Mixture and Alligation

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This Video Completely covers the problems on "Mixture and Alligation" which is more than sufficient for all kind of placement Exams eg: TCS/WIPRO/AMCAT/ELITMUS/CoCubes and all other placement Exams.

Mixture and Alligation by : Pratik Shrivastava(10 years of industry experience and awarded best Aptitude trainer)

Mixture and Alligation

Mixture: Mixing of two or more than two type of quantities gives us a mixture.
Quantities of these elements can be expressed as percentage or ratio.
(1) Percentage:- (20% of sugar in water)

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

1. Alligation:

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

2. Mean Price:

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

Mixture and Alligation

- Suppose a container contains x of liquid from which y units are taken out and replaced by water.
- After n operations, the quantity of pure liquid = $\left[x\left(1 - \frac{y}{x}\right)^n \right]$ units.
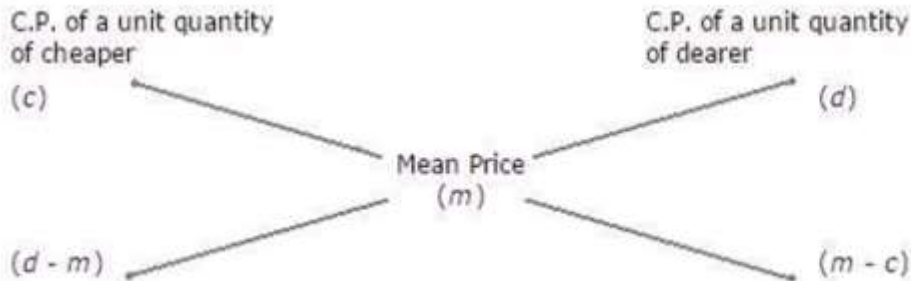
Mixture and Alligation

Rule of Alligation:

If two ingredients are mixed, then

$$\left(\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}}\right) = \left(\frac{\text{C.P. of dearer - Mean Price}}{\text{Mean price - C.P. of cheaper}}\right)$$

We present as under:

C.P. of a unit quantity of cheaper (c) ⟶ C.P. of a unit quantity of dearer (d)

Mean Price (m)

(d - m) ⟶ (m - c)

∴ (Cheaper quantity) : (Dearer quantity) = (d - m) : (m - c).

Mixture and Alligation

Q1. Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg.
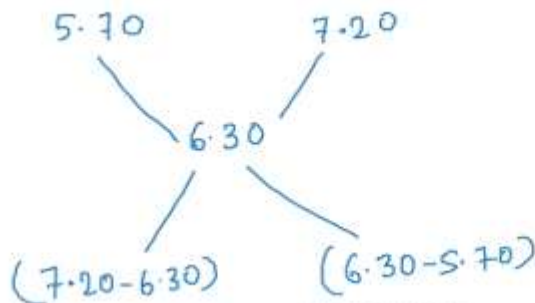
A) 1:3   B) 2:3
C) 3:4   D) 4:5

a: 2:3
3:2
Rule of Alligation

Alligation

CP of cheaper   CP of dearer

Solution:

8:2 proper
3:2

5.70   7.20

6.30

(7.20 - 6.30)   (6.30 - 5.70)

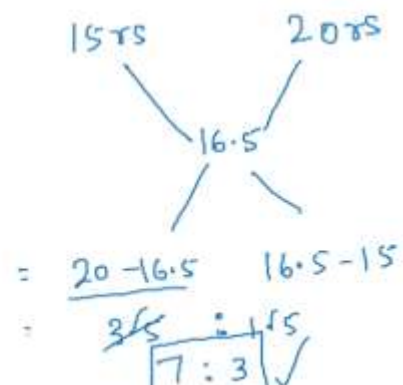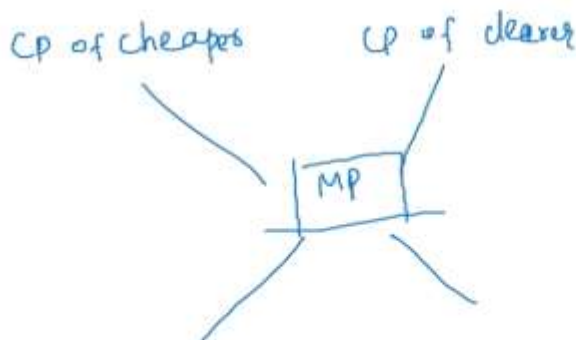CP of cheaper   CP of dearer

CP of mix

9 : 6
9:6 = 3:2

Mixture and Alligation

Q2. In what ratio must a grocer mix two varieties of pulses costing Rs. 15 and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 kg?

