

Use of allegation method in calculations

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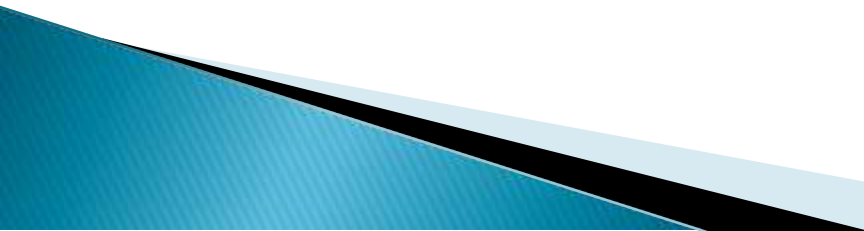
Alligation method

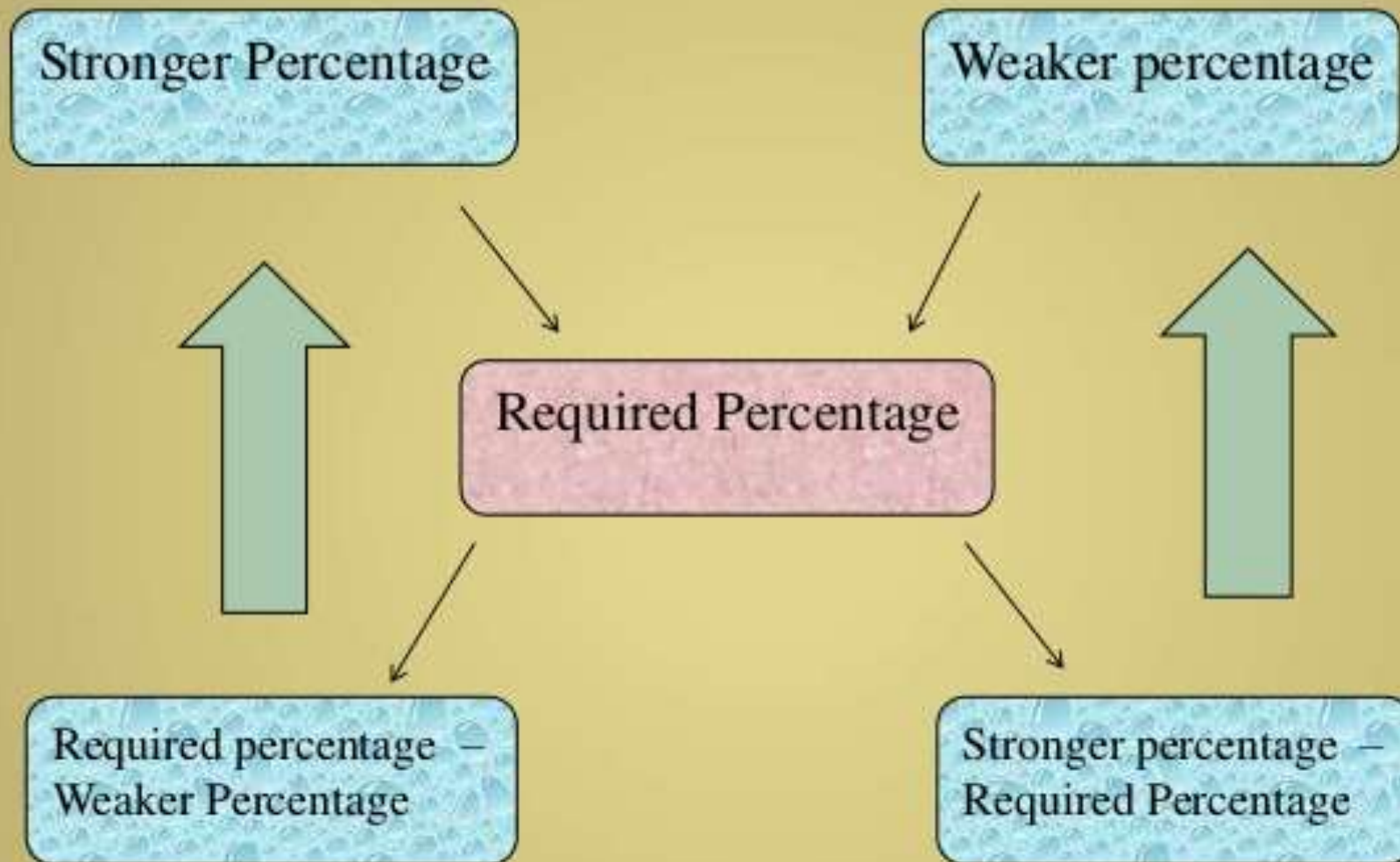
This is a mathematical method used for solving problems in which the ingredients possessing different percentage strength are mixed.

