternate:-

$\frac{5}{50} = \frac{1}{10}$

Initial	Final
10	9
10	9
10	9
1000	729

1000 units = 50 litres

1 unit = $\frac{50}{1000}$ litres

= 729 units = $\frac{50}{1000} \times 729$

= **36.45 litres**

22. (c) Part to be taken out

$= \frac{40}{200} = \frac{1}{5}$

Initial	Final
5	4
5	4
5	4
5	4
625	256

625 units = 200 litres

1 = $\frac{200}{625}$ litres

369 units = $\frac{200}{625} \times 369$

= **118.08 litres**

23. (d)

Final Quantity (Beer)	:	Final Quantity (Water)
343		169

Note → In starting the container was full of beer.

Initial Quantity = (169 + 343)

= 512

Now by using formula,

$\Rightarrow 343 = 512\left(1-\frac{15}{m}\right)^3$

$\Rightarrow \frac{343}{512} = \left(1-\frac{15}{m}\right)^3$

$\Rightarrow \left(\frac{7}{8}\right)^3 = \left(1-\frac{15}{m}\right)^3$

$\Rightarrow \frac{7}{8} = \left(1-\frac{15}{m}\right)$

$\Rightarrow$ m = 120

$\therefore$ initial amount of beer = **120 litres**

Alternate →

Note: In such type of questions follow the given below method to save your valuable time.

Initial quantity

= (343 + 169) = 512

Final quantity = 343

Initial : Final

$\sqrt[3]{512} : \sqrt[3]{343}$

8 : 7

1 unit

1 unit = 15 litres

8 units = 15 × 8 = **120 litres**

24. (a) 20% = $\frac{1}{5}$

Let the initial quantity of milk is jar = x gm

$512 = x\left(1-\frac{1}{5}\right)^4$

$512 = x \times \left(\frac{4}{5}\right)^4$

$x = \frac{512 \times 625}{256} = 1250$ gm

x = 1.25 kg.

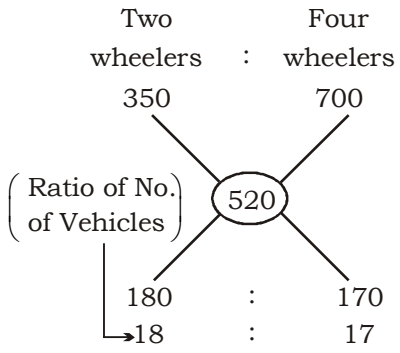
Alternate → Note → To save your valuable time follow the give below method.

Initial	Final
5	4
5	4
5	4
5	4
625	256
↓×2	↓×2
1250 gm	512 gm

Quantity of milk in the jar initially was = 1250 gm = **1.25 kg**

25. (c) By alligation Method,

Note → For detailed solution follow earlier question of same type.



Total number of two wheelers

$= \frac{175}{(18+17)} \times 18 =$ **90**

Alternate:-

In these type of questions,

Assume all vehicles be two wheelers

So, No. of wheels

Þ $175 \times 2 = 350$

No. of extra wheels

Þ $520 - 350 = 170$

These extra wheels are of four wheelers.

No. of Four wheelers

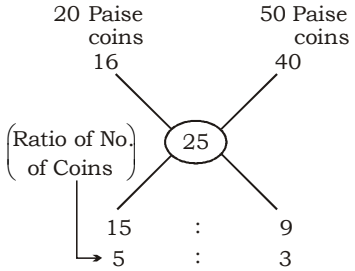
Þ $\frac{170}{2(\text{Extra wheels of four wheelers})}$

$= 85$

No. of Two wheelers

$= 175 - 85 = 90$

26. (a) By Alligation Method,



Required number of 50 paise

$= \frac{80}{(5+3)} \times 3 =$ **30**

Alternate:-

As per previous question,

Assume all coins be 20 paise coins

Total no. of coins = 80

Hence, we have 80×20

= 1600 paise or 16 Rs. Extra Rupees

Þ $25 - 16 = 9$ Rs. or 900 paise

These extra 9 Rs. are due to 50 paise coin

Extra paise in 50 Rs. coin = 50 P – 20 P = 30 paise

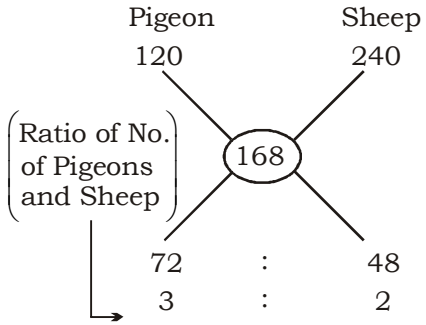
No. of 50 paise coin

Þ $\frac{900[\text{Extra Rs.}]}{30\ [\text{Extra Paise}]} = 30$

No. of 20 paise coin

Þ $80 - 30 = 50$.