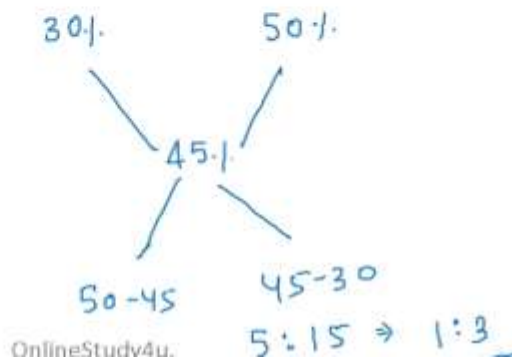A) 3:7   B) 5:7   C) 7:3   D) 7:5

Solution:

CP of cheaper   CP of dearer

MP

15 rs   20 rs

16.5

= 20 - 16.5   16.5 - 15

= 3.5   1.5

7 : 3

Mixture and Alligation

Q3. In what ratio must a mixture of 30% alcohol strength be mixed with that of 50% alcohol strength so as to get a mixture of 45% alcohol strength?

(1) 1 : 2

(2) 1 : 3

(3) 2 : 1

(4) 3 : 1

Solution:

$$30\% \qquad\qquad 50\%$$

$$45\%$$

$$50-45 \qquad\qquad 45-30$$

$$5 : 15 \Rightarrow 1 : 3$$

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Mixture and Alligation

Q4. 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 as 3 : 5?

(1) 133 1/3

(2) 1 / 200

(3) 72

(4) 66

Solutions:

Alloy = 200 gm

$$Z : C : 5 : 3$$

$$5x + 3x = 200 \, gm$$

$$8x = 200$$

$$x = \frac{200}{8} = 25$$

$$Z = 5x : 5 \times 25 = 125 \checkmark$$

$$C = 3x = 3 \times 25 = 75 \checkmark$$

Alloy (200 gm)

$$Z : C$$
$$5 : 3 \checkmark$$

$$\Rightarrow \frac{125}{75+x} \times \frac{3}{5}$$

$$\Rightarrow 625 = 225 + 3x$$

$$400 = 3x$$

$$x = \frac{400}{3} = 133\frac{1}{3} \, gm$$

Mixture and Alligation

Q5. 200 litres of a mixture contains 15 % water and the rest is milk. The amount of milk that must be added so that the resulting mixture contains 87.5% milk is

(1) 30 litres

(2) 35 litres

(3) 40 litres

(4) 45 litres

bit ✓

Solutions:

Total mix = 200 lt

200 lt
15% water
85% milk

milk $200 \times \frac{15}{100} = 30 \, lit \, (water)$

$$200 - 30 = 170 \, lt \, (milk)$$

$$100 - 87.5$$
$$12.5\%$$

$$\Rightarrow \frac{30 \, lit}{170 + x} = \frac{12.5\%}{87.5\%}$$

$$\frac{12.5}{87.5} = \frac{5}{35} = 7$$

$$30 \times 7 = 170 + x$$

$$210 = 170 + x$$

$$\boxed{x = 40 \, lt}$$

Q6. From a container, full of pure milk, 20% is replaced by water and this process is repeated three times. At the end of third operation, the quantity of pure milk reduces to

(1) 40.0 % ✓　　　　(2) 50.0% ✓
(3) 51.2% ✓　　　　(4) 58.8% ✓

Solutions:

20 % log

100 Lt　　20 Lt −20% M

Percentage　　+20 y w

Formula ✓　　x = initial Quan
y = replaced
n = no of operation

Quantity of pure milk = $x\left(1 - \dfrac{y}{x}\right)^n$
left in final ✓

$\Rightarrow 100\left(1 - \dfrac{20}{100}\right)^3$

$\Rightarrow 100(Lt) \times \dfrac{(100-20)}{100} \times \dfrac{(100-20)}{100} \times \dfrac{(100-20)}{100}$