Two alligation methods are available:

1.Alligation medial: This method involves calculating the weight average percentage strength of a mixture of two or more substances of known quantity and concentration.

2. Alligation alternate: This rapid method involves determining the proportions in which substances of different strengths are mixed to yield a desired strength or concentration.

1. The required percentage or concentration is placed in the centre.
 2. The percentage of the substance with the lower strength is placed on the lower left hand side.
 3. The percentage of the substance with higher strength is placed on the upper left-hand side.
 4. The required percentage is subtracted from the lower percentage, and the obtained difference is placed on the upper right hand side.
 5. The higher percentage is subtracted from the desired percentage, and the obtained difference is placed on the lower right hand side.
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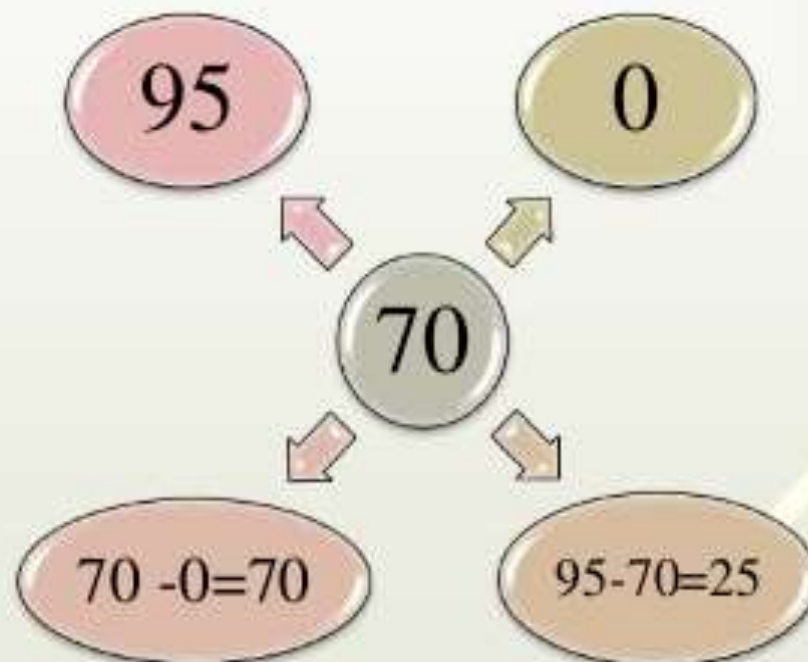
Example problems For Alligation method

1. Calculate the volume of 95% alcohol required to prepare 600ml of 70% alcohol.

Volume required = 600 ml

Percentage of alcohol required = 70

Percentage of alcohol used = 95



(Problem Contd.....)