27. (c) By alligation rule,



Required number of sheep

$= \frac{60}{(3+2)} \times 2 =$ **24**

Alternate →

Note:- In such type of question to save your valuable time we can take help from options and then satisfy the question condition.

Option (c) → Number of Sheep = 24

∴ Number of Pigeons = (60 – 24) = 36

Number of legs = $24 \times 4 + 36 \times 2 = 96 + 72 = 168$

The same data is mention in question. So option (c) is correct.

28. (d) Ratio of Soda : Water = 4 : 1

$\text{Quantity of Soda} = \frac{75}{(4+1)} \times 4 = 60$

$\text{Quantity of Water} = \frac{75}{(4+1)} \times 1$

$= 15$

Let the required quantity of water = x litre

$\frac{60}{15+x} = \frac{3}{1} \Rightarrow 60 = 45 + 3x$

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

Alternate:-

Note:- In such type of questions follow the given below method to save your valuable time.

Soda	:	Water
$4_{\times 3}$	:	$1_{\times 3}$
$3_{\times 4}$	:	$1_{\times 4}$

The quantity of soda is constant because we added water into the mixture.

After that new ratio,

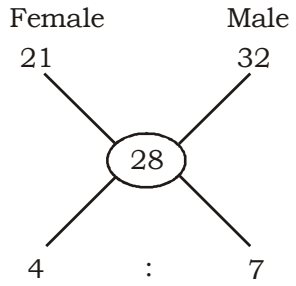
Soda	:	Water	
12	:	3	$\xrightarrow{+1}$ 15
12	:	4	$\xrightarrow{+1}$

15 units = 75 litres

1 unit = 5 litres

Required quantity of water = **5 litres**

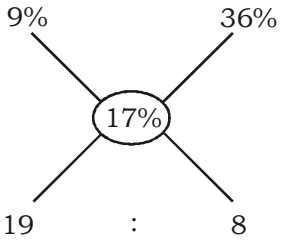
29. (c) By alligation Method,



Total number of employees would be the multiple of (4 + 7) = **11**

∴ Hence option (c) is correct.

30. (b) By alligation Method,



(19 + 8) units = 108

27 units = 108

1 unit $= \frac{108}{27} = 4$

8 units = $4 \times 8 =$ **32**

Required no. of buses sold at 36% profit = 32.

31. (a) According to the question,

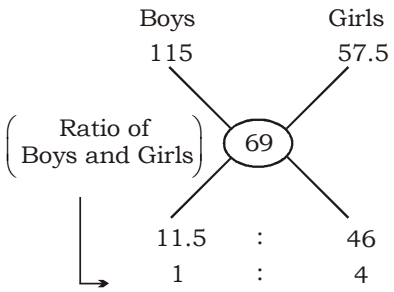
Boys	:	Girls
$2x$	:	x

$(2x - x)$ = 50 paise

x = 50 paise

$2x$ = 100 paise

Now By alligation method,



Required number of girls

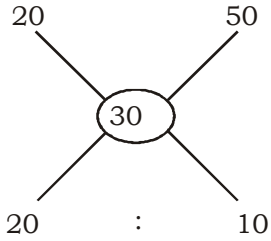
$= \frac{115}{(1+4)} \times 4 = 92$

32. (b) Profit = 12.5% = $\frac{1}{8}$

Note:- Water is freely available, so to gain 12.5% ratio of water : milk = **1 : 8**

Note:- In these type of question, convert percentage into the ratio. That will be the answer.

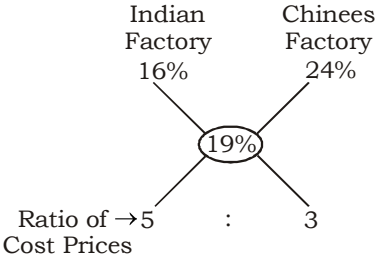
33. (b) By Alligation Method,



Since the ratio of 20% wine to 50% wine is 2 : 1, it means there is $\frac{2}{3}$ wine is replaced with wine in which the strength of spirit is 20%.

