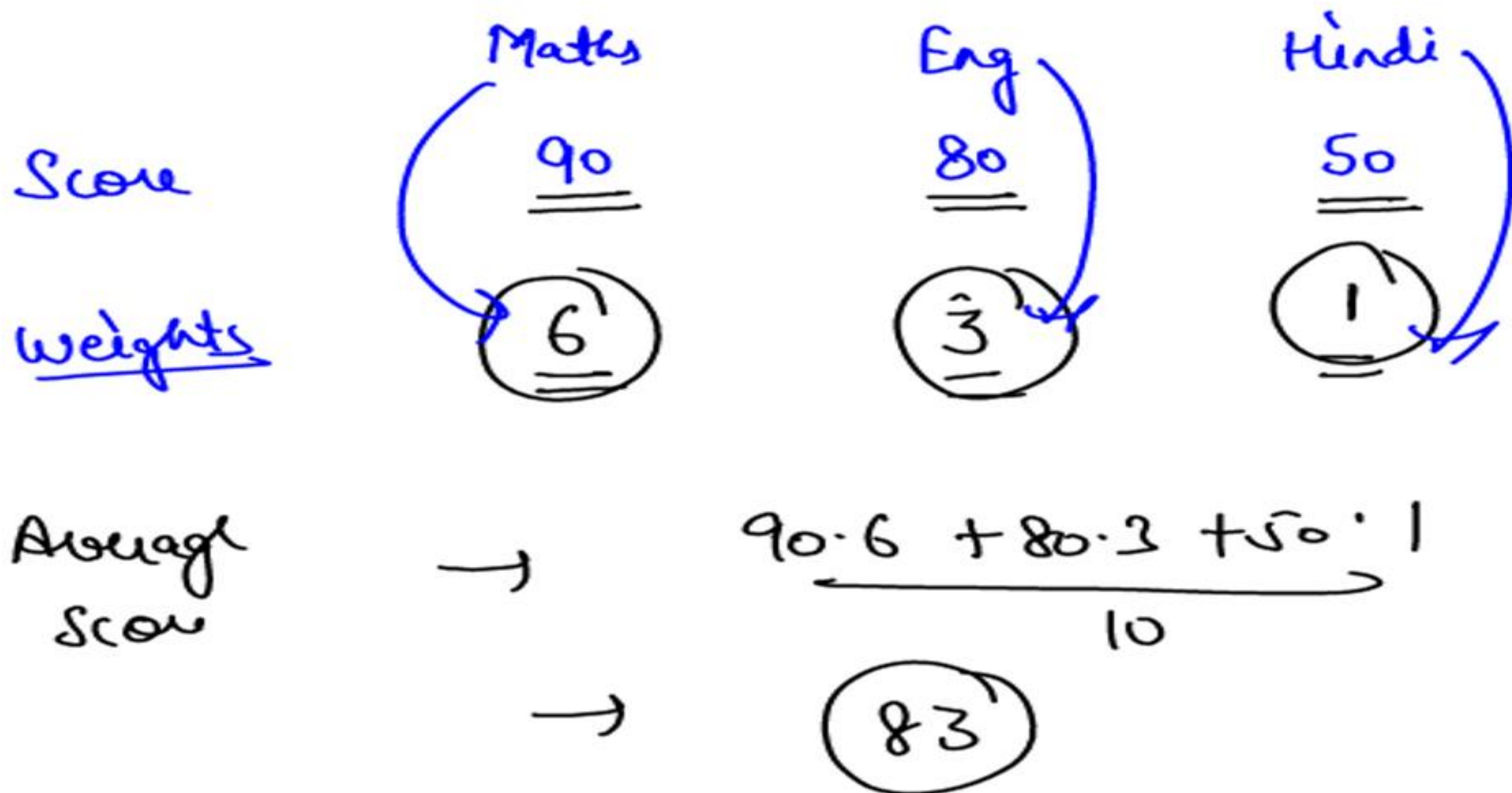# MIXTURE & ALLIGATION
Part-3

* Concept of weighted Average

** { Removal & Replacement

→ (12-14) Question

" Efficient " approach to solve question

CONCEPT OF WEIGHTED AVERAGE

Score

Weights

	Maths	Eng	Hindi
	90	80	50
	6	3	1

Average Score $\rightarrow$ $\dfrac{90 \cdot 6 + 80 \cdot 3 + 50 \cdot 1}{10}$

$\rightarrow$ 83

Pre   Mains

$80\% \longrightarrow 90\%$

2   :   3

Weight

$$\frac{80 \cdot 2 + 90 \cdot 3}{5} = \underline{\underline{86\%}}$$

$A \rightarrow 20\%$ $B \rightarrow 50\%$

2   :   5

$$\frac{20 \cdot 2 + 50 \cdot 5}{7} = \boxed{\frac{290}{7}}$$

$$\frac{\frac{290}{7} \cdot 7 + 80 \cdot 3}{10}$$

$$= 53 \checkmark$$

Eg. A $\rightarrow$ 20% Milk

B $\rightarrow$ 50% Milk

A & B are mixed in 2:5 to form a solution C. Solution D contains 80% milk. If 21 litres of C and 9 litres of D are mixed, then find the percentage of milk in that solution.

C
$$\frac{290}{7}$$
21 7

D
80%
9 3

I^{st} **Equation**

Eg. 3000 litre (40% alcohol)
How much water must be added to it, so that concentration of alcohol becomes 16%?

Alcohol = 1200 litre

x litres of water

$$\frac{\overset{75}{1200}}{3000 + x} = \frac{16}{100}$$

$x = 4500$ litres

M : W

72 litres

⑧ : 7
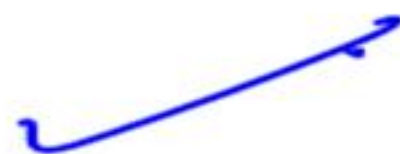
Add water

2 : 3

Eg.   Milk : Water → 8 : 7

If 72 litres of this solution is taken, then how much water must be added so that the ratio of milk and water is 2:3?

$$\dfrac{\overset{4}{8}}{\underset{2}{18}} \times \overset{24}{72} = \dfrac{2}{\underset{1}{8}} \cdot \checkmark$$

$\checkmark \rightarrow 96\ l$

Add $\longrightarrow 24$ litres

ADDITION OF A COMPONENT

ALWAYS OPERATE ON A COMPONENT WHICH IS NOT CHANGED IN THE QUESTION.

