

Dilution

&

Concentration

Dilution and concentration of solutions

- After dilution or concentration of a solution, the change in the volume or the quantity is inversely proportional to the ratio or percentage strength.

Concentration X Volume = Concentration X Volume

(before dilution)

(after dilution)

$$C_1 V_1 = C_2 V_2$$

- **C**= Concentration (% strength) , **V**= Volume

$$C_1 Q_1 = C_2 Q_2$$

- **C**= Concentration (% strength), **Q**= Quantity

Dilution and concentration of solutions

- Ex: If 500 mL of a 15% v/v solution of methyl salicylate in alcohol is diluted to 1500 mL, what is the percentage strength v/v?

Solution

$$C_1V_1 = C_2V_2$$

$$15 (\%) \times 500 (\text{ml}) = C_2 \times 1500 (\text{ml})$$

$$C_2 = (15 * 500) / 1500 = \underline{5\%}$$

Dilution and concentration of solutions

- Ex: If 50 mL of a 1:20 w/v solution of aluminum acetate is diluted to 1000 mL, what is the ratio strength w/v?

Solution

$$1:20 = 5\%$$

$$C_1V_1 = C_2V_2$$

$$5 (\%) \times 50 (\text{ml}) = C_2 \times 1000 (\text{ml})$$

$$C_2 = (5 * 50) / 1000 = \underline{0.25\%} = \underline{1:400}$$

Alligation

- **Alligation** is a practical method of solving arithmetic problems related to mixtures of ingredients.
 - Alligation medial:** is used to determine the average percent strength of a mixture of two or more ingredients of known quantities and concentration.
 - Alligation alternate:** is used to determine the number of parts of two or more components of a given strength, required to give a mixture of the desired strength.

Alligation medial

(1) Find the percent strength of ethyl alcohol in a mixture obtained by mixing 300 ml of 40% , 100 ml of 60% and 100 ml of 70% solutions of ethyl alcohol.

	<u>% strength</u>		<u>Volume</u>	
Alcohol 1	40	X	300	= 12,000
Alcohol 2	60	X	100	= 6,000
Alcohol 3	70	X	100	= 7,000
			500	25,000

% strength of mixture= $25,000/500=$ 50%

Alligation medial

(2) Find the concentration of NaOH when 2000 ml of 20%, 4000 ml of 10% solutions and 4000 ml water are mixed together.

	<u>% strength</u>		<u>Volume</u>	
20% NaOH	20	X	2000	= 40,000
10% NaOH	10	X	4000	= 40,000
Water	0	X	4000	= 0
			10,000	80,000

Concn of NaOH = $80,000/10,000 = \underline{8\%}$

Alligation medial

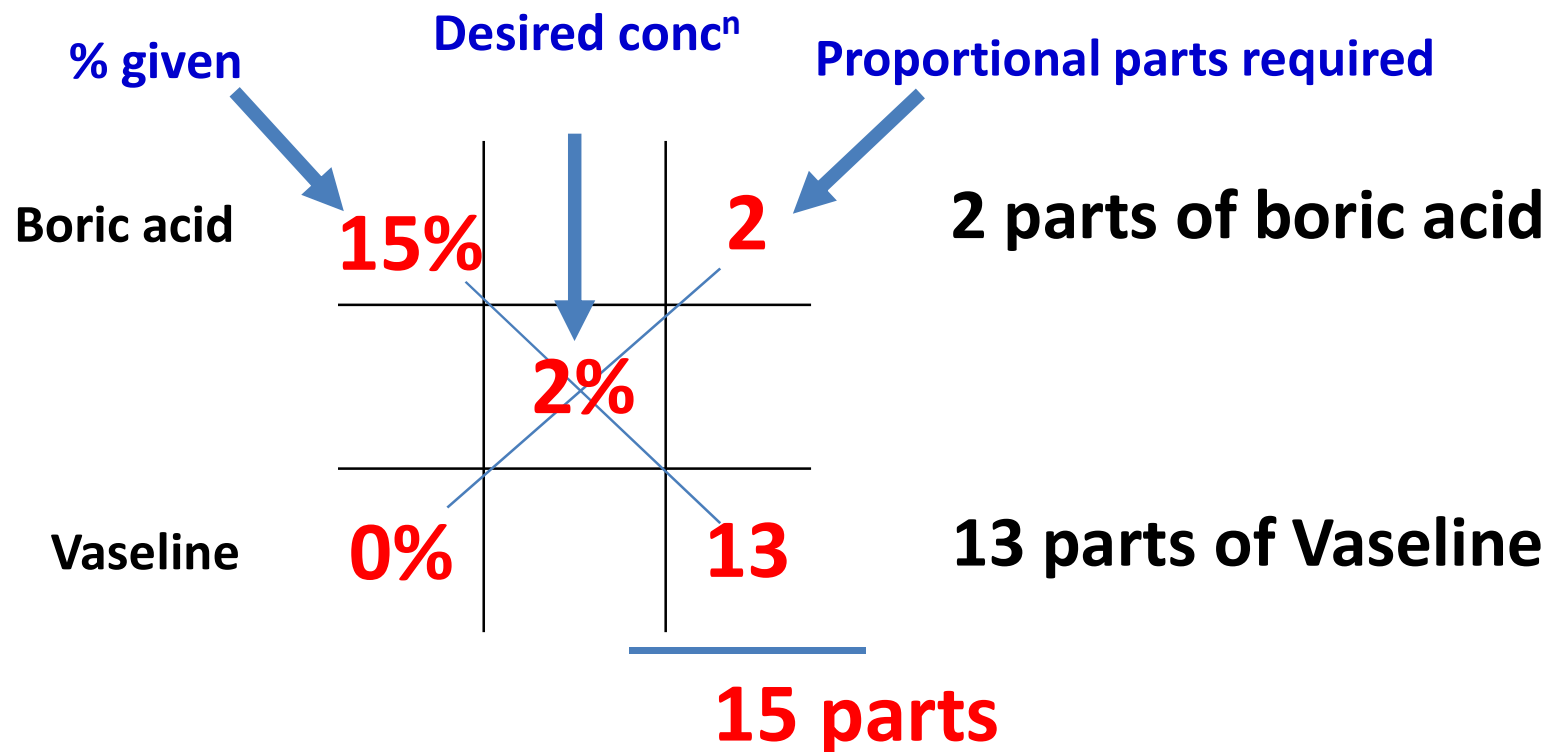
(3) Find the concentration of Zinc oxide ointment prepared by mixing 500 g of 50% , 300 g of 40% zinc oxide ointments and 200 g of Vaseline.