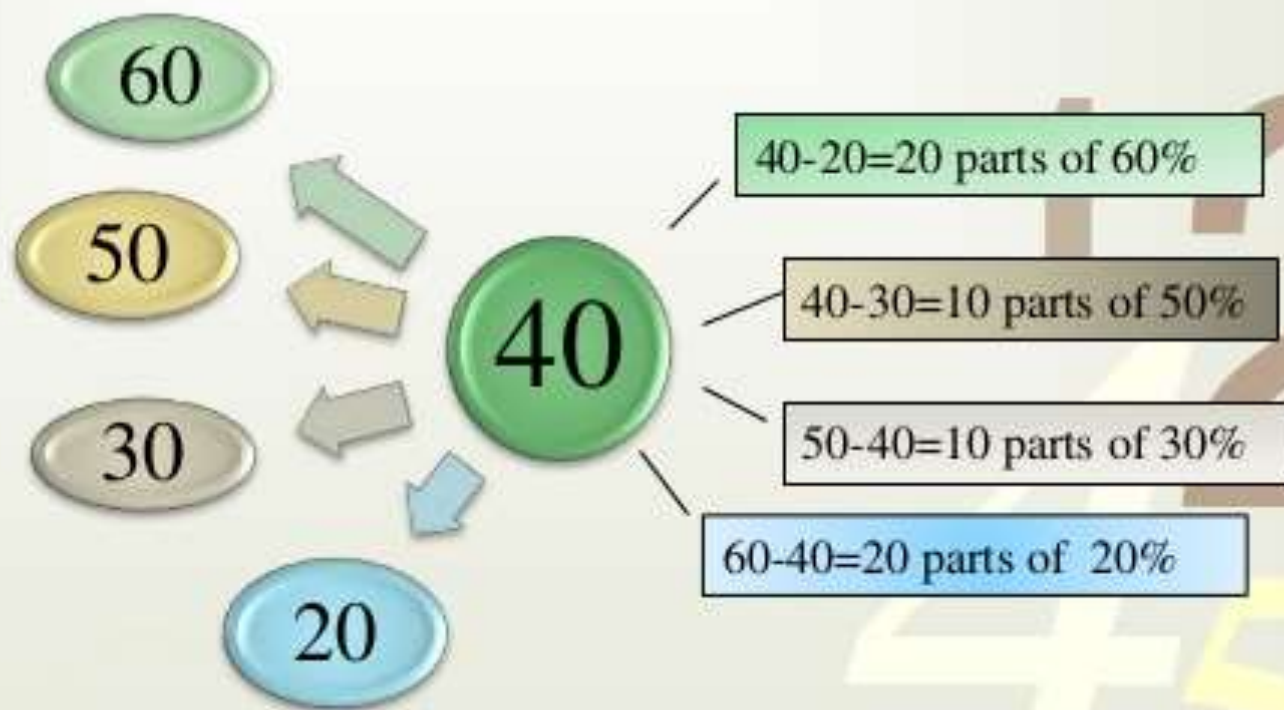
- 70 parts of 95 %alcohol and 25 parts of water will produce the required %alcohol.

$$\begin{aligned}\text{Quantity of 95\% alcohol required} &= \frac{600 \times 70}{95} \\ &= 422.10\text{ml}\end{aligned}$$

$$\begin{aligned}\text{Quantity of water required} &= \frac{600 \times 25}{95} \\ &= 157.90\text{ml}\end{aligned}$$



2. How much quantity of 60%, 50%, 30% and 20% alcohol should be mixed to get 40% alcohol.



(Problem contd.....)


- Quantity required = 20parts of 60%+10 parts of 50%+
10 parts of 30%+20 parts of 20% alcohol are mixed together, the
resulting solution will produce 60% alcohol.

Calculation can be checked by the following method:

$$= (20 \times 60 + 10 \times 50 + 10 \times 30 + 20 \times 20)$$

$$= 1200 + 500 + 300 + 400$$

$$= 2400$$


$$\rightarrow 20 + 10 + 10 + 20 = 60$$

$$\text{i.e., } 60 \times 40 = 2400$$

Proof spirit calculations

Introduction

- The strength of alcohol is calculated in **proof degrees**. The Indian standards of 100% proof spirit is equal to 57%v/v of ethyl alcohol.

i.e., 100% p.s = 57%v/v ethyl alcohol

- If the value is more than 57% then it is said to be as **over proof spirit**.

If the value is less than 57% then it is said to be as **under proof spirit**.



(Introduction contd....)

- In **India** , the exercise duty is calculated in terms of rupees per liter of proof alcohol. So, any percentage volume in volume of alcohol can be converted into proof strength and vice versa by using the following method.
 - i. Multiply the percentage strength of alcohol by 1.753 and deduct 100 from the product.
 - ii. If the **result is positive** , it is known as **over proof**
 - iii. If the **result is negative** , it is known as **under proof**.