Eg. 156 ml of Acid and Vinegar solution is taken where

Acid		Vinegar
4	:	7

How much quantity of the mixture is replaced with vinegar, so that the ratio becomes 1 : 2 ?

Now, we will discuss different approaches to solve this question.

Q. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture is drained off and the can is filled with B, the ratio of A and B becomes 7 : 9. How much litre of liquid A was contained in the can initially?
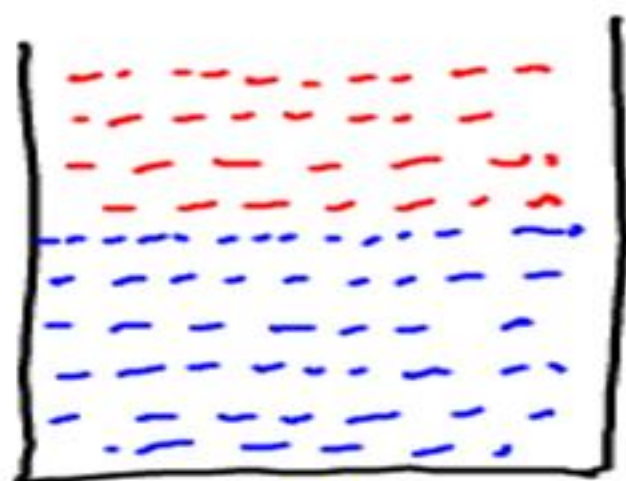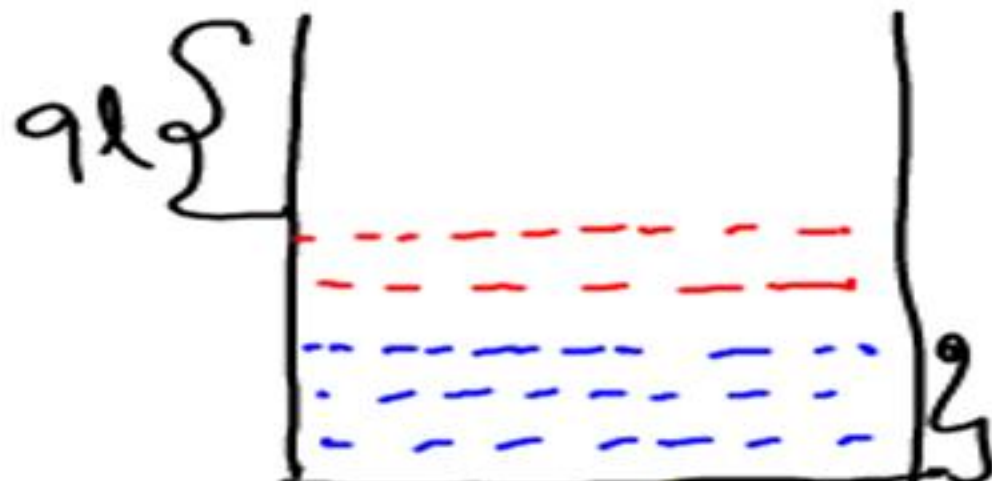
(a) 10   (b) 20

(c) 21   (d) 25
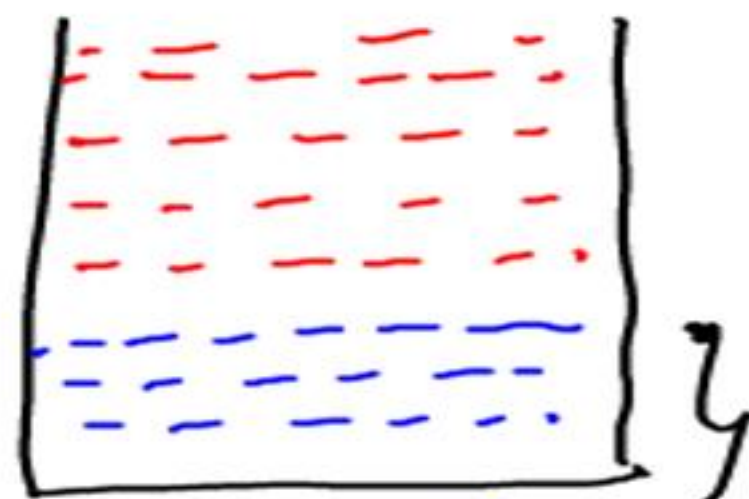
A:B = 7:5

A:B = 7:5

A:B = 7:9

9l

I^{st}

IInd

IIIrd

1st approach $\longrightarrow$ Equation Approach

$$\frac{A}{B} = \frac{7x - \frac{7 \cdot 9}{12}y}{5x - \frac{5 \cdot 9}{12} + 9} = \frac{7}{9}$$