So we can say he stole $\frac{2}{3}rd$ of the original wine.

34. (b)



Cost price of indian factory

$= \frac{72}{(5+3)} \times 5 = 45$ Crore

Selling price = $45 \times \frac{(100+16)}{100}$

$= \frac{45 \times 116}{100} =$ **52.20 crore**

35. (d) $\therefore$ 20% = $\frac{1}{5}$

	Water	:	Milk
Ratio initially	1	:	4
Ratio after mixing water	$9_{\times 4}$	:	$1_{\times 4}$

Note: The quantity of milk would be constant because we added up quantity of water.

After that new ratio,

Water : Milk $\xrightarrow{+}$ 5 (sum)

1 : 4

35 ↷

36 : 4

5 units = 25 litres

1 unit = $\frac{25}{5}$ litres

35 units = 5 × 35 = 175 litres

Alternate →

Initially quantity of water

$= \frac{25 \times 20}{100} = 5$ litres

$\therefore$ Quantity of milk = (25 – 5) = 20 litres

Let required capacity of water = x litres

$\therefore$ According to the question,

$\Rightarrow \frac{5+x}{20} = \frac{90}{10} \Rightarrow 5 + x = 180$

$\Rightarrow x =$ **175 litres**

36. (a) 9.09% = $9\frac{1}{11}$

$= \frac{1 \rightarrow \text{Water}}{11 \rightarrow \text{Milk}}$

Ratio of water : Milk = 1 : 11

Ratio of water : Mixture = 1 : 12 (1+ 11)

$\therefore$ 1 litres = 1000 ml

Thus the quantity of water in the mixture of 1 litre mixture

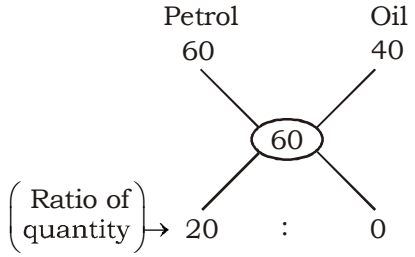
$= \frac{1000}{12} \times 1 =$ **83.33 mL**

37. (d) Profit % = 25%

$= \frac{1 \rightarrow \text{Profit}}{4 \rightarrow \text{CP}}$

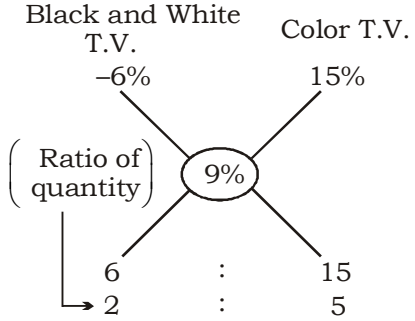
Selling price = Rs. 75

Cost price = $75 \times \frac{4}{5} =$ Rs. 60



Now we know that if we mix oil (worth Rs. 40 per litres) with petrol (worth Rs. 60 per litres), the cost price of the mixture must be less than Rs. 60 per litres, which is impossible.