$= 100\left(\dfrac{8}{10}\right)^3$

$100 \times \dfrac{80}{100} \times \dfrac{80}{100} \times \dfrac{80}{100} \Rightarrow \dfrac{512}{10} = 51.2\,Lt$ ✓
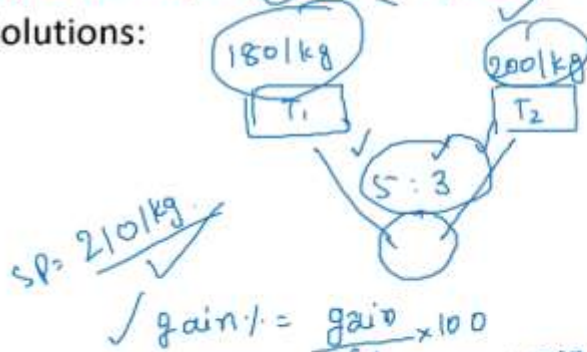
$100 \times \dfrac{512}{1000}$ ⟶ 51.2 Lt / 51.2 %

Q7 Nita blends two varieties of tea one costing Rs. 180 per kg and another costing Rs. 200 per kg in the ratio 5 : 3. If she sells the blended variety at Rs. 210 per kg. then her gain is

A) 110%　B) 11%　C) 12%　D) 13%

Profit & loss ✓

Solutions:

180/kg　T_1　　200/kg　T_2

5 : 3

SP = 210/kg ✓

gain% = $\dfrac{gain}{CP} \times 100$

$T_1 = 5x\,kg$　　$T_2 = 3x\,kg$
　　　　5x + 3x

$CP = 180 \times 5x + 200 \times 3x$

$CP = 900x + 600x = 1500x\,kg$

$SP = 210 \times (5x + 3x)$

$= 210 \times 8x = 1680x\,kg$

$\Rightarrow \dfrac{1680x - 1500x}{1500x} \times 100$

$\Rightarrow \dfrac{180x}{1500x} \times 100$

12 %

Q8. 200 litres of a mixture contains milk and water in the ratio 17: 3. After the addition of some more milk to it, the ratio of milk to water in the resulting mixture becomes 7: 1. The quantity of milk added to it was

(1) 20 litres　　　　(2) 40 litres
(3) 60 litres　　　　(4) 80 litres

Solutions:

200 Lt
M : W
17 : 3

$\Rightarrow 17x + 3x = 200\,Lt$
$20x = 200\,Lt$
$x = 10\,Lt$

M = $17x = 17 \times 10 = 170\,Lt$
W = $3x = 3 \times 10 = 30\,Lt$

$\Rightarrow \dfrac{170 + x}{30} = \dfrac{7}{1}$

$210 = 170 + x$
$x = 210 - 170$
$= 40\,Lt$

Mixture and Alligation

Q9) A shopkeeper bought 80 kg of sugar at the rate of Rs. 13.50 per kg. He mixed it with 120 kg of sugar costing Rs. 16 per kg.. In order to make a profit of 20%, he must sell the mixture at.

(1) Rs. 18 per kg   (2) Rs. 17 per kg
(3) Rs. 16.40 per kg   (4) Rs. 15 per kg

Solutions:

Sugar (13.50/kg)
80kg

(16/kg)
120kg

10/kg
2 kg = 20%

16×12
160 + 32

$CP = \dfrac{(80 \times 13.5 + 120 \times 16)}{200}$

$= \dfrac{1080 + 1920}{200}$

$\Rightarrow \dfrac{3000}{200} \Rightarrow 15.5/kg$

CP = 15.5, profit = 20%

$SP = \dfrac{CP \times (100 + \text{Profit})}{100}$

$15 \times \dfrac{120}{100} = \dfrac{180}{10} \Rightarrow 18/kg$

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Mixture and Alligation

Q10. How many kg of Sugar at 50 P per kg must a man mix with 25 kg of sugar at 34P per kg so that by selling the mixture at 44P per kg he gains 10% on the outlay?

1. 10 kg 2. 15 kg 3. 20 kg 4. 16 kg 5. 18 kg

Solutions:

V.V

SP of mix = 44P
gain = 10%

$SP = \dfrac{CP \times (100 + gain\%)}{100}$

$44 = CP \times \dfrac{110}{100}$

CP = 40
mix

$\dfrac{\text{Quantity of c}}{\text{Quantity of d}} = \dfrac{5}{3}$

$\dfrac{25}{d} = \dfrac{5}{3}$

d = 15kg

Alligation

25 kg	x kg (15kg)
34 P	50p

40p

(50-40) (40-34)
10 : 6
5 : 3 ✓

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Mixture and Alligation

Q11. Tea worth of Rs. 135/kg & Rs. 126/kg are mixed with a third variety in the ratio 1: 1: 2. If the mixture is worth Rs. 153 per kg, the price of the third variety per kg will be____?