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

$$\frac{63x - 189}{4} = \frac{35x + 147}{4}$$

$$28x = 84$$

$$\boxed{x = 3}$$

2nd Approach
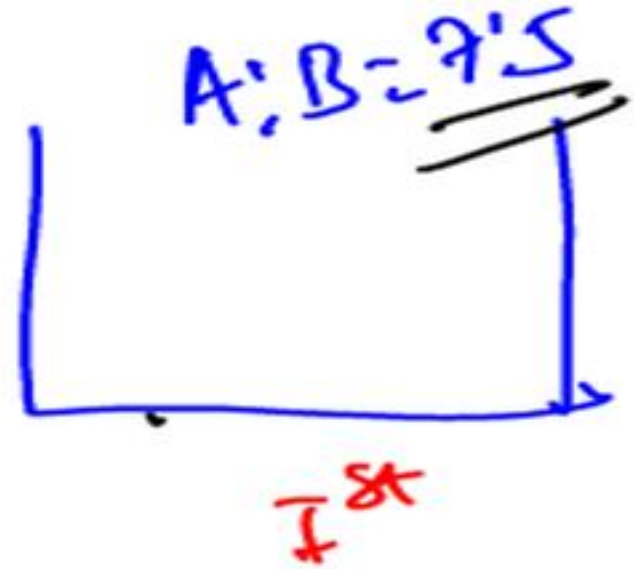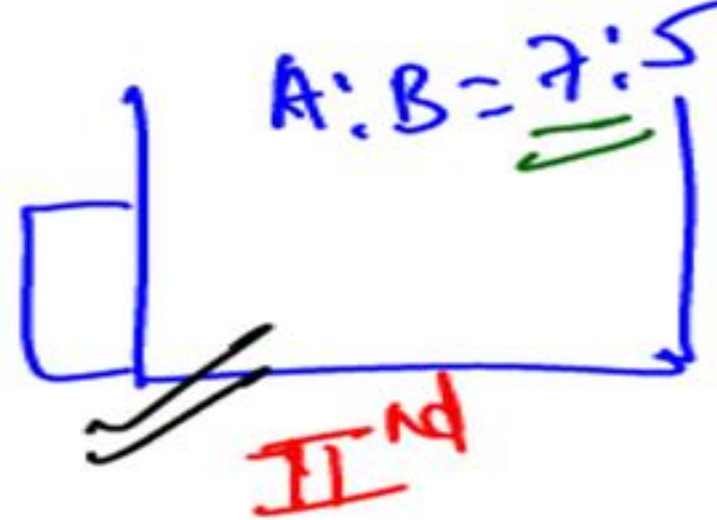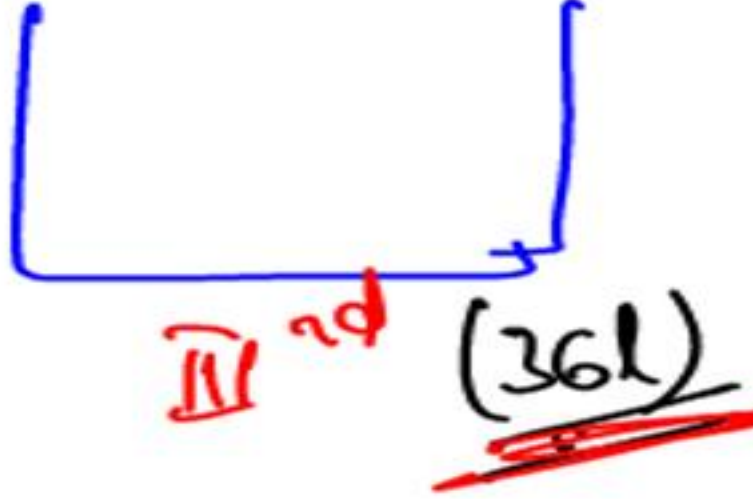
Solving question without variable
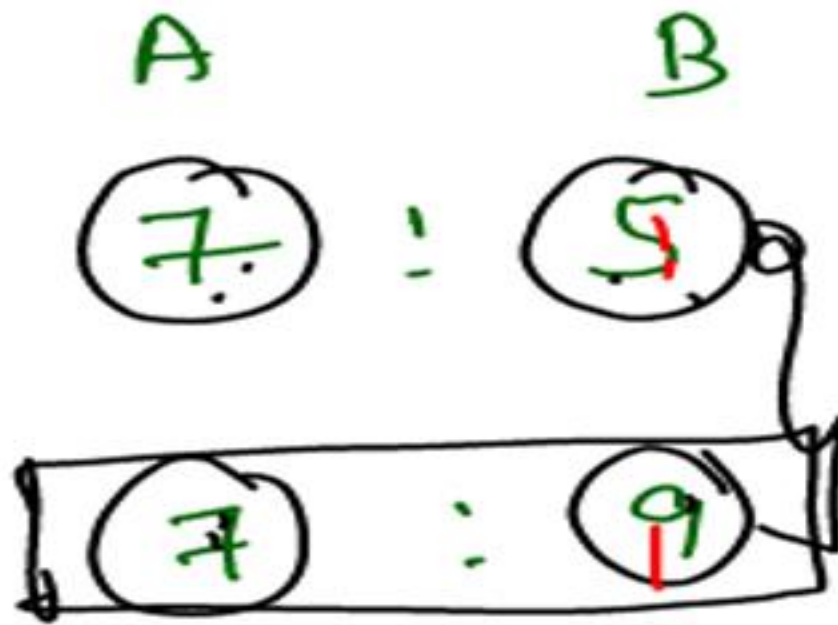
A:B = 7:5

A:B = 7:5

A:B = 7:9

7st

IInd

IVnd (36l)

$\frac{7 \times \overset{3}{\cancel{36}}}{\cancel{12}}$ = 21 litres

IInd

IIIrd

A   B

⑦ : ⑤

⑦ : ⑨

4 units = 9 l

16 units = 36 l

$\overline{II}^{nd}$ Alligation

A:B = 7:5   A:B = 7:5   A:B = 7:9

I   II   III

II

Add B   9l

$1 unit \rightarrow 9l$

$4 unit \quad \boxed{36l}$

$28 \quad \dfrac{7}{12}$

$\dfrac{7}{16} \quad 21$

9

$\dfrac{\cancel{7}^{3}}{\cancel{12}} \times \cancel{36}^{3} \quad \boxed{= 21 l}$

$21 \quad 3$

$7 \quad 1$

Ans. (c)

IInd

$A : B$

$\boxed{④ : ①} \times 1$

$② : 3 \Big\} \times 2$

$\boxed{4 : ⑥}$

$\dfrac{5 \rightarrow 10\,litres}{10 \rightarrow 20\,litres}$

$\dfrac{4}{5} \times \overset{4}{\cancel{20}}$

$= 16\,litres$

Q. A Jar contains a mixture of two liquids A & 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 liters of liquid A was contained in the jar?