38. (d) By alligation Method,



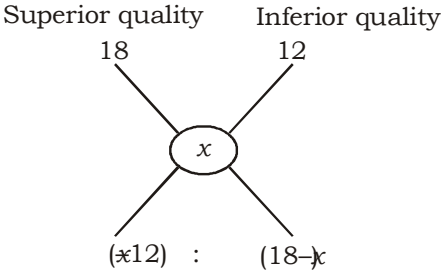
According to the question,

(2 + 5) units = 315

7 units = 315

1 unit = 45

Total numer of black and white T.V. Sets = 45 × 2 = **90**



39. (a) Selling price of the combined books = Rs. 27.5

Profit = 25% = $\frac{1 \rightarrow \text{Profit}}{4 \rightarrow \text{CP}}$

Cost price = $\frac{27.5}{5}\times 4$ = Rs. 22

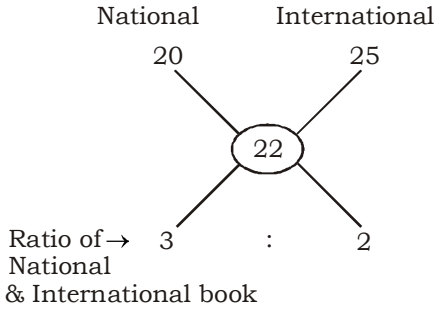
The SP of national book = Rs. 18

$\therefore$ CP = $\frac{18}{(100-10)}\times 100$ = Rs. 20

The SP of international book = Rs. 30

$\therefore$ CP = $\frac{30}{(100-20)}\times 100$ = Rs. 25

Now by alligation Method,



$\therefore$ Ratio of National : International books = 3 : 2

40. (b) Average age boys = 16.66

= $16\frac{2}{3}$ = $\frac{50}{3}$ years

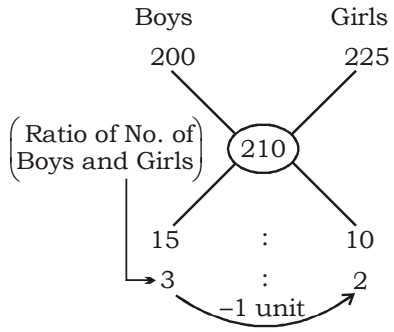
Average age of girls = 18.75

= $\frac{75}{4}$ years

Average age of the class

= 17.5 = $\frac{35}{2}$ years

Note:- Multiply by 12 in all values of average ages to avoid fraction.



1 unit = 8

2 units = 16

Required number of girls = **6 years**

41. (b)

Water : Wine

$2_{\times 36}$: $3_{\times 36}$ $\xrightarrow[\text{sum}]{+}$ 5 (36)

$4_{\times 20}$: $5_{\times 20}$ $\xrightarrow{+}$ 9 (20)

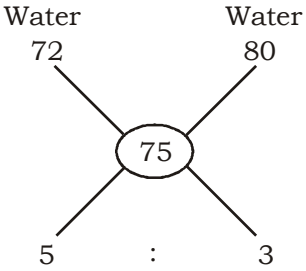
$5_{\times 15}$: $7_{\times 15}$ $\xrightarrow{+}$ 12 (15)

180 ⇓ Total Capacity

After equating the capacity of containers New ratio of water and wine

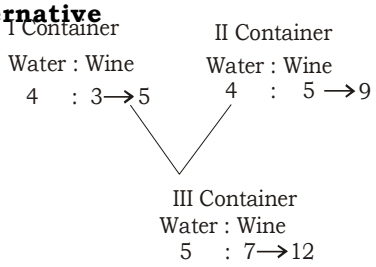
Water	:	Wine
72	:	108
80	:	100
75	:	105

Now By Alligation Method,

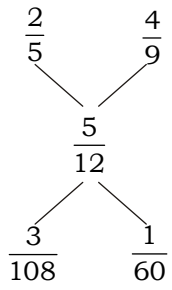


Therefore, required ratio = **5 : 3**

Alternative



So, apply to alligation



$\therefore$ $\frac{1}{36}$: $\frac{1}{60}$

$\therefore$ $\frac{1}{3}$: $\frac{1}{5}$

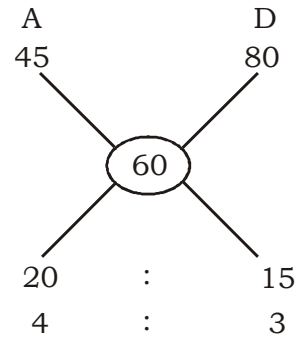
$\therefore$ **5 : 3**

42. (b) **Note:** In such type of questions examiner wants to check your intelligency.

Since the average marks of sections B and C together are equal the average marks of all the four sections (i.e. A, B, C and D).

Therefore we can say the average marks of the remaining two sections A and D together will also be equal i.e. 60%.

Now by Alligation method,



$\therefore$ Required ratio of A and D section students = 4 : 3

43. (b)

Alcohol	:	Water
8	:	32
Initial → $1_{\times 7}$	:	$4_{\times 7}$ $\left[\therefore 30\% = \frac{3}{10}\right]$
Final → $3_{\times 4}$	:	$7_{\times 4}$

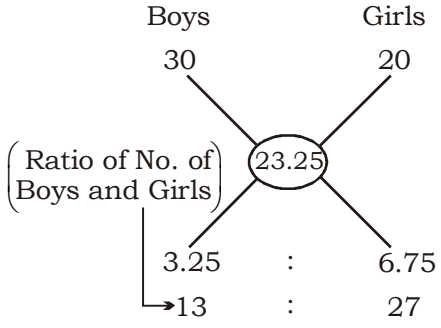
Note → Now we replaced the quantity of alcohol. So the quantity of water would be same.