- **1.753 is obtained as follows:**

57.1 volume of ethyl alcohol = 100 ml of proof spirit.

1 volume of ethyl alcohol = $100 / 57.1$

= 1.753 volume of proof spirit

Example problems for Proof Spirit calculations

Calculate the strength of 30⁰ O.P and 40⁰ U.P

30⁰ OVER PROOF = $100 + 30 = 130$

40⁰ Under proof = $100 - 40 = 60$



(Problem Contd....)

$$\begin{aligned}\text{Alcohol strength} &= \frac{100 + 30}{1.753} \\ &= \frac{130}{1.753} \\ &= 74.15\%v/v\end{aligned}$$

$$\begin{aligned}\text{Alcohol strength} &= \frac{100 - 40}{1.753} \\ &= \frac{60}{1.753} \\ &= 34.23\%v/v\end{aligned}$$

Check :



If strength is 74.15%v/v

$$74.15 \times 1.753 - 100 = 129.9 - 100 = +29.9^{\circ} \text{ or } 30^{\circ} \text{ O.P}$$

If strength is 34.23 %v/v

$$34.23 \times 1.753 - 100 = 60.00 - 100 = - 40^{\circ} \text{ U.P}$$

2. What is the proof strength of 95% v/v alcohol.

By applying the formula:

percentage strength of alcohol x 1.753 – 100

$$= 95 \times 1.753 - 100$$

$$= 166.53 - 100$$

$$= +66.53^{\circ} \text{ O.P}$$



3. How many proof gallons are contained in 5 gallon of 70% v/v alcohol

Applying the formula:

$$\text{Value in proof} = \% \text{ strength of alcohol} \times 1.753 - 100$$

$$= 70 \times 1.753 - 100$$

$$= 122.71 - 100$$

$$= 22.71^{\circ} \text{ o.p}$$

100 gallons of 70% v/v alcohol = 122.71 units of p.s

1 gallon of 70% v/v alcohol = $122.71/100 = 1.2271$

5 gallons of 70% alcohol = 1.2271×5
= 6.1355 gallons of p.s

5 gallons of 70% v/v alcohol are equivalent to 6.1355 gallons of p.s

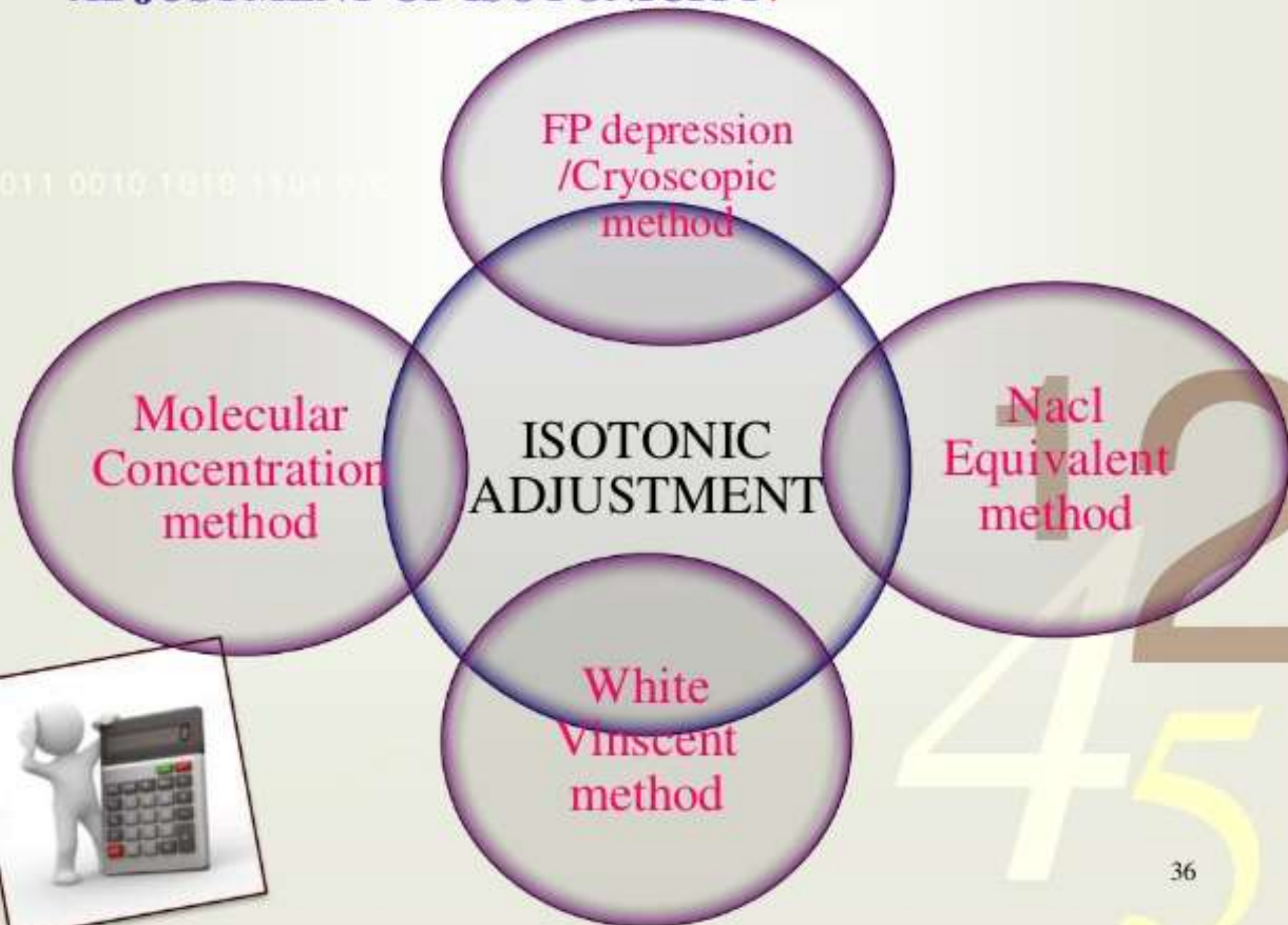


Isotonic solutions

- Isotonic solutions are which have same osmotic pressure or equal solute concentrations.
- 0.9% sodium chloride solution is considered to passes the same osmotic pressure and hence it is a standard solution which is isotonic with blood plasma.
- Any concentration **above this (0.9%)** is considered as **hypertonic** and **below this (0.9%)** is considered as **hypotonic**.



ADJUSTMENT OF ISOTONICITY:



I. Freezing point method/ Cryoscopic method

$$\%w/v \text{ of adjusting substance needed} = \frac{0.52 - PSM * a}{b}$$

Where

PSM = percentage strength of medicament

a = Freezing point of the unadjusted solution

b = Freezing point of a 1% w/v solution of a adjusting substance



Example Problem for Freezing point method

- Using cryoscopic method. How will you prepare 1% solution of boric acid, iso osmotic with blood plasma.

[Hint : The freezing point of 1%w/v solution of boric acid is 0.288°C

The freezing point of 1%w/v solution of sodium chloride is 0.576°C]

$$\begin{aligned}\text{Percentage of w/v of sodium chloride required} &= \frac{0.52 - PSM * a}{b} \\ &= \frac{0.52 - 1 * 0.288}{0.576} \\ &= 0.402\% \text{ w/v}\end{aligned}$$



1 gm of boric acid is needed for 0.402 gm of NaCl to become isotonic.

2. Nacl Equivalent method:

$$\text{Quantity of Nacl required to adjust tonicity} = 0.9 - (\text{PSM} \times \text{E})$$

Where

PSM = Percentage strength of medicament.

E = Nacl equivalent (quantity of Nacl i.e., equivalent to 1gm of drug)

3. White Vincet method :

$$V = W \times E \times 111.1$$

Where

V = volume of isotonic solution in ml that can be prepared by dissolving drug in water

W = weight of the drug.

E = Nacl equivalent .



THANK YOU