(a) 12

(b) 16

(c) 20

(d) 24

Ans. (b)

Wine : Water

3 : 1

1 : 1

3 : 3

Add 2units

Initial 6units
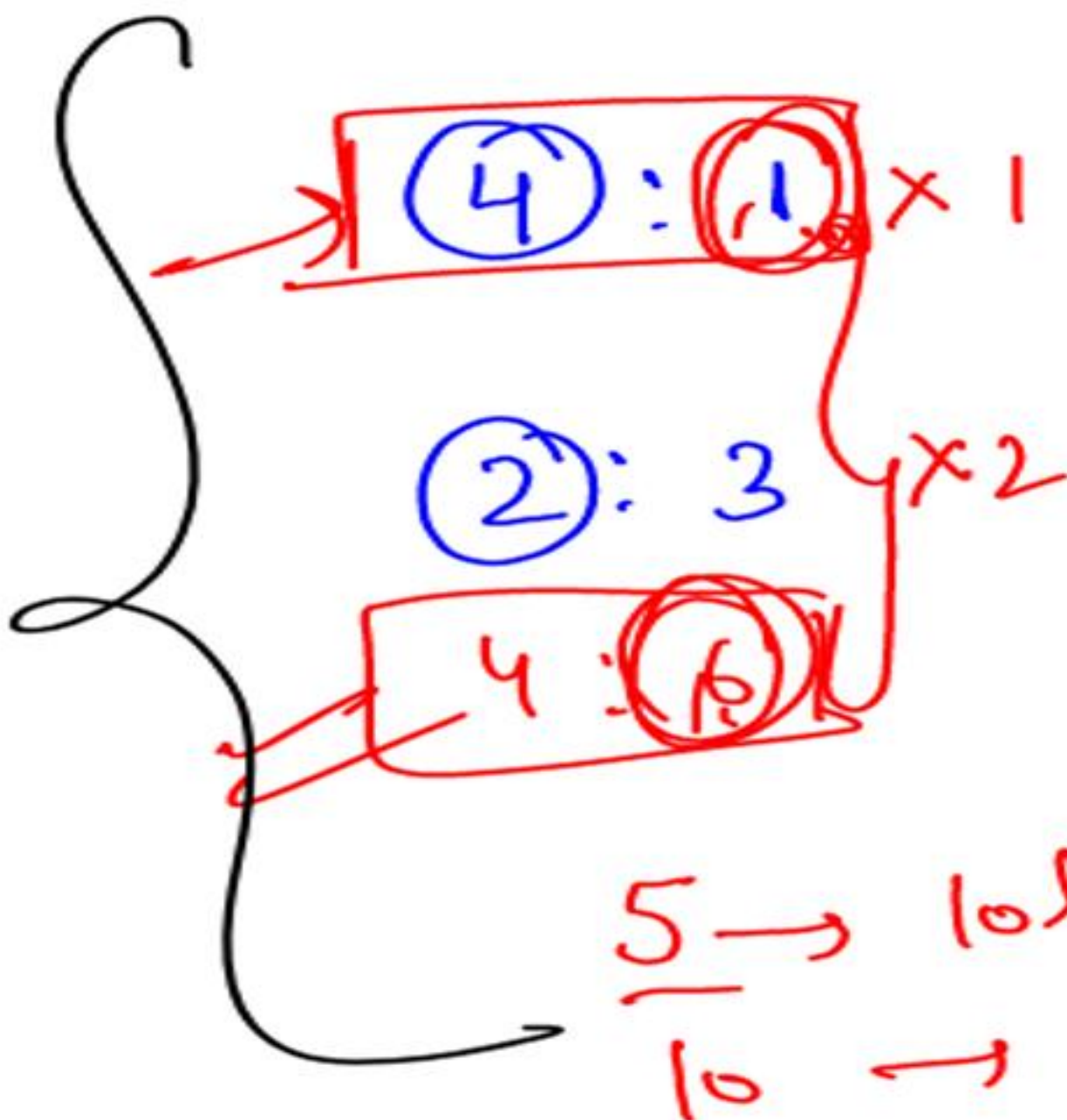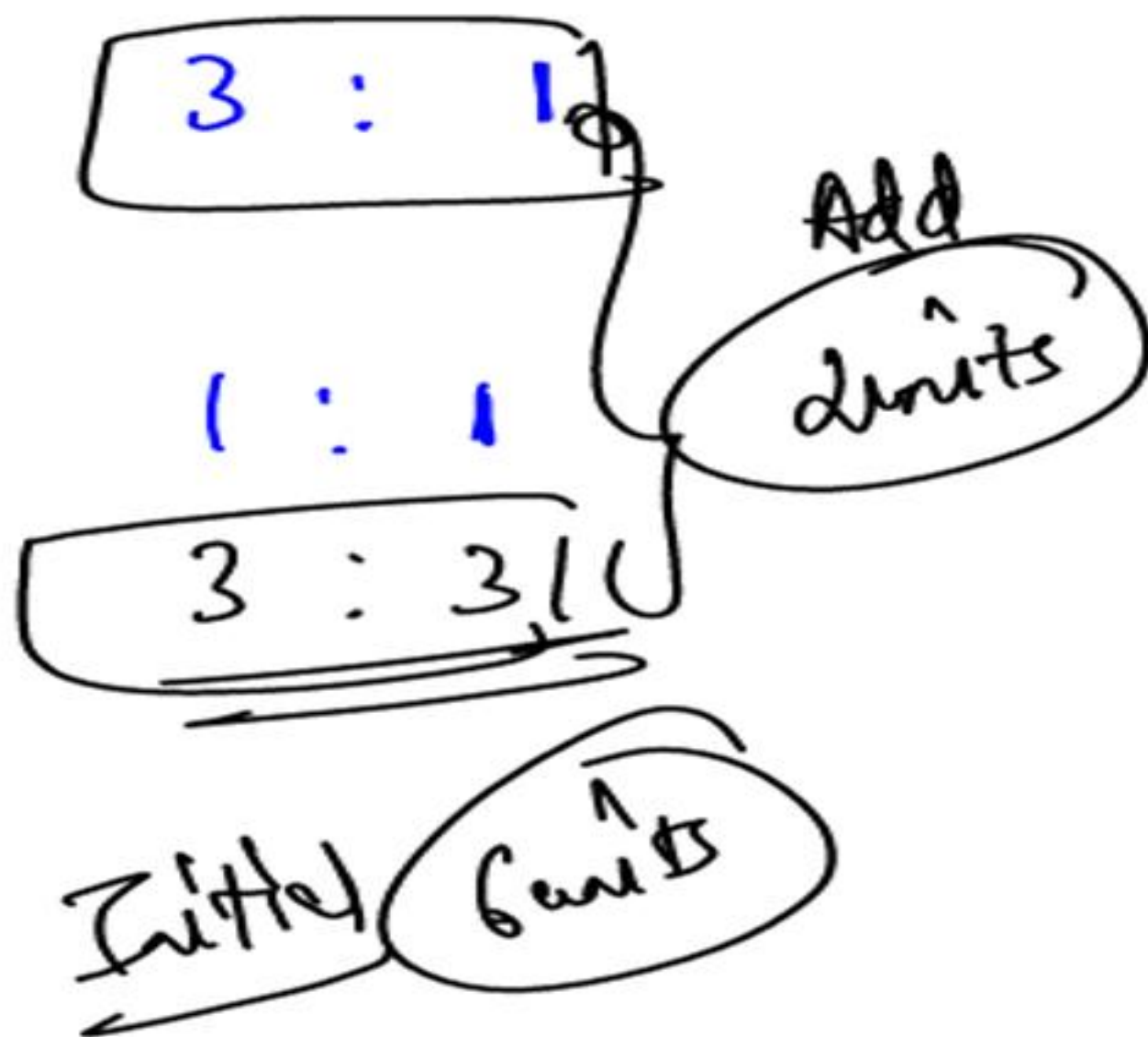
Q. A barrel contains a mixture of wine and water in the ratio 3 : 1. How much fraction of the mixture must be drawn off and substituted by water so that the ratio of wine and water in the resultant mixture in the barrel becomes 1 : 1?