After that new Ratio,

Alcohol	:	Water
7	:	28
+5 → 12	:	28

Required quantity = 5 litres

44. (b) Now by alligation Method,



The possible number of boys

and girls will be the multiple of 13 and 27 respectively.
So option (b) is correct.

45. (b) Milk : Water
74 : 26
76 : 24

$\xrightarrow[\text{Simplify}]{\text{After}}$

Milk : Water
$37_{\times 6}$: $13_{\times 6}$
$19_{\times 13}$: $6_{\times 13}$

We are replacing milk so quantity of water would be same.

	Milk	:	Water
+25	222	:	78
	247	:	78

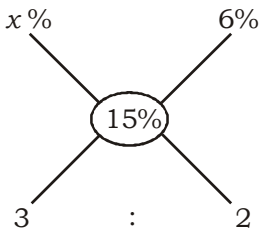
25 units = 7 litre

1 unit = $\frac{7}{25}$

(247 + 78) units = $\frac{7}{25} \times 325$

= **91 litres**

46. (b) By alligation method,
Expenditure : Savings



$\Rightarrow \frac{3x+12}{3+2} = 15$

$\Rightarrow 3x + 12 = 75$

$\Rightarrow 3x = 63$

$\Rightarrow x =$ **21%**

Percentage increase in expenditure = **21%**

Alternate:-

Let expenditure = 300,

Savings = 200

$\therefore$ Total income = Expenditure + income = 300 + 200 = 500

Increament in income

$= \frac{500 \times 15}{100} = 75$

Increament in savings

$= \frac{200 \times 6}{100} = 12$

Note:- Remaining increament (75 – 12 = 63) due to increament in expenditure.

$\therefore$ percentage increament in expenditure = $\frac{63}{300} \times 100 =$ **21%**

47. (a) In First metal copper = $\frac{4}{5}$ kg

In First metal iron = $\frac{16}{5}$ kg

In second metal copper = $\frac{5}{6}$ kg

In second metal Iron = $\frac{25}{6}$ kg

Therefore, copper in the mixture = $\frac{4}{5}+\frac{5}{6}=\frac{49}{30}$ kg

Iron in the mixture = $\frac{16}{5} + \frac{25}{6}$

= $\frac{221}{30}$ kg

Required ratio = $\frac{49}{30} : \frac{221}{30}$

$\Rightarrow$ 49 : 221

48 (b) Milk : Water
9 : 1

$3_{\times 3}$: $1_{\times 3}$

Note: We are adding water in the mixture so quantity of milk would be constant.

After that new ratio,

Milk	:	Water
9	:	1 $\xrightarrow{+}$ 10
9	:	3 (+2)

10 units = 450 litres

1 unit = $\frac{450}{10}$ = 45 litres

2 units = 45 × 2 = 90 litres

$\therefore$ Required amount of water = 90 litres

49. (b) Oil : Kerosene
$3_{\times 2}$: $2_{\times 2}$
$2_{\times 3}$: $3_{\times 3}$

Note:-

(i) Mixture is taken out from the container so ratio of oil and kerosene would not be change.

(ii) We are adding kerosene so quantity of oil would constant.

After that new ratio,

Oil	:	Kerosene
6	:	4 (+5)
6	:	9

5 units = 10 litres
1 unit = 2 litres
10 units = 20 litres

Initial quantity of water = (20 + 10) = 30 litres

50. (a) By using formula,

$$\boxed{\text{Final} = \text{initial}\left(1-\frac{x}{m}\right)^n}$$

Note: We have explained this formula earlier.

$\Rightarrow 9 = (16 + 9)\left(1-\frac{6}{m}\right)^2$

$\Rightarrow \frac{3}{5} = 1 - \frac{6}{m}$

$\Rightarrow \frac{6}{m} = 1 - \frac{3}{5}$

$\frac{6}{m} = \frac{2}{5} \Rightarrow m = 15$

$\therefore$ quantity of mixture = **15 litres**

Alternate:-

Note: Initially the container was totally filled by milk.

$\therefore$ Total quantity of milk
= (16 + 9) = 25 litres

Number of operation = 2

Initial	:	Final
$\sqrt{25}$	:	$\sqrt{9}$
5	:	3 (–2 units)

2 units = 6 litres
1 unit = 3 litres
5 units = 3 × 5 = **15 litres**