A) Rs. 169.50
B) Rs. 1700
C) Rs. 175.50
D) Rs. 180

135/kg 126/kg   x/kg
1 : 1 : 2

$\dfrac{135 \times 1 + 126 \times 1}{1 + 1}$

$\dfrac{135 + 126}{2}$

$\dfrac{261}{2} = 130.5$

$\dfrac{2 - 153}{153 - 130.5} = \dfrac{2}{2} \cdot 1$

$\Rightarrow x - 153 = 22.5$

$x = 153 + 22.5$

$x = 175.5$

Alligation

130.5/kg   x/kg   175.5/kg

153/kg

2 : 2
(x - 153) (153 - 130.5)

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Q12. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially?

A) 10 B) 20
C) 21 D) 25

Solution:
Mix & Allig

$$\frac{7x - \frac{21}{4}}{5x + \frac{21}{4}} = \frac{7}{9}$$

$\Rightarrow 9\left(7x - \frac{21}{4}\right) = 7\left(5x + \frac{21}{4}\right)$

$63x - \frac{21 \times 9}{4} = 35x + \frac{7 \times 21}{4}$

$28x = \frac{21}{4}(9+7) \Rightarrow 28x = \frac{21}{4} \times 16$

A : B
7 : 9

$\boxed{x = 3}$

$7x = 7 \times 3 = 21 \,lt$

A : B
7 : 9

122 lit ——— 7x lit (5x)

1 lt ——— $\frac{7x}{12x}$ $\left(\frac{5x}{12}\right)$

$\frac{39 \times 5}{124}$

9 lt ——— $\frac{7x}{4+2x} \times 9$ lt $\boxed{\frac{21}{4} lt}$

Quantity of A liquid left in the mix
$= \left(7x - \frac{21}{4}\right)$

Quantity of B liquid $\left(5x - \frac{15}{4} + 9\right)$
$= \left(5x + \frac{21}{4}\right)$

Mixture and Alligation

Q13 A manufacturer mixes two kinds of tea consisting Rs.35/kg and Rs.40/kg in the ratio 8:7. what is the profit or loss percentage if he sells the mixture at Rs.37.50/kg?

A) No profit and no loss B) 455% profit C).455% loss D) 25/26% loss

C) 21 D) 25

Solution:

Alligation

c ✓   d ✓
35/kg   40/kg

CP of cheap

Quantity of C   8
Quantity of d = 7

$\Rightarrow \frac{40 - x}{x - 35} \times \frac{8}{7}$

$\Rightarrow 280 - 7x = 8x - 280$

$15x = 560$ $x = \frac{560}{15} = 37.33$

SP mix = 37.50 /kg
CP mix = 37.33/kg

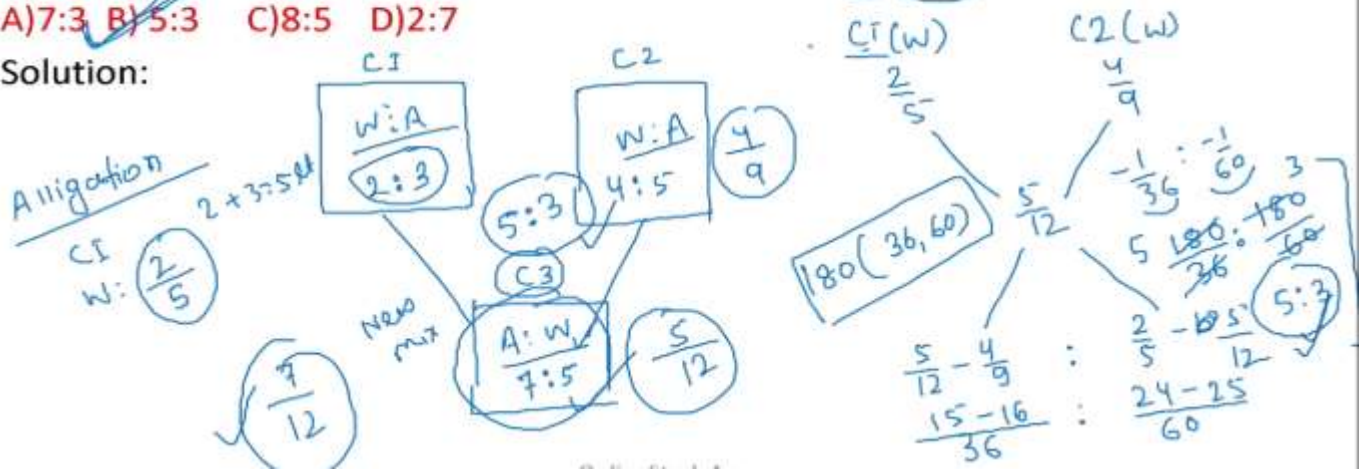Profit = $\frac{Profit}{CP} \times 100$

$\frac{.17 \times 100}{37.33}$

$= .4557$

(15) $\frac{56d\ 37.3}{45}$

$\frac{110}{105}$ $\frac{50}{45}$ $\frac{3}{}$

x → MCP of mix

8 : 7

(40 - x) (x - 35)

Q14. The ratio of water and Alcohol in the 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 new mixture in which the ratio of alcohol and water be 7:5

A)7:3 B)5:3 C)8:5 D)2:7

Solution:
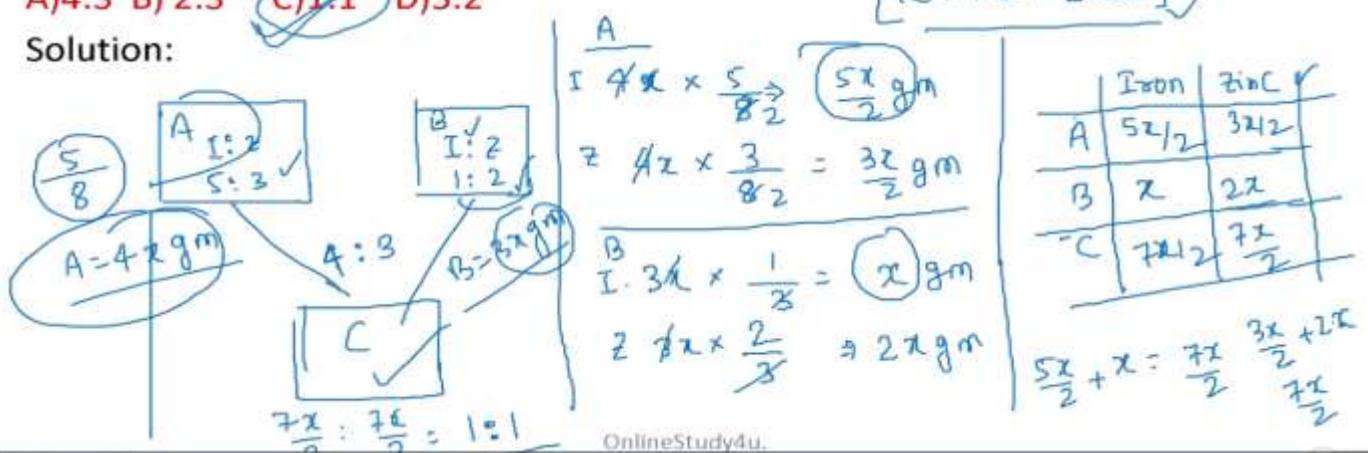
Alligation

C.I
W: $\frac{2}{5}$

$2+3=5$

C.I
W:A
$2:3$

C2
W:A
$4:5$ ($\frac{4}{9}$)

$5:3$ $4:5$

C3

New mix
A:W
$7:5$ $\frac{5}{12}$

$\frac{7}{12}$

$\frac{C1(W)}{\frac{2}{5}}$ $\frac{C2(W)}{\frac{4}{9}}$

$-\frac{1}{36}$: $-\frac{1}{60}$ 3

$\frac{5}{12}$

$180(36,60)$

5 $\frac{180}{36} : \frac{180}{60}$

$\frac{2}{5} - \frac{5}{12}$ (5:3)

$\frac{5}{12} - \frac{4}{9}$: $\frac{2}{5} - \frac{5}{12}$

$\frac{15-16}{36}$: $\frac{24-25}{60}$

Q15. The Alloy A and B both are made of Iron and Zinc. The ratio of Iron to Zinc is in the two Alloys are 5:3 and 1:2 respectively. A and B are combined in the ratio 4:3 to yield a new Alloy C. what is the ratio of Iron and zinc in C?