(a) 1/4

(b) 1/3

(c) 3/4

(d) 2/3

$$\frac{\cancel{2}^1}{\cancel{6}_3}$$

Ans. (b)

W   S

10 units

2 units

3 : 5

1 : 1

5 : 5l
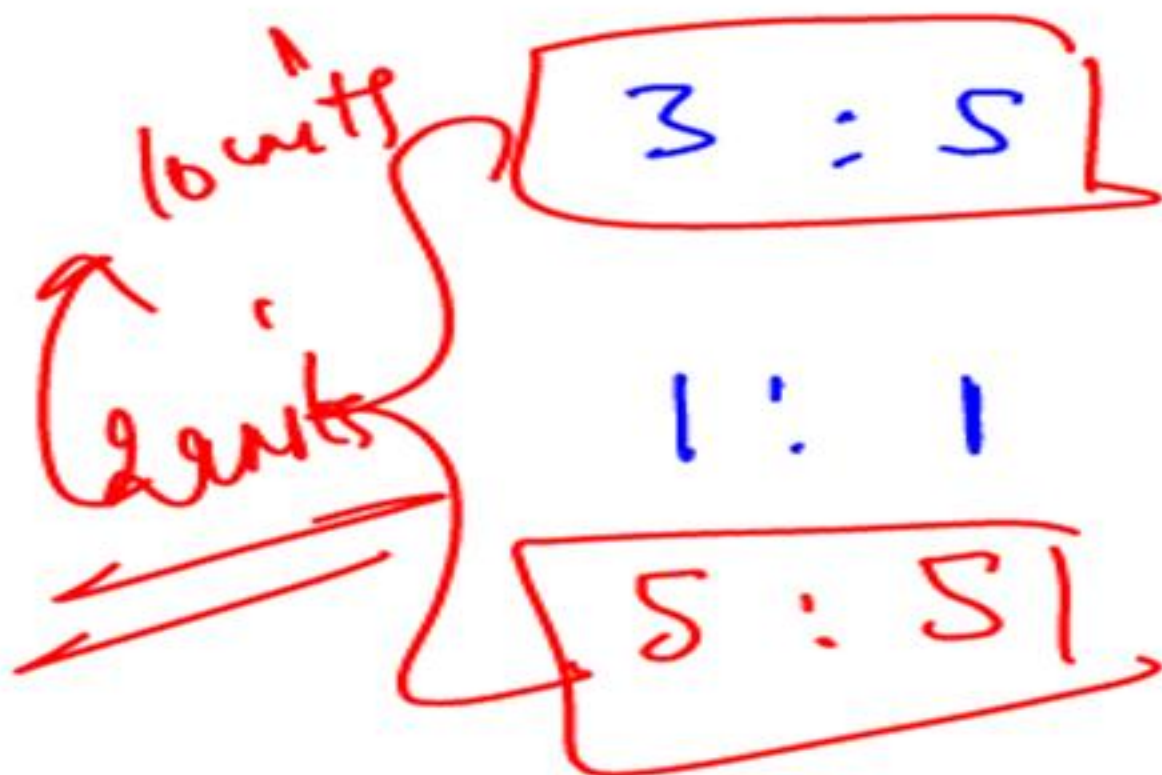
Q. A vessel is filled with liquid. 3 parts of which are water and 5 parts are syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?