	<u>% strength</u>		<u>Amount</u>	
50% oint.	50	X	500	= 25,000
40% oint.	40	X	300	= 12,000
Vaseline	0	X	200	= 0
			1000	37,000

Concn of ZnO oint.= $37,000/1000=$ **37%**

Alligation alternate

(1) In what proportion should 15% boric acid be mixed with Vaseline to produce 2% boric acid ointment?



Boric acid : Vaseline = 2:13

Alligation alternate

- (1) In what proportion should 15% boric acid be mixed with Vaseline to produce 2% boric acid ointment?
- How many grams of each ingredient should be mixed to prepare 3 Kg of such ointment?

2 parts (15% boric acid) ----- 15 parts (2% oint.)
X g ----- 3000 g

$$X = (2 * 3000) / 15 = 400 \text{ g (15\% boric acid)}$$

$$\text{Amount of Vaseline} = 3000 - 400 = 2600 \text{ g}$$

Alligation alternate

(2) Find the amount of each of the following sulfur ointments of strengths 30%, 60% and 10% required to be mixed to prepare 2000 g of 20% sulfur ointment.

		Proportional parts required	
60		10	1 part
30	20	10	1 part
10		40 + 10	50
		50	5 parts
		7 parts	

Alligation alternate

(2) Find the amount of each of the following sulfur ointments of strengths 30%, 60% and 10% required to be mixed to prepare 2000 g of 20% sulfur ointment.

1 part (60%) ----- 7 parts

X g ----- 2000 g

$$X = (1 * 2000) / 7 = 285.7 \text{ g}$$

Amount of (30%) = 285.7 g

Amount of (10%) = 2000 - (285.7 + 285.7) = 1428.6 g

Alligation alternate

(3) Find the amount of each of the following sulfur ointments of strengths 60%, 40%, 20% and 5% required to be mixed to prepare 2000 g of 30% sulfur ointment.

		<u>Parts required</u>	<u>Amounts required</u>
	60	25	5 parts (60%) = $(5 \cdot 2000) / 15$ = 666.67 g
	40	10	2 parts (40%) = $(2 \cdot 2000) / 15$ = 266.67 g
	20	10	2 parts (20%) = 266.67 g
	5	30	6 parts (5%) = $(6 \cdot 2000) / 15 = 800$ g
			<u>15 parts</u>

Homework

Practical Notes: Pages 45-48

**Mixture containing
“Infusion”**

Laxative mixture

R/ Magnesium sulfate	25 g
Compound tincture of cardamon	100 ml
Liquid extract of liquorice	50 ml
Aromatic spirit of ammonia	50 ml
Fresh infusion of senna to	1000 ml

Fiat. Mist. Mitte. 60 ml

Sig : fl ounce o.m.

	<u>Fresh infusion of senna</u>
R/ Senna leaves	5 g
Boiling water to	100 ml

Calculations

R/ Magnesium sulfate 25 g
Compound Tr. of cardamon 100 ml
Liquid extract of liquorice 50 ml
Aromatic spirit of ammonia 50 ml
Fresh infusion of senna to 1000 ml

Fiat. Mist. Mitte: 60 ml

Sig : fl ounce o.m.

Fresh infusion of senna

R/ Senna leaves 5 g
Boiling water to 100 ml

First prescription:

Each ingredient is multiplied by

60/1000

$$= (25 \times 60) / 1000 = 1.5 \text{ g}$$

$$= (100 \times 60) / 1000 = 6 \text{ ml}$$

$$= (50 \times 60) / 1000 = 3 \text{ ml}$$

$$= (50 \times 60) / 1000 = 3 \text{ ml}$$

To **60 ml**

Second prescription:

Add 25% xss on the final volume

$$60 \times 25 / 100 = 15 \text{ ml}$$

$$60 + 15 = 75 \text{ ml}$$

5 g senna -----100 ml infusion
x -----75 ml infusion

Senna leaves = 3.75 g

Procedure

- 1- Boil 75 ml water in a beaker.
- 2- Add boiling water to Senna leaves.
- 3- Invert a funnel over the beaker.
- 4- Wait 10 min and triturate every 2 min.
- 5- Filter, cool the filtrate and take about half of the infusion.
- 6- Dissolve magnesium sulfate and other ingredients.
- 7- Transfer to 100 ml measure and complete to final volume (60 ml) with infusion.
- 8- Transfer to a bottle and stick the label.

Label

Laxative mixture

One coffee cupful to be taken
every morning

Uses

- 1- Laxative in chronic constipation.**
- 2- Carminative.**

Comment

- 1- Mg SO₄ : purgative.
- 2- Tr. Cardamom : carminative.
- 3- Liquorice : Sweetening agent
- 4- Senna infusion : purgative and laxative