A)4:3 B) 2:3 C)1:1 D)5:2   [TCS NQT 2020]
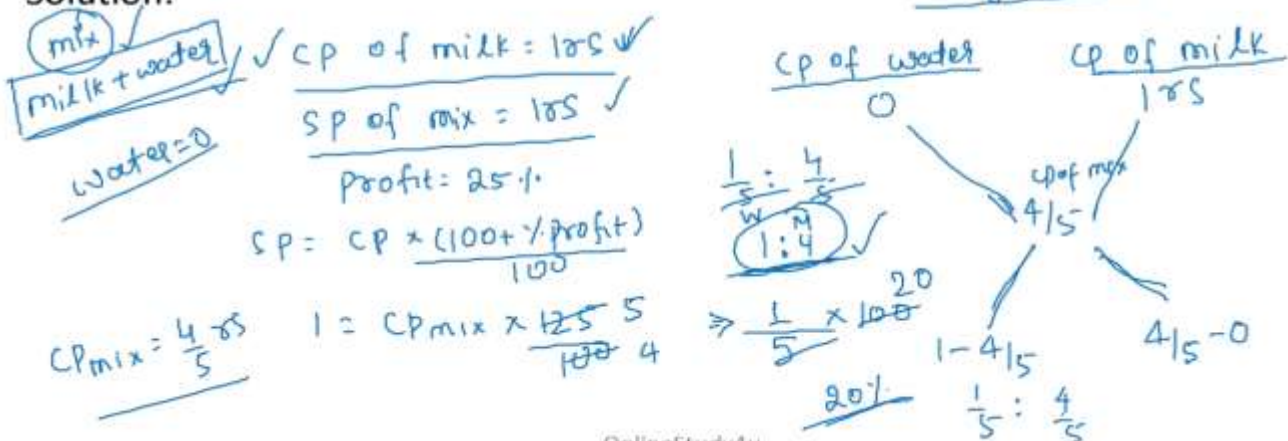
Solution:

$\frac{5}{8}$

A I:Z
5:3

B I:Z
1:2

$A=4x$ gm

$4:3$

$B=3x$ gm

C

$\frac{7x}{2} : \frac{7x}{2} = 1:1$

A
I $4x \times \frac{5}{8} = \frac{5x}{2}$ gm

Z $4x \times \frac{3}{8} = \frac{3x}{2}$ gm

B
I $3x \times \frac{1}{8} = x$ gm

Z $3x \times \frac{2}{8} = 2x$ gm

	Iron	Zinc
A	$5x/2$	$3x/2$
B	x	$2x$
C	$7x/2$	$7x/2$

$\frac{5x}{2} + x = \frac{7x}{2}$ $\frac{3x+2x}{2}$

$\frac{7x}{2}$

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Q16. A dishonest milkman sells his milk at cost price but he mixes it with water and there by gaining 25%. What is the percentage of water in the mixture?

A)10%   B)20% C)30% D)40%

Solution:

mix
milk + water
water = 0

CP of milk : 1RS
SP of mix : 1RS
profit : 25%

$SP = \frac{CP \times (100+ \% profit)}{100}$

$CP_{mix} = \frac{4}{5}RS$

$1 = CP_{mix} \times \frac{125}{100} \frac{5}{4}$

Alligation

CP of water   CP of milk
0   1RS

$\frac{1}{5} : \frac{4}{5}$
W : M
1:4

CP of mix
$4/5$

$\frac{1}{5} - 0$ $4/5 - \frac{4}{5}$

$\Rightarrow \frac{1}{5} \times 100^{20}$

20% $\frac{1}{5} : \frac{4}{5}$

$4/5 - 0$

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Mixture and Alligation   (Time, speed & distance)

Q17. A Man travelled a distance of 90km in 9hours, partly on foot at 8kmph and partly on bicycle at 17kmph. Find the distance travelled on foot.?

A)26km   B) 30km   C)25km   D)56km   E)None   Alligation

Solution:

$D = S \times T$

9hr —— 90km

1hr → $\frac{90}{9}$ (10km)

✓ speed: 10km|hr

foot → (8km|hr) ⇒ 1 hr → (8km)
bicycle – 17km|hr ⇒ 1hr → 17km

foot = 7hrs
speed: 8km|hr

foot / 8
distance: $S \times t$ ✓
= 7 × 8
= 56km ✓

bicycle / 17 ✓

10

7 : 2 ⇒ 9hrs

90-56 : 34 km ✓