(a) 1/3   (b) 1/4

(c) 1/5   (d) 1/7
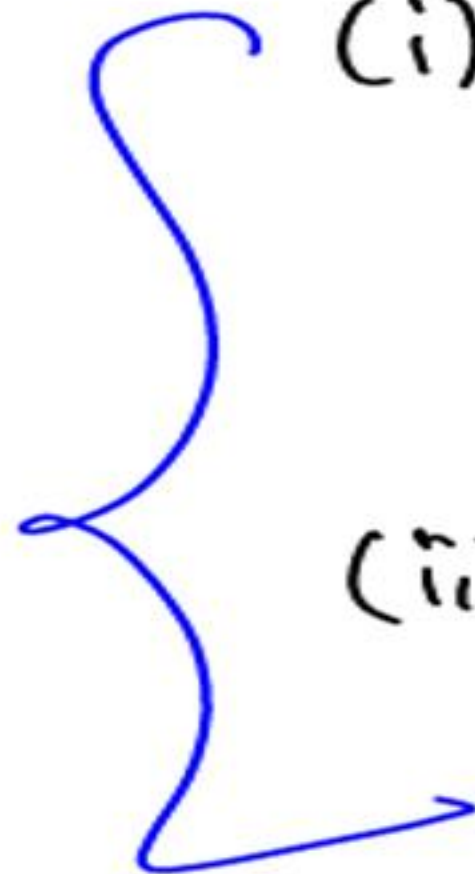
Ans. (c)

REPLACEMENT CONCEPT

Process

Mixture
$\left\{\begin{array}{l}\end{array}\right.$

(i) some part of the sol^n is withdrawn

(ii) replaced with some component

WHILE SOLVING QUESTIONS ON REPLACEMENT IN MIXTURES, ALWAYS OPERATE ON THE COMPONENT WHICH IS NOT CHANGED IN THE QUESTION.

Process

10 l of mix is withdrawn

10 l of water is added

Eg. Suppose, we have 80 litres of pure milk. If, 10 litres of the mixture is drawn and replaced with 10 litres of water and this process is done one more time.
Find the ratio of milk and water in the final solution.

Ist Detailed Approach

80 l of Milk

70 l of milk is left
10 l of water is added

$$\frac{7}{8} \times 10 = 8.75 \, l$$

Milk left → 70 - 8.75 = 61.25
water → 18.75

61.25 : 18.75

245 : 75

49 : 15

$M = \dfrac{70}{7}$ $W = \dfrac{10}{1}$

* Always operate on the component which is <u>NOT CHANGED</u>

80 l of milk

Process

sol^n

10 l's withdrawn

10 l water is added

2 Times

Sol^n

M : W

49 : 15

Milk 49

Water 15

$$M_{FP} = 1 \left(\frac{\text{Volume before adding}}{\text{Volume after adding}} \right)^2$$

$$= 1 \left(\frac{70}{84} \right)$$

$$= \frac{49}{64}$$

Eg. If, **milk is not changed**

$$\text{Milk}_{IP} \times \text{Initial Volume} = M_{FP} \times \text{Final Volume}$$

$$M_{FP} = M_{IP} \times \frac{M_{IV}}{M_{FV}}$$

$$\text{Milk}_{FP} = \text{Milk}_{IP} \times$$

Where,

IP = Initial Proportion

IV = Initial Volume

FP = Final Proportion

FV = Final Volume

$$M_F = M_I -$$

$$M_{FP} = M_{IP} \left(\frac{\text{Volume of solution before adding}}{\text{Volume of solution after adding}} \right)^n$$

V.V
imp

Eg. (100 litres of pure milk

20 litres of solution is drawn and replaced by 20 litres of water. If the process is done 3 times, then find the ratio of milk and water in the final solution.

$$M_{FP} = M_{IP} \left(\frac{\text{Volume before add}}{\text{Volume after add}} \right)^n$$

$$= 1 - \left(\frac{\cancel{80}\ y}{\cancel{100}} \right)^3$$

$$\frac{64}{125}$$

M : W

64 : 61

Ans. M : W = 64 : 61

Eg.   100 litres of pure milk

25 litres of solution is drawn and replaced by 25 litres of water. If the process is done 2 times, then find the ratio of milk and water in the final solution.

$$M_{FP} = 1 \cdot \left(\frac{75}{100} \right)^2$$

$$= \frac{9}{16}$$

$$M : W$$

$$9 : 7$$

Ans. M : W = 9 : 7

$$M_{FP} = M_{IP} \left(\frac{\text{Volume before}}{\text{Volume after}} \right)^n$$

$$= \frac{7}{12} \left(\frac{\overset{3}{\cancel{60}}}{\underset{4}{\cancel{80}}} \right)^2$$

$$\frac{7}{\underset{4}{\cancel{12}}} \cdot \frac{\cancel{3} \cdot 3}{4 \cdot 4} = \frac{21}{64}$$

Eg. **80 litres of solution**

Milk : Water = **7 : 5**

If, 20 litres of solution is drawn and replaced by 20 litres of water. If the process is done 2 times, then find the ratio of milk and water in the final solution.

M : W

21 : 43

Ans. M : W = 21 : 43

$100 l$

$I \begin{cases} \underline{20l} \text{ withd} \\ \underline{20l} \text{ add} \end{cases}$

$II \begin{cases} \underline{30l} \text{ with} \\ \underline{30l} \text{ add} \end{cases}$

$III \quad \underline{10l} \quad \text{with}$

$\underline{10l} \text{ add}$

$\therefore \quad M : W$

$\therefore \quad 63 : 62$

Eg.   100 litres of pure milk

If, 20 litres of solution is drawn and replaced by 20 litres of water. Then, 30 litres of solution is drawn and replaced by 30 litres of water. Then, 10 litres of solution is drawn and replaced by 10 litres of water. Find the ratio of milk and water in the final solution.

$M_{FP} = 1 \left(\dfrac{80}{100} \right) \left(\dfrac{70}{100} \right) \left(\dfrac{90}{100} \right)$

$= \dfrac{63}{125}$

Ans. M : W = 63 : 62

Eg.   100 litres of solution
      Milk : Water = 3 : 2

If, 20 litres of solution is drawn and replaced by 20 litres of water. Then, 10 litres of solution is drawn and replaced by 10 litres of water. Find the ratio of milk and water in the final solution.

$$M_{FP} = \frac{3}{5} \cdot \frac{\overset{2}{\cancel{80}}}{\underset{25}{\cancel{100}}} \cdot \frac{9\cancel{0}}{\cancel{100}}$$

$$= \frac{54}{125}$$

M : W

54 : 71

Ans. M : W = 54 : 71

Eg. **100 litres of solution**

Milk : Water = 3 : 2

If, **20 litres of solution** is drawn and replaced by **25 litres of water**. Then, **15 litres of solution** is drawn and replaced by **30 litres of water**. Find the ratio of milk and water in the final solution.

$$M_{FP} = \frac{3}{8}\left(\frac{80}{105}\right)\left(\frac{90}{120}\right)$$

$$= \frac{12}{35}$$

M	W
12	23

Ans. M : W = 12 : 23

$$M_{FP} = 1 \left(\frac{2}{3} \right)^2$$

$$= \frac{4}{9}$$

$$\begin{array}{cc} M & W \\ 4 & : & 5 \end{array}$$

Q. There is 81 litres of pure milk in a container. One-third of milk is replaced by water in the container. Again one-third of mixture is extracted and equal amount of water is added. What is the ratio of milk to water in the new mixture?

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

PYQ of SSC

Ans. (d)

Q. A vessel is full of 80 litre milk, 8 litre taken out and replaced by water, Again 8 litre taken out and replaced by water. Find the amount of milk in the final mixture so formed?

(a) 64

(b) 64.8

(c) 63.2

(d) None of these

$$MFP = 1 \cdot \left(\frac{72}{80} \right)^2$$

$$= \frac{81}{100}$$

$$\frac{81}{100} \times 80 = \underline{64.8}$$

Ans. (b)

Milk → sugar

$$M_{FP} = 1\left(\frac{3}{4}\right)^5$$

$$= \boxed{243} \qquad \to 486\,gm$$

$$\boxed{1024} \qquad \to 2048\,gm$$

Q. A jar is full of milk. a person draw out 25% of the milk from the jar and replaced it with sugar solution. He has done the process 5 times and thus there was only 486 gm of milk left in the jar, the rest part of the jar was filled with sugar solution. The initial amount of the milk in the jar was?

(a) 512

(b) 1024

(c) 2048

(d) 4096

Ans. (c)

Oxygen & Nitrogen

We will operate on Oxygen

$$Oxy\ FP = Oxy\ IP \left(\frac{}{} \right)^n$$

$$\frac{9}{100} = \frac{36}{100} \left(\quad \right)^2$$

$$\frac{1}{4} = \left(\frac{x}{y} \right)^2$$

$$\frac{x}{y} = \frac{1}{2}$$

Q. A 25 litre cylinder contains mixture of oxygen and nitrogen. In which oxygen is 36% of the mixture. Some litres of the mixture is taken out and replaced by nitrogen and this process is repeated one more time. At the end oxygen remained 9% of the mixture, find the quantity of mixture taken out at a time?

(a) 12.5   (b) 7.5

(c) 10   (d) 15

Ans. (a)

Q. A vessel is full of milk, 36 litre. If 9 litre of milk is taken out and replaced by same amount of water and further 4 litre mixture is taken out and replaced by same amount of water then find at the end of 2nd process the amount of water in the mixture?

(a) 6

(b) 8

(c) 10

(d) 12

$$M_{FP} = M_{IP}$$

$$= 1 \left(\frac{27}{36} \right) \left(\frac{32}{36} \right)^2$$

Water → $1/3$

$$1/3 \cdot 36 = 12\,l$$

Ans. (d)

$$B_{FP} = B_{IP} \quad (\quad)$$

$$\frac{343}{512} = 1 \left(\frac{x}{y}\right)^3$$

$$\frac{7}{8} = \frac{x}{y}$$

$$\frac{1}{8} \rightarrow 15$$

$$120\,l$$

Q. 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. If this process is done three times the ratio of beer and water became 343:169. The initial amount of beer in the container was?

(a) 90   (b) 105

(c) 120   (d) 135

Ans. (c)

Q1. In an alloy 80% is copper, and the remaining is tin, in another alloy, copper is 85% and tin is 12%. In what ratio should the two alloys be mixed so that the new mixture must have 15% tin, and also find the percentage the copper in the new mixture?

A. 3:5, 83.125%
B. 5:3, 81.75%
C. 3:4, 83.25%
D. 3:7, 80%

Ans. (a)

Q2. In an alloy, copper is 85% and tin is 12%. In another alloy 80% is copper and remaining is tin. In what ratio should the two alloy be mixed so that the new mixture has 82 2/7 % copper. Also find the percentage of tin in the new mixture

A. 16 : 19, 15 $\frac{23}{35}$%

B. 19 : 16, 16 $\frac{12}{35}$ %

C. 16 : 19, 16 $\frac{12}{35}$ %

D. 19 : 16, 15 $\frac{23}{35}$%

Ans. (c)

Q3. A container contains x litre of wine. 10 litres are drawn from this container and is then filled with water. This Operation is performed 2 more times. The ratio of quantity of the wine now left in container to that of capacity of container is 27:64. How much wine did the container hold originally.

A. 22 litres

B. 40 litres

C. 24 litres

D. 28 litres

Ans. (b)

Q4. Rakesh has three alloys A, B and C with Aluminum percentage 32%, 45% and 55% respectively in them. In which of the following ratio could we melt the three alloys and mix them so as to get a percentage of 42% in the mixture?

A. 1 : 3 : 2

B. 3 : 2 : 2

C. 3 : 1 : 2

D. 3 : 5 : 6

Ans. (b)

Q5. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio we should mix gold and copper to get a mixture which is 15 times as heavy as water?

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

Ans. (b)

Q6. A liquid 'P' is $1\frac{3}{7}$ times as heavy as water and water is $1\frac{2}{5}$ times as heavy as another liquid 'Q'. The amount of liquid 'P' that must be added to 7 litres of the liquid 'Q' so that the mixture may weigh as much as an equal volume of water, will be

(a) 7 litres

(b) $5\frac{2}{3}$ litres

(c) 5 litres

(d) $4\frac{1}{6}$ litres

Ans. (d)

Q7. Weights of two friends Ram and Shyam are in the ratio 4:5. Ram's weight increases by 10% and the total weight of Ram and Shyam together becomes 82.8 kg, with an increase of 15%. By what percent did the weight of Shyam increase?

(a) 19

(b) 20

(c) 40

(d) 50

Ans. (a)

Q8. The diluted alcohol contains 8 litre 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 litre of water in the mixture?

(a) 4
(b) 5
(c) 8
(d) 10

Ans. (b)

Q9. The liquids X and Y are mixed in the ratio of 3:2 and the mixture is sold Rs. 11 per litre at a profit of 10%. If the liquid X costs Rs. 2 more per litre than Y, the cost of X per litre is (in Rs.)

(a) 9.50

(b) 10.80

(c) 11.75

(d) 11

Ans. (b)

Q10. In two alloys, copper and zinc are related in the ratios of 4:1 and 1:3. 10 kg of first alloy, 16 kg of second alloy and some of pure copper are melted together. An alloy was obtained in which the ratio of copper to zinc was 3:2. Find the weight of the new alloy?

(a) 34 kg

(b) 35 kg

(c) 36 kg

(d) 30 kg

Ans. (b)

gradeup

Sahi Prep Hai Toh Life Set Hai
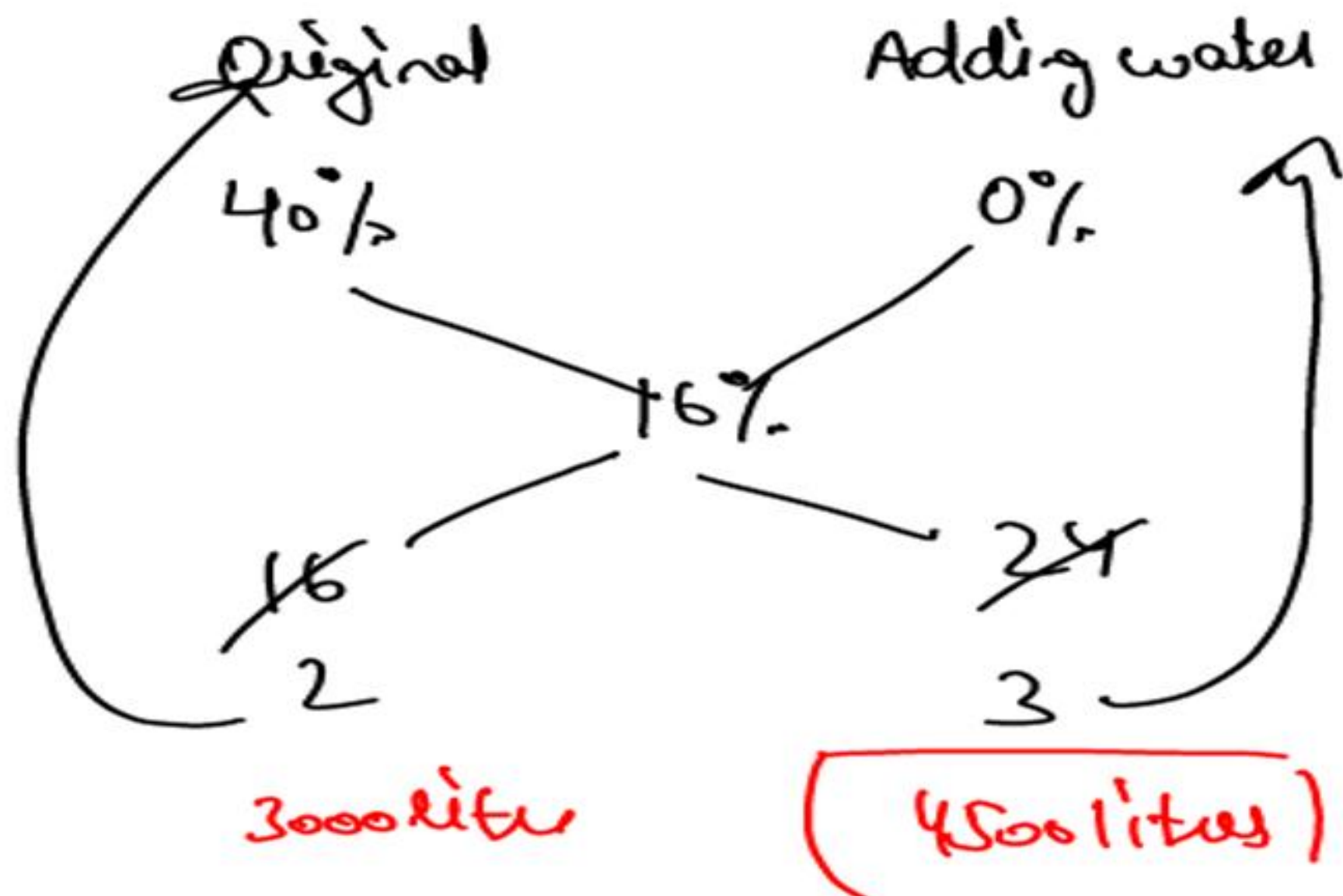
Practise
topic-wise quizzes

Keep attending
live classes

GET IT ON
Google Play

*   3000 l   (40% alcohol)

How much water should be added so
that alcohol becomes 16%

IInd   Alligation   Original   Adding water

                            40%   0%

                                    16%

                    16   24

                2   3

            3000 liter   (4500 liter)

$\underline{II]^{rd}}$

$$C_1 V_1 = C_2 V_2$$

$\underline{3000\,l} \longrightarrow \underline{40\%}$ Alcohol

How much $\underline{water}$ must be added so that 16% alcohol

$\underline{Sol^n}$ Always focus on component which is not changed in the question

$\longrightarrow$ $\cancel{54\%}\, 40\% \text{ of } \cancel{3000}^{1500} = \cancel{16\%}\text{ of } V$

$V = \underline{7500\,l}$

$Added \longrightarrow \underline{\underline{4500\ litres}}$